International Workshop on Silk Handcrafts Cottage Industries and Silk Enterprises Development in Africa, Europe, Central Asia and the Near East,
&
Second Executive Meeting of Black, Caspian seas and Central Asia Silk Association (BACSA)

Bursa, Turkey, 6 -10 March 2006

Supported by the FAO Regular Programme PE214A4

P R O C E E D I N G S

Black, Caspian Seas and Central Asia Silk Association (BACSA) www.bacsa-silk.org

Kozabirlik Sericultural Cooperative

Bursa
2006

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P R O G R A M M E

Organizing committee:

1. **Dr H.Z. Lea (FAO)**
2. **Dr P. I. Tzenov (BACSA)**
3. **Mr. A. Karagozoglu (Kozabirlik)**

Organizers:

1. **Food and Agriculture Organization of the United Nations (FAO)**
2. **Black, Caspian Seas and Central Asia Silk Association (BACSA)**
3. **Kozabirlik Sericultural Cooperative, Bursa, Turkey**

DAY 1 (Monday, 6 March 2006)
Place: Hotel Anatolia

9.00 – 10.00	**Registration**

Opening

10.00 – 10.30	**Opening** – Inaugural speeches by Turkish Government Authorities
10.30 – 11.00	**Welcoming speech** by Dr H. Z. Lea, FAO Food and Agricultural Industries Officer

Plenary Session 1:

11.00 – 11.30	**Regional report**: Silk Handcrafts Cottage Industries and Silk Enterprises Development in Africa, Europe, Central Asia and the Near East: by Dr P. Tzenov, FAO consultant

Country reports on "Silk Handcrafts Cottage Industries and Silk Enterprises Development in Africa, Europe, Central Asia and the Near East"

Chairperson: Dr P.Tzenov, President, BACSA

11.30 – 12.00	**Egypt country report**: Dr S. Mahmoud, Director, Plant Protection Research Institute, Sericulture Research Department, Cairo
12.00 – 12.30	**Bulgaria country report**: Dr N. Petkov, Director & Dr P. Tzenov, Regional Centre for Scientific – Applied Service, Vratza
12.30 – 13.00	**China country report**: Dr J. Liu, Deputy director, Dept. of Sericulture, The Regional Sericultural Training Centre for Asia-Pacific, College of Animal Science, South China Agricultural University, Wushan, Guangzhou
13.00 – 14.00	**Lunch**
14.00 – 14.30	**India country report**: Mr. Nagaraja Tiptur, International Sericulture Alliance, Bangalore
14.30 – 15.00	**Romania country report**: Dr D. Brailoiu, S.C. SERICAROM S.A. - Research Department, Bucharest
15.00 – 15.30	**Thailand country report**: Ms. S. Boonchoo, Expert, The Queen Sirikit Institute of Sericulture, Ministry of Agriculture and Cooperatives, Phaholyothin road, Chatuchak, Bangkok
15.30 – 16.00	**Coffee break**
16.00 – 16.30	**Turkey country report**: Mr. Erhan Or, President of Association of Hereke Silk Carpet Producers

DAY 2 (Tuesday, 7 March 2006)
Place: Hotel Anatolia

Plenary Session 2: Country reports on "Silk Handcrafts Cottage Industries and Silk Enterprises Development in Africa, Europe, Central Asia and the Near East"
Chairperson: Dr P.Tzenov

9.00 – 9.30	**Syria country report**: Mr. M. Othman, manager, Othman Co.
9.30 – 10.00	**Uzbekistan country report**: Dr H. Homidy, Director, Uzbek Sericulture Research Institute, Tashkent
10.00 – 10.30	**Introduction of Hangzhou textile machinery factory, China**: By Mr. Ye Wen, General Manager

10.30 – 11.00	**Coffee break**
11.00 – 11.30	**Presentation of Zhejiang national university, Sericulture department, Hangzhou**, China: By Prof. Dr Y. Miao
11.30 – 13.00	**Discussions**
13.00 – 14.00	**Lunch**
14.00 – 19.00	**Visit the Sericulture Research Institute in Bursa, visits to laboratories and field work sites**

DAY 3 (Wednesday, 8 March 2006)
Visit to Hereke Town, Hereke silk weaving factory, Hereke carpet shops

DAY 4 (Thursday, 9 March 2006)
Place: Hotel Anatolia

Black, Caspian Seas and Central Asia Silk Association, Executive Committee Meeting,
Chairperson: Dr P. Tzenov, President, BACSA
Facilitator: Dr H. Lea, FAO

Round table meeting 1

Country reports on "Follow-up activities of Tashkent Workshop and national strategies for sericulture revival and development"

Chairperson: Dr P. Tzenov-President of BACSA
Facilitator: Dr H. Lea, FAO

9.00 – 9.30	**Albania country report**: Dr A. Xhoxhi, National coordinator
9.30 – 10.00	**Armenia country report**: Dr A. Azizyan, National coordinator
10.00 – 10.15	**Azerbaijan country report**: Dr B. Abbasov, National coordinator
10.15 – 10.30	**Bulgaria country report**: Dr D. Grekov, National coordinator
10.30 – 10.45	**Georgia country report**: Prof. G. Nikoleishvili, National coordinator
10.45 – 11.00	**Greece country report**: Mr. E. Kipriotis, BACSA vice-president

11.00 – 11.30	**Coffee break**
11.30 – 11.45	**Kazakhstan country report**: Dr A. Kulametov, National coordinator
11.45 – 12.00	**Tajikistan country report**: Mr. M. Karimov, National coordinator
12.00 – 12.15	**Turkey country report**: Mr. A. Karagozoglu, National coordinator
12.15 – 12.30	**Ukraine country report**: Dr O. Galanova, National coordinator
12.30 – 13.00	**Uzbekistan country report**: Dr H. Homidy, BACSA vice-president
13.00 – 14.00	**Lunch**

Round table meeting 2

Chairperson: Dr P. Tzenov, President of BACSA
Facilitator: Dr H. Lea, FAO

14.00 – 14.15	**Regional project proposal**: "Improvement of Income-Generation Options Based on Revival of Sericultural Industries and Promotion of Small Silk Enterprise Development in Eastern Europe and Central Asia": Dr P. Tzenov, BACSA president
14.15 – 14.45	"**Opportunities for donor funding of sericulture industry development projects with special emphasis on the countries in Eastern Europe and Central Asia**": Dr P. Tzenov, BACSA president
14.45 – 15.00	**Proposal for comparative studies of silkworm hybrids performance for sericultural enterprise development in Black, Caspian seas and Central Asia region**: Dr P. Tzenov, BACSA president
15.00 – 15.30	**BACSA organizational**: Dr P. Tzenov, BACSA president
15.30 – 16.00	**Round table discussion**
16.00 – 16.30	**Coffee break**
16.30 – 16.45	**BACSA second meeting final document**: Dr P. Tzenov, BACSA president
16.45 – 18.00	**Concluding and closing session**

DAY 5 (Friday, 10 March 2006)
Place: Hotel Anatolia

9.00 – 9.30	**Uganda country report**: Mr. G. Mugyenyi, Head, National Sericulture development Center, Kampala
9.30 – 11.00	**Plenary session for scientific articles**: chairperson Dr D. Grekov, Bulgaria
11.00 – 11.30	**Coffee break**
11.30 – 13.00	**Plenary session for scientific articles**: chairperson Dr O. Galanova, Ukraine
13.00 – 14.00	**Lunch**
14.00 – 16.00	**Round table discussions**
16.00 – 16.30	**Coffee break**
16.30 – 17.30	**Concluding and closing session**
17.30 – 18.00	**Closing ceremony**

Saturday 11 March 2006 **Departure**

Welcome Speech

Dr. H. Z. LEA, Senior Officer, FAO, Rome, Italy

International Workshop on Silk Handcrafts Cottage Industries and Silk Enterprises Development, Bursa, Turkey

6 ~ 10 March 2006

Good Morning Ladies and Gentlemen,

I would like to take this opportunity to express a heartfelt welcome to all of you attending this workshop. In order to be present here today, you all must have put aside other important work and daily tasks. To anticipate, this silk workshop will provide opportunities to discuss common issues, seek solutions, share experiences and information, conceive ideas for future directions, and exchange resources and technologies, while getting to know each other for future collaboration in production and trade chains of silk and silk commodities. Welcome again, all of you, coming from far and near in an effort to make this workshop successful for the region and its impact reaching far beyond.

As you all very well know, sericulture as one of labour-intensive agro-based industries, serves as an efficient means for the development of traditional/artisanal handcrafts cottage industries in various corners of the world. It also creates job opportunities for alternative employment and additional income to the rural and semi-urban population; most of them often belonging to the group of socially and economically less advantaged people.

In recent years, I have had opportunities to observe that the tradition of silk handcrafts survived and thrives in some places for making artisanal accessories and traditional/practical apparel. I noted that the knowledge of craftsmanship and artistic talent has been passed from one generation to another. In addition, silk textile industries have been successfully maintained to meet the continuous demands for prestigious silk clothes, culturally significant silk cloths, carpets and rugs, particularly where final silk products are less exposed to competition with imported goods and privileged as one of novelty textiles of natural origin.

As conceived through regional studies during the years 2001 ~ 2004 and also based on observations at the 24th Congress of International Silk Association in 2003, FAO initiated programme activities with attention focused on silk handcrafts cottage industries as one of developmental strategies, especially for the countries with less historical backgrounds to introduce and also for the countries with more traditional history to restore and promote. This workshop is the first one of three planned international workshops on silk handcrafts cottage industries. FAO is planning to organize two additional workshops; one for Asia and Pacific and another for Latin America and the Caribbean Region. Outcome and impact of this workshop should serve as an exemplary case for the follow-up international silk handcrafts workshops.

During the initial stage of sericulture introduction and revival, sericultural industry at the cottage industrial level of programme could be considered in most of low/middle income countries until necessary resources accumulate and quantity/quality reaches the commercially viable level in international markets. This strategic consideration is of practical importance, particularly for the African countries which have only a short experience and little tradition in the production and use of silk. As these countries are not so well prepared to produce high

grade silk in exportable quantity, introduction of sericultural industries could start with the *3-L* strategy, as I called it for *L*ow investment cost, *L*ow tech-skills and utilizing *L*ocally available resources. Consideration for silk cottage industries would be a first choice; processing raw material cocoons into silk yarns/fabrics and producing artistic/traditional silk final products at cottage industries level for the internal markets or tourist points. On the other hand, during the course of sericulture rehabilitation, the countries in the Black, Caspian Seas and Central Asia should try to consume part of locally produced cocoons and silk yarns in lower quality through promotion/revival of local silk handcrafts industries.

The silk handicrafts sector employs a large number of people, many of whom work with traditional materials and locally process to produce final products, usually in remote and backward areas. The economic importance of silk handcrafts is enhanced by the fact that cottage industries offer high employment potential and require only low capital investment with high value addition rates. In some cases, domestic and international markets have been indirectly connected through buying and selling by tourists of silk handcrafts items between producer and consumer countries.

The main purpose of this workshop is to bring together people in the various areas of research and training, development and administration, business and trading, and all others, in order to share experiences, discuss challenges and opportunities, identify common problems and find collaborative solutions, and also to explore prospects in mutual benefits, design follow-ups, conceive business and other ideas for sericulture industries in general and silk cottage industries in particular. In addition, this workshop intends to identify major constraints which might have caused today's situation and recommend immediate follow-up activities which would be required for trouble shooting and also to conceive executable mid- and long-term development strategies, while laying the ground work for restoration and further progress of silk industries in the region.

As a preliminary framework to be continuously updated and upgraded, a web page "Equipment/Tools Inventory for Silk Handcrafts Cottage Industries" was established in FAO's "InPho" website last year. Along with this inventory website, I trust the newly opened BACSA website will facilitate further sharing resources and exchanging information on production and trading of cocoons, raw silk, silk yarns, fabrics, and final silk products in the region and beyond.

Finally, I wish you all pleasant stay in Bursa and a successful participation in this workshop to the end, and a safe trip back to your home countries, bringing with you some work plans and business ideas to be put into practice for further development of sericulture and silk handcraft cottage industries and silk enterprises in your respective countries and for further progressive collaboration in the region.

Thank you very much again for coming this far and for listening.

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International Workshop on Silk Handcrafts Cottage Industries and Silk Enterprises Development in Africa, Europe, Central Asia and the Near East

&

Second executive meeting of the Black, Caspian Seas and Central Asia Silk Association (BACSA)

Bursa, Turkey, 6 -10 March 2006

(Brief summary)

From 6 to 10 March 2006, in Bursa, Turkey an "International Workshop on Silk Handcrafts Cottage Industries and Silk Enterprises Development in Africa, Europe, Central Asia and the Near East" and a satellite "Second executive meeting of the Black, Caspian Seas and Central Asia Silk Association (BACSA)" were organized by the Food and Agriculture Organization of the UN (FAO) in collaboration with the Black, Caspian Seas and Central Asia Silk Association, the Government of Republic of Turkey and "Kozabirlik" sericultural cooperative in Bursa.

This workshop intended to identify major constraints which might have caused today's situation and recommend immediate follow-up activities which would be required for trouble shooting and also to produce executable long-term development strategies, while laying the ground work for restoration and further progress of silk handcraft cottage industries.

62 delegates from the following 22 countries took part at the meeting: Albania, Armenia, Austria, Azerbaijan, Bulgaria, China, Georgia, Greece, Egypt, India, Italy, Kazakhstan, Korea, Lebanon, Madagascar, Romania, Syria, Tajikistan, Thailand, Turkey, Ukraine and Uzbekistan.

It is considered that the silk handcraft cottage industry creates tremendous economic prospect and employment potentiality for the rural people, scoring on every point: one of the highest income from one unit of land, use of less water and drought resistance, income leveller - transfer of income from rich to the poor nationally and internationally, generating high rural employment, gender benign in favor of women-employment, a natural fibre and ecologically harmless, no synthetic substitute and highly demanded at the local market as well as in EU countries, Japan, the USA etc., no competitor to food crops. The silk handicrafts sector also employs a large number of people, many of whom work with traditional materials, processes and products, and in remote and backward areas. The economic importance of silk handcrafts is accentuated by the fact of high employment potential, low capital investment, high ratios of value addition and that it is almost wholly artisan based.

Even though some of the African countries have traditions and local market for silk handcrafts production, they have short experience and little tradition in sericulture. On the other hand the countries of Black and Caspian seas region should make efforts in their local silk handcrafts industries revival/development in order to utilize the cocoons/raw silk locally produced as a strategy for sericulture rehabilitation and development.

The main constraints facing the silk handcraft cottage industries in Africa, Europe, Central Asia and the Near East are:

- the silk production in most of the region countries declined;
- many weavers specialised in silk fabrics have switched to cotton or synthetic fibres;
- the traditional silk handcraft cottage industry, producing national style fabrics is now completely inactivated in some of the region countries;
- abandoning of traditional silk wears;
- the traditional technologies at the level of reeling, yarn preparation and weaving need of improvement in order to diversify the fabrics and develop potential new markets;
- using poor management with low investment and technology;
- lack of new products and new designs to meet market's needs;
- the contribution rate of Iran, Turkey, Egypt and other producers from the region in the silk carpet world market has been decreased significantly within last decade;
- high prices of local silk yarn and high labour costs due to hand made products which use labour intensive;
- the free trade in textiles stimulates the weavers to import cheap raw silk from China rather than use material produced by local farmers.

The major challenges facing the sericultural industries development in the new entrants from **Africa** are:

- irregular and insufficient supply of silkworm eggs;
- poor quality cocoon;
- non availability of quality raw silk quality looms, qualified personnel to operate the filatures and other equipment;
- lack of appropriate tools/implements for the silk handicrafts cottage industry, inadequate knowledge about markets.

The recommendations for promotion of artisanal / traditional silk handcrafts and cottage industries at the regional levels are:

- the producers should establish the network to make collaboration among different sectors of supply chain;
- promote the silk handcraft products as natural and environmental friendly;
- provide specializations to various outstanding silk craft centers in the leading countries to learn new techniques;
- improve the knowledge and competency of silk industry management and its workers through seminars, training and education;
- creation country/regional data base on the silk sector and its monitoring;
- distribute and increase more advanced type silk reeling devices and machines to region wide to produce uniform quality of yarn;
- mechanisation in certain areas which do not effect basic skill input but pertain mainly to processing and finishing should be encouraged;
- modernisation of hand looms and accessories;
- diversification of products, use of eco-friendly dyes etc;
- establish local fairs and participate in international fairs to introduce silk handcraft products to the consumers and to make producers able to connect and know the latest development in their industry field;
- reliance will have to be placed on those silk handcrafts which cater to the common man's needs and tastes for boosting exports;

- producers should not make cheaper silk products with low quality to compete for the prices but to produce products which satisfy consumers even though they are more expensive;
- to produce own unique products which are definitely different from other countries.

The participants of the silk handcraft cottage industries and silk enterprises development workshop took the following more important decisions:

- Recommend to BACSA opening a page on the silk handcrafts at its web site and uploading the Bursa workshop proceedings.

- Recommend to the workshop participants visiting the BACSA web site, and submitting regularly to BACSA information for updating the page "sell/buy information".

- A "Working group on the global silk handcraft cottage industries and silk enterprises development" under the technical supervision of FAO was established for the countries of Africa, Europe, Central Asia and the Near East. The group will identify and analyze major constraints and strategies for silk handcraft cottage industries development.

- Recommend to the workshop participants and all other interested persons/organizations/companies to use as a framework for further suggestions and discussions the already uploaded on to FAO's "InPho" Website: "Equipment for Silk Handcrafts Cottage Industries" which will be updated/upgraded as FAO receives comments.
- Recommend the workshop participants and all other interested persons to attend the planed by FAO international workshops on silk handcraft cottage industries and silk enterprises development for Asia and the Pacific and for Latin America and the Caribbean in 2007 and 2008.

The BACSA second executive meeting took decisions about:

- Searching for possible donors about funding the regional project proposal: "Improvement of Income-Generation Options Based on Revival of Sericultural Industries and Promotion of Small Silk Enterprise Development in Eastern Europe and Central Asia".
- Approves the attendance of BACSA members in the regional mini-project: "Comparative studies of silkworm hybrids performance for sericultural enterprise development in Black, Caspian seas and Central Asia region". The three silkworm hybrid testing centers in the BACSA region are Sericulture research Institute, Gandja, Azerbaijan, Sericulture Experiment Station, Vratza, Bulgaria and Uzbek Sericulture Research Institute, Tashkent.
- The next 3rd executive meeting of BACSA will take place in the end of September 2006 at Vratza, Bulgaria as a satellite of the 110 anniversary of the Sericulture Experiment Station in Vratza and the international workshop on "Utilization of mulberry and silkworm genetic resources for sericultural enterprises development".

I. Country reports on “Silk Handcrafts Cottage Industries and Silk Enterprises Development in Africa, Europe, Central Asia and the Near East”

Chairperson: Dr P.Tzenov, President, BACSA

Silk Handcrafts Cottage Industries and Small Enterprises in Africa, Europe, Central Asia and the Near East

By

P. I. Tzenov* & H.Z. Lea**

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Paper contributed to "International Workshop on Silk Handcrafts Cottage Industries and Silk Enterprises Development in Africa, Europe and Central Asia", Bursa, Turkey 6 -10 March 2006

Food and Agriculture Organization, Rome, Italy

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ABSTRACT

In the region of Africa, Europe, Central Asia and the Near East silk textile traditions have been sustained by the continuing demand for prestigious, culturally significant silk cloths, carpets and rugs which are less exposed to competition from imported goods than more everyday, utilitarian textiles.

The silk handcraft commodities produced in the region are carpets and rugs, embroidery, scarves, shawls, handloom woven traditional silk fabrics such as "kente ", "burundjuk" etc., national costume and its accessories, traditional head-kerchiefs, belts, headdresses, ribbons, tunic or hangings, tapestry, ancestral shrouds, turbans, ladies veil, bedcovers, bed sheets, upholstery, sofa covers, table cloth, shoulder cloths, skirts, wall hangings, wallets, brocade (silk fabrics brocaded with golden strings), batik, souvenirs, works of art, caps; handkerchiefs, appliqué work, ties, haute couture, wedding gowns, women's wear, table napkins, placemats, curtains, knitted wear, pillowcases, comforters, canvas for paintings, wall decors, slippers, silk decoration for churches, fabrics for religious garments, silk painting.

The silk carpets and rugs producing countries are situated mainly in Western Asia, Asia minor, Central Asia and North Africa. Today, silk carpet-weaving is a big business and takes place on a huge commercial scale.

The silk reeling machines used in Africa, Europe, Central Asia and the Near East for production raw silk, which is further used for handcraft products are traditional wheel, improved two-ends reeling machine, direct multiends silk reeling machine and multiends reeling machine with small reels. In some countries/regions the silk reeling machines used are very primitive, not allowing to produce quality silk and requiring very high labor expenses. Without very much investment costs these old machines can be replaced by more modern ones, especially designed for use in the cottage industry.

The main techniques for silk handcrafts production are horizontal handloom weaving, tie and dye, ikat, batik, embroidery, making carpets and rugs on vertical looms by hand-tying knots, knitting, silk painting.

Most of the silk handcraft producing countries can not meet their demands for raw silk. This is valid for nearly all silk carpet and rug producing countries like Iran, Egypt, Turkey, Morocco, Tunisia etc.

Even though some of the African countries have traditions and local market for silk handcrafts production, they have short experience and little tradition in sericulture. On the other hand the countries of Black and Caspian seas region should make efforts in their local silk handcrafts industries revival/development in order to utilize the cocoons/raw silk locally produced as a strategy for sericulture rehabilitation and development. Some of the traditional silk handcrafts such as carpets, batik, ikat, etc. have huge international market, while the silk souvenirs are sold mostly to the tourists at the local markets. Now the market is even over-floated with some silk handcraft products like carpets, rugs, shawls, scarves, ikat, batik etc. The strong competition requires high quality products, but commands lower prices as well.

The main constraints facing the silk handcraft cottage industries are that the silk production in most of the region countries declined, many weavers specialised in silk fabrics have switched to cotton or synthetic fibres, the traditional silk handcraft cottage industry, producing national style fabrics is now completely inactivated in some of the region countries, abandoning of traditional silk wears, the traditional technologies at the level of reeling, yarn preparation and weaving needs of improvement in order to diversify

the fabrics and develop potential new markets, using poor management with low investment and technology, lack of new products and new designs to meet market's needs, the contribution rate of Iran, Turkey, Egypt and other producers from the region in the silk carpet world market has been decreased significantly within last decade, high prices of local silk yarn and high labour costs due to hand made products, which use labour intensive, the free trade in textiles stimulates the weavers to import cheap raw silk from China rather than use material produced by local farmers.

The major challenges facing the sericultural industries development in the new entrants from Africa are irregular and insufficient supply of silkworm eggs, poor quality cocoon, non availability of quality raw silk, quality looms, qualified personnel to operate the filatures and other equipment, lack of appropriate tools/implements for the silk handicrafts cottage industry, inadequate knowledge about markets.

The recommendations for promotion of artisanal / traditional silk handcrafts and cottage industries at the regional levels are that the producers should establish the network to make collaboration among different sectors of supply chain, promote the silk handcraft products as natural and environmental friendly, provide specializations to various outstanding silk craft centers in the leading countries to learn new techniques, improve the knowledge and competency of silk industry management and its workers through seminars, training and education, creation country/regional data base on the silk sector and its monitoring, distribute and increase more advanced type silk reeling devices and machines to region wide to produce uniform quality of yarn, mechanisation in certain areas which do not effect basic skill input but pertain mainly to processing and finishing should be encouraged, modernisation of hand looms and accessories, diversification of products, use of eco-friendly dyes etc., establish local fairs and participate in international fairs to introduce silk handcraft products to the consumers and to make producers able to connect and know the latest development in their industry field, reliance will have to be placed on those silk handcrafts which cater to the common man's needs and tastes for boosting exports, producers should not make cheaper silk products with low quality to compete for the prices but to produce products which satisfy consumers even though they are more expensive, to produce own unique products which are definitely different from other countries.

The main export items of silk garments and products are carpets and rugs, women's blouses, shirts, handkerchiefs, shawls, scarves, mufflers, mantillas, veils, ties, bow ties and cravats, furnishing house wares gifts and accessories. The most promising export markets for all types of silk fabrics and products are U.S.A, EU and Japan. The local silk handcraft cottage industry should put more emphasis on indirect export market through tourists. Based on the Thailand's experience cooperative and private models of silk handcraft cottage enterprises could be recommended.

The regional strategies and follow ups may include:

1. Enlargement the radius of action of the Black, Caspian Seas and Central Asia Silk Association (BACSA) to cover the entire region of Africa, Europe, Central Asia and the Near East in terms of exchange of market information through the BACSA web site. The region countries may be formed in 5 groups, namely 1) Sericulture germplasm conservation centers (Europe and Central Asia) ; 2) P_1/F_1 egg production centers (Europe and Central Asia); 3) Cocoon and raw silk producers for export (Europe, Central Asia and Near East); 4) Silk handcraft producers (whole region); 5. Silk handcraft consumers (importers) (Europe).

In this regional scheme the European and Central Asian countries will supply the countries from Africa and the Near East with sericulture germplasm and silkworm eggs, the region countries will supply each other with dry cocoons and raw silk, the silk handcraft products will be sold locally and exported at the EU and Russian markets.

2. BACSA to open a special page in its web site on "Silk handcraft cottage industries"

3. Organizing a regional workshop on "Utilization of mulberry and silkworm genetic resources for sericultural enterprises development in Africa, Europe, Central Asia and the Near East"

The Global strategies and follow ups may include:
1. Establishment an international "Working group on the global silk handcraft cottage industries and silk enterprises development": It is necessary to establish an international working group on the silk handcraft cottage industries and silk enterprises development, which includes countries new comers, developed, developing, advantage, producer, consumer and trader, to discuss, identify, and analyze major constraints and strategies for development in global aspect. This group may include experts in all areas and fields both private and government sectors.
This working group may be organized and supported by international organization which is independent, long term recognized as FAO. The already uploaded on to FAO's "InPho" Website: "Equipment for Silk Handcrafts Cottage Industries" may serve as a preliminary framework to be updated/upgraded as FAO receives comments.

2. Organizing two further international workshops on silk handcraft cottage industries and silk enterprises development for Asia and the Pacific in 2006/2007 and for Latin America and the Caribbean in 2007/2008:

Key words: silk handcrafts, cottage industries, Africa, Europe, Central Asia, Near East, development

Chapter1. Introduction

The rural development in the developing countries could be strengthened by motivating and encouraging the rural people to setup cottage industries, undertake preparation of handcrafts based on the raw material available locally, and engage in activities that help in value addition to their produce. A number of countries have considerably augmented their exports by setting up agro-based small industrial units in the rural areas and then exporting their surplus stuff to foreign markets. Increase in the economic activity in the villages will also provide gainful employment to the rural people close to their doorsteps and thus to prevent their migration to the urban centers in search for job.

There is no single universally accepted definition of what comprises a small-scale enterprise. A distinction is usually made between very small cottage activities characterized by household location and traditional artisanal techniques and somewhat larger workshop enterprises employing some modern techniques. A convenient dividing line between the two can be taken to be five workers, with 50 workers as the ceiling for small enterprises.

Main enterprise type is that of handcrafts, the outputs of which usually go largely to urban markets, to tourists and sometimes even to export destinations. Small processing enterprises are characterized by very small size, heavy reliance on entrepreneurs and members of their families for labour, technological simplicity of operations, low capital intensity, limited industrial and managerial skills, seasonality of activities (especially for the smallest ones), and rural locational bias. The typical small enterprise thus depends heavily on inputs from the entrepreneur and his or her family. While likely to be technically proficient in craft skills acquired by working in other similar enterprises, the entrepreneur often lacks training in marketing or management but is nevertheless forced to deal with these in addition to being a production worker. Employees are generally without formal training in either the craft or management. In addition to the employment and income that they generate, small manufacturing enterprises can introduce vital skills into rural areas, conserve scarce managerial abilities, promote indigenous entrepreneurial capabilities, and channel into industry capital that otherwise would not be available for investment in this sector.

The traditional industries utilizing specific skill or local raw materials and resources, and labour intensive and related with national tradition, art and culture shall be named as cottage industries. A cottage industry is one where the production is from the home of the producer and is always a family business.

In some areas of many developing countries every family proper have hand looms to meet the requirement of the household. The looms are in fact the centre of domestic economy, the only hope of salvation in an hour of distress or despair. Handloom weaving forms a cultural constituent of the women of these areas. In earlier days most of the cloth required for the family was produced in the family itself. Now the scenes have changed totally in urban areas. Mill products are gradually replacing the homemade products.

Apart from giving a high-value product, sericulture is a highly women/old people/children - focused, labour intensive, rural based, income leveler. From one hectare of irrigated mulberry, from the stage of mulberry cultivation to the stage of weaving and marketing, about twelve persons get employment throughout the year. Since the producers of silk cocoons are mostly small farmers while the costly silk final products can be purchased only by the affluent, it transfers income from the rich to the poor, from the urban to rural families. Internationally also, the silk producing countries are mainly the developing countries while silk products have a high demand in the EU countries, Japan, USA etc.. Development of silk industry

would be given importance in the strategy for poverty alleviation, to help increase the incomes of small-scale silk producers, mostly poor women.

The ancient magic of silk handcrafts arts continues to survive and thrive in the present age mainly because this rich heritage of craftsmanship and artistic endeavour has been passed on from generation to generation as timeless tradition. Many sericultural countries have abundant, unique and varied traditions of silk artisan based activities, reflective of the country's rich craft and cultural traditions. In handlooms a good quality product could be very successful and could beat any competition so that through technology upgrading and market oriented products the traditional cottage industries could provide good source of employment for the new generation.

Strategy for initial stage of sericulture revival development in most of low/middle income countries may be based on silk cottage and handcraft industries, including support for development of small and medium enterprises (SME). This is of a crucial importance, especially for the African countries which have only short experience and a little tradition in sericulture development. Since those countries are not able to produce high grade and big amount of raw silk for export, especially at the initial phase, for them the sericulture development should be based on low cost/tech/local silk cottage industries and selling silk handcraft products mainly at the internal/tourist markets. In this respect the silk cottage industries and handcrafts production development appear to be of a strategic importance for the global sericulture development.

The absence of a comprehensive data base on silk handcrafts is a serious limitation in planning for the monitoring of the development in the sub-sector. It is, therefore, essential to conduct a comprehensive survey of silk handicrafts production and main constraints for development.

Chapter 2. Present status and future prospects of the silk handcrafts cottage industries sector in the region.

2.1.Silk handcrafts commodities, regional and country diversity of traditional silk handcrafts items and types of cottage industries by regions. Natural and socio-economic feasibility of development/expansion of silk handcraft cottage industries in the region. Current production levels of silk handcraft items.

There must be made a distinct difference between silk cottage industry and silk handcrafts production. The typical silk cottage industry means that the sericulture farmers reel their cocoons by themselves and then process the raw silk produced into ready-made silk fabrics, usually on handlooms. However in nowadays this type of silk cottage industry is preserved only in few countries like India, Thailand, Indonesia, Laos, Cambodia. In the region, this type of silk cottage industry still exists only in Africa – Madagascar. In the other region countries from Africa, Europe, Central Asia and the Near East (AECANE) most of the farmers usually sell their cocoons to silk reeling factories. Then the silk craftsmen buy the raw silk from the market or receive the ready yarn from middleman companies dealing with silk handcrafts marketing.

Therefore the silk handcrafts could be made both by silk, produced from a cottage industry or by silk, produced by commercial silk reeling/weaving factories.
The main silk handicrafts produced in the region are carpets and rugs, embroidery, national style fabrics made on handlooms and their allied products, knitted wear, souvenirs, works of art, non-mulberry silk products. The geographical distribution of different silk handcraft commodities is presented in Table 1.

Table 1.Silk handcrafts commodities geographical distribution.

Continent/country	Can the local raw silk supply meet the demand?	Types of silk handcrafts commodities
Africa		
Algeria	No	carpets and rugs; embroidery; shawls;
Egypt	No	carpets; rugs; shawls; wedding dress ;embroidery; handloom woven fabrics
Botswana	No	non-mulberry silk
Cote D'Ivoire	No	handloom woven fabrics
Ethiopia	No	handloom woven fabrics; shawls; embroidery;
Ghana	No	handloom woven fabrics: "kente";
Libya	No	embroidery;
Kenya	No	handloom woven fabrics
Madagascar	No	non-mulberry silk; handloom woven fabrics; ancestral shrouds
Nigeria	No	non-mulberry silk; embroidery ;handloom woven fabrics; "Nagbada"; *adire* (tie-dye); silk-screen printing;
Morocco	No	carpets and rugs; embroidery; handloom woven fabrics;
Tunisia	No	carpets and rugs ; belts, headdresses, ribbons, tunic or hangings; tapestry; embroidery; marriage veil;
Uganda	No	handloom woven fabrics; non-mulberry silk
Zimbabwe	No	hand reeled silk; handloom woven fabrics; mats
Europe		
Albania	Yes	handloom woven silk fabrics; traditional costumes
Bulgaria	Yes	knitted wear; silk painting; souvenirs; handloom woven silk fabrics, called "burundjuk", fabrics, having cotton warp and weft of silk, wool and silk hand-knitted sweaters, lady's blouses knitted by pure silk, knitted bed/table covers, doily, embroidery and usage as tinsel for tunic decoration; decorative objects in the churches, fabrics for religious garments
Greece	Yes	Works of art; souvenirs
Romania	Yes	"marame" (traditional had-kerchiefs), traditional costumes (silk embroidered blouses or some specific elements "catrinta" or "fota"), man's shirts, decorative traditional towels (destined as gifts at weddings or to

		decorate the icons in houses or churches), fabrics for religious garments, wallets, different knitting, tassels, pillow and table cloths, coverlets.
Turkey	No	carpets and rugs
Caucasus		
Armenia	No	handloom woven silk fabrics
Azerbaijan	Yes	carpets and rugs; national lady's head cloths "kelagai"
Georgia	Yes	embroidery
Central Asia		
Afghanistan	No	carpets and rugs; embroidery; turbans; scarves; ladies veil
Iran	No	carpets and rugs; brocades; turbans; scarves; ladies veil
Kazakhstan	No	national style fabrics; carpets and rugs; embroidery
Kyrgyzstan	Yes	carpets and rugs; embroidery;
Tajikistan	Yes	carpets and rugs
Turkmenistan	Yes	carpets and rugs; embroidery;
Uzbekistan	Yes	national style fabrics; carpets and rugs; embroidery;
Near East		
Jordan	No	embroidery; rugs;
Syria	No	brocades; rugs;

2.1.1. Silk carpets and rugs (Annex 1): The producers are Iran, Turkey, Afghanistan, Egypt, Tunisia, Morocco, Uzbekistan, Turkmenistan, Tajikistan, Kyrgyzstan, Azerbaijan. Geographically those countries are situated mainly in **Western Asia, Asia minor, Central Asia and North Africa.**

Carpet-making is one of the oldest known crafts. Its roots lie in the heart of Central Asia, where it developed and flourished before reaching its peak of quality in the 16th - 17th centuries. Today, silk carpet-weaving is a big business and takes place on a huge commercial scale. Traditional rugs and carpets are, however, still being made in many places and the use of traditional vegetable (natural) dyes is becoming more widespread.

In **Iran** there are about 2000 traditional silk-reeling workshops across the country. Close to 95 per cent of the yarn output goes to the carpet industry.About 40000 silk carpet weaving units exist in the country. The "Persian kilim", produced in Iran is considered one of the best quality in the world.

Turkey – one of the best quality of silk carpets: In written sources, belong to 15th century, there is some information about the silk carpet crafting in Bursa. The Turkish or "GÖRDES" knot, with which these carpets are crafted, makes them exceptionally strong. Each square centimeter contains from 100 to 300 double knots. One square meter with up to one million of these knots, may take any where from six to ten months to be produced. Experts agree that this double – knotting technique was invented by Turkish nomadic tribes and craftsmen who introduced it to an area extending from the steppes of Central Asia to the Mediterranean coast

by Seljuk Turks in the 12th century. The knots actually tighten with use adding to the carpets durability, brilliance and value. Color is another important point. Both chemical and vegetal dyes produced from leaves, roots and fruits and concocted from formulas passed down through generations are used. Those techniques are still practicing in the rural areas of Turkey. There are thousands of silk carpet hand looms in Turkey. Turkey exports about US$18million/year worth of silk carpets to the U.S., Europe and Arabian countries known for their beauty and strength for centuries, many of these carpets are displayed in museums around the world. Others are handed down from generation to generation, increasing in value with the passing years. Lightweight and colorful, there are often used as prayer rugs or furniture coverings or as decorative tapestries and wall hangings. They have always been a good investment.
More than 80% of the fresh cocoons produced in the country are used in silk carpet production. From fresh cocoon production to silk carpet production about 14 times added value is created. Approximately half a million people work on various fields of sericulture and silk industry such as reeling, twisting, weaving, dyeing, marketing and the country earns millions of dollars from silk carpet export. Most of the production and marketing of silk carpet are carried by the private sector and government takes part with its Hereke factory in these activities. Carpet weaving is carried greatly in homes with benches rather than workshops. Generally young girls take part in these production activities. Most of the cocoons produced in the country are used by silk carpet sector and in recent years as a result of low production levels of cocoon it can't meet carpet sector's demand and their needs were met by import raw silk from other countries.

For the rural industrialisation of Egypt through conversion of homes into centres of small industries and handicrafts is very important and the productive families' project has proved to be very successful. "**Kleem"** (carpet) is the name donated to a flat woven, woolen or silk rug that is produced by hand looms until today. This handicraft is presented in different areas of Egypt, but is concentrated in the Nile Delta area. Carpet weaving has existed in this particular area for over eight centuries. This craft started with bedouin tribes from the surrounding desert, coming with wool of their desert sheep. Later on the art of weaving silk carpets was transmitted from Iran. Although the reeling, twisting, degumming and dying of the silk have become mechanized today, the weaving still remains a hand-made cottage product. Carpet weaving has always been a cottage industry, and remains so today. The weaver sets up a loom in his/her house or adjacent to it, where he/she works at hours that suits him/her. There are commercial companies who deal with the supply of silk yarn and provide the designs. Today, the natural dyes have been replaced by chemical dyes, which have proven more efficient. Children are taught to weave from the age of eight, and they also participate in the production process. Coupled with the decline in demand for carpets, harsh economic conditions, the decrease of inflow of tourists which comprised a large percentage of the demand on silk carpets, the industry has suffered greatly in the past decade. The attempts of governmental institutions in supporting this dieing handicraft have been unsuccessful. It is now the role of the private sector to help in the preservation of this part of the Egyptian culture.

Moroccan Carpets: Moroccans are known for their handmade rugs *(kilims)*. The rugs are made from wool or silk. Certain colours and designs are associated with particular regions. A good Moroccan carpet contains up to 480000 knots per square metre and can take up to nine months to make.

TUNISIAN CARPETS AND TAPESTRIES: Being at the crossroad of various civilisations, Tunisia has always been well known for its weaving. A tapestry is a decorative

textile work, adorning a wall or covering a piece of furniture or the ground, manually woven on a horizontal or vertical loom, the pattern being made of dyed threads of wool or silk which are packed so as to hide the master strings. Examples are most wall carpets, but also the "Mergoum" and the "Klim".
A carpet is a knotted decorative textile work, generally long wool or silk, with a tied stitch, cut an woven on a vertical loom, often with a velvet-like surface, used to cover the ground. An example is the “Kairouan”. Legend attributes to “Kamla”, the daughter of a Turkish governor of Kairouan, the introduction in 1830 of the knot of “Ghiords” (ghorza) of Anatolian (Turkish) conception. The “Kairouan”, which inherited the name of the city where it was originally produced, is the ascendant of a variety of present day Tunisian carpets . This carpet was introduced in various Tunisian cities, resulting in a myriad of varieties, each characterised by regional artistic influences, religious beliefs, prophylactic symbols as well as inputs from ceramic decoration and embroideries.
At the same time as the introduction of the “Kairouan”, vivacious colour schemes were increasingly adopted in function of the imagination of the artisans.A graduating of blue, green, black and white with an influx of shades and lights, usually settled on a desert yellow, where dunes are always moving. Tunisian craftsmen have explored, with outstanding success, a blending of traditional Tunisian patterns with modern designs creating a new line of knotted carpets to satisfy more modern tastes. The “Mergoum” and “Klim” are ground tapestries, characterised by the combination of two simple geometrical patterns, the lozenge (or diamond shape) and the triangle. They belong to the millenium old art of North Africa’s first inhabitants, the “berbers” and remind us of their jewelry, their potteries and even their tattoos. After mastering the fine textures for woollen carpets, the Tunisian artisans have started the weaving of silk carpets, encouraged by the demand from local and foreign customers for this product, similar to the Oriental and the Persian carpets.
In this way, between the authentic local craft and the various adaptations, certain modern Tunisian carpets and tapestries have acquired international notoriety, thank to their originality or to their specific Tunisian character. Justly proud of the excellence of its carpets Tunisia has established a strict quality control and only those that satisfy the high standards are given the coveted label with the seal of the Tunisian Republic and information on the date, size, fineness, of the carpet.

2.1.2. Handloom woven silk fabrics, embroidery and garment

2.1.2.1. Africa

Even though in Africa silk is produced and used less extensively than cotton and wool - both geographically and socially, the rich and diverse range of silk textiles from Africa is an unexpected revelation.
Some of the earliest written records of indigenous silk production in Africa come from Tunisia; the tenth-century geographer Ibn Hawqal refers to the flourishing industry in Gabes. Mulberry trees were cultivated suggesting that the Bombyx mori, literally mulberry cocoon`, silkworm was being raised there. This variety was also reared in Madagascar - during the reign of Radama I (1817-25) local cultivation was encouraged and mulberry trees from Mauritius were introduced. Until then Chinese silk, derived from the Bombyx mori, had been imported by Arab and Indian traders. As in Tunisia, raw silk was probably obtained by boiling the cocoons to soften the gum binding the filaments, and reeling (unwinding) the threads directly from two or more cocoons at a time to form a continuous even strand.
As well as cultivated production several varieties of wild silk are known in Africa. In the highlands of Madagascar the indigenous Borocera Madagascariensis produces a coarse

greyish-brown silk which resists dye. **(Annex 1)**. It is esteemed for its durability and used almost exclusively for weaving burial shrouds. The savanna region of northern Nigeria is home to two varieties of wild silk collected from the cocoons of the Anaphe infracta and Anaphe moloneyi genus moths, which breed mainly on tamarind trees. Unlike Bombyx varieties, the Anaphe infracta caterpillars form clusters of cocoons with a communal brown silk outer casing. These communal pods are boiled in an alkaline solution to separate the silk filaments from the gummy substances that bind the outer casing together. After several rinses, the silk is dried and the fibres are spun. The yarn is coarse, greyish-brown and lacking in lustre. The Anaphe moloneyi caterpillar produces clusters of whitish cocoons unprotected by a casing. The light-beige silk yarn is spun directly from these cocoons and is mainly used for embroidery.

Import and trade

The trans-Saharan trade routes provided a vital source of silk yarn and manufactured silk cloths. Magenta waste silk, known in Nigeria as alharini (derived from harir, the Arabic word for silk), originally came from Tunisia as a by-product of the local silk industry. Later unwrought silk from French and Italian mills was imported into Gabes and Tunis and subsequently traded to Kano. The mid-nineteenth century German traveller, Heinrich Barth, recorded that 300-400 camel loads of raw silk were traded from Ghadamis in Libya to Kano annually.

The Asante people of Ghana exploited other sources to obtain silk. By the 1730s manufactured silk or composite cloths, acquired from Europe as diplomatic gifts or via the West African coastal trade, were being unravelled for their yarn. This practice continued until the early twentieth century. Similarly, silk weavers in Ethiopia relied on imported silk thread and fabrics from India, China and Arabia.

North Africa

Following the Arab invasion of the seventh century, weaving became a male profession and horizontal ground looms were introduced. Tiraz factories producing luxurious silk garments for the rulers and the Muslim elite were established. Textiles were included as tribute items or presented as gifts and rewards, particularly under the hedonistic Fatimids (909-1171) in Egypt and Tunisia. By the twelfth century specialist silk weaving guilds had been set up in Tunis.

Production also flourished in Fes in Morocco which boasted 467 inns for merchants and over 3000 houses of tiraz. Later, under the Marinids (1269-1465) this industry reportedly supported 20000 artisans.

Weaving

Silk weaving was largely based in the towns and cities of North Africa, rather than in rural areas. Treadle looms (sturdy foot-operated floor loom with shafts for raising and lowering threads. The shafts are attached to treadles which increase the speed of weaving) of various types were used from the sixteenth century. Perhaps the most complex was the large draw loom (loom operated by the weaver and one or more assistants who 'draw up' the supplementary Heddles to form the pattern elements on a textile), used in Fes to produce intricately patterned silk textiles and sumptuous ceremonial belts (hizam), often further embellished with gold. The decoration and the manufacture of these belts mirrored the complex dissemination of weaving techniques and ideas, as successive waves of refugees introduced technical and stylistic innovations. Many Andalucian exiles, including those of Jewish ancestry, settled in North African towns and cities following the fall of Granada in 1492. In the town of Mahdia today, small draw looms operated by two people, are used to weave silk ribbons (hashiya) with complex central motifs. This skill was introduced to

Mahdia by Jewish weavers from Tripoli in Libya towards the end of the nineteenth century. Such ribbons are used in Tunisia and Libya to form curtains and hangings, or to decorate marriage costumes.
Flat-woven silk textiles, often incorporating simple stripes or checks, were made on hand-operated treadle looms in Libya, Tunisia and Egypt. The practice of inserting complex tapestry-woven designs using shuttle boats is still seen today on Jerba island in the production of biskri (wrap-around cloths) and in Mahdia for the prestigious rida` ahmar (red outer germent), both of which are used by women at marriage. Tapestry-woven cloths also come from the town of Naqada in the Nile Valley, Egypt.
Prestigious items of men`s dress such as the 'aba', a sleeveless outer robe worn throughout the Middle East, and women`s modesty garments of silk and cotton were tapestry-woven in Naqada.
The introduction of the flying shuttle to treadle looms, which the weaver operates by pulling on a short cord, allowed broader cloths to be created and increased output. On Jerba island and in Mahdia today this technique is used to create silk cloths with elaborate geometric motifs by inserting numerous supplementary shed sticks through the warp. These subtle designs, often produced in two-tone, are known as khwatim trabelsi (Tripolitanian seal). The name reveals the origin of this cloth: before the arrival of Jewish weavers from Libya, such textiles were imported from Jerba island`s neighbour, Tripolitania.

Urban embroidery
While silk weaving in North Africa is essentially a male activity, embroidery is a female art. Although there are clear distinctions between urban and rural embroidery, both types are produced mainly for domestic use. Quite distinctive regional embroidery styles and techniques evolved, reflecting different external influences.
Amongst the finest embroideries are those worked on linen from Algiers; they reached the height of their elegance during the Ottoman period (sixteenth-eighteenth centuries). Beautiful hangings and curtains were produced by women for the bridal trousseau. These were usually made in panels separated by brocade ribbons and covered with exuberant floral and vegetal designs. Wealthy women also prepared personal items such as the beniqa (bath cap) which was used at the hammam to wrap damp hair. At home women wore reversible shawls (tanshifa) draped around the shoulders or covering the hair. Reserved for use on ceremonial occasions, they were extensively embroidered with foliate and floral designs inspired by Italian Renaissance or Turkish patterns.
A more formal embroidery style was adopted in Fes (Morocco) for cloths designed as home furnishings. Worked in monochrome on a cotton base cloth, the repeating patterns are arranged in bands: stylized versions of trees, hands or birds feature along the borders. Cloths for home furnishing from the town of Azemmour are decorated with stylized female figures with raised arms, birds flanking a central vase and mythical beasts, recalling pattern elements derived from Renaissance Italy and Spain.

Rural embroidery patterns
In contrast to the formal composition of urban embroidery, rural patterns reflect concerns about fertility, generate community well-being and protect against the evil eye. Embroidery communicates cultural beliefs in an exuberant and engaging manner. Striking solar, lunar and pillar motifs, worked in brilliantly coloured silks on heavy wool, characterize the spectacular wrap-around cloths (hram nfasiy) worn by Tunisian women of El-Jem. Scattered in a seemingly random manner alongside these central designs are appealing camels, fish, hands, scorpions and brides with upraised hands. Worn for the first time during wedding ceremonies, these patterns protect against the evil eye. Solar-inspired designs on the black and white

wedding dresses from Siwa Oasis in Egypt are also thought to have protective qualities. Linear embroidery creates a 'sunburst' pattern entirely covering the front of the dress. Today plastic amulets in the form of hands, fish and horseshoes act as protection. Woollen head-shawls from the Gabes area of southern Tunisia have human and animal motifs, as well as palm trees and moons worked in slightly uneven chain or herringbone stitch. These patterns echo the smaller designs on the hram nfasiy, suggesting a sub-Saharan inspiration.
In Egypt are manufactured bright purple red scarves as well as bed covers. The producers rely on raw silk imported from China a factor that is due to the insufficient local production. Also, the malass, a black cloth half woven in silk and half in cotton are also produced in Upper Egypt which are considered the traditional dress for women in this area. In addition to the imported silk for woven cloth for making men chemises. At present, a total consumption of 50 metric tons raw silk / year are used for these traditional industries. EL-Farka, a special woven cloth famous with its smooth, neatness and design. The embroidery is a famous activity for making Kaftans which is a traditional men dress, consuming another 50 tons of raw silk, with 200 workers mostly in the Delta area.

Ethiopia
Silk has played an important part in the social and religious life of Ethiopia from the earliest days of the kingdom of Aksum, which was converted to Christianity in the fourth century. It was imported in large quantities from India, Arabia and China, and stored in vast caverns in the central highlands of Ethiopia. One of the hereditary titles of the governor of Shoa province was 'Keeper of the silk Caves'. From these storehouses Ethiopian emperors would make prodigious gifts of silk to other churches in Christendom. Apart from some isolated, historical traditions such as on Pate island off the Kenyan coast, Ethiopia has long been the only major silk weaving region in eastern Africa.
Silk and the Church
Silk was used to make ceremonial umbrellas, to bind sacred books, to cover wooden altar tablets and, most spectacular of all, to weave the imposing hangings which were an essential feature of Ethiopian churches. One of these hangings survives in the collections of The British Museum, and the history and significance of silk in Ethiopian life and culture is woven into the fabric of this single cloth. It was designed as the central section of a triptych which would have screened the inner sanctum (maqdas) from the main body of an Ethiopian Orthodox Christian church. The practice of adorning the interiors of churches with silk hangings was widespread in the Byzantine empire - a tradition that survived longer in Ethiopia than it did in the rest of Christendom.
The mid-eighteenth century curtain in the British Museum`s collection is the largest tablet-woven textile in the world, and though a profoundly Christian artefact, it was probably created by a guild of Muslim or Jewish (Falasha) weavers in the city of Gondar. It is woven entirely of imported Chinese silk, and the figures that appear on it are depicted in such detail that the soldiers can be seen to be carrying firearms of Indian make. The event commemorated is probably the lying-in-state of King Bakaffa who died in 1730. He, his wife Queen Mentuab and their young son Iyasu are all depicted wearing the matab (plaited band of blue silk), which was a symbol of their Christian faith.

Silk and the State
During the nineteenth century a succession of enlightened rulers began to unify the Christian empire of Ethiopia. In common with the Asante of Ghana and the Merina of Madagascar, the complex hierarchy of religious, secular and military officialdom in this empire needed delineation. An impressive range of woven or embroidered silk costumes was created to define the status of the wearer.

The "shamma"

One such textile was the "shamma", a toga-like cotton shawl worn by both men and women throughout Ethiopia. In the mid-nineteenth century only a very few were permitted to wear the margaf, a type of shamma that boasted a decorative band (tibeb) with supplementary weft patterns in red, yellow and blue silk. In common with the kente cloth of the Asante, Ethiopia weavers first obtained their supplies of silk yarn from unravelled imported textiles. Also like the Asante kente and the lamba akotofahana of the Merina of Madagascar, the silk tibeb of the shamma became more various in both pattern and colour towards the end of the nineteenth century as it came to represent an increasingly complex social hierarchy. Not only was information about the status of the wearer conveyed by the pattern of the shamma, but also by the way in which the garment was draped or folded. This remains a feature of the shamma to this day.

The "lamd"

An honorific lion-skin cape was gradually replaced during the nineteenth century by a "lamd" (tailored garment) which was worn by clerics, nobles and high-ranking military and secular officials. Guilds of Armenian craftsmen were responsible for the rich silk embroidery, as well as the silver and gold filigree with which these capes were embellished. The base cloth and linings were made with imported velvet and silk.

The "kamis"

'A fine lady has a . . . shirt [which] is made probably of calico from Manchester, and richly embroidered in silk of divers and various patterns around the neck, down the front, and on the cuffs,' observed Mansfield Parkyns in the mid-nineteenth century. Ethiopian noblewomen embroidered their costume in this way, using Chinese silk yarn on a base cloth of calico imported from Manchester .Today similar dresses are worn by a much larger number of women, although they remain a symbol of status. The base cloth is now the finest hand-woven Ethiopian cotton; this is usually embroidered by a Muslim man, often using rayon and lurex rather than silk.

While there is a large Muslim population in Ethiopia, as well as followers of other faiths, silk is particularly significant in the predominantly Christian northern and central highlands. The ancient emirate of Harar close to the border with Somalia in the east is an exception. With its strong Muslim population and culture, it was renowned for its textiles, many of them silk, including elaborately embroidered wedding shirts.

West Africa - Nigeria

The British Museum houses an important collection of textiles and raw materials from Egga (modern Eggan) in northern Nigeria acquired by the Niger Expedition in 1841. Many of the cloths and samples incorporate both locally produced silk and imported European magenta waste silk (alharini). Silk weaving was a specialist activity in Egga and surrounding Nupe towns, and the goods were made for export. Distinctive cloths, such as the popular 'guineafowl' design, were renowned as far away as Timbuktu.

Cloth types

Male weavers using double-heddle treadle looms produce narrow strips of cloth, which are sewn together to make men`s gowns and trousers and women`s wraps. Yoruba, Nupe and Hausa weavers are most closely associated with the production of silk or cotton and silk strips. Among the most prestigious cloths are those made for men`s robes that use the local Anaphe infracta silk, usually with cotton. These beige-coloured cloths are known as sanyan in Yoruba and tsamiya in Hausa. The 'guineafowl'-patterned cloth originally included a good proportion of sanyan silk in its composition. Robes incorporating this cloth were especially appropriate dress at funerals and other traditional ceremonies. Indigenous silk was sometimes

dyed with camwood or indigo and combined with imported magenta waste silk for use in gowns or as lining materials.

Embroidered gowns

In early Islamic society gifts of clothing were presented to official or members of the court to reward service and loyalty. Similarly, in the early nineteenth century elaborately embroidered men`s gowns became popular among the ruling Muslim elite of the northern Nigerian emirates. The gowns were a symbol of political and religious affiliation. One of the finest examples of these robes of honour was presented to a senior British officer by the King of Dahomey in about 1862.

Pattern

Northern Nigerian gowns are characterized by their formal composition and the consistency of the patterns used to embellish them. Several different specialized artisans are responsible for the separate stages or elements of manufacture. Notably, Islamic scholars draw the preliminary designs on the cloth for the embroidery. The most distinctive design motifs are named ‘two knives’ (aska biyu) and ‘eight knives’ (aska takwas). Their form - long triangular elements arranged in groups of two and three - and their name suggest a protective function. In North Africa swords and daggers are often used as amulets.

Ghana

Two major weaving groups - the Asante and the Ewe people - dominate silk textile production in Ghana. As in Nigeria, men weave narrow strip cloths on horizontal treadle looms. However, Asante and Ewe textiles are distinguished by their use of colour, their sophisticated composition and, most notably, by their complex weft-float patterning. Imported silk yarns or cloths for unravelling were available from at least the eighteenth century via northern and coastal trade markets.

Asante silk weaving

Two of the most prestigious types of regalia associated with the Asante royal court were gold artefacts and silk textiles. Bonwire, a village close to Kumasi, was established as the major centre of silk weaving. The Asantehene (the king) commissioned specific cloths for his exclusive use and maintained a monopoly on certain patterns. Many of the silk cloths were distributed by him to favoured officials.

Ewe silk weaving

Historically the Ewe people did not have a strong centralized government or court, unlike the Asante, so there was no established system of patronage or monopoly of silk cloth production. Ewe cloth could be acquired by anyone with sufficient financial means and were commissioned for specific occasions such as the celebration of marriage, the birth of a child, funerals or a special festival.

The most prestigious type of Ewe cloth is the which can be woven of high-quality cotton but is more usually produced in silk or a silk and rayon mix. It is specially commissioned and in terms of social significance it relates to the Asante nsaduaso cloths. Ewe adanudo cloths also used weft-float designs which are sometimes geometric but more often representational. Animals, human figures and, recently, inanimate objects derived from daily life, such as stools, forks and knives, feature prominently. On older cloths the patterns are more stylized and less readily identifiable while more recent examples are more naturalistic and explicit in their use of images. Some adanudo cloths commemorate specific historic events, such as Ghana`s independence in 1957 or the visit of Queen Elizabeth II in 1959. Proverbs provide a rich source of visual imagery often relating directly to everyday experiences.

Kente- a high value product: In **Ghana,** silk Kente cloth is made by sewing colourful, intricately woven squares of fabric into long strips that are connected to other strips, resulting

in "the cloth of kings." Each square in a Kente cloth tells a story about its king. In addition, recent events can also inspire patterns, which, if popular, are adapted as a standard.
In **Ashante Kente** being bold and bright in primary colors featuring red, green, blue and yellow and expressing a characteristic African vitality, and **Ewe Kente** being more subtle and subdued in pastel and autumnal shades that are especially attractive to European taste. The processes of applique, tie-dye, resist dye and painting are used in the creation of these textiles. Kente is the best known and most widely appreciated of all African textiles, adopted throughout the African diaspora worldwide since the 1960s as a symbol of Pan-Africanism and Afrocentric identity. At the same time it continues to play a vital living role in the culture of its creators, the Asante (Ashanti) people of Ghana in West Africa. The story of kente is closely interwoven with that of the Asante Empire and its' Royal Court based at Kumase, deep in the forest zone of southern Ghana. One of the first accounts of Asante royal silk weaving comes from the 1730s when a man sent to the court of King Opokuware by a Danish trader observed that the king "brought silk taffeta and materials of all colours. The artist unravelled them ....woollen and silk threads which they mixed with their cotton and got many colours." Silk was also imported into Asante from southern Europe via the trans-Saharan caravan trade. Many kente cloths utilised silk for a range of decorative techniques on a background of warp-striped cotton cloth, but some of the finest cloths prepared for royal and chiefly use were woven wholly from silk. Although since the early decades of the 20th century natural silk has been mostly replaced with artificial "rayon" fibres, the artistry of Asante weavers has continued to produce remarkably beautiful cloths.The cloths woven in the nineteenth century for the court of the Asantehene, the king of the Asante empire were probably the ultimate achievement of the West African narrow-strip weavers art. The raw material for this artistry came from Europe in the form of silk fabrics which were carefully unpicked to obtain thread which could then be re-woven into narrow-strip cloth on looms that utilised two, and in some cases even three, sets of heddles to multiply the complexity of design. The king's weavers were and still are grouped in a village called Bonwire near the Asante capital of Kumase, part of a network of villages housing other craft specialists. Men's cloths, which were worn draped toga-fashion, are larger, around 3 metres by 2 metres. Women's cloths, which were usually worn in pairs, are about 2.5 metres by 1.5 metres. By virtue of its acknowledged beauty, Kente cloth commands a high price, the weavers add much value to their raw material and Kente weavers traditionally enjoy the highest incomes of all craftsmen in Ghana. Some Asante kente cloths are woven from cotton, a very few highly prized heirloom pieces are silk, but the vast majority are woven from rayon, which was adopted by Asante weavers as a substitute for more expensive silk soon after it became commercially available, at least by the 1930s/40s. Rayon has been used for some of the finest 20th century Asante textiles and is often found in cloths in major museum collections.
Since the successful take off of the FAO project TCP/GHA/2802, the demand of kente weavers for cheaper locally produced silk yarn is gradually being met and some of the silk kente produced is used in the production of handicrafts such as neck ties, bow ties, headgears, traditional sandals, traditional drum and other musical instruments, caps, table mats, cushion covers, fancy fans, dolls, stolls necklace and ear-rings. These are produced from silk fabric and silk yarn.

Madagascar
Madagascar`s many distinctively different textile traditions reflect the numerous waves of people who have settled on the island over the centuries. The most prestigious of these textiles have been made of silk, whether from the local variety of silkworm, landibe (the big worm), or the more recently introduced Chinese silkworm Bombyx mori, known in Madagascar as landikely (the little worm). Just as silk in Ethiopia was associated with the emperor and with

Christianity, in Madagascar it was associated with royalty, immortality and the deity, 'Fragrant Lord' being a literal translation of one of the Malagasy words for silk. The many different words that describe the variety of silk types and their different qualities indicate the importance of silk in Malagasy culture.

The Merina and Betsileo people are the principal silk weavers in Madagascar, and until recently all weaving, including the production of silk cloth, was undertaken by women. One of the most important woven items in Madagascar is the ***lamba***. The term lamba is a generic name for all cloth in Madagascar; however, it has come to describe the shawl that is habitually worn by Malagasy men and women, rich and poor.

Silk for the ancestors

Shrouds (***lamba mena***) are the most prestigious - and expensive - of all Malagasy textiles. Cloth woven from silk produced by the local variety of silkworm, though dull in colour, is extremely tough and durable, making it the most appropriate dress in which to approach the afterlife.

From the nineteenth century the royal court and aristocracy of the ruling Merina people of the central highlands began to use elaborately patterned silk cloths called lamba akotofahana. These textiles could be worn as a mark of status both for the living and, ultimately, for the dead. They were used as an additional shroud in the elaborate 'second-burial' rituals (famadihana) which, like much else in Malagasy culture, has its origins in Indonesia.

Pattern and colour

Most Malagasy textiles express their predominant design in the warp. However, weft-float patterns became an increasingly important feature of Merina textiles in the nineteenth century. Merina weavers were able to weave bands of complex pattern because of two principal innovations. Firstly, in the nineteenth century King Radama I introduced the Chinese silkworm to the island, which provided Merina weavers with the long, fine silk threads needed to create weft-float patterns. Secondly, Merina weavers adapted their looms, which are very similar to the technically simple ground looms of North Africa and the Middle East, to include one or more supplementary heddles suspended above the loom. Each of these heddles could then be manipulated to produce a band of complex pattern floating across the warp of the textile. In addition, weavers worked with many sheets of paper beside them; each sheet was a written record of the sequence of heddle manipulations required to produce a desired pattern.

Many, if not all, the pattern elements on the lamba akotofana were named. Those that are still recorded include ravim-pibasy (a leaf), vato peratra (stone shapes arranged as a diamond) and kintana (a star). Some patterns are derived from trees and flowers - these probably relate to the system of honours that helped to define the complex hierarchy of the Merina kingdom in the nineteenth century. Just as the complexity of the designs of the Ethiopian shamma were an indication of the wearer`s status, the combination of warp stripes and float-patterned bands on the lamba akotofahana fulfilled a similar purpose. A distinction was also made between amboradara lehibe (the great brocade), and amboradara kely (the small brocade) as it was between the silver brocades and the gold brocades.

Colours undoubtedly added a further dimension to the significance of the cloth. The colour red had been associated for centuries with royalty (who among the Marina were thought to be immortal), vitality and mystical power.

During the colonial period the Malagasy monarchy and the Merina kingdom lost its power and authority, and at the same time the significance of the colour and patterning of the lamba akotofahana dwindled. In the nineteenth century white had been a colour associated with subordinate people, commoners and slaves, but in the post-colonial period the wearing of white silk lamba has became a mark of prestige and status. Some of the patterns of the lamba akotofahana, as well as the technique of weaving them, were also preserved, though in a

white-on-white design. An innovative group of weavers from the town of Arivonimamo, near the capital Antananarivo, have revived the weaving of lamba akotofahana in recent years. Researching old designs and weaving techniques has allowed them to create high-quality textiles, yet mainly for the export market.
Since a few years, some workshops and designers are promoting important changes in the use of silk fabrics for local market and open new opportunities for export. The main changes are:

- the enlargement of the use of silk garment which is no more the privilege of elder women of the upper class with traditional lamba; younger generations, including men, wear different silk garments: modern shawls, dress, jacket,
- the creation of new types of fabrics, as the new “modern shawls” with loose weaving, natural or dyed,
- the mixing of mulberry silk with other natural fibres, particularly the wild silk and the jabo with raffia,
- the enlargement of the markets: national, tourist and export markets; garment, decoration, furnishing, bedding, fashion products.

All these diversified products keep the originality of Malagasy silk: a natural material with a rough texture and the character of handicraft products.
Importers from Europe and the USA are interested by these original fabrics. However the workshops and designers cannot meet that demand because orders are generally too big for their weaving capacity and raw material (silk) is too scarce for a regular supply in the year.

Tradition and change

It is often suggested that many African textile traditions are in imminent danger of disappearing in the face of mechanization, imported goods, changing social structures and modern fashions. However, while it may be true that certain traditions are in decline, others are taking their place just as rapidly. Throughout the continent there is probably more distinctively African cloth being manufactured today than at any other time.
The use of silk and the traditions it has inspired have always been associated with status and prestige, with aristocracy and royalty, with ancestors and even with deities. Silk textile traditions have been sustained by the continuing demand for prestigious, culturally significant cloths, such as those worn at marriage in North Africa. These glamorous textiles are less exposed to competition from imported goods than more everyday, utilitarian textiles. On the other hand, silk weaving traditions may be more vulnerable to sudden social or political change, as with the disappearance of the lamba akotofahana in Madagascar. This type of cloth was directly linked to a royal and aristocratic hierarchy that was largely dismantled during the colonial period. However, in recent years silk weavers in both Tunisia and Madagascar, while continuing to make silk cloths for local people in styles to which they have become accustomed in the post-colonial era, are also experimenting with designs and patterns not used since the nineteenth century.
In Ethiopia weavers are producing more shamma than ever before, and clients can now choose from literally dozens of different designs for the patterned band (tibeb). However, the tibeb is often woven of rayon rather than the traditional silk - an example perhaps of a modern, synthetic material stimulating rather than stunting an ancient tradition. A similar development can be seen in West Africa, where the silk kente cloth of the Asante is now frequently woven in rayon and is worn by a much wider cross-section of Ghanaian society. Kente cloths are often worn in place of a suit and tie on formal occasions. The designs and patterns are neither as numerous nor as complex as in the past, but there is no denying that kente is now an international phenomenon, familiar around the world.

Not so familiar, but now becoming widely available outside Egypt, are the textiles produced in the old silk weaving town of Naqada in the Nile valley. One design in particular, originally woven in cotton and silk for women in the oases of the Western Desert, has a remarkable story. When demand from their traditional clients waned in the mid-twentieth century, the weavers of Naqada found new markets in Sudan and Libya weaving cloth with the same basic design but using an array of brightly coloured rayon and occasionally lurex yarn. When political tension led to the collapse of these new markets, an assisted silk-weaving project was initiated for a new export market. Many women in Naqada began to weave on treadle looms - their use by female weavers had previously been strictly taboo, not just in Egypt but throughout Africa. Today textiles from Naqada may be found in shops around the world. However, those who buy them are probably unaware of the fascinating silk weaving tradition of which they are a part and which encapsulates the dynamism and versatility of so many textile traditions throughout Africa.

2.1.2.2. Europe

Bulgaria

The silk handcraft cottage industries in Bulgaria have been very well developed during 17 - 20th centuries. Around 150-200 t fresh cocoon annually have been utilized for home silk reeling and processing. The silk reeling was practiced by using the so called “Vratza’s type reeling machine (“dolap”), which even in the end of 19th century was more modern than the charka reeling machines widely used today in some countries. The silk handcrafts produced have been handloom woven silk fabrics, called “burundjuk”, fabrics, having cotton warp and weft of silk, wool and silk hand-knitted sweaters, lady’s blouses knitted by pure silk, knitted bed/table covers, doily, embroidery and usage as tinsel for tunic decoration. The local silk handcraft cottage industry played a very important role to preserve the sericulture during some periods of crisis in the international silk trade. However the local silk handcraft cottage industries have not been market oriented, but for meeting the personal needs of the farmer’s family only, thus with the urbanization and industrialization of the country in the second half of 20th century and gradual disappearing of the local traditions in the wear and national costumes, inactivation and nearly disappearing of home silk reeling and weaving industry occurred. After the transition from centralized to market economical system many people especially in the rural and semi-urban area have become unemployed thus the revival of silk handcraft cottage industries in nowadays would give a very good chance to provide job opportunities and income resources.

Romania

The silk fibers obtained in household, known as “borangic” were woven in all the Romanian regions on horizontal looms. The traditions of weaving and sewing are maintained in many centers of ethnography and folk that belonged to the Ministry of Culture or in the co-operative units of handicrafts. The handicrafts products of silk have been realized in order to be utilized as fabrics or sewing (embroideries) for clothes or different decorative objects in the living space or in churches. During the centuries, the Catholic and Orthodox cathedrals and churches have been abundantly ornamented with decorative objects made by silk, some of them being still in those churches and some being restored and kept in the custody of the Art Museums. Also the silk thread and fabrics were used to make and decorate the horse harness, the flags and fight signs of the nobles and the book covers.
When the silk thread was obtained in a large number of households, that happened at the end of XIX-th century and in XX-th century till around 1990, was woven in horizontal looms,

being obtained simple fabrics of raw silk and were cut into traditional blouses and shirts, embroidered with different motives specific to Romania sewing. There were also woven “marame”, head-kierchieves of different types for head covering. The raw silk fiber used in these fabrics could be non-twisted or weekly thrown, single or in combination with other natural threads, flaxen or cotton. The main silk seams are utilized to embroider the feast blouses and shirts, the table covers, towels and coverlets.
The traditional feast costume from Sibiu presents embroideries with black and yellow threads on the fine white linen. Other sewing realized especially in the XIX-th and XX-th centuries are represented by the table cloth. The embroidered fabric is made by flaxen.

The ancient techniques have been transmitted from a generation to another or there have been adopted and adapted new techniques from other nations, the Romanians being receptive to novelty and original in creation of new products and ornaments. One of the most significant handicrafts product of the Romanian everyday life is represented by the national costume and its accessories. This costume had a functional role but also an aesthetical one, with elements of tailoring and texture common in all the Romanian regions, but with a great variety of ornaments and motives of coloring and embroidering.
At present, the Silk Reeling Plant from Lugoj stopped its activities and Romania provides by import from China the total necessary of natural silk fibers and from Italy, China and Korea the necessary of natural silk fabrics.
In Romania the handicrafts production was made in the co-operative units or by individual handicraftsmen for obtaining traditional “marame” and silk embroideries.
So, there are produced even today “marame” (traditional head-kerchiefs), traditional costumes (silk embroidered blouses or some specific elements “catrinta” or “fota”), man’s shirts, decorative traditional towels (destined as gifts at weddings or to decorate the icons in houses or churches), wallets, different knitting, tassels, pillow and table cloths, coverlets.

2.1.2.3. Central Asia

Many ethnic groups in **Afghanistan** and nearby northern **Pakistan** are well-known for their carpets, but groups such as the Pashtun have also produced beautiful, intricately embroidered textiles, sometimes embellished with beadwork. Most are costume pieces or household items such as cushion covers, tray covers, etc. The following commodities were all made in the 20th century, and most are joyful, colorful articles that greatly enlivened the austere and often harsh environments: *Katawaz Cushion Cover,* Silk embroidery on cotton; *Pashtun Child's Vest,* Ghazni area, Silk, silver, and gold embroidery on cotton; *Katawaz Blouse,* Silk embroidery on cotton; *Pashtun Decorated Cuffs,* Katawaz, Silk embroidery and beadwork; *Katawaz Cushion Cover,* Silk embroidery on cotton; *Pashtun Embroidered Tray Cover,* Silk chain-stitch embroidery, mirror-work, silver braid and beaded fringe; *Pashtun Child's Vest,* Ghazni area, Silk, silver and gold embroidery on cotton, with beaded trim

At the present time, interesting specimens of silk brocades and velvets are woven in the brocade workshops in **Iran**. These specimens compete favourably with the best hand woven examples of this traditional art of the past period. Although the brocade designs are based on the classical combination, yet they, like other Iranian arts, lined themselves to new forms and combinations too. The raw materials of brocades, which are silk and lace, play an essential role in enrichment of this art. Dyeing of silk used in brocade is carried out by means of natural dye stuffs, hence it is valued greatly. These dyes remain fast and stable for many years. The surface of brocade woven piece is in the form of "lapehbaf", "darabi" and "atlasi", and the designs prevalent today are "boteh jeghehi" (bush aigrette), "eslimi mari" (snake like), "eslimi darham" (mixed), scattered flowers, hunting ground, feasts, bottle spectacles, animals and calligraphy. Abstract designs are rarely found in brocades of today. Technical

improvements have led to speed of weaving and accuracy of designing; and the quality of raw materials has improved, as compared with that of the past. Brocades are woven with old tools "dastoori" and "jackard". Today brocade art has occupied special place and the pieces of work found in the exhibitions attract spectators attention.

2.1.2.4. The Near East

In **Jordan** the process of making shawls and table runners involves two sets of artisans and takes days to complete. First the women in Salt, Jordan, in the Noor al Hussein Foundation project, weave the cloth using handlooms and traditional methods. The shawls and table runners are then picked up by a transporter and delivered to Hebron where the distributors collect and distribute them to the embroiderers. Each beautiful, completed shawl or table runner is thus the work of two highly skilled artisans whose work reflects their cultural heritage. Jordanian designs reflect the rich history of the area and are inspired by the many ancient and contemporary cultures which have passed through the country.

Syria

Brocar (Brocade): It's a silk fabrics brocaded with golden strings to give it a special glamour with beautiful, its paint draw from Damascus daily life, Islamic decoration, and Arabian Islamic and European history.

Damascu: Silk fabrics known by embroidery, it embroidered by paints for knights, hunters, trees, plants and fruits its name derivative from Damascus city name. Most of its usage is for furniture upholstery and curtains each cloth width between 145cm and 220cm. In the beginning it had been produced from natural silk yarn by manual looms with pedals, the pedals number changes according to colors number in the texture. In the past, the paints were inserting by hand and needle. In the present time Damascu no longer made of natural silk, we can find it nowadays made of artificial industrial silk and cotton or just cotton.

Alagabaany: It is natural silk sheets, at first it has known in Aleppo and Homs Then in Damascus. It is silk weaving in its warp and weft, then it been embroidered by hand and needle with natural silk string by tighten it to wooden table.

Alhibreyah: It is a head kerchief for women; it is natural silk in its warp and weft in white color, after that printing process goes on according to the kind of Hibreyah and request of the client.

Al hatataah (for men): It is a head kerchief for men use; it can be white or colored as request and manners of each area that will use it. Its consumption was in large quantities in 18^{th}, 19^{th} and 20^{th} centuries. It was exported to Palestine, east Jordan and Iraq in addition to its local consumption.

2.1.3. Silk handcraft cottage industries based on semi - industrial methods of production.

European tradition in silk knitting - the United Kingdom in the past: Silk knitted stockings began to reach England in Tudor times. Henry VIII and later his son, Edward VI, were each given a pair of long Spanish silk stockings which drew much admiration at Court. It was one of her subjects, a Nottinghamshire curate named William Less, who around 1590 invented a hand loom called the stocking frame. Within less than a century, knitting in silk was a well established cottage industry, located principally in Derbyshire, Leicestershire and Nottinghamshire. By the 18th century, framework knitting kept whole families in employment in their own homes. Children were put to work, winding hanks of yarn onto bobbins ready for use and seaming the finished goods. In addition to stockings, output included silk scarves, neckties, shirts, vests and underwear. As time went by, fashion

demanded mittens, 'ladies dresses' (later called combinations) and tasselled smoking caps for gentlemen. This silk knitting cottage industry survived until the end of 19th century.

East Europe – Bulgaria

Silk knitting cottage enterprise in Vratza: The silk and blended knitted garments cottage based production development is considered to be promising for Bulgaria and during 1998-2003 the government with the help of FAO has made efforts to establish a pilot silk knitting enterprise at the Sericulture Experiment Station in Vratza. The knitting enterprise is equipped by especially designed sets for reeling thick denier silk, suitable for knitting. The average denier of this silk is 150-200. Then the raw silk is processed through the operations of winding, twisting, degumming and dyeing in order to produce silk yarn on cones, ready for the knitting process. There are small modern knitting machines which are Swiss made, computerized and having more than 600 patterns in their memory. The machines are specially designed for home use and production of boutique garment, namely they have small capacity of production, but allow producing a huge varieties of patterns. The knitting machines have the ability to accept new patterns in their memory by an outside computer. The unit is equipped also with the necessary sawing machines used for tailoring the ready for the market garments. The unit produces not only pure silk knitted goods but also blended with cotton, wool, linen, likra, poliester, viskose, poliacril etc. in order to decrease the costs and the market price. One other product are the hand made winter knitted sweaters made by blend of silk/wool or silk/cotton. The unit provides the yarn and models to home knitters (women) and then pay to them for their work. Now the cottage silk knitting unit in Vratza is able to produce machine knitted pure silk ladies blouses in more than 10 colors ,pure silk knitted scarves , as well as spring/autumn ladies and men's blouses , sweaters and cardigans made by silk blended with cotton ,acrylic ,linen, polyester or viscose ,winter men's and ladies hand made sweaters and cardigans made by silk blended with wool.

Uzbekistan experience: The Uzbek Ipagi association produces national style silk fabrics ("bekasaba", "shoii", "poshshoii"), sellable mainly at the local market and exported to the neighboring countries in the region. The tie and dye technology is used. The production of dyed warp yarn is partly mechanized and the weaving is by power looms. Therefore Uzbekistan is a good example for putting the mass production of national style silk fabrics on a semi - industrial basis. Other direction of Uzbek Ipagi activities is the production of silk carpets, which is an old traditional activity in Uzbekistan. However unlike other countries such as Iran, Turkey, Egypt etc. where the silk carpet weaving is practiced as a home enterprise, in Uzbekistan it is organized in special weaving departments in the silk weaving factories. A good example is Bukhara - Samarkand Silk Carpet Factory which enterprise produces silk hand-made carpets as single specimens. The output is of high demand in the world market. Sales are effected, as a rule, directly from the enterprise to foreign tourists. The productive capacity of the enterprise is 200 carpets a year. The company's strategy is not aimed at the increase in output since in such an event there might be deterioration in quality and loss of exclusive image of the enterprise.

2.2. Silk reeling machines/techniques, used in the cottage industries.

The silk reeling machines used in Africa, Europe, Central Asia and the Near East for production raw silk, which is further used for handcraft products are as follows:

- Vratza's type improved "dolap" (Bulgaria)
- Arabian wheel (Egypt, Syria)
- Turkish reeling machine (Turkey)
- Two-ends reeling machine for thick denier raw silk (Bulgaria)

- ❖ Direct multiends silk reeling machine (Azerbaijan, Syria, Tajikistan, Uzbekistan)
- ❖ Multiends reeling machine with small reels (Egypt, Ghana, Uganda)

The first three machines are simple and with some modifications are versions of the Italian floating system of reeling which is associated with 1) reeling of cooked cocoons which float in the reeling basin, 2) high speed reeling, 3) high basin temperature reeling and 4) less number of reeling ends. This version of reeling will improve the reelability of inferior and defective cocoons without considering the quality of silk. The device consists of a large cooking cum reeling pan where boiling water is kept. The cocoons are cooked in it and filaments collected in a bunch after brushing are passed through a hole on an ordinary thread guide device. Afterwards, the thread is crossed with another co-thread for forming a chambon type croissure or the crossing of one same thread (Tavlette type croissure) in order to agglutinate the filaments and remove the water from the body of the thread. Then it is passed through a distributor before it is wound on to a large wooden reel. Two to four threads are maintained in this device. One person rotates the reel by hand and another person sitting near the cooking pan manipulates the cocoon cooking and reeling. The raw silk produced is generally coarse and suffers from many defects since no improvement devices such as button and standard croissure system in reeling are used. Also this silk is not re-reeled. The production of silk per device per day is about one kilogram. There is no standard (uniform) mechanism for this machine, therefore it varies in construction from region to region.

The **two-ends reeling machine for thick denier raw silk** was designed and manufactured in Bulgaria for reeling thick denier (180-200 denier) raw silk, necessary for silk knitting by knitting machines gouge 5 and 8. The set consists of **cocoon cooking device**, **cocoon brushing and groping end device** and **two machines for silk reeling.** Usually 2 workers serve the reeling set, but it is possible only one worker to work also economically by it. All the processes are driven by electricity, therefore there is no need of any steam boiler. **The electricity expenses** for production of 1 kg raw silk 200 D are **30.33 kw** in capacity of production 1.600 kg raw silk/8 h.
The water expenses for production of 1 kg raw silk: **125 l** ; **Number of reeling basins**:2; **Number of ends**: 4 (2 per each basin).
Each end has jettebout for easier casting the cocoon filaments in order to increase the efficiency of reeling.
Cocoon cooking device: using two pot cooking method, and having 3 stainless steel pots (2 for cooking and one for keeping the already cooked cocoons before brushing)
Cocoon brushing and groping end device: 2 brushing basins, each having separate mechanical brush with plastic hair, driven by electricity. There are two speeds of brush movement, according to the cocoon quality.
Reeling machine: Each reeling basin has attached 2 jettebouts, 3 rolls for making Tavellette type croissure, traverse guider and a big reel, having circumference of 1.5 meter. After reeling the skeins are taken off the reel and can be directly winded on bobbins. There is no need of re-reeling. The temperature of water in the cooking pots, brushing and groping end pots, and reeling basins is maintained automatically.
Productivity: Since the machine was designed for reeling thick denier raw silk, each basin has only 2 ends and is able to produce about 0.8 - 1.2 kg of raw silk 180-220 D (or 1.6 - 2.4 kg per set) per one shift (8 h) according to the cocoon quality and skill of the worker.The machine can be used to produce any thickness of raw silk, but for example if produce 20/22 D, in spite of the higher reeling speed, the productivity per basin/shift will go down to about 350 g raw silk.

The direct –reeling machine designed for reeling a silk hank of 150 cm circumference, in conformity with international standards, was originally designed and manufactured in France and Italy. At the beginning of 20th century especially popular was the "Batalia" model, produced in Italy. This model was copied in the Soviet Union and further manufactured, under the name KMS – 10. These machines are still popular in Uzbekistan, Azerbaijan and Georgia. The silk reeled by this method can be directly used for winding operations which is the first operation in the conversion of raw silk into twisted silk yarn. In this machine the cooking basin for every set of two reeling basins is provided with mechanical brushing arrangement. The standard reels are encased with a built in heating arrangement and each reel is provided with an independent traverse and breaks. Each reeling basin has 8-10 ends, equipped with jettebouts. The specificity of this system is also that the reelers are seating on chairs in front of the reeling basins and the cabinet with the reels is situated behind them. Raw silk production (20/22 D) per one shift per basin is varying from 600 to 800 g.

Multiends reeling machine with small reels: One of the most advanced model of these machines is those designed by CSTRI, Bangalore, India. This kind of machine was provided to Ghana through the FAO TCP project. The technological advantages of this machine are as follows:

- The machine is designed with standard specifications having 10 ends per basin, 10-12 basins per unit (5 to 6 basins on each side).
- The machine frames are build on cast iron structure and are sturdy in nature.
- In multiend reeling basin, appropriate thread passage is provided to keep the reeling tension within the optimum level (0.3 to 0.4 gms/d) and to give proper croissure.
- Specially designed reeling basins made of stainless steel having dropped cocoons and pupa collection partitions and steam, water drainpipe connections are provided. The reeling basin water temperature is 40-45 ^{o} C.
- Jetteboutes made of nylon material with brass sleeve for smooth drive, fitted with clutch type engage and disengage arrangement are provided and driven by 5 mm diameter polyurethane round belt at a speed of 600-800 rpm.
- Nylon reels of 68 cm circumference placed on hollow reel shaft of 32 mm outer diameter are used for smooth noiseless rotation and easy unwinding of silk during the re-reeling which makes the machine more efficient. The reel speed for 20/22 D raw silk is 100-120 m /min.
- Effective individual reel stop motion device is incorporated to prevent the breakage of silk yarn during reeling and to enhance overall working efficiency of the basin.
- Variable speed drive unit is provided to change the reel speed between 80 to 250 rpm depending on the quality of cocoons reeled.
- Planetary gear type thread distribution system (Traverse) is used to wrap the threads on the reels without ridging.
- Drying arrangement is made at the small reels zone to dry the silk during reeling. If the silk is wound on to the reel without drying, then there will be occurrence of lot of gum spots in the small reel leading to more number of breaks during re-reeling. At the same time, the silk should not be over dried as it affects the quality of raw silk. The recommended temperature in the drying zone is about 35 - 40 ^{o} C with relative humidity of 40 – 50 %. In the case of multiend reeling machine, 2-3 steam pipes of diameter 40 mm to 50 mm are used.
- Reeling button is an important gadget in reeling for removing the slugs in the raw silk and hence improve the cleanness of the raw silk. The machine is equipped with porcelain/ceramic buttons with an appropriate hole size depending upon the denier of

the raw silk reeled. To overcome some defects of the ceramic buttons, metallic buttons have been developed.

- New type plastic croissure pulleys are incorporated (4 pulleys per end) for smooth reeling.
- The main drive arrangement having 1 HP motor 3 phase 400 volts is provided with electrical control panel board and technogenerator unit.

The productivity per basin/shift is about 1 kg of raw silk.

2.3. Silk handcrafts production techniques.

HANDLOOMS AS THE LARGEST COTTAGE INDUSTRY

Handlooms are an important craft product and comprise the largest cottage industry. Millions of looms are engaged in weaving cotton, silk and other natural fibers.

In the weaving operation, the lengthwise yarns that form the basic structure of the fabric are called the warp. The crosswise yarns are the filling, also referred to as the weft. The filling yarns undergo little strain in the weaving process. In preparing them for weaving, it is necessary only to spin them to the desired size and give them the amount of twist required for the type of fabric for which they will be used. Yarns intended for warp must pass through such operations as spooling, warping, and slashing to prepare them to withstand the strain of the weaving process. In spooling, the yarn is wound on larger spools, or cones, which are placed on a rack called a creel. From this rack, the yarns are wound on a warp beam, which is similar to a huge spool. An uninterrupted length of hundreds of warp yarns results, all lying parallel to one another.

Essential weaving operations: On the conventional loom, the warp yarns that are to run lengthwise in the fabric are wound on a cylinder called the warp beam, which is at the front of the loom. The warp also extends to a cylinder called the cloth beam, which is at the front of the weaver and on which the fabric is rolled as it is constructed. Supported on the loom frame between these two cylinders (the warp beam and the cloth beam), the warp yarns are ready to be interlaced by the filling yarns that run in the width of the cloth, thus producing the woven fabric. In any type of weaving four operations are fundamental. They are performed in sequence and are constantly repeated. The essential parts of the loom are the warp beam, cloth beam, harness or heddle frame, shuttle and reed. These parts perform the following operations:

Shedding – raising warp yarns by means of harness of heddle frame.

Picking – inserting filing yarns by means of shuttle.

Battering – pushing filling yarns firmly in place by means of reed.

Taking up and letting off – winding the finished fabric on the cloth beam and releasing more of the warp from the warp beam.

As the shuttle moves back and forth across the width of the shed, it weaves a self – edge called the selvage on each side of the fabric. The selvage prevents the fabric from revealing.

Some handlooms are equipped with the so called “flying shuttle”, which increases remarkably the weaving productivity. There is a system of threads and when the weaver pulls the end of the thread the shuttle moves very fast.

The technique for **silk carpet weaving** used is nearly 3000 years old. First, the silk is carefully selected. Next, the silk yarn is degummed dyed. Carpets are made on a vertical loom by hand-tying knots of silk yarn around pairs of warps (vertical strings running through the length of the carpet). Asymmetrical knots are mainly used. After each row of knots a weft (a plain thin horizontal thread) is inserted in-between the pairs of warps and packed down tightly using a hand beater (a special comb). After a few rows of knots are finished, the pile is cut by hand using shears to achieve a uniform length. The design pattern is woven by alternating knots of different colour silk yarn.

TIE AND DYE WEAVING: PREPARATION AND PROCESS INVOLVED IN TIE AND DYE WEAVING: The process of tie and dye weaving starts with preparing the warp and weft from the degummed silk yarn. Squatted on the floor, women reel threads from primitive spinning wheels to load bobbins. Giant spinning wheels are employed to prepare the warp, which forms the length of the fabric. The warp is fastened between two poles set apart and marked according to the design. For preparing the weft (which forms the width), a fan-shaped, spiked wooden frame is used. Strand upon strand of yarn is deftly wound between the spikes and the converging rod at the other end of the frame. The yarn is tied with threads and strips of rubber, in line with the predetermined pattern marked on it. The warp and weft yarns are individually knotted and wrapped tight enough to prevent the dye from penetrating into it when dipped in different colors. This is called double-tie-dye method. The process of tying and dyeing is repeated several times depending on the number of colors required by the design. When the yarn has dried, the wrappings are carefully removed. The yarn, which is to become the length of the fabric to be woven, is stretched on the loom while the weft yarn is once again transferred to the fan-shaped wooden frame. At this stage one can see the patterns emerging, ready to be woven together. Its popular name, however, is Ikat. The technique involves great skill and precise calculations by the textile artisans. The design is very colorful, intricate and attractive but at the same time very complicated. It takes nearly 15-20 days to weave a cloth of 20 metres. The woven fabric is taken out of the loom and given a starch-polish before sending it to the showroom.

IKAT

An Ikat is a piece of cloth woven from fibers that have been dyed prior to weaving. Either the warp threads (the lengthwise fibers in a cloth) or the weft (the crosswise fibers), or both fibers, can be bound and dyed before stringing on the loom. The word "Ikat" is derivative of the Malaysian word "mengikat" which means, "to tie". Ikat refers to binding fibers with grasses, plastic or other impenetrable materials to form a "resist", an area where the dye bath will not penetrate. The dyeing process is repeated numerous times with different colors to produce a repeat pattern. After the warp, weft, or both are dyed, the fibers are then set on the loom and woven. The process of weaving the pattern after the fibers are dyed produces a blurred effect, because of the capillary action along the yarn, or the way the yarns absorb the dye. It creates a fuzzy edge that is accentuated during weaving. In Central Asia, the weaving process is called "Abra" meaning, "cloud". The ikat dying process can be found in many parts of the world. Some diverse examples of the process have been found throughout history in Pre-Columbian Peru, Egypt, the Middle East, India, Japan, Southeast Asia, Guatemala, Nigeria and Central Asia. The Ikat was developed to a fine art during the Middle Ages to the Renaissance in the above areas of the world as tapestry was developed in Western Europe.

This technique involves a time-consuming process to dye the horizontal (weft) threads before weaving. The uncolored weft threads are arranged on a frame and every break in the color of the final design must be tied off with a water-resistant plastic thread. Small amounts of dye

will seep past the thread resulting in the irregular edges of ikat patterns. Before dying each color, plastic tape is wrapped around the sections where the weaver does not want that color to be absorbed. The silk is removed from the frame, soaked in the dye, then the protective tape is removed and applied again to protect from the second dye, and so on. Weft ikat, or mat mi, is the technique of resist-dyeing the weft (the thread carried by the shuttle), by tying groups of wefts with plastic string. The weft resists dye penetration when immersed in dye. When the plastic strings are removed, the undyed parts reveal a pattern.
An experienced weaver can produce about 8meters of plain unpatterned fabric in a day, but the pace of work on complex patterned textiles is much slower. In some cases it can require a whole day to produce just one inch of material. **Supplementary thread patterning:** This technique involves placement of an extra thread beside each of the horizontal (weft) or vertical (warp) threads. Positioning this thread above and below the material can create elaborate raised patterns. Continuous supplementary thread patterns are made when a predictable pattern in a single color runs across the whole material. Discontinuous supplementary thread patterns are made when a complex pattern of different colored threads must be embroidered into the material. The incredible labor involved can be appreciated by examining the reverse side of the material where the loose ends of the supplementary threads are exposed.

BATIK

The word **batik** actually means 'wax writing'. It is a way of decorating cloth by covering a part of it with a coat of wax and then dyeing the cloth. The waxed areas keep their original colour and when the wax is removed the contrast between the dyed and undyed areas makes the pattern. The creation of batik is a three stage process of waxing, dyeing and dewaxing (removing the wax). There are also several sub-processes like preparing the cloth, tracing the designs, stretching the cloth on the frame, waxing the area of the cloth that does not need dyeing, preparing the dye, dipping the cloth in dye, boiling the cloth to remove wax and washing the cloth in soap.
Two methods of applying wax are used. The cloth is hung over the frame and the design is drawn on with a canting, a small copper cupped spout which is attached to a bamboo or wooden handle. The canting is dipped into a pot of hot wax and then allowed to flow through the spout on to the fabric. On thicker fabrics the waxing is carried out on both sides. The cloth is stretched on to long tables and a cap or copper stamping tool is used. This is dipped into a pan of hot wax and pressed on to the fabric. This enables the design to be repeated many times and is usually done on both sides of the fabric by men. This is a much faster method of wax application. The traditional dyes used are deep indigo blues and soga browns and these are still the characteristic colours for work in central Java. Towards the end of the 19th century chemical dyes were introduced in the coastal regions and as a result of this the colours are usually brilliant and more varied. The final hand made lengths of cloth, known as Tulis, may take several months to produce and are consequently very expensive.
The characteristic effects of the batik are the fine cracks that appears in the wax, which allow small amounts of the dye to seep in. It is a feature not possible in any other form of printing. It is very important to achieve the right type of cracks or hairline detail for which the cloth must be crumpled correctly. This requires a lot of practice and patience. Knowing how to use the wax is of prime importance. The ideal mixture for batik wax is 30 per cent beeswax and 70 per cent paraffin wax. For first timers even the melted wax of a candle is adequate. It is the skillful cracking that is important. While applying, the wax should not be overheated or it will catch fire. Correct knowledge of colours is also important. Practicing on small pieces of cloth helps in the beginning. Patience is of course a very important factor too. The cloth used should be strong enough to bear the heat and wax. Cambric, poplin and voiles are used

besides pure silk. Synthetic fabrics should be avoided. Since handmade batik is unable to meet with the consumer demands very often the answer is tjaping with a copper block. A tjap is a metal block made of copper strips into the required design after which it is stamped quickly and with great force. Batik is created in several ways. In splash method the wax is splashed or poured onto the cloth. The screen-printing method involves a stencil. The scratch and starch resist are the other methods.

In many **kente** cloths the design effect is achieved by the alternation of regularly positioned blocks of pattern in bright coloured silk with the more muted colours of the warp-striped plain weave background. Interestingly it is the background designs, the configurations of warp stripes of varying widths, that provide the basis for most pattern names. Most designs are produced by combining two distinct decorative techniques. The first, supplementary weft float, involves the addition of extra weft threads that do not form part of the basic structure of the cloth. Instead they float across sections of the ground weave, appearing on one face of the cloth over may be six or eight warp then crossing through the warp to the back, floating there, then returning again to the top face. Rows of these wefts are arranged to form designs such as triangles, wedges, hour-glass shapes etc. Asante weavers distinguish loosely spaced floats, which they call "single weave", from more densely packed designs that conceal the background completely and are known as "double weave." The second effect is to create solid blocks of coloured thread across the cloth strip entirely concealing the warp. Without dwelling too much on the technicalities, this effect is achieved by the use of a technical innovation unique to the weaving of southern Ghana, namely the use of a second set of heddles that has the effect of bunching together groups of warp threads allowing them to be hidden by the weft. The design of most kente cloths involves framing areas of weft float decoration within the narrow solid bands called bankuo. The finest and most elaborate examples of this style and perhaps the most spectacular cloths ever woven in Africa, completely covered the underlying warp design with alternating sections exploiting the full range of weft float designs between very narrow bands, producing a cloth named Adwinasa, meaning "fullness of ornament."

SILK KNITTING

The process of silk knitting is less complicated than weaving, avoiding a lot of operations necessary for preparation of the warp yarns. The silk yarn for knitting should have lower twists per meter, namely ~ 90-120. The silk yarn is transferred from skeins to cones, suitable for knitting. The yarn should be completely degummed and/or dyed. For the cottage type industry flat type jacquard knitting machines are used for silk knitting. The machines produce silk knitted cloth which is cut out and tailored to make the garments. The pure silk knitted cloth is suitable for production of lady’s blouses, cardigans, scarves etc.

SILK PAINTING

Silk painting is a direct paint-on method. Dyes are applied to silk fabrics using an exciting array of water colour techniques. The brilliant translucent liquid colors merge to become an integral part of the fabric, which always remains soft to the touch. Silk painting is not static. Movement and fluidity are the hallmark of this art form. As the hand of the artist delicately guides the flow of the liquid, the colours glide through the silk and generate delight and excitement. Historically, fabric painting was and continues to be very popular in the Far East: Kimono art in Japan, delicate Chinese paintings on silk and beautiful intricate batiks from Indonesia. Silk painting as we know it today, was popularized by a French artist, Litza Bain.

Bringing together the techniques first used by French milliners and silk flower makers as well as Russian artists who emigrated to France in the early part of the century, she combined these elements and developed a system for silk painting. She started to teach the art form in the early 1960s. Since then, silk painting has risen in popularity as artists the world over have found this a uniquely attractive method of decorating fabrics. Silk painting is creating art on fabric with silk as the canvas. Silk paintings can be designed as Art to hang, functional, such as wearable art or for home décor. Quilters, sewers, interior and fashion designers have found hand painted silks very useful for their purposes. Most silk painters will attest to the idea that silk painting is a sensuous experience. They say that when they start to paint they become one with the process, their creativity is unleashed and the more they experiment the more they discover that there are no limits to ideas and possibilities.

Following is a brief description of the traditional methodology involved in practicing this art form:

- The suitable fabric when silk painting with the traditional dyes is 100% SILK.
- The traditional silk painting dyes have special characteristics. They move easily and saturate the fabric. Once set, they become very brilliant and bond to the silk which is then washable and dry-cleanable.
- Some of the techniques are: resist, shading, blending, gradation, watercolor, hard edge, salting and spotting with water or alcohol. To begin silk painting, the fabric is stretched on a frame and the design is resisted (if this is the technique of choice). After it is painted, the silk is allowed to dry and then steam set to permanently bond the dyes to the fibers.
- The fabric is then rinsed, ironed and ready to be used as intended.

Natural dyes for silk: The quality of Armenian silk was praised by historians because Armenian cocoons were of high quality and hand reeling produced the finest high quality thread. Armenian silk also stood out because of its colors. Back then, in the cities of Dvin and Artashat in Armenia, a special expensive dye, cochineal (Porphyrophora hamelii/Homoptera, Coccidae), was produced and named "kirmiz". It was used to dye wool and silk and these textiles were exported to Europe under the name "kirmiz".
Plant dyes were also known to Armenians, and of them, *Rubia tinctorum*, was well known, used mainly in the carpet and silk industries. This dye proliferated due to its beauty and durability. The subterranean parts of this plant contain substances like alizarin, purpurin, rubiadin and so on, which are valuable dyes. In the centuries that followed, the dye trade started to develop in the center of the mountains. In Erivani, two types of dyes were known: "boyakhchi" and "shilachi". The former included blue dyes and the latter red.
Since ancient times Armenians have known the art of printing cloth, especially silk. The art of printing stood out clearly with the appearance of national costume. Painting cloth by printing them on wooden frames was widespread in Armenia. There were other ways to print cloth as well, for example, the cloth was covered in molten wax, and then printed upon.
The printer-ornamentalists of Armenia were always original and didn't repeat their work. Around 4000 images from the Armenian art of dyeing are kept in the Matenadaran, none of which are repeated.

2.4. Economics and markets of; market situation/trends of artisanal silk products – country policy support, supply/demand, price setting, investment/benefits. Structure and activities for internal and external trading.

Recently, the poverty alleviation programmes for poor in Africa, Asia and Eastern Europe have started stressing income and employment generating activities as more important. Government policies and programs as well as NGO activities are now focused on creating income and employment opportunities in rural non-farm activities. Sericulture is an important labour-intensive and agro-based cottage industry, providing gainful occupation to a huge number of people in the rural and semi-urban areas in more than 35 countries from Asia, Europe, Africa and Latin America. Of these, a sizeable number of workers belong to the economically weaker sections of society. The aim is to generate viable enterprises, employment and sustainable income, primarily for the weaker sections of the population, including women, in rural and semi-urban areas.

Silk production, a highly labor intensive activity, has strong potential to increase such opportunities for the poor, particularly women. Silk handcraft cottage industry creates tremendous economic prospect and employment potentiality for the rural people, scoring on every point: One of the highest income from one unit of land; Use of less water and drought resistance; Income leveller - transfer of income from rich to the poor nationally and internationally; Generating high rural employment; Gender benign in favor of women-employment; Silkworm rearing is indoors and has no arduous work - drudgery; A natural fibre and ecologically harmless, hygroscopic, absorbs body moisture and therefore comfortable to wear; No synthetic substitute and highly demanded at the local market as well as in EU countries, Japan the USA etc.; No competitor to food crops.

Silk handcrafts could be identified as a thrust sector, to create higher employment opportunities and a better standard of living for craftspersons individually and collectively through efficient production practices, professionalised management, enlarged marketing networks, for the domestic market and overseas, and preservation of the rich cultural heritage of the countries. Silk handiwork offers employment opportunities to women, disabled persons, and others ordinarily outside the mainstream.The use of silk handcraft output should be promoted as an eco-friendly and environmentally sustainable alternative.

For example the United States import about $156 million/year of hand-made carpets from India , $48 million from Pakistan and $5 million from Nepal, where the silk carpets account more than $ 20 million out of them. Exporting around $450millon worth of silk products annually, India has the largest in the world silk cottage industry. India exports also silk saries ($ 15 million/year), silk scarves($ 15 million/year). The main markets are in USA, Germany, United Kingdom, United Arab Emirates and France.Turkey exports about US$ 20-30 million/year worth of silk carpets to the USA, Europe and Arabian countries.

However the silk handcrafts find a good local market as well.The silk handicrafts sector also employs a large number of people, many of whom work with traditional materials, processes and products, and in remote and backward areas. The economic importance of silk handcrafts is accentuated by the fact of high employment potential, low capital investment, high ratios of value addition and that it is almost wholly artisan based.

At present the strategy for sericulture development in most of developing countries should be based exactly on silk cottage and handcraft industry. This is valid especially for the African countries which do not have long experience and tradition in sericulture. Since those countries

are not able to produce high grade of raw silk, for them the sericulture development should be based on low cost and low tech production and sell to the local market the silk handcraft products. In this respect the silk cottage industries and handicrafts production development appears to be of a strategic importance for the global sericulture development.

Supply and demand of raw materials for the silk handcrafts production

The main raw material for silk handcraft production is the raw silk.

Information about the ability of local raw silk production to meet the demands for handcraft production is presented in Table 1. It is evident from the table that most of the countries who are able to meet their raw silk demands have long experience and tradition in silkworm rearing and cocoon production. Even though the cocoon/raw silk production in some of these countries declined dramatically during the recent decade (Black and Caspian sea rim countries) presently they are still able to satisfy their needs of raw silk due mainly to comparatively small amount of handcraft production. On the other hand some comparatively big cocoon /raw silk producers like Iran are forced to import raw silk due to the big capacity of their silk handcraft production industries.

However some of the silk handcraft producing region countries can not meet the demands for raw silk. This is valid for nearly all silk carpet and rug producing countries like Iran, Egypt, Turkey, Morocco, Tunisia etc.

Some of the African countries have traditions and local market for silk handcrafts production, but most of those countries have started silkworm rearing and cocoon/raw silk production activities just 10-30 years ago.

Some developed countries in the European Union, where the silk painting is well developed do not have any tradition and experience in sericulture or this industry has been inactivated due to economical reasons, resulting to use only imported silk for their products.

In some countries, where the silk handcraft is very well developed, the small capacity of local cocoon/raw silk production appears to be a real problem for their further handcraft production expansion. These are most of silk carpet producing countries.

In the newly starting sericulture African countries (Ghana, Uganda) the availability of traditional silk handcraft industries is a very good chance to combine them with the sericulture as a viable silk handcraft cottage industry.

On the other hand the countries of Black, Caspian seas and Central Asia region should make efforts in their local silk handcrafts industries development in order to utilize the cocoons/raw silk locally produced as a strategy for sericulture rehabilitation and development.

Market situation and trends of supply and demand of major silk handcraft commodities

The characteristics of the domestic market are different from those of the international market. Domestic consumers and international consumers have different tests due to the different nature of domestic and export demands. However, in some cases they have some connections that benefit the tourist countries such as the indirect export of items from the country’s domestic market via purchases made by tourists.

Price of silk fabrics depends on the ingredients – like any other product – and the workmanship / skill / intricacy of the work that has a direct bearing on the time consumed in production, the brand image and reputation of the seller. Since the weight per meter of the fabric directly implies more silk content, the cost will go up in proportion to weight.

The silk handcraft prices can be fixed in several forms such as:

1. Fixing a high price. In fixing a high price, the investors must be confident their products are of high quality and customers can be assured of the quality of the product.
2. Fixing a low price in bid to capture market. Investors wishing to use this strategy must have a sound financial footing and enough working capital for the future.

A summary of the percentage distribution of money from sale of soft silk fabrics of weight 40gms, 50gms and 60gms/mtr in India is given below:

Source: CSB

% distribution of money from sale of Soft silk fabric of				
Sl no	Category of Stakeholder	40 gms/ mtr	50 gms/ mtr	60 gms/ mtr
1	Rearer	51.5	54.6	56.8
2	Reeler	6.2	6.6	6.8
3	Twister	8.2	8.7	9.1
4	Weaver	14.5	12.3	10.7
5	Trader	19.5	17.8	16.6
	Total	100.0	100.0	100.0

Silk carpets and rugs: In **Iran** on average, each silkworm egg box can produce yarn for weaving one square meter of a silk carpet, worth between US$ 1000 to US$1500. The country's total revenues from silk carpets reach around 600 million US dollars/year. Each year, about 22 million people are involved in the different stages of silk production, such as silkworm rearing, cocoon production, drying, silk reeling, silk degumming, dyeing etc. and carpet-weaving. Hence, the silk industry plays a crucial role in job creation and the growth of national economies. The carpets are graded by their fineness, the number of knots in a square meter, with a normal weave from 10000 to 40000, fine weave from 65000-90000 and extra fine from 160000 - 500000. Silk carpets may be over 500000 knots per square meter.

At the time being there are no industrial facilities for silk fabric weaving in Iran and whole country raw silk production (about 95%) are being used for hand carpets weaving. Total raw silk production in Iran reaches about 800-850 m.t at its peak which can be used to weave about 170000-180000 square meter of pure silk carpet. More than 2 million persons especially rural women share hands to put art, skill and ambition together manifesting as Persian carpet with its particular dignity in the nation economy (about 20% of non-oil export of country). However the total annual amount of silk carpet production in Iran is estimated to be around 300000 m^2 which can consume about 1400 M.T. of raw silk. This amount of raw silk is about 2 times more than national production. It is also notable to mention that carpet weavers use the raw silk not only to weave pure silk carpets but also to produce blended woven carpets along with wool. The amount of raw silk in this mixed type carpets comprised up to 10 – 20 percent which make it too difficult to separate the share of silk portion in exporting values.

Table 2. Non – oil, agricultural products and carpet export (1976– 2002) of Iran*

Year	Non–oil	Agricultural products	Carpet	Share of carpet from non-oil export%	Share of carpet from agricultural and traditional products export (%)
1976	540	377.1	94.5	17.5	25
1977	523	348.4	82.8	13.2	23.8
1978	543	368.9	83.9	15.4	22.7
1979	812	724.8	408.9	50.4	56.6
1980	645	601.7	425.1	65.9	70.6
1981	340	321.3	149.4	44	46.5
1982	284	255.3	67	23.6	26.2
1983	357	318.1	88.9	24.9	27.9
1984	361	295	89.8	24.9	30.4
1985	465	371	115.1	24.7	31
1986	916	781	356	38.9	45.6
1987	1161	991	482.1	41.5	48.6
1988	1036	770	308.8	29.8	40.1
1989	1044	894	344.7	33	38.5
1990	1312	1038	509.1	38.8	49
1991	2649	1937.7	1161.2	43.8	59.9
1992	2988	1995.6	1105.6	37	55.4
1993	3747	2516	1384	36.9	55
1994	4831	3258.6	2132.9	44.2	65.4
1995	3257	1711	981.1	30.2	57.3
1996	3120	1645.8	642.5	20.7	39
1997	2042	1250.7	635.7	22.1	50.8
1998	3025	1454	570.1	18.9	39.2
1999	3362	1514.2	691.2	20.5	45.6
2000	3763	-	619.5	16.5	-
2001	3918	-	552.8	14.1	-

* Million US$

In **Egypt** local and imported silk yarns are degummed, dyed and twisted in native cottage workshops and then sold to the carpet manufacturers at 30-35 US$/kg. Both producer and consumer are directly linked together without middleman. Home self-employed women carpet weavers sell their products to tourist bazaars and exporters for 400-500 US$ per m^2. One square meter of silk carpet consumes about 5-6 kg of silk yarn and 1-1.5 month work according to the skill of the weaver and carpet design. The carpets are sold to the tourists at the local market as well as exported mainly to Germany, Switzerland, Belgium and France. Egypt: Production and marketing of silk carpets and other handicrafts are carried out by the private sector. This enterprise is developed to the point that it is producing and selling high quality products on the competitive world market. 60% of the production are exported by the private sector, the remained 40% are displayed for tourists in the local market.

Afghanistan was also one of the remarkable cases where cocoon and silk yarn production provided farmers with job opportunities and substantial income that made possible the purchase of essential food items during the serious war in 1990s. More than 200 000 people were engaged in sericulture activity at the different levels of production such as cocoon, silk/silk yarn and silk-allied products (turbans, scarf, ladies veil and carpets). Nearly 60% of the carpets being produced in Kabul were pure silk, while the remaining 40% use silk for its weft. During the period (1979-82) the country could earn approximately 100 million US Dollar per year.

Nearly all of the silk carpets, produced in **Turkey** are exported. Especially by big carpet stores on tourist shores and in recent years by the help of internet carpets are sold. Nowadays nearly 25-30 million USA dollars is earned annually by the silk carpet export.

Table 3. Turkish foreign trade of silk carpet

YEARS	SILK CARPET EXPORT		SILK CARPET IMPORT	
	QUANTITY (kg)	AMOUNT ($)	QUANTITY (kg)	AMOUNT ($)
1984	53,360	99,259,715	-	-
1986	46,862	26,730,184	-	-
1988	48,072	39,534,489	-	-
1990	29,018	45,127,619	239	9,304
1992	23,111	50,291,832	20	20,346
1994	19,603	31,533,168	-	-
1996	42,458	28,635,184	15,239	3,411,241
2000	17,500	23,674,585	17,730	6,36,642
2002	21,379	22,545,689	20,607	5,741,917
2004	24,517	26,079,260	21,358	6,182,602

This also caused a decline on the production of raw silk as silk reeling started to be done by traditional methods. So as the quality of silk yarn became very poor, demand for imported silk is increased and export of silk yarn totally finished. Silk imports had reached to 200 tones in the year of 2000.

On the other hand, traders whom before were the main actors in the market for providing high prices for the farmers stopped purchasing cocoons and directed to import silk yarn.

In the sector, silk carpet is sole product having economic value. This sector has a real positive effect on economy. Beside its ability of creating job opportunities for thousands of people from silk reeling to carpet weaving, it is also very effective on the national economy by providing millions of dollars of foreign exchanges from exportation.

There are some 300 private companies whom are interested in producing, buying and selling of silk carpets. Each company chooses the village in order to weave a carpet and finance all of the production activities from yarn to job force. Also there is a big silk carpet weaving factory which runs by the state. This factory is situated in Hereke and was established in 1843. The carpets which are woven, are sold by the traders mainly in some big carpet showrooms especially in Istanbul and in tourist towns on the west shores.

Silk embroidery: In Jordan one excellent silk embroiderer's income allowed her to buy a refrigerator as well as send a child to university. Over the past decade, the government has been encouraging the development of high quality artisan centers in Jordan's ancient villages located near archaeological sites in order to promote Jordanian handcrafts and to integrate socio-economic development with sustainable tourism. Most handcrafts workers are paid by the piece, for example, weavers are paid by the meter, while embroidery makers are paid by the piece; however, the supervisors and some workers are paid by salary.

Handloom woven silk fabrics and their allied products: The price of silk Asante Kente, produced in Ghana varies from US$ 300 to 1600 per piece. In Madagascar the traditional shrouds made of wild silk, the *lambamena*, measures 1.4 to 2.4 m width by 2.2 m length. A large one requires 2.5 to 3 kg of yarn silk or 5 to 6 kg of opened cocoons (without pupa). They are sold between 750000 and 900000 FMG (75 to 90 US$) which makes them affordable only by the upper class.

In **Syria** fabrics and silk wear have been sold locally. Villagers are main consumers for these wear and fabrics especially in north and northeast area, where women dress silk wear depending on her habits and inherited traditions. Each area specialized in private costume distinguishes it from other area. In small quantities, these products are sold to outside Syria by travelers and tourists. There is big decrease in offered quantities of fabrics and silk wears, one of its reasons demands loss makes many factories close or change to used industrial silk yarn because of its cheapness. The other reason is traditional production process and inability to change and modernize its lead producer to be out of markets competitions.

Cottage production of silk and blended knitted blouses and sweaters in Bulgaria

The production costs for 1 kg of twisted, degummed/dyed silk yarn on cones, ready for knitting are as follows:

Item	**Costs in US$**
Cocoons	27.00
Silk reeling	7.80
Silk throwing	15.00
Silk degumming and dyeing	5.20
Total:	55.00

The costs for production of 1 knitted 100% silk ladies blouse are the following:

Item	**Costs in US$**
Silk yarn	18.00
Knitting and tailoring	3.00
Total :	21.00

The costs for production of 1 man's winter knitted silk/wool sweater are:

Item	**Costs in US$**
Silk yarn	11.00
Wool yarn	3.50
Knitting and tailoring	4.00
Total :	18.50

The local market price of the two items could be around US$ 30/piece. Fashionable knitwear made by non-silk materials is sold about this price.

Other knitted silk product are the scarves, which production costs are as follows:

Item	**Costs in US$**
Silk yarn	8.50
Knitting and tailoring	3.00
Total :	11.50

This costs allow a price at which the commodity is completely sellable at the local market.

The souvenir dolls, dressed with national costumes, having silk are sold at a price from 20 to 60 US$/piece.

In **Romania** "Romartizana" organizes annually an International Fair of Popular Handicrafts, and also the National Fair of Popular Art and Workmanship that will take place in April. In order to stimulate and to activate the market of handicrafts products, "Romartizana" presents a web page – Romania Handicrafts and Popular Art – existing on the Internet many other pages for informing and virtual selling of handicrafts products, as Infofirme – Romanian Catalogue – web Business.

For a blouse with silk embroideries the price is around 100 USD, for a man's shirt the price is 106 USD, flowers made by silk are 20 USD and a pillow cover costs 110 USD. The Romanian handicraft objects are demanded by the foreign people and also by the Romanian tourists because they represent the local specific and they are very good guide marks in memories.

2.5. Photos of the main silk handcraft commodities and the cottage industries activities
(see Annex 1)

Chapter 3. Major constraints against and recommendations for promotion of artisanal / traditional silk handcrafts and cottage industries at the regional levels.

Major constraints:

Organizational:

- Lack of enough assistance in expanding markets including preference in purchasing by government, support in joint tendering for government purchase contracts, price preference and reservation of certain product lines or industries for only small-scale manufacturers.

- The silk production in most of the region countries declined due mainly to the increasing land price and expansion of civilization, industrialization of societies and accretion of man power cost, relative preference of non-agricultural investment, emigration of productive power from rural area etc.

- It was not possible to provide training opportunities for handicrafts and this caused a quality loss in workforce

- Many weavers specialised in silk fabrics have switched to cotton or synthetic fibres for various reasons: the demand for much cheaper fabrics made of other fibres is higher; the purchase of silk yarn is a too high investment and it is difficult to get silk yarn; it is more difficult and it takes more time to weave silk fabrics than other types of fibre.

- Sometimes the workshops and designers cannot meet that demand because orders are generally too big for their weaving capacity and raw material (silk) is too scarce for a regular supply in the year.

- The traditional silk handcraft cottage industry, producing national style fabrics which has been existing for many centuries is now completely inactivated in some of the region countries, thus there aren't enough skillful workers, who are capable to weave the fabrics.

- The abandoning of traditional silk wears: as the consumption of traditional silk wear, related to poor and middle income section, where it's presents inherited traditions and habits, which express the privacy of each area from the country and by result of price traditional silk wear increases we find that a large part of people have turned to dress industrial silk wears.

Technical:

- To create new designs, patterns and conception suitable for nowadays is generally failed.

- The traditional technologies at the level of reeling, yarn preparation and weaving needs of improvement in order to diversify the fabrics and develop potential new markets.

- Reeling is another main constraint. The very rudimentary reeling method provides a very thick and irregular yarn. This type of yarn indeed is adapted to the weaving of the

traditional fabric, but it limits the possibility of developing other types of fabrics with thinner and more regular yarn. Moreover, un-uniform silk yarn is increasing production costs of silk handcrafts.

- Poor management with low investment and technology are used. It is a complicated process to try to control the colour standard of the products, as there are no high technology machines available to them.

- Lack of new products and new designs to meet market's needs. There are many silk fabrics and products with the old designs no dominant products to be attractive the customers.

- The silk handcraft products are made by hand, which requires much longer time periods for manufacture.

Economical/Market:

- The contribution rate of Iran, Turkey, Egypt and other producers from the region in the silk carpet world market has been decreased significantly within last decade. Progressive intensification of competition between carpet weaver countries, introduction of lower priced hand weaved carpets in some countries which affected the quality of weaving, dyeing and raw materials, expanded usage of machine-made or other synthetic rugs, reduction and/or limitation of international economic growth rate which encourages utilization of cheaper products, prevalence of traditional Persian designs among some overseas carpet makers as well as some exporting obstacles are among the main results of above mentioned problem.

- Selling cheap and low quality carpets especially coming from Far East could not be prevented. As the genius hand woven silk carpets didn't have a chance to compete with the others owing to their high prices, many companies left the market.

- Dependence of the sericultural final products on export. Considering their high price the domestic usage is quite limited. Therefore the international trade fluctuations can not be modified by internal planning completely.

- The price of silk yarn produced is too high which makes the silk fabrics expensive and limits their market.

- High costs of production are an important factor to limit expansion of silk handcraft cottage industry. High prices of local silk yarn and high labour costs due to hand made products, which use labour intensive. The industry needs high skills and experienced labours.

- Sericultural farmers may become endangered because of China's membership of the World Trade Organisation. The free trade in textiles stimulates the weavers worldwide to import cheap raw silk from China rather than use material produced by local farmers.

- Low cost producers from the Far East provide significant competition to the local one in labour intensive production, while Hong Kong (China), Korea, Italy and other countries have firm holds on the higher technology garment and textile market**.**

- The countries with lower costs and larger populations are thriving in the silk industry. These countries include China, India, Indonesia, Vietnam. Shortly the type of products, which are made in the AECANE region, will not be saleable because of their higher cost.

- The increase of production costs because the increase of raw material price causes the inability of competition in the international markets.

- The nonuse of modern marketing ways: industrials depend on their own skills and experience in marketing their products which cause the inability to develop and follow up markets changing needs

The major challenges facing the sericultural industries development in the new entrants from Africa are:

- Irregular and insufficient supply of silkworm eggs
- Long distance of trading units for sale of cocoons
- Poor quality cocoon
- Non availability of quality raw silk
- Non availability of quality looms
- Non availability of qualified personnel to operate the filatures and other equipment
- Lack of trained manpower in both pre and post cocoon sectors and lack of training facilities to keep entrepreneurs abreast with modern technologies.
- Lack of appropriate tools/implements for the silk handicrafts cottage industry.
- Inadequate knowledge about markets
- Dominance of the markets by China

Recommendations for promotion of artisanal / traditional silk handcrafts and cottage industries at the regional levels:

Organizational:

- The industry would need easy availability of foreign exchange for import of raw materials, machinery, tools and equipments, training facilities, market information about the latest trends in fashion and designs.
- Establish local competitions specialized in silk products and specially handcrafts and offers financial rewards to encourage the country woman to keep on in these works which need special skills to prevent its from oblivion.
- Since it will take some time for the new comers in sericulture from Africa to come out with good quality silk yarn and silk fabric that will be acceptable on the international market, these products (i.e., silk yarn and silk fabric) can be converted into unique silk handicrafts which have ready market locally and internationally. A development option, rather than a completely commercial approach to silk enterprise development needs to be adopted right from the beginning.
- Producers should establish the network to make collaboration among different sectors of supply chain. The different sectors, which include all stakeholders in silk handcraft cottage industry from downstream to upstream of supply chain, are formed into silk handcraft cluster according to local which they are. The silk cluster system can reduce and eliminate the problem of producers by supporting each other in term of raw material, technology, equipment and marketing. So this system is more efficient in

term of cost reduction, quality improvement and quick responding to consumers' needs.

- To promote the silk handcraft products as natural and environmental friendly.
- Some silk handicrafts producers would be sent on tours for market study. Similarly, they would be sent to various outstanding craft centers in the leading countries to learn new techniques.The craftsmen would be encouraged to tap the market directly and they would be given chance to participate in various fairs, exhibitions, and craft bazaars. Apart from the craft related skill, compulsory training in entrepreneurship and management, micro companies administration courses would also be given. Local handloom training centers would be developed and latest design centers would be established in them. Craftsmen would be provided financial assistance to purchase modern and advanced tools.
- The government should identify long-term strategic policies, R&D, technology development, and innovations, which the importance of the factors involved: product standard, production technology, technology development, and product innovation. Hence export performance will be increased.
- Encouraging silk handcraft cottage companies to establish global relationships, such as international joint ventures and cooperative deals in the field of research and technology licensing. The manufacturers may look for relationships with their suppliers and international competitors in order to achieve a stronger competitive position.
- To create a country/regional data base on the silk sector and its monitoring. The main data to be collected and permanently updated should concern:

✓ List of the operators (governmental, NGOs, associations, private operators) involved in silk sector.
✓ Data regarding silkworm rearers and silk reelers and weavers/knitters: surveys, location, characteristics, economic data.
✓ Agronomic data regarding monitoring of the production (based on reports of the operators supporting sericulture): sericulturists and groups supported, data on production per season, grainage, estimate of cocoon production, yields, climate etc.
✓ Economic data: price of cocoons per country and per cycle, raw silk prices, price of main inputs.
✓ International prices of raw silk.
✓ Silk import and export.

Technical:

- Innovation in product of development. There is an urgent need for product diversification to meet the demands on the international market;
- The new silk handicraft articles which could also be produced include - garlands, flowers, greeting cards, wall posters, bouquet, wall hangings, book marks, coasters, ball from silk floss, etc. Most of these items are produced from cut cocoons. Other articles are boxes, cosmetic cases, handbags, purses, wallets.
- To distribute and increase more advanced type silk reeling devices and machines to region wide to produce uniform quality of yarn. Further, mechanisation in certain areas which do not effect basic skill input but pertain mainly to processing and finishing should be encouraged. Both the designing and technical assistance should aim at adopting silk handicrafts to the utility based foreign market.

- Emphasis should be placed on upgrading existing machinery with modern technology for greater efficiency and keying in on human resource development in order to improve the knowledge and competency of Silk industry management and its workers through seminars, training and education.
- To withstand competition from Powerloom and Mill Sectors, special attention has to be given for modernisation of hand looms and accessories, diversification of products, use of eco-friendly dyes etc. Emphasis has to be laid on computer aided designs for handlooms in order to bring new designs to cater to modern requirements. For increasing the income of the handloom weavers and for achieving better quality the weavers would be provided with financial assistance and technical training for purchasing advanced technology looms. Services of design specialists in handloom sector would be provided to the weavers for providing them with modern designs.

Economical/market:

- To provide loans and financial aid and tax free for industrials to be able to develop the used means in their industry that lead to decrease production costs and increase quality
- Finding marketing knowledge to the industrials by finding specialized staffs to study the market and future and recent clients' needs and direct the industrials to produce the wanted items in the local and international markets which makes the industrials capable to follow the market changes and clients' desires.
- Establish local fairs and participate in international fairs to introduce silk handcraft products to the consumers and to make producers able to connect and know the latest development in their industry field. Sell their products by installments especially to the villages and areas, which depend on its traditional silk wears.
- Enlargement of the markets: national, tourist and export markets; garment, decoration, furnishing, bedding, fashion products. The diversification of the silk materials and products meets the demand for new and modern silk use. The diversified products keep the national silk specificity.
- The large part of the global trade belongs to articles items which cater to the common man's needs and tastes which have to be produced in bulk. Although made by hand, they need mechanical support in processing and finishing. As the export market for "cultural silk crafts" is limited, reliance will have to be placed on those silk handcrafts which cater to the common man's needs and tastes for boosting exports.
- It is expected that production costs in the AECANE region will increase and more countries will join silk production with lower labour costs. Therefore, it is challenged to the region producers to compete in the world markets. In order to survive in silk business, producers should not make cheaper silk products with low quality to compete for the prices but to produce products which satisfy consumers even though they are more expensive.
- The strategy of AECANE region silk handcraft cottage industry is to produce their own unique products which are definitely different from other countries. Most of the consumers admire the Persian type carpets and rugs, produced in the region.
- As an optimal proportion of silk handcraft fabrics market may be recommended: for domestic use about 40 %, exports 20%, manufacture of garments for domestic use 8% and garment export 32%. Most of the domestic consumption is used to make medium to low quality products at cheap prices.

- The main export items of silk garments and products are carpets and rugs, women's blouses, shirts, handkerchiefs, shawls, scarves, mufflers, mantillas, veils, ties, bow ties and cravats, furnishing house wares gifts and accessories.
- Silk products, which may be produced in largest quantities because of their bigger market are ready-made garments, handkerchiefs, scarves, shawls, bow ties, neckties, tablecloths, pillowcases, handbags, gifts and interior decoration.
- The most promising export markets for all types of silk fabrics and products (garments, furnishing, accessories and gift) are U.S.A, EU and Japan. The most sellable silk handcraft commodities at the international markets are carpets and rugs, shawls, scarves, mufflers, mantillas, blouses, shirts.
- The local silk handcraft cottage industry should put more emphasis on indirect export market through tourists. When visitors left satisfied customers of local silk products they continued their contact and began placing orders, which turned into greater scale business providing more profit than the domestic market.

Silk handcraft cottage enterprise Models

Based on the Thailand's experience two models of silk handcraft cottage industry which often found in Thailand could be recommended:

Model 1: Cooperatives silk cottage enterprise

Model 2: Private silk handicraft cottage enterprise

Model 1 Cooperatives silk handcraft cottage enterprise

Main products are traditional fabrics and products, which suit to local market. Farmers 'group operate their business in term of cooperative groups, which are promoted and supported by government.

The number of farmers is about 20 to 80, who have been trained and have experience in dyeing and weaving skill, are formed into either formal or non-formal groups. All of them have their own hand looms. They set up committee structure which consists of leader (chairman), secretary, public relation, treasurer, marketing etc. The committee members have been elected and they will appoint a small team of full time staff who are expected to work with concerning agencies for their business. Some groups may work in term of weaving cooperatives, community enterprises, some groups may be women weaving groups which are supported and promoted by the government and/or NGOs. This SME silk cottages share their inputs, capitals, marketing as well as returns. The members are paid for their wages of dyeing and weaving according to their works before sharing the profits.

Silk Yarn Purchasing: The groups buy silk yarns from members who reared silkworm and reeled silk yarn, farmers 'groups from other villages, reeling factories. Beside the silk yarns, other inputs such as dyes and chemicals are also purchased by groups.

Silk Yarn Processing: The silk yarns, produced need to rewinding, doubling and twisting before degumming process.

Designing/Products: There are two ways to design their products, the first way is individual design. Groups provide silk yarns to members who design pattern and color by themselves. Most of their products are traditional designs, which are followed by generations. The members have their own designs and special skills according to their wisdom knowledge. Government trains them on new techniques, then they can apply to their works, in order to improve products quality. The second way, designs and colors made by the customers, so the weaving groups proceed products according to their orders. There are many types of traditional silk handcrafts that may be produced by these groups. However, about 20 % of the

total silk products by these groups may be modern silk fabrics such as plain silk fabrics and batik silk fabrics.

Degumming/Dyeing: Both of chemical and natural dyes may be used by the groups. After products are designed, the members receive dyes and chemicals from the groups for chemical dyes. However, members need to prepare raw materials by themselves for natural dyes. Skeins of processed silk yarn are degummed and dyed.

Weft yarn preparation: After finishing of dying stage, the strings are then untied and the thread wound on small spools. The small spool is put into shuttle one by one as in order at the final stage of weft yarn preparation.

Warp yarn preparation: Warp yarn is produced with a simple device. The yarns used for warp are wound on a wooden board with knobs around which yarns are led so that a length of warp can be obtained without tangles. The number of warp yarns is related to specific beater to be used in the weaving. The next step, the warp yarn is removed from the frame. Each yarn is subsequently passed through the string heddles by twisting it together with warp end left from the previous weaving.

Weaving: Typical hand looms are used to weave. The looms are located in individual member‘s houses, only 5 – 10 looms at group ‘s office for demonstration. The members weave fabrics/carpets/rugs in their houses. The fabrics are collected from members and then sent to the group. Group committee collects, checks length of fabrics, quality check and collect fabrics in storage room.

Processing: Silk fabrics are sent to finishing factory or shops for finishing, then fabrics are ready for sale. Most of SME of silk handicraft cottages, do not have silk fabric finishing section, send their fabrics to proceed silk finishing at finishing factory or shops.

Marketing: The prices are set depend on the complexity of design and the labor input rather than the weaver as such. There are many channels for marketing of silk fabrics of weaving groups as following:

1. Retail trade: The total amount of silk fabrics are sold as retail trade is about 60 % of the total volume. The silk fabrics are sold to retailers through street vendors and formal retail trade. Most of SME silk handicraft cottage established their outlets for present their products for order and sale. Tourists and local people are the main customers for street vendors. The formal retail trade is the most important market. There are several fairs and exhibitions, which is organized by government both at national level and provincial level. **2. Wholesale trade:** This market channel, producers can sell their products directly to informal-contact customers, who are traders, silk processing shops, and exporters. Then they establish networks with SME in the local area and do informal-contract for ordering their products. The volume of this is accounted for about 15 % of total sale volume. In order to have value added, traders buy silk fabrics from the group as a raw material and then process into such items as tablecloths, pillowcases, handbags, neckties, gifts etc. The exporters are the other market of the group. They make pattern and design and order the group to produce at certain period. The volume of silk fabrics are sold to exporters is about 10 % of total sale volume.

Model 2: Private silk handcraft cottage enterprise

This silk handicraft cottages, are run by private sector, which most of them are rather small enterprises compared to other business. There have 30 - 80 handlooms both in the factory and contract farmers. This model **is** the main production of silk products for export.

Operation of silk handcraft cottage: This enterprises are operated by private sectors in term of company. They employ labors for all processes. Simple self designed machines are adopted to use to improve work capacity and efficiency in the factories. The production processes are more organized and more modern setting than model 1. Generally weaving factory cottage industry, they use labor both in family and hired labors. The hired labors are required to train

for a certain time by the factory particularly in weaving skill before starting works. Most of owners have high skill and experience in designing, dyeing, weaving of silk fabrics and products. The design and pattern of products is less complicate, but it is modified traditional and modern way together. Most of factories have not designers, therefore owners design by themselves. However, some of them have section for design pattern, colors and products, that lead to high demand from market.

Silk Yarn: There are two types of silk yarn used in the factories: hand reeled yarn from the farmers; silk yarn from reeling factory; Machine reeled yarn, weavers can order reeling factory to do twist and double as well as dye the yarn for them. Weavers need to pay extra cost for the process that they requested apart from raw silk price

Products: The main products may be traditional fabrics, modified fabrics for home textile, plain fabric, batik fabric, printing fabric, carpets and rugs garments and silk products.

Design pattern: Medium scale silk handicraft factory, which has design section to design pattern and colors of products both applies traditional pattern and modern pattern. However, some patterns are designed by customers (make for order). Designers use Computer as a helpful tool for design section to help designers to do good and effective jobs. While small factories without design section, owner her/himself design pattern and colors.

Degumming and dyeing: At degumming and dyeing stage, low cost equipment, which may be promoted by the government may be mostly adopted by small silk handicraft cottage factories. For medium scale factories, some of them may invest in automatic dyeing machine, which gives higher quality of dyed yarn than typical one.

Yarn preparation:

Weft: Factories hire labors to do yarn preparation in the factory. Self developed motorized equipments are designed for winder.

Warp : The same method of warp preparation as model 1 is adopted by small scale silk handicraft cottages. Warp preparation tool is used in medium scale silk cottage. This tool is developed from the typical tool.

Weaving section:

Loom: Looms widely adopted by silk handicraft cottages are typical handloom (traditional loom/ hand throwing shuttle handloom) and fly shuttle handloom. These two types of looms have each strong and weak points, then weavers use it for different propose and works. Traditional handloom is used for delicate pattern and design of traditional fabrics. The speed of weaving is low. Fly shuttle loom is an other type of loom, used in the weaving industry because of higher speed of weaving as about 2-3 times than traditional loom. Unfortunately, it can work for not complex design or pattern.

Weaving management: The factory employs labors to weave fabrics at the factory and wages are paid according to meter of fabrics are woven and design/pattern. However, factory also makes informal contract to weavers outside factory to weave fabrics. These weavers are trained on weaving techniques at the factory and have weaving experience at least 6 months. The contract weavers do their work at homes and use their own looms. They are required to finish their job at a certain time, therefore factory can control production volume. The system that factory uses their contract weavers is widely adopted because it requires less capital for investment than other systems. However, good relationship between factory and contract weavers is very important.

Quality control section: This section aims to check quality of silk fabrics woven in factory and from contract weavers. The most important points for checking such number of meters, pattern, design, texture etc.

Processing section:

Printing: All of SME factory do not have printing section because high cost of investment. If the fabrics are being printed they will be sent to printing factory. Some plain fabrics are sent

to print in the big factories. The printing factories provide patterns for weavers to select it. They charge for printing according to pattern and number of meter.

Finishing: Woven fabrics are sent to do finishing process in finishing factory. Cost of finishing process directly depends on number of meter.

Garments: Most of weaving factories have their contact garments shops to make for them. Normally garment shops order silk fabrics from weaving factories and they design and process for products. Hence, they work as a partnership together.

Marketing: The markets for silk fabrics, garments and products are mainly for export, wholesale and outlets.

1. Export: About 40 % of total amount of silk fabrics are exported to aboard. Factories obtain their export order through main channel such international fair, outlets and e-commerce. Weaving factories join international road show, international trade fair, which are promoted by the government to introduce and promote their products. The government or professional organization may establish website and collect name, address, type of products of weaving factories and traders in file of exporter list. This system is a good channel for importers to start finding out their products. In addition, some factories have their own website for marketing.

2. Wholesale: The main customers for wholesale are traders, silk processing shops, garment factories and exporters. The volume of wholesale is about 40 % of total amount of silk fabrics. The customers are both contract orders and informal contract orders. Factories get orders through website, trade show in country and international, outlets etc.

3. Retail: Most factories have their outlets at the place where fabrics are woven and in the capital, big cities, resorts etc. to present their products. Tourists, local people are the main customers of retail sale. Some weaving factories have their outlets in the fairs for marketing. The total volume of retail sale is about 20 % of the total sale volume of the factory.

Chapter 4. Regional Strategies and Follow up Actions for silk handcraft cottage industries development

4.1. Regional strategies and follow ups.

It seems to be difficult and costly for new entrants to build such a large amount of know-how in relatively short periods of time. Therefore, these problems may be eliminated by regional collaboration or network establishment. The network can coordinate and exchange information, material, technology and know how along the supply chain. Silk handcraft industries underscore the ongoing need for research and development, because new products and techniques are being developed continuously. It is essential that any producers stay informed about new developments both in silk yarn production (mulberry production, silkworm rearing, reeling), silk processing (silk fabrics, products, design) and marketing. Therefore, domestic, regional and international cooperation can help in sharing information on research and technologies.

4.1.1. Establishment of information and production networks

The purposes of a regional information and production network are dissemination technical, statistical and market information as well as a pool of local and international experts to all members, set up a silk producer cluster, so members in cluster can support and help in term of raw material (cocoons, silk yarns, silk fabrics), technology, equipment, marketing and trading. Considering the tasks and activities of the Black, Caspian Seas and Central Asia Silk Association (BACSA) it could enlarge its radius of action in order to cover the region of Africa, Europe, Central Asia and the Near East in terms of exchange of market information through the BACSA web site. The role of different countries in the regional cooperation may be as follows:

1.Sericulture germplasm conservation centers :
Countries: Azerbaijan, Bulgaria, Georgia, France, Italy, Romania, Ukraine, Uzbekistan
Role in the regional cooperation: supply with mulberry and silkworm accession to the other countries for selection/breeding purposes; training in mulberry selection and propagation, silkworm breeding and egg production.

2. P_1/F_1 egg production centers:
Countries: Azerbaijan, Bulgaria, Georgia, Romania, Turkey, Ukraine, Uzbekistan
Role in the regional cooperation: supply the other countries by high quality silkworm eggs.

3. Cocoon and raw silk production for export:
Countries: Albania, Armenia, Azerbaijan, Bulgaria, Georgia, Kazakhstan, Kyrgyzstan, Romania, Syria, Tajikistan, Turkmenistan, Ukraine, Uzbekistan
Role in the regional cooperation: export of dry cocoons and raw silk to the other countries

4. Silk handcraft production:
Countries: Africa: Algeria, Egypt, Botswana, CoteD'Ivoire, Ethiopia, Ghana, Kenya, Madagascar, Malawi, Nigeria, Morocco, Tunisia, Uganda, Zimbabwe; **Europe:** Albania, Bulgaria, Greece, Romania, Turkey; **Caucasus and Central Asia**: Armenia, Azerbaijan, Georgia, Afghanistan, Iran, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan; **Near east:** Jordan, Syria, Lebanon

5. Silk handcraft consumers (importers): Europe: EU countries, Russia

In this regional scheme the European and Central Asian countries will supply the countries from Africa and the Near East with sericulture germplasm and silkworm eggs, the region countries will supply each other with dry cocoons and raw silk, the silk handcraft products will be sold locally and exported at the EU and Russian markets.

4.1.2. BACSA to open a special page in its web site on "Silk handcraft cottage industries".

4.1.3. Regional workshop on "Utilization of mulberry and silkworm genetic resources for sericultural enterprises development in Africa, Europe, Central Asia and the Near East"

4.1.3.1. Background, rationale, status.

The cocoon/silk production can not be economically viable without high yielding and nutritive mulberry varieties and highly productive silkworm breeds and hybrids, therefore the effective utilization of mulberry and silkworm genetic resources is of a very crucial importance for the sericultural enterprises development. The centuries' old doctrine of considering the genetic material of the silkworm as a trade secret is still prevalent around the world. This places at risk the conservation of the germplasm resource and, in turn, further hampers the smooth transfer of cocoon production from the developed to the developing countries. Meanwhile, in the countries where development of sericulture would contribute greatly to the alleviation of rural poverty, such as those in Africa and the Near East scarce genetic resources are one of most serious constraints to sericulture development. This is especially the case in countries which intend to launch cocoon and silk production. On the other hand some countries from Europe and Central Asia maintain one of the richest in the

world sericulture genetic resources, which can be much more effectively utilized by producing mulberry sapling and silkworm eggs to satisfy not only the local needs but to provide valuable germplasm for the silk enterprises development in the African and the Near East countries as well. In this respect the enhanced cooperation between the countries in Africa, Europe, Central Asia and the Near East in exchange of mulberry and silkworm genetic resources, provision of mulberry saplings, parental and hybrid silkworm eggs would contribute to a great extent in the local sericultural enterprises development.

4.1.3.2. Objectives

Survey on the mulberry and silkworm genetic resources conservation status, databases creation, promotion sharing of and their effective utilization in the sericultural enterprises development strategies in the countries of Africa, Europe, Central Asia and the Near East.

4.1.3.3. Outputs expected (deliverables)

- ✓ Information collected on mulberry and silkworm genetic resources conservation status, databases creation and their utilization in the region.
- ✓ Promoted sharing of information, resources and supply with mulberry saplings and silkworm eggs between the region countries.
- ✓ Developmental strategies prepared both at the country and regional levels.
- ✓ Stakeholders identified and sensitized to sericulture germplasm conservation centres, mulberry sapling and silkworm egg producers, traders, governments, potential donors, etc.

4.1.3.4. Implementation Approach (methodology/activities)

International exchange of germplasm information between sericulture countries had either been often inadvertently neglected or purposely blocked. This was especially the case for the parental pure lines for silkworm hybrids and highly productive mulberry varieties. A first step in this regard was, however, taken by the FAO in 2002, when it called international attention to the risk of the gradual extinction of sericulture germplasm. The first international conference (Conservation Status of Sericulture Germplasm of the World) was organized and supported by the FAO, during the satellite session of the 19th Congress of the International Sericulture Commission, Bangkok, Thailand, 20 ~ 25 September 2002. Then as a result of the organized by FAO International Workshop on Revival and Promotion of Sericultural Industries and Small Enterprise Development in the Black, Caspian Seas and Central Asia Region, held from 11 - 15 April 2005 at Tashkent, Uzbekistan some background information was collected, initial contacts were established and potential host-institutes were identified to lead the sub-activities in the region.

Each participating member country will prepare a country report, in which recommendations for country - and regional development strategies are to be highlighted, based on the current status and future prospects of the sericultural germplasm resources conservation and utilization. A facilitator of the workshop would present his/her regional report, as consolidated for the region, with global implications.

Cost could be saved with more participants and observer stakeholders with best results, if the workshop coincides with events of hosting/venue institutes. Workshop month would be October 2006 or March 2007.

4.1.3.5. Monitoring Milestones (month or date and indicator)

Month	Indicators
2006	
July	Hosting institute – selection finalized
November	Organization of the workshop and contracts for country/regional reports – finalized
2007	
January	Reports submitted
March	Workshop - held
May	Proceedings – printed and distributed

4.2. Global strategies and follow ups.

4.2.1. Establishment an international "Working group on the global silk handcraft cottage industries and silk enterprises development": It is necessary to establish an international working group on the silk handcraft cottage industries and silk enterprises development, which includes countries new comers, developed, developing, advantage, producer, consumer and trader, to discuss, identify, and analyze major constraints and strategies for development in global aspect. This group may include experts in all areas and fields both private and government sectors.

The contents which to be issued at the working group should include all areas for sericultural development such as silkworm rearing, mulberry production, reeling, weaving, processing, trading, marketing, information network. This working group may be organized and supported by international organization which is independent, long term recognized as FAO. The already uploaded on to FAO's "InPho" Website: "Equipment for Silk Handcrafts Cottage Industries" may serve as a preliminary framework to be updated/upgraded as FAO receives comments.

4.2.2. Organizing two international workshops on silk handcraft cottage industries and silk enterprises development for Asia and the Pacific in 2006/2007 and for Latin America and the Caribbean in 2007/2008:

As follow ups to this workshop it is recommended that regional workshops with the support of the FAO and other international funding agencies be organized to create awareness.

The international workshop for Asia and the Pacific:

Possible hosting countries (one of the three): China, India, Thailand

Possible participating countries from the region: Bangladesh, Cambodia, China, India, Indonesia, Japan, Korea, Laos, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Vietnam.

The international workshop for **Latin America and the Caribbean:**

Possible hosting countries (one of the two): Colombia, Mexico

Possible participating countries from the region: Argentina, Bolivia, Brazil, Chile, Colombia, Cuba, Ecuador, Honduras, Mexico, Paraguay, Peru, Venezuela, Uruguay.

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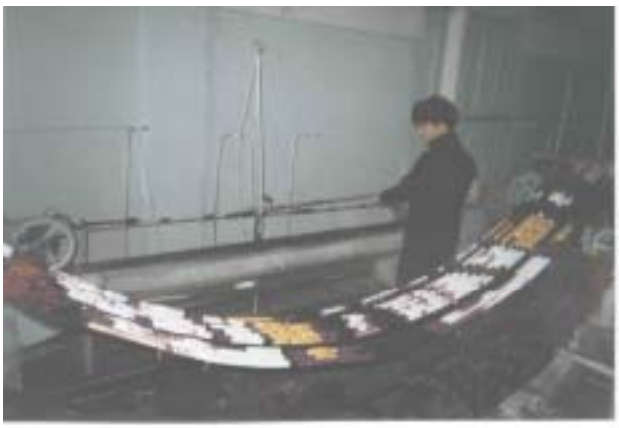
Chapter 5. Annex 1: Photos

Multiends reeling machine



Tie and dye method – Uzbekistan

Silk carpet weaving – Azerbaijan

Cottage silk reeling in Bulgaria

Persian carpet

Silk embroidery – Bulgaria

Asante kente – Ghana

Silk woman dress - Ethiopia

Silk Handcrafts Cottage Industries and Silk Enterprises Development in Bulgaria

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ABSTRACT

The silk handcraft cottage industries in Bulgaria have been very well developed during 17 - 20th centuries. Around 150-200 t fresh cocoon annually have been utilized for home silk reeling and processing. The silk reeling was practiced by using the so called "Vratza's type reeling machine ("dolap"), which even in the end of 19th century was more modern than the charka reeling machines widely used today in some countries. The silk handcrafts produced have been handloom woven silk fabrics, called "burundjuk", fabrics, having cotton warp and weft of silk, wool and silk hand-knitted sweaters, lady's blouses knitted by pure silk, knitted bed/table covers, doily, embroidery and usage as tinsel for tunic decoration. The local silk handcraft cottage industry played a very important role to preserve the sericulture during some periods of crisis in the international silk trade. However the local silk handcraft cottage industries have not been market oriented, but for meeting the personal needs of the farmer's family only, thus with the urbanization and industrialization of the country in the second half of 20th century and gradual disappearing of the local traditions in the wear and national costumes, inactivation and nearly disappearing of home silk reeling and weaving industry occurred. After the transition from centralized to market economical system many people especially in the rural and semi-urban area have become unemployed thus the revival of silk handcraft cottage industries in nowadays would give a very good chance to provide job opportunities and income resources. During the period 1998-2003 the government with the help of FAO has made efforts to establish a pilot silk knitting enterprise in Vratza. The knitting enterprise is equipped by especially designed sets for reeling thick denier (150-200d) raw silk, suitable for direct twisting, without doubling. Then the raw silk is processed through the operations of winding, twisting, degumming and dyeing in order to produce silk yarn on cones, ready for the knitting process. The knitting machines are specially designed for home use and production of boutique garment, namely they have small capacity of production, but are allowed to make a huge varieties of patterns. The commodities produced are pure silk ladies blouses in more than 10 colors, pure silk knitted scarves, as well as spring/autumn ladies and men's blouses, sweaters and cardigans made by silk blended with cotton, acrylic, linen, polyester or viscose, winter men's and ladies hand made sweaters and cardigans made by silk blended with wool or cotton. Other silk handcraft products made in Bulgaria now are silk embroidery, which is still implemented in making souvenir handkerchiefs as well as souvenir dolls, dressed with national costumes with silk, sold at the souvenir shops to the tourists. Now the only one commercial silk enterprise in Bulgaria having fully automatic silk reeling machines is "Svila "J.S.C. in Haskovo. The company has currently 2 sets of 240 ends each fully automatic Nissan reeling machines and the necessary machines and equipment for cocoon cooking, re-reeling and modern power looms for silk weaving. The raw silk produced is 2 A grade and the costs are higher than the market price. The silk fabrics and garment produced need improvement of their fashion design. Considering the experience of the already established in Vratza small silk cottage knitwear enterprise a national project for establishment of small silk enterprises dealing with cottage production of silk or blended with wool, cotton, linen etc., woven on handlooms or knitted fabrics, rugs, garment and/or knitwear may be initiated. The funding of project in amount of around 1.5 million Euro for three years may be through the European structural funds and the enterprise operation costs will be provided by loans from the European Bank for Reconstruction and Development (EBRD). The project activities will include country survey on the most appropriate regions for programme implementation, establishment 8 silk handcraft cottage private enterprises in different regions, overseas training of managerial level staff, local farmer's training, production and marketing of silk hand-woven fabrics, garment and knitwear.

About 1000 farmer's households will be engaged in the rearing of 5000 boxes of silkworm eggs annually, producing 100 t of fresh cocoons and getting gross incomes around 800000 Euro, which will be processed into silk handcrafts of total value 1 million Euro by 8 small enterprises, having 100 workers.

The role of Bulgaria in the regional short - and medium-term development strategies and necessary follow up actions may be through export of raw silk to silk carpet producer countries, which are not able to self-satisfy their needs, providing information and specialization on the basis of established in Vratza model cottage silk reeling and knitting enterprise, having closed circle of production from mulberry to the ready garment, export of high quality mulberry saplings and silkworm eggs, active participation in the international meetings on the problems of silk handcraft cottage industries development.

Key words: silk handcrafts, cottage industries, Bulgaria, development

Chapter 1. Introduction

Even though the first industrial silk reeling factory was established in 1892 in Bulgaria there had been existing a well developed traditional silk handcraft cottage industry for several centuries earlier.

The sericulture farmers, especially in the North-West and Central North Bulgaria have kept with them for their own needs a part of the fresh cocoons produced, which accounted for around 150-200 t annually, especially those from the second crop in the summer-autumn season. The cocoons have been used for home silk reeling and processing. The home reeling continued until 1970's and the silk weaving on handlooms – until 1980's. During the last decade silk has been used in very few artisan textile products because of its too high price and lack of suitable yarn.

The home silk reeling was practiced by the most primitive way or using the so called "Vratza's type reeling machine ("dolap"). In both cases the raw silk reeled was coarse and unsuitable for industrial purposes.

The silk handcrafts produced have been as follows:

1. silk fabrics, called "burundjuk": it is woven by both warp and weft silk yarns. The 'borundjuk" is usually made with stripe, which is put in the warp and prepared by special twisted and degummed silk, called "agur".
2. silk fabrics without stripe: it is woven by warp of raw silk, reeled with more twisted croissure, having 50-80 denier size.
3. thick silk fabrics: it is woven by warp and weft of twisted and degummed silk yarns, having size, according to the specific needs.
4. fabrics, having cotton warp and weft of silk: the silk weft yarn is very thin-20-22 denier.
5. hand-knitted sweaters by wool and degummed and twisted silk yarn and lady's blouses knitted by pure silk twisted, degummed/dyed yarn;
6. knitting bed/table covers, doily, embroidery and usage as tinsel for tunic decoration of twisted and degummed/dyed silk yarn.

The local silk handcraft cottage industry played a very important role to preserve the sericulture during some periods of crisis in the international silk trade.

After the change of political and economical system in Bulgaria (1944-1950) the local silk handcraft cottage industry described above gradually declined. The main reason was that the silk handcrafts produced by this home cottage industry have not been market oriented, but for meeting the personal needs of the farmer's family only. However with the urbanization and industrialization of the country the local traditions in the wear and national costumes gradually disappeared. During the communist times the government hasn't paid enough attention to the silk artisan production considering this activity as too backward. However after the transition from centralized to market economical system many people especially in the rural and semi-urban area became unemployed and the revival of silk handcraft cottage industries in nowadays would give a very good opportunity to provide job opportunities and income resources. It must be indicated that the traditional silk handcraft products should be diversified in order to meet the modern tastes for selling them mostly to the tourists at the local market as well as for export to some EU countries.

Since 1998 the Sericulture Experiment Station in Vratza has started experiments in development of suitable technology for production of silk and silk blended knitted garments. The silk and blended knitted garments cottage based production development was considered as promising for Bulgaria in order to utilize mostly inferior quality cocoons and raw silk. During the period 1998-2003 the government with the help of FAO has made efforts to establish a pilot silk knitting enterprise in Vratza. The knitting enterprise is equipped by especially designed sets for reeling thick denier (150-200d) raw silk, suitable for direct twisting, without doubling. Then the raw silk is processed through the operations of winding, twisting, degumming and dyeing in order to produce silk yarn on cones, ready for the knitting process. There are used modern Swiss made knitting machines, computerized and having more than 600 patterns in their memory. The machines are specially designed for home use and production of boutique garment, namely they have small capacity of production, but are allowed to make a huge varieties of patterns. The enterprise is equipped also with the necessary sawing machines used for tailoring the ready for the market garments. The enterprise produces not only pure silk knitted garment but also blended with cotton, wool, linen, likra, polyester, viscose, polyacril etc. in order to decrease the costs and the market price. Other product are the hand made winter knitted sweaters, made by blend of silk/wool or silk/cotton. The enterprise provides the yarn and models to home knitters (women) and then pays to them for their work. The cottage silk knitting enterprise in Vratza is able to produce machine knitted pure silk ladies blouses in more than 10 colors, pure silk knitted scarves, as well as spring/autumn ladies and men's blouses, sweaters and cardigans made by silk blended with cotton, acrylic, linen, polyester or viscose, winter men's and ladies hand made sweaters and cardigans made by silk blended with wool or cotton. SES-Vratza managed to create of a model enterprise, having a completely closed circle of production, starting with production of mulberry saplings, silkworm eggs, cocoons, raw silk, silk yarn and ready garment. This already functioning even in a small scale silk handcraft cottage enterprise could be used as a model to expand this activity in a larger scale.

Other silk handcraft products made in Bulgaria now are silk embroidery, which is still implemented in making souvenir handkerchiefs, sold at the souvenir shops to the tourists. Dolls, dressed with national costumes with silk are produced by craftswomen. There is a very big diversity of national costumes in the different regions of Bulgaria. The dolls are sold at the souvenir shops.

The first modern filature, having 80 basins of Italian type was established in 1892 at Asenovgrad (South-East Bulgaria) and used to work for 18 years, until 1910. In 1938 there were 47 silk reeling factories in Bulgaria, the number of silk reeling basins (one basin had 8-10 ends) was 1627, having a total reeling capacity to process about 3600 t fresh cocoons/year.

The Italian multiend silk reeling machines were used till the end of 1970's and after that they had gradually been shifted by Japanese Keinan and Nissan automatic silk reeling machines. Now the only one company in Bulgaria having fully automatic silk reeling machines is "Svila "J.S.C. in Haskovo. The company has currently Nissan –2 sets of 240 ends each.

During the last 5 years the company has produced only 5-8 t of raw silk annually. The quality is maximum 2A due mainly to the quality of cocoons and the higher alkalinity of the water.

The major constraints against silk handcraft cottage industries development in Bulgaria are that this traditional industry, producing national style fabrics which has been existing for many centuries is now completely inactivated. Since the traditional silk fabrics weaving has been nearly stopped now there aren't enough skillful workers, who are capable to weave the fabrics. Due to the above reasons the production of silk fabrics, woven by handlooms should start practically nearly from zero. The production of silk/blended knitwear capacity is still too low to ensure satisfactory amount of garments for certain markets. The fashion design of the silk and blended knitted garments still needs of improvement. Still haven't been made enough efforts in finding market for silk and blended sweaters in Bulgaria, especially in the big cities like Sofia, Plovdiv, Varna, the Black sea resorts, mountain winter resorts etc. as well as to search for smaller external markets which doesn't require obligatory big minimum amount of orders per style. There aren't any traditional Bulgarian national costumes, which are popular to wear by the people, even in some special occasions. The local market of souvenirs with silk is still not well developed.

The major constraints against silk enterprises development in Bulgaria are that the maximum grade of the fine raw silk, produced by Svila company is 2 A. As it is well known, this grade of raw silk now can be sold at the International market for around 20 US$ per 1 kg. However the costs of Svila for production of 1 kg raw silk are as high as around 40 US$/kg. For the ordinary Bulgarian people the silk fabrics are too expensive, compared with other similar in look kinds of cloth like rayon (viscose and polyester). For the rich Bulgarian people the locally made silk fabrics quality is not acceptable therefore they prefer to buy cloth produced in Italy or Korea. The ecological conscious and thinking of the most Bulgarian people is still too poor, therefore they prefer to buy cheap or fashion cloth and do not take into account the kind of material.

The main ways and means to alleviate the above mentioned constraints are to start production of silk fabrics, woven on handlooms through private enterprises, engaging also the local farmers, initially as a pilot project, financed by EU structural funds. To establish either at SES-Vratza or at Agrarian University of Plovdiv a laboratory for cocoon and silk quality testing. Design the silk fabrics based both on the centuries old tradition in Bulgaria and modern market demands. To improve the quality of raw silk, the fashion design of the silk and blended fabrics and garment. To improve the relationships and cooperation between all the Bulgarian companies dealing with silk production and processing in order to use the maximum existing capacity of the country.

Considering the experience of the already established in Vratza small silk cottage knitwear enterprise a national project for establishment of small silk enterprises dealing with cottage production of silk or blended with wool, cotton, linen, woven on handlooms or knitted fabrics, rugs, and/or knitwear may be initiated. The funding of enterprise operation costs will be provided through loans from the European Bank for Reconstruction and Development (EBRD).

Annually Bulgaria is visited by more than 5 million foreign tourists, mainly from the EU member countries. Therefore the most promising market for silk handcrafts are the places where there are tourists. These places are:

- The airports of Sofia, Plovdiv, Varna and Burgas
- Black sea resorts from May to September
- Winter mountain resorts, such as Borovetz, Pamporovo, Bansko etc. from December to March
- Other tiuristic places like Veliko Tarnovo (the old Bulgarian capital), Gabrovo, Troyan, Rila monastery, Batchkovo monastery etc. all over the year.
- The big cities: Sofia, Plovdiv, Varna, Burgas, Stara Zagora, Ruse etc.

The silk handcraft producer should prepare a e-catalogue of the silk handcrafts, including the best models photos, description, prices etc. and as a first step to send it by the e-mail to the possible places for sell them. In order to sell the products there should be a combination of three factors, namely presence of market, high quality and reasonable price.

Short - and medium-term development strategies and necessary follow up actions and cooperative activities for silk handcraft cottage industries and silk enterprises development at the regional level, in Africa, Central Asia, Europe and Near East may include to create under the patronage of FAO an international working group or committee on "Silk handcraft cottage industries development", having a member from each country involved in this industry. Conduct regular regional meetings in order to provide an international forum to facilitate discussions and information exchange on cultural traditions, support policy, development strategies, technology and trade in traditional silk handcrafts.

Chapter 2. Historical background, present status and future prospects of the silk handcrafts cottage industries sector and silk enterprises in the country.

2.1.Silk handcrafts commodities, regional and country diversity of traditional silk handcrafts items and types of cottage industries and silk enterprises.

2.1.1. Silk handcraft cottage industries background

Even though the first industrial silk reeling factory was established in 1892 in Bulgaria there had been existing a well developed traditional silk handcraft cottage industry for several centuries earlier.

Until 1950's the sericulture farmers, especially in the North-West and Central North Bulgaria kept with them for their own needs a part of the fresh cocoons produced, which accounted for around 150-200 t annually, especially those from the second crop in the summer-autumn season. The cocoons have been used for home silk reeling and processing. The home reeling continued until 1970's and the silk weaving on handlooms – until 1980's. During the last decade silk has been used in very few artisan textile products because of its too high price and lack of suitable yarn.

The farmers processed the cocoons into raw silk, silk fabrics and garment. This phenomenon was closely connected with the peculiarities of Bulgarian agricultural household, got accustomed to self-satisfy by most of the products, produced. The cocoons for home processing were reeled usually fresh.

The silk reeling was practiced by the most primitive way or using the so called "Vratza's type reeling machine ("dolap") (see Annex 1). In both cases the raw silk reeled was coarse and unsuitable for industrial purposes. Small parties of this raw silk were exported to Albania and some other Balkan countries only. The home silk reeling has been especially popular in North-West and Central parts of the country in the regions of Vratza, Vidin and Pleven where there hasn't been any village without silk reeling machines.

The Vratza's type silk reeling machine – "dolap" has two ends. The machine production capacity per 8 h, estimated at the Sericulture Experiment Station (SES) - Vratza is as follows:

-in silk 12/14 denier (4-5 cocoons per end): 180-200 g

-in silk 25/28 denier (9-10 cocoons per end): 300-325 g

-in silk 50/70 denier (20-25 cocoons per end): 430-450 g

-in silk 140/170 denier (50-60 cocoons per end): 850-900 g

However the Vratza's type silk reeling machine is used mainly for reeling thick denier raw silk because silk with size of 100-300 denier has been mostly used in the home weaving. The silk produced by the "dolap" has been used for weaving in the following combinations:

1. raw silk without twisting both as warp and weft;
2. raw silk, twisted for weft and without twisting for warp;
3. raw silk, twisted for both warp and weft;
4. twisted and degummed silk yarn for warp and weft;
5. warp from cotton and weft-raw silk without twisting;
6. warp from cotton and weft-thick twisted and degummed silk yarn;
7. wool and degummed and twisted silk yarn for hand-knitted sweaters;
8. twisted and degummed/dyed silk yarn for knitting bed/table covers, doily, embroidery (see Annex 1) and as tinsel for tunic decoration.

There aren't any designed especially for silk weaving handlooms in Bulgaria.. The weavers have used ordinary home looms, used for weaving of wool, cotton etc. as well, but adjusted for the purposes of silk weaving. (see Annex 1)

The silk handcrafts woven have been as follows:

1. silk fabrics, called "burundjuk": it is woven by both warp and weft silk yarns. (see Annex 1). The 'borundjuk" is usually made with stripe, which is put in the warp and prepared by special twisted and degummed silk, called "agur".
2. silk fabrics without stripe: it is woven by warp of raw silk, reeled with more twisted croissure, having 50-80 denier size.
3. thick silk fabrics: it is woven by warp and weft of twisted and degummed silk yarns, having size, according to the specific needs.
4. fabrics, having cotton warp and weft of silk: the silk weft yarn is very thin-20-22 denier.

The silk handcrafts produced by this home cottage industry have not been marketly oriented, but for meeting the personal needs of the farmer's family.

Around 1940's the Government started to promote the silk handcraft cottage industry development by organizing short (20 days) term training courses on home silk reeling, twisting, degumming dyeing and weaving at SES-Vratza. The participants were mostly teachers from agricultural schools, who further transmitted the knowledge to the ordinary rural women.

The local silk handcraft cottage industry played a very important role to preserve the sericulture during some periods of crisis in the international silk trade.

After the change of political and economical system in Bulgaria (1944-1950) the local silk handcraft cottage industry described above gradually declined. The main reason was that the

silk handcrafts produced by this home cottage industry have not been market oriented, but for meeting the personal needs of the farmer's family. However with the urbanization and industrialization of the country the local traditions in the wear and national costumes gradually disappeared. During the communist times the government hasn't paid enough attention to the silk artisan production considering this activity as too backward. However after the transition from centralized to market economical system many people especially in the rural and semi-urban area became unemployed and the revival of silk handcraft cottage industries in nowadays would give a very good opportunity to provide job opportunities and income resources. It must be indicated that the traditional silk handcraft products should be diversified in order to meet the modern tastes for selling them mostly to the tourists at the local market as well as for export to some EU countries.

2.1.2. Present status and prospects for silk handcraft cottage industries development in Bulgaria

2.1.2.1. The pilot silk knitting cottage enterprise established in Vratza.

Knitted silk goods as T-shirts, camisoles, polo-neck sweaters and cardigans have appeared in various European, American markets and in Japan. Knitted products of silk blended with cotton, linen, acrylic and viscose have been selling well in the middle price categories in Europe and especially in the United States. Luxury fibers such as cashmere, alpaca and camel hair are also blended with silk. The trade believes this is the trend for the future in several European markets.

The main producers of silk and blended with silk knitted garments are China and Italy. For example the knitted goods have been especially important to Italy's production and export trade. The country has over the years been the world's largest importer of waste silk, which is spun into yarn for the production of knit wear. It has always been at the forefront of new trends in the use of silk and silk blends in the knitted goods.

In Germany the knitted silk products are in demand with the easy care qualities of these products giving them an advantage over woven silk goods.

Almost all the Nordic markets are interested in development of silk blends with cotton, linen and other fibers. One of the leading European brands of casual wear, Marc O'Polo, has developed a cotton–silk blend for the use of its partners in India who produced knitted goods and the blend. The products using it have been highly successful. Blends, both woven and knitted, are also popular for the complete range of garments and home-furnishing textiles on the market. In the United Kingdom silk noil is blended with fibers such as cotton, linen and wool for use in the production of knitted goods. In the United States there is traditional and strong demand for knitted items in many product categories, such as T-shirts, sweaters, skirts and jackets. Silk is now blended with lycra for stretch, as well as with other luxury fibers such as linen or cashmere.

In Bulgaria, the first attempts for industrial scale silk knitting were made in the 20's - 30's of the 20th century. Due to different reasons they appeared to be unsuccessful and the companies gave up this activity. Simultaneously at the same time Bulgarian companies succeeded to develop a comparatively good silk sock-knitting industry. In the 1970's similar attempts were made by the former state group-Sirma, Plovdiv but felt down. Since 1998 the Sericultural Experiment Station in Vratza has started experiments in development of suitable technology for production of silk and silk blended knitted garments.

Till the end of 50's of the 20th century there was a well developed home silk reeling in Bulgaria. For their needs the farmers used to separate about 10-15 % of the total cocoon

production in the country or 150 - 200 t of fresh cocoons, mainly produced by the second autumn crop. A part of this home-reeled silk was twisted, degummed and dyed and after that by the yarn produced, the rural people hand made pure silk knitted blouses as well as blended with wool, cotton or linen sweaters. Some of these garments can be found even in nowadays.

In our opinion the silk and blended knitted garments production development is promising for Bulgaria and could contribute to solve some market problems of the silk industry.

The existing preconditions for this are as follows:

* silk and blended knitted garments can be made by knitting machines from №3 to №30, that means to allow utilization of very fine-20/22D as well as coarse 100-300 D raw silk.
* in the knitting with thick denier silk yarn can be used bad quality raw silk, therefore the 2nd and 3rd grade cocoons can be utilized and also cheaper silk reeling technique can be implemented.
* the raw silk, of moderate quality (A-2A) produced can be used successfully for production of silk T-shirts.
* the worst quality thick denier silk yarn can be utilized in hand made blended (silk/wool; silk/cotton) winter pullovers production.
* there is comparatively well developed knitting industry, trained and experienced workers in Bulgaria.

Taking this idea, the silk and blended knitted garments cottage based production development was considered as promising for Bulgaria in order to utilize mostly inferior quality cocoons and raw silk. During the period 1998-2003 the government with the help of FAO has made efforts to establish a pilot silk knitting unit in Vratza.

Development of small machineries and technology for cottage production of raw silk, suitable for knitting

Cottage – type cocoon drier of air circulating shelves – carrier type

The capacity of this cocoon dryer (see Annex 1) is about 100 kg of fresh cocoons per one shift/one drying, therefore 200 kg per day when work in 2 shifts. The cocoons are kept in the dryer for 4 hours at 75-90 ^{0}C in order to only kill the pupae and then the cocoons are preserved for about two months on shelves in a dry room till they reach the standard moisture of 10 %.

Cottage type cocoon cooking equipment

Two pan type cooking method was applied. This method consists of simple cooking equipment having two stainless steel basins fitted in a row on a platform or table. The basins are provided with water connection and heaters. The accessory equipment consists of a long handled brass wire cage for holding the cocoons, a wire mesh disc of a special design with wooden handle for keeping the cocoons immersed in the basin and long handled perforated ladles.

The following cooking technology must be implemented:

a) The cocoons are kept in a perforated cocoon cooking cage and immersed in the first cooking pan at 96 ^{o}C for 0.5 min.

b) The cage is then transferred immediately to the second cooking pan at 60 ^{o} C for 2 min.

c) The cage is then brought back to the first pan at 96 ^{o}C for 3 to 6 minutes (depending upon the age, compactness and shell ratio of the cocoons).

d) The cage is left in the same pan for further 2 minutes.

e) Then cold water is sprinkled slowly to bring down the temperature to about 80 ^{o} C gradually.

f) The cage is opened and cocoons are dropped in a third pan for keeping them temporarily until brushing .The temperature of water in the pan is 60 ^{o}C.

g) The cocoons are brushed in the brushing pan at 80-85 ^{o} C temperature of the water.

Cocoon brushing equipment and silk reeling machines

Two-ends reeling machine for thick denier raw silk: This machine was designed and manufactured in Bulgaria for reeling thick denier (180-200 denier) raw silk, necessary for silk knitting by knitting machines gouge 5 and 8. The set consists of **cocoon cooking device**, **cocoon brushing and groping end device** and **two machines for silk reeling** (see Annex 1). Usually 2 workers serve the reeling set, but it is possible only one worker to work also economically by it. All the processes are driven by electricity, therefore there is no need of any steam boiler.**The electricity expenses** for production of 1 kg raw silk 200 D are **30.33 kw** in capacity of production 1.600 kg raw silk/8 h; **The water expenses** for production of 1 kg raw silk : **125 l** ; **Number of reeling basins**:2; **Number of ends**:4 (2 per each basin).

Each end has jettebout for easier casting the cocoon filaments in order to increase the efficiency of reeling.

Cocoon brushing and groping end device: 2 brushing basins, each having separate mechanical brush with plastic hair, driven by electricity. There are two speeds of brush movement, according to the cocoon quality.

Reeling machine: Each reeling basin has attached 2 jettebouts, 3 rolls for making Tavellette type croissure, traverse guider and a big reel, having circumference of 1.5 meter. After reeling the skeins are taken off the reel and can be directly winded on bobbins.There is no need of re-reeling.The temperature of water in the cooking pots, brushing and groping end pots, and reeling basins is maintained automatically.

Productivity: Since the machine was designed for reeling thick denier raw silk, each basin has only 2 ends and is able to produce about 0.8 - 1.2 kg of raw silk 180-220 D (or 1.6 - 2.4 kg per set) per one shift (8 h) according to the cocoon quality and skill of the worker. The machine can be used to produce any thickness of raw silk, but for example if produce 20/22 D, in spite of the higher reeling speed, the productivity per basin/shift will go down to about 500 g raw silk.

Silk knitting process

The main parts of silk knitting process are as follows:

Preparation process:

1. The silk yarn for knitting should have low twists per meter, namely ~ 90-120

2. For knitting on low gauge machines, such as № 5, 8 and 10 the silk yarn should be degummed and/or died before the knitting. For the knitting thick denier filament silk or spun silk can be used.

3. The silk yarn is transferred from skeins to cones, suitable for knitting. (see Annex 1). During the conning the silk thread passes through paraffin.

Flat jacquard type (see Annex 1) knitting machines, gauge 5 and 8 are used for silk knitting. The machines produce silk knitted cloth which is directly tailored for making the garment. The ready made garments should be ironed.

The main kinds of knitting patterns are:

- Tuck stitch patterns on single bed or double bed.
- Slip stitch patterns.
- Pin tuck patterns.
- Lacy patterns.
- Jacquard.
- Racking patterns.

The cottage silk knitting unit in Vratza is able to produce machine knitted pure silk ladies blouses in more than 10 colors, pure silk knitted scarves, as well as spring/autumn ladies and men's blouses, sweaters and cardigans made by silk blended with cotton, acrylic, linen, polyester or viscose, winter men's and ladies hand made sweaters and cardigans made by silk blended with wool or cotton (see Annex 1).

2.1.2.2. Other silk handcraft production

- ❖ Silk embroidery: still is implemented in making souvenir handkerchiefs, which are sold at the souvenir shops to the tourists (see Annex 1)
- ❖ Dolls, dressed with national costumes with silk (see Annex 1)

These dolls are produced by craftswomen. There is a very big diversity of national costumes in the different regions of Bulgaria. The dolls are sold at the souvenir shops.

- ❖ National souvenir – "martenitza" (see Annex 1): According to the Bulgarian tradition we celebrate the spring coming on 1st March. On this day people gift each other a special national souvenir, called "martenitza". The SES-Vratza started to make this souvenir by silk about 10 years ago. Since the "martenitza" made by silk is much more beautiful than the ordinary one it has become very popular and the price is about double.

2.2. Silk enterprises development in Bulgaria

The first modern filature, having 80 basins of Italian type was established in 1892 at Asenovgrad (South-East Bulgaria) and used to work for 18 years, until 1910. The raw silk produced was exported to Lyon, Milan, London etc. During the period 1910-1930 there haven't existed any industrial silk reeling factories in Bulgaria. The main reasons were the two wars – the Balkan war in 1912-1913 and the first world war in 1915-1918 and consequent economical crisis.

Around 1922 many refugees from Armenia came to Bulgaria. Some of those people had dealt with silk reeling before and had good experience in this activity. The Armenians established one of the first silk industrial reeling factories in Bulgaria.

After 1930 the interest in establishment of silk reeling plants increased remarkably because of the locally produced cocoons were purchased at prices higher than those at the international market, therefore their export was not profitable and they had to be reeled in the country.

Other reason was the very high excise on the rayon after 1932. In 1938 there were 47 silk reeling factories in Bulgaria, the number of silk reeling basins (one basin had 8-10 ends) was 1627, having a total reeling capacity to process about 3600 t fresh cocoons/year.

The Italian multiend silk reeling machines were used till the end of 1970's and after that they had gradually been shifted by Japanese Keinan and Nissan automatic silk reeling machines.

Now the only one company in Bulgaria having fully automatic silk reeling machines is "Svila "J.S.C. in Haskovo. The company currently has Nissan –2 sets of 240 ends each. The machines were erected in 1985-1988.

They have the following machines for silk throwing, doubling and twisting:

- 3 silk winding machines of the Japanese company Kakinoki having 100 heads each and one machine with 80 heads.
- one silk doubling machine of Kakinoki model made in 1986.
- One silk twisting Kakinoki, model 1989; machine consisted of 9 sets, having 200 spindles each.
- 20 power looms, 10 out of them having automatic shuttles Miamaya, Japan type, 190 cm width and 180 cm working width.

The other 10 power looms are without shuttles, made by Somet company-Italy in 1989.

The company doesn't have facilities and equipment for silk degumming, dyeing, and printing. For these operations Svila uses the services of Danube silk – Rousse company as well as of one Greek company from Soufly (town around 100 km from the Bulgarian – Greek border).

The maximum capacities for production of Svila J.S.C. are as follows:

- raw silk by Nissan sets – 40t/year
- thrown silk –20t/year
- silk fabrics (loom state) – 100 000 linear meters

The maximum annual amount of production reached by the company average of 10 years was:

- raw silk –140 t (by working in shifts)
- spun silk –5 t
- silk fabrics (loom state)-100000 m
- thrown silk-5-7 t
- finished silk fabrics –50000 m
- silk apparel-20000 pieces

The main markets of Svila production before 1990 were Japan, Greece, Turkey, Netherlands and Italy.

In nowadays Svila sells its silk products only in Bulgaria and Greece.

During the last 5 years the company has produced only 5-8 t of raw silk annually. The quality is maximum 2A due mainly to the quality of cocoons and the higher alkalinity of the water.

The main reasons for the small local silk market in Bulgaria are the still comparatively low living standard of the people, the lower price of the Chinese silk goods, some difficulties of the financing of Svila company, the high productional costs of the Svila's silk, the high price paid by the company for the steam for silk reeling, and the not very good management.

The main solutions to solve the market problems of Svila J.S.C. in Haskovo can be the following:

* To find a better managerial team for the company ruling.
* To sell a part of company's shares to other companies, having good relationships with silk consuming factories.
* To close completely the production circle by establisment of unit for silk degumming, dyeing and printing.
* To make serious efforts in finding international markets for export of silk and allied products.

The other company in Bulgaria which has capacity to process cocoons and silk is Sirma J.S.C. in Plovdiv.

This company has the following machines:

№	Name of the machine	Quantity pieces	producer	Year of production	Capacity – kg/8h
1	Cocoon drying machine A-41	1	Japan	1974	1550/2000
2	Silk reeling machine -dupion	1	Bassasy - Italy	1991	17.2/120denier
3	Silk rereeling machine KR-UD	5	Kakinokisa kusho-Japan	1976	39.20/21 denier
4.	Bobbin winder WF -S	9	Kakinokeisa kusho-Japan	1976	21.20/21 denier
5	Doubling bobbin winder KBW-4	5	Kakinokisa kusho-Japan	1976	35.80/21 denier
6	Doubling bobbin winder KBW-4	1	Kakinokisa kusho-Japan	1985	35.80/21 denier
7	Twisting machine TK-5	6	Kakinokisa kusho-Japan	1976	26.80/21 denier
8	Twisting machine TU-7	8	Kakinokisa kusho-Japan	1985	26.8/21 denier

The company has also 40 power looms, however of not very modern model.

Sirma is able to produce the following silk yarns:

* tram –denier 20/22/2,3,4 play 150 T/M
* crepe – denier 20-22/2,3,4 play 2000 T/M
* doupion – denier 60-120/2,3,4 play 150-300 T/M

Sirma company produced and traded with silk crepe satin, crepe de chine, poplin, taffeta, shantung, jacquard as well as fabrics composed by 50/50 silk/cotton; 50/50 silk/cotton/polyester; 50/50 silk/wool; 50/50 silk/linen

The company's fashion house produced small series of high-quality men's and women's silk dressings as suits, shirts, trousers, blazers, garment accessories-ties, shawls, scarves etc.

However during the last 5 years Sirma company restricted its production to only small amount thick denier raw silk and silk yarn for export to Japan and Greece.

The market problems of Sirma Company can be solved by:

* providing fully automatic silk reeling machines to process the cocoons to high grade raw silk.
* to provide more modern type of power looms in order to improve the silk fabrics quality.
* to establish silk printing unit in order to close completely the production circle.
* to improve the relationships and cooperation between all the Bulgarian companies dealing with silk production and processing.
* searching for new markets for silk and allied products abroad.

2.3. Economics and markets

2.3.1. Present situation and possibilities for raw silk market development

The average annual raw silk production in Bulgaria for the last 5 years has been 7-10 tons. The potential raw silk producers in Bulgaria, which have capacity are the same three companies, namely Svila-Haskovo, Sirma-Plovdiv and SES-Vratza. The newly established in 2005 company Bulgarian silk, Sofia still doesn't have any machines and equipment.

There are two kind of raw silk, produced in Bulgaria - fine silk 20/22 D or 40/44 D which is produced by Svila company only as well as thick denier silk 60-300 D produced by the three companies.

The maximum grade of the fine raw silk, produced by Svila company is 2 A.

As it is well known, this grade of raw silk can be sold at the International market for about US$ 20/kg at present.

However the costs of Svila for production of 1 kg raw silk are much higher:

Item	**Costs in US$**
Dried cocoons	21
Cocoon drying and assorting	5.00
Silk reeling	16.00
Grand total	42.00

To solve this problem there are the following solutions:

* the costs for dry cocoons can not be decreased, because a fresh cocoon price less than 3 US$/kg is not acceptable by the farmers. The costs for cocoon drying and assorting could be decreased to 3 US$/kg raw silk. The costs for silk reeling could be decreased to 10 US$/kg raw silk. Even after the possible production costs decrease the raw silk price can not be lower than 34 US$/kg.

Therefore the only solution is **to pay some subsidy on the fresh cocoon price.**

* **to improve the quality of raw silk up to 3A - 4A**.: for this grade of raw silk there exists a good big market in Italy and France. However the problem for improving the raw silk quality is very complex and to solve it Svila company will need too many

time (3-5 years). For example in order to reach raw silk grade 3A - 4A first of all Svila company should improve markedly the cocoon quality as well as some parts of the reeling technology.

* **to decrease the costs for cocoon drying, assorting and silk reeling.** Now the costs of silk reeling are too high because the capacity of the Nissan automatic silk reeling machines is too big for the small amount of cocoons reeled. To decrease the unit costs of reeling Svila company could make some changes in the machines to use only some parts of them. Also the costs of reeling can be lowered by better management, using seasonal workers etc.

The other type of raw silk, namely thick denier is produced mainly by 2nd, 3rd grade cocoons and double cocoons.

The costs for production of 1kg of this kind of raw silk are as follows:

Item	**Costs in US$**
Dried cocoons	9.00
Cocoon drying and assorting	5.00
Silk reeling	7.00
Grand total	21.00

The thick denier raw silk has its market in some countries like Japan, Egypt Iran, Turkey, Greece.

At the beginning of 2001 Sirma company exported to Japan 1.5 t of thick denier raw silk. One Egyptian company, namely El-Mahallawy Co., dealing with production of silk carpets was interested to buy every year 50 t of this kind of raw silk, however the purchase price of 16 US$/kg suggested was not acceptable for the Bulgarian producers.

2.3.2. Present situation and possibilities for silk yarn market development

All the three companies are able to produce silk yarn. The silk yarn is produced with different number of twists per inch according to the customers orders. Sirma and Svila companies make time to time export of small amounts of silk yarn (mainly tram) to Japan and Greece. The selling price of 1 kg is 30-40 US$. As we mentioned above both companies have comparatively modern silk winding, doubling and twisting machines.

Svila company uses the services of other companies for silk fabrics degumming/dyeing/ printing. Sirma company and SES –Vratza have their own facilities for silk yarn degumming and dyeing. Svila company has also machines for silk wastes processing and produces spun silk yarn. The price of 1 kg is around 35-40 US$.
All these data prove that Bulgaria has comparatively big potential to produce sufficient quality silk yarn for the International market.

2.3.3. Present situation and possibilities for silk fabrics market development.

Now the three silk fabrics producers in Bulgaria are the companies Svila –Haskovo, Sirma – Plovdiv and Danube silk - Rousse.

The main amount of this fabrics is produced by filament silk (20/22 D or 40/44 D) and small amount by spun silk. The companies also produce blended fabrics– silk/polyester; silk/viscose and silk/cotton. The market price of 1 m pure silk fabrics with 1.40 m width is 8-10 US$. The companies try to sell these fabrics mainly at Bulgarian local market. Svila had a special shop

at Sofia's downtown and opened seasonally shops at the Black sea resorts. Sirma opened a special boutique in the old Plovdiv's downtown. SES-Vratza had a shop at the station but closed it two years ago. However they have difficulties in selling the fabrics due to the following main reasons:

* for the ordinary Bulgarian people the silk fabrics are too expensive, compared with other similar in look kinds of cloth like rayon (viscose and polyester).
* for the rich Bulgarian people the locally made silk fabrics quality is not acceptable therefore they prefer to buy cloth produced in Italy or Korea.
* now the tailor's services in Bulgaria are too expensive hence the people prefer to buy ready made garments.
* the ecological conscious and thinking of the most Bulgarian people is still too poor, therefore they prefer to buy cheap or fashion cloth and do not consider the kind of material. For example there are available at the Bulgarian market very fashionable fabrics made by rayon at a price of 12-14 US$ per 1 m and the people buy them.
* there aren't any traditional Bulgarian national costumes made by silk, which are popular in nowadays.

In our opinion the solution is to process the silk fabrics into silk garments. In order to sell silk fabrics at the International market the producers have to improve the quality as well as the fashion of their product.

2.3.4. The present situation and possibilities for silk garments, made by woven fabrics market development

Both companies Svila and Sirma produced silk garments like man's shirts, ladies blouses, ladies and men's suits, neck ties, ladies skirts and dresses. Almost all the garments were directed to the Bulgarian market. Before 1990 Svila used to produce also silk carpets in its branch companies in Harmanli and Svilengrad. Now this production is stopped mainly due to the high competition with other traditional producers (Turkey, China, Iran) and lack of sufficient markets. In 1998 by the assistance of the Bulgarian sericultural association in Sofia was established a trading house, having the name "Bulgarian silk". The main activities of this company were trade with Bulgarian silk fabrics and garments, making marketing investigations and giving suggestions to the producers for new commodities, investigations of the world silk market and making export of silk products, Bulgarian silk promotion. In spite of the very good idea, this trading house didn't achieve any remarkable practical results and was consequently closed.

The companies have the same difficulties like in the selling of silk fabrics. For example the price of one men's short sleeves shirt made by 100 % silk and produced by Svila – Haskovo is 20-22 US$, but the average price of the highest quality summer man's shirt, made by cotton/polyester is around 15 US$. In spite of all these constraints the companies managed to sell small amount of silk garments at the Bulgarian market. In order to expand this market not only in Bulgaria but in abroad as well they must improve mainly the fashion character of the garments.

2.3.5. Present situation and possibilities for silk and blended knitted garments and other innovative silk products markets development

The production costs for 1 kg of twisted, degummed/dyed silk yarn on cones, ready for knitting are as follows:

Item	Costs in US$
Cocoons	27.00
Silk reeling	7.80
Silk throwing	15.00
Silk degumming and dyeing	5.20
Total:	55.00

The costs for production of 1 knitted 100% silk ladies blouse are the following:

Item	Costs in US$
Silk yarn	18.00
Knitting and tailoring	3.00
Total :	21.00

The costs for production of 1 man's winter knitted silk/wool sweater are:

Item	Costs in US$
Silk yarn	11.00
Wool yarn	3.50
Knitting and tailoring	4.00
Total :	18.50

The local market price of the two items could be around US$ 30/piece. Fashionable knitwear made by non-silk materials is sold about this price.

Other knitted silk product are the scarves, which production costs are as follows:

Item	Costs in US$
Silk yarn	8.50
Knitting and tailoring	3.00
Total :	11.50

This costs allow a price at which the commodity is completely sellable at the local market.

There is a possibility to reduce the costs for the silk yarn by more than 30 % by increasing of raw silk percentage in the silk reeling and by making of some improvements in the silk winding and twisting machines.

The SES-Vratza tried to promote its silk knitted products by different ways. First we opened a new shop at the station in order to present the silk product to the local people as well as to all the people visiting the station. We also gave some garments on consignment to other companies in Vratza and on the Black sea resort. Small amounts of garments were exported to Greece, Egypt, Korea, South Africa, Libya and Dubai in order to try finding external markets. The products were exhibited at the 19th congress of ISC, held in Bangkok, Thailand in September 2002.

Chapter 3. Major constraints against and recommendations for artisanal / traditional silk handcrafts cottage industries and silk enterprises development at the country and regional levels.

The major constraints against silk handcraft cottage industries and silk enterprises development in Bulgaria are as follows:

For the silk handcraft cottage industries:

- The traditional silk handcraft cottage industry, producing national style fabrics which has been existing for many centuries is now completely inactivated.
- Since the traditional silk fabrics weaving has been nearly stopped now there aren't enough skillful workers, who are capable to weave the fabrics.
- Due to the above reasons the production of silk fabrics, woven by handlooms should start practically nearly from zero.
- The production of silk/blended knitwear capacity is still too low to ensure satisfactory amount of garments for certain markets.
- The fashion design of the silk and blended knitted garments still needs of improvement.
- Still haven't been made enough efforts in finding market for silk and blended sweaters in Bulgaria, especially in the big cities like Sofia, Plovdiv, Varna, the Black sea resorts, mountain winter resorts etc. as well as to search for smaller external markets which doesn't require obligatory big minimum amount of orders per style.
- There aren't any traditional Bulgarian national costumes, which are popular to wear by the people, even in some special occasions.
- The local market of souvenirs with silk is still not well developed.

For the silk enterprises:

- The maximum grade of the fine raw silk, produced by Svila company is 2 A. As it is well known, this grade of raw silk now can be sold at the International market for around 20 US$ per 1 kg. However the costs of Svila for production of 1 kg raw silk are as high as around 40 US$/kg.

- For the ordinary Bulgarian people the silk fabrics are too expensive, compared with other similar in look kinds of cloth like rayon (viscose and polyester).
- For the rich Bulgarian people the locally made silk fabrics quality is not acceptable therefore they prefer to buy cloth produced in Italy or Korea.
- Now the tailor's services in Bulgaria are too expensive hence the people prefer to buy ready made garments instead of fabrics. On the other hand the locally produced silk garment appear to be too expensive for the consumers.
- The ecological conscious and thinking of the most Bulgarian people is still too poor, therefore they prefer to buy cheap or fashion cloth and do not take into account the kind of material.

The main ways and means to alleviate the above mentioned constraints are as follows:
For the silk handcraft cottage industries:

- Start production of silk fabrics, woven on handlooms through private enterprises, engaging also the local farmers, initially as pilot project, financed by EU structural funds.
- The funding agency to provide the necessary funds for overseas/local training in cottage type production of silk yarn and silk handloom weaving.
- Design the silk fabrics based both on the centuries old tradition in Bulgaria and modern market demands.
- Improve the fashion design of the silk and blended knitted garments.
- Make efforts in finding market for silk and blended knitted wear in Bulgaria, especially in the big cities like Sofia, Plovdiv, Varna, the Black sea resorts and mountain winter resorts.
- Search for smaller external markets which doesn't require obligatory big minimum amount of orders per style of knitwear.
- Diversify the use of silk in souvenirs making and look for exploring new markets not only in Bulgaria but abroad as well.

For the silk enterprises:

- Since the system for fresh cocoon evaluation implemented in Bulgaria has the defect that the real amount of silk in the cocoon is not considered in order to improve the cocoon quality control as well as to stimulate the farmers to produce cocoons with higher quality is necessary to try adopting in the field the cocoon evaluation systems based on calculation of cocoon shell percentage or reelability after making silk reeling test.
- In order to improve the cocoon and raw silk quality control to establish either at SES-Vratza or at Agrarian University of Plovdiv a laboratory for cocoon and silk quality testing. This laboratory will be completely state and authorized by the Government to make independent testing of the cocoons and raw silk produced in Bulgaria or imported from other countries.
- The owners of Svila J.S.C. to make efforts in establishment a closer cooperation with other companies, having good relationships with silk consuming factories.

- To close completely its production circle Svila J.S.C. in Haskovo needs to establish by itself an unit for silk degumming, dyeing and printing, or to use the services of Danube silk company in Ruse.
- In order to start production and have competitive capacity the Bulgarian silk J.S.C., Sofia has to buy cocoon dryers and fully automatic silk reeling machines to process the farmer's cocoons into high grade raw silk, and to provide more modern type of power looms in order to improve the silk fabrics quality, to establish silk printing unit in order to close completely the production circle.
- There is an urgent need to improve the relationships and cooperation between all the Bulgarian companies dealing with silk production and processing in order to use the maximum existing capacity of the country. The newly established company Bulgarian silk, which pretends to be a textile cluster may play this role.
- In order to explore markets for their products the Bulgarian silk/silk allied products producers have to improve the quality of raw silk, the fashion design of the silk and blended fabrics and garment.
- In order to increase the cocoon production in the country one of the first steps must be the establishment of seasonal branches of the companies only for the period of cocoon purchasing in the main sericulture regions.
- Since now the cocoon production is more than 20 times less than 10 years ago the very big capacity cocoon drying machines are not suitable because the amount of cocoons produced is not enough to fill the machine and they are forced to work using half or less of their capacity. In order to make dry cocoon export the Bulgarian companies must adopt in the field small type of cocoon dryers. These dryers will decrease nearly 2 times the costs of drying and allow to establish a net of small cocoon purchasing centers in the main sericulture regions. The companies must improve the cocoon storage, especially the pest control, cocoon assorting especially to meet the demands of the possible customers, cocoon package and to try to increase the amount of production since the customers require the cocoon lots not less than certain amount.
- To find markets for its high grade raw silk Svila J.S.C. –Haskovo must improve the quality of raw silk from 2A up to 3A - 4A. For this grade of raw silk exists a good big market in Italy and France. This company must also decrease the costs for cocoon drying, assorting and silk reeling. Now the costs of silk reeling are too high mainly because the capacity of the automatic silk reeling machines is too big for the small amount of cocoons reeled. To decrease the unit costs of reeling Svila company could make some changes in the machines to use only a part of them. Also the costs of reeling can be lowered by better management, using seasonal workers etc.
- One of the ways to solve the Bulgarian silk market problems is the development of new silk innovative products which do not require very high quality of raw silk and the yarn.

Chapter 4. Strategies and Follow up Actions for silk handcraft cottage industries and silk enterprises development in Bulgaria

4.1. Programme for establishment of small enterprises for silk handcraft production in Bulgaria

Introduction

Several silk carpet weaving units operated in the South-East Bulgaria about 13 years ago. They used Turkish and Persian designs, the production was exportly oriented only, but they couldn't withstand the strong world market competition and had been forced to close. The main reason for the collapse of this industry in Bulgaria was the absence of local market for silk carpets with oriental designs.

However Bulgaria has its own more than 300 years old tradition in woolen and cotton carpets and rugs weaving in the region of Chiprovtzi, which is an area in the North-Western part of the country. These only hand – woven carpets have their own specific design, famous as "Chiprovtzi design" and they are sold successfully at the local market, mostly to the tourists. A survey made in 2004 revealed that silk can also be used in making the "Chiprovtzi" type rugs. There already exists the characteristic traditional pattern of the rug, which practically sells it at the market. The use of silk will not increase too much the costs of the rugs, because the wrap yarn shall be cotton or wool. The use of silk as weft yarn would increase very much the beauty of these traditional rugs.

Taking this idea as well as the experience of the already established in Vratza small silk cottage knitwear enterprise a national project for establishment of small silk enterprises dealing with cottage production of silk or blended with wool, cotton, linen, woven on handlooms or knitted fabrics, rugs, and/or knitwear may be initiated. The target is to produce silk handcrafts, using inferior quality cocoon, cottage type industry and more labor. By this way all the cocoons produced at country level will be utilized, the good quality ones shall be sold to the industrial silk reeling enterprises for reeling high grade raw silk by the fully automatic machines and the inferior cocoons-for silk handcrafts production. The government and local municipality will support the farmers from some under-developed regions with high unemployment and cheap work force to take up sericulture and produce cocoons. The cocoons produced by the farmers will be purchased by private enterprises, dealing with silk reeling, twisting, degumming and dyeing. Then the silk yarn will be given to local home weavers or knitters and the enterprise shall pay to them for the work, following the usually practiced system. Then the enterprise will deal with the silk products marketing. The project implementation would provide additional job opportunities and income resources to the local people and increase the product diversity and market competitiveness.

Purposes

To create job opportunities and income resources in under-developed regions of Bulgaria through silk handcraft cottage industry enterprises development

Financing

EU: the structural funds and Enterprise and Industry Directorate General programmes

Parties, responsible for the realization of the programme

Ministry of agriculture and forestry
Ministry of economics
Bulgarian sericulture association
BACSA

Sericulture Experiment Station, Vratza
Agrarian university, Plovdiv
The provincial administration
The mayors

Terms for programme realization: 2007 – 2010 (4 years)

Workplan with the necessary funding and Programme activities

Activities	2007	2008	2009	2010	TOTAL
Country survey on the most appropriate regions for programme implementation (the governorates Vratza, Montana, Vidin and Pleven in North Bulgaria; the governorates Plovdiv, Stara Zagora and Haskovo in South Bulgaria)	**Yes € 25000**				**€ 25000**
Choose 8 private companies wishing and having the necessary capacity to start this activity.	**Yes**	**Yes**			
Choose clusters of villages to be included in the programme.	**Yes**	**Yes**			
Overseas medium-term (3 months) training in India and Thailand of each company		**8 persons x € 10000 = € 80000**			**€ 80000**

manager in the silk handcraft cottage industries.					
Training of the farmers in mulberry cultivation and silkworm rearing practices.		**8 courses x 40 participants x € 100 = 32000**	**8 courses x 40 participants x € 100 = 32000**	**8 courses x 40 participants x € 100 = 32000**	**24 courses x 40 participants x € 100 = 96000**
Training of farmers and companies staff in the silk handcrafts cottage production techniques.			**8 courses x 20 participants x € 250 = 40000**		**8 courses x 20 participants x € 250 = 40000**
Equipment of the enterprises with the necessary cocoon drying machines, equipment for cocoon preservation and assorting, cocoon deflossing machines, cottage type machines for silk reeling, winding, doubling, twisting, equipment for silk yarn degumming and dyeing, machines for spooling, warping, coning, handlooms		**8 enterprises x € 150000 = € 1200000**			**8 enterprises x € 150000 = € 1200000**

and/or knitting machines, sawing machines etc.					
Production of silk hand-woven fabrics, garment and knitwear			**Yes**		
Marketing of the production: mainly to the tourists at the local market, export to other EU countries.			**Yes**		
TOTAL					**€ 1 441 000**

The funding of enterprise operation costs will be provided through loans from the European Bank for Reconstruction and Development (EBRD)

About 1000 farmer's households will be engaged in the rearing of 5000 boxes of silkworm eggs annually, producing 100 t of fresh cocoons and getting gross incomes around 800000 Euro, which will be processed into silk handcrafts of total value 1 million Euro* by 8 small enterprises, having 100 workers.
***the difference between fresh cocoon incomes and silk handcrafts incomes is small because we exoect the fresh cocoon price to be subsidized by the EU.**

4.2. Silk handcraft local marketing strategy

Annually Bulgaria is visited by more than 5 million foreign tourists, mainly from the EU member countries. Therefore the most promising market for silk handcrafts are the places where there are tourists. These places are:

- The airports of Sofia, Plovdiv, Varna and Burgas
- Black sea resorts from May to September
- Winter mountain resorts, such as Borovetz, Pamporovo, Bansko etc. from December to March
- Other tiuristic places like Veliko Tarnovo (the old Bulgarian capital), Gabrovo, Troyan, Rila monastery, Batchkovo monastery etc. all over the year.
- The big cities: Sofia, Plovdiv, Varna, Burgas, Stara Zagora, Ruse etc.

However each place has sub-places like shops, hotels etc. which should be allocated. For example in the Black sea resort "Sunny beach" - which shops?, which hotels?; Sofia which shops?, hotels?, embassies? etc. Naturally those places should be the most visited by foreign tourists. Those places may be allocated easier through an internet survey.

The silk handcraft producer should prepare a e-catalogue of the silk handcrafts, including the best models photos, description, prices etc. and to send it by the e-mail to the possible places for sell them. Then the silk handcraft producers manager shall ask for personal meeting with the potential sellers. In order to sell the products there should be a combination of three factors, namely presence of market, high quality and reasonable price.

As high quality we mean not only quality of manufacture, but also the commodity to attract the customer by something special, for example with uniqueness of the product, using only natural materials such as silk, wool, linen, cotton, if it is a national costume to be completely identical copy of the original one. For each item a special certificate confirming the above may be issued by prestigious handcraft organization.

4.3. Short - and medium-term development strategies and necessary follow up actions and cooperative activities for silk handcraft cottage industries and silk enterprises development at the regional level, in Africa, Central Asia, Europe and Near East

- Under the patronage of FAO to establish an international working group or committee on “Silk handcraft cottage industries development”, having a member from each country involved in this industry. The group to conduct regular “internet meetings” and get together once in each 3 years, as accompanying meetings of other international events.
- The already uploaded "Equipment for Silk Handcrafts Cottage Industries", on to FAO "InPho" Website is laying out foundation of preliminary framework to be updated/upgraded, as anyone suggest when they look it at and for additional inputs, or like country-wise equipment currently in use, or any other suggestions. The website is designed/programmed update materials to be inserted by anyone interested from his/her home computer.
- Make bilateral and multilateral contracts between the countries of region about exchange of scientific and technical, technological and other helpful information.
- Open a special page “Silk handcraft cottage industries” in the BACSA web site.
- Promote the Black, Caspian seas and Central Asia region as a source for providing technical assistance, mulberry saplings and silkworm eggs to the newly sericulture developing countries from Africa, Latin America, Near East etc.
- Making feasibility studies in order to plan some new production areas, especially in the regions where national income per capita is quite low comparing with the other parts of the country
- Taking into the consideration that sericulture is a specific and cultural industry, it is compulsory to keep on taking financial support from government on fresh cocoon farmers
- Conduct regular regional meetings in order to provide an international forum to facilitate discussions and information exchange on cultural traditions, support policy, development strategies, technology and trade in traditional silk handcrafts.

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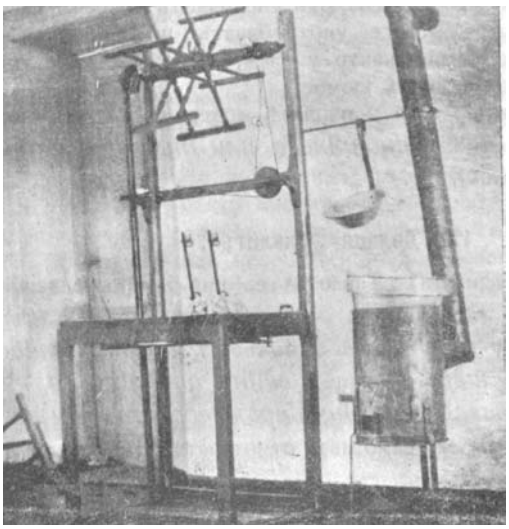
Chapter 5.
Annex 1. Photos

Cocoon storage



“Dolap” silk reeling machine

Silk knitting unit

Traditional silk fabric “borundjuk”

Silk knitwear

Dolls with silk costume

A Brief Review of Silk Industry in China

By

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ABSTRACT

China has long been reputed as a leading silk producer in the world. The silk industries always play a very idiosyncratic role in the national economy. At present, China's annual silk industrial output value amounts to 90 billion yuan (10.88 billion US dollars) and China exports more than 4 billion US dollars of silk products annually, accounting for over 80 percent of world's total silk products trade volume. Currently, about one million workers are employed in the country's silks sector. This paper was based on surveying the recent 5 years of inland silk market changes and the trend of regional layout of silk industry in China, to generalize and analyzes the ideas and strategies of China silk industry development. It was concluded that, to plan to develop the silk industries in China, it should be adjusted measures to local conditions of climate, and soil, and environment etc. to orientate the optimal situation of the cocoon silk's processing chain. Some place (West China) could actively develop the sericultural economy, and focus on developing the silk processing, and orderly R&D the comprehensive utilization of silk and its by-product. Meanwhile, for the in being development silk industry region (e.g. Sichuan, Guangxi,etc.), it must make the main existing silk producers stably develop and improve. Finally for the traditional sericulture region, mainly located in the coastal region of China, it should moderately develop the silk industry. In order to keep the silk industry continuous, stable and healthy development, it should do endeavours from the scope and size of silk industry, silk quality, benefit and optimum silk industry upgrade.

Key words: Silk industry, China, Sericulture, silkworm, Silk product, Development

Chapter 1. Introduction

China has long been reputed as a leading silk producer in the world. Its silk products had been exported to other central Asian and European countries over 2,000 years ago via the world-famous ancient Silk Road. As one of treasures in China, silk had ever served as the herald of eastern civilization and explored the well-known “silk road’. It represents the flourished culture of China. At present, China's annual silk industrial output value amounts to 90 billion yuan (10.88 billion US dollars) and China exports more than 4 billion US dollars of silk products annually, accounting for over 80 percent of world's total silk products trade volume. Currently, about one million workers are employed in the country's silks sector.

Chapter 2. Historical background, present status and future prospects of the silk handcrafts cottage industries sector and silk enterprises in the country.

2.1. The basic situation of the China silk industries

As a traditional industry of China, the silk industry concerns revenue of 20 million farmer households, job opportunities of almost 1 million people and therefore social stability. Presently, the yield of mulberry silk and silk fabrics in China accounts for above 70% and 45% of global output respectively, taking the first place in the world. In addition, the output of printing and dyeing silk fabrics, silk garment and silk knitting are also on the top of the world. As far as exportation is concerned, the export output of mulberry silk and silk fabrics occupies 80% and 60% of total trading volume in the international market. And export silk products also dominate the global market. On account of the adjustment on industrial and agricultural structure and western development policy during the ninth and tenth five years, silk production area has shifted from large cities to middle or small cities that depend upon sericulture, and formed a new structure. In the structure, middle and western areas take use of their own comparative advantages and conduct cross-area, cross-industry and cross-ownership union with government’s support to complement one another and realize coordinated development. Relying on the conventional advantage of middle and western areas in sericulture and the silk processing experience of coastal regions, national silk production bases are built in Sichuan, Chongqin, Yunnan and Guangxi provinces, and the like.

After 2000, China regulated the basic requirements for filature and silk spinning companies as follows:

(1) The production scale must reach above 2400 threads of multiends reeling machine (Computed at 1:2 for auto-reeling), above 5200 spindles of spun silk spinning ingot

(2) The average grade of filature silk must reach above 2A in 50 %(Which is the average inspection record of trusted inspection institutions)

(3) The comprehensive discharge standard of water for production must meet the requirement of 8979—88.

(4) The metric of raw material consumption and other evaluation metrics are devised by the silk administration of local province (autonomous region or municipality).

Until the end of 2000, the backward productivity of cotton spinning had been reduced 9.4 million spindles, that of wool spinning reduced 280,000 spindles and that of reeling reduced 1 million spindles. 140 million employees switched to other lines. State-owned silk companies had gained a profit of 6.7 billion RMB, which is an important breakthrough for reform and getting out of a sorry plight. It also suggests a right road for other state-owned enterprises to make reform and step out of awkward predicament. As far as ownership is concerned, such structure had formed, in which state-owned enterprise, collective enterprise, sino-foreign joint

venture, sino-foreign cooperative enterprise, foreign-funded enterprise and private enterprise coexist and develop together. As to output, state-owned enterprises accounted for 30%, collective enterprises for 26.5%, sino-foreign joint venture, sino-foreign cooperative enterprise and foreign-funded enterprise for 28.7%, and enterprises with other ownership for 14.8%. Obviously, a large number of non-state-owned enterprises have been the important force contributing to the growth of silk industry.

The silk industry turned the situation of 5 consecutive year's loss in 1999 and reached 77.1 billion RMB of gross industry output value in 2000, 15% more than that of 1995. 1.44 billion RMB profit was gained, which is 45.7 times as much as that of 1995. The export product structure was further optimized. The ratio of silk material and products kept growing, occupying 81% of total export in 2000, which is 10.7 percentages higher than that of 1995. By macro-policy steering of government and market sense enhancement of the whole line, enterprises tended to conduct rational business and make timely adjustment on production. Observed from the trend of recent domestic and foreign market, domestic silk price turned to stop dropping and move up slightly and steadily, and the export and market demand of silk-made products went up. Consequently, silk export rose back in the latter half of 2003. The situation of supply exceeding demand was relieved further and the performance of enterprises was better off. Due to sluggish global economic resurgence, however, the production and sale of export-oriented silk were still subject to many uncertain factors. According to the statistic during 2001-2005, auto-reeling frame accounted for above 60% in national silk reeling industry (above 85% in Japan, Brazil and Korea), and shuttleless loom for around 30%(90% in Italy). Although automatic airstream spinning is 4-5 times more efficient than loop ingot spinning, and shuttleless loom is 4-8 times more efficient than shuttle loom, the auto-reeling machines and the labor productivity are far behind that of developed countries because of backward technical device and craft level as well as inadequate management.

2.2. The experience of developing the silk industry in China

At present, China has attached significant importance to dyeing technology which is the key point to improve material quality. Catching the opportunity that developed countries make strategic adjustment on industrial structure and will outsource silk dyeing, garment and products, China makes great effort on introducing and absorbing technology as well as taking advantage of foreign capital. The successful experience of promoting the silk industries continuously, stably and healthily as follows.

2.2.1. The innovation on silk technology

During 1995-2000 when the silk industry of China was following the trend of new technology in the world, reform was made on the traditional industry with high tech, hence accelerating technology progress and industrial upgrade. The backward capability of reeling, silk spinning, and silk knitting was discarded and technology reform was made on existing equipment with emphasis on developing new silk composite fiber, realizing seriation of silk material, developing high-quality silk products and enhancing anti-wrinkle and anti-shrink. In addition, much effort was made on developing compound products spun and woven with silk fiber and other fiber and on producing chemical fiber commodities so as to combine the advantages of various fibers, overcome the inherent weakness of silk commodities; lower product cost and enhances competitive power.

To fully manifest the softness, elegance, comfort and magnificence characteristics of silk products and upgrade the quality level of silk material, much attention have been given to product design. After development over ten something years, the gap between silk products of

China and that of foreign countries shortens in quality, whereas it remains huge in product design. This is one of reasons for why silk product price of China is several or ten something times lower than that of developed countries. The average price of Chinese silk products was $8.5 US Dollar per unit in 2002. Nowadays, one Italian silk tie is up to $200 USD, but one "Made in China" tie is several dollars. It is also the weakness that currently hinders Chinese silk products from healthy development.

2.2.2. The innovation on silk management

Much effort is made on propagandizing, exploring domestic and international market, applying diversified market strategy, and developing new market while consolidating previous market, especially the market in non-quota area so that China can develop into "true silk industry leading country" from "big silk producing country". In addition, much concern is also given to develop name brand, explore market through improving the market share and well-known name-brand products, and increase silk consumption. Further more, products that have high added value or are ecologically and environmentally good are in great development so that the ratio of high-quality material reaches 60% to meet the requirement of garment processing and export.

Proper adjustment and optimization on product structure are carefully performed. Producing middle and high-quality garment materials are put into the center. More knitting varieties are added. And ornamental and healthcare products are developed. The detailed change is as follows. Firstly, traditional silk varieties, such as Chinese crepe habutae twill silk crepe satin plain silk velvet spun silk crepe, are upgraded by deepening dyeing processing, enhancing anti-wrinkle and anti-shrink, improving color fastness, and quality, and adding new varieties. Secondly, new high-tech differential fibers like extremely thin silk, fluffy silk and compound silk, and new compound material spun and woven with silk and other fibers like wrap yarn spinning knob silk are developed and employed to produce silk products with varying style. Thirdly, new consumption field is explored, such as silk for indoor and car ornament and commodity package. Fourthly, high-tech is applied for new uses of healthcare, medication, food and cosmetics.

2.2.3. The exploration of domestic market

Until 2005, the average fiber consumption per person in China is expected to reach around 7.4 kg. During the tenth five years, population has increased 12 million persons averagely per year. If the average consumption per increased person is computed at 1 meter in 7.4 kg fiber, additional 400,000 tons of silk fiber will be consumed over five years. The large silk fiber consumption for industry and decoration contributes to market expansion during the tenth five years.

In order to keep the silk industry revival and development continuously, it is helpful for us broadly propagating the importance, meaning and requirement of high-quality silk through multiple channels like media, exhibition and forum as well as protecting and supervising trademark, it is possible for more enterprises to adopt the trademark of high-quality silk so that more customers are able to make clean and secure purchase and perform the right of self-protection.

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Silk Handcrafts Cottage Industries and Silk Enterprises Development in Egypt

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ABSTRACT

Silk has been produced in Egypt for over thousand years. The silk industry that exists relies to a large extern on the 3 million mulberry trees that Mohamed Ali planted at the beginning of the last two centuries. Egypt had less success making raw silk, but silk mills in Cairo and Alexandria, dating back to Fatimed times used imported raw material for cloth weaving. The produced cocoons are consumed locally for making silk carpet besides some small amount of special cloth for making the malass: a traditional women dress in Upper Egypt and also for interior design which has cultural value more than economic one as well as other minor silk handicrafts as embroidery for making Kaftan: a traditional men dress in upper Egypt and also using the cocoons for making some pictures for famous rulers. Egypt has recently established itself as a producer of high quality silk carpets and very similar style to old antique rugs. Silk handicrafts and silk industries are inherited from generation to another keeping their secret industries in between the family. Silkworm rearing and processing of raw silk was established albeit on a small scale for local consumption. It became a steady seasonal occupation for the landless and low income rural population. The silk industry in Egypt is small but its potential for development and expansion is significant and promising. If circumstances related to the market for silk develop independently as expected, a large number of Egyptian rural families could benefit from the curious, droll life of the silkworm.

Key words: silk handcraft, cottage industry, Egypt, development

Chapter 1. Introduction

Egypt has produced silk since the early Islamic period, contributing to the thriving trade between Eastern and Western countries. During the early 19th Century, Mohamed Ali attempted to promote the development of the sector by planting over 3 million mulberry trees in the Delta. But Egypt found it was not able to compete favorably with the silk industry being developed in Italy at the time. Alexandria, dating back to Fatimed times used imported raw material for cloth weaving.

The mechanization of the silk industry in Europe killed production in the Near East, but at the same time it stimulated silkworm cultivation as a source of raw material for the European factories. France encouraged some countries as Egypt and Lebanon to produce more raw silk and to support such production, Mohamed Ali Pasha ordered the planting of three million mulberry trees during the early 19th Century.

Despite these efforts, silk production in Egypt never matched that of most other nearby countries and it remains minor industry.

Nonetheless, silkworm rearing and the processing of raw silk were established, albeit on a small scale for local consumption. It became a steady seasonal occupation for the landless and low- income rural population. Until the early 70's there used to be a semiautomatic reeling factory in the Menoufia Govermorate, which reeled into silk thread most of the estimated 10 tons of dry cocoons produced in Egypt at that time. In 1976, the factory closed because of several reasons, mainly the foreign competition (cheap raw silk imported from China under a barter deal). Once that marketing outlet disappeared, most rearers stopped producing cocoons.

With falling production and the resulting problems in the market, still waned further as a private domestic agricultural and industrial enterprise, the annual harvest of cocoons fell to roughly six tons in the late 1970's.

The virtual suspension of silk carpet sales to Europe in the 80's by Iran and Afghanistan presented an opportunity for the revival and further development of the Egyptian silk carpet industry. It was also a golden opportunity for the development of primary sericulture. The Catholic Relied Services (CRS), a private voluntary organization extensively involved in small-scale development projects in Egypt and USAID with the collaboration of Ministry of Agriculture (MOA) became attracted to the activity of silk production for several reasons the basic activities of silkworm rearing and raw silk reeling can be done on a small - scale in rural households, thus offering part - time income generating opportunities for farming families; the inputs of capital and skill are minimal; women are important participants in the initial stages of production hence encouraging this activity leads to increased opportunities for women. CRS design a project intended to revive the silk industry in Egypt through skill training, income generation not conflict with traditional living patterns

By 1983, the CRS / MOA project helped boost an annual production of cocoons by almost five tons, estimated to be about 40% of Egypt's total production But although local raw silk production experienced some growth it was far below the newly aroused domestic demand, largely because it continued to rely on haphazard productive base: the mulberry trees scattered around the Delta. As a result imports of raw silk rose from 120 tons a year in 1984 to 250 tons in 1991, while local production only increased from 2 to 4 tons during the same period. In the early 80's because of the availability of cheap raw silk, demand for local raw silk dropped. In 1985 the barter deal with China, which provided very cheap raw silk to Egyptian manufacturers, was phased out. The local price of imported raw silk was then aligned with world prices and therefore required hard currency for importation. Interest in locally produced raw silk revived and the price of locally produced raw silk went up several fold: one measuring unit of cocoon (safiha) moved from 10L.E. in 1984 to 40L.E. in 1990; one kg of

raw silk moved from 80L.E. per kg to 130L.E. during the same period. As a result, the number of rearers attracted by the prospect of good income in a short period also increased, as the rise in the number of distributed egg boxes

The peak in the growth of primary Sericulture was reached in 1990. The rapid increase created problem in the marketing of cocoons because the few existing reelers, who between them monopolized the purchase of local cocoons, did not have enough capital to buy all the cocoons on offer at the public auction. They pushed prices down and also imposed delayed payments on the primary producers. This primitive marking response, which the reares were unable to counter, combined with the absence of other market outlets and lack of drying and storage facilities for the cocoon producers, led to many new reelers making a loss and subsequently with drawing from sericulture. The realer hold on the auction is still strong but has recently begun to be weak end by the presence of new competition from private sector investors who are entering the reeling and weaving fields. It should be said that in marketing terms, both rearers and reelers are in a weak position, because neither group has access to credit schemes expressly designed to strengthen their activities.

Although raw silk production has fallen to a low level in Egypt, silk finishing enterprises, especially Oriental style carpet weaving, are prosperous and expanding.

These business are currently using imported silk from China as the raw material for their products, thus a good case was made for increased and improved domestic raw silk production as a substitute for these imports.

Since the 1990's till now raw silk production was almost steady in minimum level due to many reasons most of these: the Gulf War which affect the tourism activity in addition to the competition with the imported raw silk, industrial and agricultural development which caused immigration from rural to urban areas and low price of cocoons discourage the farmers to maintain rearing the silkworm

Chapter 2. Present situation of silk industry

Sericulture is one of the most labor intensive of agricultural activity. It involves long chains of interdependent operations, in both agriculture and industry, which require direct human intervention. In Egypt total of 1000 families distributed over 40 villages of 10 Governorates are involving in silkworm rearing, an average of 40200 workers are working in the silk industries.

At present, local production of 12-13 tons of fresh cocoons and 2-3 tons of raw silk are locally consumed. Therefore, Egypt imports raw silk from China for silk industry. Another important factor, Egypt imports its demand of silkworm eggs from other countries because of the shortage of silkworm pure lines.

2.1. Silk reeling

Reeling sector is a vital component of sericulture linking the agricultural based activity of cocoon production with the industrial activity of weaving production.

Simple manual machines are used crudely for reeling of the silk off the cocoons. The reeling process begins with placing the cocoons in a large tube of warm water and the actual reeling begins as the silk filaments of several cocoons are twisted together to a wooden frame around which the thread is rewound as the frame is revolved. One person constantly replaces the cocoon as they are used up while another person perceptually turns the delicate strands of silk from up to 20 cocoons are combined to make a thread which will be strong enough to resist breakage while it is worked with. These manual reeling machines are distributed among Six

Governorates in the Delta area (North part): Qualyoubeya, Gharbeya, Menoufeya, Dakahleya, Beheira and Sharkeya. Also two Governorates in Upper Egypt (South part): Fayoum and Suhag. Production is consumed locally mainly for making silk carpet in addition to minor handicraft as embroidery.

In the 90th multi- end reeling machines have been established at different governorates with total of 280 end for producing high quality of raw silk.

2.2. Silk Processing

Other simple manual machines are used for doubling and twisting the thread. These activities are also covered by the private sectors in small scale. A total of 18,000 kilos of raw silk can be processed per month. Degumming and dying processing are done also by the private sector in small scale by using 14 different colors extracted from plants as Eggplant, Clover, Tea, Mango and Mulberry fruits as well as chemical dyes.

2.3. Weaving

Domestic raw silk is made into cloth, embroidery and silk carpets. The weaving of oriental style silk carpets is another activity often undertaken in the homes of poor families in rural villages. The carpets are hand- knotted with as many as 64 individual knots/cm².

An approximately 10,000 hand looms for silk carpets distributed among 20 villages in the Delta area (North part), producing 8,000 square meter of silk carpet per year. More than 40,000 families majority, which are young girls and boys are participating in carpet weaving at their villages. The annual output of four silk metric tons and does little to match consumption that is in the region ranging from 250-400 Tons/year.

Domestic raw silk is made into cloth and embroidery, cloth woven on manual looms from manually reeled raw silk has a slightly coarse inconsistent quality to it. It is not widely popular material in Egypt and it is hard to find since a limited quantity is produced. Yet this type of silk cloth has a great appealed by tourists who are so enchanted by handmade materials and village crafts.

Besides the Egyptian silk carpet manufactures, the villages of Akhmim in Upper Egypt (Suhage Governorate) established a good reputation as weavers of the silk cloth starting with 3800 hand looms. They have opened up an export outlet in Germany for their bright purple red scarves as well as bed covers. But again they rely on raw silk imported from China a factor that is due to the insufficient local production that could easily limit further expansion ending today by 200 handlooms.

Also, the malass, a black cloth half woven in silk and half in cotton are also produced in Upper Egypt which are considered the traditional dress for women in this area. In addition to the imported silk for woven cloth for making men chemises. At present, a total consumption of 50 metric tons raw silk / year are used for these traditional industries working on 200 hand looms for more than 4000 workers inheriting these remained looms from generation to another at present

Another activity was established early at the 1930's and 1940's at Nakkada village Upper of Egypt at Qena Governorate which is EL-Farka, a special woven cloth famous with its smooth, neatness and design. El-Farka was exported to the Sudan for more than 150 years with a total amount of two million Dollars per year. The Sudanese women wear El-Farka at special occasions as weddings. But this activity was declined starting from 1987 because the commercial protocol between Egypt and Sudan was stopped which affect negatively producing of this beautiful material.

The embroidery is a famous activity for making Kaftans which is a traditional men dress, consuming another 50 tons of raw silk, with 200 workers mostly in the Delta area. The finish products are sold locally at the oriental Bazaar for the Egyptian as well as tourists.

Production and marketing of silk carpets and other handicrafts are carried out by the private sector. Other handicrafts, except for silk carpet are declined as these industries carried out by few traditional families in different villages. Around figures are given bellow:

Traditional handicraft	No. of worker	No. of villages in business
Silk carpet	40,000	20
Cloth weaving	4,000	2
Embroidery	200	2

Chapter 3. Economics and markets

Reeling families sell their products to the small number of merchants who process the silk. Profit for reeling activity can be very high for families which can reel well. One kilo of best quality of raw silk is worth up to 20 US $. An experienced family can yield 20 kilos of raw silk in about 3 weeks. Such profit is extremely appealing to rural family. Reeling has, however, been a limited activity because of some degree of skill to achieve the highest quality and profits.

By 1983 a protocol agreement that had been signed with China and provided for the importation of cheap silk was coming to an end. Suddenly there was a great demand from Egyptian manufacturers for cheap domestic alternative. The imported silks have been both a problem and a blessing for the domestic silk industry. The availability of cheap imports has, on one hand discouraged domestic raw silk production yet on the other hand, fostered the growth of silk finishing enterprises, particularly silk carpet weaving. This enterprise is developed to the point that it is producing and selling high quality products on the competitive world market. 60% of the production are exported by the private sector, the remained 40% are displayed for tourists in the local market.

Because silk carpet weaving has proved in recent years to be a successful Egyptian enterprise, the outlook is good for a steady increasing market for raw silk.

Table 1. Fresh Cocoon Statistics

Year	Quantity of produced fresh cocoons (ton)	Price of produced cocoons (U.S $ /kilo)	Quantity of imported cocoons (ton)	Price of imported dry cocoons (U.S $/ kilo)
1997	21.25	3.40	-------	--------
1998	14.60	3.30	18.67	2.64
1999	18.75	3.50	160.03	1.30
2000	15.62	3.68	------	-------
2001	14.73	3.61	-------	-------
2002	13.50	3.18	-------	--------
2003	no production	-------	-------	-------
2004	12.80	3.47	-------	-------

Table 2. Raw Silk Statistics

Year	Quantity of produced raw silk (ton)	Price of produced raw silk (U.S $ / kilo)	Quantity of imported raw silk (ton)	Price of imported raw silk (U.S$/ kilo)
1997	2.72	25.04	64.17	19.24
1998	2.25	23.07	144.43	21.15
1999	3.00	24.00	98.99	16.15
2000	2.40	28.73	26.44	15.02
2001	2.25	21.64	43.37	14.71
2002	2.30	22.25	0.745	18.62
2003	no production	---------	120.00	18.00
2004	2.25	24.22	323.719	25.00

Chapter 4. Annex 1. Photos.

Manual reeling machine

Silk carpet weaving

Silk carpet

Development of Silk Cottage Industry and Production of Traditional Silk "Kente" cloth in Ghana

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Food and Agriculture Organization, Rome, Italy

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ABSTRACT

Ghana, though fairly new in the sericulture and the silk industry, is working hard and tirelessly to develop the industry in the country and also introduce and assist other African countries to embrace it, since almost all countries on the continent have common socio-economic problems which sericulture has the potential to address.

Burkina Faso, The Gambia, Niger and Senegal are countries in Africa being introduced to the industry. Mulberry planting materials have been supplied by the author to these countries and reports are that they are doing well. Agriculture is the main stay of the Ghanaian economy. The sector supports about 80% of the total population economically. It is the largest contributed to the country's Gross Domestic Product (GDP) accounting for about 37% of it and absorbs approximately 66% of the labour force.

A group of farmers, entrepreneurs, serving and retired civil and public servants who formed the Sericulture Promotion and Development Association. Ghana is the brain and driving force behind the industry in the country.

The Food and Agriculture Organization (FAO) of the United Nations has played a crucial role in sustaining the industry in the country with the approval and implementation of the TCP/GHA 2802(A) Sericulture and Silk Processing Development Project whose objective was to assist small scale farmers in cocoon and raw silk production through the provision of basic techniques and essential equipment and tools for silkworm rearing and cocoon processing, while making additional employment and income opportunities available to them. The Association is driving its strength from the government's policy on private sector development under which the sector is seen as the engine of growth of the Ghanaian economy.

The government's efforts in promoting non-traditional exports gives more impetus to the players in the sericulture industry because all sericulture products are exportable. Beside the above mentioned policies/programmes, the governments programme on boosting the garments and textiles sector and the African Growth and Opportunity Act under which Ghana and some selected African countries export quota free garments to the United States of America is serving as an encouragement to all the state holders in the sericulture industry. Ghana has gained international renown for the products of its traditional "Kente" weavers. The Kente cloth is famous for the beauty of its multi-coloured patterns. Kente weavers use silk yarn and there is a unique collaboration between these weavers and the Sericulture Association to supply them with silk yarn.

Traditional handicrafts production is an ancient industry in the country. Sericulture products are now being used in the manufacture of some handicraft items.

On the African regional front, efforts will be made by the African Silk Network to source funding to create awareness and offer training in the silk handicrafts industry to members countries to enable them venture into it.

The international workshop on silk handicrafts industry in Bursa, Turkey is welcome. Efforts should therefore be made by the organizers and participants of this event to push it beyond the drawing board, so that this noble and innovative idea which has the potential to turn the fortunes of "deprived" sericulture countries materializes to enable these countries to diversify their silk products.

Utilization of sericulture products is of economic importance and can increase the incomes of entrepreneurs in the industry. It is, therefore, recommended that the organizers of this workshop plan to organize another workshop on the utilization of sericulture by products.

Key words: silk handcrafts, cottage industry, Ghana, development

Chapter 1. Introduction

Sericulture is an agro industry and it comprises four (4) to five (5) major activities from soil to fabric, viz.

- Mulberry Cultivation
- Silkworm Egg production
- Silkworm Rearing
- Silk reeling, twisting, weaving, dyeing, spinning and finishing of fabrics.

Each major activity results in marketable products which form the basic raw material for the next activity in the series.

Sericulture plays a unique role in the economics of countries practicing the industry. Its uniqueness lies in the fact that sericulture activities not only engage the rural households in the cultivation of mulberry and silkworm rearing, but also encompasses in their fold a whole range of reelers and weavers. Sericulture is, therefore, an industry par excellence.

The name silk itself evolves delicate feeling. Silk has grown from its traditional status and cultural bondage to a commercial venture in the past few decades. Silk, the most precious natural fibre has its own place in the textile world. For the past five thousand years, no fabric in the world has “conquered” - this fabric widely recognized as the queen of textiles. And in fact this is the magic of silk.

Silk handicrafts and other handicrafts from sericulture products like cocoons have immediate market value and are therefore gaining momentum in recent years.

The workshop on Silk Handicrafts Cottage Industries and Silk Enterprises Development in Africa, Europe, Central Asia and Near East is welcome and in the right direction. It has the potential to boost the silk handicrafts industry worldwide.

GHANA

Ghana is one of the newest countries on the world’s sericultural register.

It is a country that lies at almost the centre of the countries along the Gulf of Guinea. The country is 672 kilometers long and 563 kilometers wide with a total area of 239,460 sq. kilometers. The Greenwich meridian passes through it.

Ghana has a population of twenty (20) million. It is one of the most favored countries in the African region in terms of rainfall, temperature, humidity, sunshine and soils for mulberry cultivation and the rearing of silkworms. Unemployment and underemployment are some of the major problems facing the country. Labour is, therefore available for sericultural activities since sericulture is a labour intensive industry.

The country has good potential for sericulture and the silk industry which could open up existing possibilities for the diversification of the country’s agriculture, cottage industry and exports.

Chapter 2. Sericulture and the silk industry in Ghana

Sericulture was introduced into the country through the efforts and initiatives of the author of this paper. After undergoing training in tropical sericulture and the silk industry at the Asian Institute for Rural Development, Karnataka State Sericultural Research and Development Institute, Central Sericultural Research and Training Institute and Central Silk Technological Research Institute all in the Karnataka State of India and realizing the important role

sericulture plays in alleviating poverty through employment creation and income generation, among others, mounted an exhibition on Sericulture at the Ghana International Trade Fair Centre in Accra in 1992 with the support of an American couple, the late Mr. Bowser and his wife.

The exhibition attracted a large number of people of all walks of life. It also received wide press coverage from both electronic and print media. After the exhibition, people interested in sericulture trouped the office of the writer for more detailed information on the industry. Some of these enthusiastic people came together and formed the Sericulture Promotion and Development Association, Ghana, in the later part of 1992, with the aim of collectively assisting to develop and promote sericulture and the silk industry in Ghana to create employment, generate income and also diversify the country's agriculture, cottage industry and export base. The Association was officially incorporated under the companies code by the Registrar of Companies in May, 1994. The sericulture industry in Ghana has since its inception received technical assistance from the Food and Agriculture Organization (FAO) of the United Nations. In 1993, 1995 and 1997, the FAO sponsored a consultant to Ghana to look into the feasibility of the Sericulture industry in the country and also assist the government of Ghana and the Sericulture Association to prepare a project proposal for possible sponsorship by the FAO under a Technical Co-operation Programme (TCP).

FAO TECHNICAL CO-OPERATION PROGRAMME (TCP)

In April, 2002, the Director General of FAO approved a project TCP/GHA 2802 (A) "Sericulture and Silk Processing Development" and allocated US $ 384,000 to finance it. Among others, the amount covered the services of the International Partnership Programme Consultants specialized in cocoon production, cocoon processing and silk processing as well as National Consultant and FAO Technical Backstopping Services.

OBJECTIVES OF FAO ASSISTANCE:

The overall objective of the project was to assist small scale farmers in cocoon and raw silk production through provision of basic techniques and essential equipment and tools for silkworm rearing and cocoon processing, while making additional employment and income opportunities available to them.

IMMEDIATE OBJECTIVES

1. Strengthen Institutional capacity of Council for Scientific and Industrial Research (CSIR) in sericultural science and management skills in cocoon production and processing of cocoons to silk products.
2. Improving training and extension networks for transfer of techniques and dissemination of information for production of cocoons and silk fabrics.
3. Introduction of new skills and methods to small scale farmers for production of cocoons and to silk industries for production of raw silk, silk yarn and silk fabrics.

The assistance marked a turning point and a significant landmark in the history of the sericulture industry in Ghana in that it salvaged the industry from eminent collapse and gave it a major push into sustenance.

Apart from training of small scale farmers and officials of relevant government institutions in cocoon production to enable them increase cocoon productivity, a cocoon and silk processing factory has been installed in the country under TCP. Engineers and Technicians of the Institute of Industrial Research of the Ghana Council for Scientific and Industrial Research

and members of the Sericulture Association have been trained in the operation and maintenance of the machineries.

With the establishment of the factory, farmers are now encouraged to go in to cocoon production because they are now assured of ready market at the factory for their produce.

The Food and Agriculture Organization's TCP has contributed immensely to strengthening the capacities of Ghanaian research and extension institutions in sericulture and addressing needs of sericulture farmers.

Chapter 3. Ghana's Traditional Textiles - Kente

Ghana's kente cloth is famous the world over and has a wide range of uses. Black-waxed prints, real java and batiks are amongst the country's textile ranges. Local designers also offer their latest creations for casual and beach wear.

Ghana has gained international renown for the products of its traditional "Kente" cloth weavers. The largest Kente cloth in the world hangs in the United Nations buildings in New York, a gift to the world community from the people of Ghana.

The Kente cloth is famous for the beauty of its multi colored patterns, Ashanti Kente being bold and bright in primary colours featuring red, green, blue and yellow and expressing a characteristic African vitality and Ewe Kente being subtle and subdued in pastel and autumnal shades that are especially attractive to European taste.

The Kente cloth is woven in villages in both the Ashanti and Volta Regions in the south of Ghana. It has a large local market, where it provides traditional dress for both sexes at most social and cultural events. It has a growing export market in Europe and North America.

The Kente cloth by virtue of its acknowledged beauty, commands a highest income of all craftsmen in Ghana. However, the industry has not rested on its laurels and only sought to preserve it glorious traditions. In entering the export and tourist markets, it has been innovative in finding new uses and especially in the USA and at home in Ghana, where it has formed a lucrative alliance with the fashion and handicrafts cottage industries.

With the growth of exports and to some extent, tourism, the Kente weaving industry has increased its economic importance and is providing high quality employment across the southern half of the country. However, this high value product has an inadequate local raw material base and the leaders of the industry have been looking to the local production of silk to help solve their supply problem since the first feasibility study of 1981 indicated good prospects for a local silk industry.

In fact the Kente cloth was in the past woven with silk yarn but because of the high cost of imported silk yarn, the kente cloth weavers have switched on to using cotton and other synthetic fibres like rayon.

HISTORY OF THE KENTE

Several centuries ago, the story was told of two brothers who went into the forest in search of food. But after several weeks they came back not with food but a skill.

Apparently, they had an encounter with Ananse (the legendary Ghanaian folklore hero) who taught them the art of weaving. He had within that period, several centuries ago, taught them the art of textiles, which was considered as a seductive genre. That was the genesis of a rich heritage – Kente – textile heritage that would capture the imagination of the entire world, tactile and utilitarian, beautiful and essential.

The Kente cloth, considered an exceptional field of art, with a long history, is traditionally the textile of royalty in Ghana. Woven in strips of intricate colors, and then sewn together, it is a finely made cloth that can be a solid color or has intricate designs that constantly confound the onlooker wherever the fabric is found.

Indeed, nearly everybody in Ghana has one form of Kente or the other. Every President or Head of State has worn it at the biggest events of their lives.

Before kente was first designed, people wore clothing made from the back of the Kyen Kyen (pronounced "Chin chin") tree. This back was pulled off the tree in large pieces and then pounded till it was malleable enough to be sewn into clothing.

In the early 20th century, a man named R.S. Rattary was in Ghana doing some seminal work. From his work there, he published a book titled, Religion and Art in Ashanti (1927), that contributed to an idea about the origins of the kente tradition. Mr. Rattary was almost certain that the weaving industry was introduced from the North, as opposed to the south and the European sea routes. It is hoped that this august forum will offer the opportunity to expose the rich texture of kente, a powerful symbol of the national culture of Ghana and handicrafts made of it to the world and make them appreciate it better. It will also help expose its real economic potential to the outside world.

The author of this paper is optimistic that this event will help put Ghana on the international market as a centre of immense potential and skill in the textile and handicraft industry.

YARN SUPPLY SITUATION

Ghana possesses several textile mills at Akasombo, Tema and elsewhere, that spin, dye and weave cotton and other fibres, and supply yarns to the kente and other handloom weaving industries. However, the supply is often interrupted by shortages of raw materials. Locally grown cotton can supply just a small part of the need, as it must be blended with material imported from Egypt and India. The cotton industry in Ghana is about collapsing.

The kente cloth weavers are looking up to the infant sericulture industry in Ghana to supply them with silk yarn. Some leaders of the kente weaving industry have been trained on the machinery fitted at the silk processing factory.

There is, therefore, a good linkage and collaboration between the sericulture industry and the kente weaving industry. Even though the silk industry is in its infantile stage, some quantity of silk yarn is being supplied to the kente weavers which they incorporate into the cloth. Consumers are happy about this development and they are asking for increased production of the silk yarn so that whole kente cloth can be woven out of it.

AFRICAN GROWTH OPPORTUNITY ACT (AGOA)

Under this Act, the Government of the United States of America (USA) has opened a window for some selected African Countries including Ghana to export garments and textiles quota free to the USA.

Ghana has for the past ten (10) years been exporting garments and textiles to the USA under the Act. This has given a major boost to the garments and textiles industries in the country. Since silk is treasured the world over, and the USA is one of the major importers of silk products, some of the items being exported under the Act are silk based. The silk industry in Ghana therefore has an extensive local market and everything possible is being done to step up the production of silk in the country.

PRESIDENT'S SPECIAL INITIATIVE ON GARMENTS AND TEXTILES (PSI-GARMENTS AND TEXTILES)

The Government of the Republic of Ghana has initiated a programme termed the President's Special Initiative on Garments and Textiles some four (4) years ago. The aim of this programme which is the vision of His Excellency John Agyekum Kuffour, the President of the Republic of Ghana is to give a major push to the garment and textile industry in the country to be on its feet to meet the demands under the African Growth Opportunity Act while also creating employment and generating income.

Under this programme, support is given to the industries to boost production and also improve the quality of the products to meet international standards.

The silk industry is being considered for support under the programme to increase silk yarn and silk fabric production for supply to related industries and industries under the PSI as raw materials.

Apart from exports to the USA, operators of the garments and textiles industries in Ghana are being assisted under the PSI to export to other parts of the world.

The Silk industry in Ghana is playing a major role in this direction since some of the operators under the PSI are using silk for some of their products.

Chapter 4. Exports of Silk Products

Exports of silk products from new entrants in the silk industry look bleak.

The major challenges facing the exports of the silk products from new entrants are:

- Non availability of quality raw silk
- Non availability of quality looms
- Poor quality cocoon
- Non availability of qualified personnel to operate the filatures and other equipment
- Inadequate knowledge about markets
- Dominance of the markets by China

STRATEGIES:

In the light of the above mentioned constraints faced by most silk producing countries especially new entrants in the industry mostly from the African Continent, there is the need for these countries to strategise.

SOME OF THE RECOMMENDED STRATEGIES ARE:

- Equipping the various operators in the industry with the requisite knowledge and skills to be able to produce quality cocoons and raw silk.
- Adequate training in post cocoon technology
- Innovation in product of development. There is an urgent need for product diversification to meet the demands on the international market.
- Development of new markets – need based marketing strategies.

Chapter 5. Why Silk Handicrafts in Ghana

In Ghana sericulture and the silk industry is quite young. The industry is still grappling with difficulties, struggling to come out with good quality and acceptable products on the international market. It is in the light of this that the Executives of the Sericulture Promotion and Development Association, Ghana in 2004 reasoned and agreed with Dr. Lea Hozoo, the FAO desk officer for sericulture to diversify its products into silk handicrafts.

Needless to say that it will take some time for Ghana to come out with good quality silk yarn and silk fabric that will be acceptable on the international market. These products (i.e., silk yarn and silk fabric) can be converted into unique silk handicrafts which have ready market locally and internationally because of the Ghana government's effective tourism promotion strategy. New types and forms of silk goods are being developed to satisfy different consumer tastes and preferences. One of the objectives of the Sericulture Association is to use sericulture and the silk industry to diversify the country's cottage industry and export base. Therefore, the development of silk handicrafts cottage industries in the country was a vision of the Association at its inception.

TRADITIONAL HANDICRAFTS COTTAGE INDUSTRY IN GHANA

The handicrafts cottage industry is an ancient industry in Ghana.

The crafts of Ghana have been handed down from generation to generation and include detailed raffia and rattan work, wood carvings, pottery and leather goods.

SILK HANDICRAFTS INDUSTRY IN GHANA

Waste cocoons and silk fibre have potential use in handicrafts industry.

Since the successful take off of the FAO project TCP/GHA/2802, the demand of kente weavers for cheaper locally produced silk yarn is gradually being met and some of the silk kente produced is used in the production of handicrafts such as neck ties, bow ties, headgears, traditional sandals, traditional drum and other musical instruments, caps, table mats, cushion covers, fancy fans, dolls, stolls necklace and ear-rings. These are produced from silk fabric and silk yarn.

There is scope for adding more silk handicraft articles to those already being produced. The new silk handicraft articles which could also be produced in Ghana and for which the Technical Director of the Ghana Sericulture Association visited India last year to study their production include- garlands, flowers, greeting cards, wall posters, bouquet, wall hangings, book marks, coasters, ball from silk floss, etc. Most of these items are produced from cut cocoons.

If sericulture by products are integrated with the sericulture industry, the overall sericulture industry will be highly prosperous and viable for better economy and sustainability.

The manufacture of sports goods like tennis rackets, bats, cricket stumps and other goods like bobbins, pulleys, tool handles, toys and other fancy items from mulberry wood due to its strength and elasticity coupled with fine grains, polishing and smoothness has a lot of potential in all sericultural countries especially the new entrants in the sericulture industry from low income countries.

Ghana is considering diversifying its sericultural activities into the manufacture of items from mulberry wood to make the industry more viable for better economy and sustainability.

The Sericulture Association is collaborating with the Centre for National Culture, the Ministry of Tourism and the National Board for Small Scale Industries to embark on this new venture.

The Government of Ghana has interest in the sericulture industry generally and it is keen in supporting it through its own resources and also sourcing external support from multilateral and bilateral agencies.

LIST OF SILK REELING AND PROCESSING MACHINERY USED IN THE COTTAGE INDUSTRIES AND SILK ENTERPRISES IN GHANA

SILK REELING MACHINES:

- Multiend Silk Reeling Machine – 8 basins 1
- Silk re-reeling machine - 8 windows 1
- Silk reel permeation tank 1
- Circular Pressurised tank 1
- Long skein book making machine 1
- Epprouvette 1
- Denier Scale 1
- Silk Skeining machine 1
- Book press – 2 kg capacity 1
- Spinning machine 6
- Dupion Silk reeling machine 1
- Hot Air Electrical drier 50kg cocoon capacity 1
- Ushnakoti Drier 50 kg capacity 1
- Hand operated improved Charaka 1
- Auto Sorter for Silk Denier 1
- Steam Boiler 300 Kgs / hour 1

LIST OF SILK PROCESSING MACHINERY

- Winding Machines (50 spindles capacity 2
- Doubling Machines (40 spindles capacity) 2
- Twisting Machine (2- 200 spindles capacity 3
  (1- 160 spindles capacity)
- Bobbin to Hank Re-warping machine (20 Hanks capacity 1
- Sectional Warping Machine (200 bobbin capacity) 1
- Pirn Winding Machine (4 spindles Automatic) 1
- Hand operated – pirn winding machine 4
- Handloom 52” width (2 each Dobby and Jacquard) 10
- Hydro extractor (5 kgs capacity) 1
- Twist setting chamber (120 tubes capacity) 1
- Degumming / Dyeing VATS (30” x 24” x 30”) 2
- SS Degumming bath (8’ x 6’ x 4’) 1
- Cloth inspection table (6’ L x 4’ W x 4’ H) 1
- Fabric Meter Folding table (4’ L x 4’ W x 4’H) 1
- Printing table a) (6 meter length) 1
  b) Screen making equipment 1

Chapter 6. Markets for Silk Handicrafts

There is a vast market for silk handicrafts in Ghana. The Centre for National Culture has opened up sales outlets for handicrafts in all the ten (10) regions of the country. The Ministry of Tourism is promoting tourism aggressively and these tourists' shops at the sales outlets of the Centre for National Culture where the silk handicrafts along side other handicrafts are displayed.

Wonoo ventures is one of the leaders in the kente cloth weaving industry. This enterprise was the first to make enquiries about locally produced silk yarn for the kente cloth weaving industry. It has sales outlets locally and in Europe and North America. Their international sales outlets will be used to market silk handicrafts from Ghana and other African countries.

The trade attaches at the Ghana missions abroad will also be used to explore market for Ghana silk handicrafts.

TRAINING:

Members of the Sericulture Promotion and Development Association, Ghana attend monthly meetings at its head office in Accra, the capital of Ghana. Some times these meetings are combined with training. Training programmes are some times organized separately. Members of the Association and other people in the handicrafts industry will be exposed to silk handicrafts through some of the Association's training programmes. The Technical Director of the Association who is the author of this paper has had two weeks exposure to the silk handicrafts industry in India and he will transfer the technology in the production of various silk handicraft items to members. The Community Based Rural Development Project, a Ghana government undertaking sponsored by the World Bank and the French Government has agreed to provide funds to the Association for such activities. It is, therefore, hoped that the silk and silk handicrafts industry will grow and be sustained in Ghana.

MAJOR CONSTRAINTS AGAINST SILK HANDICRAFTS COTTAGE INDUSTRIES AND SILK ENTERPRISES DEVELOPMENT IN GHANA.

Entrepreneurs in the silk handicrafts cottage industry and silk enterprises are faced with a mirage of problems but they are managing to keep their heads above the waters.

The major problems faced by the operators in the field include:

- Low production of silk yarn and for that matter silk fabric due to irregular and insufficient supply of silkworm eggs. For instance in 2005, only one rearing was done because of the problem of eggs supply.
- Long distance of trading units for sale of cocoons
- Lack of trained manpower in both pre and post cocoon sectors and lack of training facilities to keep entrepreneurs abreast with modern technologies. The sericulture and silk industry is dynamic and new technologies are being developed day in and day out.
- Insufficient training for the operators in the field and more especially the technicians at the factory. They had just one week training in the operation and maintenance of the machinery at the factory.
- Lack of timely guidance. The Technical Director of the Association is the only source of technical information on the industry and therefore sometimes it is difficult for the operators to avail themselves of his services timely.
- Lack of appropriate tools/implements for the silk handicrafts cottage industry.
- Lack of proper governmental support.
- Lack of funding for the entrepreneurs in the industry to step up and sustain production.

SUGGESTIONS FOR ALLEVIATING THE IDENTIFIED CONSTRAINTS

- In the short term, concrete arrangements are being made with the silkworm eggs suppliers and courier services for the regular and timely delivery of eggs. In the medium to long term, a grainage should be worked for.
- The government and other establishments in the industry should arrange to procure on vehicle which will go round and pick cocoons at central points to the factory for processing.
- There is urgent need to train other people in the industry to assist the Technical Director of the Association. The technicians at the factory need more exposure. It is recommended that one expert each in cocoon and silk processing be attached to the factory for a minimum period of three (3) months to train the factory hands. Once, more hands are trained to assist the Technical Director, timely guidance of the entrepreneurs will be met.
- The government is being lobbied to set up a sericulture cell at one of government agencies.
- The banks and other financial institutions and funding agencies are being seriously lobbied to provide financial assistance to entrepreneurs in sericulture and the silk industry.

Chapter 7. The African regional programme

In 1999, the African Silk Network was founded in Cairo, Egypt with the overall objective of helping to develop and promote sericulture and the silk industry on the African continent.

In 2001, members of the Network assembled again in Kampala, Uganda to discuss problems faced by member states in the field and to work out strategies to achieve its objectives. Both meetings were funded by the United Nations Education, Science and Cultural Organisation (UNESCO) and organized by the International Programme for Arid Land Crops (IPALAC), an Israeli organization affiliated to the Ben Gurion University of the Negev.

The Network would mobilize its members and introduce them to this new concept of product diversification with emphasis on silk handicrafts.

Funding from sources like the UNESCO, United Nations Industrial Development Organisation (UNIDO), International Fund for Agricultural Development (IFAD) and the Food and Agriculture Organistion (FAO) will be sought for this activity.

The Network has on its drawing board a programme to open a sales outlet in one European country to market the products of member countries. This will be revisited and pursued. When this is done, silk handicrafts from member countries would be sent to the shop for sale.

RECOMMENDATIONS:

The following recommendations are made:

- Diversification of silk products into silk handicrafts is an innovation that is worth giving a push and every effort should be made to support members participating in this august workshop to make it a success.
- As a follow up to this workshop it is recommended that regional and country workshops with the support of the FAO and other international funding agencies be organized to create awareness.

- Producers of silk handicrafts in the various countries should be put under one umbrella i.e. co-operatives to enable them access assistance and improve the quality of their products.
- Emphasis should be placed on the development of human skills (human resources development) in sericulture and the silk industry.
- In the textile and handicrafts products, there is the need to develop skills to produce and maintain the goods which stand for high degree of craftsmanship and speak well of the people who produce them.
- There is a need to train up the grass root workers in the organizations, make them enthusiastic about their work and involve them along with practitioners themselves in taking up activities which reflect the rich tradition and products of high quality.

Chapter 8. Annex1: Photos

Administrative map of Ghana

Different types of kente cloth

Pictures of worn kente cloth

Types of kente handicrafts

Kente weaver at his factory

Indian Sericulture – An Entrepreneurial Perspective

By

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ABSTRACT

Silk has been known and used in India from at least the Vedic period. Knowledge of weaving in India is comparatively more ancient, since the references available are to silk fabrics of brilliant colour and texture and so on. References of silk in ancient Hindu literature tell us that 'the greatest weaving magicians in the world' came from Kashmir. Indian sericulture is unique in several ways. While it is the only country that commercially produces all the four types of silk – viz., mulberry silk, tasar silk, eri silk and muga silk – it is the only country that is consuming over 80% of the silk fabric production within the country. Silk has an enviable position since silk is indispensable in ceremonies and religious rituals, being a must in weddings, festivals and funerals Fascination of Indian women to the splendours and the unique rustle of silk have kept the domestic silk market alive and vibrant, which is a tremendous advantage for the average Indian silk producer. In India it is seri 'culture' that prevails and not so much seri 'business'. It is this 'culture' that often defies apparent business "logic" or 'principles' that has nurtured and sustained mullions of rural families and artisans in all parts of the country. There are gaps in the industry, which need to be filled up so as to improve its productivity, quality and sustainability. The Governments at the Centre and in the States, Donor Agencies, NGOs, trade bodies etc., have been making efforts to fill the gaps. Demand for silk yarn in India is far higher than the production. Import of silk yarn amounted to 7948 tons in the year 2004 – 05 and production was about 14,620 m-tons. The weaver sees 'quality of yarn' as that trait or combination of traits, which enhance the loom efficiency and reduces variation in the weight between consecutive pieces of fabrics produced, while generating as low a waste as possible. Within India, there are clusters that produce silk fabrics without twisting. This practice is seen even in Bangladesh and Thailand. The famous "Thai silk" has untwisted weft in some of its products. The feel, drape and such other characteristics of these fabrics become very different and it will limit the variety of fabrics that can be produced. There are variations in the woven design as well. The World renowned 'Brocades' of Varanasi, the mythological motifs woven in the Baluchuri saris of Bishnupur in West Bengal, the Tie and Dye patterns produced in Pochampalli of Andhra Pradesh and in Sambhalpur / NuaPatna areas of Orissa, the inimitable Zari designs woven in Kanchipuram and other clusters of Tamilnadu are but the most outstanding examples. Thailand and Uzbekisthan also produce tie and dye fabrics but not the brocades or the other designs found in India. Indian sericulture has the following features:

- ***Fairly consistent demand for silk products originating in both Domestic and Export Markets***
- ***Existence of various systems, processes, infrastructure, distribution channels / networks, capital and the skilled human resources to meet this demand***
- ***Opportunity in terms of lower entry barriers at certain levels and relatively easy access to market (E.g., Government Cocoon Markets)***

Silk handloom weaving has great potential for creating consistent employment to the whole family, provided there is a fairly consistent demand for handloom fabrics. In the shadow of the handloom waving, there is scope for development of all the preparatory processes and subsequent value addition processes like embroidery or printing and so on. There is no ready made answer for developing silk handloom and handicraft activities in the African, Central Asian, European and Near East countries. However, a focussed study can identify the potentials based on which an intervention model can be developed.

Key words: silk handcrafts, cottage industries, India, development

Chapter 1. Introduction

Success, whether of individuals or nations has always been associated with a spirit of adventure, courage and curiosity. Along with certain other traits, these qualities have come to be identified as entrepreneurial qualities. Research[1] has established that there is a close correlation between economic development of countries and the prevalence of entrepreneurship among the people. On this premise, concerted efforts have been initiated by the governments in India, both at the Centre and States to promote entrepreneurial development to augment the pace and quality of economic development. A number of institutions like Industrial Development Banks / Corporations, Finance Corporations etc., are functioning with the aim of identifying, assisting, supporting and promoting entrepreneurship at different levels, small, medium and large. Many schemes have been put in place to provide professional, technical, financial, marketing and other forms of support and incentives. Indian planners have given high priority to the development of small and medium enterprises (SMEs) right from the beginning of planning era in 1951. Today, Indian SMEs contribute almost 40% of overall industrial production, 40 to 45% of export of manufactured goods and provide employment to nearly 170 lakh people. The sericulture industry is an integral part of this larger mosaic, albeit with its own dynamics.

Liberalization of economic and industrial policies in India since 1991, signing of WTO agreement, the concept of the world being a 'Global Village' etc have brought about metamorphic changes in the Indian industrial and entrepreneurial environment. Recession in the textile industry in general and silk industry in particular, competition from man made fibre industries in established sari varieties have had telling effect on the growth of the silk industry. However, the scenario is somewhat different for the silk industry particularly from the point of view of WTO agreement. Silk industry has stood its ground and tried to answer the new challenges in a very special manner:

- The strong domestic demand (Indian market for Saris is a case in point),
- the vibrant range of products for the domestic and international markets,
- the astounding varieties within a given product or a product range,
- the special place for silk in the social and cultural construction

have helped the industry to mange the crisis till now.

On the other hand, the highly complicated structure of silk industry - from silkworm eggs till the finished fabrics – the chain of stages in which each stage operates as though it is an independent entity imposes many a limitation for the development of the industry in an 'organized' manner. There are gaps in the industry, which need to be filled up so as to improve its productivity, quality and sustainability. The Governments at the Centre and in the States, Donor Agencies, NGOs, trade bodies etc., have been making efforts to fill the gaps. A closer look is necessary to understand the current position of this dynamic and volatile industry from an entrepreneurial perspective particularly in the silk handloom component of the silk sub sector.

Chapter 2. Historical background, present status and future prospects of the silk industries sector and silk enterprises in the country

2.1. Brief History of Silk in India

International and national historians and chroniclers on history of Silk hold that most of the early history of Indian silk is obscure and a 'vast amount of historical evidence is as yet

[1] Entrepreneurial Success – A psychological Study by K. Ravi Chandra

unexplored'. [C.H.C.Cansdale, William. F. Legget, Mahesh Nanavaty to name a few]. Silk has been known and used in India from at least the Vedic period. Knowledge of weaving in India is comparatively more ancient, since the references available are to silk fabrics of brilliant colour and texture and so on. W.F. Legget records "References of silk in ancient Hindu literature tell us that 'the greatest weaving magicians in the world' came from Kashmir".

From the merchants of yore to the royal patronage in the medieval period silk trade in India had developed and the famous Silk Road connecting the East and the West had facilitated flow of silk in to Europe from the Asian countries. Silk trade in India was already flourishing by the time the British stepped in, in the form of East India Company. On seeing the opportunity that trading in silk offered, they tried various methods to improve the quality of Indian silk. These interventions by the British were intensified particularly after the French revolutions and the Napoleonic wars set up trade barriers preventing European silk reaching England. Between 1854 and 1858, French sericulture was wiped out by the deadly disease Pebrene, leaving the world famous French weaving industry in Marseilles and Lyons starving for silk yarn. Demand for silk yarn increased further.

However, the initiative and keen interest shown by the Kings and provincial rulers in the 19th century causing spreading of sericulture from Bengal to other parts of India – mainly to southern India, growing domestic demand for silk within India, opportunity to earn a livelihood for a large number of Indian farmers and artisans have all contributed to the growth of silk industry in India. Independent India consciously supported and developed sericulture through large scale initiatives both at the Central and State Governmental levels.

Indian sericulture is unique in several ways. While it is the only country that commercially produces all the four types of silk – viz., mulberry silk, tasar silk, eri silk and muga silk – it is the only country that is consuming over 80% of the silk fabric production within the country. Over one billion population of India is huge market by any standards. In this market, silk has an enviable position since "silk is indispensable in ceremonies and religious rituals, being a must in weddings, festivals and funerals" [V.Balu – Indian Sericulture at cross roads – paper for the 20th conference of the International Sericultural Congress]. Fascination of Indian women to the splendours and the unique rustle of silk have kept the domestic silk market alive and vibrant, which is a tremendous advantage for the average Indian silk producer.

In India it is seri 'culture' that prevails and not so much seri 'business'. It is this 'culture' that often defies apparent business "logic" or 'principles' that has nurtured and sustained mullions of rural families and artisans in all parts of the country.

2.2. Overview of Indian sericulture

Sericulture encompasses a large value addition chain, starting from silkworm eggs to fabrics, also extending to finished garments. Each activity in the value addition chain is very specialised and has its own specific dynamics in terms of technology, package of practices, economics, market linkages and above all human processes. Different activities in the value addition chain are spread across the length and breadth of the country in the form of clusters. Thus, there are cocoon producing clusters, silk reeling, silk twisting, handloom weaving and power loom weaving clusters.

Central Silk Board (under Ministry of Textiles, Government of India) has reported that during the year 2004 – 05, sericulture has provided employment to about 8 million families in about 54, 000 villages in the country. Totally, 16, 500 metric tons of raw silk has been produced comprising 14620 m.t of mulberry raw silk, 322 m.t of Tasar silk, 1448 m.t of Eri silk and 110 m.t of Muga silk. Apart from this, there has been an import of 7,948 tons of raw silk in to India. About 2, 58000 hand looms and and 29,340 power looms were estimated to be in

operation producing 448 million square meters of silk fabrics, handloom accounting for about 60% of the fabric production. The export earnings are 28,796 million INR (about US$640 million). Detailed Sericultural statistics of India is provided at Annex 1.

2.3. Development Perspective

Practical experiences in India and Thailand have established the fact that sericulture is scale insensitive. Poor and marginal producers have been able to earn a livelihood relatively consistently in a given average year. Drought resistant nature of mulberry saved the lives of several thousands of small and marginal sericulture farmers in the semi arid regions of southern India during the years of 2001 to 2004 during the harsh and prolonged drought. During this period, though there were several cases of farmers committing suicide, none was reported of any sericulture farmer. Sericulture integrates very well with the general lifestyle of people in the rural areas. Just like a coconut tree, sericulture activity at every stage does not produce anything that does not have a use or there is no waste / by-product that has no commercial value. Mulberry twigs that are left over after feeding the mulberry leaves to the silkworms are used as fuel. [Studies by one Dr Murali in and around B.R.Hills area in southern Karnataka has established that damage to the forests by people collecting firewood is considerably low where the forests are in the sericulture belt, since a significant quantity of fuel (dry mulberry twigs) is available as by-product to the sericulturist families.]

Since mulberry is a deep rooted plant, it allows for inter-cropping with shallow rooted, short term pulses, vegetables and flower plants as long as there is no spraying of insecticides.

Results of many action researches including the ones conducted by Swiss Agency for Development and Cooperation have shown that sericulture farmer groups have emerged to be 'bankable' even when they are poor and when they lacked direct access to formal financial institutions. Sericulture is highly labour intensive and in all activities except silk dyeing, the labour force comprises over 65% women. In the silkworm rearing activity, most often women work in their own houses and are happy to be indoors, doing their own work and being their own bosses, reflecting a higher level of comfort, selfworth and dignity. Similarly, the women in handloom weaving are engaged in pre-weaving as well as other preparatory processes within their own households. In silk reeling operation, family run Charaka units use the services of all members in the family while others engage wage workers. Cottage basin units and silk twisting units hire labour, which consists of nearly 80% women. Issue of child labour is significant and the policy makers are actively addressing this issue.

Reeling of silk is a semi-mechanised operation, relying largely on the skill, knowledge and judgement of the individual entrepreneur, whose earning per day is sufficient to meet the family's day to day requirements. Small scale handloom weaver who often owns one or two handlooms often depends on the jobwork available from the master weavers and trade houses, and at times cooperative societies to earn livelihood. Since sericulture is also a seasonal crop, it has its fair share of seasonality - lean and flush seasons. Added to this, since sericulture is an agro-based industry, it is subjected to vagaries of nature. When there is a crisis the poor are the most vulnerable. In the last decade, organising the poor in sericulture involved in the pre-cocoon activities has paid rich dividends in reducing their vulnerability where as, in post cocoon activities, there is still a long way to go.

2.4. Progress and achievements

Over the last four decades, Indian sericulture has grown stronger through concerted and focussed efforts in Research and Development, systematic extension support and stabilised market linkages. Gains were visible in infrastructure development, capacity building of

various stakeholders such as Officers in the Departments of Sericulture providing Extension service, R & D, Progressive farmers / producers. Efforts under the 8th, 9th and now the ongoing 10th five year plans have brought some significant changes.

World Bank aided National Sericulture Project, support by JICA, UNDP and Swiss Agency for Development and Cooperation have contributed to the development of Indian sericulture in the last two decades.

Consider the example of Karnataka, which accounts for about 70% of mulberry silk produced in India.

YEAR	1990 – 1991	2004 – 2005
PARAMETER		
Average leaf yield in metric tons per hectare per year	15	16.5
Productivity of cocoons per 100 dfls	27.95	49.55
Productivity of raw silk per hectare per year Kgs	41.5	93.6
Renditta	9.5	7.5

Though there is a reduction in the area under mulberry, the production of silk yarn has remained stagnant over the last few years on account of enhanced productivity.

This is also the trend in other countries, except China. Following figures indicate production of silk yarn in the major silk producing countries for the year 2003 in comparison to 1998.

YEAR	1998	2003
COUNTRY		
China	49,430	76,324
India	14260	13970
Brazil	1821	1563
Republic of Korea	210	150
Uzbekistan	1500	950
Thailand	900	1420
Vietnam	862	750

Source: Conference papers Volume 3 of 20th International Sericultural Conference

Better rains and improvement in the acreage under mulberry in India has contributed to slight improvement in the production of silk yarn at 14,620 m. tons.

Demand for silk yarn in India is far higher than the production. Import of silk yarn amounted to 9258 tons in 2003- 04 and 7948 tons in the year 2004 – 05. During the period April to August of 2005, following silk yarn imports have been reported:

	QUANTITY in m.tons	VALUE in Millions	
COUNTRY		INR	US $
China	3467	2792.3	64.05
Taiwan	27	26.3	0.60
Brazil	45	33.7	0.77
Uzbekistan	13	6.5	0.14
TOTAL	**3552**	**2858.8**	**65.56**
Average price / Kg	2858800000 / 3552000	804.84	18.46

Source: Dec 2005 Indian Silk of CSB

Chinese silk to the tune of 3000 to 5000 tons find their way in to Indian markets through undefined and unofficial channels (the huge and porous borders have made this possible via Bangladesh or Nepal). The estimated demand for silk in India is of the order of 25,000 tons. Large scale projects and schemes have been set in motion under the 9th and 10th five year plans to introduce bivoltine silk in India with technical assistance from Japan, mainly to produce high quality yarn that can substitute the Chinese silk coming in to India. At present there are too many bottlenecks and the Indian silk trade has always found its own comfort zone governed largely by the domestic market. During the period April to October 2005, transaction of bivoltine silk in Karnataka (largest yarn market in the country) is reported as about 6 tons valued at about INR 6.30 million (INR 1018 per Kg). It may be noted that during the same period, multivoltine silk of 20 / 22 denier has been transacted at an average price of INR 1018 per Kg Compared to the prices of imported silk as seen from the table above, India has a tough challenge in matching these prices. China will do everything under her control to sell silk yarn in India as this is the only market that can absorb large quantities of silk yarn of grade 2 A and below.

Notwithstanding this challenge, there is a shift in focus at the policy level, with a great deal of attention given to possible prospects of export market. This is pushing India towards engaging China in direct competition on products where China has already established her superiority in the World market. While this move is welcome, the real strength of India in terms of handloom products – wide range and variety of products in various combinations – is now getting very little attention or encouragement. There is a general notion to the effect that "hand-made / traditional silk production equals poor quality". Indian silk weaving industry – both handloom and power loom, demands silk yarn of various specifications. The perceived 'quality' of the end product matters more than the quality of the individual components. Silk sari accounts for the biggest segment of the domestic market. Saris produced in India's most popular handloom clusters like Kanchipuram, Varansai, Pochampalli etc are brands un to themselves, requiring yarn of different varieties like "charaka" reeled and cottage basin reeled yarn, which have different physical properties that contribute towards the specific feel and finish of the sari of a given cluster. One cannot afford to ignore this requirement in the name of quality.

Any attempt to produce silk yarn that can be a substitute to Chinese silk in India (assuming that the yarn of required quality will be produced at competitive / comparable prices) should result in augmenting the existing production and not replacing it. At the time of preparing this paper, there is a shortage in supply of silk yarn due to various reasons, which has resulted in the prices of Indian multivoltine as well as bivoltine silk reaching the levels of INR 1550 per Kg while the reselling of Chinese silk in the local market is in the range of INR 1650 – 1675 per Kg. Handloom sector and power loom sector require very different types of silk yarn invariably depending on the design requirements of the end product. High fashion saris / fabrics like Chiffon, Crepe, Georgette, Soft silk etc, which are produced on the power loom love to use Chinese silk in the warp as this will enhance loom efficiency. Heavy sari varieties, saris with a rich motif and intricate weaving produced on handlooms use local multivoltine silk reeled both on Charaka and cottage basin.

2.5. The Main Stream of Mulberry silk sub sector

Annex 2 diagrammatically represents the complex structure of Indian mulberry silk sub sector (Source: Sub Sector Study conducted by M/s Delphi Market Research P Ltd, Bangalore). From the seed organisation to domestic as well as export marketing stages, there are several layers, stakeholders, institutions, individuals, policy makers, R & D institutions, and various support services across the value addition chain.

MAIN ENTERPRISES AT WORK IN THE SILK INDUSTRY

The layout of the enterprises in the silk industry can be schematically shown as follows:

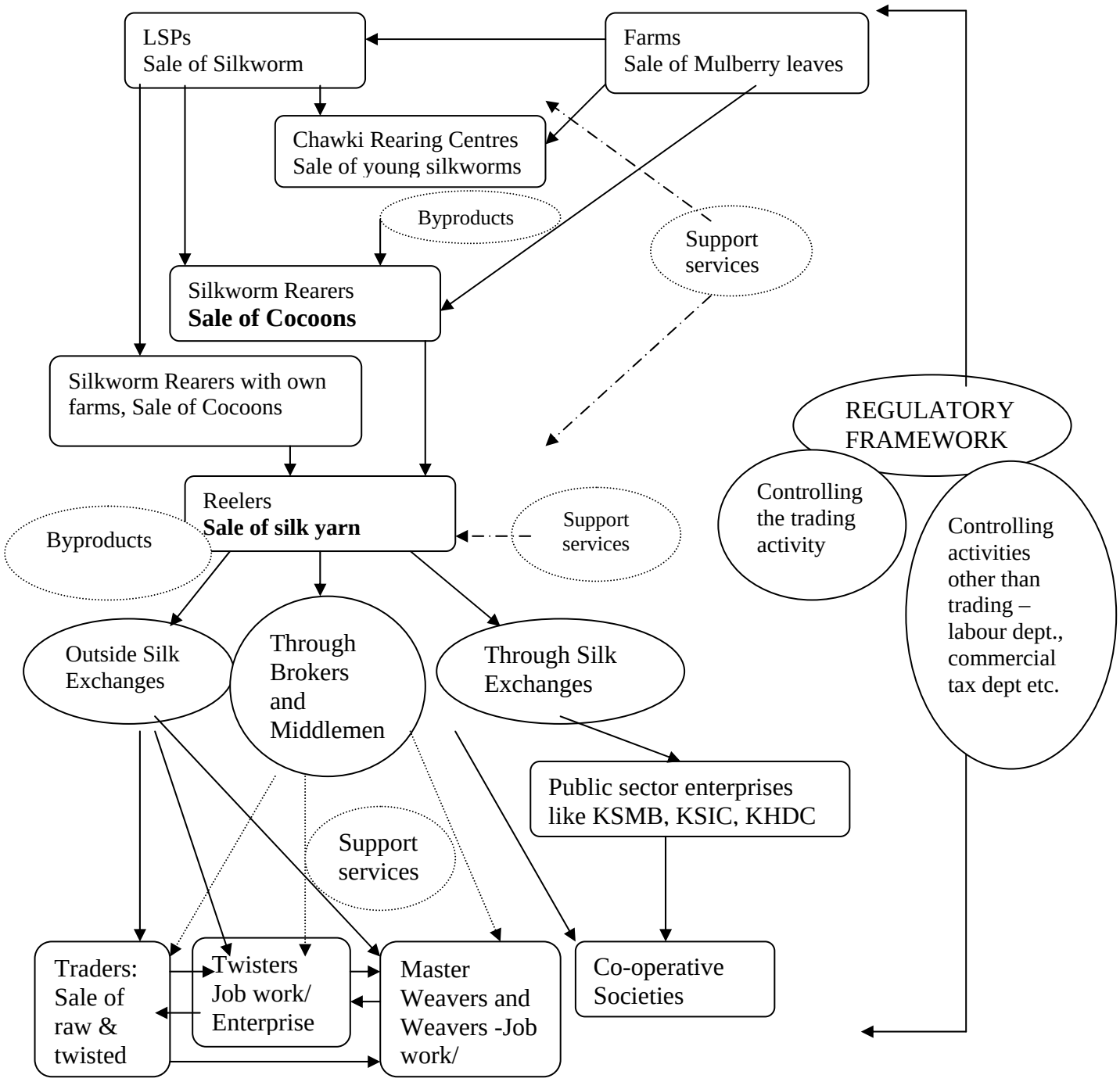


Fig 1a. Schematic diagram of layout of the enterprises in the silk industry from mulberry farmer to weaver and main channels of distribution

The schematic representation has been split up on account of the existence of the regulatory framework, which facilitates transaction of the goods. E.g. Government Cocoon Markets, Silk Exchange, Enforcement wing of Dept. of Sericulture etc.

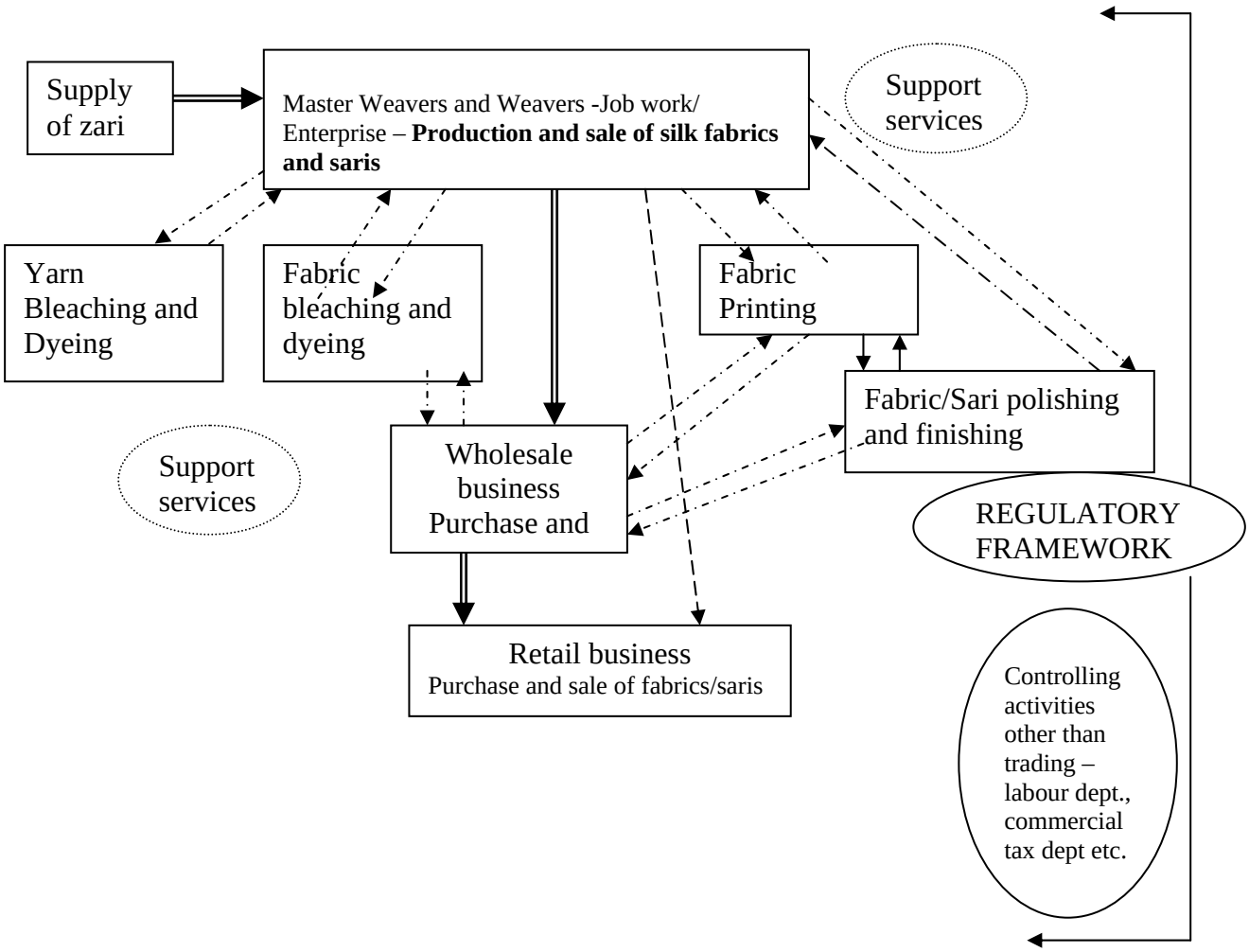


Fig 1b. Schematic diagram of layout of the enterprises in the silk industry from weaver to retail business and main channels of distribution

This is, by and large, a "self-organised" sub sector, notwithstanding the classification that it is an unorganised one and the formal agencies, both public and private, have not been able to make substantial difference, particularly in the post cocoon operations.

The map (Annex 3) indicates location of various clusters in which the activities of silk reeling through to weaving have been indicated. Though India is geographically a vast country, it is seen that most of the silk reeling and twisting activities are concentrated in Karnataka, while weaving activity is scattered all over the country. Silk twisted to required specification of any given cluster goes over to these weaving clusters, where activities like dyeing weaving and finishing (if any, since most handloom saris are preferred in a loom finished condition) is done. In cases where plain fabrics are woven (mostly on the power loom), with the intention of converting them in to printed / painted / hand crafted saris, woven fabric lengths are sent to other cluster for activities like printing or painting or handwork like embroidery, 'chicken work', 'beed work', etc and are brought back to the point of origin for redistribution to the cities where these are sold.

For example, power loom fabrics woven in and around Bangalore are sent to New Delhi of Kolkata for printing or to Jaipur in the State of Rajasthan for 'kundan work' (this hand work involves fixing semi precious stones according to a specific pattern so as to be used either as a sari or as dress material) or 'zardousi' (this handwork involves using coloured threads, shiny stickers that look like semi precious stones etc as a part of embroidery). The finished goods are brought back to Bangalore for redistribution to other cities all over the country and many times outside the country too. For this reason, Bangalore is also the Silk Capital of India.

2.6. Pricing, Quality and Product range

Price of silk fabrics depends on the ingredients – like any other product – and the workmanship / skill / intricacy of the work that has a direct bearing on the time consumed in production, the brand image and reputation of the seller. In case of a plain silk fabric, it is the weight per meter and the width of the fabrics that determine the price. However, the average fabric width 'accepted' in the market is in the range of 42" to 44", which is transacted under the category of 44" fabric. Traditional saris from reputed manufacturers range between 45" to 48" width, while most producers remain in the range of 44" to 45" width. Since the weight per meter of the fabric directly implies more silk content, the cost will go up in proportion to weight. In case of high fashion varieties like the Crepe, Chiffon Georgette and so on the production processes cost more than the plain silk and hence these will be comparatively of higher price.

Orders are placed for supply of fabric mostly based on the weight per meter, specifying a weight range like 28 – 30 gms fabric or 48 – 50 gms fabric. The buyer would always like to get the fabric weight range closer to the upper limit while the producer keeps closest to the lower limit. While keeping to the lower limit, the producer wants to maintain consistency in the fabric weight range. This is possible only when he / she has adequate quantities of uniform silk yarn in both warp and weft. This is where the question of 'quality' comes up. The weaver sees 'quality of yarn' as that trait or combination of traits, which enhance the loom efficiency and reduces variation in the weight between consecutive pieces of fabrics produced, while generating as low a waste as possible.

This is also the concern of the Twister. Twisting is a preparatory stage in the production of fabrics. Since fabrics of different weight ranges within the same width specification are produced, yarn has to be prepared according to this requirement. In India, particularly in south, ball warps are used and not warps rolled on the beams (known as beam warp). When the warps are prepared, there should be very little difference in the weight of consecutive warps produced by the twister. For E.g., ball warp of a particular cluster specified a weight range of 1 Kg to 1 Kg 50 gms, yarn of very good quality will allow production of warps within a range of say, 1 Kg 10 gms to 1 Kg 40 gms. If the yarn quality is poor, this weight range can, for example, spread over 950 gms to 1 Kg 100 gms difference. The yarn that can produce fabric pieces / warps of lesser variation at the lowest possible levels of processing wastage are considered to be of "high quality" and fetch highest price. This is used as a Quality control measure in an indirect manner in the trade. When a reeler sells the yarn, after striking an agreement on the price per Kg of the yarn, only a part of the money is paid at the time of delivery and the final settlement is made after ensuring the processing performance at the twisting stage. If the performance is poor, often the price is reduced and exact feedback on the nature of problems in the yarn quality is informed to the reeler, so that corrective action is taken at the reeling unit while producing the subsequent batches of yarn. Since there is a direct link established between the price and performance, this system has worked effectively.

There are other traits like the feel, lusture / shine, uniformity of the colour (of the yarn whether in raw form or twisted form) that also contribute to the assessment of quality. This

opens up the whole range of quality related process control, which is beyond the scope of this paper.

Within India, there are clusters that produce silk fabrics without twisting. This practice is seen even in Bangladesh and Thailand. The famous "Thai silk" has untwisted weft in some of its products. The feel, drape and such other characteristics of these fabrics become very different and it will limit the variety of fabrics that can be produced.

There are variations in the woven design as well. The World renowned 'Brocades' of Varanasi, The mythological motifs woven in the Baluchuri saris of Bishnupur in West Bengal, the Tie and Dye patterns produced in Pochampalli of Andhra Pradesh and in Sambhalpur / Nua Patna areas of Orissa, the inimitable Zari designs woven in Kanchipuram and other clusters of Tamilnadu are but the most outstanding examples. Thailand and Uzbekisthan also produce tie and dye fabrics but not the brocades or the other designs found in India.

Intricate designs are woven using dobby and jacquard attachments to the handloom. Though there are some pockets where very traditional systems like Jala are still in use, awareness about the advantages of jacquard among the weavers is increasing. Also, depending on the climatic conditions, space available in the weaver's house as well as the customary practice of a given area, pit looms or frame looms are made use of. Throw shuttle and fly shuttle weaving are in use in different areas. The clusters where complicated designs are produced using traditional practices use throw shuttle system, which involves literally throwing the shuttle between the sheets of warp threads by hand where as in the fly shuttle system, a simple weft propulsion system is attached. Fly shuttle loom has a higher productivity and is normally suited for designs of minimal intricacy and in looms that have dobby or jacquard attachments.

The range of silk fabrics produced in India on the handloom is vast. Dress material, saris, furnishing fabrics and upholstery, bed sheets and covers of very heavy construction are also woven using mulberry and non-mulberry as well as blends in various combinations of the four varieties. Use of dupion silk yarn is extensive in India in producing dress material and furnishing fabrics of different weight ranges. (Dupion silk is the yarn reeled out of 'double cocoons' that are produced when two silkworms come so close together and build one cocoon). It is difficult to unravel the filaments as they become entangled even when the silk worms are building this cocoon. Therefore, the yarn drawn out of these cocoons will be very irregular in its thickness along the whole length, producing a fancy effect. About 2 to 3 % of the cocoons may turn out to be double cocoons in a given consignment or lot. Since double cocoons get produced accidentally and since there is a good demand for dupion silk, the dupion yarn is produced using about 40 % double cocoons as the base and the remaining quantity is made up by using waste and flimsy cocoons and on occasions the regular good quality cocoons meant for reeling on charka or cottage basin.

Thailand has a distinct product in which, filaments from 100 to 120 cocoons are drawn out simultaneously to produce a thick yarn, which is used as weft directly after bleaching and dyeing according to the design requirement. This fabric has a different effect all together even though it matches the dupion fabric in terms of weight per meter.

2.7. Entrepreneurial Perspective

The complicated structure of this sub sector is propped up by a unique marketing network consisting of players from both public sector and private sector, especially in the three major mulberry silk producing States viz., Andhra Pradesh, Karnataka and Tamilnadu. Role of public sector is restricted to production and distribution of basic seed material at the level of

silkworm eggs and that of a facilitator at the level of marketing of cocoons and to a limited extent at the level of silk yarn. Private sector dominates and dictates the marketing dynamics. However, this combination is working well so far as the trade has found its own equilibrium and the results are fair to some and unduly advantageous to a selected few.

Percentage Distribution of Money:

Summary of the percentage distribution of money from sale of soft silk fabrics of weight 40gms, 50gms and 60gms/mtr is given below:

Source: CSB

% distribution of money from sale of Soft silk fabric of				
Sl no	Category of Stakeholder	40 gms/ mtr	50 gms/ mtr	60 gms/ mtr
1	Rearer	51.5	54.6	56.8
2	Reeler	6.2	6.6	6.8
3	Twister	8.2	8.7	9.1
4	Weaver	14.5	12.3	10.7
5	Trader	19.5	17.8	16.6
	Total	100.0	100.0	100.0

Each individual entity in the chain of activities depicted in Annex 2 have existed more in isolation than as collectively identifiable enterprises. However, the linkage is brought by the so called 'middle men' or the "profiteers" or the "Traders". While there are clearly noticeable "exploitative" practices, these are the only people that are providing business development services (BDS) such as

- Providing business linkages
- Investing money and bearing all the associated risks
- Setting norms for production and quality level for the goods that market demands
- Providing feedback on all aspects of design colour and styling

By nature, the industry has remained self organised and informal. Over 50% of the production processes are taking place on a job-work basis. In the Twisting and Dyeing stages, this percentage is as high as 80 % and in handloom weaving it is nearly 90%.

The artisans have very small holding capacity and are not at all in a position to cash in on seasonal price fluctuations. However, their income levels are enough to meet their requirements in their local conditions but insufficient to create any sort of surplus that could enhance their quality of life.

There are many issues that are visibly discernible, which have not been conducive to the development of this industry to its potential. The issues concern Policy, business practices, skills, exposure etc.

The major issues revolve round the following points:

- Price instability in the cocoon and raw silk markets,
- Inconsistency in demand for silk fabrics and consequently for silk yarn,
- The prevalent trade practice of credit sale with too long a time frame,
- Limitations of standardisation in product specification and product quality norms,
- Limitations on the availability of trade information to all the stakeholders who need it
- Lack of exposure to existing entrepreneurs about the various activities within the industry

- Lack of entrepreneurial skill (inclusive of technical, managerial, business / trading,) within the existing entrepreneurs
- Limitations on development and promotion of business environment conducive to enterprise development
- Inadequacies within the processes of regulatory mechanism particularly in providing any kind of protection to the handloom products
- Reduced awareness / discerning capacity / sensitivity among the domestic consumers, which problem is further precipitated by similar looking power loom products that are of cheaper prices – This always pushes the artisan in to a disadvantageous position or a position of vulnerability from which the artisan can not recover. (GI Registration has not so far been the right answer)

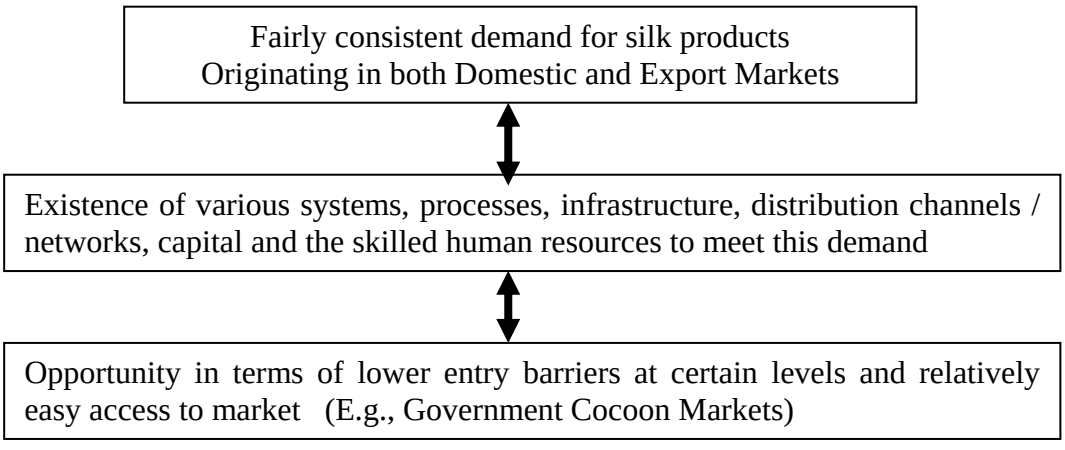
The huge domestic market at the consumer level is by and large price driven. Though there is a small segment of the market that demands 'quality of product', it has little significance in the overall picture.

2.8. Advantages

- There is a clear business stream already defined and having its own specific identity with all the required support services fully functional.
- There are given sets of products that are acceptable with clearly defined norms so that the same can be produced by an artisan with average skills supported by expert guidance.
- The products can be produced using very simple equipment on a "cottage industry" scale
- Sericulture has one of the best employment development potential in rural and semi urban areas
- Flow of wealth from the rich to the poor is visibly discernible, since silk products, normally considered as a product for the 'affording and affluent' class are made by people / families that are generally earning just the bare necessities.

Chapter 3. Possibilities for Replication in Central Asian and African Countries

This detailed picture of Indian sericulture sub sector tries to project the following:



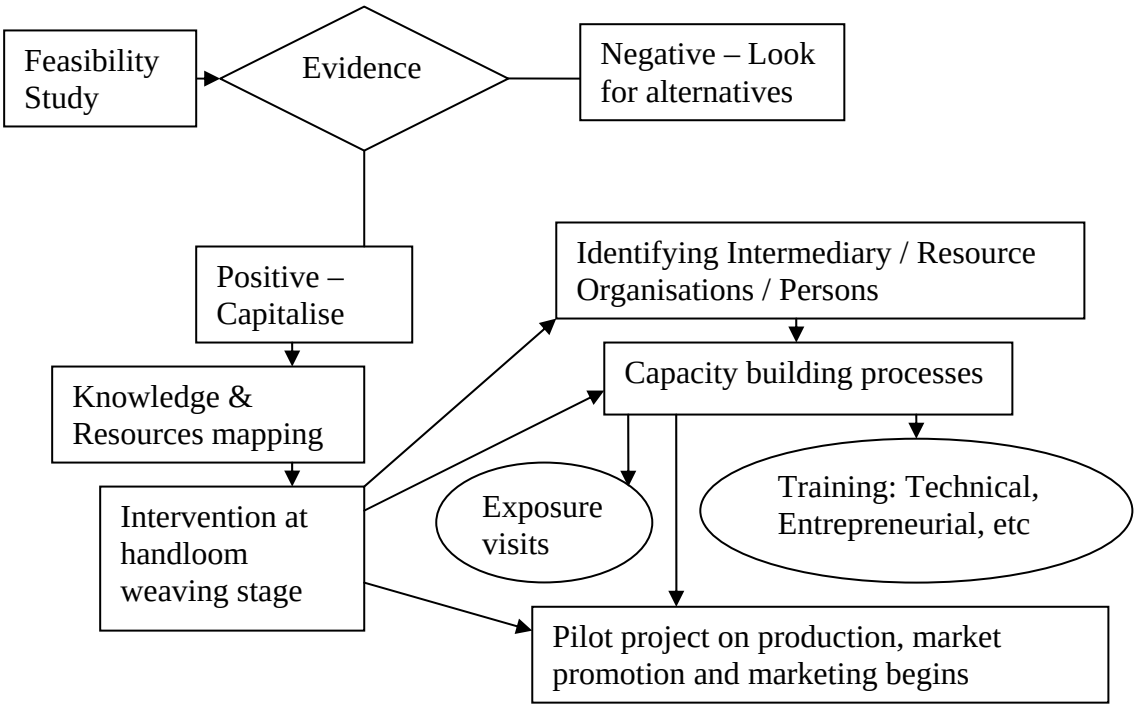
This development has evolved over several centuries. Clearly, it is difficult to replicate an integrated model consisting of silkworm seed production to fabric / garment production. The fabric as dress material / upholstery / furnishing fabrics or the sari are the products that are in the form and shape to be disposed off to consumers while all other products from silkworm eggs up to yarn and some times grey fabrics are intermediary products at each stage in the value addition chain. Therefore, it is important to zero in on two or three types of fabrics / dresses that can be made of 100 % silk or fabrics containing silk in warp or weft.

Producing a silk fabric of any given description – setting up the required line of machinery – to a certain extent training the people in technical aspects are perhaps among the simpler tasks. It is the demand for the product that will decide the issue conclusively. Demand can be felt / expressed or latent. In either case, it is possible to determine whether the product (in our case silk fabrics / dress / dress material) has a market or whether a market for that product can be 'created'.

A detailed study (by a market research organisation that has the expertise in this sort of work) to determine the market potential for silk / silk mixed fabrics is essential. The study team should go with samples of "most probable product samples" as otherwise, mere questionnaire survey would not yield practically useful data. While determining these samples, the dress code, the climatic conditions, seasonal fashion changes, culture and above all social acceptance for any given type of fabric / dress must be given due consideration. For e.g., some Muslim men as well as followers of Jainism do not wear silk for religious and cultural reasons.

If there is an evidence that there is a demand – whether latent or felt – then, the same can be analysed so as to determine the ways and means of exploiting the same or in designing an intervention. Let us consider that there is a demand for plain silk fabrics of 60 grammes variety in different colours, and we have a fair idea of the price range at which this can be marketed. Let us consider that there is demand only in the domestic market, since demand in the export market at this stage implies too many risks.

This situation is close to Fig 1 b of paragraph 2.5, Various elements of the supply chain as indicated in Fig 1 a can be added on as and when there is progress.



Two pronged approach becomes necessary. Firstly, how to keep this demand alive and secondly where and how are the resources distributed / positioned that could be pooled together in a meaningful manner so as to use the demand effectively.

The first one can be through a campaign, out-sourcing supplies according to requirement and so on. The second one can start with knowledge mapping – seeking 'expression interest' – exposure visits t o the potential entrepreneurs – firming up ideas that can contribute to evolving a concrete concept.

No doubt these steps are slow and time consuming. Nevertheless, these are the building blocks if the efforts and results are to be sustainable.

Let us consider that a group of weavers who have experience in weaving cotton / MMF have been located, who are willing to be trained in weaving silk. Then, all the preparations in terms of technical processing from yarn package to the stage when the loom is ready to weave the silk fabric will form the topic for evolving the training curriculum for those weavers. After weaving if any other value addition should take place / required – for e.g., embroidery or printing and so on, the same may be completed.

At all stages, one can see that there is creation of employment positions / additional work for the already engaged, value addition, capacity building in various aspects that can contribute to enhancing the quality of life of the people involved.

With the right kind of preparation, the larger picture can be drawn. Whether it can be a decentralised and scattered production and distribution mechanism – on lines of the Indian or Thailand business practices – or a 'Corporate operations' model, can be decided upon. Thailand also has vertically integrated production and sale units that source yarn, do the dyeing, weaving, garment making and selling through their own outlets. Uzbekistan has units making fabrics with woven / printed designs and release the same for sale both within the country and outside. Bangladesh has a trade practice very similar to India, where the weavers source the required yarn, get it dyed on job work basis, weave Saris and sell the same. To understand the intricacies of these models of the larger picture, one must see the level of success achieved in India and in Thailand under these models.

In India, Corporate operations model is yet to see success, due to variety of reasons. Attempts by large trade houses like Tatas, Thappars etc., have not yielded satisfactory results.

Chapter 4. Conclusion

Silk handloom weaving has great potential for creating consistent employment to the whole family, provided there is a fairly consistent demand for handloom fabrics. In the shadow of the handloom waving, there is scope for development of all the preparatory processes and subsequent value addition processes like embroidery or printing and so on.

There is no ready made answer for developing silk handloom and handicraft activities in the African, Central Asian, European and Near East countries. However, a focussed study can identify the potentials based on which an intervention model can be developed.

Chapter 5. Annexes

Annex 1.

Sericultural statistics of India

Particulars	Unit	1999-2000	2000-01	2001-02	2002-03	2003-04	2004-05
Mulberry Acreage	ha.	227151	215921	232076	194463	185120	171959
Production of							
Reeling Cocoon of which	M.T.	124531	124663	139616	128181	117471	120027
Bivoltine	M.T.	3283	4486	6703	5438	4721	6254
Cross Breed	M.T.	121248	120177	132913	122743	112750	113773
Production of Mulberry Raw Silk	M.T.	13944	14432	15842	14617	13970	14620
Bivoltine	M.T.	373	573	840	685	609	893
Multivoltine	M.T.	13571	13859	15002	13932	13361	13727
Silkwaste	M.T.	4153	4237	4655	4514	3764	3587
Productivity Parameters							
Reeling cocoon/Hect	kg./ha.	548.23	577.35	601.60	659.15	634.57	698.00
Rawsilk/Hect	kg./ha.	61.39	66.84	68.26	75.17	75.46	85.02
Renditta		8.93	8.64	8.81	8.77	8.41	8.21
Reeling cocoon/100 dfls	kg./100 dfls	37.62	39.17	41.84	43.90	45.21	46.79
Vanya Silk : Production of							
Tasar Reel Cocoon	Lk. Kahan	1.84	1.91	2.26	2.77	2.84	3.04
Tasar Rawsilk	M.T.	211	237	249	284	315	322
Eri Reel Cocoon	M.T.	1553	1477	1539	1767	1810	1932
Eri Spun Silk	M.T.	974	1089	1160	1316	1352	1448
Muga Reel cocoon	Lk. Nos.	4260	5260.17	4790.89	5023.09	4865.97	5197.59
Muga Rawsilk	M.T.	85	99	100	102	105	110
Vanya Silkwaste	M.T.	248	304	319	336	373	365
Total Rawsilk (Vanya)	M.T.	1270	1425	1509	1702	1772	1880
Total Rawsilk (Mulberry + Vanya)	M.T.	15214	15857	17351	16319	15742	16500
Exports $							
Silk goods Value	Crore Rs.	1722.37	2376.49	2272.55	2278.29	2773.85	2878.27
Silk waste Qty.	Lk. kgs.	14.91	18.8	14.7	9.35	2.86	0.65
Value	Crore Rs.	33.18	45.49	36.58	15.76	5.34	1.29
Foreign Exchange Earnings	Crore Rs.	1755.55	2421.98	2359.56	2294.05	2779.19	2879.56
	Mn. US$	404.97	530.21	495.29	474.08	604.70	640.90
Imports Qty.	M.T.	5018	4713	6808	9064	9258	7948
Production of Silk fabrics	Lk. sq. mtrs.	3407.24	3513.85	4072.98	4266.66	4225.85	4475.25
Prices							
Mulberry:							
Reeling Cocoon	Rs./kg.	108.26	125.89	119.85	107	126	114
Rawsilk	Rs./kg.	1015	1116	1061	805	984	915
Silkwaste(Filature)	Rs./kg.	120-250	150-255	110-235	120-160	100-230	130-215
Vanya:							
Tasar							
Reeling cocoon	Rs./000nos	725-1150	725-1350	500-1650	800-1800	825-1725	863-1300
Rawsilk	Rs./kg.	1000-1300	1200-1300	1200-1390	1230-1450	1025-1700	825-1475
Eri							
cut cocoon	Rs./kg.	135-200	180-250	180-440	220-360	250-350	250-350
Rawsilk (spun yarn)	Rs./Kg.	450-600	450-700	650-1000	650-1000	750-1100	650-1100
Muga							
Reeling cocoon	Rs./000nos	340-550	300-500	300-550	390-550	500-610	300-600
Rawsilk	Rs./kg.	2800-4300	1800-3300	2500-3500	2500-3500	2700-3300	2800-3500
Employment	Lk. Persons	53.50	54.00	55.00	56.00	56.50	58.00
Production of							
Spun silk yarn	M.T.	505	647	588	550	446	500
Noil Yarn	M.T.	224	325	262	275	224	250
Number of Reeling units							
Filature/Cottagebasin	Nos.	25785	25988	28051	26939	28631	28631
Charka	Nos.	34794	35490	32321	29733	28014	28014
Multiend	Basins	260	258	299	220	201	201
Number of Sericulture Villages	Nos.	60693	58475	58017	57936	53814	53814
Number of Sericulture families	Nos.				615068	796685	796685
Installed/Licenced spinng capacity							
Spun silk yarn	Nos.	38728	40360	40360	40360	40360	40360
Noil Yarn	Nos.	3930	4290	4290	4290	4290	4290
Number of Handlooms	Nos.	227701*	227701*	258000@	258000@	258000@	258000@
Number of Powerlooms	Nos.	29340*	29340*	29340@	29340@	29340@	29340@

* Refers to HL & PL census 1987
$ Refers to DGCIS, Kolkata
Source: SS, CSB, BANGALORE
Source: SS, CSB, BANGALORE
Last up dated 02.12.2005

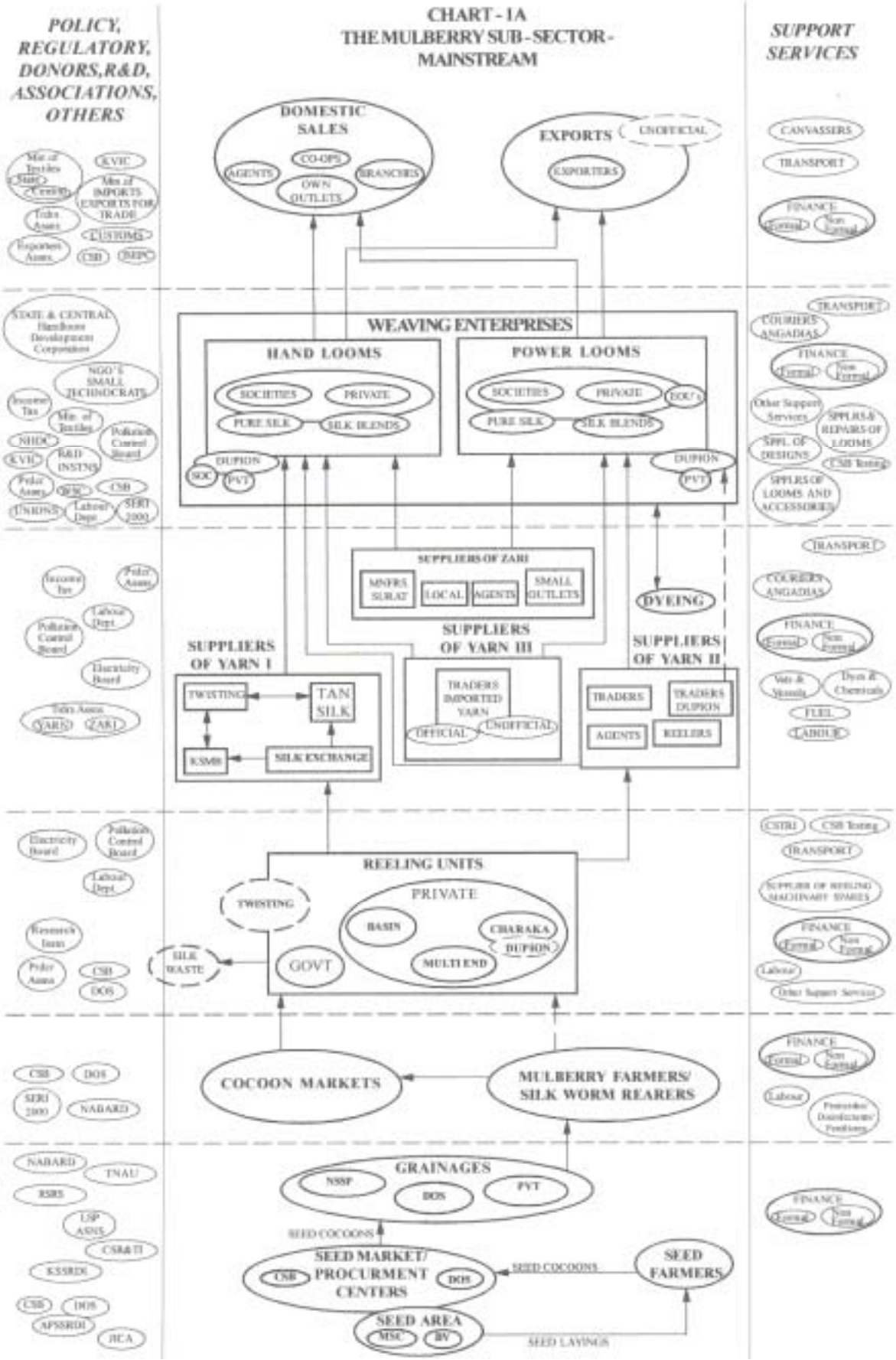
to H/L corporation of India
M.T.- Metric tonnes
Rs. - Rupees

ha. - Hectares
Lk-Lakhs
Nos. - Numbers

kg. -Kilograms
sq. mtrs. - Square meters
dfls. -Disease free layings

Annex 2.

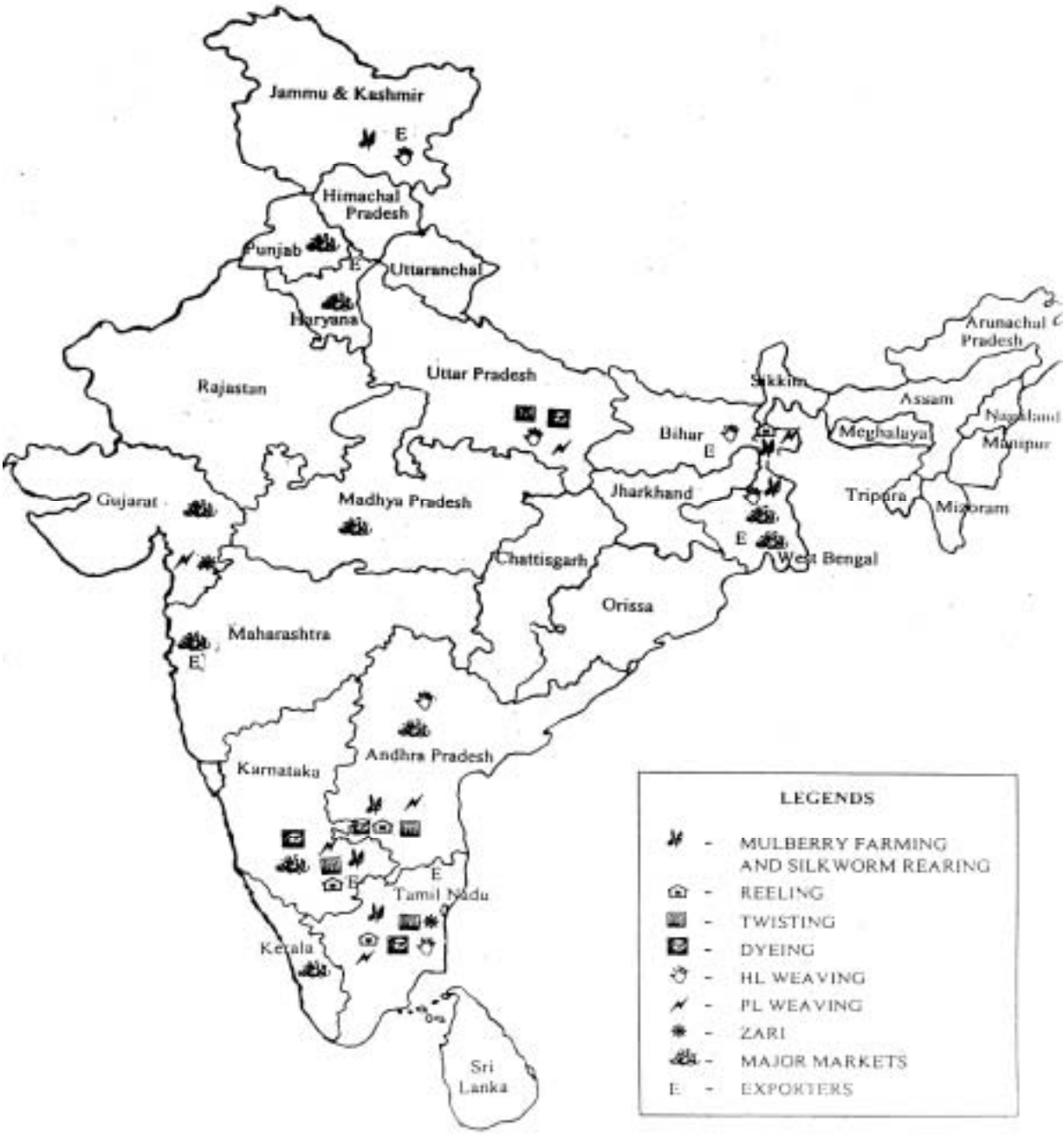
Structure of Indian silk industry



Annex 3.

Mulberry sericulture geographical dispersion in India

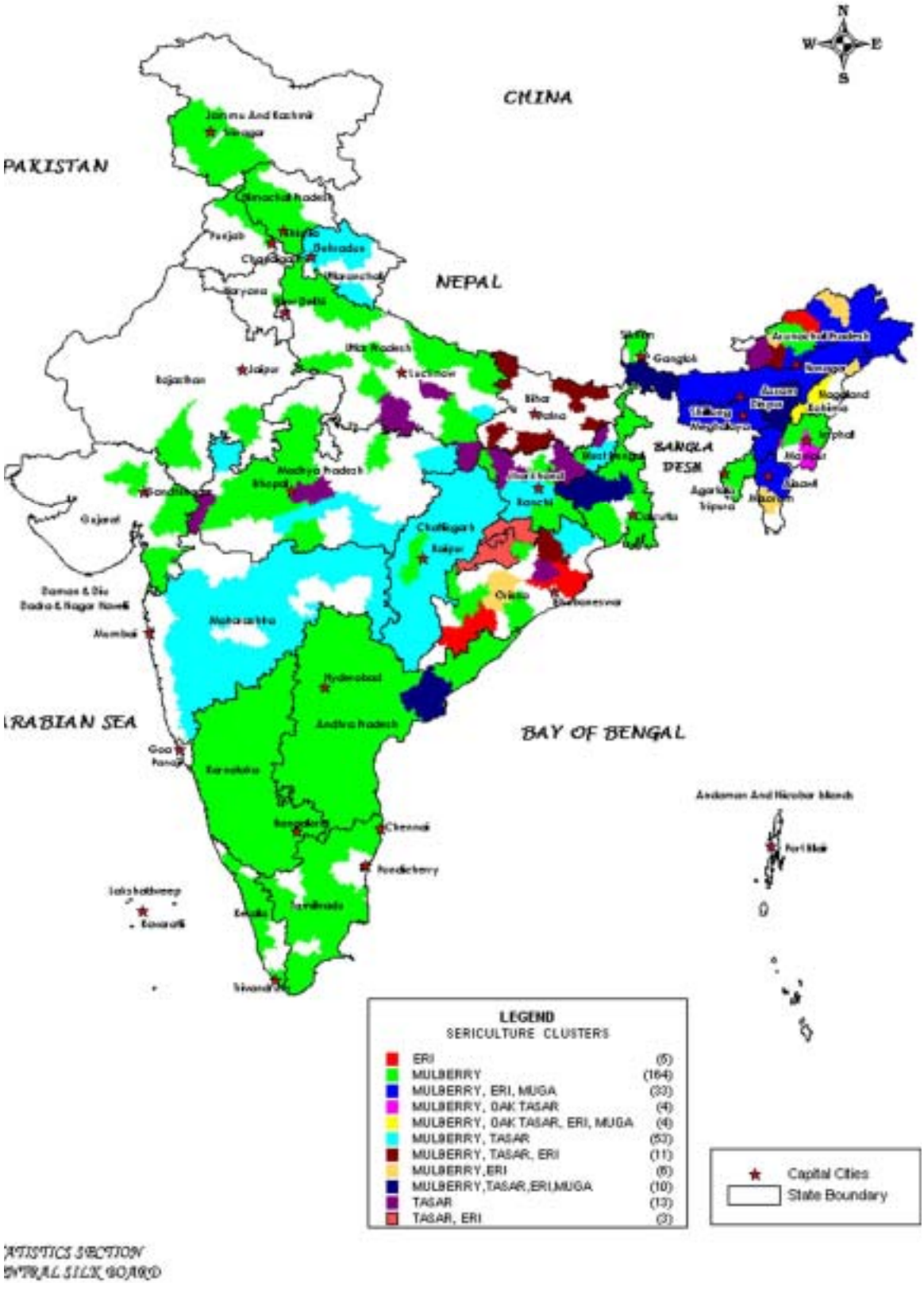
EXHIBIT 1
THE INDIAN MULBERRY SUB-SECTOR –
GEOGRAPHICAL DISPERSION OF PRIME ECONOMIC ACTIVITIES



Source: Mulberry Sub Sector Study – Delphi Market Research P Ltd, Bangalore
Sponsored by Swiss Agency for Development and Cooperation

Annex 3 A.

Sericulture map of India

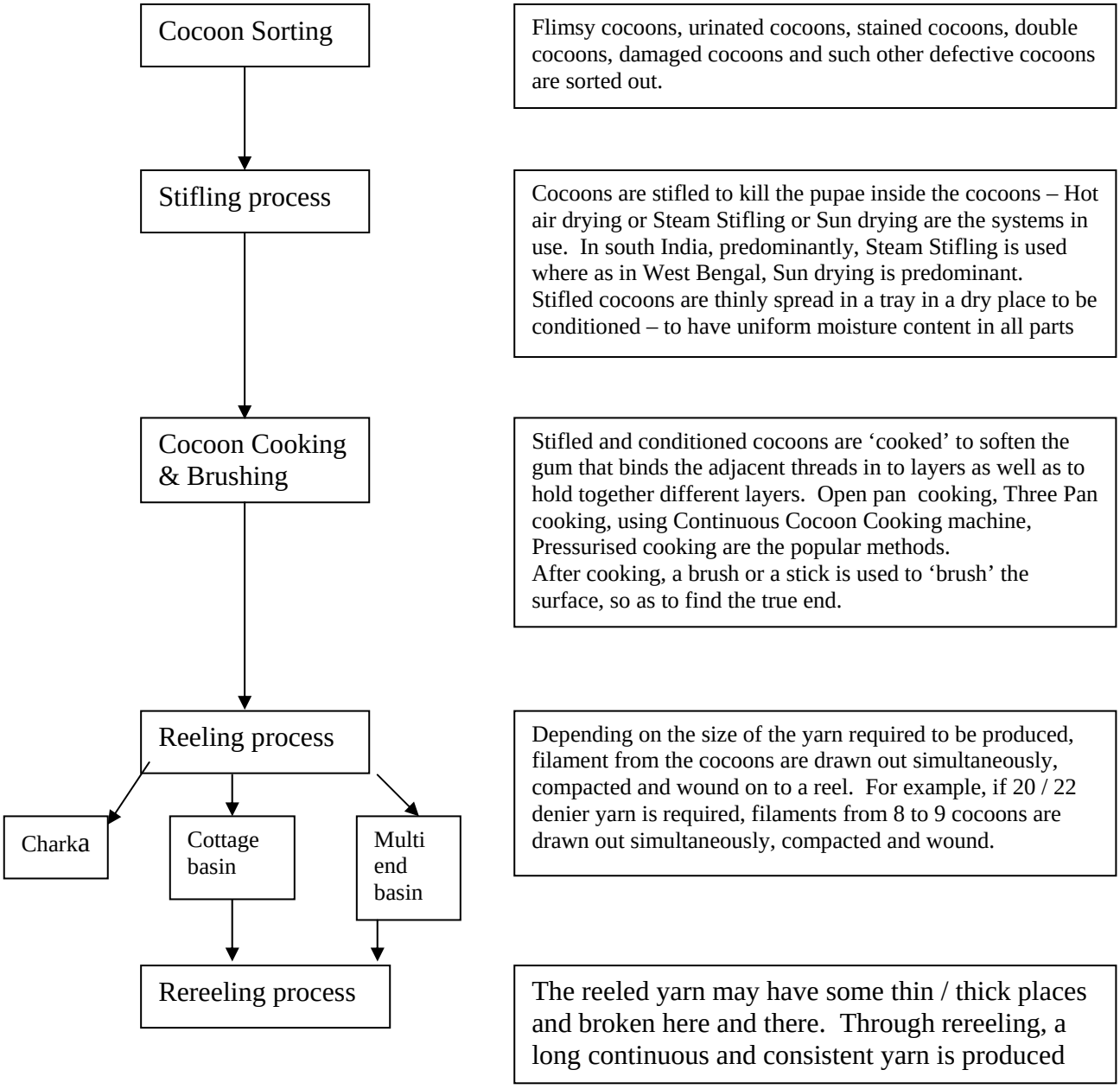


Annex 4.

Post cocoon processes that are relevant to this paper:

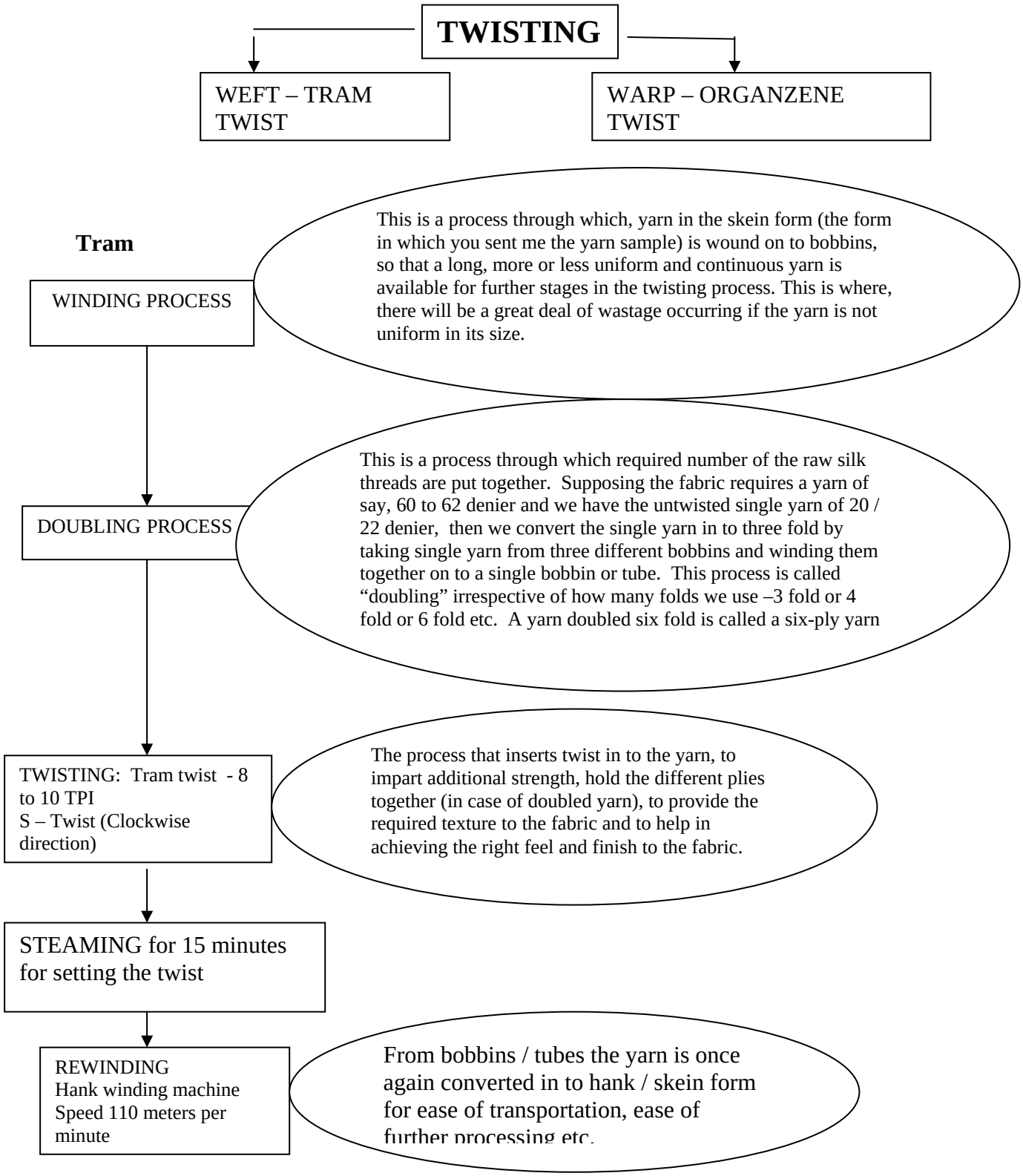
Silk Reeling

Reeling is a process of drawing out yarn from the cocoon to produce silk yarn of a given specification. There are several stages within silk reeling process.

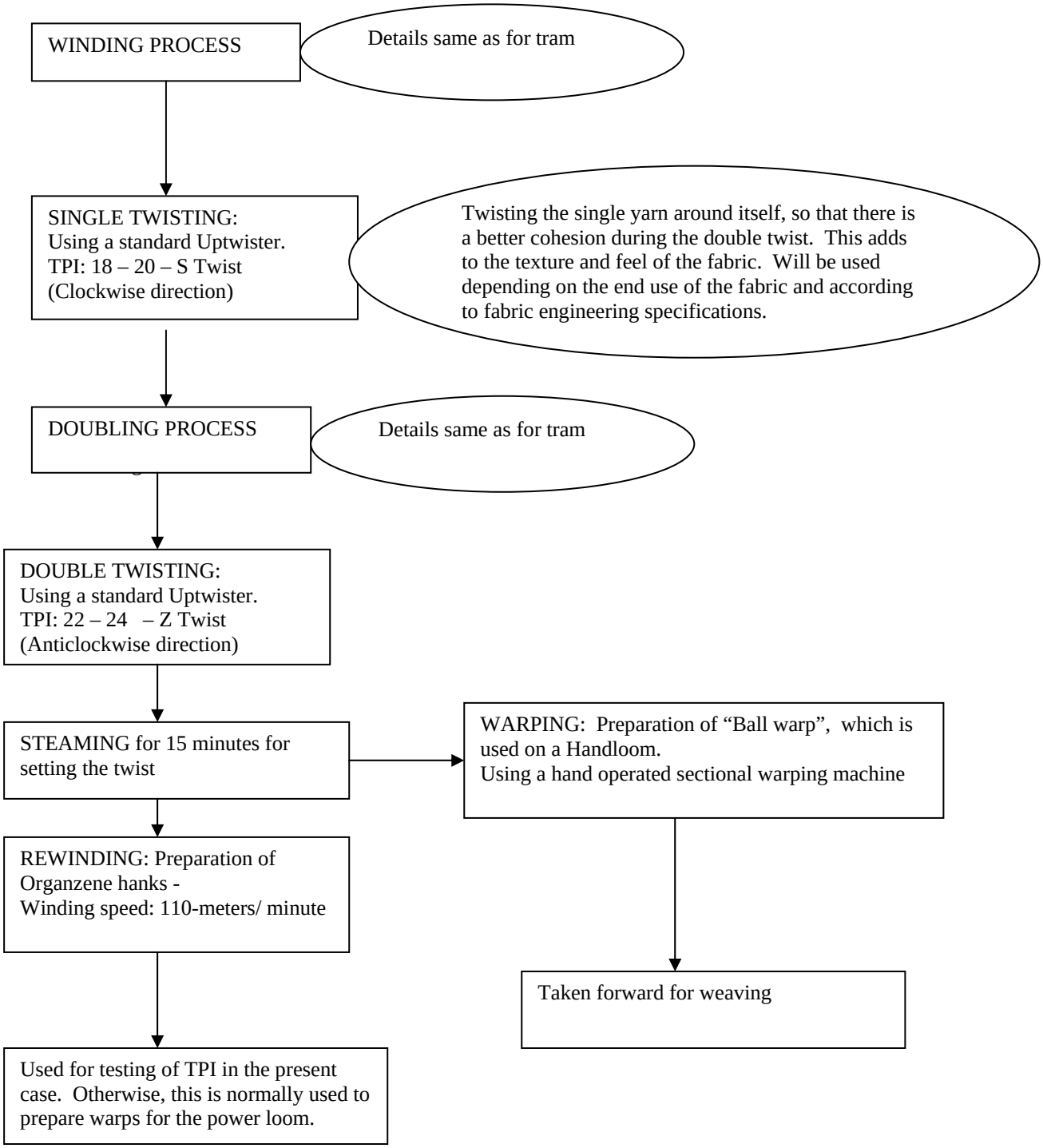


Photographs of charka, Cottage basin and Multi end basin reeling machines have been enclosed. The choice of reeling device is dictated by the quality of cocoon as well as the end use of the yarn.

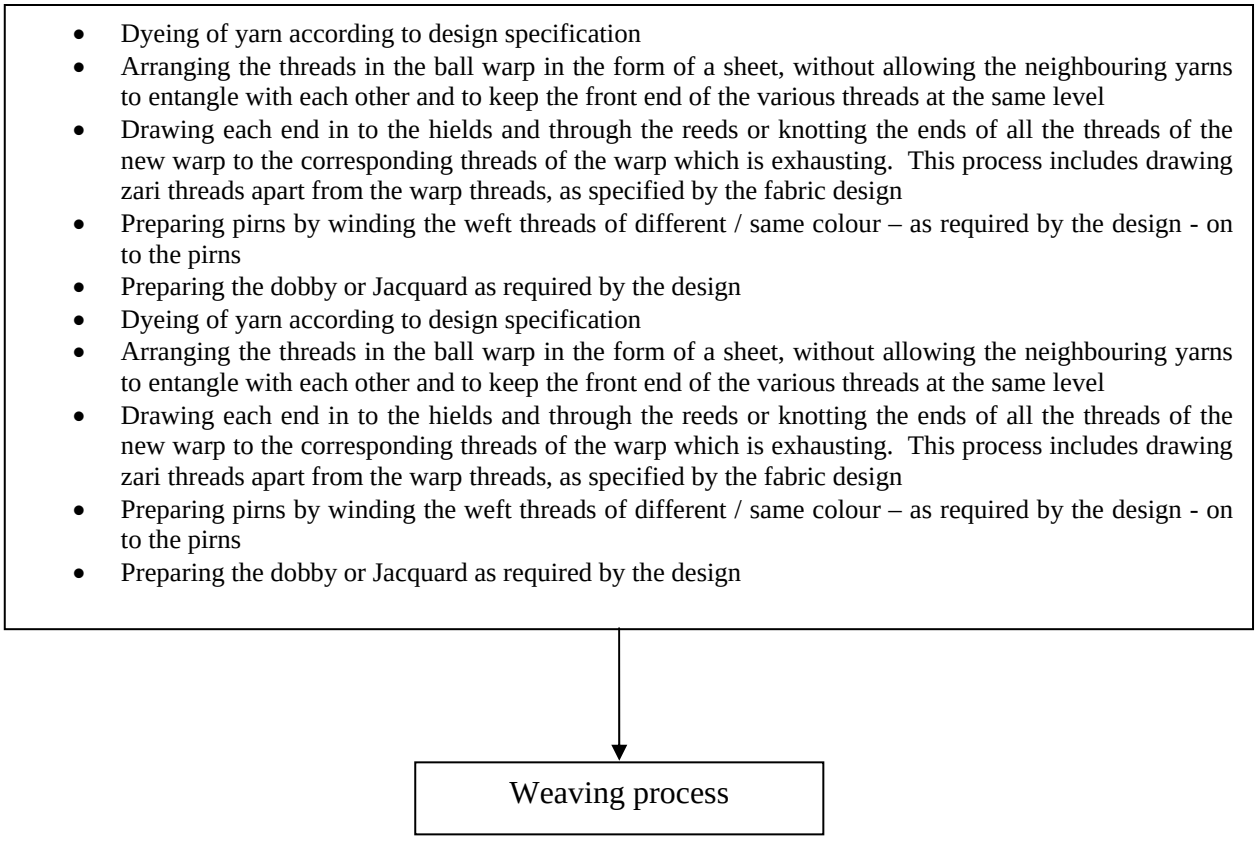
Twisting process: Converting raw silk in to twisted silk


TWISTING
WEFT – TRAM TWIST
WARP – ORGANZENE TWIST
Tram
WINDING PROCESS
This is a process through which, yarn in the skein form (the form in which you sent me the yarn sample) is wound on to bobbins, so that a long, more or less uniform and continuous yarn is available for further stages in the twisting process. This is where, there will be a great deal of wastage occurring if the yarn is not uniform in its size.
DOUBLING PROCESS
This is a process through which required number of the raw silk threads are put together. Supposing the fabric requires a yarn of say, 60 to 62 denier and we have the untwisted single yarn of 20 / 22 denier, then we convert the single yarn in to three fold by taking single yarn from three different bobbins and winding them together on to a single bobbin or tube. This process is called "doubling" irrespective of how many folds we use –3 fold or 4 fold or 6 fold etc. A yarn doubled six fold is called a six-ply yarn
TWISTING: Tram twist - 8 to 10 TPI
S – Twist (Clockwise direction)
The process that inserts twist in to the yarn, to impart additional strength, hold the different plies together (in case of doubled yarn), to provide the required texture to the fabric and to help in achieving the right feel and finish to the fabric.
STEAMING for 15 minutes for setting the twist
REWINDING
Hank winding machine
Speed 110 meters per minute
From bobbins / tubes the yarn is once again converted in to hank / skein form for ease of transportation, ease of further processing etc.

Organzene / Ball Warping



Preparatory arrangements for weaving:



Annex 5.

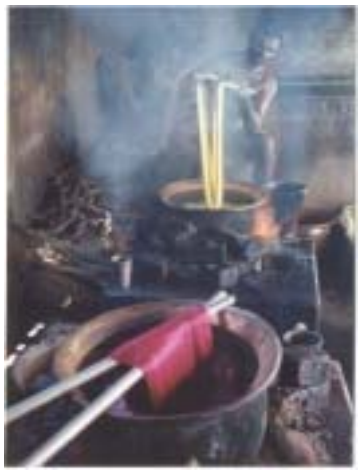
Vibrant colours and Designs Dresses or Furnishing Fabrics

Three pan cooking recommended with ME reeling

Handloom – Frame loom with Dobby attachment

Cottage Basin Reeling and Rereeling


Charaka Reeling



Dyeing, Weft and Warp preparatory processes

Silk Handcrafts Cottage Industries and Silk Enterprises Development in Madagascar

By

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Food and Agriculture Organization, Rome, Italy

TABLE OF CONTENTS

ABSTRACT

Madagascar is the only African country having an old traditional silk sector. Silk is produced in the high lands by smallholders, mainly women. Yarns of both mulberry and non-mulberry silk are weaved by individual weavers on small hand looms. After a long declining period, sericulture is recently increasing due to the diversification of the silk fabrics produced for national market and for export opportunities. The silk sector development contributes towards the poverty alleviation: sericulture is a source of cash income for many thousands families in rural area, essentially women who have limited income opportunities; the silk weaving ensures income to thousands of families and mainly women in rural and sub-urban area. The development of this sector procures alternative incomes and is contributing towards the limitation of rural migration. The handicraft way provides a wide sharing out of the added value to many families of rearers and weavers. The extension of mulberry plantations and the protection of Tapia forests, host of wild worms, contribute to the environment protection.

However, the silk sector has major constraints which need to be addressed. The main constraint is the shortage of raw material, non-mulberry and mulberry silks, which limits the potential development of the sector. The low productivity of sericulture is mainly due to the shortage of mulberry trees for land availability and land tenure reasons, the low quality of local grains (eggs) and mulberry trees and not intensive rearing practices. The many operators supporting the farmers and weavers (NGO's, associations, projects) are scattered in the country and have limited technical competencies in silk sector technology. The process and equipment for cocoon reeling, yarn preparation, degumming, dyeing and weaving are rudimentary and limit the possibility to diversify the products, the fabrics quality and competitivity and the enlargement of the markets. In spite of a rather good potential, Malagasy sericulture is fragile. The price of its silk is the double of the international prices of industrial yarn what puts in danger sericulture and limits the market of silk fabrics.

Some suggestions for regional cooperative activities in Africa, Europe and Central Asia, in order to resolve a part of the Malagasy silk sector constraints, would be based on:

- ***enhancing the silk production to meet the national demand,***
- ***adapting the reeling, twisting, doubling, dyeing and weaving equipments and process,***
- ***strengthening the professional organization of the silk sector.***

Key words: silk handcrafts, cottage industry, Madagascar

Chapter 1. Introduction

Madagascar is the only African country having an old traditional silk sector. This long silk tradition is based on the collect of cocoons of wild worms (*landibe*) and the rearing of silk worms fed with mulberry leaves. The silk sector is essentially a handicraft sector. Silk is produced in the high lands by smallholders, mainly women. Yarns of both mulberry and non-mulberry silk are weaved by individual weavers on small hand looms. After a long declining period, sericulture is recently increasing due to the diversification of the silk fabrics produced for national market and for export opportunities. The silk sector development contributes towards the poverty alleviation: sericulture and silk weaving are a source of cash income for many thousands families in rural and sub-urban areas, essentially women who have limited income opportunities. The development of this sector procures alternative incomes and is contributing towards the limitation of rural migration. The handicraft way provides a wide sharing out of the added value to many families of rearers and weavers. The extension of mulberry plantations and the protection of Tapia forests, host of wild worms, contribute to the environment protection. The annual production of mulberry silk is estimated to be around 5 t silk yarn. There is very limited registered import of silk.

The silk sector has firm prospects:

- A long experience in sericulture and a handicraft know-how.
- Its market is mainly based on the internal market with strong and still alive custom linked to the traditional use of silk. Its market is diversifying and enlarging with new silk products and a larger use for garment, furniture, decoration, fashion.
- The diversification of silk products is based on the use of the typical material of the Malagasy silk, with rough, thick and natural material, associating other fibres such as raffia, sisal, banana. These original and typical silk products find some opportunities for export.
- The evolution and diversification of the markets are promoted by dynamic workshops and designers who have the art of valorising the specificity of Malagasy silk for internal and export markets.

However, the silk sector has major constraints which need to be addressed:

- The main constraint is the shortage of raw material, wild and mulberry silk, which limits the potential development of the sector. The low productivity of sericulture is mainly due to the shortage of mulberry trees for land availability and land tenure reasons, the low quality of local grains (eggs) and not intensive rearing practices.
- The recent withdrawal of the State from sericulture services (research, grainage, extension), after a long period of stagnation due to the lack of funds, had been recently operated with the transfer of infrastructure and equipment to new operators. The long period of low activity had led to a decrease of know-how in research and grainage. The new operators have limited technical capacity in sericulture. The transfer of the genetic capital of improved races has not been maintained and developed. The transfer of grainage to some farmers who have no scientific capacity and no equipment has conducted to the supply of degenerated and contaminated grains.
- The predominating method of reeling is very rudimentary and gives a rough, flat and irregular silk yarn, indeed adapted to the traditional weaving but limits a thinner and diversified use of the yarn. The process and equipment for yarn preparation and weaving are rudimentary and limit the possibility to diversify the products and enlarge the markets.

- In spite of a rather good potential, Malagasy sericulture is fragile. The price of its silk is the double of the international prices of industrial yarn what puts in danger sericulture and limits the market of silk fabrics. With the opening of markets, imported yarn may replace local one at least for warp needs and imported schappe may replace cocoon for producing weft yarn.

To face the different problems of the Malagasy silk sector, some international cooperative activities with other countries of Africa, Europe and Central Asia, should be envisaged. These cooperative activities should be focused on:

- enhancing the silk production to meet the national demand,
- increasing the sericulture productivity,
- adapting the reeling and weaving equipments and process,
- strengthening the professional organisation of the silk sector,
- diversifying the range of finish products
- finding new export markets.

Chapter 2. Silk sector review

2.1. Silk sector context

Madagascar is one of the rare south tropical and non Asian countries having a long silk tradition which is based on two types of silk:

- the collect of cocoons of wild silk worms, the *landibe* (*Borocera* family), feeding on special trees, mainly in Tapia forests, which is used for the weaving of the traditional shroud, the *lambamena*, very important in the Malagasy funeral customs,
- the reared silk (*Bombyx mori*), fed only with mulberry leaves, and used for the weaving of the traditional brocaded shawl, the *lamba kotofahana*.

The wild silk comes from protected Tapia forests, mainly located in Arivonimamo (about 50 km west of Antananarivo), Ambatofinandrahana, in the Fianarantsoa province and the large forest of Isalo, in the south-west of the country. They are collected twice a year, during the pupa period, in November-December and in June-July. Other kinds of wild cocoons are fed from other kind of trees as Cajanus in Port-bergé area, in north-west or on mangrove trees in the area of Mahajanga in the western coast. Wild cocoons require a long process of boiling, soaking and washing for degumming and getting a schappe or floss. This schappe gives a rough spun yarn.

The mulberry silk producing area have been spread out in the Upper Lands of the Centre of Madagascar, in the range of 700 m to 1500 m height. Now they are located in 3 main area: around Antananarivo, Antsirabe and Ambositra.

Rearing is practiced in smallholders, as a complementary activity. Priority is always given to food crops and the agrarian system is rather diversified. The rearing period is possible in the rainy season when mulberries have leaves, from end of September to beginning of May.

The farmers usually have 3 to 4 crops a year. Due to the shortage of mulberry trees and room space, they rear an average of 20 “cellules” (sheet with one butterfly laying) equivalent to half a box, per crop. Productivity is low and they get around 20 kg of cocoons per year. They usually rear their own grains but they have to buy them at the beginning of the season to local grainers. Reared worms are local polyvoltines.

Fresh cocoons are sold to collectors in market places, traditionally measured by volume but more by weight now. There is no quality selection before selling.

Cocoons are reeled in the weaving area which are traditionally different from the rearing area. Reeling is very rudimentary. Around 3 kg of cocoons are boiled in big pans. The silk yarn produced is coarse one (over 200 deniers) obtained by more than 100 cocoons simultaneous reeling. Silk yarn is sold in skein of about 250 g.

Unreeled cocoons and waste are spun with spindle. In the Fianarantsoa area the cocoons are not reeled. They are cut and the cocoons, after boiling, are spun and give a schappe yarn.

Traditional weaving is done at home on simple horizontal hand looms, laid on the floor. They are Indonesian type with a continuous warp. The size of the warp allows fabrics of 2 to 2.5 m length and the hand capacity of 0.7 m wide.

Traditional weaving

Only the warp yarn is twisted, in a rudimentary way by fixing the yarn on a spindle and rolling it by hand. Degumming is done by boiling the yarn with soap. The preparation of the warp is done around stakes, with a continuous yarn.

The traditional fabric is the *lamba*, measuring 2.1 m by 0.5 to 0.6 m. it is thick, not dyed and broched with designs on the same raw, usually made of schappe silk. The lamba is generally made of 300 to 350 g of raw silk.

There are no statistical data on the silk sector. The yarn production raised up to 50 t before the independence. It has continuously decreased and it is estimated around 5 t now. Registered imports of silk are limited to less than 100 kg per year. There is no export of cocoon or silk yarn.

In the year 1980, a sericulture program has been launched and partly supported by FAO, from 1986 to 1989. It supported the establishing of a specialised public service, the Sericulture Division. Three *Sericulture Extension Centres* (*CVS*) have been implemented with facilities for mulberry multiplication, rearing and graining in Mahitsy (30 km N.W. Antananarivo), Antsirabe and Ambositra. A small multi-end reeling unit (40 ends) has been implemented in Mahitsy with a small complete twisting and assembling unit for research purpose. This unit is sometimes used for providing thin and twisted yarn to weavers who have specific fabric orders.

In the years 1990 the dramatic shortage of resources of the public services made these centres poorly active. With the national policy of privatisation and disengagement of the State, they have been recently transferred to private operators for carrying sericulture research, grainage and extension activities: Mahitsy to a private enterprise, the *Société Industrielle de la Soie* (*SIS*), Antsirabe to an NGO, *FAFIALA* and Ambositra to an association, *Soie de Mania*. Out of these operators, local operators such as associations or NGO are starting to promote silk production in a few area.

The national silk market is extending during the last years, due to the recovering of the national economy and to the enlargement of the market with the diversification of the silk fabrics and their use and to some niches for export. The market is limited by the shortage of local silk. The offer does not meet the demand and the prices of cocoons or silk yarn are high (43 to 50 US$/kg), the double of the prices of the international silk market (22 to 25 US$/kg), for industrial 20-22 deniers silk. Stimulated by the demand and the high prices of cocoons, farmers are extending their mulberry plantations.

2.2. Sericulture

2.2.1. Mulberry shortage, a major constraint

The shortage of mulberry leaves represents one of the main constraints of sericulture. Rearing size is limited by the mulberry leaves availability. Worms are most of the time under fed because the farmers grow bigger amount than the capacity of mulberry leaf. The main reasons are the small land availability, the land tenure system and the climate.

The farmers have small available land for diversifying their production and priority is always given to food crops. Most of mulberries are isolated trees, located close to the house, scattered in different plots or, in the best case, planted in row on the edges of the cropped plots. Plots with dense mulberry plantation are seldom seen. Tree sizes are variable and the estimate of leaves production per tree is not well appreciated.

The land tenure system in Madagascar is very precarious. Many farmers have no official ownership titles or rent plots. In that case, they can't take the risk to plant trees.

The long dry season (6 months, from mid April to mid October) is another constraint. Without irrigation, which is unthinkable at that farming scale, the mulberries have leaves from October and a huge production at the top of the rainy season, in January, February when health conditions are the worse for rearing. At the end of the season, in April, leaves are thicker, many are infested by mildew and their quality is lower.

Planted mulberry varieties are well adapted to the local conditions. The main planted varieties are *Andrarezina vavy*, a local variety well adapted and lightly forward and *Sakay*, an improved variety, more productive and lightly backward.

Farmers manage well multiplication, mostly by direct planting of cutting or small plants coming from their own nursery. Cutting are easily available and are not sold.

Most farmers practice a yearly pruning in the winter period, in June-July. They are however reluctant to prune during the production period the cropped stems, which limits the leaves production during the rearing period.

They don't use chemical fertiliser. In the best case they apply manure or compost at plantation and rarely later.

There is a notable tendency of extension of the mulberry plantations. Some associations try to implement grouped plantations in communal lands, which is a good alternative to the land tenure problem but more difficult to manage.

2.2.2. Silk worms

a) Local races:

Local worms are polyvoltine. Farmers get the eggs at the beginning of the rearing period from local grainers then get eggs from their own rearing.

They are well adapted to the local conditions (heat, humidity) but their productivity is low: equivalent of 10 kg per box with a silk percent below 12%. The renditta (needed kilos of cocoons for 1 kilo of reeled silk) is around 10.

b) Improved races:

The Sericulture Division had progressively raised an important parental stock made of 16 improved polyvoltines varieties and 16 bi or monovotine varieties introduced from China, Japan and France.

The local improved worms (polyvoltine) are well adapted to the local conditions and have a rather good potential: they produce 15 to 18 cocoon kg/box and their silk percent ranges from 13 to 15%.

Some mono or bivoltine races have a higher potential: up to 25 kg cocoon/box with silk percent from 20 to 25%. They can be reared only in the suitable season (cool and not humid season: October to mid December and mid April to May) and by advanced rearers in separated rearing house.

Hybrids have been experimented for polyvotines and for bivoltines but very few for cross breeds (bi into poly).

With the lack of means of the Sericulture Division, research works have been limited. The maintenance of the parental stock has not been properly kept so that some improved races have been lost and the purity of the parents has decreased. The know-how for selection and grainage has decreased too.

Due to the inefficiency of the *CVS* (*Sericulture Extension Centres*) for grainage needs, private grainers have been trained in 1990. These grainers have limited technical capacity and have no laboratory equipment. The grains they deliver are degenerated and contaminated.

The parental stock had been recently transferred to the private operators but their technical capacity is limited and their laboratory equipment is old or insufficient.

The lack of availability of performing and disease free grains is another main constraint. Within the frame of privatisation, the research and grainage systems must be completely redefined, reorganised and quality of grains has to be controlled.

2.2.3. Rearing

Farmers manage rather well the silk worm rearing. The main constraints are rearing house, lack of hygiene and rearing in the unfavourable periods.

Rearing is done at home in a room which is not occupied in many cases during the rearing period. The traditional dwelling houses have two floor levels and are made of adobe which is a good thermic insulator.

Most of farmers clean the rearing equipment and walls with whitewash made of lime once a year only. They don’t practice a sanitary vacuum and systematic disinfection between each rearing.

Disinfection with formol is difficult and dangerous. Potassium chloride (eau de Javel) is surprisingly not used.

Lime application on the worms for limiting moisture and fungus diseases is seldom and not properly used.

Rooms are however small and windows are narrow and cannot ensure a good ventilation in the hot and wet season.

They are 3 to 4 rearing periods in the year, during the rainy season:

- 1st rearing: end of September to November
- 2nd rearing: November to mid-December
- 3rd rearing: mid- December to mid-March
- 4th rearing: mid-March to May

The two first periods have the most suitable climate (temperature below 27°C and humidity below 70%) and is ideal for bivoltine worms. However the shortage of mulberry leaves limits the rearing in the first period.

The third period occurs during the cyclonic rains and temperature and humidity are very high. In spite of these unfavourable conditions, most of the farmers try their luck. Many diseases appear and the production is zero or very low. They anyway try it because this period is just before the rice harvest and their financially situation is critical. Some years the cyclonic rains are not so strong and this crop is not too bad. However, rearing during this period has negative impact because it develops many diseases which are not well eradicated. This period is not at all suitable for bivoltine rearing.

Last period has good climatic conditions but mulberry leaves are thick and have mildew disease.

The area of Antsirabe is higher (1.500 m) and colder and only 3 rearing are practiced per year, from October to April.

2.2.4. Sericulturists income

The price of fresh cocoons is 30.000 FMG (3 US$) to 40.000 FMG/kg (4 US$). It can vary from 20.000 FMG (2 US$) (very bad quality in the high rainy season) to 50.000 FMG/kg (5 US$) for the first or last crops in the year.

The main expenses are for grains and lime purchase and renovation of the rearing equipment (sticks or bamboo).

The traditional model is the most representative of the present situation: smallholder having around 50 to 100 mulberries, rearing half a box during 4 crops and getting less than 20 kg cocoons per year. The net income is around 500.000 FMG (50 US$). Return to labour is only 4.500 FMG (0,45 US$) per man-day, about the same level as paid labour in rural area (4.500 to 6.000 FMG/day).

The semi-intensive model concerns farmers having more mulberries (around 500) better technical level and rearing a box of improved polyvoltines each crop. His total production is around 50 kg cocoons per year. The net income is around 1.5 million FMG (150 US$) and the return to labour more than 7.500 FMG/man-day (0.75 US$).

The intensive model concerns specialised sericulturist having capacity to rear one box of bivoltine worms in the 3 favourable periods and getting 70 kg cocoons per year. His net income is 2.25 million FMG/year (225 US$) and return to labour is over 9 000 FMG/man-day (0.9 US$).

The income is rather low in the prevailing situation but it is an opportunity for women to get a cash income with little investment.

However, the two last models show the potential income of sericulture, with different levels of improved (and still intermediate) technologies and with the present cocoon price.

2.3. Reeling

Reeling is another main constraint. The very rudimentary reeling method provides a very thick and irregular yarn. This type of yarn indeed is adapted to the weaving of the traditional

fabric, the *lamba*, but it limits the possibility of developping other types of fabrics with thinner and more regular yarn.

Appreciable improvement could be procured by the use of improved cottage basin, with yarn crossing and cleaning systems (improved charka such as the Indian types).

The silk skein is sold between 90.000 to 130.000 FMG (9 to 13 US$/kg), around 105.000 FMG (10.5 US$) as an average. It weights 250 g (200 to 300 g) and requires around 2.5 kg of fresh cocoons. The cost of cocoon and wood for boiling sums up to 97.500 FMG (9.75 US$). The net margin for reeling is 7.500 FMG (0.75 US$) per skein which represents one man-day work. The margin seems reasonable. The marketing of the pupae represents an additional income for the reeler with 3.000 to 6.000 FMG (0.3 to 0.6 US$) per skein.

The price of yarn is around 450.000 FMG/kg, equivalent to 45 US$/kg, almost the double of the international price of raw industrial silk yarn. This high level of silk price is due to the high price of fresh cocoons due to a demand which is much higher than the offer. and weak silk containt of cocoons.

This level of price makes the silk fabrics expensive and limit their market. At this renditta level (around 10) and fresh cocoon price the raw silk produced can never be competitive. Import of raw silk or schappe silk may soon take the place of local silk.

2.4. Weaving

2.4.1. Traditional weaving:

Many weavers specialised in silk fabrics have switched to cotton or synthetic fibres for various reasons: the demand for much cheaper fabrics made of other fibres is higher; the purchase of silk yarn is a too high investment and it is difficult to get silk yarn; it is more difficult and it takes more time to weave silk fabrics than other types of fibre.

Most of small individual weavers produce silk fabrics under order of wholesalers or retailers. In that case silk yarn is advanced and they receive a fee of 40000 FMG (4 US$) per lamba or equivalent piece. The weaving of a piece represents around 5 working days, including yarn preparation. The return to labour is 7.500 FMG/man-day (0.75 US$) which is lightly higher than a daily salary.

For one lamba, the cost of silk represents around 150000 FMG (15 US$) per piece (350 g of raw silk). The retailer price varies from 400000 to 500000 FMG (40 to 50 US$) per lamba. The cumulated gross margin of wholesaler and retailer is around 130%. It seems high but it includes the investment of silk which represents around 1/3 of the price of the marketed lamba and the marketing costs.

Cotton lambas are sold 75000 to 90000 FMG/piece (7.5 to 9 US$).

2.4.2. Technical improvement in weaving:

Technical improvements have been introduced by different institutions or projects:

- *CENAM* (*Centre National de l'Artisanat Malagasy*), attached to the Ministry of Industry and Handicraft has introduced from Europe and made copies of looms with pedal, wider (1.2 m) and with longer warp (up to 15 m) requiring warping equipment. Copies of this model are sold 11 million FMG/loom (1100 US$) with all equipment. A few looms of this type have been sold to weaver organisations but are not anymore produced since 2 years. Their price seems too high.

CENAM has introduced simple improvement in the traditional loom: adaptation to a vertical use for more comfort of the weaver who can seat, tightness of the beam of the loom. They are sold 2.5 million FMG/loom (250 US$) with equipment. More units have been sold but they are much more expensive than the traditional one which costs less than 150000 FMG (15 US$).

CENAM has provided training on weaving but since 2001 the training demand is oriented to other fibres, mainly raffia weaving.

- *ADEVA* (*Action pour le Développement de l'Artisanat*) was a project carried out from 1995 to 1999 with financial support from E.U. Improvement and training have been introduced at the following levels:

- improvement of traditional loom: raising the eight of looms for facilitating seating position of the weaver, introduction of round beams allowing longer warp and requiring special equipment for warp preparation,
- introduction and copy of a loom adapted to silk, Lyon type with pedal for different types of fabrics and 1.5 m wide and of the warp preparation equipment,
- inventory of tinctorial plants and improvement of dyeing,
- enlargement of the designs for brocading,
- introduction of other fibres associated with silk.

Adoption of improved traditional looms would have been limited by some local constraints: introducing a longer warp means higher silk investment that many small weavers cannot ensure; longer warp and complementary equipment need more room space that they don't have in their small houses; some technical problems of warp preparation with high yarn density appear not to be solved.

Production of new loom seems to have been limited to 3 units. One of the main constraints are the cost and the difficulty for getting metallic combs and heddles. They may be found from scrap looms of the textile industry but are expensive (more than 1.5 million FMG for one loom).

It seems that the traditional loom give better quality (texture) for traditional lamba than the modern looms. However, these looms are well adapted for loose fabrics, mixed fibres and longer and wider sizes of stuff. Speed of weaving is largely increased: up to 3 m/day versus 0.7 m/day with traditional loom.

- *EMSF* (*Espace Métiers Solidarité Firaisakina*), created in 1997 with the support of French aid, is an association involved in the support and training of craftsmen in weaving, embroidery, wickerwork and bamboo. About 100 persons are trained yearly for weaving, using silk, cotton and raffia fibres. Training are done for both traditional loom and introduced loom, Scandinavian type, with pedal and larger width (1.5 m). However the cost of this loom is 10 million FMG (1000 US$) with equipment with the same problem for getting metallic comb and heddles. It seems too expensive for weavers.

In these different programs, no improvement had been done at level of twisting.

2.4.3. Diversification of fabrics:

Since a few years, some workshops and designers are promoting important changes in the use of silk fabrics for local market and open new opportunities for export. The main changes are:

- the enlargement of the use of silk garment which is no more the privilege of elder women of the upper class with traditional lamba; younger generations, including men, wear different silk garments: modern shawls, dress, jacket, …
- the creation of new types of fabrics, as the new "modern shawls" with loose weaving, natural or dyed,
- the mixing of mulberry silk with other natural fibres, particularly the wild silk and the jabo with raffia,
- the enlargement of the markets: national, tourist and export markets; garment, decoration, furnishing, bedding, fashion products.

All these diversified products keep the originality of Malagasy silk: a natural material with a rough texture and the character of handicraft products.

Importers from Europe and the USA are interested by these original fabrics. However the workshops and designers cannot meet that demand because orders are generally too big for their weaving capacity and raw material (silk) is too scarce for a regular supply in the year.

2.5. Wild silk (Landibé)

The traditional shrouds made of wild silk, the *lambamena*, measures 1.4 to 2.4 m width by 2.2 m length. A large one requires 2.5 to 3 kg of yarn silk or 5 to 6 kg of opened cocoons (without pupa). They are sold between 750000 and 900000 FMG (75 to 90 US$) which makes them affordable only by the upper class. Cotton shrouds, made of rough yarn with grey colour imitating the texture and colour of the genuine one, are sold 100000 FMG (10 US$).

Landibe cocoons are sold 60000 FMG/kg (6 US$). The preparation of the yarn takes almost half a month and the weaving of a large lambamena needs an other half a month. Cost of cocoons represents around 360000 FMG (36 US$) and cost of labour around 210.000 FMG (21 US$).

The demand for wild silk is increasing, due to the traditional use of lambamena and to the enlargement of the market with new types of fabrics.

Everybody agree that the Tapia forests are in danger because of the fire practice and deforestation. However cocoons are little collected in the main Tapia forest in Isalo (8 000 ha) where the rush for the search of sapphire is much more profitable.

Many weavers or workshops complain that the resource is scarce. It is not clear if the resource is scarce or decreasing. It seems that the market of landibe cocoons is not well organised for meeting the demand. It is a seasonal and very secondary activity. A specific study of the existing resource of wild silk in Madagascar and the organisation of cocoon collect and marketing would be useful.

Some projects are specialised in the protection of natural resources and forests. There is a project, attached to the Presidency of the Republic with the technical assistance of the *ONE* (*Office National de l'Environnement*) which is supporting villagers associations in 3 villages close to Ilaka Afovoany, between Antsirabe and Ambositra. They organise the associations for nursery and plantation of Tapia and trees, protection of Tapia forest, managing a kind of grainage of the landibe with reintroduction of eggs in the forest. They train villagers for weaving.

Chapter 3. Prospects of the silk sector in madagascar

3.1. The silk sector has firm prospects of development

3.1.1. The internal market is enlarging:

The silk sector is oriented mainly to the internal market. It is based on a strong and still alive tradition linked to the use and the image of silk in the Malagasy culture. The diversification of the silk materials and products meet the demand for new and modern silk use. The diversified products keep the Malagasy silk specificity. The recover of the economy should strengthen the national market.

3.1.2. The export potential lies in the niche of craft and typically Malagasy silk products:

There is a real demand for typical Malagasy silk products made of natural and rough material, eventually mixed with other natural fibres, such as raffia. These demands are for the sectors of fashion, furniture and decoration. Madagascar has competitive advantages on that niche with its original material and fabrics. However, it has no silk industrial background for competing with the Asian thin silk fabrics.

3.1.3. Dynamic designers and workshops enlarge the market:

The evolution and diversification of the market is due to dynamic operators at the downstream of the sector. They are innovative and creative and they have the art of valorizing the specificity of Malagasy silk for internal as well external markets.

3.1.4. Emergence of new operators promoting the revitalization of sericulture:

The enlargement of the silk market stimulates the raise of silk production. The withdrawal of the State for research and extension activities in sericulture has stimulated the development of many private initiatives of the civil society for developing sericulture through local associations, NGO or private operators. There is a real dynamism of revitalization of sericulture with new mulberry plantations and intensification of rearing.

3.1.5. Beginning of professional organization:

The need for organizing the various operators of the silk sector has led them to the creation of a professional organization in 1997, the *APSM (Association des Professionnels de la Soie à Madagascar*). It is a first step for coordinating the efforts to develop the sector.

3.2. The silk sector has a socio-economic impact

The silk sector does not represent an important sector in Madagascar economy. The added value of the mulberry silk is around 5.25 billions FMG (525000 US$). It however plays a not negligible part in the socio-economic development of the country :

- it provides complementary cash income to around 3000 smallholders, essentially women who have no other income opportunity,
- it contributes to improve their economic situation and limit the rural immigration to cities,

- it provides incomes to weavers in rural or sub-urban area,
- through mulberry plantation it contributes in the environment protection,
- wild silk programs imply Tapia forest protection,
- the silk weaving in handicraft way procures the maximum added value to the sector and a wide sharing out to many families.

The role of silk sector is not only economic but linked to the culture and the Malagasy identity.

3.3. But the sector has to overpass its weaknesses

3.3.1. Mainly technical and structural weaknesses in sericulture:

The main constraint of the sector is the shortage of silk due to low productivity of sericulture.

a) Climatic constraints limit the sericulture potential:

The long dry season limits the mulberry leaves production. The cyclonic rains is not favourable for rearing. Cold limits the rearing period in the upper lands. Technologies must be adapted in view of limiting the agronomic risks.

b) Sericulture is only a complementary activity in a diversified agrarian system:

The agrarian system of the smallholders gives priority to food crops. The diversity of the activities limit their risks which is possible because most of the sericulture are located close to urban centres. Consequently, sericulture is not a priority activity.

c) Land tenure constraints:

Land tenure is a major constraint in Madagascar. Most of smallholders have not secured land rights or crop on hired plots. Without land security, they can't take the risk of planting trees. They have small available land and priority is given to food crops so that most of mulberry plantations are limited with a few trees close to the house or scattered or planted on the edges of the plots. The mulberry leaves shortage is one of the major constraint of sericulture and limits the rearing potential of farmers.

d) Technical weaknesses:

Sericulture productivity is rather low. Important increase of productivity could be easily raised with the dissemination of intermediate technologies adapted to the smallholder conditions through:

- better management of mulberries with pruning and organic fertilization,
- rearing of more performing races of worms,
- better disinfection and treatment of worms,
- rearing bivoltine worms in favourable periods with higher technology by specialised farmers.

e) Loss of technical competency in the support to sericulture:

The staff of the Sericulture Division had reached a good technical level in the years 1980. Unfortunately, the long period with very limited activities in research, grainage and extension has decreased the scientific and technical know-how. The ageing, the departure or the death of sericulture specialists and the lack of their renewal had led to a deterioration of the technical

competency in sericulture. At the level of extension, the technical messages are standard, theoretical and not adapted to the specific constraints of each area, of the different types of sericulturists, of economic implication, of the family constraints. Technical advices are not well followed because they are not understood or not applicable.

f) The waste of the genetic patrimony of the worms:

The Sericulture Division had developed a stock of polyvoltine, mono and bivoltine breeds having a rather good potential. Due to the shortage of means, some breeds have been lost and the purity of the parental stock has decreased. The stock has been recently transferred to operators who have little scientific competence in sericulture and limited means for maintaining this genetic stock. Grainage has been transferred to farmers who have limited knowledge and no possibility to control quality and health of the grains. Grainage is essential in sericulture but the chain for getting good grains is weak or deficient at all stages: parental stock maintenance, hybrids development and grainage.

g) Insufficient sericulture professionalism of the new operators:

The new operators promoting sericulture, as associations, NGO or private enterprises are more dynamic than the public services and closer to the farmers but they have little sericulture background. A priority effort is necessary for strengthening their sericulture capacity, elaborating extension supports adapted to the different production situations and training their staff. Coordination and harmonisation of means are necessary because these operators are scattered.

3.3.2. Fragility and lack of competitiveness of the Malagasy sericulture

a) The high level of local silk price jeopardizes sericulture:

In spite of rather good potential, Malagasy sericulture is fragile. Its productivity is very low, the “market” quality of silk is very bad but its prices are extremely high, the double of the international market price for industrial silk. If significant increase of productivity allowing a drop of prices is not met, sericulture is endangered.

With the coming and unavoidable opening of the international markets, imported silk will take the place of local one. Malagasy sericulture had been protected by custom taxes, its relatively isolation from the silk market flows and the specificity of its silk products. However, yarn for warp can be replaced by imported yarn and schappe can replace local cocoons for weft yarn needs.

b) Madagascar has little comparative advantage for the export of raw silk or industrial silk fabrics:

The very low quantity of Malagasy silk production (around 5 t when the international exhanges represent around 15 000 t), the limited potential and low productivity of sericulture, the high silk price, the rough yarn quality and almost no high technologic and industrial background are a sum of disadvantages that don’t allow Madagascar to be a yarn exporter. The international market of yarn is dominated by China (80%) which is maintaining low prices and the market of industrial silk fabrics is dominated by Asian countries with low prices. The priority should aim at revitalizing sericulture in order to meet the national market with lower prices and to develop the markets within the specificity of Malagasy fabrics.

3.3.3. Inadequate equipment and process for the diversification of the products:

a) Rudimentary reeling causes wastes and limits the valorisation of silk:

Traditional reeling causes waste of primary material. The extremely rough, flat and thick yarn fits well with the type of local fabrics. However thinner and round yarn would facilitate silk preparation and weaving and would allow the production of other types of fabrics and the enlargement of the markets. Simple improvement may be done at the level of cottage basins.

b) Rudimentary preparation of silk and lack of adequate twisting equipment:

Existing process and equipment don't allow the yarn preparation for good degumming and dyeing and specific needs of diversified fabrics.

c) Improvement of looms without a real impact:

Improvement of traditional looms are not disseminated. Introduction of modern hand looms for diversification and enlargement of the silk fabrics have not been adopted. An evaluation of these improvements and their impact should be carried out.

3.3.4. Scattering and distrust of the operators

The new operators are small and scattered. They are rather secret and reluctant to communicate and exchange their experience.

However, an evident necessity of coordination and harmonisation appears at all the levels of the sector: for designing and implementing research and technological improvements, controlling grainage, elaborating technical packages, editing extension supports, The future of the sector depends on these activities and requires a real goodwill and a strong professional organization.

Chapter 4. Proposals for a silk sector development

Since 2002, UNIDO is carrying out a support and development programme for the Malagasy silk sector. The program aims at strengthening the whole silk sector, at silk production level, sericulture, and at weaving level in the frame of the organization of the different operators. The proposed activities are designed for reaching three objectives:

- As a priority to enhance the cocoon production in order to meet the national demand.

- To adapt the reeling and weaving equipments in order to develop the national and export markets opportunities.

- To strengthen the organization of the actors and operators of the silk sector, in the context of the withdrawal of the State in sericulture.

After three years, the results are very positive, and the programme should continue and deepen the work already done. It can also be envisaged to establish some national norms, that today do not exist, concerning the quality of the yarn and the finished products, and to create a Malagasy label to export the handicraft products with a strong identity on the international market. Some international cooperative activities and projects should be included too. Indeed, a lot of countries with a well developed silk sector could bring to Madagascar some very important and interesting know-how, and could participate to the development of its own silk sector.

4.1. To enhance the silk production

4.1.1. Technical capacity building of the new operators supporting the silk producers

The objective is to promote the exchange of experience between the new operators supporting sericulturists in order to design and harmonise the technical packages, the extension supports and the training of their technical staff and leader rearers.

- Analysis of the main constraints and potentialities of the different categories of rearers through a survey.
- Design of technical packages adapted to each type of rearer.
- Edition of extension supports: technical pamphlets and manuals.
- Training the technical staff of the new operators and the rearers leaders.

4.1.2. Improvement of the performance and quality of silk worms

The future of Malagasy sericulture depends on performing and healthy worms breeds, preferably produced in the country. Competency and equipment of the operators who got the *CVS* have to been strengthened in view to have the capacity to carry out the necessary improvement of the breeds and the research of performing hybrids at all levels: polyvoltines, cross breeds and bivoltines. The organization of grainage must be completely revised, in a professional way and with the set up of quality control. The potential of specialised farms with high technology can be expressed only by rearing high yielding poly-hybrids bivoltine grains produced abroad. Trials of rearing imported grains of this type will be carried out. The general objective is to ensure the production and dissemination of healthy and performing grains.

The proposed activities are:

- Definition of a global frame and organization for the maintenance of the parental stock and the research of performing hybrids.
- Reconsideration of the condition of grainage and quality control.
- Grainage operators training.
- Completion of the laboratory equipment of the grainage operators.
- Tests of imported high yielding poly-hybrid Bivoltines.

4.2. Adaptation of reeling and weaving equipments and process

4.2.1.Design of an overall “yarn program” for adapting the reeling and weaving equipments to the diversification of the fabrics:

The objective is to improve the traditional technologies at the level of reeling, yarn preparation and weaving in order to diversify the fabrics and develop potential new markets.

- Analysis of the needed types of yarn and fabrics for diversifying the markets (in the handicraft context).
- Evaluation of the introduction of improvement and new equipments.
- Design of an overall program on reeling, yarn processing and weaving.

4.2.2. Introduction of improved cottage reeling basin

- Design and test of an adapted improved cottage reeling basin.

- Training carpenters for making basins.
- Training reelers.

4.2.3. Adaptation of yarn preparation equipments:

- Adaptation of process and equipments for yarn preparation: twisting, degumming, dying.
- Training weavers.

4.2.4. Looms improvement

- Looms improvement for diversifying the fabrics.
- Training carpenters for making looms.
- Training weavers.

4.3. Strengthening the professional organization of the silk sector

4.3.1. Promotion of base organization by type of activity

The activities proposed involve participation and exchanges between the different actors and operators of the silk sector.

- The professional capacity building of the sericulture operators will involve:
  - operators promoting sericulture,
  - associations of sericulturists.
- The improvement of the quality of grains will involve:
  - operators promoting sericulture,
  - grainage operators.
- The introduction of improved cottage basin will involve:
  - collectors and weavers,
  - operators promoting sericulture,
  - associations of sericulturists,
  - weavers, workshops and designers.
- The improvement of the technology of yarn preparation and weaving will involve:
  - weavers,
  - workshops and designers.

As a consequence, the implantation of the proposals should be realised through the progressive promotion of professional organization by type of activity:

- sericulturists, grouped in associations most of the time promoted by the operators who support them
- grainage operators,
- collectors and reelers,
- weavers, workshops, designers.

The federation of these organizations should form an inter-professional organization, which is the purpose of the *APSM*.

4.3.2. Capitalization and dissemination of knowledge, experiences and technical improvements in silk sector:

The necessity to create a professional association, *APSM*, came during a seminar on silk organized in December 1996 by *CITE* (*Centre d'Information Technique aux Entreprises*). *APSM* is a member of *CITE* which is its registered office.

During the silk seminar, workshops had been held with representatives of all the different categories of silk professionals. Technical and economic files on the various aspects of silk sector had been elaborated and documents edited.

It is proposed to go on with that documentation, to actualise and enlarge the technical information and the data and to ensure its dissemination.

The program will assist *APSM* for enlarging this documentation through:

- Completion and up-dating of the files elaborated during the sericulture seminar (Dec. 1996) on: sericulture, landibe, reeling, weaving, silk sector economy,
- Information on existing facilities that can be oriented to the silk sector:
  - training facilities,
  - projects and funding institutions which could support the silk sector,
  - financing facilities,
- Compilation of silk technical documents: manuals, technical pamphlets, silk magazines, articles,
- Reports and studies concerning silk sector,
- Editing technical information: bibliography, synthesis, technical pamphlets, articles.

4.3.3. Establishing a silk sector data base:

Data on the silk sector in Madagascar are missing. The existing information is scattered and grouped nowhere.

It is proposed to create a data base on the silk sector and its monitoring. The main data to be collected and permanently updated should concern:

- List of the operators, NGO, associations, private operators involved in silk sector.
- Data regarding rearers and weavers: surveys, location, characteristics, economic data.
- Agronomic data regarding monitoring of the production (based on reports of the operators supporting sericulture): sericulturists and groups supported, data on production per season, grainage, estimate of cocoon production, yields, climate, estimate of cocoon production.
- Economic data: price of cocoons per area and per cycle (landibe and raw silk), price of main inputs.
- International prices of raw silk.
- Madagascar silk import and export.

Annex 1. Photos

Silk reeling

Traditional silk weaving

Silk handcraft garments

Silk Handcrafts Cottage Industries and Silk Enterprises Development in Romania

By

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ABSTRACT

The geographical position and the complex of historical facts have determined the existence of a highly original Romanian folk culture. Until today the Romanian folk culture was born and has been developed within the area bordered by the Carpathian and the Danube. This culture was preserved, among its characteristic features, the traditions of civilization dating for millennia. The history of natural silk utilization in the Romanian popular art is identified with the history of sericulture in our country. The sericulture has not been developed uniformly and simultaneously in all the historical regions in Romania (Transilvania, Banat, Oltenia, Muntenia, Moldova and Dobrogea), due to their different political and social conditions. During 1975-1990 it has been recorded the maximum level of sericulture development in Romania, with high productions of silk cocoons and raw silk. After 1990 it began the dramatical decline, as regards both silk production and mulberry areas. The handicraft women made costumes, headdresses, table clothes, towels, embroidered blouses with wonderful bright colored motives, proving creative imagination, critical sense, aesthetical taste, originality and science to combine the useful with the beautiful. Representative for the national costume of Romanian women are the traditional blouses with a specific tailoring and the headdresses called "marame", usually made by raw natural silk known as "borangic". The domestic silk cocoons reeling, named cocoons "draught" has been made manually, with hand or reel. Usually 5-10 silk cocoons were reeled to obtain one raw silk thread (borangic). The techniques of silk embroideries used in the entire zone of Romanian popular culture are stitch point, flat decorated, embroidery in relief. There were auxiliary used silver spangles, the simple silver thread or that spinned on natural silk or covered with natural silk. Similar techniques have been also made in the workshops of the monasteries from Moldavia – Agapia and Putna, from Muntenia – Tismana, Tiganesti, Rinca and Florica, in order to obtain different religious objects and garments for priests. The Romanian sewings with silk fiber embroidered or woven have become popular art in time, expressing feelings and thematic symbols, having extremely varied technical features, decorative and chromatic, from a region to other, specific to each one. The specific blouses made for common days, but especially those for feast days can have a sober chromatic – black, brown, olive, red - but also velvety nuances, with a throw of points in crosses and dense lines. The traditional costume from the past but also from the present have embroidered pierced works on thread networks with spiders realized in a multiplicity of colors. The prices practiced on the virtual market of workmanship products of traditional clothes, including those made by silk or decorative objects varies between 20 – 100 – 200 USD. So, for a blouse with silk embroideries the price is around 100 USD, for a man's shirt the price is 106 USD, flowers made by silk are 20 USD and a pillow cover costs 110 USD. The constitutive elements of the silk market, producer and beneficiary, aren't organized by commercial relationship stipulated by contract represent the major constrain against and the promotion of international collaboration projects with potential partners in the sericultural field from Europe and members of BACSA Association represents the recommendation for shot and medium term development strategy.

Key words: silk handcrafts, cottage industry, Romania, development

Chapter 1. Brief historical background of silk handicraft cottage industry

The geographical position and the complex of historical facts have determined the existence of a highly original Romanian folk culture. Until today the Romanian folk culture was born and has been developed within the area bordered by the Carpathian and the Danube. This culture was preserved, among its characteristic features, the traditions of civilization dating for millennia.

This folk culture and art includes elements of the Roman, Byzantine and Western civilization, integrated into an original vision.

In spite of the changes brought about in time and especially by the modern technologies specific to the last century, in all the regions of Romania the folk craftsmen continue to exist, to build up houses of wood, to shape the gates of their households into triumphal arches, to make their tools and objects necessary in the households even if these objects coexist with those industrially manufactured, they are making pottery and are painting on wood and glass.

The history of natural silk utilization in the Romanian popular art is identified with the history of sericulture in our country.

The sericulture has not been developed uniformly and simultaneously in all the historical regions in Romania (Transilvania, Banat, Oltenia, Muntenia, Moldova and Dobrogea), due to their different political and social conditions.

Therefore, from historical point of view and documentary attestation, the silkworm rearing and the silk handicraft cottage were mentioned for the first time in 1342 in Transilvania and then in Banat, Romanian regions situated under the political influence of Austrian-Hungarian Empire. The developing of silkworm rearing and textile industry in Transilvania has been linked of the sericulture development in the Hungarian Kingdom. In 1680 the Italian emigrant Passardi Ianos Peter, born in an old family of silk weavers, had established in Pellerd a reeling and weaving mill for damask and brocade. From this period have been documentary attested the silkworm rearings in many rural areas from Transilvania, Romanian land belonging to Hungarian Kingdom.

The sericulture development in Banat was due to the general Mercy, the military ruler of the region. In 1735 he had requested the abbot Rossi from Montana, Italy, who had established a building destined for silkworm rearing, a reeling and a weaving plant.

After 1735 many Italian handicraftsmen have moved their workshops in Hungary, being documentary attested the year 1776, when in Pesta the Italian Valerio Tomas had established a weaving mill with 100 looms, founding the textile industry (in the period of Maria-Tereza Empress). The Emperor Joseph the II-nd has legislated measures for mulberries planting along the public ways, has attributed important rewards to silkworm breeders and has provided the free publishing and distribution of some booklets concerning silkworm rearing in the entire Austrian-Hungarian Empire. He had introduced the obligatory character of silkworm rearing by the armies stationed in the confines.

During 1800-1840, on the backgroung of the Napoleon the decline of silk production has taken place. After 1840 the development of silk industry has been integral part of the independence movement of Hungary to the Habsbourgic Empire, when it has been obtained a production of 400000 kg silk cocoons, exported in France.

In 1876 the first Inspectorate for silkworm rearing has been established at Skekrzard and also here the first silk reeling plant with 30 basins has been built.

In 1879 a very small production of silk cocoons, of only 2507 kg has been obtained. But after this year a fast increasing of the sericultural production has been recorded, so in 1905

Hungary produced over 2 millions kg, being on the third place in Europe, after France and Italy, the most important quantity of this production being obtained in Transilvania.

This spectacular increasing of the production has been based especially on the building and setting up of over 10 silk reeling plants, including that from Lugoj in Banat, Romanian territory, all these reeling plants having 1176 basins and 2650 workers.

In the other three historical regions, Muntenia, Oltenia and Moldavia, the silkworm rearing is introduced by Turks beginning with the XVIII-th century, when the Ottoman Empire had political and economic domination over an important part of Europe. From the Turkish language was adopted the name of "borangic" used for raw silk, this word being assimilated and included in the linguistic patrimony of the Romanian people (Ifrim S., 1985).

If the silkworm rearing was initially destined to obtain the "borangic" production for self-consumption, in time this has become a part of the economic obligations of the Romanian Countries to the Sultan from Istanbul, as a tribute.

The silkworm rearing in household system was gradually spread in the rural area, being initially done on estates of local aristocracy or rulers.

After 1845 the silkworm rearing was intensively spread in Moldavia, by the free distribution of over 60000 mulberries and after 1852 in Muntenia, where 400000 mulberries were free distributed. These mulberries were still being exploited after 40-50 years, as is mentioned in the 1910 lists of breeders which received for free the silkworm eggs from the Sericultural Station Cotroceni.

The obtaining of the independence of Romania in 1877 created the premises of institutional organization of the sericulture activity following the establishment of a development program by the Ministry of Agriculture, Industry and Trade. This program determined in 1906 the establishment in Bucharest of the Cotroceni Sericulture Station and Mulberry Nursery, having the following competences:

- free distribution of mulberry seedlings and silkworm eggs (from import) in order to stimulate the people interest in sericulture;
- demonstrative rearing of small lots of silkworms;
- experimental observations and microscopic control of silkworm eggs using Pasteur method.

It was intended to provide the internal necessary of natural silk reeled in household system to be utilized in the obtaining of some traditional weavings and sewing. Each breeder that had received free silkworm eggs had to give 25 silk cocoons for each gram of silkworm eggs, in order to produce silkworm eggs for the demonstrative lots and microscopic control. During the silkworm rearing the Sericulture Station had organized training courses for the sericulture agents selected from the graduates of rural elementary schools. They became employees of the Mayoralty or of the Prefecture, their duty being to organize the silkworm eggs distribution and silk cocoons collecting for the Sericulture Station.

There have been official documents since 1910 that showed the carrying on of the sericulture activity at the beginning of modern age in Romania, such as official addresses of the Prefecture to the Sericulture Station, the lists of silkworm breeders, signed and sealed by the local mayors and the approval of these lists of free distribution of silkworm eggs.

It must be mentioned the interest and financial and moral support of the Royal Family, through Queen Maria, who stimulated the introduction of the national costume at the Royal Court, including head-kerchief ("borangic marama").

In 1916 Sericulture Station from Cotroceni was moved in its own buildings from the area Herastrau-Baneasa and was renamed Sericulture Station Baneasa. During the First World War the station activity has been reduced in the conditions of interdiction of silkworm eggs import.

After 1918 when the Great Romania was formed by reuniting the Banat, Transilvania and Basarabia, the Sericulture Station Orsova and the Silk Reeling Plant Lugoj, both established under Austrian-Hungarian domination, were included.

The Sericulture Station Baneasa became in 1920 the Central Sericulture Station, with its own regional centers, managed by the Administration of Agriculture and Zootechnics which provided the financing of sericulture in the period 1920-1922.

After 1922 the activity of the Station has been organized as economic unit with commercial character, in order to achieve high incomes from its activities of selling silkworm eggs, silk cocoon reeling and raw silk selling.

The patrimony of Central Sericulture Station was increased by including the mulberry nursery from Cazaci – Dambovita district and beginning with 1949 the activity has been oriented to experiments and scientific researches, becoming the Experimental Sericulture Station Baneasa under the authority of the Institute of Agricultural Researches from Romania.

During 1937-1947 the Sericulture Station Baneasa produced a quantity of silkworm eggs that varied between 100-200 kg, in comparison with a necessary of 500 kg, the difference being provided by import.

During 1948-1956 there were produced between 400-800 kg of silkworm eggs annually and from import there were provided only the silkworm eggs necessary for reproduction.

After 1957 the Central Research Station for Apiculture and Sericulture was established, with the following competences:

- elaboration of the technologies for silkworm rearing and mulberry plantations exploitation in order to increase the productivity;
- providing of the entire sericulture production (silkworm eggs and silk cocoons destined for raw silk obtaining);
- sericulture organizing and development in the State Agricultural Farms;

The Central Station included the stations from Baneasa, Orsova, Cislau, Rusetu and three farms from Timisoara, Cluj and Iasi.

In 1974 was elaborated the Sericulture Developing Program for the entire country which stipulated the increasing of the sericulture production in specialized farms and in population households and schools, being also stimulated the silkworm rearing in the co-operative agricultural units and in some units of the Forestry Ministry.

During 1975-1990 it has been recorded the maximum level of sericulture development in Romania, with high productions of silk cocoons and raw silk. After 1990 it began the dramatical decline, as regards both silk production and mulberry areas.

Chapter 2. Past, present and future status and future prospects of the silk handicrafts cottage industries sector and silk enterprises in Romania

2.1. Commodoties, regional and country diversity

There are handicrafts workshops in numerous centers all over the country and women still work at home on the weaving looms. The existence of these workshops have allowed along

the centuries the preservation and continuity of crafts, handed down traditionally from father to son, from mother to daughter: pottery, embroidery, painting, processing of metals and bones, egg painting, weaving of natural fibers (hemp, flax, cotton, wool and silk).

At present the artistic handicrafts in Romania entered into a new historical stage in accordance with the development of the contemporary society. Beside the co-operation units, folk artistic handicrafts continue to traditionally manufacture all kind of products both in rural and in the urban area.

The preserving of the most remarkable popular art objects made by craftsmen of the Romanian villages and the stimulation of the new production determined by the state preoccupations and by the initiative of many museums and popular art collections, represented a true guidance for the popular creators in all traditional area.

Also specialized foundations and museums encourage the development of private handicraftsmen workshops, some of them being detached from the former cooperative units of folk handicrafts, others being newly set up. In this respect the treasure of the Romanian traditional folk handicrafts is a valuable source of inspiration for a diversified production like the one of nowadays.

Due to a thorough knowledge of the folk art, of our national traditions and customs, the rural Romanian women have developed, used and achieved handicraft motives with a remarkable aesthetical sense, thus contributing to the perpetuation of the beauty treasured by the genuine popular inheritance.

The handicraft women protected tradition, cultivated the ancestor's virtues, kindness, care, pride, seriousness, smile, wisdom, patience, intelligence, sensibility and skills.

The handicraft women searched the past and created things by seeing not only the particular moment, but also into the future.

Their work keeps people in connection with nature and the society. They make costumes, headdresses, table clothes, towels, embroidered blouses with wonderful bright colored motives, proving creative imagination, critical sense, aesthetical taste, originality and science to combine the useful with the beautiful.

Our national embroideries became exhibition objects all over the world, representing efficient means for establishing cultural collaborations and dialogue among nations.

The practice of the art handicrafts by the women in the rural and urban areas contributes to enriching the types of small commodity objects of the contemporary society and also can ensure incomes and new places of work.

An important fact in the maintaining of the interest for the products of the folk handicrafts is the tourism expansion all over the country.

The handicrafts objects are demanded by the foreign people because they represent the local specific.

The handicrafts have a special importance for the modern society to discover the rural values, to make a link between art and production, to bring a beautiful note into the family life, to determine the young generation to preserve and to continue the Romanian traditional folk culture.

All the 41 administrative counties from Romania have ethnographic centers, museums and handicrafts units which preserve the local traditions. Among these, there are representative those from Horezu area – Valcea district for pottery, Maramures for wood carved houses and gates, North Moldavia area – Suceava district for painted eggs and vestment objects of leather and fur, Oltenia zone for traditional carpets, Bistrita area for decoration objects and

Mehedinti, Dolj, Olt, Teleorman, Ilfov, Buzau and Vrancea districts for silk garments and for silk traditional headdresses.

All the handicrafts products have been made by procedures and techniques of local natural resources processing – clay, wood, natural fibers, animal bones and horns, skin of domestic and wild animals, different metals, feathers and eggs, glass or stone.

Representative for the national costume of Romanian women are the traditional blouses with a specific tailoring and the headdresses called “marame”, usually made by raw natural silk known as “borangic”.

In the Southern districts of the country, Mehedinti, Dolj, Olt, Teleorman, Ilfov, Buzau, Ialomita, Constanta, Tulcea, Vrancea, Galati, the “marame” were decorative objects for head, being warn on holidays or on the wedding day, being a dowry object for young married women.

From these two pieces of the national costume, blouses and headdresses, begins the history of natural silk utilization and the importance of silk cottage handicraft industries in the regional and national economy.

During the XIV-XIX-th centuries in all the Romanian historical regions silk handicrafts cottage industries have been contributing to maintain the national unity, by enriching the joint artistic patrimony of the Romanian population, expressed in some common sewing techniques and styled motives.

The Romanian traditional art developed until the XX-th century belonged to the popular culture of the Balkan area and became a link with the peoples from Minor Asia, around the Black Sea.

Due to the historical context from the past and geographical neighborhood areas, the sericulture in Balkans and around Black Sea had a joint past and future and consequently there are more common elements than differences in handicrafts art found in these specific folk culture zones.

The popular art has constituted an element of national unity. Till 1918 the territories where Romanian populations have lived, from administrative point of view, belonged to an European Empire, Transilvania and Banat under Austrian-Hungarian political domination, Muntenia and Moldavia became one single country in 1859 and the Romanian Kingdom (1866) became independent of Ottoman Empire in 1877.

The traditions concerning techniques, work methods, motives and coloring of Romanian sewing were transmitted and maintained despite the existence of administrative borders.

The Romanian language as communication meaning, the Orthodox religion common to all Romanian people and the traditions, including those of handicrafts, have united the Romanian populations.

2.2. Silk reeling machines and techniques

In Muntenia and Moldavia was practiced the Turkish system of silkworm rearing and also their households methods of silk cocoon reeling by hand or wheel, and some of the silk weaving and sewing techniques.

The silkworm races reared in the Romanian villages have been races with yellow or white cocoons, the silkworm eggs being provided from France, Italy, Turkey and later from Japan (Cetateanu N. and coll., 1988).

The thread obtained by these simple and relative primitive methods was often irregular and weak, of low quality (Moldoveanu, 1962).

In Muntenia, in 1858, the Silk Reeling Plant from Damaroaia, a peripheral quarter of Bucharest has been established, with equipments from France. Over 60 young girls from Bucharest have been qualified by French handicraftsmen in order to learn the silk reeling methods used in France. The entire silk production was exported in France, so in the documents from that period has been mentioned that "this reeling plant offered a profit of millions ducats to the state", fact proving the property of the state.

Documents from the next period (1859-1863) have attested the increasing of silkworm eggs and silk cocoons export to France, indicating the existence of both silkworm breeders and specific sericultural equipments, silk cocoon dryers, respectively (Teodoru Ana, 1995).

However, due to the skill and original aesthetic sense, there have been obtained weavings and embroidering with functional and superior aesthetical qualities, specific to the traditional folk art, highly appreciated both in the past and at present.

The domestic silk cocoons reeling, named cocoons "draught" has been made manually, with hand or reel. Usually 5-10 silk cocoons were reeled to obtain one raw silk thread (borangic). The manually reeling has consisted in thread end catching from the five silk cocoons taken out from the boiling recipients and their moving into a large vessel with maize, having the role to prevent thread's sticking.

The reeled thread was wrapped up on the left forearm, then the silk hank was knotted and washed in warm water to remove the maize. The silk cocoons reeling with wheel was done by catching the silk thread end on winch followed by its passing on bobbin.

So, the raw silk thread called "borangic" was obtained, being used for weavings in horizontal looms.

In the first installations of industrial type, the technique of silk thread obtaining has contained the following operations:

- Silk cocoon boiling and thread end catching ;
- Properly reeling and silk hank obtaining;
- Silk hank passing on bobbin.

The silk cocoons have been introduced in very hot water (80-90^{o}C) to dissolve the silk "glue" (sericine) and the cocoons have been agitated with a rigid brush made of straw in order to catch the end of the silk thread. The superficial silk layer has been detached from brush and removed.

Then, the silk thread has been handled slightly and continuously reeled from the cocoons moved in the basin with warm water and transversally passed to winch, where the silk hank has been formed.

After 1810 the steam has been used to heat the water from the silk cocoons boiling, after 1870 the first mechanical brushes for thread ends finding have been built and after 1883 the first mechanical reeling ends have been built.

After this period, the technology of raw silk obtaining has contained the following operations:

- 60-80 dried cocoons have been introduced in the boiling basin for 5-7 seconds at a temperature lower then 90^{o}C in order to be soaked;
- The cocoons have been boiled in this basin for 30-90 seconds, simultaneously the brush moving alternatively to find the thread ends;

- The workers, holding the silk threads with the left hand had removed the impurities from the thread, have raised the cocoons with a sieve or a metal spoon and have introduced them in the reeling basin;
- Under a reeling end, 3-8 raw silk threads have been united and have been passed through a spinning nozzle and then through a twisting system to the winch. The threads' twisting has been important because the raw silk thread must be cylindrical and clean, without impurities, being also removed the water content.

In this system of silk thread obtaining, each basin had its own boiling basin.

At the semi-automatic and automatic reeling machines, the cocoons have reached to the spinning nozzle through a small channel, moving a mobile arm and the reeling end had bigger dimensions. The cocoons boiling have been done centralized in an automatic boiling device, the cocoon being initially submitted to steam treatment and then boiled to different temperatures in order to maintain a content of 4-5% sericine in silk thread.

In the Silk Reeling Plant from Lugoj, modernized after 1950, during 1965-1970 have been used new reeling technique, consisting in osmotic treatment of threads and their re-reeling, the method including silk thread dipping in a sulphoned oil emulsion at 1.5 atmosphere pressure. This method has conducted to the increasing of extra quality silk percent.

Quality / %	Thread obtained from simple machines	Thread obtained from automatic machines
Extra – quality	75.5	79.2
Second – quality	20.9	19.0
Low – quality	3.6	1.8

At the present, in Romania doesn't work any silk reeling plant. In the frame of the Commercial Society SERICAROM Bucharest exists a silk reeling with 120 ends, with an annual capacity of 30 t of dried silk cocoons, but it doesn't work.

There is an interest in the establishment of a public-private partnership in order to set up this reeling plant.

2.3. Silk handicrafts production techniques

The climatic and soil conditions being favorable for mulberry cultivation and implicitly for silkworm rearing, in the entire territory of country, excepting the mountain areas and high hills, the sericulture can be practiced in a large number of rural households. So, there can be processed enough quantities of "borangic" or silk fiber that were utilized in the obtaining of handicrafts products of current use or for decorative purpose, for self-consumption or for marketing.

The variety of sewing types, including the handicrafts products, the silk sewing expressed the creative spirit and the originality of the handicraftsmen.

The silk fibers obtained in household, known as "borangic" were woven in all the Romanian regions in horizontal looms using the same work technique.

Sewing and embroideries used to decorate the national costume were made from materials wide spread in all the country regions, existing permanent contacts between the village populations, in local fairs, trading practices, sheep rearing over Charpathians Mountains, participation at common religious feasts.

The traditions of weaving and sewing are maintained in many centers of ethnography and folk that belonged to the Ministry of Culture or in the co-operative units of handicrafts.

The handicrafts products of silk have been realized in order to be utilized as fabrics or sewing (embroideries) for clothes or different decorative objects in the living space or in churches.

So, from fine fabrics or silk suiting were made clothes for kings, princes and their families or for local aristocracy, nobles from Transilvania and landowners from Muntenia and Moldavia.

During the centuries, the Catholic and Orthodox cathedrals and churches have been abundantly ornamented with decorative objects made by silk, some of them being still in those churches and some being restored and kept in the custody of the Art Museums from different cities of Romania. In the Art Section of Banat Museum there is an embroidery on natural silk named "Vergin Saute" from the XIX-th century, executed following a pattern of the French School.

The Art Museum of Transilvania from Alba Iulia preserves in its collection a donation of silk fabrics from some Hungarian nobles and princes to the Catholic churches in Ardeal. Among these there are embroidered fabrics utilized for covering some religious objects.

This collection comprises:

- Goblet cover – Transilvania 1636 – realized as embroidery on flaxen linen with colored silk thread, weekly twisted. The work technique is embroidery after counting, identical on both sides, realized point by point in cross shape;
- Cover for God's table – Transilvania, XVIII-th century – embroidery on white silk taffeta, realized with colored silk thread, with flat filigree and golden silver thread and Belgium embroidery on borders. The embroidery is made with different types of contour point: cord, feather, common flat, splitt flat, gobelin and embroidery in relief;
- Pulpit curtain made by flaxen linen of veil type with embroidery of colored silk thread. The work technique consists in different variants of embroidery point, like those presented previously.

Other techniques of silk embroideries used in the entire zone of Romanian popular culture are stitch point, flat decorated, embroidery in relief.

There were auxiliary used silver spangles, the simple silver thread or that spun on natural silk or covered with natural silk.

Similar techniques have been also made in the workshops of the monasteries from Moldavia – Agapia and Putna, from Muntenia – Tismana, Tiganesti, Rinca and Florica, in order to obtain different religious objects and garments for priests.

The fabrics and silk threads used were brought from France, Italy, Turkey or there were obtained from silkworm rearings in nobles or peasants households.

The same work techniques were used to realize the embroideries for the magnificent vestymentary objects of the rulers or local aristocracy.

Also the silk thread and fabrics were used to make and decorate the horse harness, the flags and fight signs of the nobles and the book covers.

By silk were made the handkerchiefs with role of vestymentary accessory, the fillets and tassels used in different ornaments.

When the silk thread was obtained in a large number of households, that happened at the end of XIX-th century and in XX-th century 'till around 1990, was woven in horizontal looms,

being obtained simple fabrics of raw silk and were cut into traditional blouses and shirts, embroidered with different motives specific to Romania sewing. There were also woven “marame”, head-kerchiefs of different types for head covering.

The raw silk fiber used in these fabrics could be non-twisted or weekly thrown, single or in combination with other natural threads, flaxen or cotton.

The Romanian sewing with silk fiber embroidered or woven have become popular art in time, expressing feelings and thematic symbols, having extremely varied technical features, decorative and chromatic, from a region to other, specific to each one.

The artisanal motives used in the Romania sewing are represented by:

- physiomorphous motives as celestial phenomena (lightning, star, sun, moon);
- phytomorphous motives as flowers, leaves, stems, fruits;
- zoomorphous motives as sheep, ram horn, snake, horse, in styled formes;
- anthropomorphous motives which represent human silhouette, eyes, children, peer of dancers and Romanian round dance;
- schematic motives – which represent objects and tools made by human, as harrow, plough, well bucket, hook, scythe, coins, etc.;
- social motives inspired by the social-economical activity – houses, wheat ears crown, etc.;
- primordial or abstract motives as circle, square, rhomb, line or triangle.

With all these symbols, the sewing can express feelings, events or creative imagination in a personal and pictorial style. The composition of sewing, the combining of filler spaces with free spaces and the color harmonization is learned and passed from a generation to another, being also specific to different Romanian regions.

Therefore, in the folk sewing made in Transylvania districts as Cluj and Alba it prevails the black color on white linen, being associated with silver silk thread, expressing the reflexes of love. Black with yellow and black with white also realize elegant combinations.

In the rural areas from Muntenia the floral and zoomorphous motives realized in cross point are intense colored in red, black, cherry-colored, green and yellow.

A beautiful element of national costume as “catrinta” from Sibiu is realized by black cloth with alternative embroideries of pink and violet flowers. Golden and silver threads throw bright light among combinations of lines worked in points that represent plant stems.

The main silk seams are utilized to embroider the feast blouses and shirts, the table covers, towels and coverlets.

The traditional feast costume from Sibiu presents embroideries with black and yellow threads on the fine white linen.

The specific blouses made for common days, but especially those for feast days can have a sober chromatic – black, brown, olive, red – for example those from Buzau and Prahova districts but also velvety nuances, with a throw of points in crosses and dense lines as those from Moldavia.

The traditional costume from the past but also from the present have embroidered pierced works on thread networks with spiders realized in a multiplicity of colors.

Other sewing realized especially in the XIX-th and XX-th centuries are represented by the table cloth. The embroidered fabric is made by flaxen of Celia type.

The sewing presents in the middle a network with motives in crosses made with two black threads on a link thread and the lines are realized by a yellow thread in a special sewing point (behind the needle). Linear element are combined with polygonal motives that remind us of the world of wild camomile flowers, delicate yellow flowers, in alternation with black little breads.

The ancient techniques have been transmitted from a generation to another or there have been adopted and adapted new techniques from other nations, the Romanians being receptive to novelty and original in creation of new products and ornaments.

One of the most significant handicrafts product of the Romanian everyday life is represented by the national costume and its accessories. This costume had a functional role but also an aesthetical one, with elements of tailoring and texture common in all the Romanian regions, but with a great variety of ornaments and motives of coloring and embroidering.

2.4. Economics and market situation

During 1986-1989 the Central Station of Production and Research for Sericulture has made important quantities of silk cocoons destined to obtain silkworm eggs and to process cocoons by reeling, recording the following dynamics of the production:

Year	1986	1987	1988	1989
Silk cocoon production (t)	510	700	1000	1894

The maximum production was in 1989 and after that it has been recorded a pronounced decline of the silk cocoon yield, with the lowest values after 1990.

At present, the Silk Reeling Plant from Lugoj stopped its activities and Romania provides by import from China the total necessary of natural silk fibers and from Italy, China and Korea the necessary of natural silk fabrics.

Between 1947-1948 has taken place the modernization and increasing of silk cocoon processing capacity of the Silk Reeling Plant from Lugoj that could process about 300 t of dry silk cocoons annually.

In Romania the handicrafts production was made in the co-operative units or by individual handicraftsmen. All these handicraftsmen belonged to the Professional Association of Popular Art Producers, Workmanship and Artistic Handicrafts from “Romartizana” Handicrafts Cooperative. This association elaborated the developing politics in this field, providing the access at financing of some projects for products marketing and participation at national and international fairs and exhibitions.

After 1995 when the stock of silk fibers produced in the Reeling Plant Lugoj which stopped its activity in 1993, was finished Romania imported from China the quantities of silk fiber necessary for obtaining traditional “marame” and silk embroideries.

The only unit which produces silk handicrafts products was “Marama” from Campulung Muscel – Arges district.

The handicrafts products with silk were realized in a large variety of woven objects with natural silk embroideries, their traditions being maintained in co-operative handicrafts units or by individual handicraftsmen. So, there are produced even today “marame” (traditional had-kerchiefs), traditional costumes (silk embroidered blouses or some specific elements “catrinta” or “fota”), man’s shirts, decorative traditional towels (destined as gifts at weddings

or to decorate the icons in houses or churches), wallets, different knitting, tassels, pillow and table cloths, coverlets.

Among the private firms active on the internal and external market there are “Anna Design” Bucharest (specialized in producing and marketing clothes made by vegetal fibers with silk embroideries),”Dorotytextils” and “Selena”, both from Ploiesti – Prahova district.

The dynamics of production in textile industry during 1995-2004 is presented in table no. 1. The data made evident the continually decreasing of the silk fabrics production, from 56 t in 1995 to 25 t in 2004.

In order to support and to promote the silk production in Romania (silk cocoons and sericulture genetic stock) some rules have been elaborated by the Romanian Government, from which HG 157/2004 that established the subvention of 40 lei (around 100 Euro) / per silkworm egg laying (family) for 3250 laying (families) and HG 1593/2003 that accorded product subvention of 10 lei / box of silkworm eggs.

For the knowledge and promotion of the handicrafts traditions and products there have been financed a series of projects by Phare Program or by the Developing Resources for Cooperatives and Small and Middle Enterprises, as the Project “Oltenia – European Region” which promoted fabrics, traditional costumes and traditional carpets realized in the Workshops of Ethnographic Museum from Slatina, in the Cooperative of Household Art from Tismana and in the private firm “Diana” from Drobeta Turnu-Severin.

“Romartizana” organizes annually an International Fair of Popular Handicrafts, that will take place in 2006 during 3-11 June, this being the XVth edition and also the National Fair of Popular Art and Workmanship that will take place in April.

In order to stimulate and to activate the market of handicrafts products, “Romartizana” presents a web page – Romania Handicrafts and Popular Art – existing on the Internet many other pages for informing and virtual selling of handicrafts products, as Infofirme – Romanian Catalogue – web Business – Romanian Art on line (virtual shop), Workmanship Company – ProRomBusiness (web page with 88 firms recorded and 34888 visitors).

The prices practiced on the virtual market of workmanship products of traditional clothes, including those made by silk or decorative objects varies between 20 – 100 – 200 USD. So, for a blouse with silk embroideries the price is around 100 USD, for a man’s shirt the price is 106 USD, flowers made by silk are 20 USD and a pillow cover costs 110 USD.

To promote and maintain the handicrafts tradition there have been elaborated and approved a series of legal normatives contained in a Legislative Packet of Financing and Supporting the Handicrafts and Workmanship by National Cultural Resources.

In accordance with the data of “Romartizana” the annual value of the incomes obtained from handicrafts products marketing has been 5 millions USD, the products being made in 40 cooperative units, by a total of 5000 handicraftsmen.

The National Agency for Cooperation and Small and Middle Enterprises has financed the project “The Art of Manual Work” which had the following objectives:

- maintaining of the work techniques and methods for the realizing of the handicrafts products;
- obtaining of some modern handicrafts products of workmanship inspiration (decorative objects, clothes, knittings from vegetal fibers, objects made by metal);
- obtaining of some objects of decorative art (tapestry works, macramé, ceramics, furniture) which satisfy the requests of internal and external consumers.

The National Developing Strategy of Handicrafts Production was established in 1990.

An important fact in the maintaining of the interest for the production of the artistic handicrafts is to connect the folk art with the tourism expansion all over the country and world.

The Romanian handicraft objects are demanded by the foreign people and also by the Romanian tourists because they represent the local specific and they are very good guide marks in memories.

In the Strategy for Developing the Handicrafts Products are contained politics of professional training for young generation or re-qualification of dismiss personnel in the handicrafts centers of "Romartizana" for different trades: pottery, weaving, wood processing, etc., or in the workshops of Art and Ethnography Museum, in the frame of Ministry of Culture.

The traders of Handicrafts Products can access through different projects of financing resources of the National Agency for Cooperatives and Small and Middle Enterprises or the Program Sapard (measure 3.4.).

With the National Program of Research and Developing there can be realized different projects of research-developing, technological transfer and valuing, in the frame of the Technological Platform "Production and Integrated Management of Production".

In 2005 the acquisition price of the fresh silk cocoons was 3.3 Euro/kg, adding the governmental subvention of 0.83 Euro/kg provided from the financial sources of the Agriculture Ministry.

The acquisition price of silk thread imported from China is 16 USD/kg and the quantity of raw silk imported for silk handicrafts products is about 100 kg annually.

The sericulture by-products (pupae) are commercializated to a firm of pharmaceutical products at a price of 10 Euro/kg.

Chapter 3. Major constrains against and recommendations for artisanal and traditional silk handicrafts cottage industries

Major constrains against and recommendations for artisanal and traditional silk handicrafts cottage industries and silk enterprises development at the country level are the following:

- The constitutive elements of the silk market, producer and beneficiary, aren't organized by commercial relationship stipulated by contract;
- At the present, in the silk market the absence of commercial company capable to purchase and process in private system the fresh cocoons from the farmers, it is the main limiting factor for the silk production increasing;
- After 1989, the cocoon and raw silk production has dramatically decreased, due to the lack of Reeling Plant and Silk Cottage industry;
- In the rural area doesn't exist enough market of mulberry saplings and silkworm eggs and it doesn't exist production for the silk market;
- Most of the trees are wild or hybrid, having much inferior quality and quantity of the leaves compared to those of the cultivated trees and the quality of mulberry leaves also affects the development of silkworms;
- The abrogation of the law for mulberry trees preservation against breaking up;
- Decreasing of the young generation's interest for sericulture and decreased number of the students and young researchers in sericulture activity.

The Romanian macro-economy politics include through the development strategies of agriculture and small and middle enterprises, the financial support for artisanal and traditional silk handcrafts cottage industries and silk enterprises.

The Ministry of Agriculture presents the objectives of agrarian politics in the sericulture field:

- organizing the market and silk cocoons processing networks;
- preserving and improvement of sericulture genetic stock;
- producing the sericulture biologic material (animal and vegetal);
- supporting the establishing of sericulture exploitations with economic efficiency in the rural zone;
- increasing the incomes for silkworm breeders and the transition from self-consumption to commercial production;
- stimulation, supporting and protection of the internal production by different measures used in EU.

Chapter 4. Romanian strategies for silk handicrafts cottage industries development

The climatic conditions in Romania are favorable for mulberry cultivation and for silkworm rearing in two series, in spring and summer-autumn seasons.

The economical and technical aspects that contain the feasibility of the sericulture activity in Romania are:

- Providing of financial support of government concerning the subventions for product and for genetic stock, based on the strategy of sericulture development in Romania ;
- Providing of internal necessary of sericultural biological material from national genetic resources;
- The existence of the silk reeling plant at SERICAROM Bucharest;
- Governmental financial support to develop the sericultural activity and maintain the sericultural genetic stock ;
- Promotion of research, developing and technological transfer projects at national level organizing some workshops with producers and beneficiaries for production and integrate management of silk production in Romania;
- Promotion of some international collaboration projects with potential partners in the sericultural field from Europe and members of BACSA Association.

In the Strategy of Romanian agriculture development the sericulture represents on important activity for income increasing and diversifying in rural areas.

Short and long term strategies for solutions and proposals:

- With the help of government financial support new producers can be encouraged to activate in the sericultural field, especially in the perspective to obtain the European subventions;
- Training activity for cocoon farmers in order to participate at different projects;
- Inventory studies on handicrafts should be finished rapidly. An organizing for handicafts products marketing should be established. With this aim, many institutions should be organized under a common agricultural policy;

- New marketing techniques must be applied. With the promotions and advertisements of silk handicrafts should be developed and new opportunities for marketing such as mix marketing strategies;
- Actions and cooperative activities in the silk handicrafts production for the regional producers, including the establishment of a multinational private enterprise in this field, especially in the trade activity and professional training.

Romania has great possibilities for the development of sericulture. The main measure for re-establishment this field of activity has been applied by the Agriculture Ministry, the assurance of governmental credits by “Farmers” Program, partial subsidized by the state, respectively.

By the financing programs through Ministry of Education and Research can be provided the research development projects for:

- the development of private sector by attraction of the private farmers in sericultural activity, supplying the turning to account of sericultural products;
- the improvement of mulberry cultivation and silkworm rearing technologies, adapted to the new forms of private sericulture;
- the development of new technologies for the utilization of sericultural by-products and their turning to account in the market economy system;
- the realization of complex programmes of collaboration in the sericultural field with traditional sericultural countries interested in such actions.

The strategy of sericulture reform and development in Romania has also the objective to cooperate with firms and economic agents of the same profile from other countries.

Therefore the continuity and developing of cooperation relations in the sericulture field in this area, based on complex joint projects financed from both internal sources and FAO or EU resources, can contribute at the sudden improvement of the sericulture (for example PF7 for research activity). These joint projects will establish and make permanent complex teams of researchers and specialists in extension and technologic transfer, that could materialize projects for the sericulture developing in Africa, Europe and Central Asia.

Chapter 5. Annexes

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Annex 2. Tables

Table No. 1

The dynamics of production in the textile industry in Romania during 1995-2004

Product	Measure unit	Quantity of products / Year									
		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Cotton and cotton type yarns	thousands tons	47	48	43	36	28	27	29	28	28	28
Woolen and wool type yarns	thousands tons	27	29	28	20	17	19	10	21	21	21
Flax and hemp and flax and hemp yarns	thousands tons	8	7	5	5	4	4	4	3	3	3
Fabrics	mill.sq.m.	305	302	276	240	200	194	200	204	226	216
Cotton	mill.sq.m.	190	187	173	170	143	145	154	160	170	160
Wollen	mill.sq.m.	41	39	34	22	18	13	17	14	19	20
Flax, hemp and jute	mill.sq.m.	21	20	17	8	7	5	4	4	9	9
of which: Thin fabrics	mill.sq.m.	11	9	9	6	5	3	2	2	2	2
Silk	mill.sq.m.	53	56	52	40	32	31	25	26	26	25
Unwoven textiles	mill.sq.m.	17	18	15	17	13	11	14	14	14	14
Knit wear	mill. pieces	44	44	46	33	36	38	35	33	33	46
Cotton	mill. pieces	16	16	14	8	7	7	5	5	5	7
Wollen	mill. pieces	21	20	24	20	24	24	20	18	18	27
Silk	mill. pairs	7	8	8	5	5	7	10	10	10	12

Source: The National Institute of Statistics

Annex 3. Photos

The Romanian traditional blouse with silk embroideries

Traditional silk handicrafts - Details of head-kerchief named “marama” and blouse

Silk handicrafts for religious garments

Silk Handcrafts Cottage Industries and Silk Enterprises Development in Syria

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ABSTRACT

In 1946 the number of silkworm egg boxes which were distributed in Syria was about 50000. The number of reeling factories in Syria was five, they were Italian made, producing raw silk of different deniers. The quality of the raw silk was equal to the international standards, in addition to these factories there were manual silk reeling machines in villages, called Arabic wheel – the wheel diameter was 200cm, it produced denier 100. In Syria the cocoon production had started to decrease since 1970, that was the reason which made the factories closed one after one except for Othman's factory, which still works in 20% of its total capacity. The number of silkworm egg boxes which were imported from Japan in 2005 was 400 box, the weight of each one was 11.7 g and the reserved quantity of egg boxes to spring and summer of 2006 are 200 box. In Syria there are various kinds of silk handcrafts cottage industry products, such as women kerchief, head kerchief, embroidered table covers, wall carpets etc. The silk handcrafts techniques depend completely on handlooms. The major constraints are the decrease the cocoon production, the high price of cocoons and raw silk which effects on market demands, the nonuse of modern marketing ways, the abandoning of traditional silk wears. The suggested solutions to develop the silk handcraft cottage industries in Syria are to provide loans, financial aid and tax free for industrials, finding marketing knowledge to the industrials and direct them to produce the wanted items in the local and international markets, establish local fairs and participate in international fairs to introduce Syrian silk industry to the consumers and to make producers able to connect and know the latest development in their industry field, offering cheap row materials, establish local competitions specialized in silk products and especially handcrafts and offer financial rewards to encourage the country woman to keep on in these works which need special skills.

Key words: silk handcrafts, cottage industries, Syria, development

Chapter 1. Introduction

The resource of silkworm is ASAM mountains in northern India and in Bengal. The man had learned how to spin the silk strings from cocoons; for the first time in northern China, and this had happened in Tareem river tank.

In the ancient periods, Far East nations had kept on silk industry and exported silk gaining high profits from its trade, until the other nations had recognized this precious material. In the third millennium before Christ, Chinese had known silk industry and kept its secret for three thousand years.

It had been known from the historical documents three roads for silk trade:

1- The first was connecting China with India and Southeast Asia.

2- The second was connecting the old Asian nations with Europe.

3- The third was the southern road, which was for crossing the caravans between China and western Asia. It had been known as " silk road " and had many branches, one of them was crossing Palmyra -the Syrian city- which was the center of collecting and allocating to the caravans between north, south, east and west, and this what gave Syria a big importance for silk trade in that time.

This industry had moved from China to Japan then to India, where it became well known, making India the most important silk production resource of the world.

Silk industry had moved from India to meddle east (Syria, Lebanon, Palestine, Iraq, and Egypt), Black sea and Greece, it had spread in many Syrian cities- especially in Damascus city – Syria silk became emulate Chinese one in efficiency and craftsmanship.

The Syrians had been known in characteristic silk handcrafts industry, and they have been famous of certain kinds of textures and silk wears in which no one could imitate it. Here are some examples:

1- Brocar (Brocade): soft goods made from silk and golden strings.

2- Damascu: its name derivative from Damascus city name.

In the end of 19^{th} century, the looms' number was about 9000 looms, in Damascus and Aleppo cities, work in its field about 50000 workers. Before the First World War, the looms' number reached about 22000.

In 1952, the industrial silk string entered Syrian markets, so the looms number in Syria started to decrease to 6000 looms and reached about 40 looms at the end of 20^{th} century.

The silkworm eggs boxes which was distributed in Syria in 1946, about 50000 box, weight of each box was about 12.5g, and the filature plants was about 5 plants, produce different deniers from silk strings – 20/22, 26/28, 30/32, – according to the international standards, these plants were Italian made, semi-automatic.

In addition to these plants, there were reeling wheels for filature silk cocoons in villages. It had called the" Arabian wheel"; the diameter of each wheel was more than 200 cm, produce 100 denier string, the cocoons color was golden and it produced locally.

The hybrid silkworm eggs imported from Italy in 1953-1954, their cocoons were white and production of cocoons was higher because of hybridization, the production of the silk yarn had increased too. The overflow of the cocoons and silk yarn had exported to France and Italy. The overflow of the silk yarn which produced by Arabian wheel had exported to Iraq and Egypt.

We started to import silkworm eggs from Japan in 1970, because the Italian factory, which produces silkworm eggs, had closed, the new silkworm eggs were hybrid also and each box of eggs was weight 11.7g.

By time the production of silk cocoons started to decrease, this reason made most of silk yarn plants closed. The remaining plants are two, one of them is belong to Syrian ministry of industry– full automatic plant – and the other one is our plant, it works now by 20% of its total production power, that because there is rareness in silk cocoons and breeders loath silkworm eggs breeding.

The number of silkworm eggs boxes, which imported in 2005 are 400 boxes, each box weight 11.7gs, the reserved quantity for spring and summer seasons 2006 about 200 boxes.

The used method in drying silk cocoons was by boiling cocoons in water, the temperature degree was more than° 80 then put it under the sun light to dry by the sunrays and air. After that, they started to dry cocoons by hot air; the used fuel was firewood, until it became automatic nowadays.

The price of silk yarn per/kg which produced by semi-automatic plants – like our plant –was in the First World War period about 3 golden lira (the golden lira is an English coin equal 8g from gold), then the price reached 5 golden lira through the second world war. The price of silk yarn which produced by Arabian wheel was 3 golden lira per/kg in the Second World War, in 1950 the price of silk yarn was about 7 USD/kg for Arabian wheel production and 14 USD/kg for semi-automatic plant production.

The silk handcrafts cottage industry is very important for Syria and other countries, breeding silk worms and producing silk yarn and silk texture has two important sides: first is agricultural: starting from planting mulberry trees, producing silkworm eggs, breeding silkworm eggs, and end by preparing cocoons for producing raw silk. Second is industrial: include silk filature, preparing silk yarn by twisting silk strings, yarn-dye, and preparing yarn for producing different kinds of texture.

These two sides make silk material supportive for national economy. In the beginning of 20th century the number of workers in silk field reaches more than 160000 workers, this number has decreased to less than 15% in the beginning of 21st century.

Chapter 2. Status and future prospects of silk handcrafts cottage industry and silk enterprises in Syria

Silk handcrafts cottage industry has reached its lowest levels in the beginning of 21st century. The looms number was 22000 looms in the beginning of 20th century and it is nowadays about 40 looms producing certain kinds of texture and traditional silk wear. And at the time that the number of silk yarn plants was 5 it becomes 2, one of them our plant – semi-automatic – and the other one belongs to Syria ministry of industry - automatic plant – producing different kinds of deniers.

The silkworm eggs breeding and silk industry are distributed in different places in Syria, each place is specialized in certain kind of silk product, there are five main cities works in silk field: Draikish, Damascus, Aleppo, Homs, and Hamah. Each city is famous of certain kind of product.

2.1. Silkworm rearing and silk yarn production

Draikish city and its surrounded villages are famous of rearing silkworms; the rearing methods are primitive and random, the farmers used it with their families, the period of rearing is between 30 and 35 days.

This rearing takes place in the farmers' own houses; they devote one or two rooms in there living houses. Moreover, all the family members do the rearing process together. They used residual methods lack minimum scientific rearing components, at which they used salver made from dried animal dung, which makes the worms target to different kinds of diseases, effects the worms in their growing period. This makes the eggs' boxes less yield. It needs also high efforts in collecting mulberry leaves for feeding, because mulberry trees planted irregularly and scattering, which makes it waste long time and efforts to pick and collect it. Different kinds of plants branches are used as cocoon mountages, these branches are situated around and outside the rearing salver, this method increases the percentage of the waste and double cocoons, in addition to that, cocoons' ability to filature in the modern machines becomes in its mini production level.

The farmers sell the cocoons to natural silk company – owned from ministry of industry – and our plant, they are now the only working plants in Syria as we mentioned above. The silkworm rearing decreased until it reached very small amount, this decrease happened for many reasons:

1- Financial gain downturn, that results from worm rearing.
2- Using old methods and tools in the rearing and unspecialized places because rearing gives low cocoons production and bad quality.
3- Mulberry planted trees fall-off and spread it in many different and far places make its collection hard.

2.2. The follow up steps in cocoons filature after buying it from breeders:

We start to dry cocoons using hot air as following:

Drying place is room 5m long, 3m height, in the room land, there is a burning machine connected with fuel tank. Above it, zinc boards on 1m height, after the boards there is a wooden tank its height about 60cm, its floor made of metal screen, this tank placed above the zinc boards. The cocoons placed in the wooden tank, the hot air comes through it from the heated boards; temperature degrees between° 50 and° 80 in the end of drying process, the cocoons moved upside- down every 3 hours, herein below cocoons drying room design:

<table>
<tr><td>cocoons</td><td>cocoons</td><td>cocoons</td><td>cocoons</td><td>Wooden tanks</td></tr>
<tr><td colspan="4">Metal screen</td><td rowspan="3"></td></tr>
<tr><td colspan="4">Zinc boards</td></tr>
<tr><td colspan="4">Burning machine connected to fuel tank</td></tr>
</table>

After drying cocoons, they are being sorted to three kinds:

1- First kind: good cocoons about 85% of total amount.
2- Second kind: waste cocoons (thin cocoons) about 10% of total amount.
3- Third kind: double cocoons about 5% of total amount.

The first and second kinds filature in our plant, second kind produce second-degree yarn, third kind sold to countrywoman who filature it manually.

The good cocoons give different deniers (20/22 - 26/28 - 32/35 - 40/45 – 50/55 – 70/80 – 90/100), denier and related quantity had been defined and confirmed by the manufacturer depends on his needs.

2.3. Fabrics and silk wear

Fabrics and silk wear industry had spread widely all over Syria it has been produced very various kinds and models, some of them still on and the others either stopped its production permanently or turn to industrial (artificial) silk production because of its cheapness comparing with natural silk price. The used looms are two kinds, semi-automatic looms it is about 90% and its 1929 production the other one are handlooms its about 10% and it is located especially in Damascus city. Here are list of some remaining fabrics and silk wear (the used names are locals so it couldn't be translated):

1- Brocar: in different kinds and shapes (Damascus city specialized in its production)
2- Damascu: in different kinds and shapes (Damascus city specialized in its production) as well known these two kind gave Syrian silk industry distinction and gives it an international fame because no one could imitate it
3- Alagabaany: in different kinds and shapes (Damascus city specialized in its production)
4- Alhibreyah: in different kinds and shapes (Aleppo city specialized in its production)
5- Al adlass, and al moukassab: in different kinds and shapes (Damascus and Aleppo cities specialized in its production)
6- Al hatataah and Allafha:(for men and women) in different kinds and shapes in different kinds and shapes (Damascus city specialized in its production)
7- Al iegale, al breem, and al zinaar: (Homs city specialized in its production)
8- Al maslubah: (women kerchief), table cloth, bed sheets, and shawls, sewing by Arabian loom in Dair mama village which follow with Hama governorate.

In addition, the kinds that its production had stopped, we can mention:

1- Al hatataah Al deirhamliyah Al halaapiyah.
2- Al sakrawaniyah Alhalaapiyah and Al homsiyah
3- Al shargad
4- Al samniyah
5- Al hamidiyah (for men and women)
6- Shampar alharir

We will explain and clear out some items which are still in production:

1- Brocar (Brocade)

String 20/22 denier used in its production, it's a silk fabrics brocaded with golden strings to give it a special glamour with beautiful, its paint draw from Damascus daily life, Islamic decoration, and Arabian Islamic and European history, for example:

- Eastern paint: it is decoration draw from omaawie mosque figures in Damascus it consisting in figure inside it twelve sides.
- Salah aldeen al ayuoby battle paint " Islamic Arabian history"
- Noah ship paint "religious legend"
- Romeo and Juliet paint "European heritage"
- Omar al kaiam paint: it is a view of deer hunting, Abigail dances, men sitting smoking narghile "Iranian heritage"

- Lovebird paint (beau & lass): Queen Elizabeth had chosen this texture the second to make her wedding dress of it, the Brocar merchants had called it by Queen Elizabeth name.

The used colors in Brocar are white and black main used for warp, red and green then blue and beige in small amount for weft.

2- Damascu

Silk texture known by embroidery, it embroidered by paints for knights, hunters, trees, plants and fruits its name derivative from Damascus city name.
Most of its usage for furniture upholstery and curtains each cloth width between 145cm and 220cm. In the beginning it had been produced from natural silk yarn by manual looms with pedals, the pedals number changes according to colors number in the texture. In the past, the paints were inserting by hand and needle. In the present time Damascu no longer made of natural silk, we can find it nowadays made of artificial industrial silk and cotton or just cotton.

3- Alagabaany

It is natural silk sheets, at first it has known in Aleppo and Homs Then in Damascus. It is silk weaving in its warp and weft, then it been embroidered by hand and needle with natural silk string by tighten it to wooden table, nowadays Damascus is well known in producing this fabrics except for that embroidering by electrical machine and weaving made of cotton, organza or industrial silk.

4- Alhibreyah

It is a head kerchief for women; it is natural silk in its warp and weft in white color, after that printing process goes on according to the kind of Hibreyah and request of the client. There are many kinds of it; produced in Aleppo city we can mention some of it for example: Al malas, Al majaz, Al soudaniyah, etc…

5- Al hatataah (for men)

It is a head kerchief for men use; it can be white or colored as request and manners of each area that will use it. Its consumption was in large quantities in 18^{th}, 19^{th} and 20^{th} centuries. It was exported to Palestine, east Jordan and Iraq in addition to its local consumption. The used denier are 40/45 and 50/55, each one weight between 300g and 400gs.

<u>Hatataah production method</u>

1- By using old hand wheel, two or three strings twist together.
2- The new string turns into skein.
3- The skein wraps up to long stick called Motwayah
4- The stick puts into the fixed part of manual loom to make warp strings in the opposite side of the loom. There are bobbin contain weft strings, the movement of the loom controlled by pedals.
5- After weaving the kerchiefs, it has put into large pot containing boiling water for several hours on calm fire.
6- Then the kerchiefs purified from blotches.
7- Last step done by women: who do some shapes at the surrounded ends of the kerchiefs by needle.

There is one manufacturer in Syria who makes this kerchief in Homs city.

6- Al maslubah and table cloth

There are two common sides between Al maslubah and tablecloth:

1- The way of filature used yarn in this handcraft.

2- The production area “Dair mama village” that is famous in this handcraft.

- The way of filature silk yarn

Waste and double cocoons are filature as following:

1- Floss has been taken of cocoons.

2- Put cocoons into boiling water in pot then left it for several hours on calm fire.

3- Drying cocoons by air and sunrays until it became completely dry.

4- Spinning cocoons by manual spindle by women.

- Table cloth

It had produced by women using needle and uncertain denier of string in different sizes as requested to put it on the salon tables.

- **Al maslubah**

The used string denier 200 and it had been making as following:

Putting silk skein into boiling water makes the skein softer by losing some glue from its strings, then drying the skein by putting it in air, then the skein hooked to the rooftop and its strings go to wooden wheel then to bobbin, each skein makes 18 bobbins. A girl starts to spin bobbin strings by spindle, then she takes the strings from the spindle and reels it to small pipes for the shuttle, then puts the warps in to Arabian loom with pedals and the weaver starts to weave the women kerchief which called Al maslubah.

After that, she puts the kerchiefs in hot water and adds into soap pieces to make it smooth. On its edges, women make by needle, some shapes using silk string, and in hot water yellow dye called al safira, then the kerchief wetted in that water and squeezed directly to have light yellow color. Al maslubah length 175cm and width 35cm for girls, and its length 175cm and width70cm for ladies.

2.4. Silk reeling machines techniques

There are three kinds of reeling machines:

1- manual reeling wheel (Arabian wheel)

2- Semi-automatic plant

3- Automatic plant

We will describe the first two kinds.

1- Arabian wheel

There are reeling wheels for filature silk cocoons in villages it had called the” Arabian wheel”; it is made of wood the diameter of each wheel more than 200cm, produce 100 denier string.

2- Semi-automatic plant

It consists of fourteen wheel inside big hall each wheel has two workers. It is divided to two iron tables each table has twelve pot for boiling cocoons and twelve filature plats. For each pot worker called boiling girl and for each plat worker called filature girl and for every four wheels have worker called connecting girl, its work to connect any string if it cut, and for each filature plat six moving reels to pull the strings from filature plat to the wheel. Each wheel has hot steam water tube, the boiling girl and filature girl take there needs from hot steam. Each filature plat gives 500g of silk yarn every 4 hours. It gives different denier according to our clients needs (from 20/22 to 90/100) the string quality is very good.

2.5. Silk handcrafts production techniques

Fabrics and silk wear production get through several stages. Each one makes an independent handcraft and they make together a complete work. Each stage has its own name; it has taken from the nature of the stage or the handcraft.

1- Alfataale (twist maker)

He is the person who gathers two or three string as request and then he twists these strings to make the needed string, for example in Brocar he twists the strings between

400 and 500 round for warp string, and 250 rounds for weft strings. The twist ways is different according to the needed weaving, so the work method in making Brocar weaving is different from in Hatataah weaving. Moreover, the used machines could be manual or electrical.

2- Almasdee (warp maker)

He is the person who is responsible of preparing warp strings (the long strings in the fabrics). Warp in Damascus electrical, it changes strings from the reels, which brought from twist maker by big drum – its diameter between 2 and 5m – to a big and long skein, its length might reach 240m. Warp in Aleppo and Homs some of it still handy.

3- Al sabaag (Dyer)

The skein sent to the dyer where he will start degumming process. He will put the raw silk in tank with boiling water and add to it soap and soda and keep the silk in the tank for more than two hours then he wash it by clean water and squeeze it. Skein becomes shiner and whiter because the glue material has removed and dyer start dyeing stages (dyeing still by hand in Syria):

- **Stage one**

The dyer puts pomegranate peel in to large boiling water pot for a long time until watercolor became a liking yellow-brown. Then he puts weft strings in the pot and continues boiling the mixture for fifteen minutes, after that he keeps the strings in the covered pot to the next day. On the other hand, warp strings left up from the boiling water and kept out until it cool then it replaced in the cold water to the next day.

In the next day dyer pickup the strings from the pot and he squeeze them, their color became yellow-brown and this called base color, it is important if we want to dye in black color because it helps to fix black color and it is not important for other colors.

- **Stage two**

The dyer replaces colored water with new clean water and adds to it dye powder and vitriol material, which helps silk strings to absorb dye, moreover there are anther materials which

helps to fix the dye, as verdigris, olive oil and iron filings helps to strengthen the strings. After the mixture boil, dyer and his helper starts to dive the strings in to the mixture and moving them to different directions, he repeats this process several time until strings absorb color more and more, then dyer squeeze them and replace it into the boiling mixture.

- **Stage three**

The mixture continues boiling with strings inside it. Then fire turn off and dyer pull out strings, squeeze them and put them in high place. next day he starts diving strings in to clean water several times until the color of water that results of squeezing strings became clear, after squeezing he hit strings to floor to prevent them from sticking and to make them softer at the end he hang them to dry.

4- Al mzaeek

The man who works in this craft called Al mzaeek, he takes warp strings from dyer and he dives them into solution containing starch and glue mixed in water, diving process takes five minutes.

Then he squeezes the strings and hit them to floor to separate strings and prevent them from sticking, and he begins to coil strings to a wooden spool until it takes prolate ball. In early morning "about 3 A.M.", Al mzaeek takes his silk balls and goes to an empty square containing long wall. He puts wooden sticks into the wall in vertical shape, this sticks contain wooden jut like teeth, then he starts to hang the strings on the sticks along the wall "about 60m", after that he begins to separate strings by his finger preventing it from sticking after diving process.

Separating process must done before sunrise or the strings will stick together by sun heat and because atmosphere in early morning moistly. Diving process helps to make warp strings stronger so it can bear loom combs strikes. Weft strings does not do this process because it is protecting by shuttle.

5- Al malkey

Al malkey word means; interlocking warp strings with alneer. He is the person who inters warp strings into alneer.

Alneer is different kinds. In brocar looms, it is two thin iron bars with holes connected to a net, which are vertical linen strings with floor, it is responsible of making draws on Brocar looms.

- These crafts are common in most silk fabrics industries. We can find some crafts related to some kinds of silk fabric industries, as:

1- Al-darakly (tie man)

It's a craft connected to dyeing craft, used in certain kinds of fabrics. The tie man takes silk skein (warp strings) and tie it in different places in certain length using cotton strings. Then he sends it to dyer who dye it in yellow color for example, after it dry, the dyer sends it back to tie man. Who untie the first tie "tie area is uncolored" and he ties again the colored area with cotton strings and sends it back to the dyer who will dye the strings in new color. And so on, he repeats this process several times, depending on the needed colors number.

2- Al-tarbeed

Women usually do this work in there homes. Loom man let part in the end and beginning of the Hatataah unweaves by weft strings. Therefore, warp strings became like lashes. A woman twists these lashes and coils its end by brocade like bells and lantern. This process called is Al-tarbeed.

3- Al-hibreyah printing

There are two kinds of printing:

1- printing on long table

2- printing on Al-dazkah

1- printing on long table

A- The printer receives the kerchiefs (Al-hibreyah) after it had been degummed by the dyer.

B- By photocopy machine or electrical sensor, contain fluorescent lamps. A photo process happened to the paint - that they want to print it on the kerchief- on a silk soft good tighten to a wooden matrix equal to the kerchief space.

The paint draws on a transparent paper. Then they put the paper on the photocopy machine glass, under the glass there are fluorescent lamps. The wooden matrix with the tightened silk on it placed over the paper. If the paint in three colors, the same paints, have to be photo in three steps using three matrixes.

C- The white kerchiefs spread each one alone on the tables, then two workers

standing around the table against each other take by there hand the matrix

which they had printed the paint on its silk soft good and start to pour the

black dye over the matrix and they move the dye forward and backward until

it cover all the matrix space. When they lift the matrix black color paint, appear on the white kerchief. If the paint has more colors, the workers repeat there work using different matrix. Each matrix used for one color.

D- The workers hang the kerchief on air to dry.

E- After drying the worker puts the kerchiefs over a pot contain boiling water mixed with Material to fix the dye. The kerchiefs absorb the moisture for seventy-five minutes.

F- Last step is to wash the kerchiefs by water and iron it.

2- printing on Al-dazkah

Al-dazkah is an oblong table with short leg. The printer set on the floor near it, he puts thick fabrics on it, and above he puts the white kerchief and manually starts to print on it by carved wooden matrix.

- **Arabian loom**

All looms are similar in their main parts and work methods. However, they are different in some parts related to work purposes, we will explain two kinds of looms.

1- Arabian loom with pedals

1- Al-misdayah: a wooden cylinder to tighten warps on its top.
2- Al-maaber: a wooden cylinder under the first one, to tighten warps on it.
3- Al-motwat: a wooden cylinder near the weaver, used to coil the weaved fabrics.
4- Al-neer: it has different kinds.
5- Al-mosht(Big comb): the weaver uses it to collect warp strings to weft strings.
6- Al-garar: a hanged rope used to move the shuttle.
7- Al-makook(Shuttle): contain weft string pipe.
8- Al-athkale (weights): To tight, warp strings.
9- Al-madaouss (pedals): it might be 2,4,6,8 or more.
10- Al-asafeer: connected to pedals

2- Towing loom (used in Brocar weaving)

1- Al-garaz: it's a props to fix the loom over it. It's a strong wooden shafts.
2- Al-motwat: a wooden cylinder used to coil weaved fabrics on it.
3- Al-mostaarah: is a crowbar to coil Al-motwat.
4- Al-zairakoon: movable strong wooden shelf, the weaver sits on it when he weaves.
5- Al-garar: a hanged rope used to move the shuttle.
6- Al-makook(Shuttle): contain weft string pipe.
7- Al-mosht(comb): the weaver uses it to collect warp strings to weft strings.
8- Motwat alsooda: wooden cylinder against the first motwat, to coil warp strings on it.
9- Al-madaouss (pedals): its is one in this loom.
10- Al-mateet: two pieces of wood connected together situated on the width of weaved fabrics, to keep weft strings tighten with warp strings after weaving.
11- Al-jakar machine: is responsible of drawing, connected to the loom by linen net.
12- Al-minkash: a small tongs, used to clean weaved texture.

2.6. Inside and outside marketing situations of silk products

Silk product can be divided into two groups:

1- Cocoons and raw silks.
2- Fabrics and silk wears.

A- cocoons and raw silk

Farmers are the main production resource of cocoons through rearing silkworm larvae, which are distributed by natural silk company in Draikish city. The rearing methods are simple and primitive, in addition to the decrease in silkworm box reared quantity. Natural silk company and our company buy cocoons. There are two kinds of the produced yarn:

1- First one: produced by automatic and semi-automatic plants, this gives standard deniers.

Silk filature plants, directly to the industrials and handcrafters, distribute the standard silk yarns. Yarn deniers produced according to the clients' request. A small quantity of the yarn marketed outside Syria by travelers and tourists.

Comparing the recent period (the beginning of 21st century) with the beginning of 20th century, we find a huge difference between the two periods, by production quantity and marketing. In that time silk yarns where exported to France "especially to Lyon city" and England in big quantities in addition to the local consumption.

2- Second one: produced by manual spindle, it has been used locally by the same person who filature it. They used it to produce Al-maslubah (women kerchiefs) and tablecloth.

B- Fabrics and silk wear

Fabrics and silk wear have been sold locally. Villagers are main consumption for these wear and fabrics especially in north and northeast area, where women dress silk wear depending on her habits and inherited traditions. Each area specialized in private costume distinguishes it from other area. In small quantities, these products are sold to outside Syria by travelers and tourists.

Supply and demands

- **A- Natural silk yarn**

The decrease in silkworm rearing, results to decrease the offered yarn quantity in local market. This decreasing did not effect on offered yarn prices because it had accompanied with demands decrease because the most of handcrafters and industrials either close his plant or change to use industrial (artificial) silk string, also because exporting silk yarn to Europe had stopped.

B- Fabrics and silk wear

There is big decrease in offered quantities of fabrics and silk wears, one of its reasons demands loss makes many factories close or change to used industrial silk yarn because of its cheapness. The other reason is traditional production process and inability to change and modernize its lead producer to be out of markets competitions.

- Pricing policy

Silk goods prices are connected to silk yarn price. Market policy in offers and demands does not effect on price setting. Silk yarn prices are connected to cocoons price/kg. High agriculture board set price policy depends on cocoons quality. Cocoons bought from the farmers upon this price, therefore we find that silk productions prices are high because raw material price is high, so producers cannot decrease it when demands is low. If they want to decrease the prices, they have to decrease there profits because the costs are very high.

- **Outside marketing**

There is no outside marketing for silk products in its two kinds, it can be distributed indirectly in three ways:

1- Tourists

2- Some limited business deals.

3- Goods and handcrafts products exchange in fairs.

Chapter 3. Main difficulties against silk industry in Syria

- **For silkworm rearing**

We can divide difficulties, which face silkworm rearing into two sections: the first technical and the second financial.

A- technical difficulties:

1- There are no especial places for rearing. Most of rearers, grow the larvae inside there houses using small spaces, which does not conform to scientific rearing essentials.

2- The nonuse of modern methods and rearing tools: because most of farmers use traditional which cause eggs production decrease because of the diseases that may occur to the worms and to decrease in cocoon's quality.

3- Mulberry trees rareness and spreading them in different and far places, which make leaf collecting very hard, in addition to nonuse of special kinds to match with worm instars progress.

4- The nonuse of specialized centers to produce hybrid silkworm eggs and the nonuse of special section for keeping and cooling eggs.

B- financial difficulties

1- The increase of silkworm eggs price because of importing it from Japan.

2- The decrease of financial profits of sericulture farmers caused them abandoning this craft.

3- The absence of governmental support to develop this craft scientifically and financially.

- **For silk yarn production**

1- The rareness of row materials (cocoons) which caused by sericulture farmers abandon this craft.

2- The increase of production costs.

3- Low demand of silk yarn because many plants which produce fabrics and silk wear closed and the turnover of some plants to use industrial strings.

- **For handcraft cottage industry and silk weaving**

1- The increase of production costs because the increase of row material price causes the inability of competition in the international markets.

2- The nonuse of modern marketing ways: industrials depend on their own skills and experience in marketing their products which cause the inability to develop and follow up markets changing needs

3- The abandoning of traditional silk wears: as the consumption of traditional silk wear, related to poor and middle income section, where it's presents inherited traditions and habits, which express the privacy of each area from the Syrian country areas and by result of price traditional silk wear increases we find that a large part of people have turned to dress industrial silk wears.

- **The needed recommendations and proposals to develop traditional silk handcrafts cottage industries and silk enterprise development in Syria**

- **For silkworm rearing:**

1- Establish research center to produce hybrid silkworm eggs, disease resisting, with high production. And distribute eggs to the farmers for free or very cheap prices.

2- Establishing incubator center for silkworm eggs for first and second instars larvae rearing and distribute them in the beginning of the third instar in the husbandry area.

3- Encourage the farmers to plant mulberry trees, especially for silkworm rearing, and distribute it of free and distribute reports clearing the percentage of fruitful and unfruitful trees matching the worm instar and its needs of food for each kind.

4- Distribute new rearing tools to the farmers in cheap prices or dividing it to a long time payments without any rates

5- Teach farmers the new scientific rearing methods by making training courses in silkworm rearing area and give complete scientific and veterinary knowledge by worm diseases and protection methods. That result high cocoon production and high quality of cocoons and yarn, which allows entering local and international competition.

6- Establish storing and cooling eggs' center in the silkworm rearing area to facilitate keeping and distributing to the breeders in summer and autumn.

- **For silk filature industry**

Silk filature industry depends on two main reasons:

1- Allowing reachable raw materials giving high production and good quality that lead to produce high quality silk yarn capable to competition in international markets.

2- Allowing reachable cheap raw material leads to decrease production costs, which make its distribution easy in the local and international market.

- **For traditional handcrafts cottage industry**

1- Gives loans and financial aid and tax free for industrials to be able to develop the used means in their industry that lead to decrease production costs and increase quality

2- Finding marketing knowledge to the industrials by finding specialized staffs work to study the market and future and recent clients' needs and direct the industrials to

produce the wanted items in the local and international markets which makes the industrials capable to follow the market changes and clients' desires.

3- Establish local fairs and participate in international fairs to introduce Syrian silk industry to the consumers and to make producers able to connect and know the latest development in their industry field.
4- Offering the needed facilitation to keep handcrafts progressing by offering cheap row materials and sell their products by installments especially to the villages and areas, which depend on its traditional wears on silk wear.
5- Establish local competitions specialized in silk products and specially handcrafts and offers financial rewards to encourage the country woman to keep on in these works which need special skills to prevent its from oblivion.

Chapter 4. Strategies and follow up actions to develop traditional handcrafts cottage industry and silk enterprise

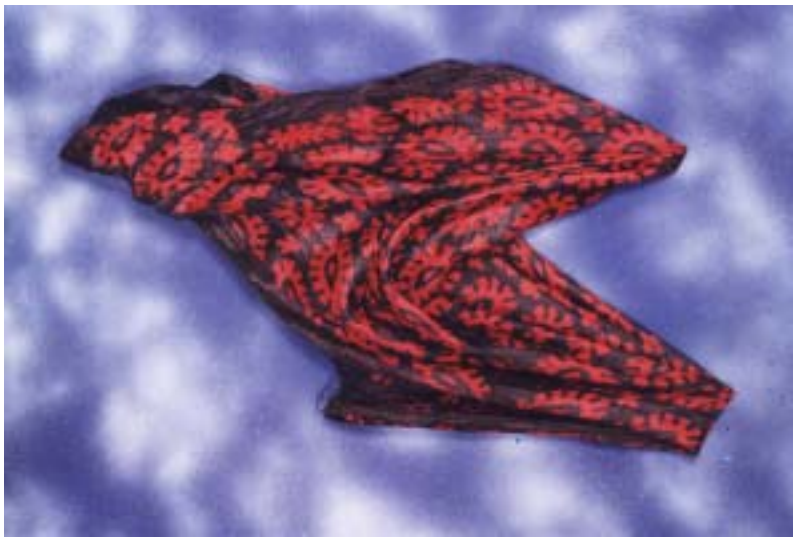
In year 2004, the ministry of agriculture established the silkworm husbandry development office in Syria.

This office still starting, it has not yet offered any support to the husbandry of silkworm and its relevant industry.

We hope that Food and Agriculture Organization (FAO) helps the silkworm husbandry development office in Syria by offering the necessary experiences to develop these handcrafts cottage industries and offering the financial support for this enterprise with cooperation of ministry of agriculture in Syria and offers marketing studies to establish cooperation between Africa, Europe Central Asia and the Near East.

Annex 1. Pictures for some kinds of silk handcrafts cottage industry

Silk knit



Silk fabrics

Thai Silk Handicrafts Cottage Small and Medium Enterprises

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ABSTRACT

Sericulture is one of the traditional agricultural occupation. Thai silk is famous in the world as characterized by unique colors and designs. Sericulture in Thailand, started more than 3,000 years ago, particularly in the Northeast. Silk handcraft production is complex and involves very diverse steps of production. The main production stages are silkworm rearing, silk reeling, and weaving. At present there are 136,884 households who are engaged in silkworm rearing. Most of farmers are small scale, who rear Thai variety to produce silk yarn for their own weaving and for sale to weaving factories. The total production of silk yarn is 1,420 tones, with 1,100 tones are from Thai and Thai- hybrid varieties. Thai silk handcraft cottage products are the results from the integration of Thai indigenous knowledge, culture and the ways of life which are reflected through traditional artistry in weaving techniques, colors, and designs of the locality in which they were made. There are three main types of silk fabric producers in Thailand namely: individual weavers (farmers) in their own houses, small to medium scale weaving enterprises, and large weaving factories. Most of them prefer to use local Thai silk yarn. There are approximately 450,000 people who are engaged in silk handicraft cottage industries. Most of them (98%) are engaged in community enterprises or cooperative groups or private silk cottages as rather small enterprises and only 2 % are involved in big silk factories. The total domestic fabric supply amount 6,871,500 meters. The final use of these fabrics are for domestic use about 40 %, exports 20 %, manufacture of garments for domestic use 8 % and garment export 32 %. The types of fabrics are produced 50 % of the fabrics are mud-mee and the rests are plain silk, Phrae-wa, Chok, Yok, printed silk and batik silk etc. The total value of silk handcraft cottage industries are about 176.5 million USD per annum that divides into domestic market value is 125 million USD (includes tourists purchasing) and export value is 51.75 million USD. The main silk handcrafts for export items are women' s blouses, shirts, handkerchiefs, shawls, scarves, mufflers, veils, ties, bow ties, cravats, furnishing house wares, gifts and accessories. However, there are some weak points that Thai silk handcraft cottage industry is faced to such un-uniform quality of local yarn, high costs of production and lack of new products and new designs to meet market needs. In order to cover these weak points, the government makes policies and strategies to as follow: increasing the standard of quality, promote the development of a stronger and diversified domestic market and encourages outward expansion for international markets, form silk supply chain as silk cluster, development of designs and new products, and promote and strengthen Thai silk handcraft cottage industry. In order to maintain the Thai silk products in the international market, Thai silk handcraft cottage industry should concentrate to produce Thai unique products, which show the country's image nationwide, with high quality products to be the alternative products in the market.

Key words: silk handcrafts, cottage industries, Thailand, development

Chapter 1. Introduction

1.1. Historical background

Silk cloth is the world's third most important natural fabric after cotton and animal cloth. However, silk yarn has its own special characteristics, particularly its shiny appearance, and in this respect Thai Silk has set standards of style and beauty that are recognised throughout the world. Sericulture seems to be almost ideally suited to the widely predominant small scale farming pattern in the Northeast because it is highly labor-intensive and can provide a vast number of jobs and supplementary income in the form of cottage industry, especially to the disadvantaged, otherwise hardly employable labor reserve of women, oldsters and children. Bedsides, its feed base does not compete with other crops for better quality land but is compatible with wide range of major cultivation patterns. It is, therefore, a field of predilection of production diversification. The Government‘s a point of view, sericulture has many important multiple roles to play in the rural sector and the economy of the country namely:

- Generating employment opportunities and increasing income for village people**.**
- Increasing agricultural land use efficiency in the rural community**.**
- Promoting commodity diversification in agriculture and rural trade.
- Helping foreign exchange saving by filling silk demand of the country with domestic source.

1.2. Importance for the national/regional economy

Silk handcraft production is complex and involves very diverse steps of production. The main production stages are silkworm rearing, reeling, weaving, product processing, and marketing. These stages are combined in various ways along the value chain, with agents who are carrying out one or more of these production functions. Some farmers rear silkworms and sell cocoons for processing in factories; other rear silkworm, reel the cocoons and sell silk yarn, either to other villagers or to weaving factories; another group buys yarn and concentrates on dyeing and weaving; and some producers complete the whole process from planting their mulberry plots for silkworm rearing in order to produce and sell silk yarn and fabric.

1.3. Sericultural farmers

There are three types of sericulture farmers in Thailand according to their variety of silkworm is reared as follows:

1. Polyvoltine group (yellow cocoon): There are about 105,384 farm families who reared polyvoltine /Thai native variety which are relatively resistant to diseases. With 95% is in the Northeast with the traditional practice. These farmers, are small scale, have sericulture as their second occupation from rice or other field crop growing. They produced silk yarn, which can be kept for weaving or sold at sometime afterward.
2. Thai-hybrid group (poly-bivoltine) with yellow cocoon: There are approximately 24,500 households are Thai hybrid farmers who are more commercially oriented than those who rear polyvoltine varieties. The producers sell their cocoons to village reeling factories or reel silk yarn themselves by hand-reeled tools. The total of raw silk is 1,100 tons are produced annually from polyvoltine and Thai hybrid varieties.

3. Bivoltine group: Bivoltine varieties produce white cocoons, farmers can rear bivoltine varieties on a commercial basis for 8-12 cycles/year. There are about 7,000 farm households who rear bivoltine and most of them are contract farmers. They produce cocoons about 2,100 tons of fresh cocoons, which then were sold to reeling factories whom provide inputs such as silkworm eggs, fertilizers, herbicides and rearing inputs to them. Amount of 320 tons of silk yarn, are high standard and quality, are produced from 8 reeling factories with machine reeling.

1.4. Silk yarn production/ demand

At present there are about 136,884 farm families who are engaged in sericulture. Mulberry trees are grown in the area of 24,882 hectares which can produce 1,420 tons of raw silk of which 40 % is sold to weaving factories and remainder of 60% is used in local weaving by the farmers for their own use and domestic market. Even though 48 provinces of 76 provinces record silk production, sericulture farming is highly concentrated in some provinces in Northeast. There are two types of silk yarns are consumed in the market:

1. Hand-reeled yarn is produced by relatively simple equipment. Farmers produce cocoon and reel silk yarn by themselves. They may sell the silk product to local markets or local weavers or use it by themselves to produce fabric in traditional styles. Small amount of silk yarn is sold to factories. About 129,500 households fall under this category, most of them live in the northeastern region. These farmers rear silkworm as a secondary occupation. In 2004, they produced 1,100 tons of yarn.
2. Machine-reeled yarn is produced in factories where the farmers sell their cocoons. In general, the farmers keep larger mulberry fields than the hand-reeled groups. In 2004, the number of farmers engaged in this category was about 7,416 households, with about 2,100 tons of fresh cocoons produced per year, equivalent to 320 tons of silk yarn.

Since Thai silk has a good name for its beauty in the world. At present, the demand for raw silk is high but the production in the country is not sufficient. Therefore, the number of raw silk import 200 - 300 tons (table 1).

1.5. Silk fabric producers

There are three main types of silk fabric producers in Thailand namely: individual weavers in their own houses, small to medium scale weaving enterprises, and large weaving factories. Most of them prefer to use local Thai silk yarn. Thai silk handcraft cottage industries and silk enterprises play an important role to both in term of economy and society. As know as Thai silk handicraft cottage products are the results from the integration of Thai indigenous knowledge, culture and ways of life which are reflected through traditional artistry in weaving techniques, colors, and designs of the locality in which they were made. At present, silk handicraft cottage industries and silk enterprises cover many types of producers which involve in this industry such as: farmers, who rear silkworm to produce cocoons and raw silk; farmer‘s reeling groups, who produce silk yarn, reeling factories; weavers; silk fabric and silk product producers.

The total number of people are engaged in silk handicrafts cottage industries and silk enterprises are approximately 450,000 people. About 98 % are engaged in community enterprises/ cooperative groups/ private silk cottages and are classified as a small and medium silk handicraft enterprises and only 2 % are involved in silk industries (large scale).

1.6. National economics

Thailand produces not only raw silk but also silk fabrics and silk products of which have a good image worldwide. Thai silk has it own distinctive character, with a unique beauty, luster and softness. In 2004, foreign exchange earning from the export of silk goods have reached about 2,070 million baht (51.75 million USD) per annum, besides, there has the value of silk which purchasing by tourist about 2,500 million baht (62.50 million USD) and, local market consumption about 2,500 million baht (62.50 million USD). The total value of silk product is about 7,070 million baht (176.50 million USD) per annum.

1.7. Regional production and trade

The world raw silk production in 2000 was 80,480 tons, rising up for the third consecutive year after a time of decrease since 1995. China is still accounting for about 75% of the supply and year after year India also gains ground, producing 15,214 tons in year 2000. Brazil remains stable. Thailand, Uzbekistan, Japan and Iran make the rest of suppliers. The main importers are India, 33%; Europe, 20% (Italy accounting for about 85% of the market); Japan, 15%; South Korea, 10%, the remaining 20% are coming from France, U.K., Germany, Switzerland, U.S.A., Canada. While Thailand produces raw silk only 1% of the world production (table2).

China is today's largest supplier of raw silk to the international market. India by contrast, has become the world's largest importer of raw silk.

The trade in made up silk goods, once dominated by Europe, is now increasingly characterised by the presence of developing countries. China is an outstanding example. India has also become a supplier of ready to wear garments (mainly for women) and items for interior decoration such as bedspreads and cushion covers. Thailand also exports finished silk goods although this trade has declined in recent years. As in the past, Thailand's export will continue to depend to some extent on imported supplies of raw silk and silk yarn.

Currently the international dominant countries are China for all 3 sectors, especially for apparel and accessories such as scarves and ties, but also for some furnishings; India, for fabrics, for apparel, and furnishing, which is an important exporting sector for the country. About 5 big companies dominate the market; Brazil for raw silk, Italy for fabrics and made ups; France and UK for fabrics and made-ups, especially for furnishing fabrics, U.S.A. for consumption of fabrics and made ups, especially furnishing fabrics; Japan for consumption of fabrics, scarves and ties (table 3). It is estimated that global silk trade is a multi-billions dollar business.

1.8. Problems of silk handcraft industry

Even though Thai silk fabrics and products are well known and good image to consumers, however they still have many weak points that need to be solved in order to strengthen Thai silk handcraft cottage industry to compete in the world markets. The main problems are often mentioned as follow:

1. The main problem of silk handcraft cottage industry is un-uniform quality of local silk yarns. Most of yarns are produced by individual farmers, so the yarn quality depends upon their skills and knowledge, which lead to produce various quality of silk yarn. These materials are affected to more difficult for enterprises to control their production level, quality and quantity as well as quick responding to customers' needs. Moreover, un-uniform silk yarn increasing production costs of silk handcrafts.

2. High costs of production is an important factor to limit expansion of silk handcraft cottage industry. High prices of local silk yarn and high labour costs due to hand made products, which use labour intensive. The industry needs high skills and experienced labours.
3. The weak points of Thai silk handcraft cottage industries which most of them are small scale cottages which the production level is small and poor management with low investment and technology are used. Therefore, it is a complicated process to try to control the colour standard of the products, as there are no high technology machines available to them.
4. Lack of new products and new designs to meet market's needs. There are many silk fabrics and products with the old designs no dominant products to be attractive the customers.

1.9. Future direction

1**.** In order to increase local silk yarn to meet demand of silk handcraft industry, Ministry of Agriculture and cooperatives set the policy to concentrate to increase local silk yarn (yellow yarn) in term of quantity and quality. The main strategy to support the policy is as follows:

- To change from polyvoltine to poly –bivoltine (Thai hybrid). Polyvoltine farmers, who have ability to move to Thai hybrid, will be selected and support to produce yellow cocoons to sell to community reeling factory.

- To distribute and increase community reeling factory to nation wide to produce uniform quality of yarn. Network between cocoon production groups and reeling group will be seriously promoted in the concentrate sericultural areas particularly in the Northeast. Community reeling factory will be the market for cocoons of network farmers, so this system will reduce individual reeling farmers.

2. Thai silk products are mainly of medium to low quality, so the country is becoming less competitive against countries with cheaper labour costs such as China, Indonesia, India, Pakistan, and Vietnam. It is expected that production costs in Thailand will increase and more countries will join silk production with lower labour costs. Therefore, it is challenged to Thai producers to compete in the world markets. In order to survive in silk business, producers should not make cheaper silk products with low quality to compete for the prices but to produce products which satisfy consumers even though they are more expensive. As know as Thai silk is recognized as superb and valuable items due to its unique in term of hand made, reeling, design, colour and weaving. The strategy of Thai silk handcraft cottage industry is to produce their own unique Thai silk with is definitely different from other countries. Most of the consumers admire Thai silk as good quality, stiffness, different texture and luster. Hence, producers should maintain good image of Thai silk to stimulate their production to produce products which not to compete to the other countries. Moreover, Thai silk handcraft industry needs to increase standard of quality of silk products are sold under name of 'Thai silk".

3. Producers should establish the network to make collaboration among different sectors of supply chain. The different sectors, which include all stakeholders in silk handcraft cottage industry from downstream to upstream of supply chain, are formed into silk handcraft cluster according to local which they are. The silk cluster system can reduce and eliminate the problem of producers by supporting each other in term of raw material, technology, equipment and marketing. So this system is more efficient in term of cost reduction, quality improvement and quick responding to consumers' needs. The collaboration may be covered to regional countries or global silk producer countries to exchange and supply raw materials,

technology, equipment as well as marketing. The silk produced countries may plan to set silk strategy in term of type of silk products, demand/supply and marketing, so they can either avoid to their competition or support each other.

1.10. Silk handcraft cottage strategies

The Ministry of Agriculture and Cooperatives has formulated its five - year strategy plan for 2005 -2009. There are three strategic issues for silk handcraft cottage development. The following are the details of the four strategic issues.

Strategy 1 Improving product standard of silk yarn and silk products**:** The Ministry will emphasize on the following issues:

- To increase productive efficiency by providing good varieties of mulberry, silkworm and transfer technology to farmer groups.

- To reduce cost of production by the good knowledge and good management.

- To conduct research work by developing high-yield (mulberry, silkworm), modern technology of Thai silk product, reeling and weaving equipment, which suite to local condition.

- Strengthening the farmer groups and has special knowledge for production.

- To develop production model for niche market products.

- To establish basic standard system for local Thai silk yarn.

Strategy 2 Diversity of silk products development**:** While the priority is given to:

- To develop diversity of silk products in term of types (items) of products, patterns, and packaging.

- To improve production technology as well as modern designing method, which are flexible, then producers can response to fashion and consumers' needs quickly.

- To establish R & D in field of product development of all supply chain and marketing of silk handcraft cottage industry in short and long term, in order to response to further market.

- To promote and protect local wisdom by establish property right in term of brand, license, geographical indications etc.

Strategy 3 Promote and strengthen Thai silk handcraft cottage industry: The Ministry will emphasize on the following issues:

- To join road shows and exhibitions in the country and international to introduce and distribute unique products of Thai silk handcrafts to the markets.

- To establish brand which is good representative and good image for unique products of Thai silk handcrafts to certify the consumers.

- To promote Thai silk products as a natural products and environmental friendly.

- To improve efficiency of logistic system of all supply chain of silk handcraft cottage industry.

- To collaborate and make network of silk cluster both in the country and Regional.

Chapter 2. Historical background, present status and future prospects of the silk handcrafts cottage industries sector and silk enterprises in Thailand.

Thai silk is famous in the word in term of their unique characteristics. Silk fabrics reflect the traditional artistry in weaving techniques, colors, and designs of the locality in which they were made. Sericulture has been on going in Thailand for over 3,000 years as evidenced by the scrap of silk fabric found attached to a prehistoric bronze bracelet found in Northeast part of Thailand. Sericulture was prevalent during the reign of King Rama V especially in the Northeast. In 1861, King Rama V sought improve and promote sericulture and established a research center and mulberry plantation under Ministry of Agriculture and Cooperatives in the Northeast region. He also hired Japanese experts as his technical and research advisors as well as teachers on silkworm rearing, silk reeling and weaving. Therefore, it was the start point of sericulture to expand to other parts of Thailand.

2.1. Silk handcraft commodities

Thai Silk handcraft industries, are rather small in size compare to other industries, generally using small amount of capital to establish the business. The making of Thai silk has developed from a cottage industry. The products are more tradition designs. Most of the weaving is still done on hand looms with either hand - thrown shuttles (traditional hand loom) or fly shuttles. Result to Thai silk fabrics are popular from its distinctive beauty, consummate craftsmanship, soft smooth texture, iridescent sheen, attractive colors, and artistic designs which set it apart from silk made elsewhere. So far number of products have been classified for promotion Thai silk handicrafts such as hand woven fabrics, gifts, accessories and decorative items. These cover a vast variety of traditional items made in communities the length and breadth of Thailand. Each lovingly silk handicraft from local materials with skill and pride handed down through many generations, each with the inimitable flavor and style of their localities, just look at the renowned Thai silks, whose designs, patterns, color, even weaving style are strongly influenced by the topography of where they are produced. Well known products of Thai silk in market are traditional and modern silk fabrics, silk garments, home furnishing and decorative items, and gift/accessories items.

Thai silk handcrafts cottage industries in Thailand are established in form of private companies and farmer cooperatives group. In 2004, it is estimated that there are about 451 enterprises of silk handcraft cottage of which 30 % perform in private companies and 70 % of the total are farmer cooperatives groups. About 85 % of the total number of silk handcraft cottages are in the Northeast and North part. The total domestic fabric supply amount 7,635,000 yards (6,871,500 meters). The final use of these fabrics are for domestic use about 40 %, exports 20%, manufacture of garments for domestic use 8% and garment export 32%. The types of fabrics are produced 50 % of the total fabrics are mu-mee and the rests are plain silk, Phrae-wa, Chok, Yok, printed silk and batik silk etc. In addition Thai silk is also used for accessories and decorative items such boxes, cosmetic cases, handbags, purses, wallets. The other important item of Thai silk is used for interior decoration applications as drapery and panel covering because it does not support combustion. The main export items of silk garments and products are women’s blouses, shirts, handkerchiefs, shawls, scarves, mufflers, mantillas, veils, ties, bow ties and cravats, furnishing house wares, gifts and accessories.

The expansion rate of Thai silk fabrics and products for exported market is average 2.08 percent in last five years. The increase in the competition of global silk trade due to the end of the Agreement on Textile and Clothing (ATC) on January 1, 2005. On the other hand, the abolishment of quotas and the lowering of textile tariffs have also opened up new opportunities by providing Thai exporters access to new markets. Thai producers have to

improve their competitiveness to maintain their domestic market share as well as to expand to the regional market. The major challenges to the Thai silk sector are to improve its position in the world silk trade and increase return to stakeholders along the market chain.

2.2. Silk reeling machines/techniques, used in the cottage industries

Silk reeling, is a process by which the silk filaments are drawn from the cocoon, and involves the boiling of the cocoon, from which a number of filaments are drawn and twisted into single shiny strand. Three basic reeling sources are available in Thailand, namely; (1) Silk reeling at farm, (2) Silk reeling community level and (3) Silk reeling at industrial level.

2.2.1. Silk reeling at farm level

Reeling tools are often used at farm level as following:

Traditional reeling tool: This traditional reeling tool created by the farmers and was used from one generation to generation by using very simple method and materials which were founding in the village. There are two parts of reeling tool are boiling pot, which is used as a reeling basin to boil cocoons and control size of silk yarns through the number of cocoons. The other part is reeling set, with two-three iron prongs leading from the edges upward from the pot, and overhead roller, bamboo thong or/and reel. The cocoons are gathered and placed in boiling pot to remove outer layer of silk filaments before cocoons removing from the boiling pot and waiting for reeling again. The certain number of removed-cocoons are gathered and place in boiling pot then the group of silk filaments are castrated in 12-15 centimeters in length then the silk filaments are slowly unraveled from the cocoons, wound into basket directly or onto wooden reel. The reeler holds the cocoons in a boiling pot with a bamboo thong in one hand, and she delicately maneuvers the silk filaments upward to the reel with the other hand. This reeling tool is used for reeling cocoons of polyvoltine and poly-bivoltine varieties. This is a family enterprise, with women and elderly members of the household involved in most of the reeling tasks. Often farmers do not market the yarn they produce, processing it by themselves. Reeling by hand usually can produce 200 g of yarn per day in case farmer reel silk yarn into basket (without reel), and up to 500-1000g of yarn per day, depending on the size of the reels. Since traditional methods of reeling are used to create yarn, the reeling process requires high levels of skill and attention by the person reeling. The cocoon filament being spun must have a constant supply of cocoons in the boiling pot and a constant rate of reeling otherwise the filament will break or the denier will be uneven. Yarn from polyvoltine and poly-bivoltine variety is classified as yellow yarn (Thai) and used as weft yarn in weaving industry. This type of yarn gives the Thai silk its unique textured characteristics. Sericultural farmers that use polyvoltine and poly-bivoltine varieties are normally engaged in yarn reeling as well. There are around 129,884 households are polyvoltine and poly-bivoltine reelers in Thailand.

2.2.2. Silk reeling at community level

Reeling tools are often used at community reeling facotry as following:

Community reeling machine (multi-end reeling manchine): This simple reeling machine is classified as multi –ends reeling machine, which applied motor less than 0.5 HP in the process. The set of reeling machine consists of 5 to 6 – ends basin which set up denier detector to control size of silk yarns. The size of reeling machine is 0.75 x 2.1 x 1.6 meter with reeling speed 80-110 rpm. The machine run by motor and reeling process is controlled

by 2 labors usually can produce 4 – 4.3 kg of raw silk/ day (8 hrs). This reeling machine helps the farmers produce better quality of silk yarn which is suitable for weaving factories. The most of community reeling factories manage in term of farmers' group and community enterprises which had their networks (member) to support poly-bivoltine cocoons to them. This system is promoted and supported by the government. At present, there are 17 community reeling factories in Thailand, 12 factories in the Northeast. Fresh cocoons are bought from members before sorting eliminated cocoons from good cocoons. Then cocoons are boiled and removed outer layer of cocoon by hand reeling tool lead to silk yarn grade 3 is obtained. Then the cocoons are boiled in separate boiling pot at preparation stage. The cooked cocoons are put into stand by basin, which adjacent to reeling basin before the process of end groping is starting. The process of end groping and cocoons feeding are operated by the two reelers, who stand and operate reeling machine. Silk yarn is control size and evenness by dinier detectors in each end before pulling onto small reels. Silk yarn in reels are re-reeled and process into standard skeins before selling to market as grade 1. This kind of silk yarn can be marketed as hand woven. Unreelable cocoons left in basin will be taken for hand reeling to obtain grade 3 of silk yarn. After finishing reeling process all boiled pupae are sold to market as human food.. Generally, the price of silk yarn grade 1, which is produced from this reeling machine, is always higher 10-20 percent than hand reeled yarn.

Silk yarn, which process from traditional reeling tool and community reeling machine are recognized the same as Thai silk yarn, is classified into 3 grades:

grade 1: from inner layer of cocoons, smooth, more even, bright color, 120-250 denier

grade 2: from mixing outer and inner layer of cocoons together, thicker, 350- 450 denier

grade 3: from outer layer of cocoons, rougher, less evenness, 350 -500 denier

2.2.3. Silk reeling at industrial level

Reeling machine which is used in reeling industry is:

Automatic reeling machine: There are only around 7 reeling factories currently in Thailand, of which 4 are in Northeast all of factories belong to private sector. Factories that upgrade to new technology have to switch to bivoltine cocoons because the newer technology is not suitable for poly-bivoltine cocoons. Normally the set of automatic reeling machine has 400 reeling ends. Bivoltine cocoons are purchased from contract farmers. The cocoons of low quality are eliminated after the assorting then the good cocoons are dried using a hot air dryer. Cocoons are cooked by automatic cooking machine (steam cooking). The cooked cocoons are sorted out and searching a thread (end groping stage) then they are moved to reeling basin by rotating cocoon baskets, which move simultaneously around the reeling basin and pour cooked cocoons to reeling ends. Size detector, which function as denier controller of silk yarn through automatic controlling for cocoon feeding into reeling ends. The automatic reeling machine reels with speed 330 rpm. However, the efficiency of reeling and quality of silk yarn is sensitively affected by many factors such as cocoon quality, drying and cooking processes as well as quality of reeling water. After reeling, the raw silk yarn is sent to re-reeling, rewinding, drying before sending to twisting section. This section, is for finishing process of silk yarn, re-reeling, doubling and twisting processes are carried out according to order. There are many types of silk yarn are produced such as 17/19, 21/22, 27/29 denier etc., with production of raw silk approximately 320 tons. Reeling factories are marketing most of their production directly to weavers, and few are selling onto the open market (around 5 percent of total yarn produced). Most of the yarn being sold onto the open market is sold to small scale

weavers as warp yarn. The yarn is produced both weft and warp yarn for sale to weaving factories.

2.3. Silk handcrafts production techniques

2.3.1. Silk fabrics

There are estimated about more than 90 % of silk fabrics in Thailand are hand-woven results in giving special characteristic for Thai silk. These produce silk fabrics rather thick, offer fine artistry, painstaking workmanship, and delicate beauty. Thai silk has a special luster and unique patterns and color schemes. Their weaving knowledge and skills differ from region to region. Silk fabrics from all regions are not inferior to one another since each shows beautiful indigenous culture record. These set it apart from silk made elsewhere and enables Thailand to dominate the hand-woven silk market. They are luxury market items and tend to be high in price. The best known and most popular Thai silk fabrics are:

1.1. Mud-mee (Ikate)**:** Mud-mee, is regarded as the "Queen of Thai Silk" because of its intricate patterns, is a venerable textile traditional of the Northeastern region of Thailand which is different design according to its locality. Mud-mee is made by tying string on the yarns of either the warp or the weft in the desired pattern. The yarns are then dyed, and the exposed portions do not. After dying, the strings are removed and the piece is woven. In most Thai mud-mee, the design is tied on the weft however, in some provinces such as Chiang – mai, Maehongson, Ratchaburi, and Petchaburi, it is the warp that is tied.

1.2. Khit: Khit fabrics are made by lifting yarns of the warp (called " kep khit") with a piece of bamboo (mai kep khit) and introducting into the weft extra yarns, which extend from one side of the piece to the other. Khit fabrics can be distinguished by the fact that the extra weft yarns result in ridges of the same color extending across the piece and that the design is repeated. It may or may not extend the length of the piece, but it has definite starting and ending points. Khit fabrics are made all over the Northeastern region and in some provinces of Central region and Northern region.

1.3. Yok (Brocade weaving): Yok fabrics are made by introducing extra silver or gold weft threads (supplementary weft) in a manner similar to that by which khit fabrics are made. Pieces thus produced may be used as the ornate border sewn to the bottom of the skirt, or sin, or the technique may be used in weaving both the skirt and the border. Yok fabrics, are well known and very famous, are made in the Northern region particularly in Lumphun. However, in Southern region such as Nakhon- srithammarat is also made Yok fabrics for long time.

1.4. Chok: Chok fabrics are made by introducing extra weft yarns as is done in khit fabrics, however, this is done at intervals; a yarn is not visible across the entire piece. This makes possible much more complex designs and color combinations than are found in khit fabrics. Chok is mainly woven to decorate the edge of pha sin, so it is sometimes called sin tin chok. Its delicate designs are always admirable. All over the Northern region particularly in Nan, Phrae, Uttaradit, Sukhothai, Uthai Thani, and in some provinces of Northeastern region are sources of Chok fabrics.

.1.5. Phrae Wa: Phrae Wa fabrics, khit and jok techniques are combined in a single piece. The name "phrae wa" comes from the fact that pieces typically have a length of about one "wa", or fathom. Phrae wa is associated with the Phu Thai, in whose culture such cloth is used on ceremonial occasions. The traditional base color of the phrae wa is red; however, recently both the color and size have been adapted to suit contemporary fashion and tastes.

1.6. Plain silk: This type of silk fabrics are made by plain weaving usually using yarns of the same color for both the warp and the weft. The color is smooth and generally not

patterned. Sometimes different colors are used for the warp or weft, giving striped or checkered patterns.

1.7. Silk Batik: Silk batik, is one type of silk fabrics in Thailand, is made by sketching designs on cloth and covering portions with wax before dying. The dye is not taken by the wax-covered portions. Northern region such as Phrae and Western region such as Khanchanaburi are famous for silk batik.

Power loom woven silk fabrics: There are only 10 % of power loom woven silk fabrics in Thailand. Some types of silk fabrics such as plain silk, knitting silk and simple pattern fabrics can be made by power loom. These are available in solid colors or printed designs. They are popular used for ready-made garments and for other silk products.

2.3.2. Silk Products

Silk products produced in largest quantities are ready-made garments, handkerchiefs, scarves, shawls, bow ties, and neckties, tablecloths, pillowcases, handbags, gifts and interior decoration. Many garment factories are located in the vicinity of Bangkok, North and the Northeast. There is a trade flow of silk fabrics from the Northeast to the other parts. Garments producers source their fabrics from mainly SME weaving industries, which they are networks together or owned themselves. Smaller scale garment and silk product cooperatives as well as tailoring enterprises are present at the local level.

2.4. Economics and markets

2.4.1. Economics

Silk handcrafts cottage industry is paying an important role to Thai economics from downstream to upstream of value chains. It is quite effective in term of earning money in the country because most of raw materials used, labours in the country. There are about 450,000 people, who are directly engaged in this cottage industry particularly poor people in the Northeast. The total value of silk fabrics and silk products is approximately 7,070 million baht (176.50 million USD) per annual, with 2,070 million baht (51.75 million USD) of the total value from export; 2,500 million baht (62.50 million USD) from local market, and 2,500 million baht(62.50 million USD) purchased by tourists in the country.

2.4.2. World market demand

However, we can mention Thailand that has quite a thriving export business for furnishing fabrics with very luxurious brands known throughout the world. We can also talk about Uzbekistan, which after years of Soviet Rule has re-developed raw silk production as well as yarn production and fabrics. They also have some fashion designers starting to make apparel sold abroad. Vietnam, Nepal, Cambodia, South American and African countries are not to be forgotten, as they are also a part of the silk picture, yet without any international exchanges that are noticeable to let them appear in statistic masses.

For the sector of silk yarns, we can see that, all in all, the production increases in ‘producing’ countries (China, India, Brazil…), but the imports from transforming countries lose ground year by year. The whole trend is to have more and more finished products being exported to Japan, the USA, and Europe. The products are coming from China, Korea. An exception is seen when raw silk and yarns are being exported more extensively than fabrics, which is the case of Italy.

For the sector of fabrics, Europe resists fierce competition with the rest of the World, basically thanks to a level of quality and excellence that is very high, they also make an effort to supply customers with what they want and are very market oriented. They'll be reactive and will offer the fashion and furnishing markets with the right fabrics, the right designs at the right time. However production costs make it a harsh reality that forces a lot of companies to close down production units in Europe and North America. Design studios, quality controls and deliveries remain in their hands but production is coming more and more from the Far East and India.

The global image is that Chinese companies are very reactive for silk weaving for fashion, the Koreans are particularly praised for the quality of their prints, and India is an excellent source for high value products such as embroidered silk fabrics, silk fabrics with beads and pearls, as well as furnishing.

For Silk made ups, although competition from other materials such as synthetics is quite high silk dresses and blouses maintain a good level of export on the markets. It is however worth noticing that even though China is still the world's leading supplier it loses more and more ground to the benefit of India.

Silk scarves are also on a rise, leading countries are South Korea and Italy; Silk scarves represent about 10% of the whole scarves on offer in the world. On the other hand, for neck ties the trend is in the opposite direction, silk ties represent about 85% of the World offer for ties and leading exporters are China, Korea, and Italy.

The markets for scarves and ties are to be found in Japan, in the U.S.A. and Europe, U.K., Italy, France.

2.4.3. Market condition of Thai silk handcrafts

The two markets for Thai silk handcraft products are domestic market and international markets (export).

Domestic market

Although the Thai silk sector experienced untold hardships and great difficulties, it still has a bright future after a long period of adjustment. Known as the queen of fibres and the second skin of the human body, silk remains incomparable to other materials in both comfort and healthcare functions. Domestic consumption makes up around 70 percent of total production. Most of this consumption is used to make medium to low quality products at cheap prices.

There are reported that the domestic market conditions are not related to export market conditions. The characteristics of the domestic market are different from those of the international market. Domestic consumers and international consumers have different tests due to the different nature of domestic and export demands. However, in some cases they have some connections that benefit Thailand, such as the indirect export of items from the country's domestic market via purchases made by tourists. This market is accounted for 35 percent of total production and it seems to be more benefit for Thai economics. The development of a tourist industry result in exposure of Thai silk industry to world markets have broadened the scope of the traditional products such items as table cloths, handbags, scarves, pillowcases etc.

Demand conditions stimulate domestically based firms to bring new products to market. Nations gain competitive advantage in industries or industry segments where the home demand gives local firms a clearer or earlier picture of buyer needs than foreign rivals can

have. Nations also gain advantage if homebuyers pressure local firms to innovate faster and achieve more sophisticated competitive advantage compared to foreign rivals. Demand for products has recently declined. In the past six years, the wholesale price of this product has dropped while production costs has increased.

International Market

Thailand is a small player in a highly concentrated international market of raw silk. Thailand is the fifth largest producer of silk yarn in 2004, produced 1420 tones, equal to about one percent of world production. However, Thai silk and products have the market share about 5 % of the world silk trade, while China have market share for 40 %, followed by India which have market share 26 %. The other silk producers have market share 29 %.

The main export markets for all types of Thai silk fabrics and products (garments, furnishing, accessories and gift) are U.S.A which accounts for 30 percent, EU accounts for 23 percent, Japan accounts for 7 percent, and other countries account for 40 percent of total exports. In 2003, Thai silk handcraft commodities are exported to international markets, about 38.76 percent are shawls, scarves, mufflers, mantillas, 31.13 percent are blouses, shirts, only 19.98 percent are silk fabrics.

There are four commodities of Thai silk handcrafts which are exported to international markets as follow:

1. Silk fabrics: This commodity is accounted for 39 % of total export value. The main markets are U.S.A, United kingdom, Italy, Japan, Spain, Singapore and Australia.
2. Furnished house wares and interior decoration: It is accounted for 28 % of total export value and the main markets are U. S.A, Singapore, Japan, France and Australia.
3. Other silk products: The export value is accounted for 21 % of total export value. The main markets are U. S.A, Singapore, France, United kingdom and Germany.
4. Garments: This commodity is accounted for 12 % of total export value. Garments are divided into 4 group of products namely:
    (1) Women or girl's blouses, shirts and shirt-blouses: This group has value of export about 39 % of the total value of garments. The main markets are Japan, United Republic of Tanzania, U. S.A, Singapore, United kingdom and Italy.
    (2) Shawls, scarves, muffles, mantillas, veils and the like: This group has value of export about 48 % of the total value of garments. The main markets are Italy, Japan, France, Hong Kong and U. S.A.
    (3) Ties, bow ties and cravats: This group has value of export about 11 % of the total value of garments. The main markets are Italy, Singapore, Malaysia and U. S.A.
    (4) Handkerchiefs: This group has value of export about 2 % of the total value of garments. The main markets are Singapore, U. S.A., Japan and Malaysia.

2.4.4. Policy support

The main government organizations, which are mainly involved to various degrees in the policies and programs for the sericulture sector as well as Thai silk handcraft cottage industry are the following:

1. Ministry of Agriculture and Cooperatives

1.1 The Queen Sirikit Institute of Sericulture: This institute aims to be the core organization to response all processes of sericulture sector, it is under Ministry of Agriculture and Cooperatives, has been established since October, 2005 by combining Sericulture Institute, Dept. of Agriculture (DOA) and Sericulture sub- Division, Dept. of Agricultural Extension (DOAE) The main function of the institute is for technical support to farmers in the field of raw silk production, processing and marketing of silk cottages. The institute strategy is to increase the production of domestic yarn to support silk handcraft cottage industry. The second major aim of the strategy is the promotion on high quality silk yarn at community level.

1.2 Dept. of Cooperatives Promotion: This department has a main function to promote and support farmers to form cooperatives group to develop their business.

2. Ministry of Industry: Department of Industrial Promotion has promoted SME in term of providing knowledge on SME operation, commercial silk processing techniques, financial linkage etc.

3. Ministry of Commerce: Department of Export Promotion who is responsible to promote and provide advice on export procedure, international market information on silk handicrafts.

4. Ministry of Interior: The main department, who is responsible to silk handicraft, is Dept. of Community Development which promotes and supports villagers to operate community business by developing knowledge from local wisdom to increase their incomes.

Beside the main function of government organizations which mention above, The Royal Thai Government has made the policies, which respect to support and strengthen of Thai silk handcrafts cottage industry such as:

(1) Royal folks and arts craft foundation

The foundation was established in 1976 by Her Majesty the Queen. Firstly, all expenses were borne by Her Majesty the Queen. Her Majesty the Queen is interested in Thai silk especially mud-mee in the Northeast. Theirs Majesty wishes to release their people from the difficulties and maintain the well living, especially to the villagers. Then Her Majesty the Queen decided to put sericulture, which are specialized at under her royal patronage. Therefore, Thai tradition and culture were well maintained and contributed to new generation. Her Majesty the Queen is heartfelt in publicize the silk, especially mud-mee as the initiator to use in many occasion, as well as pleased all officers to dress in Thai silk in order to support silk handcraft cottages and disseminate Thai silk to the market. On the occasion of visiting to aboard of theirs Majesty, Her Majesty the Queen will have all wearing apparels made from Thai fabrics such as silk as the vision to repute the products to the world wide and attract their attentions to Thai silk handcrafts. These are very strong support policy for traditional Thai silk cottages are popular in the world market for their unique characteristic appearances as well as permanent conservation of Thai silk handcrafts

(2) Local silk yarn promotion

- To promote sericulture as an occupation for farmers, particularly in the North East where there is a strong tradition of sericulture and where there are limited alternatives for income generation.
- To preserve and protect the Thai silk handcraft cottage industries as a national asset.

- ❖ To encourage an increase of production of silk yarn so that domestic demand can be met with less dependence on import.

(3) Local wisdom promotion

Thai silk handicraft cottage, the diverse products of Thailand's local communities are the culmination of local wisdom and experience handed down from generation to generation. They are exquisitely hand-made from local materials, refined over hundreds of the years with skill and creativity into products and designs unique to their localities. Currently the Thai government is providing advice on production methods, quality control, packaging and designs to make them even more attractive to export markets.

(4) Encouraged domestic consumption

The wearing of Thai fabrics, especially silk, has been catching on, helped by the government's encouragement of cabinet ministers to set the trend. However, buying silk is still limited to the well-off and middle-aged and older women who place importance on elegant clothes and social status. Civil servants were asked to support the government's policy on a voluntary basis by wearing Thai fabric on Fridays but many junior officials prefer modern fabrics that are lower in price and easier to clean

(5) OTOP project

OTOP stands for " One Tumbon One Product". A Thai government initiative launched in 2001 to identify and promote unique products made by (Tumbon) as a means of expanding the country's domestic and international trade as well as improving incomes of villagers. Under the umbrella of OTOP, community products are reaching out to the world market thanks to their unique appeal and designs. OTOP exhibitions are a feature of trade shows in Thailand organized by the Department of Export Promotion (DEP), enabling thousands of international buyers to discover the quality and appeal of attractive hand-made local products as well as silk products.

The OTOP logo created by the department of export promotion, the OTOP logo is a symbol of excellence. It is award to those handcrafted items includes silk handicraft produced in village, communities that reach the high standards set by the OTOP national committee and have good potential for export. Look for the OTOP logo and be assured of quality and satisfaction. The Ministry of commerce plays an important role in marketing the unique OTOP products by introduction the very best of them to local and international markets, besides providing advice to local communities on design, packaging and quality control. The Ministry determines the market potential of OTOP products, protects local wisdom through establishing intellectual property rights and facilitates matchmaking links between domestic and international market.

2.4.5. Price setting

Pricing: Before fixing a price on a product, investors must conduct a study on the market components and their competitors. Prices can be fixed in several forms such as:

1. Fixing a high price. In fixing a high price, the investors must be confident their products are of high quality and customers can be assured of the quality of the product.

2. Fixing a low price in bid to capture market. This is suitable for durable goods. Investors wishing to use this strategy must have a sound financial footing and enough working capital for the future.

There are three categories of price setting which are:

- Price setting according to cost-oriented
- Price setting according to demand-oriented
- Price setting according to competition-oriented

After the investors conduct a study on the market components and their competitors and they make decision about gross profits margin which they want to get from the investment. The cost of products are calculated to be a basic information for price setting. Then the cost of product and gross profits margin are put in the formula to estimate the price will be set for sale. The Office of Industrial Economics estimated that the gross profit margins of the Thai silk handcraft industry are approximately 15 – 25 percent. The formula to estimate the price as follows:

$$\text{Mark –up percentage} = \frac{\text{\% of gross profit margin}}{100 - \text{\% of gross profit margin}} \times 100$$

Sale price for customer = cost of product + (mark-up % X cost of product)

2.4.6. Structure and activities for internal / international trading

1. **The silk retail sector** is highly heterogeneous. The domestic retail market primarily sells fabric products. Excluding the tourist sector, the domestic market for non-cloth use is still small; equal to no more than 20 percent of the domestic use of silk fabric. Marketing of silk products to end users occurs at all levels; from villages to provincial centers, from street stalls to fairs and retailers at major tourist destinations. Most silk retail shops in the Northeast have their own weaving units. This form is particularly common in the Chonnabot district area. Street vendors are the most flexible of the retailer groups. Retail costs and margins vary substantially by type of outlet. Estimates in percent profit vary from a low of 2 percent for village traders up to 17 percent for small retail shops. The mark up between purchase price and retail price ranges from 2 percent to 20 percent.

2. **Whole sale sector.** This market channel, producers can sell their products directly to informal-contact customers, who are traders, silk processing shops, and exporters. The most of traders, have outlets in Bangkok. The second channel of marketing is through silk processing shops for dress making or processing to increase value added. The exporters are the other market of the group.

There are many trade fairs and exhibitions to provide producers to obtain retail and whole sale as following:

- Road shows for Thai silk handcraft cottages
- Internal/ international trade fairs
- Annual fairs at each provinces
- OTOP city fairs

Chapter 3. Major constraint against and recommendations

3.1. Major constraint against

There are some factors which may become the main obstacles for Thai silk handcraft cottage development. The major obstacles such as:

3.1. Sericultural farmers in Thailand could become an endangered species because of China's membership of the World Trade Organisation. However, free trade in textiles, due in 2005, could see weavers worldwide opting to import cheap raw silk from China rather than use material produced by local farmers.

3.2 The report from silk companies indicated that the quantity of available raw materials is very important. They argued in the same way that there were not enough raw materials produced in Thailand, especially raw silk and for this reason the raw material price became high. They also supported claims that firms could not make the huge orders asked for by customers because there was not enough raw silk material. This resulted in firms vanishing along with the opportunity to expand the market.

3.3 At recently the most of Thai Silk manufacturers have used low that it is difficult to make enormous orders within a limited time frame because almost all Thai silk products are made by hand, which requires much longer time periods for manufacture. However, Thai Silk might gain an advantage from trading handmade products as they represent high value and unique products.

3.4. Thai silk handicraft is suffer from lack of product design and value adding. The extent of design creativity is still in the early stages. Results from part of the issue has been differences in technology and quality which makes Thai silk suitable only for some types of products.

3.5. Thai silk domestic market has experienced severe domestic competition, higher customer requirements, and low support from the government. Thai silk manufacturers are facing extreme pressure to increase their profit margins by reducing production costs. They therefore have to continually generate and sustain their competitive edges over local competitors in order to survive in the aggressively competitive market. In addition they also push very hard to expand exports to potentially new foreign markets.

3.6. The competition both locally and globally is violent. In Thailand manufacturers have to contend with competitors such as the local silk market. Thai Silk exporters are now confronted with extremely high competition, it is interesting to study how they can survive in this highly competitive situation, and be successful against other global competitors. With regards to international trade, the Government is making the preparations that are deemed necessary to move the economy gradually but carefully ahead, towards a freer and open trading environment. The free trade arrangements are designed for a win-win situation, providing Thailand with strategic network and new markets for trade and investment expansion. Moreover, Thailand is fully committed to the multilateral trading system and the global trade liberalization under the supervision of the World Trade Organisation (WTO). There is no doubt that its negotiations to establish free trade areas at bilateral and regional levels are consistent with WTO rules, and will thus contribute to the multilateral trading system and the expansion of global trade and investment. Therefore, the global alliance of the major competitors in the industry will affect the overall Thai silk industry. High competitiveness in the international markets. The global Silk market is dominated by China. It is large in size, has worldwide networks, high technology advancement, and mass production whereas, Thai Silk manufacturers being of the small to medium size level, have not developed their own manufacturing technology and have instead relied on adopting technologies from

other countries, whilst competitors from other countries have technology that is comparable to China. Low cost producers provide significant competition to Thailand in labour intensive production, while Hong Kong, Korea, Italy, the U.S. and other countries have firm holds on the higher technology garment and textile market. The countries with lower costs and larger populations are thriving in the Silk industry. These countries include China, India, and Indonesia. Shortly the type of products, which are made in Thailand, will not be saleable because of their higher cost. Therefore, Thai Silk firms will have no choice but to compete with higher-cost producers who have product potential.

3.2. Recommendations

1. As result of WTO, Thai silk farmers face competition with foreign silk. Meanwhile, the silk weaving industry would benefit from the opening of the market due to the availability of cheaper raw material. Such market opening can help producers using raw silk yarn, as cheaper raw materials save production costs and gain a greater capability of an increase in exports; to earn more foreign exchange for Thailand. However, the Thai silk farmers would be affected and that they must make some adjustment to improve their efficiency and their capability of producing silkworm cocoons. A higher yield of silkworm variety is required to increase the economic return. The government may assist the Thai silk farmers by engaging in a research and development program directly or indirectly, in order to improve the varieties of mulberry trees and silkworm breeds/hybrids and reduce the cost of production. The polyvoltile and Thai hybrid are not competitive internationally, particularly against Chinese yarn imports. The government‘s policy should put more emphasis on polyvoltile and Thai hybrid both to increase raw materials and avoid strong competition. The polyvoltile and Thai hybrid silk yarns are the basis for high quality hand woven traditional silk products that fetch a premium relative to mass-produced silk fabrics. Rather than trying to compete on price, the polyvoltile and Thai hybrid silk industry should aim for high niche marketing trading. The importance issue that producers need to establish a Company’s brand name and “Made in Thailand/ Thailand best” are also important factors in gaining export success. Some producers indicated that the advantage of using made in Thailand is that Thai Silk is unique and can be differentiated from others.

2. Silk manufacturers need to forecast and prepare themselves for new regulations. Consumers are now intensively concerned about quality, design, and price. The social values about the well-being and interrelationship of the individual and the environment have led to mounting consumer support for “Environmental friendly” company initiatives and products. Therefore, it is an advantage for the silk industry because it is a naturally environmentally friendly product. The silk industry uses only a few chemical fertilizers and practically no insecticides. Silk, primarily made of proteins, it is close in composition to human skin, making it extremely comfortable to wear

3. Thai silk industry is focusing its efforts on improving the competitiveness of the local garment and textile businesses. Emphasis has been placed on upgrading existing machinery with modern technology for greater efficiency and keying in on human resource development in order to improve the knowledge and competency of Silk industry management and its workers through seminars, training and education. The Institute has tried to guide Thai textile and clothing manufacturers to operate similarly to those in countries with developed industries improving their designs, management, brand-name development, or to establish business relationships with foreign firms. Note that the development of the product and technology factor includes production and production technology measures but not product innovation. However, it can be assumed that technology or machinery for finishing

Silk fabric is going to be necessary in the future. The government should identify long-term strategic policies, R&D, technology development, and innovations, which the importance of the factors involved: product standard, production technology, technology development, and product innovation. Hence export performance will be increased.

4. There is still great potential for increasing domestic silk yarn production. Both the government and the private sector are working to improve the quantity and quality of silk production in order to reduce the need for imports. The challenge is to achieve these goals while at the same time reducing production costs so as to compete effectively in the world market. Thai silk handcraft cottage industry should put more emphasis on indirect export market through tourists. Because the exportation of goods began due to the influx of foreign visitors to Thailand. When visitors left satisfied customers of Thai silk products they continued their contact and began placing orders, which turned into greater scale business providing more profit than the domestic market. For this reason, Thai Silk firms believe that the export process needs to be improved at a greater rate than perhaps the domestic markets.

5. The rising costs of R&D and the need to develop new areas of technology are encouraging silk handcraft cottage companies should establish global relationships, such as international joint ventures and cooperative deals in the field of research and technology licensing. Some Thai manufacturers have been looking for relationships with their suppliers and international competitors in order to achieve a stronger competitive position.

Chapter 4. Two models for developing silk handcraft cottage industries

Silk handcraft cottage Model

Two models of Thai silk handcraft cottage industry which often found in Thailand are as follow ;

Model 1: Cooperatives silk cottage enterprise

Model 2: Private silk handicraft cottage

4.1. Model 1: Cooperatives silk handcraft cottage enterprise

This model is accounted for 53.4 % of the total number of SME silk handicraft cottages in Thailand. Main products are traditional fabrics and products, which suit to local market. Farmers ‘group operated their business in term of cooperative groups, which are promoted and support by government. There are many organizations of government, which promoted and supported silk handicraft cottage in form of farmers ‘s cooperative groups, such as The Queen Sirikit Institute of Sericulture (united Dept. of Agriculture and Dept. of Agricultural Extension since October, 2005), Ministry of Industry, Ministry of Commerce, Thai Tourist Organization etc.

Operation of silk handcraft cottage

The number of farmers is about 20 to 80, who were trained and had experience in dyeing and weaving skill, are formed into either formal or non-formal groups. All of them had their own hand looms. They set up committee structure which consists of leader (chairman), secretary, public relation, treasurer, marketing etc. The committee members have been elected and they will appoint a small team of full time staff who are expected to work with concerning agencies for their business. Some groups are worked in term of weaving cooperatives,

community enterprises, some groups are women weaving groups which are supported and promoted by SUUPORT foundation (Royal folks and arts crafts). This SME silk cottages shared their inputs, capitals, marketing as well as returns. The members are paid for their wages of dyeing and weaving according to their works before sharing the profits.

Silk Yarn Purchasing

The groups buy silk yarns from members who reared silkworm and reeled silk yarn, farmers 'groups from other villages, community reeling factories or factories. They used both hand reeled yarns and machine reeled yarn for warp yarn depending on their products and their orders. Silk yarns are purchased in a large quantity by their groups before diving into individual weaver. Beside the silk yarns, other inputs such as dyes and chemicals were also purchased by groups.

Silk Yarn Processing

Hand reeled silk yarns, were produced by the farmers, need to rewinding, doubling and twisting before degumming process. Silk yarn is being spun on a wheel which is set at an angle to the spinner for convenience and comfort during the process of twisting and doubling. The final step is re-reeling processed, silk yarn is being spun into skeins with weight 500 – 800 grams/ skein through their own traditional tools.

Designing/Products

There are two ways to design their products, the first way is individual design. Groups provided silk yarns to members who designed pattern and color by themselves. Most of their products are traditional designs, which are followed by generations. The members have their own designs and special skills according to their wisdom knowledge. Government trains them on new techniques, then they can apply to their works, in order to improve products quality. The second way, designs and colors made by the customers, so the weaving groups proceeded products according to their orders. There are many types of traditional silk fabrics that are produced by these groups such as mud-mee, chok, yok, khit, and prae-wa. The products had their unique through different patterns and designs according to the local where they are produced. However, about 20 % of the total silk products by these groups are modern silk fabrics such as plain silk fabrics and batik silk fabrics.

Degumming/Dyeing

Both of chemical and natural dyes are used by the groups. After products are designed, the members received dyes and chemicals from the groups for chemical dyes. However, members need to prepare raw materials by themselves for natural dyes. Skeins of processed silk yarn are degummed and dyed. In the Mud-mee fabrics, weft yarns are tied with strings, which is referred to in Thai as "Mud-mee", indicating how the name of this type of silk originates. Then it is dyed and tied and dyed several times according to their designs and patterns. The patterns and colors of the finished silk fabrics are determined at this stage, with complicated designs, which look like a printed designs on the both side of fabrics. While the warp yarn, which runs along the length of the cloth, it can be dyed in desired colors directly after degumming.

Weft yarn preparation

After finishing of dying stage, the strings are then untied and the thread wound on small spools. Dyed thread winding is also an important stage since the correct sequence must be followed, otherwise, the woven material will be flawed, and then pattern will be out of alignment, discontinued or change into an altogether design. The small spool is put into shuttle one by one as in order at the final stage of weft yarn preparation.

Warp yarn preparation

Warp yarn is produced with a simple device. The yarns used for warp are wound on a wooden board with knobs around which yarns are led so that a length of warp can be obtained without tangles. The number of warp yarns is related to specific beater to be used in the weaving. The next step, the warp yarn is removed from the frame. Each yarn is subsequently passed through the string heddles by twisting it together with warp end left from the previous weaving.

Weaving

Typical hand looms (pedal operated handlooms) are used to weave mud-mee, which has complicated designs. The looms are located in individual member‘s houses, only 5 – 10 looms at group ‘s office for demonstration. The members weave fabrics in their houses. After inserting the weft (as a small cone into a shuttle), weaver has to adjust by hand the position of tied and dyed weft in order to making clear pattern in the design. So this kind of loom gives lower production of silk fabrics about 1.5 – 2 yards (1.35 – 1.8 meters) / day (8 hrs). However, the end product has high value. The fabrics are collected from members and then sent to the group. Group committee collects, checks length of fabrics, quality check and collect fabrics in storage room.

Processing

Silk fabrics are sent to finishing factory or shops for finishing, then fabrics are ready for sale. Most of SME of silk handicraft cottages, do not have silk fabric finishing section, send their fabrics to proceed silk finishing at finishing factory or shops. The processing silk fabrics includes dry cleaning, fixing, printing on the silk fabrics which are needed to improve their quality in term of texture.

Marketing

The prices are set depend on the complexity of design and the labor input rather than the weaver as such. There are many channels for marketing of silk fabrics of weaving groups as following:

1. Retail trade: The total amount of silk fabrics are sold as retail trade is about 60 % of the total volume. The silk fabrics are sold to retailers through street vendors and formal retail trade. Most of SME silk handicraft cottage established their outlets for present their products for order and sale. Tourists and local people are the main customers for street vendors. The formal retail trade is the most important market. There are several fairs and exhibitions, which is organized by government both at national level and provincial level. The national trade fairs, which are very well know such OTOP and Made in Thailand Fair. The OTOP fairs are being organized 2-3 times/ year by Dept. of Export Promotion, Dept. of Community Promotion. This fair aims to promote the production of local goods by the communities and

assist communities in the marketing of their products. It is recognized that is an affective market channel for SME products. Producers can obtain both of retail trade and whole sale through advance orders. At provincial level, fair is organized by local government generally one a year.

2. Wholesale trade: This market channel, producers can sell their products directly to informal-contact customers, who are traders, silk processing shops, and exporters. The most of traders, have outlets in Bangkok, they did not have any factory to produce goods. Then they establish networks with SME in the local area and do informal-contract for ordering their products. The volume of this is accounted for about 15 % of total sale volume. The second channel of marketing is accounted for 15 % of total sale volume, that through silk processing shops for dress making or processing to increase value added. In order to have value added, traders buy silk fabrics from the group as a raw material and then process into such items as tablecloths, pillowcases, handbags, neckties, gifts etc. The exporters are the other market of the group. They make pattern and design and order the group to produce at certain period. The contract is made one by one. The volume of silk fabrics are sold to exporters is about 10 % of total sale volume.

See Annex

4.2. Model 2: Private silk handcraft cottage industry

This silk handicraft cottages, are run by private sector, which most of them are rather small enterprises compared to other business. There have 30 - 80 handlooms both in the factory and contract farmers. This model, is accounted for 46.6 % of the total silk handicraft SME in Thailand, is the main production of silk products for export.

Operation of silk handcraft cottage

This enterprises are operated by private sectors in term of company. They employ labors for all processes. Simple self designed machines are adopted to use to improve work capacity and efficiency in the factories. The production processes are more organized and more modern setting than model 1. Generally weaving factory cottage industry, they use labor both in family and hired labors. The hired labors are required to train for a certain time by the factory particularly in weaving skill before starting works. Most of owners have high skill and experience in designing, dyeing, weaving of silk fabrics and products. The design and pattern of products is less complicate, but it is modified traditional and modern way together. Most of factories have not designers, therefore owners design by themselves. However, some of them have section for design pattern, colors and products, that lead to high demand from market.

Silk Yarn

There are three types of silk yarn used in the factories: hand reeled yarn from the farmers; silk yarn from community reeling factory; and machine reeled yarn. All types of yarn can be used as weft depend on texture of fabrics, design of products, and customers' need. However they used only machine reeled for the warp, because it is more convenience for them to process.

- Hand reeled silk yarns, were produced by the farmers, need to process the same method with model 1. The final step is re-reeling, processed, silk yarn is being spun into skeins with weight 80 – 100 grams/ skein through modified motor equipment, which self design.

- **Yarn from community reeling factory** normally produces only simple standard yarn. Weavers need to do twisting by themselves if they need strong twisting except simple twist, which already done from the factory. Community reeling factory produces yarn to meet the basic standard of local Thai silk yarns such a diamond cross yarn, more evenness yarn, 80-100 grams of yarn/skein, standard diameter of silk skein. Then weavers used less labor for yarn processing. Therefore, this yarns are recognized as local Thai silk yarn and more popular for weavers.

- **Machine reeled yarn**, weavers can order reeling factory to do twist and double as well as dye the yarn for them. Weavers need to pay extra cost for the process that they requested apart from raw silk price

Products

The main products are traditional fabrics, modified mud-mee, modified fabrics for home textile, plain fabric, batik fabric, printing fabric, garments and silk products.

Design pattern

Medium scale silk handicraft factory, which has design section to design pattern and colors of products both applied traditional pattern and modern pattern. However, some patterns are designed by customers (make for order). Designers use Computer as a helpful tool for design section to help designers to do good and effective jobs. While small factories without design section, owner herself design pattern and colors.

Degumming and dyeing

At degumming and dyeing stage, low cost equipment, which is promoted by Dept. of industry Promotion, are mostly adopted by small silk handicraft cottage factories. The low cost equipment consists of: a typical dyeing oven, which is made from cement; one or two stainless steel vessels each of capacity 400 liters installed with one single chimney outlet. Either firewood or gas is used as fuel for heating the dye solution. The capacity of this equipment is about 100 kg of raw silk per day per set. For medium scale factories, some of them invest automatic dyeing machine, which give higher quality of dyed yarn than typical one.

Yarn preparation

Weft: Factories hired labors to do yarn preparation in the factory. Self developed motorized equipments are designed for winder. Machine consists of motor, a simple wooden frame mounted through an axle on pedestals on both sides of frame. The frame rotates freely when a handle attached to the end of axle is turned. Weft threads are laid out systematically on the frame for enabling marking of designs. The speed of winder is controlled by motor. This equipment can supply the weft yarn for weaving up to 10 looms/ set. This machine can reduce the labor cost of production.

Warp : The same method of warp preparation as model 1 is adopted by small scale silk handicraft cottages. Warp preparation tool is used in medium scale silk cottage. This tool develops from the typical tool. The set of tool consists of frame and 2-3 series of spools on the vertical frame. So yarns are being drawn from a series of spools on the vertical frame passed onto the horizontal frame which measures the warp. The process to prepare warp yarn

operates by hand. This tool is more convenient and has more efficiency to work. Warp yarns are prepared for ready to weave, the process to connect the new warp with the previous weaving operated the same as in model 1. This stage can not use any machines or any tools, it is only hand operation.

Weaving section

Loom: Looms are widely adopted by silk handicraft cottages are typical handloom (traditional loom/ hand throwing shuttle handloom) and fly shuttle handloom. These two types of looms have each strong and weak points, then weavers use it for different propose and works. Traditional handloom is used for delicate pattern and design of traditional fabrics particularly mud-mee. The speed of weaving is low. Fly shuttle loom is an other type of loom is being used in the weaving industry because of higher speed of weaving as about 2-3 times than traditional loom. Unfortunately, it can be worked for not complex design or pattern such modern mud-mee, plain fabric, traditional fabrics which is simple design and pattern.

Weaving management: The factory employs labors to weave fabrics at the factory and wages are paid according to yard of fabrics are woven and design/pattern. However, factory also makes informal contract to weavers outside factory to weave fabrics. These weavers are trained on weaving techniques at the factory and have weaving experience at least 6 months. Tied and dyed weft yarn (mud-mee), weft yarns, dye warp yarns are provided to weavers to make fabrics, which are ready designed pattern and colors from the factory. The contract weavers do their work at homes and use their own looms. They are required to finish their job at a certain time, therefore factory can control production volume. Generally, simple pattern, general and old design (design is being released for long time) is released to contract weavers otherwise factory has specific technique to control the products. The system that factory uses their contract weavers is widely adopted because it requires less capital for investment than other systems. However, good relationship between factory and contract weavers is very important.

Quality control section

This section aims to check quality of silk fabrics woven in factory and from contract weavers. The most important points for checking such number of yard, pattern, design, texture etc.

Processing section

- **Printing**: All of SME factory do not have printing section because high cost of investment. If the fabrics are being printed they will be sent to printing factory. Some plain fabrics are sent to print in the big factories most of them located in Bangkok. The printing factories provide patterns for weavers to select it. They charge for printing according to pattern and number of yard.

- **Finishing**: Woven fabrics are sent to do finishing process in finishing factory in local area and Bangkok. Cost of finishing process directly depends on number of yard

-**Garments**: Most of weaving factories have their contact garments shops to make for them. About 10 % of total fabrics is used for garments and other products. Normally garment shops order silk fabrics from weaving factories and they design and process for products. Hence, they work as a partnership together.

Batik silk fabric

A few weaving factories which do batik fabric. Most of the silk batik cottages buy plain fabrics from weaving factory and they then process batik at their factory. At present they do various of batik fabrics such original batik and modern batik which insert silver and gold paint in it.

Marketing

The markets for silk fabrics, garments and products are mainly for export, wholesale and outlets.

1. Export: There are about 40 % of total amount of silk fabrics are exported to aboard. Factories obtain their export order through main channel such international fair, outlets and e-commerce. Weaving factories join international road show, international trade fair, which are promoted by Dept. of Export Promotion to introduce and promote their products. Dept. of Export Promotion establishes website and collects name, address, type of products of weaving factories and traders in file of exporter list. This system is a good channel for importers to start finding out their products. In addition, some factories have their own website for marketing.

2. Wholesale: The main customers for wholesale are traders, silk processing shops, garment factories and exporters. The volume of wholesale is about 40 % of total amount of silk fabrics. The customers are both contract orders and informal contract orders. Factories get orders through website, trade show in country and international, outlets etc.

3. Retail: Most factories have their outlets at the place where fabrics woven and in Bangkok to present their products. Tourists, local people are the main customers of retail sale. On the other hand, the formal retail trade, which is organized by government both at national level and provincial level such OTOP fair, Made in Thailand Fair and annual fair of each province. Some weaving factories have their outlets in the fairs for marketing. The total volume of retail sale is about 20 % of the total sale volume of the factory.

See appendix D

Chapter 5. Regional Strategies and follow up action plan for silk handcraft cottage development

5.1. Thai government strategies

1. Increasing the standard of quality: Thai silk handcraft industry needs to increase the standard of the quality of silk products that are sold under the name of Thai silk. There are many varieties of silk products and standards are sold as the brand name of Thai silk. In order to increase the standard of Thai silk, it is necessary to improving fundamental reeling or weaving technique. The government’s policy to set up standard with different qualifications according to materials and process to certify its quality and standard. That will assure consumers to buy silk products which the quality and standard of the products met their required. Therefore, the products are guaranteed in term of quality and standard which will be described.

2 **.**The Ministry of Commerce's has created some new management policies in response to the changing business environment. This approach places a greater emphasis on maintaining a close working relationship with the business sector, while seeking to reform the organisation and inject new vigour into the working style of ministry officials. The flexible and streamlined working approach is reflected in the Ministry's achievements, particularly in

export growth. The policy promotes the development of a stronger and diversified domestic market and encourages outward expansion for international markets. Sustainable support from the government must be given. The assistance includes advice, creating jobs upcountry and facilitating export procedures.

3. Silk handcraft cottage are still small compare to other and still doing their business independently. Such system is not efficient for responding to consumers' needs quickly. They should jointly carry out silk production under their unified targets. Effective networking system such silk handcraft cluster should be established. In order to support each other in term of technology, raw material and marketing, that will promote silk handcraft development through the reduction of cost and at same time improving quality of the products. Silk handcraft cottage should concentrate to form networking as clusters in regional. In area of concentration of local silk handcraft cottage and SME which form the core of regional economy is called " silk cluster". The silk enterprise groups which resemble one another and silk handcraft cottage or SME groups which form supply chains may be regarded as one specific silk cluster.

4. Development of design and new products, in order to expand to new markets, by boosting of production of newly-designed silk textile and silk products based on market requirement.

5. Since experience from Thai silk, consumers admire and believe that they have different characteristic in silk yarn, design, dyeing, weaving method, which lead to make Thai silk is recognized the uniqueness of its properties. Thai silk handcrafts industry puts more emphasize on Unique Thai silk products. In order to compete to global silk market, Thai silk handcraft industries should expand and produce unique Thai silk which is different from silk made in the other countries. This image is expected to be a key factor to stimulate the Thai silk industries. Therefore, only one way to achieve this target is to use of local Thai silk yarns and traditional dying and weaving methods. At present, there are more countries will join silk production with lower costs. However, it is important strategy for Thailand is not to produce cheaper silk products with low quality to compete for prices but to produce things that satisfy consumers even though they are more expensive. Consumers usually have definite impression that silk is superb and valuable. It is important to produce silk materials and products to meet consumers' demand.

6. There are several directives to promote Thai handicrafts which would make them competitive in the global market. And to increase efficiency, marketing strategies are needed. These strategies include:

- To concentrate more on producing outstanding Thai goods which show the country's image nationwide and display them overseas, especially in countries where Thai goods have never been displayed before. Serious attention must be given to product quality and on goods development.

- Designs on the products as well as packages must be outstanding with an objective to attract attention from prospective customers right away.

- Administration run by the entrepreneurs must match the general economic situation, inside and outside the country. The administration involves laying out plans for production volume and quality which are designed for lowering costs of production in order to make them more competitive, fixing competitive prices despite the volatility in currency exchange in the future, and having a proper stockpile which would enable the delivery to customers within the deadline.

- Exploring for new markets overseas to cater for an expected increase in production. Although Thai handicrafts have been enjoying sustainable development, competitors like China, Indonesia and the Philippines which have been offering cheaper prices and have simultaneously developed their products with the objective to compete with Thailand. More risks must also be placed on new markets in case problems occur in the key markets.

Increasing markets is, therefore, the responsibility of every concerned party to give more attention along with boosting the efficiency of the production process and lowering the production costs in order to boost competitiveness. Concerned agencies must also conduct an in depth study on customers' demands or the targeted customers so that it can be used as information in developing the products in future.

5.2. Opinion/ comments

1. The threat of new entrants: The increased demand of Silk attracted many new competitors into the industry. Then existing firms found it difficult to raise sufficient barriers to entry. New potential competitors, especially Vietnam, bring a new capacity, and seek market share, and purchasing down margins, which limit the overall profit potential in the silk industry. However they need to develop their own technologies, these can be costly. Even more important than technology is the know how, built by existing players over their history, especially of the Chinese producers, it seems to be difficult and costly for new entrants to build such a large amount of know-how in relatively short periods of time. Therefore, these problems may be eliminated by regional collaboration or network establishment. The network can coordinate and exchange information, material, technology and know how along the supply chain.

2. Development of R & D should do by the government sector to reduce costs of silk handcraft products. Firms that successfully gain competitive advantage in an industry are those that move early and aggressively to exploit a new market or technology. Derived from the research findings, creating Competitive Advantage in the Silk industry demands an improvement in raw material and production processes, in addition to searching for better ways to compete globally. The Silk manufacturers will gain competitive advantages by technology, developing well-known brands, design or service provided, and speed of delivery.

5.3. Propose short/medium term development strategies and necessary follow up action

5.3.1. Short term development strategies

World forum for Sericulture

All countries participate in sericulture development can be grouped into developed countries and developing country. Most of developed countries are the main consumers of silk fabrics and silk products such Japan, France, Italy, USA, Switzerland, United Kingdom and Germany etc. While group of developing countries, such China, India , Thailand, Veitnam, Brasil, are recognized as producer country. Although international committee and Regional association for sericulture have been established to coordinate and exchange knowledge and experience mainly concerning on technical matters. However, there few countries participate in international committee and association, it may due to expense and policy of each country. Therefore, it seems to be a gap for international forum for sericultural countries, which include new comer, developed, developing, advantage, producer, consumer and trader, to discuss, identify, and analyze further major constraints on sericulture development in global aspect. This forum may recruit expert in all areas and fields both private and government

sectors. The solutions may lead to establish cooperation in many aspects within and between the groups. The contents which to be issued at forum should include all areas for sericultural development such silkworm rearing, mulberry production, reeling, weaving, processing, trading, marketing, information network. This forum should be organized and supported by international organization whom independent, long term recognized as FAO. There are many good views for FAO to set up World forum for sericulture as follows:

1. All countries are engaged on sericulture will join the forum because they honor FAO as an organization to assist all countries in the word without take any advantages.
2. It is the first forum of sericulture from the downstream to upstream countries to discuss in global.
3. Participated countries will appreciate and feel free to provide data and information, which is requested by FAO.
4. The solutions may lead to establish widely cooperation within and between regional in the further.

5.3.2. Medium term development strategies

1. Technical assistance and regional cooperation

There are broad areas where technical assistance through the regional cooperation can be effective. These areas cover from the production of raw material, processing to marketing.

1.1 Technical cooperation

In order to support each other among member countries/international producers in area of technical assistance and cooperation in production, this can include

(a) Exchange of germplasm by providing silkworm and mulberry cultivars to use in hybridization. This can help new coming/developing countries to develop their productions more efficiency and quickly.

(b) Exchange knowledge and experience in areas of egg production, silkworm rearing, silk reeling, dyeing, weaving, processing, mulberry production and management, pest and diseases control, sericulture extension, silk handcrafts production and marketing. This cooperation can be done in many aspects as following:

    1. Technical cooperation project which can be supported by FAO. The projects:
    2. Bilateral cooperation between countries
    3. Exchange experts/technical staff

1.2. Research and development

- The rising costs of R&D and the need to develop new areas of technology are encouraging silk companies to establish global relationships, such as international joint ventures and cooperative deals in the field of research and technology licensing. Some Thai manufacturers have been looking for relationships with their suppliers and international competitors in order to achieve a stronger competitive position.

- Regional / international cooperation can also include investment in research, because it ensures that the efforts are not duplicated given the high financing costs. Financing from donor countries /organizations can be considered to encourage investment in research. Silk handcraft industries underscore the ongoing need for research and development, because new products and techniques are being developed continuously. It is essential that any producers stay informed about new developments both in silk yarn production (mulberry production,

silkworm rearing, reeling), silk processing (silk fabrics, products, design) and marketing. The investment costs are high and need some skills and experience. Therefore, domestic, regional and international cooperation can help in sharing information on research and technologies.

- Marketing research**:** The cooperation and technical assistance in the area of marketing which members / silk producers ‘s group require for their developments in term of market expanding. Market surveys about niche markets in Europe, Japan, USA etc. Market surveys and study can provide information on silk market situation, market trend, regulation for exporting of silk products. This surveys and study requires financing which is supported by the donors or all members. The results are analyzed and used for planning of silk producing among member countries according to their specialize and potential to avoid the duplicated products and competition in the markets.

2. Establishment of networking

2.1 Establishment of information networks

In order to establish regional information network which would update and to be as the tool to disseminate technical, statistical and market information as well as a pool of local and international experts to all members on a regulation basis. So that both private and public organizations can have easy to access to technical assistance.

2.2 Establishment of production networks

The production network can be set up as silk producer clusters, so members in cluster can support and help in term of raw material (cocoons, silk yarns, silk fabrics), technology, equipment, marketing and trading.

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Chapter 6. Annexes

Annex 1

Table 1. Silk yarn production in Thailand (2001-2004)

Year	Silk yarn production (tons)	
	Hand reeled - yarn	Machine reeled-yarn
2001	1100	410
2002	1150	350
2003	1080	320
2004	1100	320

Source : Dept of Agricultural Extension, 2005

Table 2. World rawsilk production

In metric tons, per calendar year unless otherwise stated

YEAR:	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994
CHINA	N.A	84600	60000	58600	60 000	55 990	49 430	55 117	59 000	77 900	72 000
INDIA	14620	16369	16000	1585	15 214	13 944	14 000	14 048	12 927	12 884	13 200
JAPAN	263	287	391	431	557	649	1 080	1 920	2 580	3 240	3 900
BRAZIL	1512	1563	1807	1484	1 389	1 554	1 821	2 120	2 270	2 468	2 520
Uzbek.	N.A.	N.A.	N.A	N.A	1 100	923	1 500	2 000	2 500	1 320	1 800
Vietnam	N.A.	N.A	2250	2000	N.A.	780	862	834	1 500	2 100	N.A.
Thailand	1420	1500	1500	1500	955	1 000	900	1 039	1 144	1 313	1 377
Iran	N.A.	500	630	770	900	710	400	500	600	750	396
S.KOREA	N.A.	N.A	N.A.	N.A	15	28	146	146	146	346	491
N.KOREA	N.A.	N.A	N.A.	N.A	N.A.	150	150	200	360	600	1 200
OTHERS					1 250	1 272	1 438	1 666	2 165	2 217	3 504
TOTAL					80 480	76 290	71 727	79 590	85 192	105 138	100 388

Remarks: Figures in shaded cells are unconfirmed estimations

1) Figures of India by CSBB (Central Silk Board Bangalore)

2) S. Korea Prod figs estim. from Korea Sericultural Assoc. (KSA)

N.A. : Data not available

SOURCE: International Sink Association, 2005

Annex 2

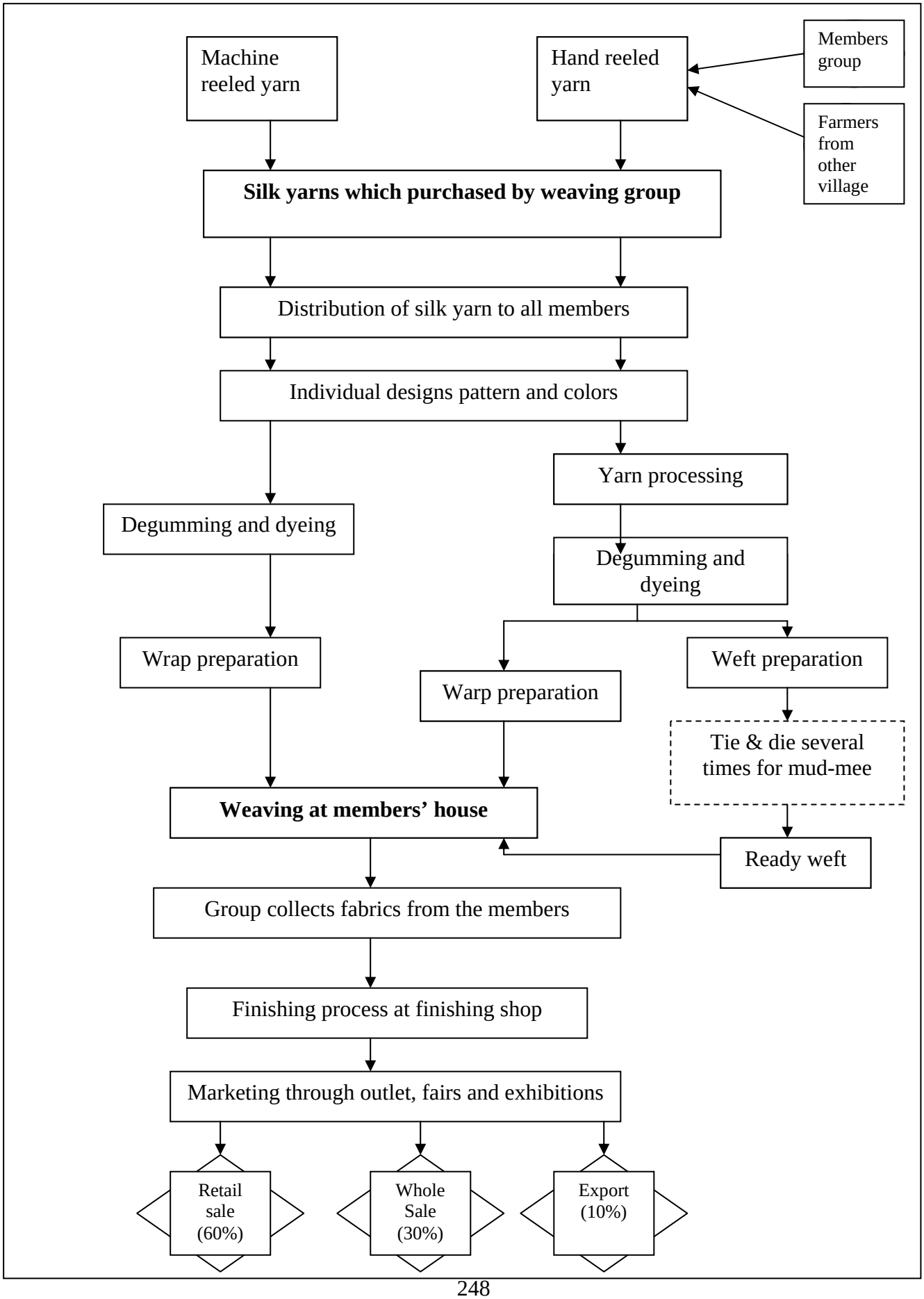
Table 3. The participants in the international silk trade can be divided into four categories

Categories	Countries
Mainly raw silk producers	Uzbekistan, Vietnam
Raw Silk producers and manufacturers of processed silk good	Brazil, China, India Thailand and Uzbekistan
Silk-converting countries which rely entirely on imported raw materials	France, Germany, Italy, Japan, Korea, Switzerland and UK
Neither produce raw silk nor process it	Certain European countries, Australia, New Zealand, Canada, USA, and the most of Africa and Latin America

Source: International Trade Centre UNCTAD/WTO, 2002

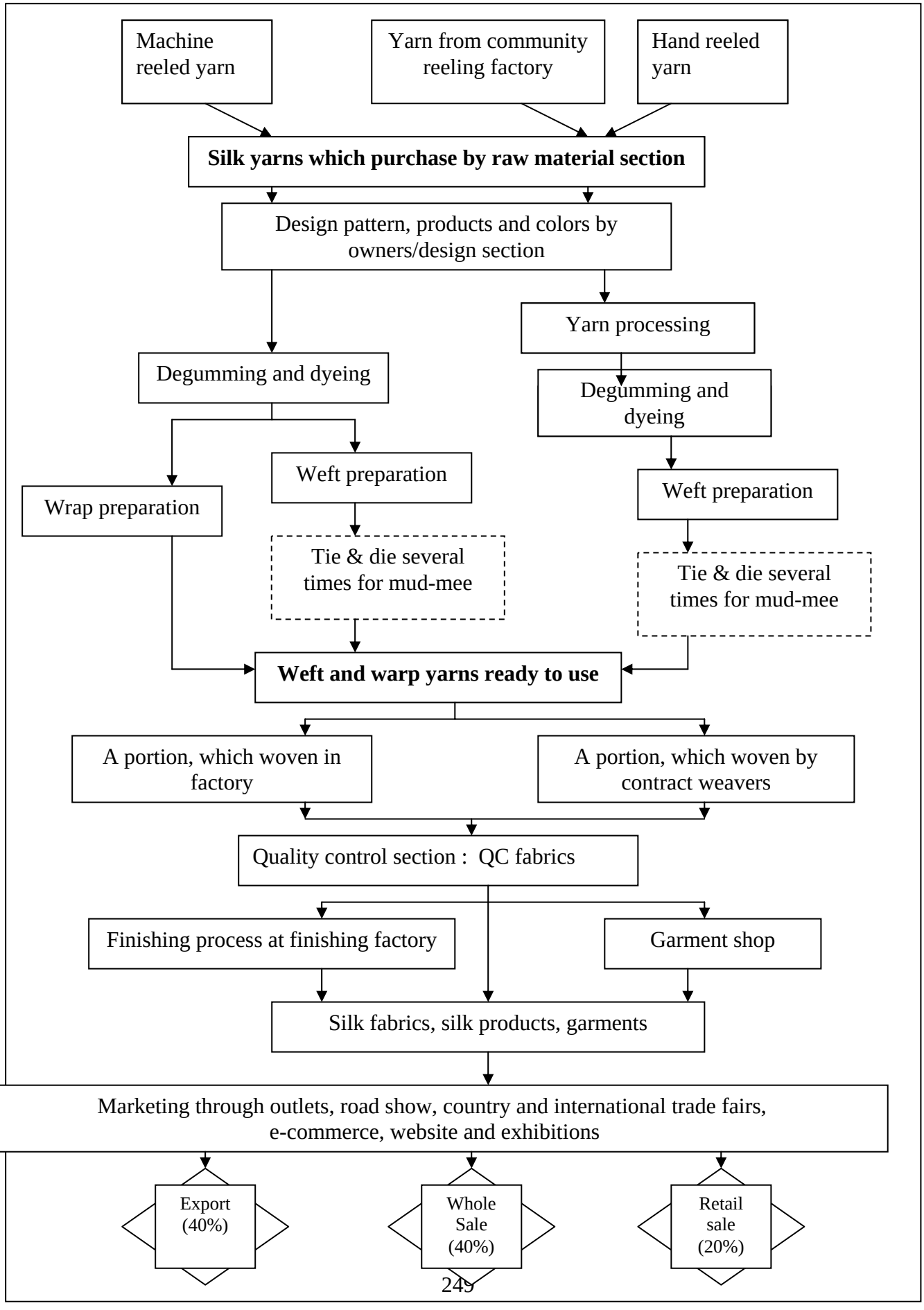
Annex 3

Model 1: Cooperatives silk handicraft cottages enterprise



Annex 4

Model 2: Private silk handicraft cottages industry



Annex 5

Photo of main types, activities, equipments of silk handcraft cottage industry

Traditional handlooms

Traditional reeling tool

Silk handkerchiefs

Community reeling machine

Silk boxes

Silk handcrafts cottage industries and silk enterprices development in Turkey

By

Erhan Ör
HEREKE CARPET WEAVERS ASSOCIATION

Paper contributed to "International Workshop on Silk Handcrafts Cottage Industries and Silk Enterprises Development in Africa, Europe and Central Asia", Bursa, Turkey 6 -10 March 2006

Food and Agriculture Organization, Rome, Italy

TABLE OF CONTENTS

ABSTRACT

Silk cottage industries were first established in Turkey during the 14th Century, and developped in ashort time to become world famous. In the 19th Century, many institutions and enterprises are established for the research, training and industrial production of silk handcrafts.

Today silk cottage industries still plat an important role in the socio-economic balance with the opportunity of providing income for disadvantaged women population living in rural, and sub-urban areas in Turkey. 80.000 women are generating income from silk based handcraft items.Main commodities of silk handcrafts are, Carpets, embroidery, fabrics, and textile accesories. Total volume of production worths USD. 139 Millon as of 2004.

Major constraints against silk cottage industries are: low labour and materials costs in far eastern countries, low quality raw materials, lack of financial resources, replications of Turkish designs by the other countries, and marketing problems.

Turkish silk handcrafts mainly consist of carpets, should be standardised, capacity utilisation and the quality should be improved. Handcrafts training programs, and generic marketing campaigns on national and international level are expected to have positive impact on the future of Turkish traditional silk handcrafts.

Keywords: silk, cottage industires, handcrafts, sericulture, carpet weaving, embroidery, fabric weaving, Turkey, Hereke

Chapter 1. Introduction

It is a know fact that the silk industry has played a significant part in the lives of many nations since the times of Antiquity. This industry has acquired more importance as it reached our day. Silk and spices deriving from the Far East always enjoyed a remarkable role in international relations. Silk has also enabled the west to get acquainted with the East. This was initiated primarily by merchants travelling in both directions.

The Egyptians followed by the Romans, purchased silk from the Chinese and it began to be used by Westerners as early as 753 B.C.

Studies reveal that it was the monks who first brought cocoons to Byzantium from China in the year 555A.D. the cocoon trade spread from Byzantium to Greece and from there to Italy, Spain and France from the 7th Century onward.

Silk cottage industries were first established in Turkey during the 14th Century, and developed in a short time to become world famous. Bursa and Diyarbakır had become main centres for silk and silk fabrics called; kadife, sırmalı, diba, atlas were woven and exported worldwide.

During the Ottoman Empire and early Turkish Republic eras, Silk industry was an important sector, and silk products had a considerable share in overall exports. With the industrialisation, and introduction of synthetic fibres, the share of traditional silk crafted items reduced. After the globalisation movement in the 20th Century and specially, China's opening the doors for international trade, Turkey's sericulture and cottage industries effected negatively.

Before the mass production of textile and apparels, the tradition was; the elderly used to teach the techniques to the young ones at home. There were some women, known as 'Aşina Kadınlar" (the experienced women) who used to visit other houses and teach handcrafts techniques as well.

In the 19th Century, the art of silk handcrafts took on an additional dimension with the opening of many institutions teaching embroidery, carpet, and woven fabric making. Amateur products were produced at home to support family income professionally. The products produced at home used to go to the bazaar to be sold to domestic and international markets and apart from being a focal point for knowledge, appreciation and skill, became a source of income for the country as well. Cooperatives used to coordinate the flow of products from houses to the market.

This system went on for many years, until the young ones did not had anymore interest for these handcrafts, where many machine-made products were available in the market in many variations at cheaper prices.

When the risk of the loosing this cultural heritage become obvious, some precautions at government and NGO level had been introduced. With the effort of Ministry of Culture and Tourism, and Ministry of Education, Art and Crafts Schools for girls established after 1930's. Today many civilian initiatives like Hereke Carpet Weavers Association, municipalities, foundations, and public education and training centres are involved in the survival of silk handcrafts.

Handcrafts play an important role in the socio-economic and inter-gender balance with the opportunity of providing income for disadvantaged women population living in rural and sub-urban areas. It is estimated that about 80.000 women and their families generating income from silk based cottage industries where the majority is carpet weaving.

The accumulated know-how, tradition, and available labour are the opportunities for silk handcraft cottage industries. However the diminishing sericulture, poor reeling facilities in

Turkey, and low labour wages in far eastern and Asian countries are the main risks for the Turkish silk and silk based handcrafts.

Training, design and product development and marketing issues are main items in the agenda. It is envisioned that, funds should be deployed for the protection of this cultural heritage at national and international levels. Tax and social security issues should be solved for organised production and marketing of these products.

Chapter 2. Background, present status and future prospects of the silk handcrafts cottage industries sector and silk enterprises in Turkey

2.1. Background

Handicrafts have been around since man's earliest days in accordance with the prevailing environmental conditions. The first examples were necessities such as protection or coverings. Handicrafts were later improved and adapted according to environmental conditions, eventually becoming "traditional" and accepted as an art that reflects the artistic sense, feelings and cultural characteristics of a society.

Traditional Turkish handicrafts form a rich mosaic by bringing together genuine values with the cultural heritage of the different civilizations which have passed through Anatolia over the millennia.

Traditional Turkish handicrafts include; carpet-making, sumac, cloth-weaving, tezhip(illumination), tile-making, ceramics and pottery, embroidery, leather manufacture, musical instrument-making, masonry, copper work, basket-making, saddle-making, felt-making, weaving, woodwork, cart-making etc.

Weaving materials in traditional Turkish handicrafts consist of wool, mohair, cotton, bristles and silk. Weaving is a handicraft which has been practiced in Anatolia for many years and considered as a mean of earning a livelihood. Silk carpet weaving centres were Kayseri and Hereke. Today silk carpets are woven in Konya, Tokat, Sivas, Gazi Antep as well.

Embroidery, a unique example of Turkish handicrafts, is not only used for decoration but also as a means of communication tool with the symbolism in its designs. Today, embroidery made with tools such as the crochet needle, needle, shuttle and hairpin designed either as a border or motif, and goes by different names according to the implement used and the technique. These include; needle, crochet needle, shuttle, hairpin, silk cocoon, wool, candle stick, bead and left-over cloth. Embroidery is generally seen in the provinces of Kastamonu, Konya, Elazığ, Bursa, Bitlis, Gazi Antep, İzmir, Ankara, Bolu, Kahramanmaraş, Aydın, İçel, Tokat and Kütahya, although it is gradually losing importance and becoming restricted to trousseau chests.

As a result of changing living conditions, and particularly industrialisation, the production of these has now pretty much ceased altogether[1]

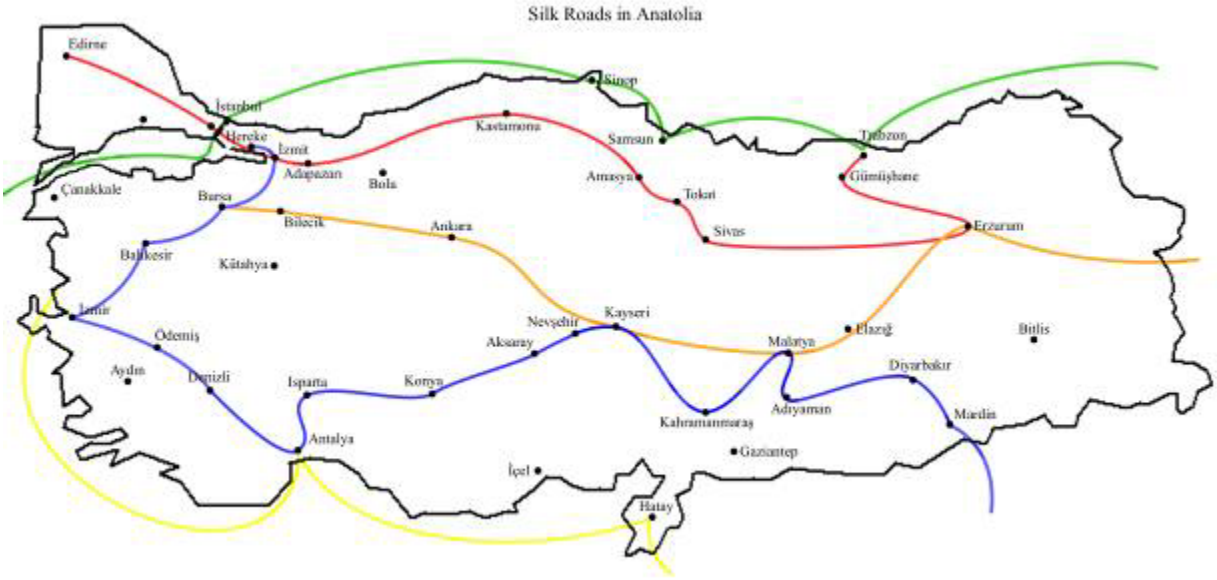
2.2. Silk Roads of Anatolia[2]

Anatolia, due to its geographic location, is functioned as a gate and bridge between west and east as well as being a place on where various civilizations are founded and developed since ancient ages. As a result of this, during various periods, road webs with various directions and

[1] Ministry of Culture and Tourism - Turkey
[2]Ministry of Culture and Tourism http://goturkey.kultur.gov.tr/turizm_en.asp?belgeno=9262

character such as Kings Road (VIth century B.C., Roman Era Roads (IInd century B.C.), have surrounded the Anatolia.

Transportation of silk and spice as well as other products of east to west, is formed commercial roads named as "Silk Road" today and reaching Europe from China. Silk Roads were not only the commercial roads but also maintained cultural relations between east and west for centuries.



Silk Roads in Anatolia:

At north; Trabzon, Gümüşhane, Erzurum, Sivas, Tokat, Amasya, Kastamonu, Adapazarı, İzmit, İstanbul, Edirne;

At south; Mardin, Diyarbakır, Adıyaman, Malatya, Kahramanmaraş, Kayseri, Nevşehir, Aksaray, Konya, Isparta, Antalya, Denizli centers are followed.

It is known that Erzurum, Malatya, Kayseri, Ankara, Bilecik, Bursa, İznik, İzmit, İstanbul route is also used. Extension of Antalya - Erzurum route, composed with connections of Sivas and Kayseri on North and South routes, is connecting Anatolia to Iran and Turkmenistan.

On this commercial axis, maritime lines besides road is also used, and it is following.

In the Black Sea, Coming from North to Trabzon, Samsun, Sinop, İstanbul, Bursa, Gelibolu, Venedik over Batum;

In the Mediterrenean; Antakya, Antalya, İzmir (Foça), Europe line over Syria.

After 14th century, Silk Road continued its importance, and begin to loose its vigor as a result of inventions made during New Age. On 16th and 17th centuries, after begun of cultivation of silk in Europe, it has faced with the danger of loosing its former importance.

Caravans become vanish and products of Far East begun to loose their attraction with increasing maritime activities. Silk Road become not used beginning from 19th century.

Although history of silk and silk based handicrafts is very old in Anatolia, silk demand increased specially with the expansion of Ottoman Empire during XVI. th century.Untill the end of XVI.th Century, Ottomans imported raw silk from China and Iran. During the reign of Sultan Yavuz Selim (1512 – 1520), silk trade had been dominated by the Turkish tradesmen.

An important part of the silk brought to Anatolia had been exported to Italy, Hungary, Lehia and Russia.

Bursa had been an importand center for both silk trade and silk woven fabric production. With a policy to relive from dependancy to Iran, first sericulture was started at Bursa in 1587.

Silk weaving which was started during the XIVthe Century developped during XV th century and peaked at the XVI. Century. In 1500 there were about 1500 silk weaving looms in Bursa. Main weaving centres were; Bursa, Istanbul, Edirne, Amasya, Denizli, Izmir and Konya. From XVI th Century silk weaving deceased, and Turkey become a raw silk exporting country.

The first silk reeling mill was opened in Bursa by Konstanz Bey in 1833, and a second by Boduryan Efendi in 1843[3]. Imperial Silk Mill was opened by Sultan Abdulmecit in 1852[4]. Gradually the traditional small craftsmen made way for industrial scale manufacturing.

2.3. Regional and country diversity of traditional silk handcrafts items

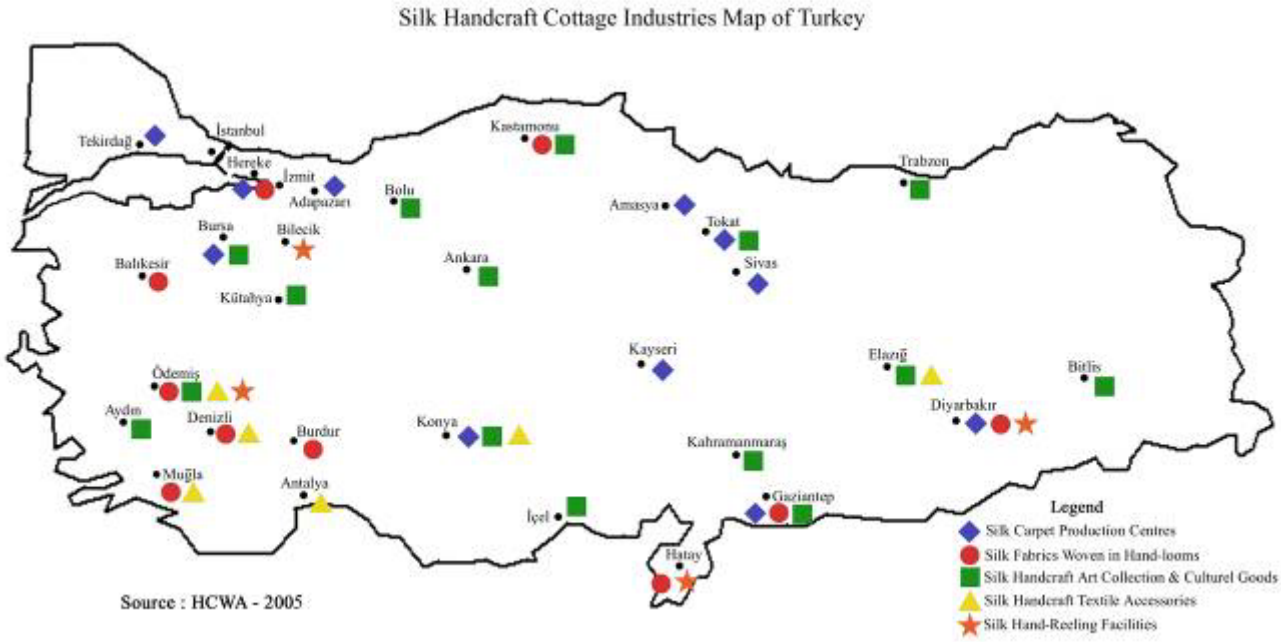
Silk cottage industries are established on the Silk road routes passing Turkey and sericulture farming areas.
Main centres are as follows;

Silk reeling :
Bilecik, Diyarbakır, Hatay

Silk Carpets:
Kocaeli (Hereke) , Bursa, Adapazarı, Konya, Kayseri, Diyarbakır, Gaziantep, Tokat, Amasya, Tekirdağ and Sivas

Hand-loom Fabrics:
Denizli (Buldan), İzmir (Ödemiş, Tire), Hatay (Harbiye), Kocaeli (Hereke)

Embroderies:
Bursa, Trabzon, Bilecik, Kütahya, Çankırı, Burdur, Kahramanmaraş, Yozgat, Kastamonu, Adana, İçel



[3] Ministry of Culture and Tourism http://goturkey.kultur.gov.tr/turizm_en.asp?belgeno=1933
[4] History of Textile Istanbul 1992 - Prof. Dr. Emre Dölen p.160

2.4. Silk cottage enterprises types in Turkey

1. **Villagers** – self employed, often weave carpets or knit embroideries for own consumption (Cradle covers, cradle sets, peşkirler (napkins), bed sets, bride and groom's cloths, table covers, floor coverings, etc.) Sometimes the products are traded for income at village markets. Product types are embroideries, carpets, kilims. For this type, main motivation is not trade or income but to satisfy own personal needs.
2. **Family enterprises**: Consists of 2 to 3 women of the same family (i.e. mother and 2 daughters) weave carpets at home and sell in the village market. Motivation behind the production is more income generation for the family.
3. **Trader entrepreneurs**: Acts as the financer for the loom, raw materials and equipment. Recruits 5 to 50 weavers at villages on a monthly wage. Another system is pre-finance of the 50% of total carpet production cost. In this case the materials are purchased by the weaver herself. The remaining 50% is paid at the finalisation of carpet. Mostly act as an intermediary between the producers and larger trading companies or carpet stores.
4. **Small and Medium Size Enterprises** (SMEs): these types of enterprises are more structured companies with design, production and marketing units. Companies have workshops or weaving mills for carpet or silk fabric production. Some companies produce, textile accessories and garments, but mostly use mechanical ways or machinery rather than handcrafts in silk commodities. Those which can be considered as cottage industries recruit and subcontract 50 to 2000 workers on a monthly wage. The typical production capacity is about 100 to 2500 sqm of silk carpet or silk fabric.
5. **Non-profit organizations** (NPO's): Produce silk commodities as a result of vocational training programs. These programs are financed from the local budget or, regional development funds. Examples to those NPO's are Municipalities, Chambers of Trade, Foundations or Associations. Main aim is to preserve silk weaving culture and traditional handcrafts, and provide income for disadvantaged women or disabled persons living in rural and sub-urban areas.
6. **State Enterprises**: Hereke Imperial Silk woven fabrics and Carpets Factory and Sümer Halı are examples to this type of enterprises. While Sümer Halı is still active in hand woven carpets production, Hereke Imperial factory does not have any commercial facilities since 1993. The Factory is transferred to Turkish National Assembly, and services as a museum.

2.5. Silk Handcraft Commodities in Turkey

Embroidery

Embroidery is the ornamentation of materials such as leather, cloth or felt with silk, wool, linen, cotton and metal threads and needles.

The art of Turkish embroidery has a long history. The word "ornament" is used as a definition of decoration in houses, clothes and furnishings.

Embroidery began in the palace, later becoming a decorative folk art.
The embroidery techniques and needles that are used today are the end product of many changes based on economic and geographic conditions and aesthetical values.

Knitwear

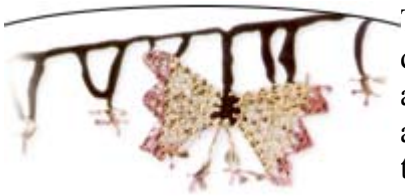
Knitting occupies an important place in traditional arts, and is still widely practiced today. Turkish handicrafts have a rich accumulation of thick and thin fabrics made with hooked and knitting needles, hairpins and shuttles with silk, cotton and woollen threads. Knitting is done by holding the thread with loop knots with the help of the needle.

Edging Embroidery

Oya (edging embroidery) is one of the most elegant examples of Turkish handicrafts and has been described as: "thin lacework" or "decorative silk or thread knitted and fringed onto women's clothes (outdoor slippers etc.) by needle-work or else by sewing on ready-made ones."

"Oya is the name of ornamentation knitted by a coloured thread in the shape of a leaf or flower," "Oya is a kind of lacework. It is characteristic of Turkey. Normal lacework has two dimensions, however, whereas oya can be knitted in three. It is placed on the sides of the fabric as a decoration," "Oya is an art that involves knitting techniques with the aim of embellishment and decoration." One might also describe oya as a handicraft made by tools such as needles, weaver's shuttles, awls and hair-pins and by using auxiliary objects such as silk, cotton, spangles and beads.

Needle Embroidery



Turkish needle embroidery is known as "Turkish lace" and does, indeed, resemble lacework at first sight. The two are actually different, however. Lacework is made by sewing onto an object, and is two-dimensional. Turkish embroidery is three-dimensional and may be used as separate, distinct ornament. Silk is the material most generally used for needle embroidery. The invention and development of needle embroidery is largely the result of Anatolia's being on the Silk Road and having its own silk production.

Picture: Butterfly, Ankara/Nallıhan

Cocoon Embroidery

The materials used in cocoon embroidery are pieces of cocoon and silk. The main decorative elements are made with cocoons, and then parts knitted with pins or hooked needles are added to the cocoons. Sometimes the cocoons are painted in different colours. This embroidery is as difficult as needle embroidery and takes a long time to make.

Picture: With Butterfly, Niğde

Bead Embroidery

Bread embroidery is done with silk, cotton and synthetic threads and by using beads. The beads are added onto the edge of the embroidery, which is itself made by pins or hooked needles.

Different names are employed depending on the embroidery and tools used. This type is the most commonly made embroidery in Anatolia. **Picture:** Grape Leaf, Konya

Socks

Taking national costume as a whole, knitted socks clearly occupy an important place with their original designs and harmonious use of colour. Knitted socks which occupy an important place and have a particular significance in Turkish handicrafts with their different materials and meaningful designs began to lose importance with the advent of machine-made products.

Weaving

Weaving can be defined as the production of a plain surface created by horizontal and vertical passing movements of weft and warp loops.

Warp loops standing side by side are divided into two with the help of a tool called a "nire," and weft loops are passed through this empty space (called the mouthpiece) with the help of a shuttle, and plain surfaces are thus produced.

Weaving can be classified into three categories depending on tools and techniques used:
1- Shuttle Weaving: Fabric weaving, Siirt blanket, kola and capon weaving.
2- Weaving with Kirkit:
A- Plain Weavings with Kirkit: carpets, Cecil, zillion (sill), sumac
B- B- Kirkit Weaving with Pile: rug
3- Weaving without a Shuttle: Palaz, Kolan, carpana (with or without card)
Weaving without Tissue (felt)

Traditional Turkish weavings can be grouped into those made for house, market and palace. These are made of wool, cotton and silk, and are produced by women in houses as examples of Turkish handicrafts. They come in various types such as carpet, fabric, handkerchief, towel and large napkins.

2.6. Production Techniques of silk handcrafts

Embroidery

Turkish embroidery techniques vary according to the way the needle is used; the needle may applied to the woven threads (Chinese needle, Romanian needle, Cretan needle, French knot, calculation needle, herringbone, eyebrow etc); or to pull the woven threads (scalloped ribbon); needles may help to close the threads (Bukhara knot, Jacobean weft, Maraş work, appliqué, bead work, sequin work), or to bind the threads (patchwork, dove eye, Antep work, passing work etc.).

Embroidery is done with various materials such as, silk, wool, linen, cotton and metallic threads over felt, leather and various textile products, using different kinds of needles and application techniques. The application techniques seen on fabrics are divided into five main groups according to the basic system applied on the weft and warp threads of the fabric.

There are rich variations in the context of these main techniques, namely: needlework created with running the threads of the fabric, needlework created with ending threads of the fabric, needlework created with pulling threads of the fabric, needlework created with cutting threads of the fabric, and needlework created with tied fabric or threads of the fabric. The action of the needle in sewing in manners of different quality and quantity that decorate the surface of the fabric results in different sorts of application variations under the five main techniques. In the first group, the length and width threads of the fabric are either covered in a free manner or are covered by counting. In the second group, the threads assigned to the small or large surfaces of the fabric are covered with decorative embroideries or other types of fabric, scales, beads or plates. In the third group, needlework is applied either on the sides of the pulled

threads or to the sides of the length and width threads left open to be pulled. In the fourth group, needlework is applied to decorate and avoid deformation of fabric torn, cut or to be cut. In the fifth group, needlework is applied to tie the threads of the fabric or to combine fabrics together.

Needlework applied in the Ottoman Empire period can generally be listed as: open-work embroidery, streamline stitch (akma), satin-stitch embroidery (anavata), appliqué, astrakhan stitch, herringbone pattern, Bosnian stitch, straw stitch, coarse muslin (cheesecloth) stitch, dival (gold/silver thread) embroidery, knot stitch, braiding embroidery, Crete stitch, Gobelin stitch, mat stitch, calculative stitch, post-needle stitch, suzeni stitch, kesme ajur (cut open-work embroidery), cord attachment, sand (fine) stitch, susma stitch, tel kırma (thread cut) stitch, surface pesent stitch, scaling, steel stitch, and chain stitch.

Needle embroidery

Needle embroidery is done by making loops with threads and by pulling the needle and thread through the loop. There are two types of needle embroidery: square and triangular. Needle embroiders can be either single or double-embossed. In single-embossed embroidery, the needle is first stuck into the fabric and the thread turned from right to left in order to form a circle. The loops are repeated with particular spaces between them, and the first line, called the giraffe, is thus constituted. On the return, the loop is made by passing it through the circle from left to right. The second line is made by repeating the same process by sticking the needle into the connecting point in the first line or into the middle of the loop by forming designs such as root, rock and main embroidery that will create the main contour
Picture: Grapevine Rose, Elazığ

Shuttle Weaving
Weft loops are passed through the group of warp threads with the help of a shuttle, and woven fabric with a plain surface is produced.

Silk handcraft fabric types are attached as Annex-1

Kolan Weaving: These are belt-like weavings, flat and wide in shape and composed of wool, linen, cotton and bristle threads. In Kolana and carpana weavings, a stick is used instead of the "gücü," but as these are made with a shuttle, they are considered part of the shuttle group.

In Kolan weaving, warp threads are stretched between two sticks staked into the ground and another stick that can play the role of the "gücü" is passed through them. As the third stick is rotated, a hole opens between the warps and weft threads are passed through these holes and tightened in order to produce the weaving.

Weaving With Carpana (tablet): This is the simplest of weaving techniques, made with square cards with holes on the edges. Tablets, which may be made of camel or ox skin or else walnut, are called carpana.

The warp threads are arranged according to their colour and passed through the holes. When the card begins to rotate, a space opens up and the weft threads are passed through this space, and so the process continues. One tip of the warp is tied to the weaver's belt or to the sticks on the ground. The surface of the woven fabric is full of warps.

Weaving with Kirkit

A. Plain weaving with kirkit:

In some parts of hand weaving, a tool called a "kirkit" is used in order to tighten the weft loops, and the hand-made material produced by using the kirkit is called 'weaving with kirkit.'

Kilim Weaving: This is a weft surfaced weaving, in which the weft threads are passed through the warp threads, one to the front and the other behind, and in which the warp threads are tightened and hidden. In kilims, on special areas where designs exist, coloured weft threads continue until they reach the borderline of another design and then return. In this way, designs begin to appear when same coloured wefts go and come between the warps.

When the weft thread sticks between stretched warps, this is called the "face of warp," and when wefts and warps are tightened equally, this is called "bezayağı" weaving.

Kilims may differ according to their weaving techniques: these include, carpets on which there are warp spaces between colours, carpets in which warp spaces are diminished (single clamp, double clamp, cross knitting, weaving wefts on a single warp), kilims in which warp spaces are diminished between colours, carpets whose designs are put in a framework, carpets with curved wefts and carpets that include additional threads between wefts.

Cicim Weaving: This is a kind of weaving done with different coloured design threads applied and tightened between weft and warp threads. Cicim is a kind of weaving which is applied on the reverse. Cicim weavings whose weft is composed of bristles are very common.

Relief's, which look as if they have been additionally applied with a needle, are to be found here. Weft and design threads follow each other in cicim weaving. After the weft thread has been dropped, either the design thread or a number of warp threads are dropped in order to create the design.

In cicim weaving designs on the surface may have different appearances due to the width of the threads employed. Fabric bags, tablecloths, bridal sacks, prayer sheets, pillows and quilts are all made from cicim weaving. Cicim is produced in weft thread or bezayağı techniques. There are two or three kinds of cicim weavings according to the application of the design thread.

Zili (sili) weaving: Design threads are applied three on the surface and one below the surface in their own design area. After the line is completed, one or more wefts are applied and tightened. In diagonal designs, this process is continued with the sliding of the thread on each line. Sometimes both diagonal and perpendicular designs are applied in the same weaving.

Zili, which has a hard and rough appearance, is composed of briest. It is still produced by nomadic shepherd peoples, and because it is hard to create designs on it, it has changed very little since the earliest days. Zili weavings are preferred for making various tents, sacks, cushions, pillows and mats. There are plain, cross, frame worked and checked zili weaving, all depending on the different application techniques.

Sumak weaving: In sumak weaving, design threads are continuously wrapped around the warp loops in the same coloured design area. While being wrapped around the warps in the same area, threads may also be wrapped in other design areas by reversing or going up the sides. Design threads create reliefs on the surface of the cloth. In sumak weaving where weft threads are not used, cicim, zili and kilim techniques may be applied. It is preferred in the

making of prayer sheets, packsaddles and mats. Plain, reversed weft, crossed weft and herringbone are some of the commonest types.

B. Kirkit Weaving With Pile (Carpet Weaving):
Carpets: A warp skeleton is constituted by placing bristle, cotton, silk and wool threads side by side. Every double thread in the skeleton is tied with silk or floss silk by means of various techniques and is tightened with the weft thread and kirkit. This is how weaving with piles is done. In rug production, there may be two or three wefts.

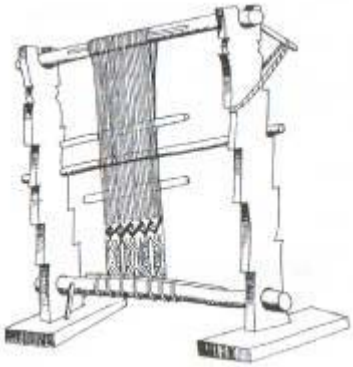
In Turkey, two-wefted carpets are generally more common. After completing each line, pile is cut to the desired length with the help of carpet scissors. In recent years, there have also been rugs whose piles are cut to different lengths in order to create reliefs on the surface. These can also be used as mats, coverings and pillows etc.

Two types of knots are used in rug weaving.

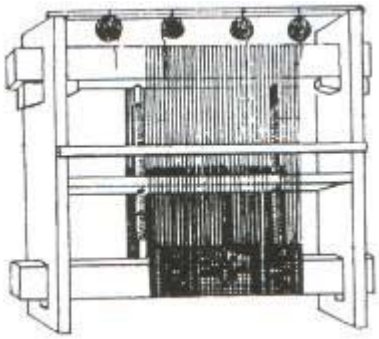
1- Turkish Knot (Gördes Knot – Double Knot – Closed Loop):
This is known in the relevant literature as the Turkish knot, which is used in carpet production and takes that name from the way it was initially used in the village of Gördes in the province of Manisa. There are two types of Turkish knot. In Central Anatolia, first the front then the rear double warp is wrapped around with the thread. In Western Anatolia, the reverse procedure is carried out. Although these two types do not differ in quality, the pile of Western carpet is easier to cut.

2- Persian Knot (Sine Loop – Single Knot – Open Loop):
This takes its name from the fact it was first used in Western Iran. In this knot, the thread is only tied to the front part of the double warp, then passed behind the other warp and tightened by pushing downwards. In rugs with a Persian knot, two warp threads are also used.

Looms may be classified as follows according to type of use:
a- Looms with Kirkit: There are three such types; the table or horizontal looms (portable looms used to produce bezayağı weaving), the perpendicular loom used for carpets and plain weavings.

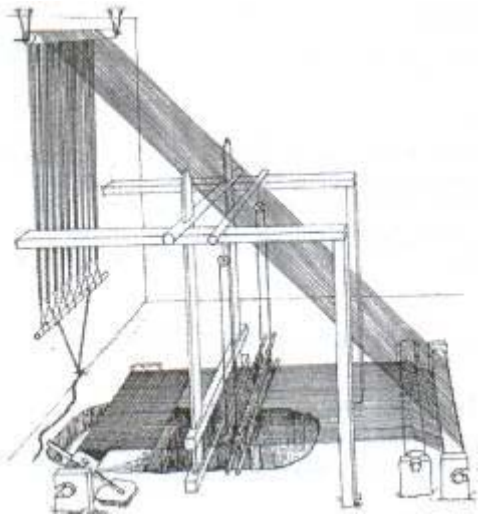


Wrap Loom

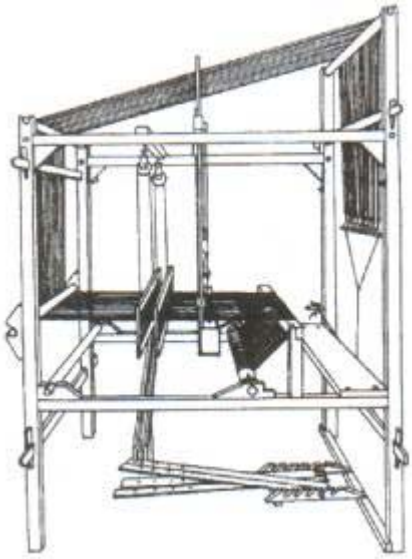


Brace Loom

b- Looms with Shuttle: Non-whipped looms (generally with two pedals, the shuttle being worked by hand), looms with whip (the whip pulls the shuttle while weaving), dimple looms (the place where the weaver sits and the pedals stand is in a hole), high looms and jacquard looms (used in weavings which require more than thirty two gücü).



Dimple Loom



Whip Loom

Jacquard Hand Loom weaving

This type of loom has advantages for weaving complicated designs. Every warp stretched individually enabling an individual weft can pass through. Perforated motif cards are used in this type of looms. These looms are used in the Hereke Imperial Factory since the 19th century and even today four looms are still operational for restoration of original fabrics used in Dolmabahçe Palace and other Chalets from Ottoman period.

Picture: Jacquard loom workshop in Hereke Imperial Factory

The Technique of Hereke

The initial preparation of the loom is different compared to other techniques in the world. The first warps are in the front, the second warps necessary to wind the threads, are behind the first in other types of rugs they are beside one another. This style allows the possibility to pass a second weft is thinner and it zigzags to hold the knots in case the carpet is damaged. Accordingly this is the factor that makes the difference between other carpet making techniques and the Hereke technique. Hereke are double-knotted, this results in the carpets having higher durability and the knots can not be undone and taken out unlike single knotted carpets which can come undone if pulled with force. Using the double knots we also ensure 45 degree angled piles, as opposed to the piles single knotted carpets which have a 90 degree angle. Single knotted piles result in the carpets becoming shiny by using. At the same time

however, they become damaged. Another effect of the 45 degree angle is that Hereke carpets have two different appearances from two opposing sides. Natural silk has a darker colour inside compared to the shinier surface of the thread. This difference in colours between the inside and surface of the thread causes the changing appearance when the carpet is viewed from different directions.

After completing each knotted row of the carpet, the knots are squeezed by using the force of an iron comb. This puts all the knots in order and increases the density and strength of the carpet. After this stage is completed, a horizontal line is passed between the front and the rear warps. Then a wooden dowel in the loom set above the knotting area is moved up. This causes the rear warps to come to the front. Now the second weft is zigzagged through the two lines of warps. After this is done the wooden dowel has to be taken back down, and the two horizontal lines are forced down by the iron comb. Now the ends which are forming the pile are cut down very carefully by using special scissors. All this is done after completing every single row of knots.

Colour, Design and Painting in Traditional Arts

Design:

Designs, the result of prevailing environmental conditions, are the cultural language and source of art. These symbolic designs reveal the characteristics of a society in social research.

The Turks continued to live in clans and tribes after migrating to Anatolia. After a long period of different beliefs, they finally turned to Islam but the heritage of the old beliefs, legends and myths are still alive and can be seen in various symbols that are used in the decorative arts today.

Design is the main component of ornamentation. In Anatolia, designs are known by different names, such as motif, im, yanis and nakis.

Different designs exist in all branches of traditional arts depending on the place, purpose of use or message contained. These may be vegetal (trees, flowers, fruits etc.), animal (birds, butterflies, horses, wild animals, snakes, scorpions etc.), objects (for daily use), figures (inspired from daily life etc.).

Colour- Painting:

Colouring is one of the oldest arts, the history of obtaining dyes from natural sources going back thousands of years.

It is true that human beings respect and admire the colours that exist in nature. The relations between man and plants are a very old one. Early man not only used plants to feed himself, but also used leaves as a covering.

People realized the impossibility of colouring textiles with un-dissolved substances, and so used the root, body and leaves of plants. Besides plants, some dyes were also obtained from animals.

In Anatolia during the Ottoman period, colouring materials were exported until the 19th century, although the invention of synthetic dyes had a severe impact. Today, a few educational institutions in some regions are trying to keep the tradition of natural dyes alive.

People have considerable knowledge of natural dyes in some regions of Anatolia, especially those where rugs and carpets are produced. Families involved in rug-making keep such information on dyes a closely guarded secret.

The material “mordan” is used to prepare the object for colouring and help the object maintain its colour. Arborvitae is the most commonly used kind of mordan in Turkey. Studies have shown that, red, green and yellow have historically been the most widely used colours.

Examples of Silk Fabric Weaving

Çatma kadife (silk velvet)Screen and

Drapery and upholstery

Chair upholstery from Dolmabahçe Museum
from Yıldız Chalet Museum

Bindallı Bridal Costume

Sack outer garment

Embroidered robe

All three costumes are from Sadberk Hanım Museum

Examples of Embroidery Art

Maraş Work (Hole Work)

Motifs of Çorlu Fedelli - Yozgat Central Museum

Bead embroidery from İçel and Adana

Examples of carpet weaving

Silk Hereke Carpet

Silk Kayseri Carpet

2.7. Silk reeling machines/techniques in the cottage industries and silk enterprises

Due to the recession of silk production in Turkey, the last reeling mill owned by Kozabirlik (Cocoon Union) was sold to Turkmenistan, and today silk is reeled with primitive manual catapults. The villagers located in Söğüt / Bilecik, Hatay and Diyarbakır can reel only small quantities of silk with old fashioned boiler and lathe. The quality of silk yarn produced with this process is not always suitable for fine fabrics and embroideries. Hence most of the produced silk yarn is consumed in carpet making.

The sericulture support incentives (as applied in EU) are sought to be guaranteed by governmental ruling. If the case may be, Kozabirlik has plans to buy a reeling machine with a capacity of 150 tons / year of raw silk.

2.8. Economics and markets

Today 98% of silk handcrafts cottage industry consists of carpet making. Although hand-made silk carpet is the main silk item produced in Turkey, its significance is vanishing day by day. Since 1990s the volume of production and exports reduced drastically due to price competition from far eastern countries.

Silk handcrafts commodities produced in Turkey can be grouped under 5 headings;
Fabrics woven in hand-looms
Hand-made lace and embroidery
Hand-made shawls and scarves
Hand-made pile carpets

Market Volume for Silk Handcraft items

Total production of silk handcraft items worth USD.139.190.000.- as of 2004[5] . Direct registered exports are USD.30.809.435.- , indirect exports (tourist shops and giftware sales) are USD. 92.020.565.- , remaining USD.16.360.000.- consists of the local consumption.

Turkey's production and exports of silk handcraft items in 2004

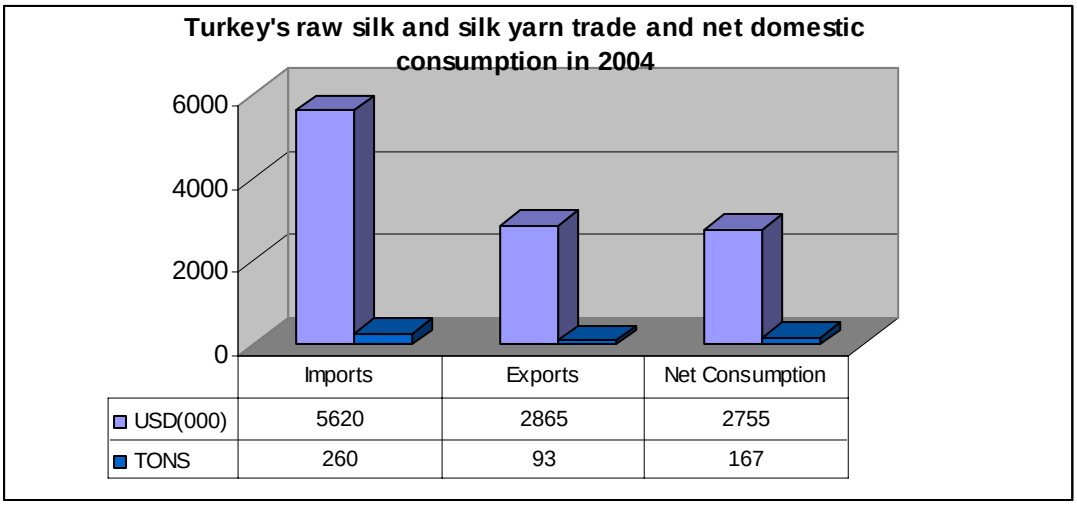
Item	Total Production USD.	Local Consumption USD	Exports (Direct & indirect) USD	Share in Total %
Carpets	136.000.000	16.100.000	119.900.000	97,60
Lace & Embroidery	3.000.000	200.000	2.800.000	2,30
Fabrics	100.000	30.000	70.000	0,06
Shawls & Scarves	90.000	30.000	60.000	0,04
Total	139.190.000	16.360.000	122.830.000	100,00

Source: Hereke Carpet Weavers Association (HCWA)

Silk raw materials and finished products foreign trade

Turkey's raw silk and silk yarn consumption during 2004[6]

[5] Hereke Carpet Weavers Association Trade estimate

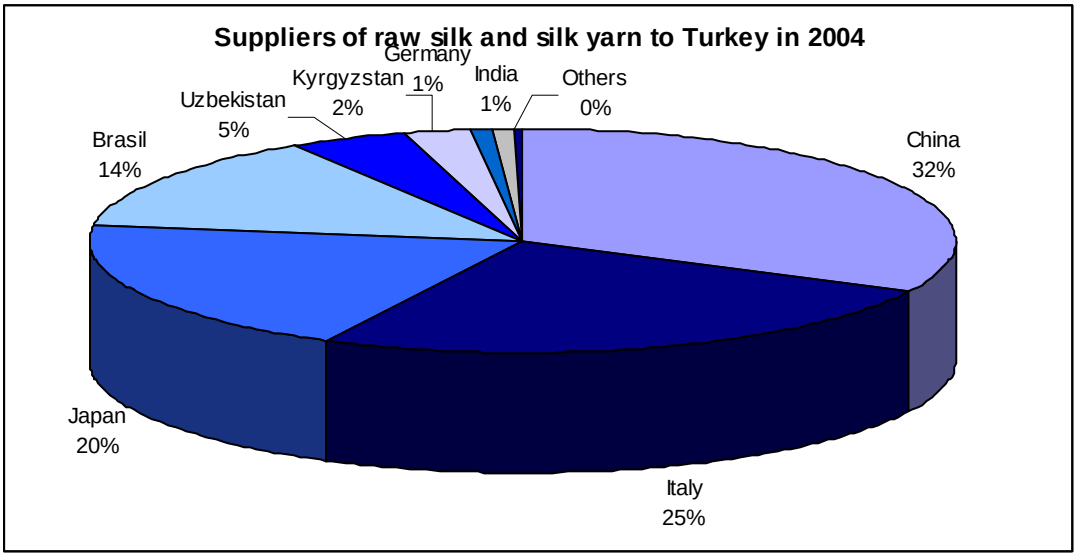


Source: International Trade Corporation (ITC) Calculations based on COMTRADE Statistics

Turkey's raw silk and silk yarn imports in 2004

SUPPLIER	USD(000)	TONS
China	1.821	84
Italy	1.416	43
Japan	1.110	45
Brazil	773	34
Uzbekistan	256	31
Kyrgyzstan	130	17
Germany	48	1
India	55	3
Others	11	2
TOTAL	5.620	260

Source: ITC Calculations based on COMTRADE Statistics



Turkey's silk product exports[7] in 2004 and share of handcraft silk cottage industries

[6] Products covered : Harmonised system(HS) codes 500200,500310, 500400, 500500, 500600
Silk products HS codes are supplied as Annex-1

[7] Covers only direct registered exports excluding tourist sales

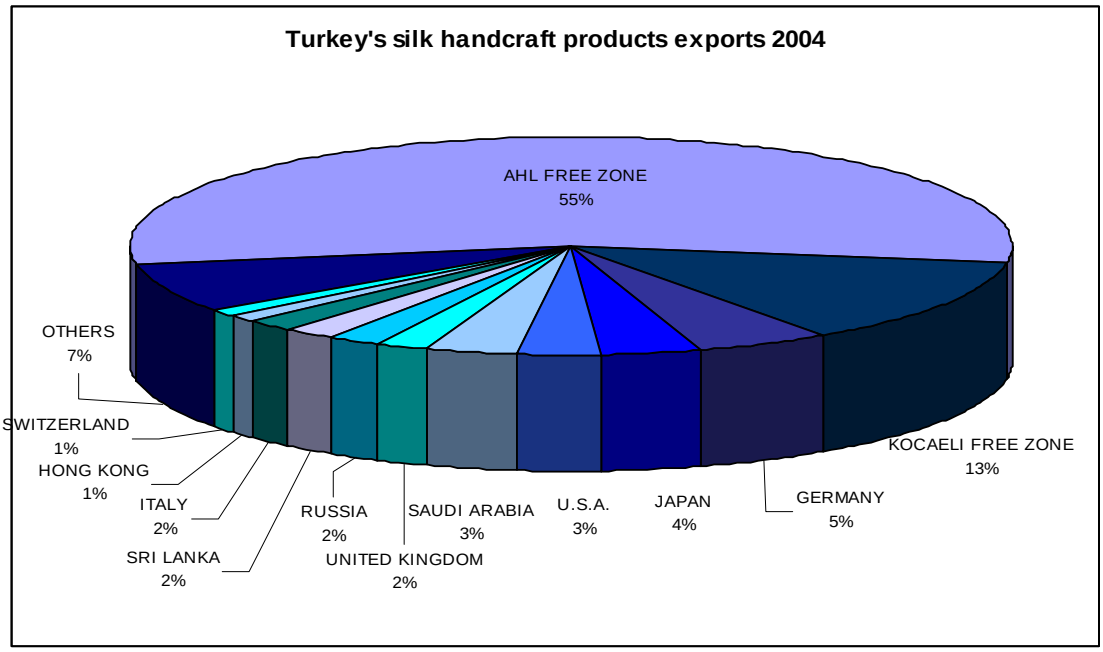
PRODUCT GROUPS	TOTAL USD	HANDCRAFTS USD	SHARE OF HANDCRAFTS
Pile carpets	28.070.663	28.070.663	100,00%
Accessories	10.446.899	51.833	0,50%
Apparel	4.932.442	0	0,00%
Fabrics & Speciality textiles	3.016.321	69.783	2,31%
Art collections & Cultural goods	2.617.157	2.617.157	100,00%
TOTAL	49.083.482	30.809.435	62,77%

Source: HCWA Calculations based on Istanbul textile and apparel exporters union (ITKIB) statistics

Turkey's silk handcraft products exports in 2004[8]

IMPORTERS	USD
AHL FREE ZONE	16.990.684
KOCAELI FREE ZONE	3.958.629
GERMANY	1.535.982
JAPAN	1.117.014
U.S.A.	990.110
SAUDI ARABIA	979.246
UNITED KINGDOM	624.737
RUSSIA	589.803
SRI LANKA	579.043
ITALY	515.043
HONG KONG	404.212
SWITZERLAND	335.774
OTHERS	2.189.159
TOTAL	30.809.435

Source: ITKIB



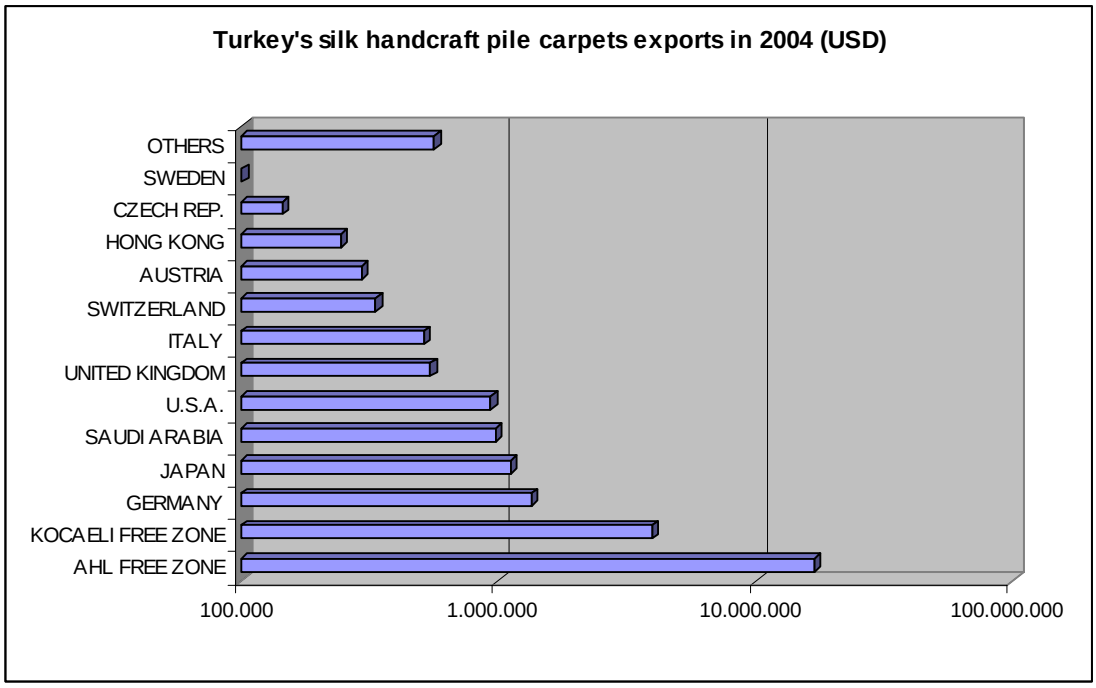
[8] Products covered : HS Codes 570190, 621410000011, 500720410011, 580430, 581099

Main markets for Turkish silk handcraft products;

Pile Carpets (HS Code 570190) Exports in 2004

IMPORTERS	USD
AHL FREE ZONE	16.981.632
KOCAELI FREE ZONE	3.958.629
GERMANY	1.345.180
JAPAN	1.117.014
SAUDI ARABIA	979.246
U.S.A.	940.388
UNITED KINGDOM	544.554
ITALY	515.043
SWITZERLAND	335.774
AUSTRIA	294.304
HONG KONG	245.820
CZECH REP.	145.162
SWEDEN	101.028
OTHERS	566.889
TOTAL	28.070.663

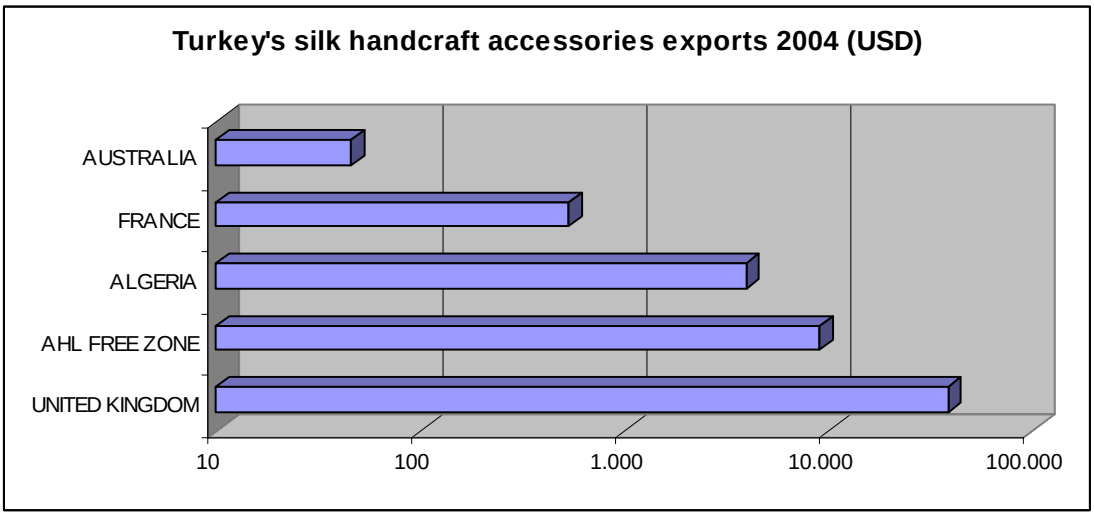
Source: ITKIB



Accessories (HS Code: 621410000011) Exports in 2004

IMPORTERS	USD
UNITED KINGDOM	38.275
AHL FREE ZONE	9.052
ALGERIA	3.927
FRANCE	533
AUSTRALIA	46
TOTAL	51.833

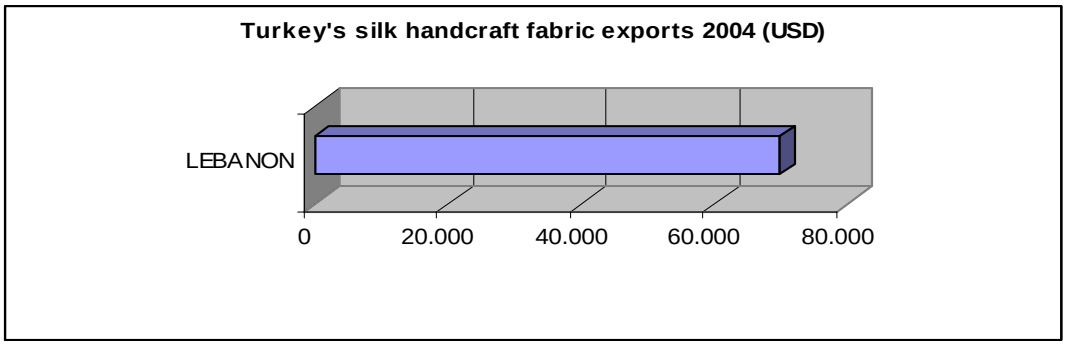
Source: ITKIB



Fabrics and speciality textiles (HS Code: 500720410011) Exports in 2004

IMPORTERS	USD
LEBANON	69.783
TOTAL	69.783

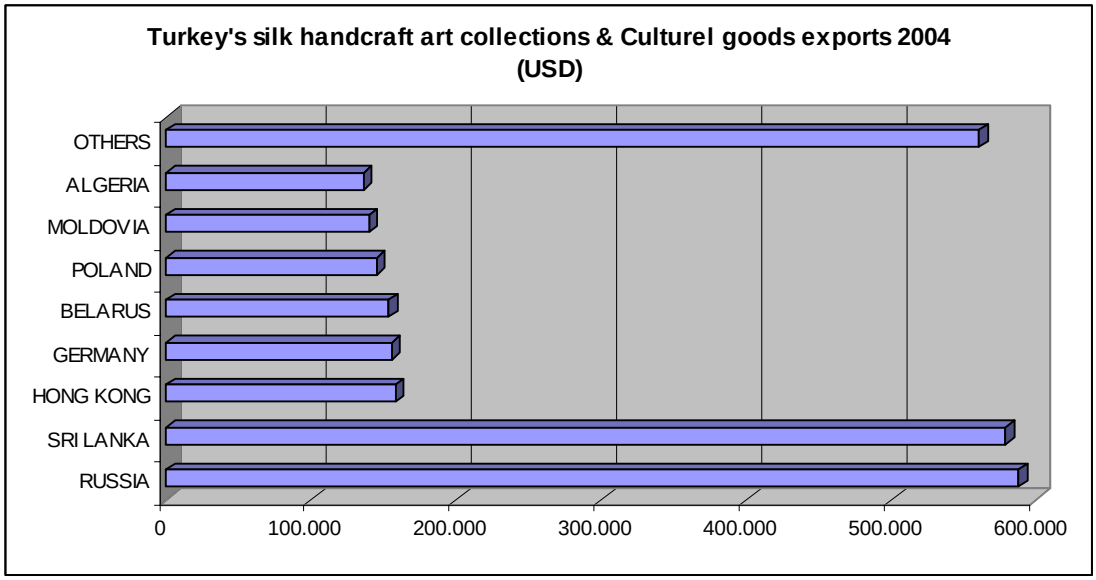
Source: ITKIB



Art collections& Cultural goods (HS Codes: 580430, 581099) Exports in 2004

IMPORTERS	USD
RUSSIA	587.906
SRI LANKA	579.043
HONG KONG	158.392
GERMANY	155.678
BELARUS	153.637
POLAND	145.233
MOLDOVIA	139.936
ALGERIA	136.249
OTHERS	561.083
TOTAL	2.617.157

Source: ITKIB



*Detailed statistics of Turkey's silk product trade is supplied as Annex-2

General market trends for silk products and performance of developing countries

When we analyse the World trade data supplied by ITC, we can identify that most of silk products lays in" champions" or "achiever in adversity" quadrants, implying that developing countries have usually been gaining market shares over last 5 years. Although the figures do not give us an exact opinion regarding silk handcraft cottage industries, the data supplied can lead us to understand the general trend.

Developing countries have outperformed in silk products listed below;

Product	Change in market share over 2000-2004	Total value of market in USD millions (2004)	Market share of developing countries in 2004
Ties, bowties, cravats	16,9%	806	31,3%
Woven fabrics	11,7%	233	53,5%
Embroidery of oth. textile materials in the piece	7,8%	142	69,5%
Shawls, scarves, veils	4,4%	331	48,2%
Carpets, knotted	0,5%	211	88,4%

Source: ITC Product Map

Market share of developing countries for products listed above are noticeable, and implies importance for the economies of those countries. Hand-made silk carpets are especially important for Turkey as Turkey's exports represent 14% of world exports for this product; its ranking in world exports is 3rd.

An other analysis is the under achievement of developing countries for hand-made lace where total value of market increased by 36,5% over the last 5 years, developing countries share reduced by 23,5 % during the same period.

Statistical tables are supplied as Annex-4

Trade channels for silk handcraft products in Turkey

Trade structure for silk handcraft products represents a distribution as below;
Local sales 10%
Direct exports 15%
Tourist sales 75%

Village market places: Direct sales from villagers in rural open markets in silk handcraft locations throughout Turkey. Usually the markets are held on Saturdays at the villages. Once an important volume of trade had been performed through this channel, the activity is very limited today.

Wholesalers/Exporters: Micro and small sized enterprises sales their production to local speciality retail stores, tourist gift shops, and carpet speciality stores. Some of them have direct exports as well.

Permanent exhibitions: Many handcraft items including silk ones are on display of these permanent exhibitions. The outlets are mostly run by the foundations or associations including state support organisations without profit objectives. The products are out-puts of training programs, and handcraft school students works.

E-commerce: Many e-commerce web portals are available to market handcraft products. The products sold are mainly low value gift items.

Speciality retail stores: Although a few, there are some speciality retail stores for handcraft cultural goods. Volume of business is very small.

Co-operatives: These are the local organisations initiated by the villagers or Ministry of agriculture and rural affairs. They are mainly active in carpet making and sell their products to the wholesales, exporters, or carpet speciality retail stores. Some of them are sub-contracted by medium scale carpet wholesalers.

Tourist gift shops: Mainly located in places of tourist attraction**.** The downtown stores located in costal cities sell silk items like embroideries, and textile accessories.

Carpet speciality retail stores: These stores, each covering about 15,000 sqm halls for carpet sales are known as carpet palaces. They are mainly located in Cappadocia, Pamukkale, Antalya, and Istanbul. Informative and sales sessions are organised for the tourists stopping by as a part of their tour package. They have arrangements with leading tour operators and perform the major volume of hand-made carpet business in Turkey. It is estimated that about 75% of total hand-made carpet sales are generated by these stores.

State support policy, advantages and investment benefits for silk cottage industries in Turkey

Major advantages of the silk cottage industries from the socio-economic point of view are;

- Maximum efficiency and employment rate with the minimum investment on fixed assets
- Generation of foreign trade revenues and high value added production

Considering two major benefits outlined above, handcrafts and cottage industries have an important role in economic welfare of least developed regions and offsetting social disparities. Even the most industrialised regions of Turkey still suffer a major gap between the income levels of the highest and lowest quintiles.

State Supports for Handcrafts, and cottage industries:

Training and marketing:

Handcrafts are supported mainly by Ministry of Culture and tourism, Ministry of agriculture and rural affairs and Ministry of education. The support is concentrated in trainings and coordination of economic ventures like producer cooperatives and permanent exhibitions for marketing the handcraft items.

Policy:

With an effort to attain the problems and introduce solutions, a research commission is established within the Turkish National Assembly. The commission has finalised the research stage and a regulation is expected to be drafted for the approval of National Assembly in the near future. New rulings are expected to harmonise, social security, tax and intellectual property rights of craftsmen, and include handcrafts under coverage of Cultural investments and ventures support Act nr.5225, and Intellectual and Art works Act nr. 5846.

Investment supports, SME supports:

Investments originating whether domestic or foreign are supported by law. Generally, tax benefits, VAT exemptions, reduced energy fees, are provided for the industrial and agricultural investments in the least developed regions of Turkey. Many state supports for the small and medium sized enterprises are available through KOSGEB (SME Development and Support Administration)-an organisation of Ministry of Industry and Commerce, İGEME (Turkish Export Promotion Board) and DTM (Undersecretary of Foreign Trade)

Chapter 3

Major constraints against and recommendations for artisan / traditional silk handcrafts cottage industries and silk enterprises development in Turkey and Regional levels

Low labour and materials costs in competing countries

Due to the low production and labour costs in silk producing and processing countries like, China, India and Pakistan, Turkish silk cottage industries recessed since 1990. EU policies for agriculture, arts and crafts are not applied in silk industries in Turkey. Tax policies for silk cottage industries should be reviewed, villagers working in handcraft cottage industries should be covered with social security benefits with low premium rates.

Overpriced and low quality raw materials

Small sized companies and craftsmen can not benefit from economies of scale due to their very small individual capacities. Low sericulture out-put and poor reeling techniques in Turkey causes inferior quality and overpriced silk yarn from one of the best silk cocoons in the world. This dilemma should be resolved with the increase in domestic sericulture and advanced reeling processes.

Financial resources

Most of the silk cottage enterprises lack of investment and operational capitals. Especially inventory turnover and return on investment rates are very low in the case of carpet production. It takes about a year to produce one square meter of a Hereke silk carpet, while

the labour costs and other fixed costs are paid on a monthly basis, the sales can be achieved only after the production is finalised in full. Average sales period is about 3 months (period that carpets stay in stock) and average collection period is 6 months in wholesales. The carpet making costs are financed at least a year before the revenue is produced.

Low income levels for craftsmen

Due to low income levels, most of the labour of cottage industries and freelance craftsmen are not keen on practicing handcrafts. This problem causes the new generations refrain from earning their lives from handcrafts. The ones who do not have better job alternatives works for silk cottage industries unless they find a better income.

Structure of silk cottage enterprises

Tight profit margins of the silk cottage enterprises make them avoid from employing labour due to high social security burdens. They often prefer to buy finished products made by villagers at their homes. As a result the companies are mostly trading enterprises rather than industrial establishments who can not benefit state supports granted to industrial SMEs.

Replications of Turkish traditional designs

The replications of traditional Turkish motifs and designs applied in carpets by those countries reduced the international market share and prices of Turkey. Turkish handcrafts designs, motifs, and geographical signs should be registered in international markets, and protected against unfair replications.

Imports of cheap products

Import of cheap far-eastern products is threatening Turkish producers, and jeopardizes the silk handcraft cottage industries. High costs and insufficient income levels does not motivate the local production. As the main potential buyers of silk handcraft items are the tourists visiting Turkey, only the authentic locally made products should be sold in the gift and tourist shops. The retail outlets should be controlled and classified by the state authorities and voluntary organisations.

Production management and quality issues

Most of the producers are either villagers or micro enterprises, lacking organisation capabilities. As a consequence standardised products can not be produced. Modern management techniques like, planning, quality control, research are not applied. The required quality can not be achieved. Establishment of medium sized enterprises and cooperatives active in silk cottage industries should be encouraged by means of investment incentives, tax exemptions and support for marketing. The production should be moved from houses to workshops for a regularly controlled quality and standardised production.

Market Trends, consumer demands

Cottage industries lag behind the fashion trends, and consumer expectations. Development of new designs and use of new colours are very limited. New products can not be developed. Although there are many foundations, universities, associations, vocational schools for arts and hand crafts, research and design development is not satisfactory. Old designs and colours developed centuries ago still applied. Design development efforts are limited to a few medium scale commercial companies. Handcrafts research and design institutions should be activated and the students in art schools should be graduated with necessary skills for product development in traditional arts. Intellectual property rights of design developers should be protected effectively.

Coordination of activities

The regulatory authorities for sericulture, handcrafts, and cottage industries are quite diversified and do not have joint efforts. Each authority has different regulations and the lack of coordination results with poor local and national policies. Vocational trainings, production

and marketing efforts do not create a synergy. An umbrella organisation should be established to coordinate all sericulture, handcraft, and cottage industries. This organisation should produce necessary policies to be implemented in national and international levels.

Marketing

International distribution channels are not utilised as the channels are mostly operated by the competing country ventures. Participation to international trade shows and fairs are very limited. Joint marketing companies could not be established. State supports for handcraft items exports are very limited. Funding from Turkey's promotion agency and ministry of culture and tourism is required.

Chapter 4

Country and Regional strategies and follow- up actions for silk cottage industries and silk enterprises development

Strategy	Recommendation	Action
PRODUCTION		
Application of controlled, standardised production techniques and improvement of quality and capacity utilisation	Extensive workshop production rather than home based production units	Development and implementation of standard norms for silk raw materials and finished products of silk cottage industries
	High quality, high value added carpet production	
	Development of new and unique designs in line with the prevailing fashion trends	Establish a handcraft fashion and research centre
		Establish a design data-base
TRAINING		
Awareness campaigns and training activities for rehabilitation of production processes, improvement of quality, consumer demands, new colour and designs	Organise trainings, seminars and conferences by Public Education Centres, Exporters unions and Ministry of Education	Establish a National Coordination Committee to coordinate the sectoral activities and produce an action plan
	Disseminate information to all relevant beneficiaries	
MARKETING AND PROMOTION		
Marketing campaign at national and international level.	Make research for target markets	Establish a hand-woven carpet promotion group
	Actively attend and exhibit in international trade shows	Register national anonymous designs and patterns
	Raise funds for promotion	Run a generic silk handcrafts campaign
Build image as an high-end prestigious luxury product		Wide-spread the certification system established by HCWA

Chapter 5

Annexes

Annex-1 Silk Handcraft Fabrics of Turkey[9]

Alaca: It is a red cotton cloth, woven with yellow stripes. There are also silk "alacas" and thus there are two separate kinds, the cotton alaca and silk alaca. They have been woven on hand-looms in Anatolia since very old times. The alaca's of Erzincan and Tire have been known to be of the highest quality in these cloths. Having a very strong texture, this cloth was used for men's shirts and for women's skirts and robes.
Atlas: It is a silken cloth for making robes and is always plain red, blue, yellow or green, without any other colours or ornamental figures whatsoever. There is thin and thick atlas clothing that makes a special fine feel when touched. The thin atlas was used in the middle classes for bridal dresses and for the robes of boys used at circumcision ceremonies.
Badilcani: It is silk, dark red (Bordeaux red) colour cloth with white, light red and purple stripes
Bürümcük: It is a nice old summer cloth woven from raw silk with the addition of a minute quantity of linen thread. It was used for underwear shirts and also used for underwear pants as luxury wear. It had a very thin version like tulle and a slightly thicker version, yet the thin version though very light, was not transparent. Thin brümcük was used for women's underwear and thicker version was for men's shirts.
Canfes: It is a light texture pure silk cloth. Used to make kaftans as well as gold and silver embroidered parts of women's dresses, red and lilac colours were more popular.
Çatma: It is the name of a very closely woven old Turkish cloth of silk velvet with floral designs, and sometimes it is woven with gold gilt thread. It was one of our most luxurious cloths used in the garments of the Sultans. The çatma's were woven in various kinds for garments, covers, curtains and pillows.
Futa: It is the silken bath towel (peştemal) wore around the waist in the bath or a cloth wore as an apron (futa) while at work. The futa's would always be woven with a design of griddled lines, the lines being thin, thick and in darker shades than the basic colour. In futa's shades of red had become traditional.
Gezi: It is the name of a tough and moiré water-silk cloth and the pastel colours were more in demand although it was woven in all colours. It had names such as Şam (Damascus) gezisi, Halep (Aleppo) gezisi and Bağdat (Baghdat) gezisi but the most sought after was the Indian gezisi.
Hareli: It is a pure silk or cotton mixed taffeta used for making daily dresses of women
Hatai: It is the name of an old silken cloth. Sade (plain) hatai, Telli (threaded) hatai, Nevzuhur (new) hatai were some of its types. [10]

Kemha: It is a silken cloth embroidered with gold and silver thread. It was woven on a plain single colour and used especially in heavy robes of honour. Robes of honour were not used after the reforms in attire during the reign of Sultan Mahmut II and the kemha became a heavy upholstery cloth for the palaces and the homes of the rich.

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[9] Compilled from Clothes living in lines of poetry – Turkishtime sectors magazine November 2004 issue and *Kaftanlar / Fikret Altay / Yapı Kredi Bankası / İstanbul / 1979*

[10] Ottoman historical terms and idioms by M.Z.Pakalın

Papazi: It is name of very thin tulle like texture of silk cloth. It was used as an ornament on the collar of women's dresses and also sometimes used to make head knots. It had colours like pink, blue, light green and similar light colours.
Sevai: It is the name of an old silk cloth. The ones embroidered with gold or silver thread were called telli sevai. It was a cloth in demand and used to make women's and men's dresses.
Sündüs: An other old silk cloth embroidered with silver and gold thread.

Annex-2 Silk products Harmonised system codes

Harmonised system codes for products containing silk	
Silkworm cocoons, raw silk and silk yarn	
HS Code	Product Description
500100	Silkworm cocoons suitable for reeling
500200	Raw silk neither spun nor thrown
500310	Silk waste incl. Cocoons unsuitable for reeling, yarn waste and garneted stock neither carded nor combed
500390	Silk waste incl. Cocoons unsuitable for reeling, yarn waste and garneted stock carded or combed
500400	Silk yarn other than that of schappe or bourette (excl. That put-up for retail sale)
500500	Silk yarn made of silk waste (excl. That put-up for retail sale)
500600	Yarn of silk, schappe or bourette, put-up for retail sale ; Silkworm gut
Fabrics and speciality textiles	
HS Code	Product Description
500720110019	Creps other, not blanched/blanched and cleaned silk or silk waste => 85%
500720190019	Creps other, silk or silk waste => 85%
500720410011	Woven fabrics of silk containing=> 85%. Hand loom weave
500720590019	Woven fabrics of silk containing=> 85%. Other dyed
500720690019	Woven fabrics of silk containing=> 85%. Made of dyed threads
500720710019	Woven fabrics of silk containing=> 85%. Other printed
500790100019	Woven fabrics of silk containing< 85%. Other not blanched / blanched and cleaned
500790300019	Woven fabrics of silk containing< 85%. Other dyed
500790500019	Woven fabrics of silk containing< 85%. Made of dyed threads
500790900019	Woven fabrics of silk containing< 85%. Other printed
600390000011	Other knitted hosiery made of silk or silk waste, width =< 30Cm
611790000013	Patches made of silk or silk waste
Clothing and accessories	
HS Code	Product Description
610329000012	Men's or boys' suits made of silk or silk waste t-75
610439000011	Women's and girl's jackets and blazers made of silk or silk waste
610449000011	Women's or girls' dresses made of silk or silk waste t-157
610690300011	Women's or girl's blouses of silk or silk waste t-156
610690300012	Women's or girl's shirts of silk or silk waste t-156
610690300013	Women's or girl's blouse-shirts of silk or silk waste t-156
610990900012	Singlet made of silk or silk waste, knitted t-157
610990900013	Vests made of silk or silk waste, knitted t-157
610990900019	Other underwear made of silk or silk waste knitted t-157
611090900011	Women's or girls' jerseys made of silk or silk waste knitted t-157
611090900012	Men's or boys' jersey made of silk or silk waste knitted t-157
611090900014	Men's or boys' pullovers made of silk or silk waste knitted t-157
611090900051	Women's or girls' pullovers made of silk or silk waste knitted t-157
611190000011	Baby's t-shirts knitted made of silk or silk waste

611190000017	Baby's other clothing and accessories knitted made of silk or silk waste
611710000013	Shawls, scarves, mufflers, mantillas, veils and the like. Made of silk and silk waste
611780900013	Made-up clothing accessories, knitted or crocheted made of silk or silk waste
620429900011	Women's or girls' ensembles, hand printed. made of silk or silk waste t-161
620429900019	Women's or girls' ensembles, other made of silk or silk waste t-161
620429900029	Women's or girls' ensembles of silk or silk waste t-161
620449100000	Women's or girls' dresses made of silk or silk waste t-159
620590900011	Men's or boy's shirts made of silk or silk waste
620610000011	Women's or girl's blouses of silk or silk waste t-159
620610000012	Women's or girl's shirts of silk or silk waste
620610000013	Women's or girl's blouse-shirts of silk or silk waste
621310000000	Handkerchiefs of silk or silk waste
621410000011	Shawls hand made. Made of silk and silk waste
621410000019	Shawls. Made of silk and silk waste
621510000000	Ties bowties and cravat’s of silk or silk waste (excl. Knitted or crocheted)
621600000014	Gloves, mittens and mitts made of silk or silk waste
Art collection and cultural goods	
HS Code	Product Description
580429100000	Lace woven by mechanical ways not knitted silk or silk content
580429900000	Lace woven by machinery, not knitted silk or silk content
580430000000	Hand-made lace in the piece, as strips or motifs. Made of noil silk woven
581099000000	Embroidery in the piece, strips or motifs made of silk and silk waste
Carpets and Kilims	
HS Code	Product Description
570190000000	Carpets and kilims hand made. Made of silk or silk waste
Others	
HS Code	Product Description
560490000000	Medical threads made of silk yarn
511999000011	Silk-worm seed
580410900000	Tulle made of noil silk
590500900011	Silk wall coverings
591120000011	Sifter textile made of silk
591131190011	Silk woven textiles for use in paper machinery

Note: The list is not exhaustive

Annex-3 Trade statistics tables

Silk-worm cocoons exports of Turkey

List of importing markets for a product exported by Turkey in 2004

Product : 500100 Silk-worm cocoons suitable for reeling

Turkey's exports represent 7% of world exports for this product, its ranking in world exports is 5

Importers	Exported value 2004 in US$ thousand	Share in Turkey's exports, %	Exported quantity 2004	Quantity unit	Unit value (US$/unit)	Export trend in value between 2000-2004, %, p.a.	Export trend in quantity between 2000-2004, %, p.a.	Export growth in value between 2003-2004, %, p.a.	Ranking of partner countries in world imports	Share of partner countries in world imports, %	Total import growth in value of partner countries between 2000-2004, %, p.a.
World	216	100	61	Tons	3,541	72		-37			-26
Japan	102	47	29	Tons	3,517			-70	1	41	-30
Thailand	11	5	4	Tons	2,75				9	3	-46

Source: ITC calculations based on COMTRADE statistics

Raw silk and silk yarn trade of Turkey

List of supplying markets for a product imported by Turkey in 2004

Product : 500600 Silk yarn&yarn spun from silk waste, put up f retail sale; silk-worm gut

Turkey's imports represent 3% of world imports for this product, its ranking in world imports is 11

Exporters	Imported value 2004 in US$ thousand	Share in Turkey's imports, %	Imported quantity 2004	Quantity unit	Unit value (US$/unit)	Import trend in value between 2000-2004, %, p.a.	Import trend in quantity between 2000-2004, %, p.a.	Import growth in value between 2003-2004, %, p.a.	Ranking of partner countries in world exports	Share of partner countries in world exports, %	Total export growth in value of partner countries between 2000-2004, %, p.a.
World	445	100	15	Tons	29.667	114	92	411			19
Italy	336	76	12	Tons	28.000	183		586	4	7	9
China	59	13	2	Tons	29.500				1	47	21
Germany	48	11	1	Tons	48.000	88		85	5	6	11

List of supplying markets for a product imported by Turkey in 2004

Product : 500200 Raw silk (not thrown)

Turkey's imports represent 1% of world imports for this product, its ranking in world imports is 11

World	3.821	100	194	Tons	19.696	4	-4	29			-6
China	1.285	34	56	Tons	22.946	-6	-16	-23	1	84	-6
Japan	1.110	29	45	Tons	24.667				3	4	201
Brazil	773	20	34	Tons	22.735	15	17	-17	17	0	-23
Italy	268	7	11	Tons	24.364		92	1017	2	5	53
Uzbekistan	256	7	31	Tons	8.258	32	31	95	7	0	23
Kyrgyzstan	130	3	17	Tons	7.647	-14	-15	-36	12	0	-5

List of supplying markets for a product imported by Turkey in 2004

Product : 500400 Silk yarn (other than yarn spun from silk waste) not put up f retl sale

Turkey's imports represent 1% of world imports for this product, its ranking in world imports is 18

World	1.208	100	35	Tons	34.514	49	36	184			-6
Italy	753	62	18	Tons	41.833	62	60	130	3	11	-4
China	421	35	16	Tons	26.313	32	20	652	1	40	-10

India	30	2	1	Tons	30.000	41		150	19	0	60

List of supplying markets for a product imported by Turkey in 2004

Product : 500500 Yarn spun from silk waste, not put up for retail sale

Turkey's imports represent 0% of world imports for this product, its ranking in world imports is 26

World	120	100	12	Tons	10.000	64	60	118			1
Italy	59	49	2	Tons	29.500	30		392	5	2	-11
China	56	47	10	Tons	5.600	143		37	1	69	7

List of supplying markets for a product imported by Turkey in 2004

Product : 500310 Silk waste, not carded or combed

Turkey's imports represent 0% of world imports for this product, its ranking in world imports is 21

World	26	100	4	Tons	6.500						-8
India	25	96	3	Tons	8.333				8	3	-31

Source: ITC calculations based on COMTRADE statistics

List of importing markets for a product exported by Turkey in 2004

Product : 500600 Silk yarn&yarn spun from silk waste, put up f retail sale; silk-worm gut

Turkey's exports represent 0% of world exports for this product, its ranking in world exports is 23

Importers	Exported value 2004 in US$ thousand	Share in Turkey's exports, %	Exported quantity 2004	Quantity unit	Unit value (US$/unit)	Export trend in value between 2000-2004, %, p.a.	Export trend in quantity between 2000-2004, %, p.a.	Export growth in value between 2003-2004, %, p.a.	Ranking of partner countries in world imports	Share of partner countries in world imports, %	Total import growth in value of partner countries between 2000-2004, %, p.a.
World	29	100	3	Tons	29.000	65	-45	164			12
France	11	38	1	Tons	11.000				4	7	26
Italy	11	38	1	Tons	11.000				8	3	13

List of importing markets for a product exported by Turkey in 2004

Product : 500400 Silk yarn (other than yarn spun from silk waste) not put up f retl sale

Turkey's exports represent 1% of world exports for this product, its ranking in world exports is 9

World	2.836	100	90	Tons	31.511	16	-10	18			0
Italy	2.815	99	89	Tons	31.629	16	-10	17	1	29	0
China	21	1	1	Tons	21.000				12	1	-16

Source: ITC calculations based on COMTRADE statistics

Silk Fabric trade of Turkey

List of importing markets for a product exported by Turkey in 2004

Product : 500720 Woven fabrics of silk/silk waste,o/t noil silk,85%/more of such fibres

Turkey's exports represent 0% of world exports for this product, its ranking in world exports is 19

Importers	Exported value 2004 in US$ thousand	Share in Turkey's exports, %	Exported quantity 2004	Quantity unit	Unit value (US$/unit)	Export trend in value between 2000-2004, %, p.a.	Export trend in quantity between 2000-2004, %, p.a.	Export growth in value between 2003-2004, %, p.a.	Ranking of partner countries in world imports	Share of partner countries in world imports, %	Total import growth in value of partner countries between 2000-2004, %, p.a.
World	2.799	100	30	Tons	93.300	209	100	289			5
Romania	939	34	8	Tons	117.375			1059	24	1	58
Free Zones	783	28	5	Tons	156.600			11086	62	0	54
United Kingdom	227	8	3	Tons	75.667			118	12	3	2
France	226	8	2	Tons	113.000			679	8	5	7
Lebanon	105	4	0	Tons					35	0	42

Bulgaria	80	3	1	Tons	80.000				34	0	57
Tunisia	79	3	6	Tons	13.167				42	0	39
Hong Kong (SARC)	64	2	0	Tons				700	4	8	-1
Germany	59	2	1	Tons	59.000	30		1080	10	4	-2
Mexico	59	2	0	Tons				228	26	0	1
Spain	41	1	0	Tons				720	11	4	21
Greece	26	1	1	Tons	26.000				16	1	38
Russian Federation	23	1	1	Tons	23.000				76	0	-45
Netherlands	21	1	0	Tons		39			32	0	1
Australia	16	1	0	Tons					17	1	7
Austria	13	0	0	Tons					31	0	-1
Philippines	11	0	1	Tons	11.000				39	0	21

Source: ITC calculations based on COMTRADE statistics

List of importing markets for a product exported by Turkey in 2004

Product : 500790 Woven fabrics of silk, nes

Turkey's exports represent 0% of world exports for this product, its ranking in world exports is 31

Importers	Exported value 2004 in US$ thousand	Share in Turkey's exports, %	Exported quantity 2004	Quantity unit	Unit value (US$/unit)	Export trend in value between 2000-2004, %, p.a.	Export trend in quantity between 2000-2004, %, p.a.	Export growth in value between 2003-2004, %, p.a.	Ranking of partner countries in world imports	Share of partner countries in world imports, %	Total import growth in value of partner countries between 2000-2004, %, p.a.
World	211	100	21	Tons	10.048	70	58	35			2
China	50	24	1	Tons	50.000			100	3	6	5
Russian Federation	31	15	5	Tons	6.200			138	68	0	-46
Tunisia	26	12	5	Tons	5.200				65	0	30
Iran (Islamic Republic of)	21	10	2	Tons	10.500	48			73	0	120
Spain	14	7	2	Tons	7.000				9	4	7
Philippines	13	6	0	Tons					53	0	1
Turkmenistan	13	6	4	Tons	3.250	31		44	115	0	48
United Arab Emirates	10	5	0	Tons				-47	14	2	15
United States of America	10	5	0	Tons					1	13	1

Source: ITC calculations based on COMTRADE statistics

List of supplying markets for a product imported by Turkey in 2004

Product : 500720 Woven fabrics of silk/silk waste,o/t noil silk,85%/more of such fibres

Turkey's imports represent 1% of world imports for this product, its ranking in world imports is 18

Exporters	Imported value 2004 in US$ thousand	Share in Turkey's imports, %	Imported quantity 2004	Quantity unit	Unit value (US$/unit)	Import trend in value between 2000-2004, %, p.a.	Import trend in quantity between 2000-2004, %, p.a.	Import growth in value between 2003-2004, %, p.a.	Ranking of partner countries in world exports	Share of partner countries in world exports, %	Total export growth in value of partner countries between 2000-2004, %, p.a.
World	14.472	100	216	Tons	67.000	24	11	113			5
China	5.839	40	110	Tons	53.082	61	52	100	1	34	13
Italy	3.569	25	24	Tons	148.708	14	-19	84	2	16	4
India	1.918	13	32	Tons	59.938	13	3	92	3	15	8
Free Zones	885	6	5	Tons	177.000				10	2	-9
Korea, Rep. of Korea	588	4	6	Tons	98.000	46	39	221	4	7	-5
France	581	4	5	Tons	116.200	36		321	7	4	5
Germany	246	2	2	Tons	123.000	-31	-42	24	8	4	2

Belgium	192	1	3	Tons	64.000	142		1500	13	0	75
Kazakhstan	129	1	19	Tons	6.789	19	104	52	41	0	20
Spain	115	1	1	Tons	115.000	17		379	12	0	37
United Kingdom	111	1	3	Tons	37.000	16	9	28	9	2	12
United States of America	74	1	2	Tons	37.000	26		155	14	0	8
Hong Kong (SARC)	68	0	1	Tons	68.000	64		-18	6	5	-6
Greece	39	0	1	Tons	39.000			388	24	0	86
Switzerland	39	0	0	Tons		-35		1200	16	0	-10
Netherlands	27	0	1	Tons	27.000	75		-10	20	0	14
Hungary	17	0	0	Tons		34			28	0	163
Thailand	16	0	0	Tons		-4		-62	11	1	-5

Source: ITC calculations based on COMTRADE statistics

List of supplying markets for a product imported by Turkey in 2004

Product : 500790 Woven fabrics of silk, nes

Turkey's imports represent 1% of world imports for this product, its ranking in world imports is 34

Exporters	Imported value 2004 in US$ thousand	Share in Turkey's imports, %	Imported quantity 2004	Quantity unit	Unit value (US$/unit)	Import trend in value between 2000-2004, %, p.a.	Import trend in quantity between 2000-2004, %, p.a.	Import growth in value between 2003-2004, %, p.a.	Ranking of partner countries in world exports	Share of partner countries in world exports, %	Total export growth in value of partner countries between 2000-2004, %, p.a.
World	1192	100	16	Tons	74.500	10	-2	22			1
Italy	689	58	8	Tons	86.125	13	-6	15	1	31	0
Germany	128	11	2	Tons	64.000	-13	-27	10	8	4	-7
China	108	9	3	Tons	36.000			1443	3	9	1
India	101	8	1	Tons	101.000	4	-3	-34	2	15	6
France	35	3	1	Tons	35.000	31		67	5	5	6
Sweden	34	3	1	Tons	34.000	107		580	39	0	29
Korea, Rep. of Korea	25	2	0	Tons				150	7	4	15
Greece	21	2	0	Tons					49	0	-2
United Kingdom	21	2	0	Tons		-14		-16	6	5	5
Spain	11	1	0	Tons		112		-27	15	1	19

Source: ITC calculations based on COMTRADE statistics

List of supplying markets for a product imported by Turkey in 2004

Product : 500710 Woven fabrics of noil silk

Turkey's imports represent 0% of world imports for this product, its ranking in world imports is 56

Exporters	Imported value 2004 in US$ thousand	Share in Turkey's imports, %	Imported quantity 2004	Quantity unit	Unit value (US$/unit)	Import trend in value between 2000-2004, %, p.a.	Import trend in quantity between 2000-2004, %, p.a.	Import growth in value between 2003-2004, %, p.a.	Ranking of partner countries in world exports	Share of partner countries in world exports, %	Total export growth in value of partner countries between 2000-2004, %, p.a.
World	52	100	1	Tons	52	-11		550			6
Hong Kong (SARC)	25	48	0	Tons					1	35	-2
Italy	11	21	0	Tons		7		57	6	8	17

Source: ITC calculations based on COMTRADE statistics

Silk clothing and accessories trade of Turkey

List of importing markets for a product exported by Turkey in 2004

Product : 620610 Women's/girls blouses and shirts, of silk or silk waste, not knitted

Turkey's exports represent 0% of world exports for this product, its ranking in world exports is 21

Importers	Exported value 2004 in US$ thousand	Share in Turkey's exports, %	Exported quantity 2004	Quantity unit	Unit value (US$/unit)	Export trend in value between 2000-2004, %, p.a.	Export trend in quantity between 2000-2004, %, p.a.	Export growth in value between 2003-2004, %, p.a.	Ranking of partner countries in world imports	Share of partner countries in world imports, %	Total import growth in value of partner countries between 2000-2004, %, p.a.
World	2.267	100	81	Tons	27.988	14	3	38			2
United Kingdom	752	33	7	Tons	107.429	160		1267	2	11	31
Iraq	308	14	43	Tons	7.163			231	46	0	
Germany	301	13	8	Tons	37.625	-8	-21	-22	6	3	-8
Russian Federation	228	10	2	Tons	114.000	378		-53	35	0	39
France	160	7	1	Tons	160.000	74	-3	38	5	4	24
Libyan Arab Jamahiriya	123	5	3	Tons	41.000	83	-10	2360	57	0	113
Netherlands	64	3	2	Tons	32.000	11	7	16	18	0	9
Belgium	39	2	1	Tons	39.000	20		22	12	1	24
Ukraine	38	2	0	Tons				-42	41	0	35
United States of America	34	1	0	Tons		-37		209	1	50	-2
Free Zones	30	1	1	Tons	30.000	43	12	-67	73	0	29
Saudi Arabia	29	1	2	Tons	14.500	5	-14	-36	25	0	-6
Denmark	21	1	0	Tons		14		-45	15	1	34
Tajikistan	20	1	4	Tons	5.000			25	93	0	
United Arab Emirates	19	1	1	Tons	19.000	23		73	27	0	12
Lebanon	17	1	1	Tons	17.000	26		70	37	0	13
Cyprus	13	1	1	Tons	13.000	13			40	0	31
Israel	10	0	1	Tons	10.000	-7		43	54	0	-16

Source: ITC calculations based on COMTRADE statistics

List of importing markets for a product exported by Turkey in 2004

Product : 621410 Shawls,scarves,veils and the like, of silk or silk waste, not knitted

Turkey's exports represent 0% of world exports for this product, its ranking in world exports is 31

Importers	Exported value 2004 in US$ thousand	Share in Turkey's exports, %	Exported quantity 2004	Quantity unit	Unit value (US$/unit)	Export trend in value between 2000-2004, %, p.a.	Export trend in quantity between 2000-2004, %, p.a.	Export growth in value between 2003-2004, %, p.a.	Ranking of partner countries in world imports	Share of partner countries in world imports, %	Total import growth in value of partner countries between 2000-2004, %, p.a.
World	662	100	15	Tons	44.133	-7	-20	15			0
Germany	121	18	2	Tons	60.500	52		5	6	6	-10
Spain	98	15	1	Tons	98.000			416	7	5	4
Lebanon	69	10	1	Tons	69.000	69	0	-8	41	0	38
Free Zones	68	10	1	Tons	68.000	-31		10	70	0	-28
Greece	51	8	3	Tons	17.000	66			17	1	17

United Kingdom	47	7	1	Tons	47.000	20	0	-15	5	8	3
France	31	5	0	Tons		45		-34	2	12	-1
Netherlands	22	3	1	Tons	22.000	8		633	16	1	-2
Hungary	19	3	1	Tons	19.000				47	0	11
Czech Republic	17	3	0	Tons					35	0	18
United Arab Emirates	16	2	0	Tons		13		129	10	3	
Russian Federation	15	2	0	Tons				650	33	0	14
Belgium	12	2	0	Tons		85		20	11	2	1
United States of America	10	2	0	Tons		-35		0	1	21	1

Source: ITC calculations based on COMTRADE statistics

List of importing markets for a product exported by Turkey in 2004
Product : 621510 Ties, bow ties and cravats, of silk or silk waste, not knitted
Turkey's exports represent 0% of world exports for this product, its ranking in world exports is 20

Importers	Exported value 2004 in US$ thousand	Share in Turkey's exports, %	Exported quantity 2004	Quantity unit	Unit value (US$/unit)	Export trend in value between 2000-2004, %, p.a.	Export trend in quantity between 2000-2004, %, p.a.	Export growth in value between 2003-2004, %, p.a.	Ranking of partner countries in world imports	Share of partner countries in world imports, %	Total import growth in value of partner countries between 2000-2004, %, p.a.
World	1.890	100	20	Tons	94.500	31	-11	186			6
United States of America	1.138	60	9	Tons	126.444	328		393	1	25	4
Russian Federation	352	19	3	Tons	117.333	66		1971	31	0	12
Germany	107	6	2	Tons	53.500	-12	-36	-17	4	6	4
Free Zones	43	2	1	Tons	43.000	-34	-44	19	81	0	-17
Cyprus	33	2	0	Tons		34		120	47	0	1
Bulgaria	32	2	1	Tons	32.000				74	0	61
Ukraine	22	1	0	Tons				1000	42	0	49
Sweden	20	1	1	Tons	20.000	-7		-52	19	1	2
Slovakia	19	1	0	Tons				-27	65	0	14
Belgium	16	1	0	Tons		105		220	14	1	4
France	15	1	0	Tons		37		-25	5	6	13
South Africa	13	1	0	Tons		79		550	61	0	-6
Austria	11	1	0	Tons		27		83	13	1	5

Source: ITC calculations based on COMTRADE statistics

List of supplying markets for a product imported by Turkey in 2004
Product : 620610 Women’s/girls blouses and shirts, of silk or silk waste, not knitted
Turkey's imports represent 0% of world imports for this product, its ranking in world imports is 28

Exporters	Imported value 2004 in US$ thousand	Share in Turkey's imports, %	Imported quantity 2004	Quantity unit	Unit value (US$/unit)	Import trend in value between 2000-2004, %, p.a.	Import trend in quantity between 2000-2004, %, p.a.	Import growth in value between 2003-2004, %, p.a.	Ranking of partner countries in world exports	Share of partner countries in world exports, %	Total export growth in value of partner countries between 2000-2004, %, p.a.

World	976	100	10	Tons	97.600	17	17	72			0
China	286	29	5	Tons	57.200	-3	6	153	1	40	-4
Italy	249	26	1	Tons	249.000	21	0	21	3	8	13
France	84	9	0	Tons		58		38	6	3	28
Spain	66	7	2	Tons	33.000	109		187	11	1	32
India	62	6	1	Tons	62.000	137		520	4	6	14
Romania	54	6	0	Tons		148		800	17	1	128
United Kingdom	36	4	0	Tons		34		260	8	2	34
Germany	31	3	0	Tons		17		-60	5	5	-1
Greece	25	3	0	Tons					37	0	7
Slovenia	24	2	0	Tons				243	20	0	8
Hong Kong (SARC)	11	1	0	Tons		46		-15	2	22	-4
United States of America	10	1	0	Tons		-5		150	15	1	7

Source: ITC calculations based on COMTRADE statistics

List of supplying markets for a product imported by Turkey in 2004
Product : 621310 Handkerchiefs, of silk or silk waste, not knitted
Turkey's imports represent 0% of world imports for this product, its ranking in world imports is 30

Exporters	Imported value 2004 in US$ thousand	Share in Turkey's imports, %	Imported quantity 2004	Quantity unit	Unit value (US$/unit)	Import trend in value between 2000-2004, %, p.a.	Import trend in quantity between 2000-2004, %, p.a.	Import growth in value between 2003-2004, %, p.a.	Ranking of partner countries in world exports	Share of partner countries in world exports, %	Total export growth in value of partner countries between 2000-2004, %, p.a.
World	31	100	0	Tons		44		29			-5
Italy	19	61	0	Tons		45		90	2	27	-8

Source: ITC calculations based on COMTRADE statistics

List of supplying markets for a product imported by Turkey in 2004
Product : 621410 Shawls,scarves,veils and the like, of silk or silk waste, not knitted
Turkey's imports represent 1% of world imports for this product, its ranking in world imports is 19

Exporters	Imported value 2004 in US$ thousand	Share in Turkey's imports, %	Imported quantity 2004	Quantity unit	Unit value (US$/unit)	Import trend in value between 2000-2004, %, p.a.	Import trend in quantity between 2000-2004, %, p.a.	Import growth in value between 2003-2004, %, p.a.	Ranking of partner countries in world exports	Share of partner countries in world exports, %	Total export growth in value of partner countries between 2000-2004, %, p.a.
World	2.792	100	44	Tons	63.455	29	24	142			0
China	1.256	45	20	Tons	62.800	56	22	243	2	19	11
Italy	807	29	5	Tons	161.400	26	-7	147	1	26	-2
India	578	21	18	Tons	32.111	83	124	62	4	12	7
Germany	66	2	1	Tons	66.000	86		230	7	3	-2
France	44	2	0	Tons		-34		33	3	13	2
Spain	15	1	0	Tons		0		200	20	0	10

Source: ITC calculations based on COMTRADE statistics

List of supplying markets for a product imported by Turkey in 2004

Product : 621510 Ties, bow ties and cravats, of silk or silk waste, not knitted

Turkey's imports represent 1% of world imports for this product, its ranking in world imports is 20

Exporters	Imported value 2004 in US$ thousand	Share in Turkey's imports, %	Imported quantity 2004	Quantity unit	Unit value (US$/unit)	Import trend in value between 2000-2004, %, p.a.	Import trend in quantity between 2000-2004, %, p.a.	Import growth in value between 2003-2004, %, p.a.	Ranking of partner countries in world exports	Share of partner countries in world exports, %	Total export growth in value of partner countries between 2000-2004, %, p.a.
World	5.104	100	37	Tons	137.946	17	8	-1			4
Italy	4.088	80	25	Tons	163.520	14	4	6	1	45	2
Germany	366	7	5	Tons	73.200	30	48	195	6	3	9
France	353	7	2	Tons	176.500	40	35	-63	3	8	5
China	209	4	4	Tons	52.250	62		83	2	22	32
United Kingdom	40	1	0	Tons		-24		21	4	4	6
Spain	30	1	1	Tons	30.000	-4		-32	12	1	11
Free Zones	10	0	0	Tons					24	0	-10

Source: ITC calculations based on COMTRADE statistics

Art collections and cultural goods trade of Turkey

List of importing markets for a product exported by Turkey in 2004

Product : 580430 Hand-made lace, in the piece, in strips or in motifs

Turkey's exports represent 3% of world exports for this product, its ranking in world exports is 8

Importers	Exported value 2004 in US$ thousand	Share in Turkey's exports, %	Exported quantity 2004	Quantity unit	Unit value (US$/unit)	Export trend in value between 2000-2004, %, p.a.	Export trend in quantity between 2000-2004, %, p.a.	Export growth in value between 2003-2004, %, p.a.	Ranking of partner countries in world imports	Share of partner countries in world imports, %	Total import growth in value of partner countries between 2000-2004, %, p.a.
World	672	100	75	Tons	8,96	23	30	98			31
Algeria	141	21	20	Tons	7,05			74	50	0	80
Moldova, Rep.of	132	20	3	Tons	44			91	57	0	64
United States of America	52	8	4	Tons	13			373	16	1	-13
Germany	40	6	13	Tons	3,077	-31	-3	67	18	1	3
Iraq	40	6	9	Tons	4,444			700	40	0	
Romania	33	5	1	Tons	33				38	0	19
Libyan Arab Jamahiriya	22	3	7	Tons	3,143	160		-24	20	1	283

Source: ITC calculations based on COMTRADE statistics

List of importing markets for a product exported by Turkey in 2004

Product : 581099 Embroidery of other textile materials, in the piece, in strips/motifs,nes

Turkey's exports represent 1% of world exports for this product, its ranking in world exports is 13

Importers	Exported value 2004 in US$ thousand	Share in Turkey's exports, %	Exported quantity 2004	Quantity unit	Unit value (US$/unit)	Export trend in value between 2000-2004, %, p.a.	Export trend in quantity between 2000-2004, %, p.a.	Export growth in value between 2003-2004, %, p.a.	Ranking of partner countries in world imports	Share of partner countries in world imports, %	Total import growth in value of partner countries between 2000-2004, %, p.a.

World	1,944	100	126	Tons	15,429	13	23	-23			7
Sri Lanka	538	28	10	Tons	53,8			311	30	1	5
Russian Federation	467	24	53	Tons	8,811	31	35	-1	69	0	8
Germany	145	7	8	Tons	18,125	40	47	-62	8	4	4
Hong Kong (SARC)	144	7	3	Tons	48	96		13	20	1	-2
Belarus	137	7	5	Tons	27,4			585	34	1	14
Turkmenistan	93	5	4	Tons	23,25			-43	80	0	
United Kingdom	47	2	1	Tons	47	42		422	6	7	-7
Hungary	36	2	1	Tons	36			50	53	0	-5
Mali	27	1	9	Tons	3			23	93	0	
Kazakhstan	25	1	0	Tons					102	0	-31
Israel	20	1	2	Tons	10	-24		900	19	1	3
Thailand	19	1	0	Tons					15	2	17
Argentina	18	1	0	Tons				13	82	0	-10
Latvia	16	1	0	Tons		-6		220	44	0	117
Bosnia and Herzegovina	15	1	3	Tons	5			15	101	0	
Saudi Arabia	15	1	4	Tons	3,75			-35	12	2	8
Greece	14	1	1	Tons	14	3		0	13	2	31
Poland	14	1	1	Tons	14	-20		-92	27	1	18
Macau	13	1	0	Tons				-46	91	0	-8
Qatar	13	1	0	Tons					108	0	-20
Netherlands	12	1	2	Tons	6	-45	-38	-94	25	1	60
Iraq	10	1	3	Tons	3,333			-9	120	0	
Free Zones	10	1	2	Tons	5	-8		-69	106	0	-16

Source: ITC calculations based on COMTRADE statistics

Silk carpet trade of Turkey

List of importing markets for a product exported by Turkey in 2004

Product : 570190 Carpets of other textile materials, knotted

Turkey's exports represent 14% of world exports for this product, its ranking in world exports is 3

Importers	Exported value 2004 in US$ thousand	Share in Turkey's exports, %	Exported quantity 2004	Quantity unit	Unit value (US$/unit)	Export trend in value between 2000-2004, %, p.a.	Export trend in quantity between 2000-2004, %, p.a.	Export growth in value between 2003-2004, %, p.a.	Ranking of partner countries in world imports	Share of partner countries in world imports, %	Total import growth in value of partner countries between 2000-2004, %, p.a.
World	35.910	100	1.164	Tons	30.851	5	82	43			0
Free Zones	23.702	66	83	Tons	285.566	31	48	98	4	10	31
Germany	2.646	7	60	Tons	44.100	-23	22	-58	3	12	-9
Switzerland	1.613	4	6	Tons	268.833	16	34	105	6	5	16
Japan	1.305	4	4	Tons	326.250	-16	-4	-4	2	13	-16
United States of America	1.278	4	8	Tons	159.750	-35	-18	14	1	21	16
Iran (Islamic Republic of)	1.098	3	196	Tons	5.602	99			16	1	44
Saudi Arabia	922	3	267	Tons	3.453		122	130	14	1	1

United Kingdom	588	2	7	Tons	84.000	89	67	-6	5	5	36
Italy	496	1	83	Tons	5.976	18	90	69	10	2	3
The former Yugoslav Rep. of Macedonia	284	1	146	Tons	1.945	58	286	17	120	0	-26
Austria	277	1	11	Tons	25.182	64		78	12	1	0
Greece	227	1	50	Tons	4.540	26	143	64	13	1	12
Hong Kong (SARC)	225	1	0	Tons				2713	27	0	-16
Czech Republic	145	0	1	Tons	145.000			339	52	0	14
Iraq	116	0	25	Tons	4.640			346	55	0	
Netherlands	93	0	19	Tons	4.895	49	73	-86	23	1	-1
Sweden	93	0	1	Tons	93.000				41	0	-3
Singapore	90	0	0	Tons				1400	11	2	12
Cyprus	64	0	5	Tons	12.800	7		28	86	0	-16
China	59	0	1	Tons	59.000				40	0	-26
Russian Federation	54	0	18	Tons	3.000	91		800	65	0	38
United Arab Emirates	54	0	30	Tons	1.800			50	17	1	-12
France	49	0	12	Tons	4.083	2	33	-63	8	4	1
Romania	47	0	20	Tons	2.350	62		-53	96	0	-19
Georgia	44	0	46	Tons	957			175	93	0	35

Source: ITC calculations based on COMTRADE statistics

List of supplying markets for a product imported by Turkey in 2004
Product : 570190 Carpets of other textile materials, knotted
Turkey's imports represent 4% of world imports for this product, its ranking in world imports is 7

Exporters	Imported value 2004 in US$ thousand	Share in Turkey's imports, %	Imported quantity 2004	Quantity unit	Unit value (US$/unit)	Import trend in value between 2000-2004, %, p.a.	Import trend in quantity between 2000-2004, %, p.a.	Import growth in value between 2003-2004, %, p.a.	Ranking of partner countries in world exports	Share of partner countries in world exports, %	Total export growth in value of partner countries between 2000-2004, %, p.a.
World	9432	100	191	Tons	49.382	5	18	31			0
China	8194	87	139	Tons	58.950	15	35	84	1	29	-7
India	570	6	28	Tons	20.357	23	16	-29	2	21	9
Iran (Islamic Republic of)	328	3	1	Tons	328.000	30	7	-74	4	14	1
Switzerland	81	1	0	Tons				523	26	0	2
Italy	72	1	18	Tons	4.000	27		929	8	2	8
United States of America	62	1	1	Tons	62.000	-18		210	6	3	-4
Nepal	42	0	1	Tons	42.000			31	12	1	13
Free Zones	32	0	0	Tons		-21		-73	32	0	-4
Pakistan	27	0	1	Tons	27.000	-31			36	0	
Germany	13	0	2	Tons	6.500	-68	-39	-61	5	4	-6

Source: ITC calculations based on COMTRADE statistics

Annex-4 General Trade Trend and Performance of Developing Countries

PRODUCTS (items)			**ESTIMATED WORLD IMPORTS**, values in USD millions (Share in World Imports of Products from Developing Countries in %)								**Performance of Developing Countries**
Textile fibres, fabrics and speciality textiles											
CODE (HS)	DESCRIPTION	% of CLUSTER	2000	2001	2002	2003	2004	Annual change in value terms over 2000-2004	Annual change in volume terms over 2000-2004	% change in market share over 2000-2004	**Performance quadrant**
500200	Raw silk (not thrown)	0.17	359 (90.5 %)	331 (94.3 %)	288 (88.4 %)	273 (90.1 %)	278 (93.8 %)	-6.8	-0.7	0.2	Achiever in Adversity
500310	Silk waste, not carded or combed	0.01	22 (84.7 %)	16 (80.3 %)	11 (79.5 %)	14 (86.6 %)	19 (91.1 %)	-4.2	-4.1	2,1	Achiever in Adversity
500390	Silk waste, nes	0.02	51 (82.4 %)	39 (80.6 %)	35 (79.7 %)	35 (80.1 %)	30 (73.7 %)	-10.7	-4.4	-2.0	Declining Market
500400	Silk yarn (other than yarn spun from silk waste) not put up f retl sale	0.13	192 (65.4 %)	167 (68.8 %)	147 (69.6 %)	166 -73%	211 (76.3 %)	1,9	6,1	3,8	Product Champion
500500	Yarn spun from silk waste, not put up for retail sale	0.07	142 (85.7 %)	124 -85%	93 -86%	84 (84.9 %)	111 -87%	-8.4	-8.7	0.3	Achiever in Adversity
500600	Silk yarn&yarn spun from silk waste, put up f retail sale; silk-worm gut	0.01	7 (35.3 %)	7 (25.9 %)	8 (37.6 %)	13 (48.8 %)	15 (49.4 %)	22,1	24,5	17,6	Product Champion
500710	Woven fabrics of noil silk	0.05	62 (52.6 %)	53 (53.1 %)	54 (58.6 %)	63 (65.4 %)	85 (68.3 %)	8,4	-3.3	8,2	Product Champion
500720	Woven fabrics of silk/silk waste,o/t noil silk,85%/more of such fibres	0.79	1117 -57%	970 (56.8 %)	915 (57.2 %)	1021 (58.4 %)	1275 (59%)	3,2	2,4	1.0	Product Champion
500790	Woven fabrics of silk, nes	0.15	169 (37.4 %)	173 (37.1 %)	168 (43.1 %)	202 (50.6 %)	233 (53.5 %)	8,2	-0.8	11,7	Product Champion
Total cluster		100%	138110 (31.2 %)	131295 (31.3 %)	132228 (32.8 %)	144378 (34.4 %)	160347 (36.4 %)	4		8.3	
Clothing and accessories											
580190	Woven pile fab&chenille fab of other tex mat,o/t terry&narrow fabrics	0.04	65 (15.5 %)	57 -16%	60 (18.5 %)	60 (20.1 %)	70 (29.9 %)	1,8	-2	17.0	Product Champion
580390	Gauze of other textile material, o/t narrow fabrics	0.02	30 -12%	22 (16.5 %)	24 (21.4 %)	26 (30.2 %)	30 (32.8 %)	1,5	4,6	30,3	Product Champion
580429	Mechanically made lace of oth tex mat,in the	0.09	94	93	121	135	139	12,1	5,6	14,6	Product

	piece,in strips/in motifs		(16.6 %)	(16.1 %)	(21.3 %)	(21.7 %)	(26.2 %)				Champion
611090	Pullovers,cardigans&similar articles of oth textile materials,knittd	1,03	2502 (77.4 %)	2654 (77.8 %)	2464 (79.3 %)	2445 (81.8 %)	2642 (83.7 %)	0.3	2,3	2,1	Product Champion
611790	Parts of garments/of clothg accessories,of textile materials,knittd	0.34	799 (42.3 %)	865 (40.7 %)	924 (39.4 %)	894 (41.5 %)	876 (41.7 %)	2,2	-1	-0.1	Under Achiever
611710	Shawls, scarves, veils and the like, of textile materials, knitted	0.29	351 -61%	336 (63.8 %)	389 (65.2 %)	515 (69.1 %)	734 (73.5 %)	20,9	27,4	5,6	Product Champion
611780	Clothing accessories nes, of textile materials, knitted	0.13	223 (54.9 %)	228 (54.5 %)	257 (58.4 %)	274 (58.7 %)	329 (54.9 %)	10,2	7,9	0.8	Product Champion
611190	Babies garments&clothg accessories of other textile materials,knitted	0.02	51 (61.6 %)	57 (64.6 %)	55 (65.9 %)	57 (67.4 %)	58 (78.2 %)	2,7	10,0	5,5	Product Champion
610690	Women's/girls blouses and shirts, of other materials, knitted	0.19	370 (74.2 %)	421 -77%	415 (76.5 %)	412 (75.2 %)	475 (76.2 %)	4,9	8,5	0.3	Product Champion
610439	Women's/girls jackets, of other textile materials, knitted	0.04	67 (58.6 %)	74 (63.1 %)	75 (62.9 %)	78 (59.9 %)	93 (51.5 %)	7,3	0.6	-3.3	Under Achiever
610449	Women's/girls dresses, of other textile materials, knitted	0.03	60 (53.3 %)	57 (55.8 %)	51 (58.4 %)	56 (56.4 %)	74 (51.3 %)	4	1,9	-0.6	Under Achiever
610990	T-shirts,singlets and other vests,of other textile materials,knitted	1,74	3158 -55%	3125 (55.8 %)	3345 (55.1 %)	3740 (58.1 %)	4458 (61.8 %)	9,1	n.a.	3.0	Product Champion
620429	Women's/girls ensembles, of other textile materials, not knitted	0.08	210 (51.7 %)	180 (48.7 %)	174 (50.4 %)	175 (57.1 %)	202 (59 %)	-1	7.1	4.3	Achiever in Adversity
620449	Women's/girls dresses, of other textile materials, not knitted	0.41	817 (67.8 %)	758 (70.3 %)	680 (67.9 %)	907 (65.7 %)	1059 (69.1 %)	7,2	2,2	-0.3	Under Achiever
620590	Men's/boys shirts, of other textile materials, not knitted	0.28	462 -71%	470 (73.8 %)	521 (76.8 %)	663 (80.7 %)	716 (80.5 %)	12,9	11,7	3,9	Product Champion
620610	Women's/girls blouses and shirts, of silk or silk waste, not knitted	0.28	642 (84.4 %)	674 -82%	610 (78.4 %)	659 (80.4 %)	716 (80%)	2	n.a.	-1.3	Under Achiever
621600	Gloves, mittens and mitts, of textile materials, not knitted	0.24	493 (83.2 %)	464 -84%	467 -82%	532 (81.5 %)	613 (82.1 %)	5,9	3,6	-0.6	Under Achiever
621510	Ties, bow ties and cravats, of silk or silk waste, not knitted	0.32	643 (16.9 %)	630 (20.5 %)	647 (23.2 %)	699 (26.2 %)	806 (31.3 %)	5,7	7,2	16,9	Product Champion
621310	Handkerchiefs, of silk or silk waste, not knitted	0.01	19 (48.2 %)	23 (46.2 %)	19 (47.3 %)	17 -42%	19 (44.5 %)	-3.2	-3.4	-2.5	Declining Market
621410	Shawls,scarves,veils and the like, of silk or silk waste, not knitted	0.13	316 (41.3 %)	314 -39%	263 -42%	287 (44.2 %)	331 (48.2 %)	0.1	5,8	4,4	Product Champion
Total cluster		100%	200966 (67.4 %)	202892 (68.4 %)	207038 (68.5 %)	231588 (70.3 %)	255687 (71.3 %)	6.3		7.8	

Art collection and cultural goods

581099	Embroidery of oth textile materials, in the piece,in strips/motifs,nes	0.10	111 (53.7 %)	95 (55.8 %)	110 -57%	125 (66.5 %)	142 (69.5 %)	8	9,9	7,8	Product Champion
580430	Hand-made lace, in the piece, in strips or in motifs	0.01	5 (32.2 %)	4 -44%	9 (25.4 %)	12 (20.2 %)	16 (17.2 %)	36.5	0.9	-23.5	Under Achiever
	Total cluster	100%	110388 (53.5 %)	108671 (53.7 %)	114141 (53.7 %)	125962 (57.3 %)	143829 (57.5 %)	7		9.3	

Carpets and wall coverings

570190	Carpets of other textile materials, knotted	1,6	216 (86.5 %)	201 (87.5 %)	175 (87.6 %)	182 (88.4 %)	211 (88.4 %)	-1.5	2,7	0.5	Achiever in Adversity
	Total cluster	100%	10440 (30.5 %)	10124 -31%	10347 (31.2 %)	11487 (32.1 %)	13002 (33.7 %)	5.8		8.4	

Source: ITC Product Map www.p-maps.org/pmaps
Note: Handcraft products are bolded

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Glossary

Terms used in traditional Turkish textile handcrafts

Akma: A variation of backstitch. It is made by a twice repeated backstitch. In order to get best results in this stitch that gives an open worked (ajur) appearance to the finish, an open weave fabric and thick twisted thread should be used. In some examples, rich variations can be seen by wrap threads or on the pulled thread areas.

Anavata: A variation of a raised wrapping stitch that is made by coloured silk threads.

Aplike: (Appliqué) Embroidery that is made by attaching motifs those are prepared from different fabrics, to a foundation fabric. This embroidery has two ways of doing this: open "aplike" and covered (plain) aplike. In the first variation, the prepared motif is attached to the surface of the fabric either by "sarma"(wrap stitch) or festoon stitch. Then, the edges of motif are cut away. For the second, , the edges of the piece to be applied are turned under and the motif is sewn down with a hidden running stitch.

Another "aplike" variation is called employs metal plaques, and was used during the Ottoman period. In this technique that is known as "çakma plek" in Azerbaijan, motifs metal pieces encrusted with jewels like gold, silver, brass, etc. are prepared. These motifs either have holes that can be used to attach them, or have clips. They are then ornamented with thick twisted cord like threads. It is possible to see this technique, that was made jointly by jewellers and embroiders, among the examples of throne covers, curtains, pillows; arrow and bow bags, gun cases, pamphlet purses, "cilbent" (book cover), "nihalis" (ornamented cover) in The Topkapı Palace Museum.

Also the water-carriers' cloth in The Istanbul Military Museum, ornamented with brass plaques on leather is an elite example.

Different techniques were used to apply mirror like spangles instead of plaques to "cepken" (short jacket) and waistcoats. This was in favour at the end of 19th and beginning of 20th century in lower classes.

Astragan ignesi: (Candlewick) This is embroidered from the reverse side of the fabric with a special tool made of metal that carries the thread through the fabric, a wooden handle of this is used to push the tool through. The thread is held in a hole at the tip of the needle. This technique is suitable to make raised motifs. The astrakhan work tool is placed on the design which is drawn on the reverse side of the fabric. Then, the embroidery is done by moving the mallet up and down, leavings tufts on the right side. In order to get best results, thick twisted silk, cotton, or wool yarn should be used, and closely woven fabric should be used.

At Örtüsü: (Horse blanket or saddle cloth) An embroidered cover for a horse. Sometimes used under the saddle, it has certain variations.

Ayna Örtüsü: A cover of approximately 50x120cm. It is used either to cover a mirror, to ornament it or to hide it. These covers which are made from linen, cotton and silk fabrics, are ornamented with various techniques and they have variations like either both their two narrow tips or as borders all round. Some are of a triangular composition; this was widely used in the 17th century.

Bag isi: (Knotted fringe) A kind of decorative edge for finishing sheets etc. Made without using any kind of tool like needle; known as knot work, sheet tie, Kastamonu knot, etc. and it

is a type of lace. In some sources, it is also known as “Suleiman knot”. It is made by a chain process. A circle is first formed and then the continuing thread is pulled through this circle. This way with varying knots a lace fringe is formed. Beside the Kastamonu method, there are some other attractive variations made in Tarsus and Çorum. Rich examples are also used to ornament Bulgarian Turks’, Kırgzhızs’, Kazakhs’ weaves and embroideries.

Balık Sırtı: (Herring bone) A stitch, generally used to ornament leaves, branches and flower stems, formed by crosswise “sarma” embroideries. In the West, this work is generally performed in free style and without counting the threads. However, in Turkish embroideries, a variation in which thread is counted and both sides have the same appearance, is also used. The stitches must form a diagonal line and the needle must always b e inserted where the previous thread came out. The embroidery is completed by making the diagonal lines side by side.

Slav stitch, a variation of “balık sırtı” needle (hog backed stitch), is formed by placing the diagonal lines on top of each other in returning rows and gives the opportunity of ornamenting the whole surface as a border instead of motifs. In The Topkapı Palace Museum, a group of ceremonial handkerchiefs which are ornamented by this technique is one of the masterpieces of the period.

Besik-Besik Örtüsü: A variation of “yaygı” (covering spread out on the ground). It is used for the purpose of complementing or ornamenting a wooden cradle. The one piece cradle covers are rectangular, square, etc...they are commonly made with matching pillows. Beside leather cradle covers, there are also two pillows, a cover, two cradle belts and a cradle tie that decorated wooden cradles, were found also. Sets for cradles, made by certain tradesmen, is in a special collection in Ayas and gives some information on this subject.

Bindallı: (A Thousand Branches) A bridal dress in different sizes and designs, made either by velvet or satin, ornamented by metal or metal twisted thread. This dress is generally long sleeved and is to the ankles. There are two types: one of them is a dress alone, and the other one is a combination of a jacket and a skirt. In both types, collar and collarless designs are seen.

Bohça: Covers found in different dimensions like 73x73cm, 75x70cm, 114x100cm, 140x140cm, etc... , shaped either square or rectangular, ornamented by embroidery and made of fabrics such as linen, satin, velvet, cotton, etc... , produced for the purposes of keeping things clean or carrying them. In Turkish art, “bohças”, especially those given as engagement presents have special importance.

Buhara Atması: A stitch is a type of satin stitch that covers the threads of the fabric It is used to ornament large sized motifs. It is formed as following: the needle comes out from one border of the drawn design, and then goes to the other border. In this stitch, the threads lie close to each other and ornament the surface in such a close and continous manner that ranks like diagonal lines are produced.

A Rumanian version is widely used in Turkmen and Uzbek embroideries. There are some “yaygıs” that are ornamented with this stitch. In general, the same threads are used throughout . In one group, the colour of thrown thread is different from the attached ones and firstly, the thrown threads are laid on the design, then the attaching process is completed by using different coloured threads.. This work is made with two tones of a same colour, skipping a line. Combinations like light blue-navy blue, pink-coral colour, etc... are attractive in this embroidery.

Cepken: A short jacket with open front. It is ornamented with embroideries, and made of fabrics like velvet, satin, broadcloth, etc... , long sleeved, collarless and it was put on over the "göynek" (long sleeved and collarless shirt). Cepken for men, women and children are very remarkable.

Cigerdeldi: A kind of pierced stitch. This free style applied stitch like "fisto nakis" (broidery anglicize) is made around a dot that is pierced by a cigerdeldi chisel.(stileto) There is also another way which is made in counted thread work on loosely woven fabrics without actually piercing the fabric.

In Turkish embroidery, cigerdeldi which is made when doing counted thread work is widely used and is made as following: it is made by "gözeme" (a kind of coarse needlework) embroideries which form a square from a centre by counting around it. Since all the embroideries return to same centre, the centre point of the weaving looks like a hole.

Cilbent: A book cover which is sometimes embroidered and is prepared for the purpose of covering books and keeping them clean. There are some variations of "cilbent" in Topkapı Palace Museum.

Civankası: A kind of wrapped stitch which is made by counting and arranging triangles side by side in a zigzag form. This needlework has mainly two variations which develop in the diagonal system and the horizontal system, in other words, plain needlework.

Cüz Kesesi: A bag which is made for the purpose of hanging the Qur'an on the wall, or carrying. it can be embroidered. It is formed with a triangular flap, a pouch shaped purse and a handle for carrying or hanging.

Çapraz igne: (coarse muslin work) A variation of loose weave linen work. A double looped gobelin stitch. This needlework is also called "kaneviçe" (needlework made on coarse muslin). This technique is used in embroidering public garments, especially after the 19th century. Garments and accessories are examples of this technique.

Çarsaf: (Sheet) A big rectangular cover, laid over the bed, but under the quilt, made for aesthetics concerns or preventing the bed getting dirty. Generally both of its wide edges are embroidered.

Çevre: A kind of cover, dimensions approximately 60x60cm, made of ornamented linen or cotton weave whose 4 edges are embroidered with "su" border or by motifs on the four corners.

Çini Ignesi: (Stem stitch) A wrap stitch used to fill in. Long and short wrapped stitches are used alternately in the first row, and the next row the long and short are in reverse so as to fill in.

Delme: A short, collarless, sleeveless waistcoat,. The back and edges of its fore collar are ornamented with embroideries. There are rich variations especially in Antep region.

Dival isi: (nailwork-Maras work) A kind of wrapping needlework. It has a rich repertoire. Some sources call it "dival isi, Bursa isi, zerduz isi". Beside the plain wrapped appearance, there are other variations such as hog backed and mat stitch, etc... Although it is generally embroidered over lime wood moulds, there are other examples which are embroidered over thick broadcloth or cardboard moulds. It also has variations applied with golden-blonde or silver-grey metal threads in all centuries during the Ottoman Empire period, there are some

others made with gold-silver metal threads The Palace. In this work two types of thread are used, one on the surface, the other on the reverse side. The work is held in a “cülde” (an embroidery tool) instead of in an embroidery frame, and an awl is used as well as a needle. It is made as follows: either metal or metal twisted threads are laid in order on the fabric which is pierced by an awl, along the lines of the design. The top metal threads are caught by the underneath threads that pass through these openings. This way the upper metal thread does not go through the fabric, but is held in place by the lower one. By this process, the valuable metal treads are not wasted. This is done over the thick wood or card moulds so as to give a raised effect. The lower thread which is not seen on the top, was waxed to keep it supple.

During this process, the article that is being embroidered is attached to “cülde” in order to set both hands free. The hand at the bottom brings the bottom thread up while the other hand is employed in piercing with the awl and carrying the top threads. If the article that is to be embroidered is too big for “cülde”, it is hung on a hanger and the part that is to be embroidered is attached to the “cülde”. In order to get the best results, metal threads must be thin and the required thickness is made by increasing the thread number. For this purpose, the “çag” (an embroidery tool) on which 5-10 bobbins are fixed, must be placed in such a way as to enable the embroiderer to pull the threads easily.

Divan Örtüsü: A long rectangular cover, made of fabrics like velvet, etc... that are ornamented with embroideries. This cover is also known as “sedir örtüsü”. It has two units: bottom edge unit and the unit comprising the sitting place. It is generally produced as a set with pillows.

Dolama: A type of scarf, shaped in a broad, long rectangle, generally the two ends or its two narrow sides are ornamented with embroideries. Examples, dating from the 19th century, are embroidered with red and yellow metal twisted thread and silk thread over black surface.

Duvar Halısı: A panel embroidered as a wall covering, generally as big as “seccade”, (a kind of cover which is prepared for namaz.) made of satin, broadcloth, velvet, cotton weaving, etc...

Eger Örtüsü: (A saddle cloth) An embroidered cover for a saddle. Those that were used on a bride’s horse, have a special importance. There are several examples in Alanya Museum, in The Topkapı Palace Museum and in The Military Museum. These covers which are generally rectangular, can be seen embroidered with various motifs.

Entari: A long sleeved dress. It is worn under the caftan and its neck is opened wide enough too allow the head to pass through it. There are small ones for children.

Etek: (Skirt) A garment extending from waist to knees or to the ankles. It is worn with a jacket.

Feretiko: A hand made weave whose natural colour is beige. It is made in “Rize” mountain villages, woven of linen thread, hard and porous.

Fisto Nakısı: An embroidery made for the purpose of preventing the edge of the fabric unravelling and also to ornament them.

Gergef: An embroidery frame with four legs used when working. It can be adjusted to the size of the cover that is to be embroidered.

Gelinlik: (Wedding dress) The dress that bride wears on her wedding day. Beside the ones that are sewn, embroidered, and sold in centres such as Istanbul, there are some other variations which are locally made and embroidered. A group of work from Kastamonu and Beypazarı is outstanding.

Gelin Duvagı: (Bridal veil) A thin fabric, ornamented with embroideries. It is produced to embellish the bride's headdress ornamentation and to cover her face. There are square, or rectangular.

Göynek: A kind of collarless, long sleeved chemise or under shirt. There are several types made of silk, cotton and linen for both women and men.

Gözeme: A kind of coarse needlework stitch, generally used to define lines in Turkish embriodery. In this work which is carried out over counted threads, regularly spaced a line is formed. This can be done in such a way as to give the same appearance on both sides of the fabric.

Hamaylı: A long belt or band that is 15cm wide, and ornamented with embroideries. It is placed from the shoulder cross.

Hasır igne: A wrapping stitch made by counting threads of the fabric. Squares and rectangles can be formed placed in rows. After the 18th century, in Turkish embroidery, it has been generally used to embroider flower centres with metal threads.

Havlı: (Towel) A soft material used as a drying cloth, made of cotton, produced in different dimensions. It has two sections at each end that are nap less, and these are ornamented. "Havlıs", were produced in sets consisting of three parts for the head, body and shoulder. The most elegant "havlı" sets where those used by brides in the Turkish bath, and have a special importance in Turkish culture.

Hesap ignesi: (Counted thread work) This work which is known also as "Bosna ignesi"," Holbein ignesi", etc..., has mainly two variations developing on plain and diagonal lines. This work which is done by counting threads, has the same appearance on both sides of the fabric. Horizontal or vertical or diagonal lines are worked. This work which is used to embroider motifs with triangle or lozenge shaped units, is based on "gözeme" (plain coarse sewing) embroidery that are placed side by side in a geometric manner. In the plain variation, parallel, plain, horizontal or vertical stitches are lined up side by side. In diagonal work, plain, parallel, vertical stitches are placed rising on each other's spaces like a ladder. In both types, when lines are formed, the thread is carried on fabric's surface, and also the same is done on the reverse side in return. In this work it is important that the threads of the fabric are counted correctly. In variations developed on either a plain or diagonal line, "hesap isi"i can be used either as a filling stitch or as a linear system. Being used as a filling stitch it can be made in two ways: with "gözeme" and without "gözeme". In the plain system, gözeme lines are used to transform rectangular forms which are placed diagonally, into triangle forms. On the other hand, in diagonal system, "gözeme" lines are used to transform squares which are placed on top of each other, into triangles.

Hırka: A long sleeved, collarless jacket that is generally quilted, in other words, fabrics, made of linen, cotton flannel, book muslin, are quilted onto a cotton lining. In a group of quilted garments with different geometric designs, embroidered bands are seen on the surroundings of collars and on cuffs. On another group, embroidered motifs are sprinkled among the quilted geometric designs.

Ilme: (suzeni) (Tambour work) A variation of chain stitch embroidered from the reverse side of fabric by means of a little tool with a hooked end. It is known as "suzeni' in embroidery terminology.

Ipek: (Silk) A fabric which is woven of brilliant, thin, soft threads obtained from silkworm cocoons.

Ipek iplik: (Silk thread) A thread that is obtained by unravelling silkworm cocoons.

Kaftan: A long, loose, opened fronted, wide sleeved, collarless garment worn over the "entari". In the Ottoman period, there were variations whose whole surface. Another group with embroidered lining can be seen.

Kalkan: (Shield) An ornamental object which is used in ceremonies. It is made of willow branches around a central bosse made of metal, and the surface is embroidered with wrapped silk threads. The "kalkans" are used in one hand in ceremonies, and there are beautiful examples dating from the Classical period.

Kapı Perdesi: (Door curtain) A kind of rectangular cover which is ornamented with embroideries. It was hung in the spaces of the door frames, it is made for decorative and practical purposes. A group of valuable curtains made of velvet and satin, dating from the 19th century, are exhibited in the "Hırka-ı Saadet" section in The Topkapı Palace Museum.

Kas Bastı: (Head band) A long, 3-5cm width, embroidered, rectangular band. It was made to either to keep a scarf in place or to complement the hair.

Kavuk Örtüsü: A cover, 100x100cm, a rectangle or square, sometimes ornamented with embroideries. A "Kavuk" is a type of fez. It was used to cover the "kavuk" for decorative or protective reasons. The of this cloth is defined by a circle. Many valuable examples dating from the 16th and 17th centuries are to be seen. Some of these covers were used as bridal headdresses and some of them kept the "kavuk" from getting dusty. A group of them were ornamented with motifs directed to a centre while some of them are with motifs in lines. These covers were made of linen in the Classical period. And some other examples made of lined satin date from the 18th and 19th centuries.

Kemer: (Belt) A long, rectangular embroidered band or waist tie, that is made for functional or decorative purposes.

Kese: A kind of small, embroidered lidded or un lidded purse which is square, triangular, or rectangular. It is used to carry things such as money, tobacco, watch, seal, etc...

Kesme Ajur: A kind of pierced work made on thick and regular weaves by using thick threads and sometimes two colours. This work is applied to form horizontal borders, the weft threads of the fabric are pulled out after being framed by hemstitch or buttonhole stitch. The remaining warp threads weft threads are then caught at the top and bottom alternately, and blocks are formed. Having finished the blocks, a thread can be passed through the fabric threads.

Kına Bezi: A triangular cloth whose surface is embroidered. It is produced for the purpose of wrapping the bride's hands when they are dyed with henna.

Kordon Tutturma: A stitch to attach a cord which is lying on the surface of the fabric. This work has two variations in which either the edges only are worked with cord, or a space can be filled, by using the same technique. In the latter the cords can be attached to each other

without being fixed to the fabric's surface by means of a hidden stitch underneath the cords. Dating especially from the 18th, 19th centuries and the first half of 20th centuries, a group of "üç etek" (a garment used in the Ottoman Empire) which is embroidered with motifs, ornamented with cords, is made by this technique.

Kum ignesi: This work is called "ince igne" by some sources, is formed of "gözeme" rows lined side by side. A group of examples dating from the 17th century that are embroidered with this needlework which is made by over either warp or weft threads is attractive. Among the pieces which are embroidered by counting a single thread, "kavuk" covers and bed sheets are remarkable. Superficial "pesent" which is a kind of "kum ignesi "but made in different numbers, was widely used in Turkish embroidery in the Classical period. This work which gives a "pesent" appearance to the weaves surface is made by counting 3-1 or 5-1. The needle that is carried on the fabric's warp and weft threads comes out to the front surface after being carried for one thread space on the reverse side. This work developed by embroidering rows leaving regular spaces or by leaving a row empty, and is worked in either a plain or diagonal system.

Kupon Kumas: A piece of fabric which has dimensions 90x400cm, made of organza and ornamented with sprinkled embroidered motifs. It is produced either be used on a dress which has to be made urgently or to be given as a present. Among these pieces, a group dating from the 19th century is noticeable.

Kur'an Kabı: Qur'an case or protector. An embroidered case in which to keep a Koran.

Lamba Örtüsü: An embroidered cover to keep a chimney of an oil lamp from getting dirty, when not in use.

Makine Nakısı: Embroideries made by machines which were invented in 1830 by Thimmonier, then developed by Elias Howe in 1846. In 1856 they were renewed by Singer and new variations were added by Jones, Grover and Baker in 1880. The embroideries made by using this equipment, apart from wrapping and chain work variations, "dival isi" and "anavata" stitches were attractive. To be able to understand if a work is hand or machine made the tread must be pulled. Machine made embroidery unravels if the thread is pulled. Another difference is those machines made embroideries do not have the same appearance back and front, as most hand made ones do.

Makrama: A rectangular cover, whose dimensions are 50x110cm, thus smaller than a "dolama". Very like a namaz cloth, 'makrama" two narrow edges are ornamented with thick borders. On some the narrow edges are decorated by knitting, crochet, or needle lace up to where border begins.

Mendil: A 50x50cm square piece of embroidery which was worn on the belt on the waist of a dress, or held in the hand. They are named according to their functions, and are usually ceremonial. Either their edges are ornamented with embroideries in a thick border or their corners are embroidered with motifs. Among ceremonial handkerchiefs, there are some examples the centres of which are embroidered.

Metal Iplik: Threads that are pulled from gold or silver or copper, then gilded gold or silver. In folk work, there is a variation of metal thread that can be called metal twisted silk which is made by twisting metal and silk together, is called "sim". There is another variation of it which is made of silver and called "sırma".

Musabbak: This kind of stitch which is called "üçgen Türk ignesi" in some sources, is counted thread work. Although it is embroidered without pulling threads, it gives the same appearance to both sides of the fabric and by the needle being inserted into the same place twice it takes on an appearance of pierced work. In this embroidery which begins with diagonal "hesap ignesi" in the return rows triangles are formed between the two parallel diagonal lying lines. The triangles are formed by "gözeme" embroidery, in the next return row the empty threads are filled. However, on the return of the second diagonal parallel lines, the pierced work (ajur) appearance is obtained by pulling the thread. Depending on the fabric and the thread, the work is the same on to the fabric's front and reverse sides.

Mürver: A kind of embroidery stitch which inspired by the name of a a flower. The front and reverse sides which are embroidered by counting the thread do not have the same appearance.

Nalın Bantı: A rectangular, thin, long band which is sometimes ornamented with embroidery. This band which is made of either wood or silver covered plaques on wood, and is placed on the sole of the clogs in order to hold the foot.

Nihali: A circular embroidered cover whose radius is 50cm. It is made for the purpose of decorating trays. There are also 80 cm radius "nihali" covers, as well as some that are rectangular. Larger dimensioned, circular shaped ones that are used as table cloths and ground cloths, can also be seen.

Ocak Yasmagı: A decorative cover, sometimes ornamented with embroideries. They are used to cover the top of a stone fireplace, mainly to keep the fire from smoking.

Ok Torbası: A quiver in which arrows are placed, sometimes ornamented with embroideries. Some elegant examples which are ornamented with encrusted metal plaques encrusted with valuable jewels such as pearls, diamonds and rubies and which are decorated with "kordon tutturma" needlework, are exhibited in The Topkapı Palace Museum.

Örnek Bezi: (Sampler) A piece of cloth used as a design catalogue, made for the purpose of learning and teaching various embroidery techniques.

Paçalık: Under pants whose certain units are embroidered with several ornamentations. It is worn under the bride's dress in some regions.

Perde: Large-sized, rectangular, embroidered cloth made either to cover windows or door spaces or to divide the tent into rooms. They are made in sets consisting of two sides pieces and a top piece.

Pesent: A kind of needlework formed by "gözeme" lines which are made by repeating some processes in the same number on either warp or weft threads of the fabric. It has two types; one of them is applied either horizontally or vertically while carrying the needle on the same line. The other variation is formed by slipping a row and embroidering in a diagonal system." Pesent ignesi" which has been applied widely in all periods of Turkish embroidery, gives the fabric's both surfaces the same appearance.

Peskir: A rectangular cover made of by either linen or cotton weave. Its two narrow edges are embroidered with borders and it is made to dry the hands and face after washing them. It is known that "peskirs" are used to cover knees like napkins as well. Among them, there are some embroidered kinds called "sumak peskir" which are made big enough to surround the floor around the dining-table. These peskirs were used to cover knees of those who were sitting around this table.

Pul isi: A kind of ornamentation technique in which different sized spangles are used. The spangles are attached to the cloth by using needle and thread in many ways. However, there is also a variation in which spangles are held in place by using beads.

Puside: A sarcophagus cover. A large sized cover made to ornament or covers the symbolic sarcophagus of monumental graves. It is made of either velvet, satin or leather and is ornamented with Koranic verses, geometric and vegetal embroideries or "dival isi".

Puside Levhası: An embroidered cover, placed in front of the sarcophagus in monumental graves. It gives information about the dead person and involves some explanations about him/her.

Sarma: (Satin stitch) A free style needlework made by putting the needle on a point and taking it to the point opposite. This stitch wraps the weave. It was used as an auxiliary needlework during the classical period, but it became the most used with machine embroidery during later periods. In Turkish embroidery, a widespread application form of sarmas, in especially 19th and 20th centuries is string "sarma". A group made in Bursa and Konya among string sarma examples which are made by using a special two-holed needle, is attractive.

Salıncak Yüzü: A kind of rectangular cover, embroidered by several stitches, made of either fabric, leather or the combination of them. It is made for the purposes of rocking or lulling the baby to sleep. It is hung by ropes tied to the four corners. Metal or wooden rods are fixed to its narrow ends. Two elegant examples are exhibited in The Beypazarı History and Culture Museum and in Afyon.

Sayeban: An large sized umbrella or sunshade. An embroidered group of "sayebans" which are in different dimensions and which had numbers of poles, made during Ottoman Empire period, can be seen. An elegant collection one of which belongs to Murat the Second can be found in The Military Museum.

Seccade: A cloth, ornamented with embroideries, made as a prayer rug. It consists of "ayetlik", "secde" and "tabanlık". There is a large sized group called a "saf seccade" which was prepared for 5-10 people standing a line and which is made by repeating "seccade" units. Among "seccade", the two pieced example whose inventory number is 12/3506 in The Istanbul Dolmabahçe Palace Museum, is attractive. The "ayetlik and "secde" of these "seccade" are of one piece and the "tabanlık" unit is separate.

Serpus: A felt made cap whose units around the head are ornamented with embroideries. Its variations are exhibited in The Maçka Military Museum.

Susma: A kind of wrapping needlework made by counting in suitable numbers to form shapes like triangle, square, rectangle or lozenge. Beside the mono-coloured "susma' that are made by "su" (border) which is formed with side by side lined up shapes like square, triangle, rectangle and lozenge, there are multi-coloured "susma" as well. They are used in embroidering the design ground lines in Turkish embroidery. A group of multi-coloured "susma" is used as a colour key in either determining colour harmony or choosing the colour. It has variations called as "ince süsme", "arpa süsme", etc... which are applied in either forming motifs apart from border or being used as auxiliary sprinkled motifs.

Sünnet Takımı: These sets which consist of a cloak, a cap, a purse, a belt, a cuff and breast knot; are worn on the circumcision days of boys. During The Ottoman Empire period,

“sünnet” sets which were produced in markets, were sold and sent to Anatolia and Roumelia from Istanbul.

Shalvar: A wide, long trousers which are worn by both men and women. They were prepared by different pieces and fly cuts. A group of ”shalvar” which are made of fabrics such as satin, velvet, broadcloth, cotton, etc..., are ornamented with embroideries. There are bands on the pocket edges, the lower part of the legs and the sides. “Shalvar” for males can be sometimes found as sets with waistcoats and jackets, and were in favour in the 19th century. The same situation was valid for women as well. “shalvar”-jacket sets were typical for henna nights.

Taban Halısı: A large sized ground cloth, “yaygı”, “nihali”, embroidered for either functional or decorative concerns. Like knotted carpets, embroidered carpets have two main types: one whose embroideries are developed from a centre and those whose embroideries are arranged by many rows of motifs.

Takke: An embroidered cap or head gear, without a peak, worn by men.

Taht Saçagı: A long, rectangular, embroidered cloth whose breadth is approximately 20cm. It lay on the sides of the thrones. This cloth which was widespread during especially 19th century was kissed when by people when in the presence of the Sultan.

Tel Kırma: A kind of flat, diagonal cross needlework in various silver covered threads, made by using thread and a one-holed needle. In this needlework which is made by counting the fabric’s threads, a diagonal “z” is made on the top, and a cross is formed on the reverse side.

There is another variation of this. This kind is differentiated from the other technique by forming a long arm vertically and the short arm as a diagonal cross shape. Its reverse side has an appearance of pierced work. Its variations can be seen in Yozgat and Konya.

Tel Kırma ignesi: A kind of flat and large-holed embroidery needle which is different from round-holed embroidery needles.

Terlik Yüzü: The velvet or satin fronts and sides of the slippers which are put on at home.

Tırnak: A kind of tripod used for stretching embroidered fabric over, and used as a kind of small table. There are variations which were in favour in later 19th century and which were made by this technique, and there are also folding screens elegant examples of which are exhibited in The Dolmabahçe Palace Museum.

Tıras Önlügü: A big rectangular, closed front, embroidered apron with a round collar. It is made to be worn when being shaved or having a haircut. It is tied at the back of the neck. The ones that were made for the bridegroom’s shaving are generally found as sets which are formed by a bundle and a rectangular cover on which shaving set is put.

Uçkur: A kind of long, rectangular tie, dimensioned 25x125cm. Its two narrow edges are embroidered. It is made to either ornament the garment or hold the dress or “shalvar” waist.

Üç Etek: A long, wide, long-wide sleeved, collarless, opened fronted, deep slitted woman dress. Sometimes its surface is worked with embroidery, sometimes the bottom edges are embroidered with borders.

Üniforma: A kind of garment on European lines, formed of trousers and a jacket whose front collar and sleeve cuffs are embroidered. Members of the Ottoman army wore this dress during the 19th and 20th centuries. In The Topkapı Palace Museum, there are some elegant uniforms

belonging to Abdülhamid the Second, Abdülmecid, Murad, Mehmed and Resat. Some paintings of uniformed Sultans or army members and tailor notebooks give us detailed information about embroidery forms and how they were made. There are interesting paintings in Dolmabahçe Palace Museum, The Military Museum and in The Naval Museum concerning uniforms.

Yaglık: A small sized "peskir" (napkin) whose two narrow edges are embroidered.

Yama isi: (Patchwork) A method of decoration which is made by attaching various coloured and designed fabrics to each other by backstitch and coarse sewing, etc... What is essential in this work is to form a composition by attaching pieces to each other. "Yama isi" which was widely applied especially in the 19th century, has a variation called "geçme isi" which is made by little pieces of cloth to form a mosaic design. In this variation, composition is completed by interlacing designed motif or composition units in a patching process.

Another interesting group of "yama isi" can be found among embroideries called "Banyaluka". This type is made by different techniques and combinations of different materials like broadcloth. Elegant examples of this type are known to be made in Banyaluka Spa center which is situated in the north-west of Sarajevo.

There is another variation of "yama isi" which is made by linking the motifs but leaving spaces between them. Elegant examples of this variation can be found in Konya Eregli Bekdik tents, and they point to the existence of an "aplike" which looks like lace.

Yastık: A filled, embroidered cushion in square, rectangle, round, or cylinder forms. It is prepared to either lean against or to rest the head.

Yatak Örtüsü: An embroidered, rectangular cover made for the purposes of either covering the bed to keep it clean or ornamenting them. These covers which are generally produced in markets, are designed as sets with two pillows.

Yay Torbası: Bow case. During the Ottoman Empire period, there were some "yay torba" which were made of various materials and techniques in The Palace. They are generally found as sets with arrow bags. The most elegant examples of these applications are exhibited in The Topkapı Palace Museum.

Yelek: A short, sleeveless, collarless, opened fronted jacket. Sometimes its whole surface, sometimes its edges are embroidered. They are worn over "göynek' (a kind of shirt).

Yorgan Yüzü: A washable, portable, rectangular cover, sometimes ornamented with embroideries. It covers a quilt which is filled by either cotton or wool.

Yün ipi: Thread spun from sheep's wool. In a group of embroidery, it is noted that various techniques are applied by using wool threads.

Yüzeysel Pesent: A kind of "kum ignesi". A kind of embroidery stitch which gives a "pesent" appearance on the fabric's surface and a tacked appearance on the reverse side of it.

Zerduz isi: Attaching stitch made by using metal thread. In other words, a variation of "dival isi".

Zincir isi: (Chain stitch) A kind of embroidery made by interlaced rings of thread. The difference between "ilme" (suzeni) work and this work is that, there is no other tool used but a needle.

Promotion and Development of Silk Handcraft Cottage Industries and Silk Enterprises in Uganda: Past, Present and Prospects for the Future

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ABSTRACT

Silk Development in Uganda started way back during the early part of the 20th century. Since the early 1990's attempts to promote and develop silk enterprises and allied industries have been led by the private sector. Silkworm rearing and cocoon production are being promoted as rural farm enterprises and support
directly to farmers and industrial enterprises has come from different agencies. It has been demonstrated that sericulture and the silk industry in general can
be successfully developed in Uganda. Training and introduction of appropriate technologies have made it possible for marketable products to be produced.
Farmers are now producing high quality bivoltine cocoons throughout the year. The all year round production and marketing of cocoons and silk products
and the current socio-economic conditions make silk enterprise development more attractive than any other opportunity, because of the potential it offers in
employment and wealth creation. Silk reeling, spinning and processing are being developed as cottage, small and medium scale enterprises in urban and rural areas. Establishment of technical bases for production of silk cocoon which are the primary raw material for the silk enterprises needs a long term approach rather than a completely commercial orientation. This paper highlights the past activities, experiences, lessons learned, current activities and strategies as well as prospects for silk enterprise development in Uganda.

Key words: silk cottage industries, enterprises, Uganda, development

Chapter 1. Historical Background

Uganda is one of the most favoured countries in the African region in rainfall, temperature, humidity, sunshine and soils for mulberry cultivation and silkworm rearing. The climate is equatorial, with two well-marked rain seasons. The peak of the first rains usually occurs in April, and of the second rains in October. Rainfall is low in June and July over the regions near the equator, but further north, its distribution tends to be unimodal. Most of the land receives on average between 750 and 1250 mm of rainfall. Moderate temperatures are for the most part. Climatic variations are°between 21 and 25 ^{o} C. These favorable climatic conditions make Uganda a comfortable home of sericigeneous fauna and the associated flora. For example many species of wild silkworms are reported to occur in Uganda. Anaphe silk was one of Uganda's exports in the period 1910-1945 with annual export of about 9 tons per year. Despite the fact that bridelia trees on which the anaphe silkworm feeds are found growing luxuriantly in most parts of Uganda, most of the anaphe silk was being collected from the wild trees of Mubende district in the central region. Attempts were made to introduce mulberry sericulture in the 1920s. Silkworm eggs were imported from Europe and Madagascar but unfortunately the eggs always hatched on the way. This problem was overcome by importing hibernating eggs. However, lack of cold storage equipment during this time affected the progress of research and development activities. Further efforts to develop silk in Uganda were hampered by lack of silkworm eggs, trained indigenous manpower and the speculation that synthetic fibers would replace natural silk.

During the early 1970s, attempts were again made to introduce the industry. In 1970, the Japanese government dispatched a survey team to Uganda to undertake a feasibility study on possible cultivation of mulberry and rearing of silkworms in Uganda. The Japanese brought along with them mulberry plants, seeds, grafting twigs and cuttings. The seeds and cuttings were planted and the scions grafted onto domestic mulberry trees. The experts trained Ugandans on how to plant and maintain mulberry. In their report, the Japanese experts acknowledged that Uganda was most favoured in temperature, humidity, rainfall and sunshine for planting mulberry and silkworm rearing. The Japanese also concluded that the most comfortable climate throughout the year would make it possible to produce more than 5 crops of cocoons in a year.

A collection of local mulberry varieties was done, multiplied and together with imported varieties mulberry plantations were established at Kawanda Agricultural Research Institute. Studies were limited to mulberry agronomic trials because of lack of silkworms to undertake rearing trials. These studies stopped in 1975 because of lack of trained personnel and the then political situation in the country.

In 1985, the Indian government and Swiss Development Corporation provided a training opportunity to Uganda and one person was trained at the International Center for Training and Research in Tropical Sericulture, Mysore. On return from the training, sericulture activities were revived at Kawanda Agricultural Research Institute. About 20 people have trained at this institute since that time. Rearing trials using silkworm eggs imported from India, evaluation and multiplication of mulberry varieties were undertaken during the period from 1986 to 1989. In 1989, a team of sericulture experts from India carried out a feasibility study to identify potential areas for launching of on-farm activities. Bushenyi district in Western Uganda was identified as the most promising area on account of its high population density and most favourable climate.

In 1990, two private sector companies namely Uganda Silk Industries Limited and Inuula Silk Estates Limited initiated commercial cocoon production operating mainly in the Central, Eastern and Western regions. USIL was operating in the Central and Western Uganda while ISEL was operating in Eastern Uganda. In September 1990, the United Nations Development Program sponsored a study to identify problems and constraints affecting the operations of the companies. A reeling and silkworm-rearing expert did the study from Japan. Cocoon production kicked off in 1990 with assistance of the Japanese experts who participated in training of extension personnel employed by the two private companies. The companies had started with establishment of large estates of mulberry each 10 to 15 ha in anticipation of undertaking their own large scale cocoon production for export and establishment of filatures. Central rearing facilities comprising of egg incubation, young silkworm and old silkworm rearing and construction of cocoon dryers. However, available production facilities and systems failed to achieve productivity levels and stabilization of the cocoon crops that were essential for the survival and expansion of the sector. Initially, and all along, these private companies faced problems, which were technical, environmental and financial. The companies came to learn that sericulture as opposed to other forms of agriculture in Uganda was more scientific and entailed more than just procuring mulberry varieties from the research institute and distributing them and asking farmers to participate. Production facilities and systems had failed to achieve productivity levels and stabilization of the cocoon crops that were essential for the survival of the sector. There were insufficient material inputs, lack of eggs including preservation and treatment facilities, lack of working capital and lack of rural credit schemes at farm level.

This led to a feasibility study sponsored by United States Agency for International Development and Ministry of Finance and Economic Development conducted in 1993 with a view of identifying the problems of the sector and the potential of the sericulture industry in Uganda. A project was subsequently designed and funded by the European Union to bring about sustainable increase in national silk export revenues and smallholder incomes through the development and strengthening of the commercial sericulture sector.

The two-year project intended to eliminate the identified constraints was later extended to 5 years to:

- Assist private companies producing silk for export to have access to core facilities, technical assistance, and credit and stabilized supply of cocoons.
- Assist 1,000 small-holder families to increase cocoon production and income by developing and applying a successful and replicable complete crop-credit package and extension methodology through silk development centers.
- Ensure that the pilot activities can be sustained and expanded through the strengthening of Uganda Silk Producers Association and establishment of a staff counterpart structure.

The project had six components:

- The core facility for egg preservation and treatment with laboratory cooled incubators with capacity of 15,000 boxes per annum
- Loan to private companies to provide commercial loans to silk companies that were members of Uganda Silk Producers' Association
- Material credit to farmers to enable the project to establish a revolving fund to be administered by USPA on a full-cost recovery basis

- To enable the project establish 12 silk development centers to serve 240 farm families
- Strengthen USPA to ensure project activities could become sustained and extended and that USPA should take over the activities of the project
- Sericulture support services provided by or through USPA by conducting studies to support the sector as a whole.

Cocoons produced before and during the project period were exported to Japan. The quality of the cocoons exported was generally for production of raw silk grade 2A. The export accounted for 70% of total production. The rest of the 30% of production were low grade and/or unreelable cocoons which could not meet the Japanese standard of quality. They were held in stores, buried or burnt. However, cocoon exports were affected by the low production of cocoons which necessitated a long time of waiting to fill a container of 1.6 to 1.7 tons of dry cocoons as the minimum export order. Fluctuation of the international prices of raw silk and products affected the market for dry cocoon in Japan. It was found difficult to export the cocoons to Japan, pay the freight charges and obtain a profit on the undertaking. The project had not anticipated establishment of processing factories and craft processing of low grade cocoons and nor was there any project review during the life of the five year project to address the unanticipated problems.

The EU project ended in 1999 when export of cocoons had ceased. Lack of a sales outlet affected on-farm production, which decreased drastically. Around the time the EU project was winding in Uganda, another sericulture project was starting at International Center of Insect Physiology and Ecology, Nairobi, Kenya. The ICIPE project was funded by International Fund for Agricultural Development. Silk reeling trials using a small (ten end) multi-end silk reeling machine were undertaken by ICIPE in Uganda in collaboration with the Ministry of Agriculture, Animal Industry and Fisheries for a period of one year. The trials were successful. This led to signing of a memorandum between ICIPE, MAAIF, a local silk farmers association and NOBWE Silk Development company to collaborate in development of a silk market place at Bushenyi in Western Uganda. In August 2002, ICIPE/IFAD provided financial support for equipment and training of personnel. A 60-end silk reeling machine, re-reeling machine, winding and doubling machine, twisting machine and a weaving machine. Three years of reeling, twisting and weaving of silk have shown that Uganda has the potential to become a leading silk producer at least in the African region. Raw and twisted silk yarn has been exported, cloth is being produced and sold locally.

The introduction of cocoon and silk processing has encouraged farmers to expand their mulberry fields and rearing facilities. In 2003, farmers in Kanungu and Bushenyi districts in Western region have received assistance from African Development Foundation, USA to enhance their capacity to produce more cocoons and increase their incomes. The support has been provided as a revolving loan fund intended to enable the farmers to realize full employment potential by increasing the number of rearing cycles per year from three to six or more. The assistance has been applied to establishment of co-operative young silkworm rearing centers, construction of individual old silkworm rearing houses by individual farmers, procurement of cocoon frames sufficient to sustain the rearing of two boxes of eggs per cycle which is considered to be profitable enough to benefit the farmer. The increase in cocoon production necessitated expansion of cocoon reeling facilities. Again with the assistance of ADF, USA a 400-end automatic silk reeling machine was installed in Kampala in 2003 to meet the capacity for the increasing cocoon production and production of high quality raw silk.

In June 2005, Japan International Co-operation Agency provided an expert at the request of government to assess the current state of the industry and to provide advice on how to expand the sericulture industry to economic levels, improve cocoon production, processing and marketing. Low quality cocoons have been cut and de-gummed. The product is exported to processors in Zimbabwe and South Africa. The small volumes available make it difficult to reach out to big buyers in the traditional silk markets. Craft processing of the low grade cocoons using hand reeling machines and spinning machines as well as hand weaving has already started. This paper highlights the experiences and lessons learnt from the past activities and prospects for silk enterprises development in Uganda in future.

Chapter 2. Experiences and Lessons from Past Activities

Pioneer companies came forward in the early 1990s to take up large scale sericulture farming. It was thought that with the policy of liberalization and privatization in place, there would be sustainable increase in silk export revenues and small-holder incomes through the private sector. Initially the pioneer companies planted mulberry on estates and attempted silkworm rearing on the estates. It was thought that silk processing would be linked rapidly to the estates and high returns were expected to be achieved through export of silk cocoons and reeled silk. One company in Eastern Uganda bought a silk reeling machine after establishing the silk estate. The company also set up an out-grower scheme hoping to reel estate produced cocoons and those produced by out-growers to produce silk for export. This was not to be. To-date all estates have collapsed with severe financial consequences. All cocoon production activities are now mainly on small land holdings. The small land holding system has been found to be the best for sericulture development because 90% of the population in Uganda is employed in agriculture mainly on small land holdings. Most of the agricultural employment is household farming, which is based on very high labour intensity. The dependency ratio in Uganda is more than 100%. Because of poverty, the incidence of wage labour in rural areas is low, casual workers account for a very high proportion. Most of the members of the rural labour force are usually predominantly occupied with work on their own farms.

The people are unskilled and the work on their household farms is the most convenient and remunerative occupation. This scenario makes silk and allied enterprises suitable for rural areas in Uganda.

Table 1. Annual Fresh cocoon production (kg) 1992-2004

Year	Quantity
1992	431
1993	8,332
1994	8,679
1995	8,302
1996	9,451
1997	10,705
1998	14,085
1999	3,399
2000	0
2001	0
2002	4,701
2003	3,073
2004	3,566

All projects in the past have emphasized provision of credit to farmers to set up rearing facilities. However, it has been found that acquisition of practical sericulture skills, better marketing through value addition should be included in all project designs. For the EU supported project, each farmer was to establish an economically viable sericulture farm unit based on 1.5 acres of mulberry for rearing more than 2 boxes of worms per cycle producing 60 kg of cocoon 6 times per year. This was considered to be a reasonable level of entry into sericulture enterprise and to reduce poverty. However, by the end of the project, the objectives and targets set by the project varied significantly from the actual achievements. The project had failed to recognise the fact that sericulture was a new and specialised enterprise. For example, increase in mulberry seed stock and establishment of targeted mulberry acreage could not be done quickly as per project design. Trainers with no experience in sericulture were employed to train and supervise completely new farmers. One day seminars were considered adequate for imparting skills to the new farmers who had never seen the silkworm. The management and technical assistance to the project did not have any experience in sericulture or silk development. In short, the design of the project wrongly assumed that the condition for sericulture development other than working capital for companies and farmers were in place. By the end of the project, each farmer had planted 0.5 acres on average, one box of eggs was reared per cycle producing 20 kg.

Table 2. Survey on mulberry acreage after 4 years of project implementation (1998)

Region	**No. farmers**	**No. mulberry trees**	**Total acres**	**Acre/household**
Western	134	178,971	60	0.45
Eastern	62	90,149	31	0.49
Total/Average	196	269,120	91	0.47

Mulberry acreage could not be increased overnight which was made worse by the fluctuating world market silk prices. Inputs provided by the project on loan
could not be utilized efficiently leading to low or no loan repayments by the farmers. Low silk prices led to complete stop in dry cocoon export and abandoning of the industry by trading companies. In absence of local silk processing and marketing channels most farmers were forced to stop silkworm rearing or abandon the enterprise.

Table 3. Number of rearing cycles/cocoon crops undertaken in a year (1998)

No. of cycles	No. of farmers	% farmers
1	128	43
2	79	26
3	47	16
4	25	8
5	10	3
6	8	3
7	2	0.7
8	1	0.3
Totals	300	100

Table 4. Results of tests fresh cocoons produced by farmers (1995)

Month	Cocoon weight (g)	Shell weight(g)	Shell%
January	2.128	0.430	20.21
February	2.050	0.530	25.85
March	1.802	0.411	22.83
April	1.592	0.385	24.18
May	1.972	0.490	24.87
June	1.906	0.449	23.56
July	1.862	0.460	24.70
August	1.689	0.392	23.21
September	1.572	0.385	24.49
October	1.882	0.453	24.06
November	1.860	0.455	24.46
December	1.865	0.406	21.77
Average	1.848	0.437	23.66

Table 5. Test results of cocoons produced by farmers 1993-1999

Year	Average cocoon wt (g)	Average shell wt (g)	Shell wt (g)
1993	1.54	0.37	24.03
1994	1.68	0.42	25.00
1995	1.85	0.44	23.66
1996	1.90	0.44	23.16
1997	1.98	0.46	23.23
1998	1.87	0.44	23.53
1999	1.77	0.41	23.16
Average	1.80	0.43	23.89

Table 6. Test results of dry exported cocoons 1992-1995)

Year/Parameter	1992	1993	1994	1995
Reelability %	62	73	75	71
Filament length (m)	873	881	1051	-
Raw Silk %	36.22	37.17	36.22	38.42
Denier	-	-	2.67	-
Grade	B	2A	2A	2A

Table 7. Cocoon Productivity 1999-2004

Year	Boxes eggs reared	Fresh cocoon (Kg)	Fresh cocoon/box kg (20,000 eggs)
1999	227	3,399	14.97
2002	205	4,701	22.93
2003	158	3,073	19.45
2004	163	3,566	21.88
Average	152	3,685	19.81

The selection of Uganda by the IFAD funded project at ICIPE, Nairobi late 1999 for processing and marketing trials, demonstration and establishment of production and marketing systems for sericulture farming came as a blessing. Silk reeling and weaving was successfully done to produce reeled silk and cut de-gummed cocoons which were being exported. Silk cloth was produced and sold locally. During the process of these trials and demonstration which were intended to determine if Ugandans could process and market silk, a number of lessons were learnt. It was realized that the quality of silk thread depends on the work done on the cocoon for example drying, storage, cooking and reeling as well as doubling, twisting, weaving, bleaching, dyeing, printing and designing. It was also realised that the technology of cocoon production and processing can be learned though practical training not just theoretical lessons.

The conclusion drawn from these experiences were that the only reliable way to establish a silk industry in a place is to establish technical bases for cocoon production, small and medium scale filatures, cottage cocoon processing and weaving facilities which are affordable and can be sustained by existing production capacities. A development option, rather than a completely commercial approach to silk enterprise development needs to be adopted right from the beginning.

Chapter 3. Strategies, Activities and Prospects

The climate of Uganda allows silkworm rearing and for most of the areas several rearings per year or even non-stop rearing is possible.

Mulberry for sericulture production has been planted in more than 50 out of the 69 districts of Uganda. Young silkworms are produced at cooperative centers and distributed to farmers. The capacity of the young silkworm centers varies from 50 to 200 boxes per cycle of rearing. Shoot rearing on platform beds is practiced. Average cocoon production per box (12g) of eggs is 20 kg. Farmers rear silkworm up to 8 times per year depending on acreage of mulberry. Production of silk cocoons is targeted for high quality in order to get recognized and compete in the international market. Average cocoon weight of the last 10 years is 1.90g, shell weight is 0 .44g and shell percentage is 24%. Raw silk % is on average 37%, and filament length is 800-1,000 meters. Cocoon grade is 2A. It has been demonstrated that high quality bivoltine cocoons can be produced in Uganda throughout the year. Trials in cocoon and silk processing have also been successful.

A policy structure and strategy to be adopted for improvement of sericulture in Uganda has been based on the experiences and lessons learnt after a number of years of trials. The purpose of the policy is to establish a framework for harmonious development of the silk industry, promotion of good practices, prevention and control of diseases, monitoring of quality and quantity of silkworm eggs and cocoons and silk products. The strategy aims at establishing a sustainable base for supply of high quality mulberry leaves, suitable silkworm breeds, availability of technology for production of the quality seeds, silkworm rearing and appropriate techniques for silk processing, as well development of markets for the products locally and internationally. The strategy will aim to work out mechanisms for efficient utilization of installed facilities at farm and industrial level.

Strategies being followed to ensure sustainable development of the silk sector are shown below:

- Establishment of mulberry germplasm and mother gardens of suitable varieties
- Multiply and distribute good mulberry varieties
- Train farmers in growing techniques

Silkworm egg production

- Establish silkworm germplasm and maintain suitable stocks
- Silkworm breeding
- F_1 egg production
- Support establishment of grainages for egg production
- Support establishment of more (cooperative) young silkworm rearing centers.

Silkworm rearing and cocoon production by farmers:

- Training and retention of sericulture extension personnel by farmers organizations and local governments.
- Set up a system for regular training of extension personnel and farmers.
- Provide extension services (follow-up activities for farmers by sericulture personnel).
- Set up demonstration sites aimed at farmers.
- Establish cocoon buying centers to be run by farmers' associations.

Development of Silk Processing Capacity and Marketing

Silk reeling is already a private sector activity. Automatic and multi-end silk reeling machines have already been installed. Raw silk of denier 20/22, 60/70 and 250 is exported. However, use of less sophisticated machines, but with experienced personnel, makes it possible to use lower grade silks. This has been practically demonstrated. The silk cocoons which cannot be machine processed are now being hand reeled or spun. The yarn is used in the weft of handlooms. Development of industrial weaving on mechanical and power loom will be experimented by the private sector in existing mills. There is a lot of interest both in the public and private sector, which indicates that silk enterprise development in Uganda can be speeded up. Compared to cocoon production, more external technical assistance are needed in the development of silk processing. Installed factory capacity needs 300 tons of cocoons. Current production needs to be increased 100 times. Mulberry farm productivity increase will be emphasized to utilize current silkworm rearing facilities and increase cocoon production. Adequate working capital will be needed by the factories for prompt payment for cocoons so as to encourage farmers to produce more cocoons.

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Conditions and development prospects of cottage industries and silk branch in the Republic of Uzbekistan

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ABSTRACT

In Central Asia the origin of fabric manufacturing traditions concerns to deep antiquity. The pieces of silk fabrics, found in Northern Bactria (II-III century AD), witness that already at that time fabric weaving and dying techniques had achieved here high development. The centers of local handicraft manufacture were and still are cities Bukhara, Samarqand and regions of the Fergana valley (Margelan). Today these places are famous for the beauty of manually made silk fabrics.

According to the information on national crafts industry condition nowadays in the Republic are functioning 19 factories and 1404 private artels consisting of 140896 persons engaged in the craft of gold embroidery, 4 factories and 70 private artels of more than 500 men, annually producing 680000 pieces of consumer goods for the sum of US$ 1152542.3. There are 22 factories and 772 private artels engaged in carpet and art fabrics production. More than 10000 men are employed by these enterprises, which produce 6100 m^2 of carpets for the sum of US$ 716500 and 12140000 m^2 of fabric for the sum of US$ 35637881,2.

General population employment in national crafts is156868 men. Annually by them are produced consumer goods for the sum of US$157227310. About 25 % of these goods for the sum of US$38240813,8 are exported.

In our Republic and other countries many competitions and exhibitions of national crafts art often are organized. Thousands foremen demonstrate their skills and talents on competitions, that testifies to scale development and distribution of national crafts in our country. It is a result of both material, and spiritual support of self-denying work of them.

Last years the fashion designers of the Republic have participated in many international exhibitions and festivals of styles.

Key words: silk handcraft, cottage industries, Uzbekistan, development

Chapter 1. Introduction

In Central Asia the origin of fabric manufacturing traditions concerns to deep antiquity. The pieces of silk fabric, found in Northern Bactria (II-III century AD), witness that already at that time fabric weaving and dying techniques had achieved here high development. The centres of local handicraft manufacture were and still are cities Bukhara, Samarqand and regions of the Fergana valley (Margelan). Today these places are famous for the beauty of manually made silk fabrics. In olden time silk was considered to be luxury, the most precious goods. Even money was made of silk. Tributes and trade bargains were paid with it.

Ancient trade road, that already in the II century BC has connected China with Mediterranean, East with West, not casually has received the name the Great Silk Road. Caravans carried wool and leather, bronze and porcelain, cobalt and parfumes. Was among all goods also the one that is more gentle and lighter than air, was appreciated more expensively than gold - silk. The skilful weavers of Bukhara, Samarkand, Balkh, Khamadan, Damascus, Baghdad made of raw-silk unique and beautiful fabrics.

The history of sericulture development in Central Asia has deep roots. The materials of Archeology Institute of the Science Academy of Uzbekistan prove existence of sericulture and silk-weaving on territory of Republic more than 4000 years ago in the Fergana valley, on sources of the Zaravshan river, and also in the south of the Republic.

During the kingdom of Amir Temur (1336-1405) on territory of Central Asia, especially on the Great Silk Rode routes – Samarkand, Shahrisabz, Bukhara, Turkistan and Fergana valley wide development have received sericulture, silk-reeling and silk-weaving with application of gold embroidery elements.

From antiquity in Central Asia and other parts of the world in Afghanistan, Iran, Iraq, Syria and Pakistan were known silk fabrics, picturesque, original on contrast and harmonicity of colouring, - atlas and khan - atlas, easy and thin fabrics for female clothes – “shoyi”, “poshoyi”, heavy fabrics – “bekasam”, “adras”, “banoras”.

Already prior to the beginning of XVI century eastern silk fabrics were on sale in all main markets of Europe. And these fabrics were delivered by the same roads of the Great Silk Road.

The historical information on export of silk production from the given region testifies that since XIX century, the silk fabrics and high-quality paper from cocoon-wastes were exported from Central Asia to India, Arabian states, on Caucasus and, further to Russia and Europe.

The historical conditions, in which the Central Asian culture developed, have predetermined to crafts the special role. Within many centuries its technical and art traditions were created by people. The art traditions of the people are extremely steady: changing together with conditions of life of the people, they do not lose the national basis. The development them according to new tasks and requirements is the main and indispensable condition of successful development and revival of crafts.

Presently traces of deepest olden time are combined with modernity. Traditional Uzbek Khan-Atlas fabrics are woven with new modern designs: in perfect ancient patterns of Uzbek embroiderers are added patterns and rhythms of modernity - architecture and epigraphics; the foremen of stamping art, using traditional ornaments, apply new engineering of modern stamping manufacturing; Uzbek foremen of ceramics use factory materials, and the ceramics get new sounding, remaining thus deeply national in its form and ornament. The groove on alabaster and wood harmonically match modern buildings from a glass and concrete.

National traditions are carefully saved and creatively developed by many generations of the talented foremen. Their use according to new tasks and needs - indispensable condition of successful development and revival of crafts.

Lasting interest to crafts, their historical cultural role are determined by that in craft as well as in the epos and music, poetry and dance the most secret features of national character, its aesthetic sights, taste, its world outlook, its talent are reflected.

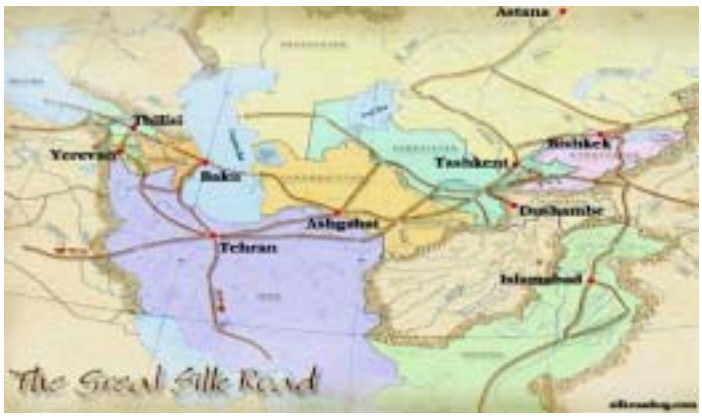
Chapter 2. Role and importance of the Great Silk Road in historical development of Central Asia and in particular economic development of the Republic of Uzbekistan

One of the remarkable achievements of ancient civilizations considers to be the Great Silk Road. For the first time in a history of mankind on huge open spaces from Mediterranean up to Pacific ocean it has connected the various countries and peoples, has connected their material, art and spiritual cultures. Many centuries on this ways the exchange of crafts, ideas, technologies, beliefs was carried out.

Beginning of occurrence of the Great Silk Road in all of its extent - 12800 kilometers - the historians attribute to the second half of II century BC, when the Chinese diplomat and scout Chzhan Tzian for the first time has discovered for the compatriots unknown earlier western territory - Central Asia.

The concept " the Great Silk Road " is connected with precious in those times goods – silk, which acquainted two different worlds: West and East. It is considered, that the secret of silk manufacturing was discovered almost 5 thousand years ago. Growth of scientific and public interest to the Great Silk Road, its place and importance in a world civilization is not accidental, as this concept is much more capacious, than simply a caravan road. Researchers consider that due to distribution of spiritual values, scientific and technological knowledge, religions and cultures along all of its routes there were large trade cities. The Great Silk Road has rendered huge influence on formation of the political, economic, cultural device of the countries, through which it passed. Here were more than once conquering and internecine wars, during which were created and destroyed great and small states, the former capitals conceded a place to the new ones.

The peoples of many countries today aspire to study roots of the history, to understand sources of their spirit, national participation in world culture. Such opportunity is given by the decision on revival of the Great Silk Road as a major channel of the profound international cooperation in the fields of diplomacy, culture, science, trade, tourism.



Uzbekistan is successfully located in the heart of the Great Silk Road. The nature of the region gave it a wonderful variety of landscapes. The coast of the Aral sea is replaced by

Kizilkum desert, subtropics of the Surkhan-Darya oasis are changed by Pamir ranges, the fertile Fergana valley is closed Tian-Shan foothills. After declaration of independence in 1991 Uzbekistan became an equal member of world community. The Republic is a member of the United Nations Organization and has diplomatic delegations in more than hundred countries. Economy of republic dynamically develops. The Tashkent airfactory produces transport planes, which are exported to twenty countries, and passenger medium route planes Il-144-100. The automobile plant in the Fergana valley is constructed. Uzbekistan is on one of conducting positions among gold-extracting countries. In republic the colour metallurgy and chemical industry is advanced, it is one of largest cotton fibre and cocoon production manufacturer in the world. Wide cooperation with the international partners, favorable conditions for foreign investments attraction into the country, participation in the international scientific and technical programs - major constituent parts of economy of Uzbekistan.

Chapter 3. Historical development of national crafts and its importance in economic development of the republic

3.1. Gold embroidery

Gold embroidery as usual a national craft for the first time is mentioned in 14th century by the historian Klaviho, marking existence in the city of Samarqand a whole neighbourhood of gold embroiderers. Clothes with gold embroidery, found in I-II centuries by archaeologist near Tashkent and information of the Arabian sources of the VIII century, specify existence of this craft on territory of republic even in earlier period.

Gold embroidery was mostly developed in Bukhara in the middle of the last century, where in workshops of ruler's palace skilful foremen decorated magnificent clothes of the governor and his retinue. Gold embroidery craft was hereditary and passed from father to son. Man's dressing gownes, turbans, tyubeteikas, footwear; from female clothes: dresses, dressing gownes - kaltacha, headbands - peshanaband, shawls, shoes were embroidered with gold and silver threads. The embroidery with gold using precious stones and metals plentifully decorated pieces of furniture of a palace interior, and also horse-cloths.

The art of gold embroidery in the middle of XIX century has achieved high perfection of composite construction of patterns and its workmanship. The patterns drew on kid or cardboard, then cut out, attached to tense fabric on tambour-frame and sewed up by gold or silver threads. For each decorated product the certain embroidery techniques were used: solid – zamin-duzi, on the cut out figure on a free background - gulduzi. Each part of a pattern embroidered by the certain seam, them was known over thirty.

Foremen embroidered on a velvet of dark tones of cherry, dark blue, lilac, brown, crimson colours. The soft depth of a velvet strengthened decorative effect of gold sewing, on contrast revealed features of a difficult lacy-relief pattern. Clothes with gold embroidery were worn by richest and high-born local aristocracy, and it is completely natural, that this kind of art carried in itself features of solemnity, quite often passing ornamental oversaturation.

Now with gold embroidery are decorated details of ceremonial toilet: ceremonial national hats, female sleeveless jackets, shoes, hand-bags, and also cases for glasses, covers for cushions, bindings for albums, decorative coverlets etc.




These products of gold embroidery are produced on the factory in Bukhara, during which existence the art of gold embroidery was taken possession by women. Scale unique products - theatrical curtains, beautiful luxurious panel are also created at the factory.

Since 1960 gold embroidering craft began to function in system of the Ministry of a local industry. In 1962 the gold embroidering factory of Bukhara has received a new building, where more than 400 foremen, most of whom are women began to work.

Production of factory reflects three directions of creative search of the foremen.

One direction continues a traditional line of gold embroidering craft, ornaments of which are rich with motives and images of the last century. It has found a reflection in products of the Uzbek national costume.

The second direction continues creative search on creation of unique monumental panels and curtains. The third direction is connected with manufacturing of souveniers, in which the decorative function predominates.

In 1990-s the gold embroidering becomes the widely spread kind of art craft. Except for the historically usual centre in Bukhara, it began to develop in Andizhan and in a village Marhamat of the Andizhan region, Uchkurgan and Kasansay (Namangan region), Yaz'yavan (Fergana region), Samarqand, Urgut, Karshi. The conducting modern embroidery foremen are Bakhshillo Djumaev, Saida Akbarova, Tabassum Sadikova, Gulshod Bozorova, Gulchehra Pirimkulova.

The great skill and skill to subordinate a composition of a pattern and its scales to the various form of things has an effect in decoration of beautiful details of a costume: belts, purses, scabbards, shawls, sashes, decorative tape and especially original head-dress - tubeteykas.
In art sewing of Uzbekistan the set of techniques was used, the large importance was given to a choice of seams, fine divasion of details. Here are some most popular seams: "bosma", "iroki", "yurma". And each of the named seams had set of variants, at the various embroidery art centres was preferred to this or that engineering of sewing, as helped creation of local style.

3.2. Printed fabrics

The manufacturing of printed fabrics was widely distributed at the peoples occupying present territory of Central Asia. Printed cloths, every possible curtains, blankets, shawls, high-quality fabrics for a female dress, various coverlets, including horse-cloths, even funeral shrouds and other both piece and meter printed products carried out utilitarian functions and served as a decoration of everyday life.

Bukhara and settlements near it were famous for this art. The perfect products were developed by the foremen of Urgut, Scahrisabz, Samarkand, Katta-Kurgan, Fergana, Tashkent; printing of Khorezm differed by its originality.

The traditional art of fabric decoration by a printed pattern is connected with ornamental woodcarving. Archaic methods of manual printing with the help of wooden carved stamps are known by many peoples, and everywhere this surprising on the simplicity and generosity of art expression art is marked by a seal of a national originality. The centuries-old culture of development of this art in territory of Uzbekistan is doubtless. Found by archeologists the wall lists of V-VIII centuries quite often contained the images of richly ornamented clothes from various fabrics trimmed with embroidery, embroidered and stamped patterns.

Black-red pattern with a pinkish background - severe and simultaneously warm scale - favourite printing colour of the foremen of XIX-XX centuries. In the past the printing colours were more diverse, were developed and were popular dark blue, indigo patterns. The tradition of national art has selected and has saved up to now only original black - red pattern.

The ways of manufacturing of printed fabrics are original. Decorating fabric, cotton or mix of a cotton and silk, impregnated with a solution of tanin, in the past made of pistachio-tree, the pattern was rendered on a fabric manually with the help of wooden stamps.

The individuality of creativity of each foreman was expressed during printing a pattern, in his skill to pick up and to group patterns, which at each foreman was present on several of tens or even of hundreds copies. Patterned stamps served for a long time and were passed by right of succession.

3.3. Carpet manufacturing

Carpets - spell of East. There during many centuries the carpet served a table and bed, was a good gift and rich dowry. Eastern people considered it to be most reliable charm. They knew, that the carpet not only creates an atmosphere of heat and cosines in the house, but also is capable to protect dwelling from malicious spirits, to frighten off snakes and wild animals.

Carpet weaving appeared the II century BC, and later became popular in Bulgaria, Albania, Romania, Greece, Yugoslavia, Armenia, Azerbaijan, Georgia, Dagestan, Kazakhstan, Kirghizia, Uzbekistan, Tajikistan, Afghanistan, Russia, China, Nepal, India, Morocco, Tunis, Algeria, Turkey and Iran.

As the famous Great Silk Road, the brisk connection between the large cultural and industrial centres of the old world, passes through Uzbekistan, it results in repeated crossing of a history of these grounds and their east and western neighbours of India and Persia; Buddism and Parisismus had prevailing influence, before they have been replaced by Islam in 9 -10 centuries.

It is surprising, but for thousands years of carpet weaving history, its techniques practically has not changed. Certainly, if we speak about original carpets of manual job.

The original carpets are weaved only from natural materials - wool and silk, as a basis flax, hemp, jute and even silk are used. A basis is pulled on a special wooden frame and pile is manually entwined in it. Each string is fastened with a special knot. For each knot a specialist spends about 2 seconds and makes about 10-14 thousands knots a day.

The conducting exporters, delivering production to Germany, are Iran and India. Further follow - by way of the importance - Nepal, China, Pakistan, Turkey, Morocco and Afghanistan.

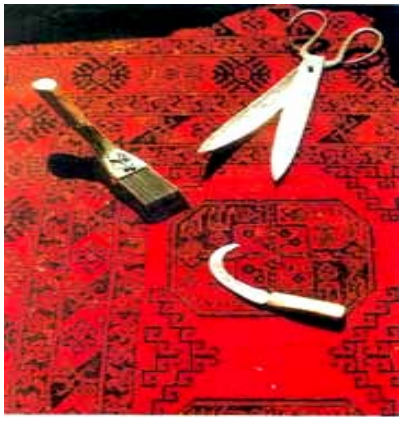
In total in 1998 by the European countries was imported approximately 18, 8 mln. m^2 of eastern carpets for the sum of 1.77 mlrd. DM. From them the greatest part is necessary on Germany: total amount of knot carpets of manual job has made, on the data of Federal statistics department, about 9.8 mln. m^2 for the sum of more than 1 mlrd. DM.

The products of manual job made in regions of Central Asia, have the Persian origin. The carpets represent, basically, products of new design, among them often there are Caucasian motives sold under the names "chichin", "ensi". "chapbaff" or "peshavar".

Manufacture of carpets in Uzbekistan has a long history. In the modern world this products, similar to them, were weaved only for home use, and the young girls learned the art of it in the house of their parents during getting their dowry ready, which lasted for years. Dowry consisted of carpets, blankets, pillows, curtains.

The carpet was a most necessary thing in a home life. First of all were appreciated its good quality, durability. For manufacturing a carpet the best spring flat sheep wool was selected. For spinning of strings of a basis were used longest fibres. Such carpet lived centuries, not losing the qualities. The carpets not only replaced furniture, but also satisfied aesthetic inquiries of the people.

The art of carpet manufacturing developed originally on the both sides of Amu-Darya river in Iran, Turkmenistan, Afghanistan etc. During centuries the Uzbek foremen developed own patterns and colour combinations, and now their carpets strongly differ from carpets of the neighbours in Iran, Afghanistan and etc. If to consider them in general, the "know-how" of carpets in these countries is rather monotonous: except for silk carpets, all carpets are made on a fabric basis of a wool yarn (basis and weft). Carpets of thin job are made sometimes with use of silk strings of a basis and silk weft strings. Only silk small carpets – mostly from Bukhara or Kabul – achieve the density of 750.000 knots per m^2.art craft has not only practical and decorative meaning, but also celebratory. The art of manufacturing of carpets was passed from generation to generation.



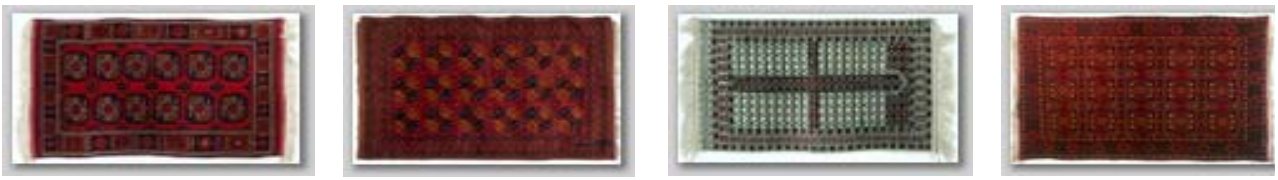
Traditionally the Uzbek foremen work on horizontal weaver's machine tools, but now there is an aspiration to replace them with vertical metal machine tools. In parallel with this modernization, the foremen try to develop new patterns and "know-how" of high-quality carpets of extremely manual job.

The diversified goods moved on caravan routes of the Great Silk Road. Wool and leather, cotton and fruits, products from glass and metal, jewels, parfums, jeweller products, the invaluable silk fabrics carried heavily loaded caravans. And everywhere were especially in a great demand eastern carpets, also the ones created by the Uzbek foremen.

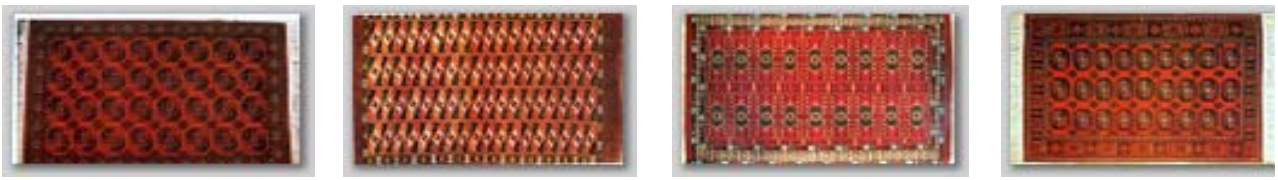
In palace workshops were created magnificent silk and gold nap carpets. Such products incredibly dearly were appreciated, they decorated palace halls, imperial residence, served as precious gifts to foreign governors.

“Ahal Teke”

“Beshir”



“Ersari”



“Kerki”

“Teke”

Versions of Bukhara –Turkmen carpets

Marco Polo, having visited Central Asia, wrote: " You should know that here are manufactured the most thin and beautiful carpets in the world…" The brisk trade relations, connecting European countries with East on the Great Silk Road, have made eastern carpets famous in the whole world.

In due course manufacture of silk carpets, this elite and expensive production, came in decline, and from a beginning XIX of century them practically did not manufacture, the technology of manufacturing was lost.

To revive the unique craft of silk carpets weaving have undertaken in workshop "Bukhara - Samarkand" founded by our famous contemporary Muhammad Avaz. Now at this enterprise more than 400 persons work, 30-40 carpets of manual job here are made per one month. The work at one carpet can last from 6 to 12 months, as weaving density is very high: in a pattern of each product it is necessary to connect hundred thousand, sometimes even more than one million knots on each square meter.

The game of dark and light tones is characteristic for silk carpets. Examining such product from the different sides, is possible to see as background colour changes shades. It extraordinary enriches colouring of the whole carpet. Very thin - height of pile does not exceed 2 millimeters - they differ by a dense velvety surface and, despite of their lightness, are strong and are durable. The paints at such carpets do not fade in due course, moreover, they become more sated, refined. In patterns of a silk carpet are used in basic classical east compositions.

In a deep antiquity a carpet yarn was painted with natural dyes of a vegetative and animal origin. The ancestors knew many plants, from which such paints were extracted. For reception of colour tones of a red scale more often was applied an extract of “marena”. From indigo the scale of dark blue colours was extracted. By extracts received from broths of an oak bark, nut, pomegranate, a yarn was painted in brown, black and yellow colours. The recipes of manufacturing of dyes were carefully kept in family, were passed as greatest value. And now at the enterprise of Muhammad Avaz at colouring a carpet yarn this technology, verified by centuries is applied. Some of necessary plants he grows himself , in a court yard of the workshop. The vegetative paints, which only is in use of Samarkand carpet producers, give the special nobleness to their products: contrast tone of strings softens, the nap surface becomes like velvet, shines. In due course occurs silvery, and sometimes golden outflow, that gives to a carpet the great art value and highly is appreciated by the connoisseurs.

The carpets and now invariable draw to themselves attention of the numerous visitors coming to Uzbekistan from the different countries of the world. And the workshop "Bukhara - Samarkand" located in an old part of Samarkand, is one of favourite places of visiting for foreign tourists: unique silk carpets here are manufactured.

During last years in Samarkand, Bukhara, Fergana, Namangan and other large cities have arisen well equipped manufactures, at which the carpets are weaved under the control of the foremen - handicraftsmen. There are used the first class raw materials and dyes at application of modern colour engineering along with traditional natural dyes. They take care of production quality preservation of traditional Asian carpets, and also simultaneously try to enter new patterns and decisions, certainly, respecting thus initial samples and feature of national carpets. The made here carpets are known as most noble both most thin Bukhara (turkmen) and Persian carpets. Some are made of pure silk, domestic manufacture, other of a wool with addition of silk. Density of knots lays between 340 000 and 630 000 on sq.m. Some of these carpets can seem unlike on traditional Asian carpets, since. The colour combinations cover not only traditional style but also such samples of patterns, as a pattern as a vase, stage of hunting, stylized flowers etc.

Versions of Asian carpets

On the main Samarkand square Registan, in a number of craft workshops and trade shops, the urban authorities have helped to open a special room of exhibition - sale of carpets of manual job made in workshop "Bukhara - Samarkand". The best samples of products intended for sale here are exposed.

And in a hall always are foreign tourists wishing to admire imperishable beauty of silk east carpet to get for themselfselves perfect creation revived from neglect by the skilful Samarkand handicraftsmen. These silk carpets keep memory of centuries and warmth of hearts of the Uzbek foremen.

3.4. Artistic fabrics

Among remarkable traditions, with which Uzbek art is rich, the special place occupies artistic decorating of fabrics. This branch of traditional art has arisen in a deep antiquity and already in the age of antiquity and early middle ages get the advanced character.

In XIX century the basic centres on manufacture of the Uzbek artistic fabrics were generated. Alongside with cheap simple fabrics of mass consumption, manufactured in all settlements and cities in home conditions, in special weaver's workshops were made amazing on beauty high-quality cotton, mixed silk, gold-weaved, silk and wool fabrics.

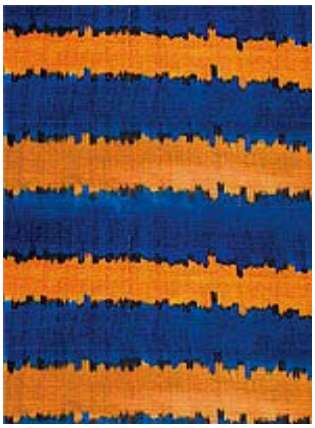
The traditions, formed during centuries, never died and have lived up to now. And today traditional art weaving occupies one of conducting places in modern national art of Uzbekistan. The Uzbek fabrics have not only historical-household importance, but also great art value.

In the second half of XIX century was the most advanced branch of craft in Uzbekistan. Bukhara, Namangan, Margilan, Samarkand, Shahrisabz, Kitab, Karshi, Khodjent, Urgut, Khiva were glorified for its fabrics. The greatest distribution has received cotton fabrics: “kalami”, “alocha”, “susi”, “chit”; mixed silk fabrics: “bekasab”, “banoras”, “pasma”,“adras”, “duruya”, “yakruya”, “atlas”, “bahmal”; silk fabrics: “shoyi”, “atlas”, “khan – atlas”. In these fabrics except for the atlas and velvet (bahmal) the elementary interlacings were used. The woolen fabrics for the top clothes were produced also.

Among various fabrics the outstanding place belongs to mixed silk velvets of Bukhara and Kokand, coverlets of Samarkand and Fergana, most thin transparent silk shawls "kalgay".

The special interest all over the world is caused by fabrics, produced in traditional technology – “ikat”. The word "ikat" has come from Indonesia and there was it from a verb "mengikat", that means " to connect, to twine round". Its hardest engineering of fabric figures which are carried out exclusively manually, which consists in reservation, i.e. twinning round of string beams with the purpose of gradual coloring of them in the certain colours. Uzbek “ikat” differs by that figure fills completely in strings of the warp, and the patterns cover all surface of a fabric. Such engineering is called “abrband”, that in translation means – “tied cloud”.

The researchers of handicraft crafts of the end of XIX century describe tens kinds of local cotton fabrics: “mata”, “khosa”, “buz”, “kalami”, “janda”, “astarchey”, “susi”, “alacha”, with varieties: “damhaba”, “misri”, “chapanahi” etc. However already in first half XIX of century this externally prospering craft started its decline, the reason of which was the excessive competition of manual manufacture with machine. Only local silk and mixed fabrics, decorated by strips and patterns have sustained a competition. The fabrics executed in “ikat” engineering can be mixed, where weft is made from cotton strings and are called “alocha”, “adras”, “shoyi”, “bekasab” and etc., and also are weaved and from pure silk and carry the almost same names, as “alocha”, “shoyi”, “atlas”, and the pure silk fabrics are either decorated by the same engineering of bandaging of a basis, either are weaved one-color and in fine stripes or crate, and sometimes in such a manner that the warp is made from threads of one color, and weft - from threads of other color, which gives a beautiful difficult on color outflow to fabric.



Adras (50% - Cotton, 50% - Silk)

Ala-bahmal (Velvet, Silk)

Unbleached calico (Cotton)

Shoyi (100% Silk)

In these highly artistic products of national creativity were embodied riches of man-made experience and subtlety of perception peculiar to the Uzbek foremen.

In 70-s of XIX century in Tashkent 1550 handicraftsmen weavers worked. In cities of the Fergana valley - Margilan, Namangan, Kokand, Khodjent handicraft weaving was one of the main crafts. So, in 1896 in Margilan, Namangan, Kokand were up to 600 silk-weaving workshops. In 1910 in Fergana region functioned 1387 silk-weaving handicraft workshops with 3165 workers, including 911 workshops with 2570 workers in Margilan. In 1903 in Khiva were present up to 40 silk weaving machine tools, in Khanki-about 20, in Durgadik - 10, and in the last one were produced mixed silk fabrics only.

In the Samarkand region in 1912 were 237 silkweaving workshops, in Bukhara in 1916 - 46, in Karshi-19.

In the beginning of XX century in workshops, and then in artels and at factories, manufacture of many kinds of traditional Uzbek fabrics restores. In 1920-s the shortage of factory fabrics in the country has caused increase of handicraft cotton fabrics manufacture. In Uzbekistan with its own weaving traditions, manufacture of fabrics didn’t face many changes. The same elementary fabrics –“kalami”, “sarpinka”, “astarchit”, “alocha” were developed. The traditional patterns and colour of fabrics, their local uniqueness were saved. The centres of cotton fabrics manufacture were – Samarkand, Urgut, Nurata, settlements of Bukhara region - Gijduvan, Vardanzi, Zandona, in the Fergana valley - Namangan, area Besh-Arik.

After liquidation in 1960 of trade cooperation the release of traditional fabrics has passed to the state industry enterprises. The uniqueness of fabric engineering requiring application of manual work determined necessity of allocation of their manufacture in the special enterprises: in Margilan - industrial silk-weaving association "Atlas", in Namangan and Kokand – silk-weaving factories (all three enterprises concerned to the Ministry of light industry).

Since 1976 on the Ministry of local industry the small weaver's enterprises of handicraft character in Margilan, Shahrisabz on khan-atlas manufacture, in Kitab, Urgench - atlases and “bekasab” from artificial silk, in Baysun – “janda” were revived.

The trade form has revived to life the special most highly artistic type of the fabrics which were bought as gifts. Such patterns of fabrics as "Kreml", " guli nomozshom ", "shakhmat" were included in pattern gold fund of the Uzbek fabrics; they were created till 1960, i.e. before transition of weaver's art into system of an art industry. At the enterprises of the Ministry of light industry creative activity of the foremen was not appreciated. The basic attention was given to mechanization and automation of fabric manufacture processes. As a result these enterprises reduced assortment of national silk fabrics produced.

The traditions of national silk-weaving by virtue of their deep rationality have appeared viable, despite of long-term neglect. In these highly artistic products of national creativity were embodied riches of man-made experience and subtlety of perception peculiar to the Uzbek foremen. Constant need to work and learn nature induces the modern foremen to search for ways to even more profound and realized attitude to the applicability - to comprehend and to create philosophy of fabric interpretation of the world with its interlacings, colour sides, patterns, shine, symbols and overall harmony.

In 1990-s in connection with revival of traditional customs and holidays, attention amplification to national clothes, the demand for artistic silk fabrics of manual manufacture has arose. In various regions of Uzbekistan, and especially in cities of the Fergana valley - Margilan, Kokand - began to be restored manufacture of manual silk fabrics.

The manual weaving craft passes from generation to generation. For example in the Fergana valley of Republic, historical city of the weavers - Margilan, lives and works the whole dynasty of weavers to this day, where the conducting foreman is Turgunbay Mirzaahmaedov - the man having professional skills of manual weaving, foreman of the seventh generation. The fabrics weaved by him represent really best samples of national Uzbek fabrics. He was born in family of the hereditary foreman Fozil in 1944. At one time he was one of those who created remarkable and unique in Central Asia factory of manual weaving "Yodgorlic", where he has created more than hundred patterns of fabrics.

Turgunbay is not only talented foreman, he is also the man supporting preservation and revival of Uzbek manual weaving traditions, he has restored manufacture of a fabric “shoyi”, “adras”, “bekasab”, “banoras”, which were ceased to weave since 1950-60-s. He is the first national foreman of Uzbekistan who received certificate of UNESCO for the contribution to preservation and development of craft traditions. The manufacturing of such fabrics is long

and rather labour-consuming work, concluding in itself 38 stages, but is necessary to say, that due to the national foremen - this process and technology have remained constant till now. For manufacture of such kind of a fabric the separate strings tie, so to not admit their colouring. At this kind of weaving, figures and the colours of a fabric are carefully thought over beforehand.

On the base of ornament the yarn is tied in those places, where it is necessary to save initial colour, and then is dyed. The foreman repeats process for each colour separately, from light tones to dark, till on a yarn all colours of figure will be transferred. Having prepared, thus yarn, he establishes it in the weaver's machine tool, where the gradually richly painted fabrics by a magically turn to geometrical and vegetative patterns and ornaments.

The fabrics produced by in "Ikat" method can be mixed, where weft is made from cotton strings, they are called “alocha”, “adras”, “podshoy”, “becasab” and etc., and also are weaved from pure silk and carry the names “alocha” and “shoyi”, and the pure silk matters are ornamented either by means of the same method of basis bandaging, or are weaved one-colour, stripped or checked, and sometimes in such a manner that the warp is made from strings of one colour, and weft - from the other colour, that makes fabric to receive beautiful complex on colour outflow. So, for example, at a yellow warp is used red weft, that gives outflow of orange colour, or at a dark blue warp - red weft, that gives violet shade to the silk. The foreman Mirzaahmedov has passed skills and has taught craft to his son Rasul, who also, as well as the father carefully treats heritage of the past and creates most beautiful silk and mixed of fabrics.

The father and son with each year master new colour combinations and patterns, adding them to an already available collection of images. Rasul Mirzaahmedov in his creativity has gone further and at the end of 90-s began to work on traditions restoration of a unique kind of a fabric named "ala-bahmal", ceased to be made about a century ago. It is the special kind of "ikat", used only for celebratory expensive clothes. One of the rearest copies of "ala-bahmal", more than 6 meters in length, is in the collection of the famous collector Gvido Goldman. This piece of cloth represents a figure from alternating strips of dark blue and white colour. "Ala-bahmal" was made only in Bukhara, owing to what the clothes from this fabric were considered very prestigious in Central Asia. It is a silk velvet, checked or with patterns, with effect of "emerging" and "receding" colours, manufacturing process of which is very much complicated, requires the large expenses of time and amount of silk strings on 1 m^2 of a fabric. "Ala-bahmal" was made during very brief period of time, approximately from 1860 to 1910. Fortunately, apparently, missed for ever rare kind of a fabric is revived now anew, due to hands of Rasul Mirzaahmedov - foreman sincerely wishing to show to the world refined creations of the past. At an exhibition some of “ala-bahmal” samples, crated by him are submitted.

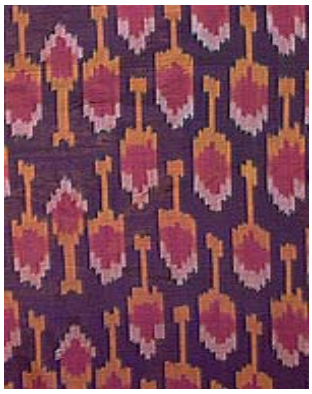
Several words about other dynasty of the foreman-weaver Dadajonov Fazlitdin, son of the foreman Muhammadjon. He was born on March 2, 1964 in family of the handi-craftsmen in Margilan city. He is the foreman of the fourth generation. He is engaged in it from childhood - since he was 13. For years of independence Fazilitdin became an author of more than 30 works, such as “Amir-Temur”, “Shahlo”, “Ohongrabo”, “Navruz”, “Kirolicha”. Also he was engaged in restoration of ancient copies of “Bodomcha”, “Nogora”, “Oftoba”, “Chaen”.

Now is an active participant of seminars and exhibitions of Tashkent, Ashkhabad, Bishkek and Bukhara.

At the present time with the purposes of development of applied art and craft training of youth in Margilan he has organized the educational centre of applied art.

In these highly artistic products of the national foremen such as Turgunbay and Rasul Mirzaahmedov, Dadajonov Fazlitdin, son of the foreman Muhammadjon, realised riches of man-made experience and subtlety of perception, peculiar to many Uzbek foremen. By them are made different kinds of fabric form pure silk, cotton, and mixed natural and artificial threads.

“Shoyi”



“Shoyi”

“Khan-atlas”

“Shoyi”

“Shoyi”

“Shoyi”

“Shoyi”

“Shoyi”

“Shoyi”

“Shoyi”

“Shoyi”

“Shoyi”

”Ala-bahmal” 9

”Ala-bahmal” 9

”Ala-bahmal” 10

”Ala-bahmal” 11

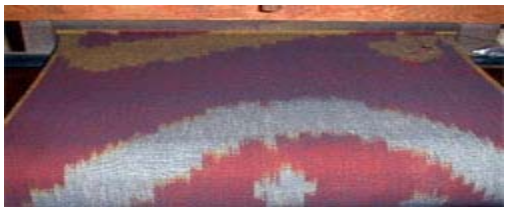
Pure silk fabrics

Unbleached calico

Unbleached calico (Cotton)

Unbleached calico

(Cotton)



(Cotton)

Unbleached calico (Cotton)
Cotton fabrics

Adras (50% - Cotton, 50% - Silk)

Adras (50% - Cotton, 50% - Silk)

“Ala-bahmal” (Velvet, Silk)

“Bekasab” (50% Silk -50% Cotton)

“Bekasab” (50% Silk - 50% Cotton)

“Adras” (50% - Cotton, 50% - Silk)
“Adras” (50% - Cotton, 50% - Silk)

“Bekasab” (50% Silk - 50% Cotton)

Mixed fabrics

Due to unusual universal properties - these fabrics stay cool in summer and worm in winter. Out of them multifunctional clothes are created - for example, from “shoyi” it is possible to sew blauses and evening dresses, magnificent accessories - scarves, cachenez and even coats, raincoats for winter, using lining fabric from same group.

The nobleness of these fabrics and rich assortment allows to use them in decoration of an interior in so named east style - for example, “bekesab”, is perfect for wall design, curtains, lamp shades, sewing of pillows, soft furniture upholstering, that give the special man-made value to these things. It is necessary to note, that these fabrics already have subdued the European market and more than once were absolute authority at exhibitions in London, Washington, Paris, Berlin. The official distributor of the national foremen and small, average enterprises manufacturing manually-made fabric, is the "KARAV" company. Thanks to the great job, done by designers of the Republic, the modeling business develops. The models, created by them, have huge success. The refined colour, the charming combination of a body plastics with poured lines of patterned fabrics makes their models really precious for man-made art uniqueness.

These last years fashion designers of the Republic participated in many international exhibitions and fashion festivals:

- 1995 - Exhibition " Spring and women ". Association of the business women of Uzbekistan, Tashkent
- 1996 - "Youth exhibition ". Association of the business women of Uzbekistan, Tashkent
- 1999 - Festival " Night in the palace of Shivanshah", Baku (Prize for the best realizatin of tradition
- 2000 - Fashion festival" Asia - style ", Tashkent (Prize for the best female model)
- 2000 - Exhibition of the graphics and display of models. Theatre " La Comedia ", Paris
- 2001 - Exhibition of the graphics and display of models. " Raspay studio", Paris
- 2002 - Exhibition " Navruz ". Embassy of the Republic of Uzbekistan, Paris
- 2002 - Exhibition of the graphics and display of models. Europian parliament, Bruxelles
- 2002 - International folklore festival " The Great Silk Road " USA, Washington
- 2002 – Exhibition of graphics and display of models. Embassy of the Republic of Uzbekistan in Berlin, Uzexpocentre, Switzerland

Festival"Silk Road". Washington,2002

Display of models at " La Comedia " theatre. Paris, 2000

Fashion parade at A. Vasiliev's Theatre " School of Drama Art", 2004 (Moscow)

Display of models in the embassy of Uzbekistan in USA

Display of models at Marymount university, USA

Display of models in the embassy of Uzbekistan in USA

Display of models at the modern arts centre, 2005 (Tashkent)

3.5. Development of national crafts industry and its prospects

The thin silk string for many centuries connected huge spaces from a Great Chinese wall up to the Mediterranean sea.

The rebirth of the Great Silk Road has the significant importance for Uzbekistan - country, whose geopolitical situation on an extent of history made the country " a gold piece of the Great Silk Road ". The ways opening to foreign-made ports creates favorable conditions for strengthening traditional connections not only with the Central Asian countries and Russia, but also with the countries of Southern Caucasus, Turkey, China, Korea, Iran and Pakistan.

In the newest history a silk thread took the role of tourism development, since its development isn't possible without national crafts prosperity. In this connection the World Tourist Organization created the long-term tourist project " the Great Silk Road".

On March 31, 1997 was issued the Decree of the President of the Republic of Uzbekistan " About measures of state support of the further development of national art crafts and applied art ". According to the document Republican association "Hunarmand" for the first time was created. And on May 1, 1998 was accepted the Law on establishment of a honourable rank " the National foreman of the Republic of Uzbekistan ".

The given decree and law serve the important factor in revival, development of national crafts and applied art having a centuries-old history, all-round support of the foremen and formation of their new generation. In home market updating the special place belongs to products of national crafts and applied art. The great importance has glorifying of unique products created by skilled hands of the foremen of our country, revival in this direction of our ancient traditions, giving it a new sense and contents, their wide propagation.

Since the first years of independence to revival and development of these our forgotten traditions was given more attention. One of the main tasks in the given branch became continuation of beautiful traditions, training of youth to crafts. In this connection in a departments of "Hunarmand" association, (Andizhan, Samarkand, Margilan, Kokand) the schools on craftsmen preparation have opened.

Now honourable rank " the National foreman of the Republic of Uzbekistan " awards more than twenty foremen who have earned respect of the people, bringing up large number of apprentices and at the same time fruitfully working in the branch.

In the Republic and abroad competitions and exhibitions on national crafts art often are organized. In these competitions have taken part and have shown their skills and talents more than four thousand foremen, that testifies to scale development and distribution in our country of national crafts. It is a result of both material, and spiritual support of their self-denying work.

According to the Decree of the President, persons engaged in home conditions in individual labour activity, in particular engaged in national craft, manufacture of products of an art craft and applied art, on long term are exempted from payment of the income tax.

According to the information on a condition of national crafts industry national, today in the Republic there are 4 factories and 70 private artels, consisting of 140896 men, engaged by gold embroidery craft, 4 factories and 70 private artels where more than 500 men annually make 680000 pieces of consumer goods for the sum of US$1152542.3. 22 factories and 772 private artels are engaged at carpet and artistic fabrics manufacture. These crafts employ more than 10 000 men making 6100 m^2 of carpets for the sum of US$716500 and 12140000 m^2 for the sum of US$35637881.2. General population employment in national crafts is**156868 men**. Annually by them are produced consumer goods for the sum of US$157227310. About 25 % of these goods for the sum of **US$38240813,8** are exported.

Information on economic conditions of national crafts industry of the Republic of Uzbekistan

National craft	Produced goods	Amount of manually made products manufacturers		Employment of the population, man	Volume of manufacture per one year	Amount of made goods per one year, $ US	Export potential, $ US
		Factories	Private artels				
Gold embroidery:	Man's dressing gownes	3	70	1760	21120	715932,2	286372,8
	Tubeteikas	3	256	16300	5000000	8474576	1694915,2
	Female clothes, dresses, dressing gownes etc.	6	600	112180	7000000	88983050	26694915
	Shawls, headbands, ties etc.	3	300	8974	7000000	1779610,1	167961,0
	Shoes, footwear	3	150	1362	850000	320338,9	31033,8
	Different decorations	1	28	320	150000	750000	375000
In total		**19**	**1404**	**140896**	**20021120**	**120756627,2**	**29250197,8**
Printed fabrics:	Printed table-cloths, various coverlets, curtains, blankets, shawls	2	30	2300	26010	11059,3	-
	Souvenirs, ceremonial goods	2	40	3000	680000	1152542,3	2881355,9
In total		**4**	**70**	**5300**	**706010**	**1163601,6**	**2881355,9**
Carpet products:	Woolen	4	15	1600	3000	180000	72000
	Silk	5	33	1900	1600	304000	182400
	Mixed			1400	1500	232500	139500
In total		**9**	**48**	**4900**	**6100**	**716500**	**393900**
Art fabrics:	Cotton	8	120	2020	2600000	3305084,7	495762,7
	Silk	5	268	768	5850000	14872881,3	3718220,3
	Cotton - silk		110	1020	1300000	2203389,8	661016,94
	Mixed: cotton - wool		86	560	630000	1625000,0	243750,0
	Natural - artificial		140	680	1760000	1491525,4	596610,16
In total		**13**	**724**	**5772**	**12140000**	**35637881,2**	**5715360,1**
Total		**45**	**2247**	**156868,0**		**157227310**	**38240813,8**

Chapter 4. Basic problems, conclusions and recommendations

During the time of Soviet government after transition of national crafts industry to system of an art industry at the enterprises of the Ministry of light industry, creative activity of the foremen was rejected. The basic attention was given to mechanization and automation of processes of fabrics manufacture. As a result of the enterprises have ceased manufacture of the goods distinguished with great decorativeness and originality, and have reduced manufacture of assortment national silk and mixed fabrics.

In the last years in connection with revival of traditional customs and holidays, amplification of attention to national clothes, the demand for art silk fabrics of manual manufacture has increased. The government of Republic pays large attention to revival and development of national craftsmanship. Thus in the high-quality goods manufacture exists a number of problems:

- Lack of craftsmen preparation schools and centres, promoting revival of ancient traditions;
- Duly maintenance of existing factories and private artels with qualitative raw materials;
- Absence of marketing researches and advertising service of production selling;
- Poor organization of national crafts and applied art products exhibition and fashion parades prepared from art fabrics.

QUESTIONS FOR DISCUSSION

1. **At BACSA association creation of the centre on organization and realization of symposiums, exhibitions of national crafts, art fabrics products and its advertising.**
2. **Exchange of experience by the scientists and experts in introduction of advanced technology on restoration and development of national craftsmanship industry.**
3. **Creation of the international fund on revival and development of national craftsmanship industry in the countries-participants of the symposium.**
4. **Adjustment and expansion of the trade-economic relations between the participating countries of the symposium.**

II. Second Executive Meeting of Black, Caspian seas and Central Asia Silk Association (BACSA)

Country reports on "Follow-up activities of Tashkent Workshop and national strategies for sericulture revival and development"

Chairperson: Dr P.Tzenov, BACSA President

The Tradition Revival and Development of sericulture in Albania

By

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Paper contributed to "International Workshop on Silk Handcrafts Cottage Industries and Silk Enterprises Development in Africa, Europe and Central Asia", Bursa, Turkey 6 -10 March 2006
Second Executive Meeting of Black, Caspian seas and Central Asia Silk Association (BACSA), 9 March 2006, Bursa, Turkey

Food and Agriculture Organization, Rome, Italy

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ABSTRACT

Albania is one of the first European countries that has cultivated and elaborated natural silk. Its biggest development was between 16th and 19th Century where cultivation became a family tradition by young women, working on weaving machines preparing fabrics, handcraft garments for their need and also trading it to their neighbor countries. During the last Century the production of natural silk was dramatically reduced due to many factors such as the First and Second World War, Pebrine epidemic and also the presence of artificial silk. From 1950 to 1990 the Albanian economy was centralized and everything was owned by state thus reducing the private development of silk. Priority was given to state owned sector. The first state owned silk station was build with 5 production sites. Its main role was scientific work and production of over 30Kg silkworm eggs hybrids each year. Over one million local mulberry saplings were grown. This activity remained local in the country and never spread our or collaborated with any other countries. The cocoons were elaborated in the silk factory in Shkoder, which manufactured colored fabrics, surgery thread for medical needs. Part of this production was used by military industry and remaining crisalides were used as protein food for animals and birds. Albania has very good climatic conditions for mulberry cultivation. Today there are many varieties of mulberries cultivated in all regions from north to south Albania. During this time a great job is done toward silkworm diseases. Good results are achieved from local varieties crossing (monovoltine) with imported varieties bivoltine A1, A2, A6, A17 etc. Their hybrids are very resistant against pebrine. In Albania, pebrine is very scarce. A great help toward this issue was given from collaboration between research and scientific institutes of veterinary and zootechnic.

What happened after 1990? The silk industry was destroyed, following the drastic political changes in Albania. Many efforts were put toward reviving this culture but without success. Started with Italtrend in 1993, followed by another effort in 1995 with Balkan countries such as Rumania, Bulgaria, Macedonia, Turkey and Greece to work together on a project for this matter. In 1999-2000 another help was reached from Chinese specialists from Academy of science in China but this was unsuccessful too due to lack of monetary funds.

We hope that the partnership of the countries in the Black Caspian seas and Central Asia region and the help of FAO will be realized the revival and development of sericulture industry and small silk enterprise in Albania. We have to try to find ways of solving problems and apply strategies from improving existing areas and setting up new sericulture areas. Silk industry and silk handcrafts are on of the important cultural tradition in Albania and deserves to be protected.

Key words: sericulture, silk, revival, Albania

Chapter 1. Tradition, initiation and development of silk production in Albania

In the 6th century A.D., silkworm raising was introduced in Europe through Byzantium (the silk road), becoming thus an international activity. For centuries, natural silk has blossomed in the world, and has also gone through serious crisis. Albania is one of the first European countries to raise silkworms and manufactured natural silk. Albania has had good relations with the Byzantine Empire and later on since the middle Ages, during the 16th and 17th century as a part of Turkey Ottoman Empire. Historical documents of the 16th and 17th century indicate that there was wide use of silk products in Albania in clothing and garments crafted by women in their home weaving machines. During the second half of the 19th century, many North-Albanian families (Shkoder, Lezhe) had developed silk manufacturing into an artisan activity that also included raising silkworm eggs, and had become well-known exporters in Europe. Hundreds of kilograms of silkworm eggs were sold in Austria, Hungary, France, Italy and neighboring countries. Albanian immigration, a known phenomenon of the time, spread this profession in countries of their immigration, typically in Turkey (south-west of Bursa), Italy (Sicilia and Calabria), etc., where Albanians introduced their artisanship of silk carpets and garments. Because of the very favorable climate and geographical conditions in Albania and the high price of silk in the international market, artisan tradition of silk manufacturing continued through the centuries regardless of economic, social and political changes that Albanian underwent.

Geographical location and climate

Albania is an agricultural and stockbreeding country located in the southwest Balkans, with autochthonous people of Illyrian descent, with an area of 28,000sq.km and a population of 4 million people. Two thirds of Albania's terrain is mountains and hills and one third is plains and coastal area, bordering the Adriatic Sea and Ionian Sea. Albania belongs to the Mediterranean climate zone, with a sub-tropical climate in the south of the country, with temperatures varying from 25-30 degree Celsius in summer and 1 degree Celsius in winter in plain and coastal areas, and with more rain during the winter period, about 300-400m/m. Mulberries vegetation period starts at the beginning of April and ends at the beginning of November, allowing two generations of silkworms to grow (in Spring and Fall). Mulberry grows along the plain and coastal area. Tree plants also grow along the mountainous area of Albania, of which 100,000 ha of oak forests (Quercus), which encourage the growth of wild silkworms (Antheraea Perny). Albania is subject to neither strong winds and tornados nor floods or strong earthquakes.

Chapter 2. Summary Review of Sericulture Situation

Between 1960 and 1990, silk manufacturing and all other industries in Albania was planned as part of the centralized socialist economy. All silk manufacturing was state owned. During this period, the Albanian Zoo-technical General Institute ran silk manufacturing. The Central Silk Station, which included 5 production facilities in 5 different coastal areas of Albania, from north to south, was established in 1970. Each facility managed an area of 50 to 100 ha of mulberry parcels and 420,000 mulberry plants, as well as silkworm raising sub-facilities. The Station ran scientific research and production activity. The Station produced biological products like:

1. Mulberry saplings for selected varieties. There are two main mulberry varieties in Albania, Morus Alba and Morus Nigra, which are found in Albania in 12 varieties of mulberries planted in private house gardens by Albanian families, which use them their fresh or dried fruit, liquor production, syrup, etc., as well as for raising silkworms and making simple home tools like rolling pins, kitchen tools like spoons, cups, water glasses and containers, cart wheels, etc.

Regions of Natural silk cultivation in Albania.

Mulberry in home gardens grow high and has a life of over 50 years, and is also used to support grapes. Pruning is applied twice a year, in winter and spring, which is used to produce fresh leaves in the fall. Mulberry in Albania grows low, medium high and high (with a crown growing 0.5m, 1m and 1.5m from the ground respectively). About 800,000 hybrid mulberry saplings (Morus Bombyx) were planted during 1970-1975 mainly in 5 areas in Albania. For botanical characteristics, see table 1.

2. About 3,000 boxes of hybrid silkworm eggs per year and performed all research and preventive measures. During 1955-1975, scientific and genetic research was focused on local and imported silkworm eggs (China, Korea and Soviet Union).

Table 1.

Nutritive substances of mulberry leaf needed from silkworm by age

Age	Water (%)	Dry substance (%)	Protein (%)	Fat (%)	Cellulose (%)	Ash (%)
1	82.07	17.93	36.35	3.17	9.27	8.11
2	79,99	21.01	31.04	3.10	9.52	7.13
3	77.49	22.51	28.29	2.82	10.15	7.33
4	78.40	21.60	27.35	3.15	10.79	7.97
5	75.65	24.35	24.16	3.49	10.71	7.20

Hybrid seeds with a growth cycle of 27 days in the spring and 29-30 days in the fall were used in Albania, which were cost-effective and required less food per kg of produced cocoons.

Table 2.

The spring cultivation of hybrid eggs (F_1)

Race and Hybrid	Hatching (%)	Larval duration (Days/hours)	Eliminated silkworms (%)	Production of fresh cocoons (Kg) per 1 g larve	Leaf consumption needed (Kg) to produce one kg fresh cocoons
Pure A1	94	26.17	11	3.7	10
Pure A2	96.5	26.16	13	3.65	10.7
A1XA2	94,5	27	11	3.8	9.1
A1XA17	98	28	13	4	7.3
VXA1	95	28.1	7	3.6	8.2
VXA2	96	28.12	10	3.2	8.7
A1XA16	91	26	9	3,1	8,5
A16XA17	94	27	11	3,4	8

Table 3.

The autumn cultivation of hybrid eggs (F1)

Race and Hybrid	Hatching (%)	Larval duration (Days/hours)	Eliminated silkworms	Production of fresh cocoons (Kg) per 1 g larve	Leaf consumption needed (Kg) to produce one kg fresh cocoons
A1XA2	92	32.7	14	2.7	11.2
A1XA17	82	31.06	18	2.5	11.6
VXA1	90	30.15	14	2.8	10.3
VXA2	92.6	29.17	12	2.8	10.8
A1xA16	94.8	30.03	16	2.55	9.7
A16Xa17	86.2	32	12	2.68	10.8

Calculated statistical values compared to the average thread length in the pure lines is as follows:

Lines	A1	A2	A16	A17	Local
A1					
A2	0.249				
A16	1.492	1.504			
A17	4.835***	4.502***	3.264***		
Local	1.292	0.907	2.439*	5.326***	

Note:

*shows that A17 line has a big valued statistical change.

Experimental work that is done in 1980-1990 on imported and local races have given satisfactory results in a large production in summer and autumn cultivation.

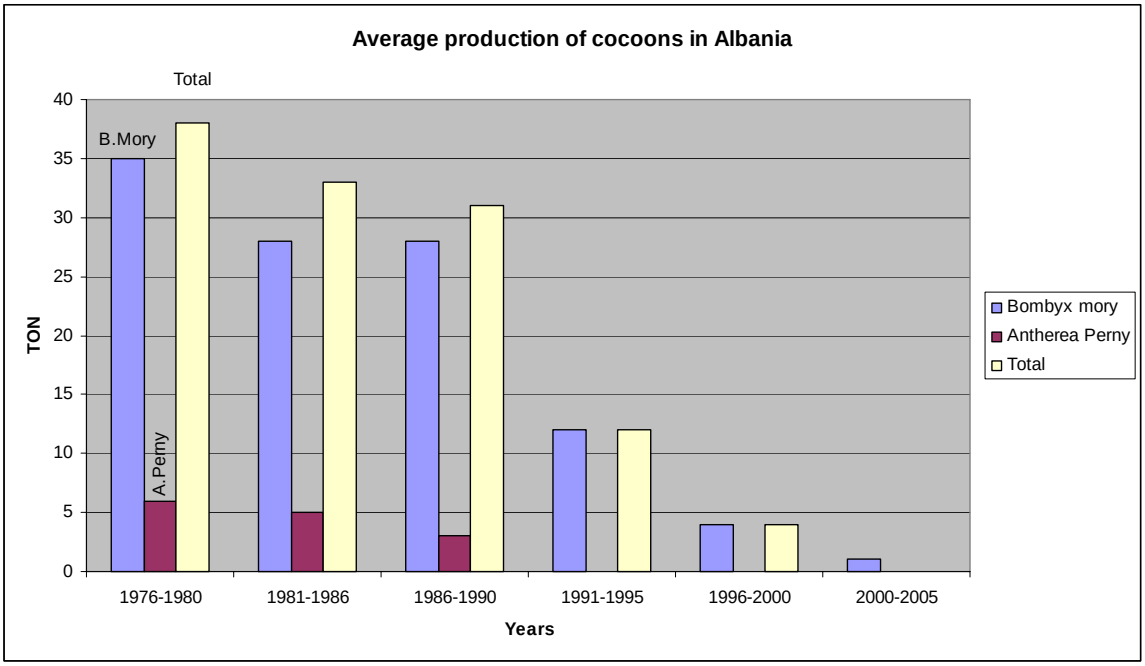
As shown in the table above, between 1950 and 1970 silk was produced by the members of collective farms and amateurs, which shows the desire to privately produce silk. Existing experience with and conditions of a natural raising the oak worms make it possible to start this activity again. A production rate of 120-300kg fresh cocoons per hectar of oak forest has been achieved in one growth. Attention must be given to drying the cocoons and processing the thread, which requires a different technology from the mulberry cocoons (found in China), since this industry is very developed in China.

After 1990, following the drastic political changes in Albania and Eastern Europe, economic growth came almost to a halt. The silk industry was destroyed, mulberry plants were cut down, and silkworm egg labs were destroyed, while the growth facilities and the only silk production factory in Shkoder with an old and amortized technology were closed.

Based on this biological material the dynamic of silk cocoons production in 5 years is shown below: This is an annual average in 5years.

Years	Cocoons bombyx mory.(Ton)	Cocoons, A Perny (Ton)	Total (Ton)
1956-1960	30	0	30
1961-1965	32	0	32
1966-1970	38	0	38
1971-1975	24	2	26
1976-1980	35	6	38
1981-1986	28	5	33
1986-1990	28	3	31
1991-1995	12	0	12
1996-2000	4	0	4
2000-2005	1	0	0

Following graph shows the decrease of production from 1990.



The same situation has continued during 2000-2005. The government has not done anything to revitalize this sector, although local and foreign experts have prepared 2 studies, in 1994 and in 2002, on the revitalization of this sector. However, the government continued to remain indifferent to this industry with the excuse that there were other sectors more important to revitalize first. It is possible today to help this sector. Albania has entered the market economy and many private farmers are able and willing to carry out this activity.

Chapter 3. National Strategy for Sericulture Revival and Development in Albania.

Albania has material and human capacity to produce over 100 ton of fresh silk cocoons per year. There are, however, certain technical and organizational measures to be taken to revitalize and stabilize this industry.

There are two ways to develop silk production in Albania:

A. The traditional artisan method of cultivating natural silk (Bombyx More L.); and
B. The centralized method, with a modern technology of silk cultivating with biological material (selected silkworm eggs and mulberry). This method ensures high quality silk with a thread 3A and 4A, very much in demand in the international market.

3.1. The traditional artisan method of cultivating natural silk (Bombyx More L.) (Method A)

Factors that encourage the traditional artisan method of revitalizing and developing natural silk cultivation in Albania are:

1. Optimum climate and land conditions to allow 2 growth per year;
2. Historical tradition of natural silk cultivation; and
3. Cheap labor and economic benefit to individual farmers.

3.1.1. Climate and land conditions

Warm climate in the Spring, with temperatures 18-25C^0 and rains typical for this period of the year are the basic factors encouraging early blossom of mulberry leaves to fulfill the nutrition needs for the Spring growth and a good production of cocoons of about 20 kg per egg box (1 egg box = 10 g eggs). Land conditions are also good for mulberry growth during this period. A second growth, in fall, may also be achieved in Albania, during the period between August 25 and October 10 when the temperature is between 20C^0 and 28C^0. Albania has experience in this respect and has achieved a good mulberry cocoon production rate.

Climate and land conditions and the nutrition basis made of low oak forests (of the variety cuercis identata – mongolika) of the period April-May and up to June 15, when the temperatures are between 18C^0 and 25C^0 and the humidity at levels of about 55%-70% support a normal growth of Antheraea Perny silkworms in the north-east area of Albania. There is also experience in raising this species.

3.1.2. Historical tradition

Albania has a century long tradition of mulberry silkworm artisan growth. This has been in centuries a family business. This tradition makes it optimistic and ensures the conduct of a study on the development of silk industry in Albania.

3.1.3. Labor and Economic Factors

The current social and economic situation of farmers in Albania, which is supported by the property laws in effect, makes this an important factor and ensures wide participation of farmers in this industry. Another indicator of benefits in this sector is the short labor cycle of only 5 weeks, which will secure farmers a price of around 140Euro from both summer and autumn silk cultivation. Elderly and disable people and children of the family, who constitute free labor in the family, may also work. Participation of these categories of people makes this family business very lucrative.

This is how the dynamics of revitalization and development of silk industry through the family artisan tradition will work:

Table 5.

Production of cocoons in years

Year	District Number	Number of families	Number of egg boxes (10g each)	Production of cocoons (Ton)
2006	3	50	50	1
2007	5	250	500	10
2008	8	1000	2500	45
2009	10	2500	4000	70
2010	10	4000	5000	80-100

Note: This table assumes that the cocoons will be purchased from a company with an average price of 2 to 3 Euros per Kg (fresh cocoons).

Investments needed to revive the silk production in Albania.

Capital investments by years

Year	Number of Mulberry saplings To be planted	Value (Euro)	Renovation of silk lab, supply, etc.	Warehouse Construction Tools, drying machines	Total investments (Euro)	Income (Euro)	Balance sheet in Euro
2006	30000	60000	100000	100000	260000	15000	-245000
2007	300000	600000	90000	100000	790000	30000	-760000
2008	400000 (local)	400000	50000	80000	530000	150000	-380000
2009	200000	200000	50000	50000	300000	200000	-100000
2010	70000	70000	45000	35000	150000	300000	+150000

As indicated by the analytical prognosis, repayment of the 2 million Euro loan will start on the 5th year and will be repaid completely within 5 years. This takes into account that the silkworm eggs will be provided free of charge in the first 2 years, while the fresh cocoons will be sold for a price of 2.5-3.0 Euro per kg. The price of saplings that will be provided to the farmers has not been calculated.

The main objective of this study is to start the activity immediately, i.e. by 2006. For this reason, it is necessary to revitalize the existing facilities in Elbasan, Berat and Krraba (Tirana), which have been privatized. In Krraba is also the traditional method of silkworm egg production lab and the mulberry saplings seedbed. In this way, the production will be cost effective and will eliminate the need for imports. Since revitalization and development of the traditional method silk production will be supported by locally produced biological material, the silkworm egg facility and mulberry seed-bed must be considered with priority and provided with financial and technical support by the government of foundations like FAO, etc., as well as other domestic and international scientific institutions. Since the existing mulberry plants will support the activity in the first and second year, production rate will be low. At the same time, 1 million mulberry saplings will be provided to the farmers in the coastal area, who will plant them in home gardens, next to water canals or in small parcels of land to ensure early production that will support the industry and guarantee a continuous annual production. To facilitate growth of silkworm larvae farmers will use area and village-based concentrated incubation methods, drawing from the experience of other countries like Uzbekistan, Thailand, etc., which have a good tradition in this method of raising silkworms.

Special attention must be given to the collection and drying of the fresh cocoons, which should be done at a village or commune level, where collection centers will buy fresh cocoons from the farmers based on their quality and will package them in baskets or bags and be ready to be transported to the processing plant, since Albania at this time has no silk processing capability. This may be the subject of another study. The cocoons may be transported to Bulgaria or Turkey for processing based on a future cooperation with these countries that have a high demand for raw material.

Managing and marketing of the product, I think, must be the subject of another detailed study to be conducted in a collective effort with foreigners (with the Balkans in this specific case) with regard to both, the dried cocoons and the final product. It is a known fact that developed countries are strong consumers of natural silk and are interested in this product.

3.2. The centralized method, with a modern technology of silk cultivating with biological material (selected silkworm eggs and mulberry)
(Method B)

The centralized method, with a modern technology using biological material to produce high-quality silk cocoons of a 3A and 4A thread.

3.2.1. Introduction

Natural silk is produced by insects of the group bombycidae, commonly known as silkworms, which produce silk thread from the leaves of the mulberry tree. Natural silk is an important raw material not only for the textile industry but also in diverse fields such as medicine, the Army, the chemical, the food industry and many others. Silk has an enormous value in the world market today.

For centuries, the production and processing of silk in Albania has been a traditional craft activity cultivated by a large number of families in the coastal and lowland areas of our country. Today, as Albania develops into a market economy, its tradition, climate and geographical position continue to favor the development of a modern silk industry.

It is hoped that other countries in the Balkans that share a tradition of silk production may also eventually participate in the revival of the silk industry as part of the regional economic development that is now being promoted. But the object of this demonstration project is to take a modest first step toward bringing the most modern techniques for silk production to a test area in Albania to determine whether it is possible to successfully reestablish silk production in Albania by blending the long local tradition with the most modern current practices. To do this, a model zone will be established where all the phases of silk production and treatment will be demonstrated growing shoots and cultivating mulberry trees raising silkworms, producing eggs and cocoons, drying cocoons.

The four years of the demonstration draft project will include management training market analysis and the writing of a detailed plan for revival of silk production. The project will conclude with the international conference on the possibilities for sericulture and silk manufacture in Albania with the participation of FAO, BACSA and other developed countries in sericulture. In the event that the demonstration project is successful and sericulture and silk manufacturing business are implemented on a large scale, the demonstration zone will continue to serve as an experiment station and training center.

3.2.2. The demonstration zone

The choice of location was made after a long and detailed study of 12 centers in seven districts with a tradition in the production of silk (Tirane, Lezhe, Shkoder, Elbasan, Kavaje, Fier, Berat.) The criteria for the selection of the best zone were:

a. Tradition in the production of silk and the presence of a low-cost labor force. The presence of a low-cost and qualified labor force, as well as the possibility to engage specialized local managers is important for the success of the project.

b. Ownership and use of the land. It turned out that state-owned land is preferable to privately owned land, because for a surface area of parcels of land aggregating approximately 30 hectares, which we determined to be optimal for the project, there may be as many as 20 private owners. This makes it very difficult to negotiate for use of the land. Also, in the zones studied, which are considered suitable for the production of silk, the rental cost of private land is two to ten times larger than for renting state land (for the same quality of land.)

c. Climatic Conditions and the quality of land. The lands suitable for growing mulberry trees for the production of silk are classified as light, sandy/alluvial lands of neutral pH. These lands are located mainly in lowland and coastal zones, where a Mediterranean climate dominates.

d. Water sources. Growing mulberry trees needs constant and abundant sources of water.

e. Zone infrastructure. The existence and location of irrigation and drainage canals, of the main roads and the roads within the parcels, the electricity network of one and three phases, and the distance from the inhabited urban and rural zone are the most important elements of infrastructure to be considered.

On the basis of the above-mentioned criteria, the three best zones were selected initially, from which the zone that we propose for the implementation of the project was determined through a second selection:

The Zone of Cerrik in the Elbasan District

Elbasan is a district with tradition in the production of silk. It is approximately 50Km from Tirana. Its major city is Elbasan. The zone that we have selected is 1km from the national road and the railway, and is near both inhabited rural and urban zones. It has electricity throughout the year, is naturally protected by hills and has a suitable climate for growing mulberry trees. In this zone there are approximately 400 hectares of land owned by the state Forestry Enterprise (and of which 70 hectares, the parcels selected are not forested). The rental cost of the Forest Enterprise land is approximately 4 to 5 times less than other parcels of land of the same quality.

The land is alluvial, very fertile, of 6.5 pH, managed and easily mechanized. It contains nitrogen, phosphorous and potassium of an average level, and it is placed on an incompact formation, which filters the water very well. It has a constant water flow from the river Shkumbin, which passes near the parcels. The road infrastructure is very good, and there is a complete network of irrigation and drainage canals, which have been rehabilitated through a World Bank funded project on irrigation and drainage works. The station of the motorized pumps, which supplies the whole zone with 150 liters of water per second, is also located near the parcels selected. The electricity source is a three-phase line, which passes 500 meters far from the parcels. The electricity network is in a good state.

Approximately 400 rural families, who offer a low-cost and qualified labor force, live near the parcels. Outbuildings with an agricultural destination are located approximately 500 m from the parcels. They may be rented and used for our project, as an alternative to the construction of new buildings. Other agricultural projects are also planned for the zone. The area is in harmony with the transport plan for the district.

One particular advantage of this choice is that it would be possible to rent it for twenty or thirty years, long beyond the period of the demonstration project, at the present low cost. That would enable it to continue to serve the sericulture and silk manufacturing industry as an experiment station and training center.

Goals of the draft project

Albania’s silk production was collectivized and industrialized after the Second World War, with most if not all of the silk (cloth, surgical thread, military items), intended for domestic production. Now unemployed and underemployed, many of the former sericulture workers are eager to engage in the silk production again. This, and Albania’s 1000 year experience in sericulture, suggests that if the country continues on its present path toward social and

economic stability, it should be possible to produce silk of the highest quality if the most modern techniques and technologies are implemented. Meanwhile, it is very important that Albania can become a potential silk supplier to World market and other Western Buyers because the lower labor and transportation costs if the silk quality is good enough.

The Demonstration Draft Project will include:

1. Introduction of modern sericulture practices:
   - A comparison of the imported mulberry varieties including F_1 mulberry seeds with the local varieties to chose 2-3 mulberry varieties those are suitable for local conditions.
   - Defining the optimum planting size and the technical parameters (grafting, cutting, manure, irrigation, harvesting, etc.) of mulberry trees in Albanian conditions.
   - Importing 5-6 pairs of F_1 silkworm races to determining which variety is suitable to be reared in Albania and the silk produced meets the demands of the buyers. If investment is enough (it is very costly and difficult to get pure line of the silkworm), try to establish a F_1 silkworm egg production farm.
   - Establishing a system of silk quality tests.
   - Demonstration of the results in this zone by the end of the third year.

2. Training managers and workers in modern techniques.
   The technical assistance is crucial to the draft project. This will take several forms. Organize the qualification improvement of research and technical staff gaining experience in the sericulture from developed countries such as China and the countries that are part of BACSA, Training an Albanian project manager to supervise all facets of the project (sericulture, management and marketing). This manager should be a relatively young person who not only have strong organizational skills, but also has, or is willing to acquire, training in agriculture and sericulture and also in finance and/or business management.

3. Determining whether and where sericulture can be competitive with other crops.
   One important fact that will determine whether sericulture can be reestablished in Albania is whether it can compete (financially) with other agriculture crops, those can be grown in the same zone.

4. Study on silk market.

As noted in the introduction, natural silk of high quality (3A, 4A) is an important raw material for the industry and much required in the world market.

3.2.3. Demonstration outline

Planting 30 hectares of mulberry land the major target: Is as following table:

Mulberry cultivation (year)	Leaf output (kg/ha)	Cocoon output (kg/ha)	Income (Euro)	Observation (per ha)
3rd	9000	450	47,250	30
4th	15,000	1,500	156,000	30

That means total cocoon will reach 150,000 Euro totally from demonstration farm only. If the around farmers are encouraged it is forecasted that sericulture can be planted in 100 ha. Of mulberry land and raw cocoon income will be about 750,000 Euro in Albania in 5 Years.

1. The first year 2006-2007

    1.1. The creation of the mulberry seedbed with local mulberry seeds in 0.2 ha.
    1.2. Technical assistance for the services in the seedbeds and the preparation for the second year.
    1.3. Local training of the staff on the services in the mulberry seedbeds and the cultivation of the mulberry trees.

2. Second year 2007-2008

    2.1. Grafting mulberry with imported good varieties of mulberry shoots. Planting of mulberry saplings in other parcels.
    2.2. The local training of the staff of the draft project on the services in cultivation of the mulberry trees and silkworm rearing.
    2.3. Trial rearing silkworm in the autumn. Searching of silk importers to guarantee the market.

3. Third year 2008-2009

    3.1. The start of the rearing of hybrids (F_1) of the silkworm for the production of the cocoons with cooperation of the silkworm lab in Krabe, Tirana.
    3.2. Local training of the staff for the silkworm rearing
    3.3. Marketing study undertaken.

4. Fourth year 2009-2010

    4.1. Continuing to rear the hybrids (F_1) of the silkworm for the production of the cocoons for experimental and demonstration purposes with cooperation of silkworm lab Krabe, Tirana.
    4.2. Local training of the staff for the silkworm rearing.
    4.3. Cocoons drying and packing.
    4.4. Marketing study undertaken.

3.2.4. Management

1. The responsible party.

The financial responsibility for the study will rest with a party yet to be established. This could take one of several possible forms: For example, it might be a law office in Tirana or a non profit organization that will be created just for this study and will also serve for the form A, where is the traditional rearing of silk in Albania.

2. Staffing.

One General manager, two sericulture technicians, and 15 to 20 workers (including guards and storekeepers)

3.2.5. Budget (outline)

The land
The surface area of the parcels is 30 hectares, of which 2000 m^2 is occupied by outbuildings and constructions.

Land management
The management of the local roads, of the irrigation and drainage canals, electricity, and illumination of the territory.

Buildings
The surface of 2000 m^2 is occupied by wooden outbuildings that could be renovated and used for the production, drying of cocoons, and warehouse and so forth.

Salaries
Sericulture local technician
Financial local expert
Agriculture workers(approximately 15)
Storekeeper
Guard

Technical assistance and training
1. Foreign sericulture expert for 12 months in Albania
2. The international conference. Final demonstration (Invitees from other countries with a tradition of silk production as well as from other potential regions in Albania, examined previously by the project).

Economic of experimental center of silk cultivation with modern methods
Cerrik local sector of district of Elbasan after 4 years will be in full production with an annual balance sheet as below:

Mulberry cultivation Leaf output for 30ha	Cocoon output (kg)	Income (Euro)
450,000kg	45,000	135,000
Income from agriculture crops		15,000

This will give a total income of ----------150,000 Euro in Annual expenses

Administrate	Time (12 months)	Value in Euro
General manager	"	12x300=3,600
2 sericulture technicians	"	12x400=4,800
15-20 workers, including guard and storekeeper	"	36,000
		Total 44,400
Production expenses, fertilizers, transportation	"	28,600
Amortization, investments, rent, etc.	"	17,000
		Total 45,600

Final Balance sheet

Annual income, 150,000 Euro
Annual Expenses 90,000 Euros
Profit = 60,000 Euro

The quantity of mulberries that will be planted into this parcel will cost 2.5 million Euros. This will even out in 4 years as per profit mentioned above.

Chapter 4. Major Problems, Issues, and Recommendations

- We have to find ways of restoration and development of sericulture both in scientific and production aspects. Revitalizing and developing the natural silk production in Albania through artisan and modern methods requires several immediate measures suggested by the long experience of our country be taken, including:
- Commence silk production by first revitalizing the 5 basic silk production facilities in Albania, located in Shkoder, Elbasan, Tirana, Berat and Fier.
- A silk technician is assigned in each district to commence their assignment in April 2006.
- The study and plan to revitalize the silk industry in Albania be published through the central and local electronics and print media, emphasizing the economic benefits to farming families.
- The silk campaign is coordinated with agriculture experts in districts and communes responsible for raising silkworm.
- Organize the first seminars and exhibitions during 2006 with distinguished silk producers and mulberry prunes.
- Establish by the end of 2006 a national sericulture association with proper bylaws and regulations. The association should have 3 divisions: an organizational/financial division; a technical division with two sections: agriculture and industry; and a marketing division for the development relations between subjects of the sericulture branch and the market.
- Establish regional associations with the participation of silk technicians, farmers and experts from agricultural institutions, the district department of agriculture and other social local organizations.
- Increase collaboration with the Ministry of Agriculture, domestic and international scientific sericulture institutions, FAO, BACSA and other foreign organizations through coordination and intertwining relations with regard to assistance with biological materials like silkworm eggs, good variety saplings, cocoon drying etc.
- Collaborate with other silk cultivating countries through exchange of experience by the scientist and experts in introduction of advanced technology on restoration and development of silk industry and handcraft manufacture of silk, visits and exhibitions tourism in members states of BACSA, etc.
- Research with the Ministry of Agriculture and Forests and other government agencies ways to encourage development of this sector and ensure a fast revitalization through offering farmers a subsidy of 0.4 euro per kg of first quality cocoons and providing mulberry saplings at half price etc methods used in other countries.

- Organize within 2006 training courses for low and medium technicians, international training courses for high-level experts and collect international literature from countries in which this sector is highly developed.
- Promote the relations between the participating countries in BACSA to help each other on revival and development of sericulture industry (including Albania) that is a traditional producer of silk handcraft items and is nearby the European silk market where the demand for the natural silk is increasing.

We hope that the cooperation between our country and the countries of the Black, Caspian seas region and Central Asia will help Albania on restoration and development of silk industry and handcraft manufacture of silk.

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The Situation of Sericulture in Armenia

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Food and Agriculture Organization, Rome, Italy

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ABSTRACT

The silk branch of Armenia has deep historical routes. According to knowledgeable historians, silk extraction spread into Trans-Caucasia, particularly Armenia, in the 5th-6th centuries A.D., mainly from Central Asia. In ancient times, whole royal clans immigrated into Armenia from central China bringing with them workers and soldiers. This communication left deep impressions on the skill, experience and culture of silk production in Armenia. In this way, silk processing and embossing of silk has existed in Armenia for more than 1400-1500 years. In this period, when trade acquired a more important role and when its widening started to increase the role of money, silk played the role of a common equivalent, the role of currency. Taxes were paid in silk. Arab historians of that time have given a number of indicators of the wide proliferation of silk processing, silk embossing and about the trade in ancient and medieval Armenia.

Certain periods of the history of Armenians saw the decline of silk extraction and processing, and then, its rebirth; it occupied an important position in the Armenian economy. The Armenian silk thread, obtained by homemade handlooms, was famous for its excellent quality. Hand silk reeling was practiced by Armenians even in ancient times, and from local, high quality silk thread - raw silk - skilful, expensive silk cloth was produced. Along with handlooms, primitive processing of raw silk, silk-reeling and silk spinning, silk textile as well as silk dyeing also developed.

The quality of Armenian silk was praised by historians because Armenian cocoons were of high quality and hand reeling produced the finest high quality thread. Armenian silk also stood out because of its colors. Back then, in the cities of Dvin and Artashat in Armenia, a special expensive dye, cochineal (Porphyrophora hamelii/Homoptera, Coccidae), was produced and named "kirmiz". It was used to dye wool and silk and these textiles were exported to Europe under the name "kirmiz".

Since ancient times Armenians have known the art of printing cloth, especially silk. The art of printing stood out clearly with the appearance of national costume. Painting cloth by printing them on wooden frames was widespread in Armenia. There were other ways to print cloth as well, for example, the cloth was covered in molten wax, and then printed upon.

The printer-ornamentalists of Armenia were always original and didn't repeat their work. Around 4000 images from the Armenian art of dyeing are kept in the Matenadaran, none of which are repeated.

Cocoon-reeling started to be mechanized and automated, increasing its producing power. Low quality cocoons and waste were re-processed and the raw silk obtained was used for the production of cloth meant for wide consumption. The technology of the silk industry allowed for considerable widening of the assortment of goods and the increased production of crape cloth from natural silk, printed silk, cloth with nap (plush, velvet, staple items and so on). There was a collection of examples of cloth (more than 600) items, which was released by the enterprises of the Armenian silk industry in hundreds of colors and with motifs of the national Armenian ornaments. The silk-producing industries of Armenia did not always rely on the processing of local raw material, produced in the country. Raw material used to be brought in from other countries.

The production of the silkworm cocoon began to fall in Armenia in 1970. Since then, only research institutions have continued the genetic selection work on silkworms.

In 1990 after the falling of the Soviet Union, the Armenian government began to restore Sericulture in Armenia. They established an 800 hectare mulberry plantation so cocoon

production could begin. The Faculty of Sericulture then opened in the Armenia Agriculture University.

However, after privatization of the lands and the formation of the farming facilities the sericulture practices turned out to fully depend on the farmers desires, which was a problem because of the unassisted programs of the Government. Armenia's low economic level has not allowed them to possibly help the farmers with reconstruction and revival of sericulture.

The dryness of the climate, absence of frost in the spring and of sharp fluctuations in temperature during the feeding period are factors suitable to the growth of worms, which, in Armenia occurs at a faster pace, than in other sericultural regions. Such climate creates condition for reduction of the diseases of the silkworm and mulberry. In this connection is expedient to restore the production of cocoons in Armenia

Since 1995-2005, cocoon production was organized in some farming facilities in small amounts, but this did not prosper. Their production of these cocoons cannot be produced in large amounts without the help of the Sericulture organization. Because of this, YANS-SHERAM (Silkworm) LTD., ECO-SILK, and Environment and Health Protection Non-Governmental Organizations, have begun to promote rehabilitation and revival of Sericulture in Armenia. Before these organizations were created, the study of the potential of sericulture was done by Armenia (Fund Eurasia). We engineered the Electric Device for rooting the mulberry cuttings and production of saplings. We also organized actions on the land bordering the mulberry plantations.

For sericulture rehabilitation in Armenia it is necessary to organize: mulberry planting, silkworm breeding and silkworm egg production system; cocoons and raw silk realization.

Key words: sericulture, silk, Armenia, revival

Chapter 1. Introduction

THE HISTORY:

According to knowledgeable historians, silk extraction spread into Trans Caucasus, particularly Armenia, in the 5th-6th centuries A.D., mainly from Central Asia. In connection with this it is interesting to note, that it is no coincidence that the name given to silk by the Armenians, Georgians and Central Asian people, especially Iranians, is very similar - "Abreshum".

In ancient times, whole royal clans immigrated into Armenia from central China bringing with them workers and soldiers. This communication left deep impressions on the skill, experience and culture of silk production in Armenia.

In this way, silk processing and embossing of silk has existed in Armenia for more than 1400-1500 years. In this period, when trade acquired a more important role and when its widening started to increase the role of money, silk played the role of a common equivalent, the role of currency. Taxes were paid in silk. Arab historians of that time have given a number of indicators of the wide proliferation of silk processing, silk embossing and about the trade in ancient and medieval Armenia.

Certain periods of the history of Armenians saw the decline of silk extraction and processing, and then, its rebirth; it occupied an important position in the Armenian economy. The wide development of silk processing and embossing can be explained by the development of sericulture, high quality of cocoons, and the geographical conditions of the country. With a

local cocoon raw material base silk reeling, silk spinning and the embossing of various silk items developed.

The Armenian silk thread, obtained by homemade handlooms, was famous for its excellent quality. Hand silk reeling was practiced by Armenians even in ancient times, and from local, high quality silk thread - raw silk - skilful, expensive silk cloth was produced. Along with handlooms, primitive processing of raw silk, silk-reeling and silk spinning, silk textile as well as silk dyeing also developed.

The quality of Armenian silk was praised by historians because Armenian cocoons were of high quality and hand reeling produced the finest high quality thread. Armenian silk also stood out because of its colors. Back then, in the cities of Dvin and Artashat in Armenia, a special expensive dye, cochineal (Porphyrophora hamelii/Homoptera, Coccidae), was produced and named "kirmiz". It was used to dye wool and silk and these textiles were exported to Europe under the name "kirmiz".

Plant dyes were also known to Armenians, and of them, *Rubia tinctorum*, was well known, used mainly in the carpet and silk industries. This dye proliferated due to its beauty and durability. The subterranean parts of this plant contain substances like alizarin, purpurin, rubiadin and so on, which are valuable dyes.

In the centuries that followed, the dye trade started to develop in the center of the mountains. In Erivani, two types of dyes were known: "boyakhchi" and "shilachi". The former included blue dyes and the latter red.

Since ancient times Armenians have known the art of printing cloth, especially silk. The art of printing stood out clearly with the appearance of national costume. Painting cloth by printing them on wooden frames was widespread in Armenia. There were other ways to print cloth as well, for example, the cloth was covered in molten wax, and then printed upon.

The printer-ornamentalists of Armenia were always original and didn't repeat their work. Around 4000 images from the Armenian art of dyeing are kept in the Matenadaran, none of which are repeated.

Chapter 2. Sericulture statistics

SILK PROCESSING:

The initial path of silk processing was through the handloom reeling of cocoons and spinning. Later cocoon-unwinding and silk textile cottage industries were set up. The silk industry of Soviet Armenia included the silk-spinning, silk-reeling and silk-weaving produce of the Republic, and, as far as industrialization goes, it was equipped with new technology and new machinery. Cocoon-reeling started to be mechanized and automated, increasing its producing power. Low quality cocoons and waste were re-processed and the raw silk obtained was used for the production of cloth meant for wide consumption.

The technology of the silk industry allowed for considerable widening of the assortment of goods and the increased production of crape cloth from natural silk, printed silk, cloth with nap (plush, velvet, staple items and so on).There was a collection of examples of cloth (more than 600) items, which was released by he enterprises of the Armenian silk industry in hundreds of colors and with motifs of the national Armenian ornaments. The silk-producing industries of Armenia did not always rely on the processing of local raw material, produced in the country. Raw material used to be brought in from other countries. The dynamics of the growth of cocoon-production, raw silk and silk weaving power are depicted in diagrams 1, 2 and 3.

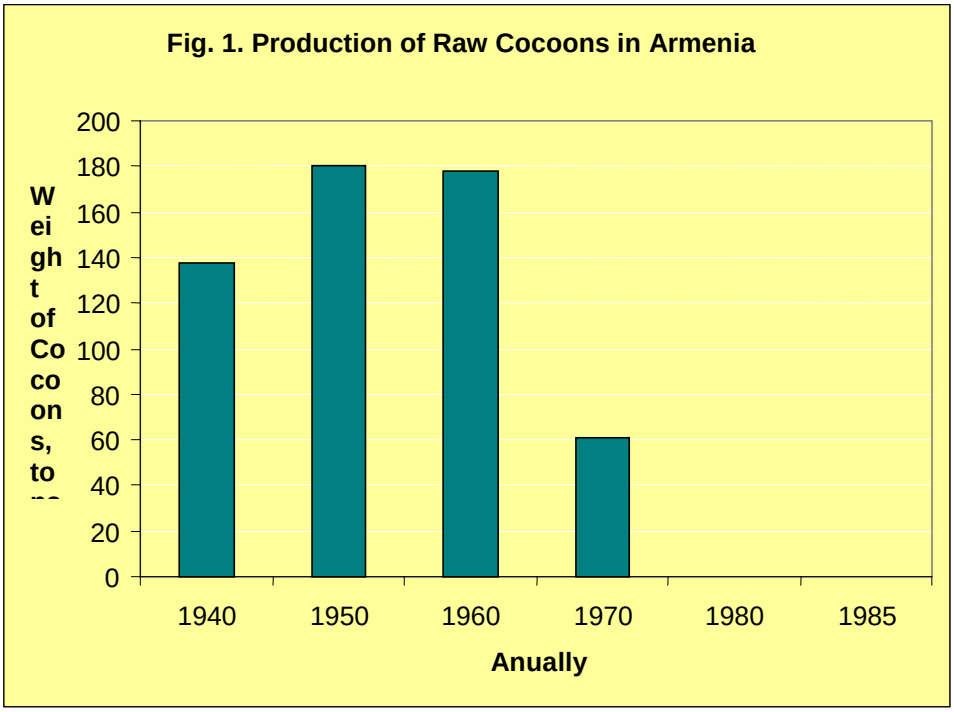


Fig. 1. Production of Raw Cocoons in Armenia
Weight of Cocoons, to
200
180
160
140
120
100
80
60
40
20
0
1940
1950
1960
1970
1980
1985
Anually

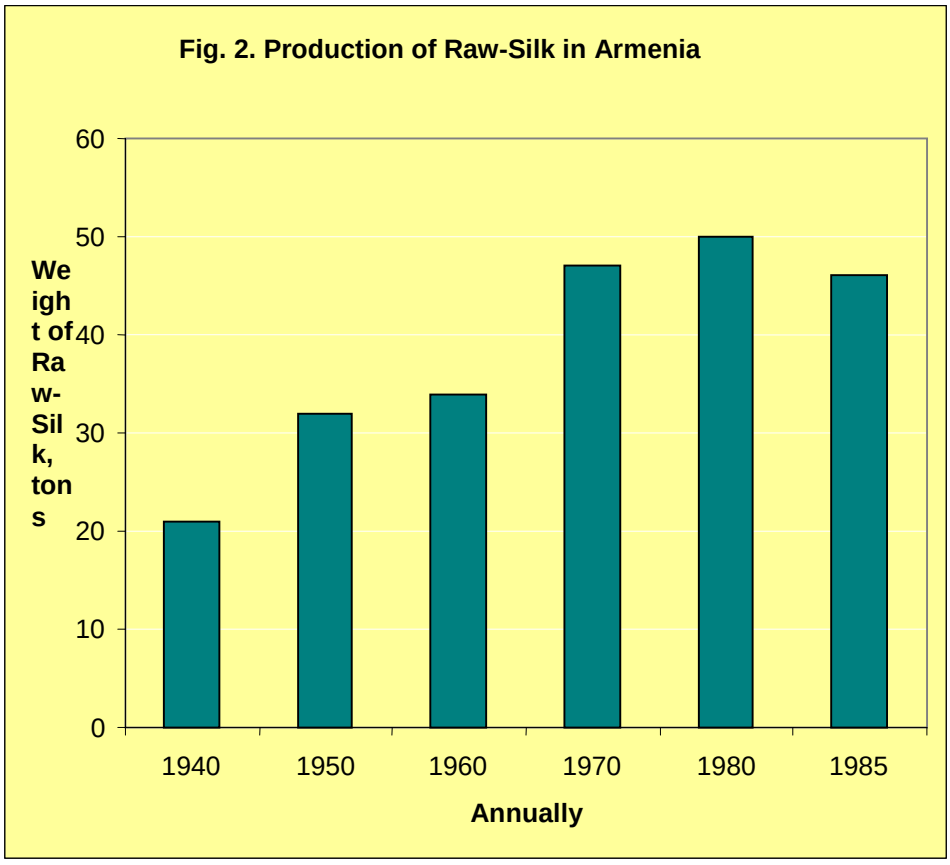
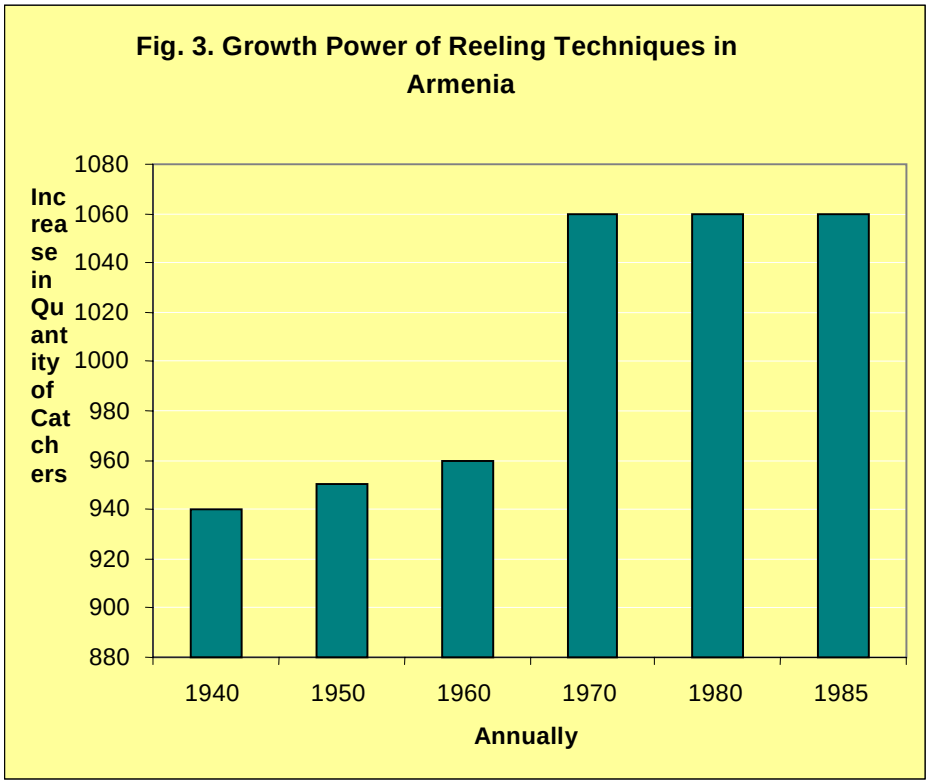
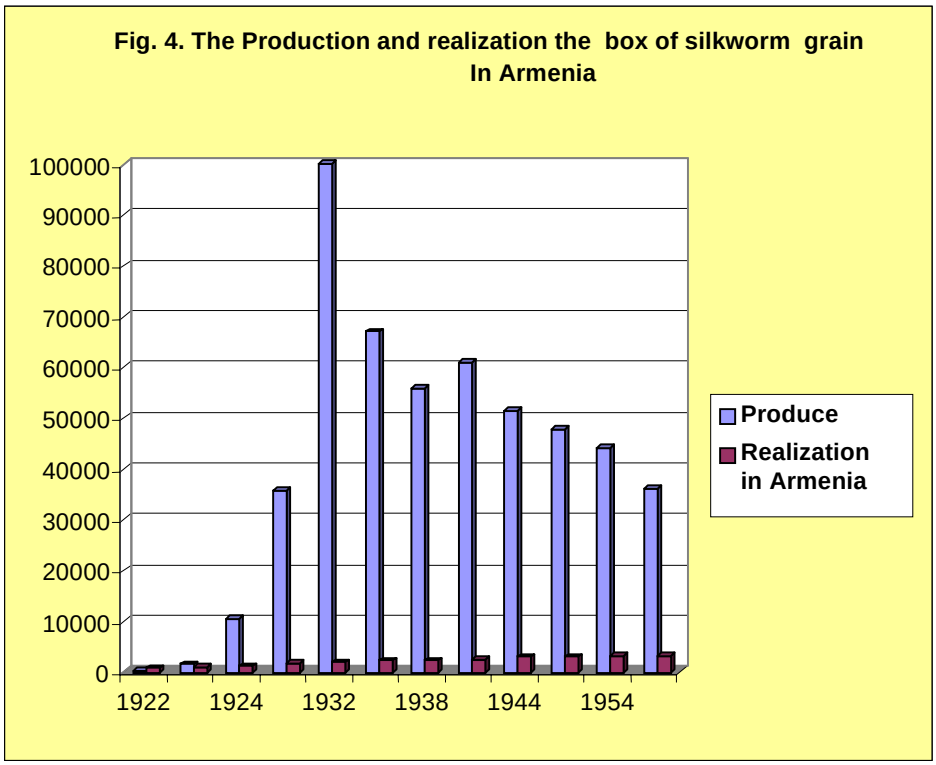


Fig. 2. Production of Raw-Silk in Armenia
Weight of Raw-Silk, tons
60
50
40
30
20
10
0
1940
1950
1960
1970
1980
1985
Annually





GRAINAGE:

Government organization for the production of high quality eggs started in the 1920s. Egg production factories were constructed, equipped with advanced technology and highly qualified specialists. Hence, production of eggs in the Republic grew sharply in a few years. Their production grew so much that Armenia became a supplier of high quality silkworm

eggs to other countries. Not only were Armenian and Azerbaijani sericultural regions supplied with eggs, but so were Iran and Turkestan. Egg production factories were constructed in Armenia in 1929-1970 (in Yerevan and Meghri). On the basis of the quality of the eggs Armenia occupied one of the foremost positions in the Union. Armenian eggs stood out due to their high hatchability percentage, high yield of cocoons and the viability of worms. These qualities are some of the main factors for the profitability of sericulture. In grainage an increase in the amount of eggs obtained from one kilogram of cocoons is a big reserve, which allows a considerable decrease in the cost price of the eggs, and also the improvement in the quality of selection of purebred material and economy of manpower in grain production. At the Sericultural Station of Armenia was constructed and designed the machine for mechanized rearing of the silkworm (1965-70, Sarkisyan).

INFORMATION ABOUT THE MULBERRY TREE IN ARMENIA

Morus alba L. (white mulberry) has many varieties and is spread out everywhere in Armenia. The leaves of all types of this mulberry tree are very nutritious and are used as feed for mulberry silkworm larvae. In Armenia, the sorts of mulberry cultivated are mainly the ones that have been growing here for a long time, although new sorts are also being brought in from other countries.

Despite a large love for heat, the local forms of the mulberry tree bear the great frosts of winter (-35°C, -37°C) quite well. This kind of temperature is not lethal to the mulberry; only freezing of the shoot tops is observed.

The geographical zones of Armenia (from six climatic types) the four climatic types are suitable for mulberry plantation.

Reasons of the bring about decay the Sericulture in Armenia

The production of the silkworm cocoon began to fall in Armenia in 1975-85. Since then, only research institutions have continued the genetic work on silkworms. The main reasons for the cocoon production decline and consequent stop in Armenia were as follows:

1. The appearance of the synthetic fibers and their huge distribution in the international market;
2. The instability of cocoon and silk prices within the local markets;
3. The crop re-structuring in areas where sericulture was popular and mulberry plantation had a big share among crops, which provided higher incomes (vegetable, grape) and lead to the replacement of the mulberry plantations.

Chapter 3. National strategy for sericulture revival and development in Armenia

In 1990 after the falling of the Soviet Union, the Armenian government began to restore Sericulture in Armenia. They established an 800 hectare mulberry plantation so cocoon production could begin. The Faculty of Sericulture then opened in the Armenia Agriculture University.

However, after privatization of the lands and the formation of the farming facilities the sericulture practices turned out to fully depend on the farmers desires, which was a problem because of the unassisted programs of the Government. Armenia’s low economic level has not allowed them to possibly help the farmers with reconstruction Sericulture.

Since 1995, cocoon production was organized in some farming facilities in small amounts, but this did not prosper. Their production of these cocoons cannot be produced in large amounts without the help of the Sericulture organization.

Because of this, YANS-SHERAM Sericulture LTD., ECO-SILK, and Environment and Health Protection Non-Governmental Organizations, have begun to promote rehabilitation of Sericulture in Armenia. We engineered the Electric Device for rooting the mulberry cuttings and production of saplings. We also organized actions on the land bordering the mulberry plantations.

In the last few years a regain tendency is being observed for the Armenia sericulture, because is an increasing demand within the countries for natural and biological products.

Survey on the potential for sericulture in various regions of armenia mainly due to the next:

- taking stock of preserved plantations of mulberry or other trees, studying the sort variety.
- selecting suitable territory for the creation of mulberry plantation.
- collecting information about the willingness and resources of the population to practice silk production..

The following methods were used for research into each region:

- meeting the regional head, familiarizing him with the task at hand and the current program, the role of the Eurasia fund in it and so on.
- meeting the head of the agricultural division, presenting him with the concrete program.
- discussing the task at hand and the program in the agricultural division in the presence of specialists, representatives of agricultural councils and others.
- studying the region along with the head agronomist and other specialists in agriculture with the aim of collecting information regarding sericulture (past, present and future).
- Frequent discussions were held with the representatives of local agricultural councils, farmers and people living in the villages and towns about their resources and willingness to participate in silk production.
- Stock taking and examination of the mulberry plantation was conducted and its sort variety was studied.
- Research was carried out, aiming at the possible reestablishment of manufacture or manual production of raw silk and items, as it used to be earlier.

The research has shown, that mulberry trees, and in some places, plantations, have been preserved mainly around houses, farmsteads, fields, on the edges of roads, in gardens and parks. In urban settlements, the mulberry has been kept as a decorative or fruit-bearing tree.

On examination of the sort variety it was discovered that many local sorts of mulberry had been preserved as had sorts obtained in many other parts and brought in from other countries (Russia, Georgia) which have been cultivated in local conditions for a long time. Polyploidy forms of mulberry (with large leaves), created specially for application in sericulture were also seen. All varieties of mulberry which used to be cultivated in Armenia for sericulture are mainly preserved in the state of Syunik - Goris, Meghri, Kapan, Sissian and partly in other regions (Etchmiadzin, Ashtarak and so on). These trees can serve as the foundation for a collective mulberry gene pool in Armenia and to start new plantations.

Discussion with local populations showed that silk production is not a completely forgotten field yet. They reminisced about the silkworm with great warmth and almost all of them would like this field to be reestablished in Armenia. On asking local residents about the

facilities and their desire to practice silk production, it was made clear that in regions suitable for sericulture, 80 - 100 % of the residents were willing to practice cocoon production, if the realization of raw material (silkworm cocoons) on agreement with corresponding organizations is organized.

On discussion with residents of agricultural localities it was observed that although they are familiar with this field, this is not enough for the modern level of silk production. In order for the population to professionally get down to practicing sericulture, it is necessary to carry out educational and demonstrative programs with them on worm feeding and organization of worm cocooning, manual unwinding of cocoons and preparation of various silk items. Their education must be carried out using the newest methodology, familiarizing them with the new technology used in the international practice of sericulture.

As a result of the research, regions, areas, villages and territories were marked where it is currently possible to practice sericulture, to start and expand silkworm cocoon production. In each region there are certain unused territories which peasants can use for the plantation of mulberry and after two years allow it to be used to obtain silkworm cocoons.

Table 1.

General characteristics of administrative points, recommended for practicing silk production and Possible dynamics to increase mulberry plantations in different regions of Armenia

Name	Presence of mulberry plantations (ha)	Recommended area for planting (ha)	Possibile expanding of territory (ha)
Goris	50	100	500
Kapan	20	50	100
Sissian	50	200	500
Meghri	5	115	150
Armavir	3	24	200
Aragatsotn	5	110	200
Total	133	599	1650

In some regions forest expanses can be used for mulberry plantation. These regions are in the north as well as the south and belong to the four climatic types:

1. Dry sub-tropical climate. Formed in the north-eastern (up to 700-800 m) and south-eastern (till 900-1000 m) regions
2. Dry continental climate. It dominates in the low-lying part of the Central Araks depression till an altitude of 1300 m in conditions of desert or semi-desert zones.
3. Temperate, warm and dry climate. It is typical of the foothills with altitudes up to 1700 m, and of the dry steppes zone.
4. Temperately cold climate. It is characteristic of hilly forest zones and includes mountainous altitudes up to 2000 m, and in some places, 2300 m.

The following prerequisites exist for the reestablishment of silk production in Armenia:

1. The desire and facilities of the population of villages to practice sericulture.
2. The geographical zones of Armenia (from six climatic types) the four climatic types are suitable for mulberry plantation. The dryness of the climate, absence of frost in the spring and of sharp fluctuations in temperature during the feeding period are factors

suitable to the growth of worms, which, in Armenia occurs at a faster pace, than in other sericultural regions. Such climate creates condition for reduction of the diseases of the silkworm and mulberry. In this connection is expedient to restore the production of cocoons in Armenia.

3. Armenian silk also stood out because of its colors. Back then, in the cities of Dvin and Artashat in Armenia, a special expensive dye, cochineal, was produced and named "kirmiz". It was used to dye wool and silk and these textiles were exported to Europe under the name "kirmiz". In Armenia (In Ararat plane of Armenia have an insect (Porphyrophora hamelii/Homoptera, Coccidae) which selects known natural redden paint under the name "kirmiz" (ecological clean, lightproof stain). Use a new technologists receptions of such paint and dye silk threads could raise the beauty and quality silk fabric.
4. A large amount of Government and privatized territory and forest expanses (10 - 20%), not currently in use, which are potential sources for the creation of mulberry plantations and for the practice of sericulture.
5. A special firm exists, Yans Sheram joint-venture, which can be as the Center of Sericulture (with skilled specialists) and provide :
    - high-yield eggs of mulberry silkworm to various regions of Armenia.
    - saplings of sorts a mulberry, recommended for silk production, in a specific variety ratio.
    - technology for accelerated cultivation of trees and creation of plantations.
6. ECO-SILK, and Environment and Health Protection Non-Governmental Organizations can provide: Training Courses for farmers in various regions of Armenia, mass media, distribution of mulberry saplings for planting in private farmers land and government forest land (if International organizations will support).
7. 2006-2010 years - all sericultural organizations of Armenia will be revived: mulberry planting, silkworm breeding and silkworm egg production system; cocoons and raw silk realization. Sericulture in Armenia is now being helped and funded by any different international organizations (FAO, UNDP, JICA, KOICA, IFAD European Commission, etc.) which greatly benefits the many farmers throughout Armenia with handicraft manufacture of silk, development the manual manufactures and new technology of coloration the silk of red natural paint, karmiz which there is in Armenia; for collect the all good sort mulberry of Armenian germplasm for distribute corresponding sort of mulberry to farmers.

Chapter 4. Major Problems and Issues, and Recommendations

1. After privatization of the lands in Armenia and the formation of the farming facilities the Sericulture practices turned out to fully depend on the farmers desires, which was a problem because of the unassisted programs of the Government. Armenia's low economic level has not allowed them to possibly help the farmers with reconstruction Sericulture and the lack of financial support of the government.
2. Mulberry fields are destroyed.
3. Lack of local silkworm egg production and dependence to imported eggs not always having the best adaptation to the local conditions
4. Absence of adapted modern technology, appropriate facilities and equipment for silkworm rearing and breeding and reeling.
5. Absent a standard control system for silk production.

6. Lack of adequate training and extension services in sericulture in Armenia.
7. Full absence financing and support the Sericulture from Government and International Organizations

Chapter 5. BACSA Development Strategies

On the basis of the carried out analysis we count, for rehabilitation of sericulture in Armenia it was necessary to realize the following suggestions:

1. For sericulture rehabilitation in Armenia it is necessary to organize: mulberry planting, silkworm breeding and silkworm egg production system; cocoons and raw silk realization.
2. Promotion of links between producers and buyers and system for quality control.
3. Organize training courses on different regions of Armenia for farmers training and improvement of professional skills with invite expert from Black, Caspian seas and Central Asia region countries.
4. In Armenia, basically rural population have not a job and is very poor, so it's reasonable to help and stimulate the manual reeling of cocoons. As well as using old-time Armenian traditions to get the final product from silk by too manual way (carpet, embroideries by silk thread, lace and etc.).
5. Mutual exchange and comparative testing of mulberry and silkworm genetic resources.
6. Sericulture in Armenia to be helped and funded by different international organizations (FAO, UNDP, JICA, KOICA, IFAD European Commission, etc.), which greatly benefits the many farmers throughout Armenia with handicraft manufacture of silk, development the manual manufactures and new technology of coloration the silk of red natural paint ,"karmiz", which there is in Armenia. Help us for collect the all good sort mulberry, in a germplasm of Armenia for distribute corresponding sort of mulberry to farmers.
7. Help to search donors for funding a project for sericulture revival in Armenia.

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Follow-up activities of Tashkent Workshop and national strategy for sericulture revival and development in Azerbaijan

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ABSTRACT

Available in Azerbaijan 2 parental egg stations, 7 hybrid egg production factories, cocoon drying centers in 30 districts, about 80 centers on preparation and primary processing of cocoons, Sheki silk factory, Ordubad silk reeling factory have suspended their industrial activity, hundred thousand people have remained without work. However in 2001 significant means were allocated from the state budget and was restored industrial activity of Sheki Ipak J.S.C. (former Sheki silk factory). Now for manufacture of raw silk with full capacity the enterprise needs annually 650-700 tone of dry cocoons that makes about 2000 tone of fresh cocoons. However, because of very low level of volumes of silkworm rearing and fresh cocoon production in republic, the enterprise for partial satisfaction of the capacity, for last 2-3 years has bought from abroad dry cocoons. At the same time by rational use of available potential opportunities, including strengthening of the forage reserve and silkworm egg production in republic it is possible to raise 2000 tone of fresh cocoons per annum. Thus of 50-60 thousand farmer's households (or approximately 200-250 thousand person) will be provided with seasonal work for silkworm rearing. The experts have developed a national program of sericulture development in Azerbaijan Republic for the period 2006-2015. In its realization, alongside with Sheki Ipak J.S.C., all corresponding bodies and the organizations of republic, including the Ministry of economic development and agriculture, the republican Center of agrarian sciences, Azerbaijan Scientific research institute of sericulture and others should take part. At the same time, support of this program on the part of the Government of Republic, could create favourable preconditions for its realization. For achievement of the above-stated purposes it is necessary to solve below-mentioned problems: To strengthen the forage reserve of sericulture by improvement existing and establishment of new mulberry plantations; To organize breeding works on production high-quality P_2, P_1 and F_1 (hybrid) silkworm eggs on a scientific basis; To increase volume of production of qualitative industrial cocoons on the basis of progressive improvement of the silkworm rearing technology; To organize preparation and qualitative primary processing of fresh cocoons at a high level; To equip the silk reeling manufacture by the modern process equipment; To increase volume of manufacture and export of competitive raw silk on the basis of modern technologies. According to the prepared program, the annual volume of fresh cocoon production in Azerbaijan is planned to reach up to 2185 tons in 2015. For the purpose there will be a need of not less than 39595 boxes of silkworm eggs. (one box =29 g) and to produce more than 40 thousand tons of mulberry leaves for what it is necessary to have 5652 hectares of maintained mulberry plantations. Due to efforts of the management and experts of Sheki Ipak J.S.C., in republic manufacture of a high-quality planting material (mulberry seedlings and saplings) in sufficient volume are restored and three hybrid silkworm egg production factories as well as one parental egg station operate in more than 10 areas of republic.

Concerning continuation of cooperation of the countries of region the following in the near future is possible to tell: Azerbaijan is ready to cooperate with any of the countries - members of the BACSA in sphere of sericulture germplasm exchange, silkworm egg production, mulberry seedlings and saplings production. Azerbaijan is able to deliver high-quality hybrid silkworm eggs in the countries of region, for example to Tadjikistan and Kirghizia, with that condition that the dry cocoons produced by them would be exported to Azerbaijan.

Keywords: sericulture, Azerbaijan, revival, development, strategy

Chapter 1. Introduction

The sericulture in Azerbaijan has an ancient 1500 years history and famous traditions. According to historical sources, Azerbaijanians have started to be engaged with sericulture still in V th century A.D. Glorified all over the world, due to high quality, the Azerbaijan silk since XII century, began to export on the Great Silk Road to the countries of Asia and Europe. It led to formation not only trading, but also cultural and political connections of Azerbaijan with other countries of the world.

In second half of XXth century and it is especially, since 70th years, the sericulture development has received the greatest scope. During this period in republic annually produced 5-6 thousand tone of fresh cocoons, 350-400 tone of raw silk, developed tens millions square meters of silk fabrics of various assortment. With the silkworm rearing and manufacture of cocoons were engaged more than 150 thousand country families (approximately 750-800 thousand person). In the silk industry worked more than 14 thousand person, including in Sheki silk factory more than 7 thousand person. Azerbaijan in Soviet Union took 2nd place on manufacture of fresh cocoons and 1-st place on quality of cocoons and raw silk. The Azerbaijan cocoon and silk produced were shown at the international exhibitions and received high estimations of experts.

Unfortunately, after purchase by republic of independence, because of incompetence of the forces which have come to authority, in the country the political and economic chaos which has put the strongest impact on many branches, including on sericulture was formed. Available in republic 2 parental egg stations, 7 hybrid egg production factories, cocoon drying centers in 30 districts, about 80 centers on preparation and primary processing of cocoons, Sheki silk factory, Ordubad silk reeling factory have suspended the industrial activity, hundred thousand people have remained without work. 1500 years sericulture in Azerbaijan appeared before threat of destruction.

However, secondary returning to authority of national leader G.Aliev has prevented alongside with many troubles and this danger. Under his personal assignment and the order in 2001 significant means have been allocated from the state budget and is restored industrial activity of Sheki Ipak J.S.C. (former Sheki silk factory). Now for manufacture of raw silk with full capacity the enterprise needs annually 650-700 tone of dry cocoons that makes about 2000 tone of fresh cocoons. However, because of very low level of volumes of silkworm rearing and cultivation of fresh cocoons in republic, the enterprise for partial satisfaction of the capacity, for last 2-3 years has bought from abroad dry cocoons. At the same time by rational use of available potential opportunities, including strengthening of the forage reserve and silkworm egg production in republic it is possible to raise 2000 tone of fresh cocoons.

Thus of 50-60 thousand farmer's households (or approximately 200-250 thousand person) will be provided with seasonal work for silkworm rearing, and in this business teenagers, old pensioners and invalids can be engaged not only physically healthy people of mature age. The opportunity of improvement of well-being of socially least protected layer of the population hence will open. Alongside with it, 1000-1200 constant workplaces at again started enterprises on silkworm egg production, bases on preparation and primary processing of cocoons and in the industrial enterprise Sheki J.S.C. will in addition open, again planted mulberry plantations render positive influence on ecology of republic, the increase in manufacture of cocoons will promote acceleration socially - economic development of many areas and as a whole of republic, to agricultural population will be annually paid about 4 million US dollars for the cocoons brought up by them, will increase internal total production and an export potential of the country due to manufacture of raw silk and the silk products corresponding to the international standards.

Proceeding from above-stated, under the initiative and direct support of a management of Sheki Ipak J.S.C. experts develop the national program of sericulture development in Azerbaijan Republic for the period 2006-2015. Realization of this program is a difficult and crucial business. In its realization, alongside with Sheki Ipak J.S.C., all corresponding bodies and the organizations of republic, including the Ministry of economic development and an agriculture, the republican Center of agrarian sciences, Azerbaijan Scientific research institute of sericulture and others should take part. At the same time, support of this program on the part of the Government of Republic, could create favourable preconditions for its realization. Support of the Government of Republic could consist of below-mentioned privileges:

- Delivery to sericulture farmers, mulberry sapling production nurseries and silkworm egg production factories of short-term and intermediate term credits on favourable terms;
- Clearing of the customs of materials imported in the country and used for equipment of egg production factories, primary processing of cocoons and manufacture of raw silk;
- Clearing of the customs exported from the country silkworm eggs and raw silk;
- Clearing of all kinds of the tax, for the period of 10 years, manufacturers of silkworm eggs, cocoons and raw silk;
- Granting to silkworm egg producers, cocoons and raw silk producers of fuel, electric energy and natural gas under reduced rates within 10 years.

Concerning continuation of cooperation of the countries of region the following in the near future is possible to tell: our country is ready to cooperate with any of the countries - members of the BACSA in sphere of silkworm egg production, mulberry seedlings and saplings production. We have completely restored activity of three hybrid silkworm egg factories and one parental egg station which capacity allows to prepare high-quality hybrid eggs in the volume, many times exceeding internal need of our country. Therefore, we can deliver high-quality hybrid eggs (obtained by crossing of the Chinese and Japanese breed) in the countries of region, for example to Tadjikistan and Kirghizia, with that condition that the dry cocoons received by them would return these countries to us. We also can deliver in any country a high-quality mulberry seedlings and saplings.

Chapter 2. The results of the Tashkent international workshop achieved in Azerbaijan

To many our colleagues it is well-known, that under the initiative and at direct financial and organizational support of FAO in April, 2005 in Tashkent the First International Workshop on Revival and Promotion of Sericultural Industries and Small Enterprise Development in the Black, Caspian Seas and Central Asia Region with participation more than ten countries of region has been organized and carried successfully out. On this workshop the major problems and ways of sericulture revival and development in the region which results rendered positive influence on the relation to sericulture all countries - participants of this workshop including in Azerbaijan have been discussed. So, " The State program of social and economic development of regions of the Azerbaijan Republic ", authorized by the President of Republic I.Aliev includes actions on sericulture development in ten areas, including in the Nakhichevan Autonomous republic, included in the Azerbaijan Republic.

In Azerbaijan Scientific research institute of sericulture the thematic plan of scientific researches for 2006-2010 is made proceeding from the major problems of sericulture, put on the Tashkent symposium. Besides the institute makes bilaterial contracts about cooperation

with colleagues from Bulgaria and Ukraine on carrying out of joint researches and an exchange of germplasm of silkworm and mulberry.

The most significant works with the purpose of sericulture development in republic it is executed in open joint-stock company Sheki Ipak. In it special sericulture management which carries out the big organizational actions on restoration of silkworm rearing and to expansion of the forage reserve of sericulture in 14 areas of republic is created. In 2005 it was planned to produce more than one million mulberry saplings. There are restored and resulted in a condition of working readiness more 10 bases on primary processing the fresh cocoons, the hybrid egg production factories and one parental egg station. In Sheki Ipak silk factory are completely repaired industrial premises such as silk reeling unit, unit on processing waste products of silk reeling and boiler-house. Repair work in silk twisting unit, weaver's and silk dyeing units are started. Repair - landing works of all technical constructions and the process equipment, including multiends silk reeling machines are carried out, the ventilating system is established.

The most remarkable event is that under the initiative and direct support of Sheki Ipak J.S.C. experts of republic develop the national program of sericulture development in the Azerbaijan Republic for the period 2006-2015 which in a brief kind is stated in the following section. The main executor of this program is Sheki Ipak J.S.C. It will finance actions of this program. However, for successful realization of the program huge means are required and we hope, that shortly the Government of Republic and the corresponding international organizations will consider this program with due attention and render feasible financial support for its performance.

Chapter 3. The national program of sericulture development in the Azerbaijan Republic

3.1. Strategy of the program

Strategy of the program is conceived as a component of strategy of the economic policy, spent by the state in the country. It is known, that the state policy spent now for the further strengthening of the national economy is directed on acceleration of development of the branches which are not concerning to oil sector, on the basis of rational use of the big economic successes achieved in oil sector of the country. In view of it, the sericulture development can play the important role in development of two important branches of the country not concerning to oil sector - light industry and the agriculture. At the same time, as a result of sericulture development, the raw silk obtained from processing of strategically important raw material - cocoons of the silkworm, can be realized in the world markets due to what inflow of a foreign currency to the national economy will amplify.

3.2. The purpose and problems(tasks) of the program.

The basic purpose of the program consists, by the interconnected development of all sericulture parts - a forage reserve (mulberry plantations), a breeding affair (silkworm egg manufacture), cultivation, preparation and primary processing of fresh cocoons, manufacture of raw silk from dry cocoons - in achievement below-mentioned:

- ✓ Increase in the export potential of the country by manufacture and deliveries to the world markets of competitive raw silk;
- ✓ Strengthening of inflow of a foreign currency in the national economy;
- ✓ Creation of the new processing enterprises in agrarian sector and the industry;
- ✓ Promotion to acceleration of social and economic development in sericultural regions;

- ✓ Maintenance of the population of the country with new workplaces (including 200-250 thousand seasonal and up to thousand constant workplaces);
- ✓ Maintenance of effective industrial activity of Sheki Ipak J.S.C. on the basis of production of enough cocoon raw material in the republic.

For achievement of the above-stated purposes it is necessary to solve below-mentioned problems:

- ➢ To strengthen the forage reserve of sericulture by improvement existing and planting of new mulberry plantations on the basis of agrotechnical actions;
- ➢ To organize breeding works on manufacture high-quality P_2, P_1 and F_1 (hybrid) silkworm eggs on a scientific basis;
- ➢ To increase volume of production of qualitative industrial cocoons on the basis of progressive improvement of the silkworm rearing technology;
- ➢ To organize preparation and qualitative primary processing of fresh cocoons at a high level;
- ➢ To complete silk reeling manufacture by the modern process equipment;
- ➢ To increase volume of manufacture and export of competitive raw silk on the basis of modern technologies.

3.3. Creation of regulatory-legal base of branch

For correct and objective (on the lawful bases) settlements of carried out industrial - technological processes, labor and relations of production in all directions of sericulture, and also for a correct estimation of quality made products (for example: silkworm eggs, fresh cocoons, dry cocoons, etc.), presence of regulatory-legal base is required. This base will consist of various instructions, norms and specifications of the charge of materials and time for carried out works in various directions of sericulture, and most important of state standards on cocoons of the silkworm - fresh, air - dried and waste cocoons. These standards in sericulture of the republics are available. However, all of them are accepted during the Soviet authority, have become outdated and today do not correspond to requirements of free market economy. And new national standards in republic till now are not developed. Despite of it, there is a simple decision of this question. In 2004, Interstate council of the CIS countries on standardization, metrology and certifications has accepted at the session interstate standards on cocoons of the silkworm fresh, air - dried and waste (the report № 25 from May, 25, 2004). For acceptance of these standards have voted 6 countries engaged in the sericulture, including Azerbaijan. For coming into force of these interstate standards in our republic, only corresponding order of the head of republican State agency on standardization metrology and patents is required.

Besides the Ministries of economic development and agriculture should present in the government the offer on preparation of the project and acceptance of a "Law about sericulture".

3.4. A choice of the most suitable areas for accommodation and developments of sericulture

Definition of the most suitable areas of republic for sericulture accommodation and the further development is carried out on the basis of the following criteria: presence in area of a forage reserve (mulberry plantations) and their volume, a degree of technical suitability of

regional base on primary processing fresh cocoons and the process equipment available in it, presence in the area suitable personal and farms for silkworm rearing and people showing interest to these.

On the basis of the analysis of the information on the above-stated criteria of the areas extracted by experts of Sheki Ipak J.S.C., for sericulture accommodation and developments at the given stage are chosen 14 below-mentioned areas of republic:

1. Агдашский	8. Кахский
2. Агджабединский	9. Габалинский
3. Агсуинский	10. Шекинский
4. Белоканский	11. Уджарский
5. Бардинский	12. Евлахский
6. Гёкчайский	13. Закатальский
7. Кюрдамирский	14. Зардабский

Mulberry plantations existing now in republic in volume of 2342 hectares are concentrated on territory of the chosen areas. The technical condition of bases of primary processing of cocoons and process equipments in the chosen areas also are more satisfactory, than in other areas. Besides in the chosen areas the quantity of suitable for silkworm rearing personal and farms and people, wishing to be engaged in this business are relative higher, than in other areas.

From available in the chosen areas 14 bases of primary processing of cocoons 9 are privatized, the others 5 are at a stage of privatization.

Manufacture of P_2 and P_1 silkworm eggs is solved to organize on Кахской parental egg station, manufacture hybrid (industrial) eggs - on Шекинском, Закатальском and Белоканском egg production factories. All of them are on balance and submission of the Ministry of Agriculture.

The management of Sheki Ipak J.S.C., for realization of the program of sericulture development, plans to organize work of all above-stated industrial structures on a contractual basis.

3.5. The basic directions and actions in sericulture development

The sericulture as a branch of national economy, has complex structure and it is actually divided on two large sub-branches - the silk industry and silkworm rearing and cocoon production. In turn, everyone sub-branch will consist of the several industrial structures distinguished from each other by industrial - technological and organizational features. Experts name these structures the basic directions of sericulture. These industrial structures (the basic directions) of sericulture are the following:

In silkworm rearing and cocoon production:

- A forage reserve (manufacture of forage for the silkworms);
- Breeding business of the silkworm (manufacture of silkworm eggs of various category);
- Silkworm rearing and manufacture of fresh cocoons;
- Preparation and primary processing of fresh cocoons (manufacture of dry cocoons).

In the silk industry:

- Processing dry cocoons (unwinding of cocoons and manufacture of raw silk);
- Processing waste products of silk reeling;
- Silk twisting;
- Silk weaving;
- Silk dyeing/printing etc.

It is necessary to note, that production obtained (mulberry leaves, silkworm eggs, fresh cocoons, dry cocoons etc.), in each of the above-stated industrial structures (directions), is used in the subsequent structure as raw material for obtaining of other production. Therefore, wrong planning of volume of manufacture or infringement of normal industrial activity for any reason in what or from these structures negatively influences industrial activity of the subsequent structures, and finally leads to reduction in volume and quality of made raw silk and silk allied products.

For realization of the program of development actions on the basic sericulture directions, which are developed on the basis of the executed calculations have relationships with each other on all agrotechnical, zootechnical, to technological and industrial parameters. At performance of calculations a number of specifications and instructions on the basic sericulture directions (on moriculture, silkworm egg production, silkworm rearing, primary processing fresh and processing of dry cocoons), and also existing scientific recommendations and literary data are used.

Below, in corresponding sequence, it is stated actions of development on the basic directions of sericulture.

3.5.1. Strengthening the forage reserve

For strengthening the forage reserve of sericulture in republic increase of productivity of mulberry leaves of the existing and establishment of new mulberry plantations is necessary.

Increase of productivity of mulberry leaf of existing mulberry plantations. - On the statistical data, in 1989 in republic were presented more than 23 thousand hectares of mulberry plantations. However, in the next decade a significant part of these plantations, on a number of the objective and subjective reasons, it has been put out of action. Now in republic there are 2342 hectares of mulberry plantations. Their accommodation and volume on areas of republic is given in table 1. The greatest volumes of plantations are concentrated in Шекинском (593 ha), Уджарском (340 ha), Закатальском (327 ha), Бардинском (300 ha), Зардабском (270 ha), Белоканском (143 ha) and Кюрдамирском (107 ha) areas which in total make 88.8 % of plantations available in republic. It is necessary to note, that as a result of the insufficient agrotechnical care in the last 10-15 years, leaf productivity of mulberry plantations available in republic has considerably decreased. So, in opinion of experts, in 2006 expected average productivity of leaves from 1 hectare of available plantations, will make 1.5 tons (table 2). At the same time, on the basis of corresponding agrotechnical actions, the crop of mulberry leaves from each hectare can be increased in 5-6 times and to reach 7-8 tons. Therefore, since 2006, will be carried out a number of agrotechnical actions in available mulberry plantations. First of all, operation of pruning the old mulberry trees will be carried out. For this purpose each old tree it will be cut at the basis of a crone. Subsequently, the new shoots will be transformed into one-year branches, which will be formed as fist form. On younger trees operation of “thinning” will be carried out. For this purpose, on each young tree it will be cut off 30-50 % of available branches, and the dried up and underdeveloped branches first of all will be cut off. Each tree it will be cleared from young growths, appeared

near the stem. Plowing inter-rows in plantations and irrigation them for 6-8 times for all vegetative period will be carried out. Alongside with these actions, for satisfaction of need of mulberry trees in mineral fertilizers, to mulberry plantations on republic ammonium sulphate, superphosphate and potassium chloride in the volume specified in table 4 will be annually brought.

As a result of these actions, gradual increase of mulberry leaf yield from each hectare of maintained mulberry plantations up to 8 tons (table 2) is expected.

Establishment of new mulberry plantations. - According to the prepared program, the annual volume of fresh cocoon production in Azerbaijan is planned to reach up to 2185 tons (table 6). For the purpose there will be a need of not less than 39595 boxes of silkworm eggs. (one box =29 g) (table 7) and to produce more than 40 thousand tons of mulberry leaves for what it is necessary to have 5652 hectares of maintained mulberry plantations. For finishing a forage reserve of republic up to the required volume, in view of existing plantations, it is necessary to plant 5652-2342 =3310 hectares of new mulberry plantations. Thus, planting of 3310 hectares of new plantations it will be completed in 2013 as new plantations are commissioned for 3rd year from the establishment. Last two years (2014-2015) 1200 more hectares of new plantations will be incorporated. Thus, in 2015 the volume of the forage reserve in republic will reach 6852 hectares, that three times it is more in comparison with present volume. The total amount of again planted mulberry plantations is allocated between areas (table 1) in view of dynamics of development of fresh cocoon production in these areas (table 6).

The future productivity of mulberry leaves newly established plantations is influenced by a number of factors among which two are more important. These factors are the circuit of planting of a new plantation and quality of planting material.

There is a set of variants of the planting circuit. So, the distance between rows can change from 3.5 meters up to 4 meters, distance between plants in the row - from 0.5 meters up to 4 meters. By results of numerous researches it is convincingly shown, that with reduction of distance between plants the crop of a leaves from 1 hectare of plantations increases. Therefore, for establishment of new plantations is planned to use the planting circuit 5m x 0.5m. The chosen circuit of planting has some advantages:

1) Provides obtaining from each hectare of the greatest crop of leaves;

2) The planted plants for 3rd year act in operation;

3) Allow to combine more rationally the moriculture with other kinds of plants.

As, at the chosen circuit of planting it is formed low-cut or the sectional plantation, trees in the ranks of do not shade other kinds of the plants planted between rows of plantations. At the same time, the stipulated distance between rows (5 m), allows to use widely agricultural machinery, including technical equipment of the Soviet manufacture at which majority, overall dimensions make 4.5 meters, at plowing and performance of other agricultural works. Alongside with it, cultivation of the second kind of plants in new mulberry plantations, will lead to reduction in the cost price and increase of economic efficiency of production of both kinds of plants.

In the future productivity of leaves of planted mulberry plantations, the important role will play also the quality of planting material. As a planting material, as a rule, are used seedlings and saplings of mulberry. For high quality maintenance of both kinds of planting material, they should be prepared from highly productive mulberry varieties and meet the technical requirements of state standard.

Required quantity of planting material is at the rate of 4000 saplings on 1 hectare, according to the chosen circuit of planting, and the total amounts necessary for establishment of new mulberry plantations in the planned volume, are submitted in table 3. Apparently from the data of this table, for establishment of new plantations annually it is required 1.34 – 2.40 million saplings.

Manufacture of planting material is planned to be organized on Фахралинской base on moriculture, which used to be under the Scientific research institute of sericulture, and now is in submission of Гянджинского regional center of agrarian sciences. This base has 80 hectares of the ground area from which 39 hectares are under mulberry plantations. In these plantations about 300 mulberry varieties and forms created worldwide, including in Azerbaijan are collected. Besides here there is seed mother plantation on 3 hectares.

3.5.2. The organization of silkworm egg production

In sericulture, for obtaining of high crops of cocoons, the important role is played with the correct organization of breeding works on manufacture of silkworm eggs. As a rule, in sericulture are made eggs in 3 various categories – P_2, P_1 and F_1 (hybrid). These eggs differ to destination. The P_2 and P_1 eggs are prepared from pure breeds and serve for duplication of these breeds on stages of breeding work. Hybrid egg it turns out from hybridization of two pure breeds (female moths of one breed are crossed to male moths of other breed) and intend for manufacture of fresh industrial cocoons. The P_2 and P_1 eggs are produced at the parental egg stations, and the hybrid eggs - on hybrid egg production factories.

Volume of manufacture P_2, P_1 and F_1 (hybrid) eggs, required for realization of the program of sericulture development on years it is designed in view of existing fodder resources and dynamics of their development, i.e. the forecast of mulberry leaf yield. (table 5).

Manufacture P_2 and P_1 eggs is solved to organize on Кахской parental egg station, and hybrid eggs - on Шекинском, Закатальском and Белоканском hybrid silkworm egg factories.

It is necessary to note, that for even considerable increase of productivity of cocoons, the significant role is played with use at egg production more highly productive breeds and hybrids of the silkworm. Taking into account it, the Sheki Ipak J.S.C. management, 3 years ago has delivered in republic eggs of one Japanese and one Chinese type breeds and has organized their multiplication. In 2005 enough P_2, P_1 and F_1 (hybrid) eggs was prepared and these breeds in 2006 will be used at realization of the concept of sericulture development prepared. At the same time, understanding the importance of creation of new, more productive breeds and hybrids in the republic for the further sericulture development, the management of Sheki Ipak J.S.C. was adjusted with connection with the corresponding scientific organizations, in particular with Azerbaijan Scientifically - Research Institute of Sericulture and having concluded the contract, has ordered creation of new breeds and the hybrids of silkworm answering to modern requirements of the world standards.

All complex it is industrial - technological actions and the operations which are carried out for manufacture P_2 and P_1 eggs and are in details stated in the “Basic methodical positions of breeding work with the silkworm ", and for manufacture hybrid eggs - in the instruction " Key rules of preparation industrial silkworm eggs on egg production factories ". For maintenance of manufacture qualitative eggs of all categories, experts of a sericulture department at Sheki Ipak J.S.C. will be carried out the strict control over performance of requirements of the specified instructions by workers Кахской parental egg station, and also Шекинского, Закатальского and Белоканского hybrid egg production factories up to the mark. Alongside

with it, in the specified enterprises will be carried out a number organizational - economic actions.

With the purpose of a choice of elite facilities for parental egg station and breeding facilities for hybrid egg factories, are examined the work force available and the farms located in a zone of their activity and are determined most suitable of them for carrying out elite and breeding silkworm rearings. In the chosen elite and breeding facilities it will not be allowed to conduct silkworm rearing of industrial purpose. Delivery the brought up on elite and breeding facilities of fresh cocoons in places of acceptance them at the parental egg station and hybrid egg factories only in the morning (till 10.00 A.M.) and only in firm container (baskets, wooden or plywood boxes with lateral apertures for aeration, etc.), that will allow to prevent deterioration of fresh cocoons.

For carrying out mother moth examination for pebrine are purchased 30 phase- contrast microscopes of foreign mark which are distributed between the parental egg station and three hybrid egg factories. Use of these microscopes at the factory and state microanalysis will allow to determine more precisely infected with illnesses egg batches, in due time to reject them and to exempt sold eggs from diseases.

3.5.3. Silkworm rearing and fresh cocoon production

One of the primary goals of the program of sericulture development is the increase of fresh cocoon production. A number of other tasks of the program, namely strengthening and expansion of the forage reserve, and also silkworm eggs of various categories production, are directed on the successful solving of this primary goal.

According to plans of the program, in republic (table 6) is planned to reach manufacture of fresh cocoons from 161 tons in 2006 with 2185 tons in 2015. Distribution of total amount of cocoons made in republic on years and areas (table 6), are designed in view of corresponding conditions (the current condition and the subsequent development of the forage reserve, amount of facilities, suitable for carrying out silkworm rearing, etc.) in each area.

For increase in manufacture of fresh cocoons in republic, actions both extensive, and intensive type will be carried out. For extensive development of manufacture of fresh cocoons, the increase in silkworm rearing volumes, organized on republic is planned, according to rates of development of the forage reserve. So, in view of an existing condition of the forage reserve in 2006 the volume of industrial silkworm rearings will make 3000 boxes, breeding rearings - 200 boxes. These volumes will be gradually increased on years and in 2015 the volume of industrial rearings will reach 38090 boxes, and breeding rearings - 1505 boxes (table 7).

For increase in manufacture of cocoons actions of intensive development will be carried out also. It’s well-known, that productivity of cocoons from 1 box of eggs depends on two intensive factors - a level of silkworm rearing techniques and from the level of hereditary efficiency of breeds and the hybrids used on the rearings. Taking into account it, the management of Sheki Ipak J.S.C. as it has already been marked, has delivered in republic one Japanese and one Chinese breed possessing high efficiency and has organized their breeding multiplication. Thus, one of planned intensive actions has been carried out beforehand. Thus it is planned, in 4-5 years, to replace these breeds and their hybrids with new, more productive breeds and the hybrids adequate to modern requirements of the world standards, created by local selectors. For realization of other intensive action - correct silkworm rearing techniques will be transmitted by experts and regional representatives of the sericulture department of Sheki Ipak, prior to the beginning and in the course of rearing, explanatory conversations with

agricultural population on places, the organization of seminars for farmers - sericulturists, the publication in local regional newspapers of articles about rules of silkworm rearing is planned.

Taking into account a considerable role of the correct silkworm incubation in obtaining of high crops of cocoons, it is planned to organize in 2006 from above 30 incubatory chambers. With this purpose, in cocoon producing areas will be found and suitable premises in which incubatory chambers will be organized, rented and provided with all necessary materials and stock (thermometers, humidity-meters, 2 - 3 floor rearing shelves, technical balance, covering paper, fuel, etc.) for correct carrying out of silkworm egg incubation.

As a result of carrying out of planned actions, the increase in average productivity of cocoons from 1 box of eggs (29 g) on industrial rearings from the planned 50 kg in 2006 up to 55 kg in 2014, on breeding rearings - accordingly from 55 kg up to 60 kg (table 7) is expected. Alongside with it, improvement of quality (high-quality structure) made fresh cocoons is expected also. So, if in 2006 in total amount of a crop of the fresh cocoons accepted to primary processing, high-quality cocoons will make 87 %, and the spoilage/unreelable cocoons - 13 %, in 2015 these parameters will make accordingly 93 % and 7 % (table 8). Thus, the amount of high-quality cocoons in the general crop of fresh cocoons will be raised for 6 absolute percent that is high enough result.

3.5.4. The organization of preparation and primary processing of fresh cocoons

Quality of cocoons intended for production of raw silk, substantially depends on the correct organization of preparation and primary processing of fresh cocoons.

Preparation of cocoons is meant as purchase of fresh cocoons from the farmers - business executives, quantitative and quality standard of parties of cocoons (definition of percent and physical weight of high-quality and low-grade cocoons in parties), registration of the documentation on payment of the accepted parties of cocoons, time storage of the accepted fresh cocoons before primary processing.

Primary processing of cocoons mean their stifling and the subsequent drying. For cocoon stifling and drying exist set of ways. However, among them, the most suitable for practical use is the fresh cocoon stifling by hot air and their subsequent shadow drying. At such primary processing, natural and technological properties of cocoons are kept better. Now many regional bases are equipped with simplex devices and shadow dryers which allow to carry out primary processing of fresh cocoons by the mentioned above way.

Considering above-stated, is solved to organize preparation and primary processing of the fresh cocoons made in chosen areas, on bases of the same areas. For carrying out of preparation and primary processing of cocoons it is up to the mark planned a number of actions.

For successful carrying out of preparation of fresh cocoons, in territory of base the procuring item consisting from waiting - room, balance, storehouses for high-quality and defective cocoons, laboratories will be organized. The waiting - room intends for preparation of parties of cocoons for delivery to the inspector. Balance, the area of 20-30 m^2 intends for definition of weight of an accepted party of cocoons, conformity of cocoons in a party to requirements of state standard and sampling for the laboratory analysis. The storehouse of fresh cocoons will serve for time storage of them within 1-2 days before primary processing. For protection of stored fresh cocoons against a wind, a rain and solar beams, the canopy here will be established. Taking into account absence in republic of national state standard on fresh

cocoons of the silkworm, the estimation of accepted parties of cocoons will be carried out on the basis of specifications on the interstate standard (31257-2004).

For a correct and objective estimation of parties of cocoons, they will be accepted only in the afternoon. Parties of cocoons, they are sometimes artificially humidified and containing unripe cocoons, therefore such a parties will be accepted only after enough drying in a shadow and maturing of cocoons. Generally speaking, unripe cocoons are one of principal causes of deterioration of cocoons at primary processing. Therefore, for elimination of this lack and prevention of cocoon batches deterioration, experts of Sheki Ipak J.S.C. during the period of cocoon spinning/mounting will visit the sericulture farmers to determine the degree of maturity of cocoons and day of their harvesting from the mountages.

Other principal cause, worsening quality of cocoons is delivery of fresh cocoons to places of acceptance in soft container (in bags, etc.). Therefore, corresponding measures for delivery of fresh cocoons to places of acceptance only in firm container (in baskets, wooden, plywood or cardboard boxes/cages with lateral apertures for aeration, etc.) will be adopted.

For qualitative primary processing of fresh cocoons corresponding measures also will be accepted.

On each base, prior to the beginning of silkworm rearing season, simplex devices and shadow dryers will be checked up, in required cases are repaired and resulted in a condition the worker of readiness. For maintenance of trouble-free work of simplex devices during primary processing of cocoons, the bases will be supplied with all necessary materials and fuel. At primary processing of cocoons correct observance of a mode of stifling and duly performance of all required technological operations, for qualitative drying of cocoons will be provided during 1.5-2.0 months.

The complex of planned actions will give a number of positive results. For example, improvement, to be exact reduction such important economically parameter, as factor of an output of dry cocoons from fresh is expected. This parameter making 2.70 in 2006, will be gradually reduced on years and in 2014, 2.50 (table 8) will be achieved. And it means, that the cost price of dry cocoons will considerably decrease. Alongside with it, improvement of quality (high-quality structure) dry cocoons is expected also. So if in 2006 high-quality cocoons will make 87 % of total amount of dry cocoons gradually improving on years, will reach 93 % in 2015. It in turn, will create good preconditions for manufacture of qualitative raw silk.

3.5.5. Processing dry cocoons and manufacture of raw silk

One of the basic purposes of sericulture development in republic is the production of enough local cocoons for maintenance of trouble-free work of the silk reeling manufactures of Sheki Ipak J.S.C. with full capacity. At the same time, for trouble-free work of this enterprise with full capacity, alongside with enough cocoons, it is required also the corresponding technical and technological conditions providing economically effective manufacture. Therefore, the management of Sheki Ipak J.S.C., with the purpose of creation of required conditions, has carried out a number of actions.

Industrial premises of silk reeling units, units on processing waste products and boiler-house are completely repaired. In the units are carried out repair – adjustment works of all technical constructions and the process equipment, including multiends silk reeling machines, the ventilating system is established. The factory is provided by natural gas. Alongside with it, for improvement of working conditions of workers, are built a number of household objects (a

dining room, a locker room, a bath, a toilet, etc.), adequate to modern sanitary-and-hygienic norms.

Alongside with the carried out actions, the management of joint-stock company, for increase in capacity of the enterprise, plans purchase of two foreign automatic silk reeling lines.

Thus, in view of purchase of two foreign fully automatic silk reeling lines, annual production of raw silk at the enterprise will make 216.9 tons. The volume of cocoons required on years for manufacture of the specified quantity of raw silk is submitted in table 9. Apparently from the data of this table, in 2013 it will be possible to provide needs of silk reeling manufacture completely for the account of local cocoon production. And till that time, for full maintenance of manufacture with raw material, it is necessary annually to deliver from abroad dry cocoons in the volume specified in table 9. At the same time, in 2014-2015, owing to significant increases of dry cocoons production in republic, it will be possible to exceed the planned level (216.9 t) manufactures of raw silk in 2014 on 46 tone, in 2015 on 80 tone. Therefore, in 2013 it will be already necessary to buy additional silk reeling machines.

It is necessary to note, that as a result of realization of all actions stipulated in the program of sericulture development in republic, alongside with increase in volumes of fresh and dry cocoons production, there will be also an improvement of some their quality indicators, including silk shell percentage and the raw silk percentage. Due to this, the charge of dry cocoons for obtaining of 1 kg raw silk (table 9) will be reduced annually. It will lead to annual reduction in volume of the dry cocoons spent for obtaining 216.9 tone of raw silk. For example, in 2006 for production of 216.9 tone of raw silk, 776.5 tons of dry cocoons whereas in 2012, on production of the same amount of raw silk only 615.2 tons of dry cocoons will be spent, that in comparison with 2006 it is less on 161.3 tons or on 21 %. Reduction of the charge of dry cocoons will lead to reduction in the cost price of raw silk produced and increase of economic efficiency of manufacture.

Finally, due to significant improvement of cocoon quality and the technological level of production, it will be possible to develop competitive raw silk of a class 2A, 3A, 4A, and also high-quality silk production and to leave on the world markets.

Chapter 4. The basic problems, conclusions and recommendations

Stated in this report facts about a modern condition of sericulture and the silk industry of Azerbaijan convincingly testify to presence of all necessary preconditions for development of these branches in the country. So, all industrial premises and process equipments of the only one existing in the country silk reeling and processing company Sheki Ipak are repaired, organized and now the company works almost with full capacity, but basically on imported raw material (dry cocoons). Therefore, sharply there is a problem on sericulture development and increase in volume of cocoon production in the country. It needs strengthening and expansion of the forage reserve (mulberry plantations), restoration of silkworm egg production system, renewal and adjustment breeding and industrial silkworm rearings in areas of republic, the organization of acceptance and primary processing of fresh cocoons. I inform that, due to efforts of the management and experts of Sheki Ipak J.S.C., in republic manufacture of a high-quality planting material (mulberry seedlings and saplings) in sufficient volume, are restored and three hybrid silkworm egg production factories as well as one parental egg station operate in more than 10 areas of republic. The bases of primary processing of cocoons are resulted in a condition of technical readiness. It is unique a weak part in this chain absence in areas of special structures or establishments (like former regional offices on sericulture) which would carry out all organizational - technical and technological processes on industrial silkworm rearings, that is, would be engaged both in egg incubation

and distribution of larvae to the farmers, would supervise carrying out of silkworm larvae rearing under optimal conditions, would organize preparation and primary processing of fresh cocoons. Creation of required structures as well as performance of all actions stipulated in the national program of sericulture development, huge financial expenses which not under force to any joint-stock company, as though it was not strong economically demand, without the help of the state. Proceeding from this, we ask Executive Committee of the BACSA to address a letter on its own behalf to the Government of the Azerbaijan Republic with the following requests:

1) To discuss and ratify the national program of sericulture development in the Azerbaijan Republic as the state program and to render financial support for its realization; To exempt the mulberry seedling/sapling, silkworm eggs, cocoons and raw silk from all kinds of the tax for the period of 10 years and to give to them electric energy, natural gas, fuel and fuel materials under reduced rates in current 10 years;
2) To exempt from the customs materials imported in the country the equipment for the enterprises for silkworm egg production, primary processing of cocoons and manufactures of raw silk and also exported by the country silkworm eggs and raw silk.

Chapter 5. Strategy of development of the BASCA

1. For sericulture development in region by joint actions our country is ready to cooperate with any of the countries - members of the BACSA in sphere of mulberry saplings and silkworm egg production.
2. Sheki Ipak J.S.C. can deliver high-quality hybrid eggs, obtained from crossing the Japanese and Chinese breeds, in any countries of the region, with that condition that the dry cocoons produced by them would be exported to Azerbaijan. We also can deliver in any country of region high-quality mulberry saplings.
3. That our association BACSA had an opportunity to carry out the certain projects on sericulture with participation of the several countries, it should have financial resources. Therefore we suggest to ask the government of all countries - members of the BACSA to pay a membership fee in the certain sum.

Annex 1. Tables

Table 1

Prognosis about distribution and increase of mulberry plantations in the regions of Azerbaijan (2006-2015).

Regions	Area under mulberry plantations, ha														
	2006			2007			2008			2009.			2010.		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Агдаш	56,0	30	86	86	30	116	116	30	146	146	35	181	181	35	216
Агджабеди	13,0	10	23	23	15	38	38	15	53	53	50	103	103	50	153
Агсу	-	10	10	10	10	20	20	10	30	30	25	55	55	25	80
Балакан	143,0	35	178	178	40	218	218	45	263	263	50	313	313	50	363
Барда	300,0	25	325	325	30	355	355	40	395	395	40	435	435	40	475
Гёй-чай	32,0	35	67	67	35	102	102	40	142	142	40	182	182	40	222
Курдемир	107,0	35	142	142	35	177	177	35	212	212	30	242	242	30	272
Гах	87,0	30	117	117	30	147	147	35	182	182	30	212	212	30	242
Габала	74,0	30	104	104	35	139	139	35	174	174	35	209	209	35	244
Шеки	593,0	-	593	593	-	593	593	-	593	593	10	603	603	10	613
Уджар	340,0	15	355	355	15	370	370	15	385	385	20	405	405	20	425
Евлах	-	20	20	20	20	40	40	20	60	60	30	90	90	30	120
Закатала	327,0	30	357	357	30	387	387	30	417	417	20	437	437	20	457
Зардаб	270,0	30	300	300	30	330	330	30	360	360	25	385	385	25	410
Total	**2342**	**335**	**2677**	**2677**	**355**	**3032**	**3032**	**380**	**3412**	**3412**	**440**	**3852**	**3852**	**440**	**4292**

A - At the beginning of the year; B - Newly planted; C – In the end of the year

Table 1 continued

Regions	Area under mulberry plantations, ha														
	2011			2012			2013			2014.			2015.		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Агдаш	216	60	276	276	44	320	320	45	365	365	40	405	405	40	445
Агджабеди	153	50	203	203	57	260	260	60	320	320	60	380	380	70	450
Агсу	80	20	100	100	10	110	110	15	125	125	15	140	140	10	150
Балакан	363	80	443	443	82	525	525	70	595	595	100	695	695	135	830
Барда	475	30	505	505	45	550	550	40	590	590	60	650	650	30	680
Гёй-чай	222	80	302	302	63	365	365	80	445	445	100	545	545	135	680
Курдемир	272	20	292	292	18	310	310	25	335	335	15	350	350	20	370
Гах	242	20	262	262	28	290	290	30	320	320	50	370	370	60	430
Габала	244	10	254	254	16	270	270	15	285	285	20	305	305	10	315
Шеки	613	-	613	613	7	620	620	-	620	620	-	620	620	-	620
Уджар	425	-	425	425	-	425	425	-	425	425	-	425	425	-	425
Евлах	120	10	130	130	-	130	130	-	130	130	10	140	140	-	140
Закатала	457	60	517	517	70	587	587	60	647	647	100	747	747	60	807
Зардаб	410	10	420	420	10	430	430	20	450	450	30	480	480	30	510
Total	**4292**	**450**	**4742**	**4742**	**450**	**5192**	**5192**	**460**	**5652**	**5652**	**600**	**6252**	**6252**	**600**	**6852**

A - At the beginning of the year; B - Newly planted; C – In the end of the year

Table 2

Prognosis about mulberry leaf yield in Azerbaijan.

Years	Plantations under exploitation, ha	Leaf yield, (t)	
		Per 1 ha	total
2006	2342	1.5	3513
2007	2342	2.3	5387
2008	2677	3.9	10440
2009	3032	5.4	16373
2010	3412	6.7	22860
2011	3852	7.5	28890
2012	4292	8.0	34336
2013	4742	8.2	38884
2014	5192	8.0	41536
2015	5652	7.5	42390

Table 3

Prognosis about mulberry saplings production in Azerbaijan

Years	Mulberry saplings, million pieces.	Costs of saplings (1 piece 700 manat or 0.15 $)	
		In million manat	in US$
2006	1,340	938,0	188732
2007	1,420	994,0	200000
2008	1,520	1064,0	214084
2009	1,760	1232,0	247887
2010	1,760	1232,0	247887
2011	1,800	1260,0	253521
2012	1,800	1260,0	253521
2013	1,840	1288,0	259155
2014	2,400	1680,0	338028
2015	2,400	1680,0	338028
Total	**18,040**	**12628,0**	**2540845**

Table 4

Plan for implementation of fertilizers in the mulberry plantations

Years	Mulberry plantations area, ha	Annual norm for fertilizers input					
		On the basis of active substance, t			On the basis of physical weight, considering the active substance %, t		
		Nitrogen, norm per 1 ha – 180 kg	Phosphorous, norm per 1 ha – 80 kg	Potassium, norm per 1 ha – 90 kg	Ammonium sulphate 34%-530 kg	superphosphate 18%-500 kg	Potassium chloride 52,4%-175 kg
2006	2342	421,6	187,4	210,8	1241,3	1171,0	409,8
2007	2677	481,9	214,2	240,9	1418,8	1338,5	468,5
2008	3032	545,8	242,6	272,9	1607,0	1516,0	530,6
2009	3412	614,2	273,0	307,1	1808,4	1706,0	597,1
2010	3852	693,4	308,2	346,7	2041,6	1926,0	674,1
2011	4292	772,6	343,4	386,3	2274,8	2146,0	751,1
2012	4742	853,6	379,4	426,8	2513,3	2371,0	829,8
2013	5192	934,6	415,4	467,3	2751,8	2596,0	908,6
2014	5652	1017,4	452,2	508,7	2995,6	2826,0	989,1
2015	6252	1125,4	500,2	562,7	3313,6	3126,0	1094,1

Table 5

Prognosis about the dynamics of P_2, P_1 and F_1 silkworm egg production development in Azerbaijan

Years	P_2		P_1		F_1 hybrid	
	boxes	kg	boxes	kg	boxes	kg
2006	28	0,812	355	10,3	4327	125,5
2007	37	1,073	528	15,3	8511	246,8
2008	45	1,305	726	21,0	13138	381,0
2009	51	1,479	895	26,0	18384	533,1
2010	55	1,595	1034	30,0	23156	671,5
2011	59	1,711	1168	33,9	27802	806,2
2012	60	1,740	1241	36,0	31400	910,6
2013	63	1,827	1315	38,1	34640	1004,6
2014	69	2,001	1436	41,6	38090	1104,6
2015	73	2,117	1554	45,1	41600	1206,4

Table 6

Distribution and dynamics of fresh cocoon production in Azerbaijan (2006-2015), in ton

Regions	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Агдаш	4,0	5,8	11,0	21,5	31,2	48,0	65,5	84,5	101,0	122,0
Агджабеди	1,0	1,6	3,7	5,6	9,0	16,5	27,5	45,5	65,9	91,0
Агсу	-	-	0,5	1,0	4,0	8,5	14,0	23,0	30,0	38,0
Балакан	15,0	19,6	36,0	49,2	70,5	87,0	105,5	134,5	150,0	180,5
Барда	30,0	37,5	74,0	95,0	128,5	143,0	157,5	175,4	191,0	214,5
Гёй-чай	3,0	4,0	8,0	15,8	25,0	40,0	55,5	76,5	103,0	125,5
Курдемир	9,0	12,1	25,0	37,5	53,0	72,5	90,5	110,0	130,0	140,0
Гах	3,0	6,6	12,0	28,7	41,2	64,5	86,0	105,0	131,5	134,5
Габала	1,0	4,5	9,5	24,8	36,0	60,0	83,0	101,0	121,5	132,0
Шеки	20,0	46,0	85,0	159,0	214,0	280,0	320,0	322,0	323,0	325,0
Уджар	34,0	42,5	83,0	105,2	139,0	150,0	158,0	170,0	174,5	180,0
Евлах	-	-	1,0	3,0	8,0	15,5	27,6	40,0	55,5	65,2
Закатала	16,0	30,0	56,0	94,7	131,5	173,0	204,0	220,0	235,0	250,0
Зардаб	25,0	32,0	61,0	86,1	119,0	132,0	150,0	165,0	176,0	187,0
Total:	**161,0**	**242,2**	**465,7**	**727,1**	**1009,9**	**1290,5**	**1544,6**	**1772,4**	**1987,9**	**2185,2**

Table 7

Prognosis about the number of silkworm egg boxes reared, fresh cocoon yield by one box of eggs and total cocoon production in Azerbaijan

Years	Number of silkworm egg boxes reared		Fresh cocoon yield by one box of eggs, kg		Total cocoon production, t		
	hybrid	pure line	hybrid	pure line	hybrid	pure line	total
2006	3000	200	50	55	150,0	11,0	161,0
2007	4327	383	51	56	220,7	21,5	242,2
2008	8511	565	51	56	434,1	31,6	465,7
2009	13138	771	52	57	683,2	43,9	727,1
2010	18384	946	52	57	956,0	53,9	1009,9
2011	23156	1089	53	58	1227,3	63,2	1290,5
2012	27802	1227	53	58	1473,5	71,1	1544,6
2013	31400	1301	54	59	1695,6	76,8	1772,4
2014	34640	1378	55	60	1905,2	82,7	1987,9
2015	38090	1505	55	60	2094,9	90,3	2185,2

Table 8

Basic quantitative and qualitative parameters of fresh and dry cocoon production in Azerbaijan (2006-2015)

years	Fresh cocoon production, t	Out of them used in the silkworm egg production, t	Cocoons for primary processing, t	Out of them:		Dry cocoon obtained from fresh cocoon coefficient	Production of dry cocoons, t	Out of them:	
				Good quality, t	Rejected and waste, t			Good quality, t	Rejected and waste, t
2006	161,0	3,0	158,0	137,5	20,5	2,70	58,5	50,9	7,6
2007	242,2	5,8	236,4	205,7	30,7	2,68	88,2	76,8	11,4
2008	465,7	8,7	457,0	402,2	54,8	2,65	172,4	151,8	20,6
2009	727,1	12,1	715,0	629,2	85,8	2,63	271,9	239,2	32,7
2010	1009,9	14,9	995,0	885,6	109,4	2,60	382,7	340,6	42,1
2011	1290,5	17,5	1273,0	1133,0	140,0	2,58	493,4	439,1	54,3
2012	1544,6	19,6	1525,0	1372,5	152,5	2,55	598,0	538,2	59,8
2013	1772,4	21,2	1751,2	1593,6	157,6	2,53	692,2	629,9	62,3
2014	1987,9	22,9	1965,0	1807,8	157,2	2,50	786,0	723,1	62,9
2015	2185,2	25,0	2160,2	2009,0	151,2	2,50	864,1	803,6	60,5

Table 9

Amount of gradable dry cocoons, produced in the country and imported in order to ensure the work of Sheki Ipak J.S.C. in full capacity and the raw silk production (2006-2015)

years	Produced in Azerbaijan			Imported			Total raw silk production, t	Total dry cocoons used, t
	Dry cocoons		Raw silk production, t	Dry cocoons		Raw silk production, t		
	Volume, t	Necessary to produce 1 kg raw silk, kg		Volume, t	Necessary to produce 1 kg raw silk, kg			
2006	50,9	2,75	17,0	725,6	3,30	199,9	216,9	776,5
2007	76,8	2,70	25,8	693,4	3,30	191,1	216,9	770,2
2008	151,8	2,65	52,0	598,6	3,30	164,9	216,9	750,4
2009	239,2	2,60	83,6	483,9	3,30	133,3	216,9	723,1
2010	340,6	2,55	121,6	345,9	3,30	95,3	216,9	686,5
2011	439,1	2,50	159,7	207,6	3,30	57,2	216,9	646,7
2012	538,2	2,50	195,7	77,0	3,30	21,2	216,9	615,2
2013	629,9	2,50	229,0	-	-	-	229,0	629,0
2014	723,1	2,50	262,9	-	-	-	262,9	723,1
2015	803,6	2,45	297,6	-	-	-	297,6	803,6

Follow-up activities of Tashkent Workshop and national strategy for sericulture revival and development in Bulgaria, with emphasis on status and/or prospects of silk handcraft cottage industries development.

By

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ABSTRACT

The sericulture is one of the few agricultural branches, capable to provide without big investments and for a comparatively short period of time incomes to the farmers, while the cocoon and raw silk processing – opening new working places. With the near joining of Bulgaria to European Union it is expected to dispose new favorable opportunities for cocoon production increase through the subsidies, provided by European funds. Bulgaria has a high potential for sericulture industry development in terms of favourable agro-climatic and socio-economical conditions. However, sericuluture industry development in the country has been inactivated with rapid change of its political and economical system and a large portion of sericulture farmers has consequently given up cocoon production activities thus to loose their job opportunities and income resources. Bulgaria has one of the extraordinary advantages for sericulture development, having more than 1.3 million existing mulberry trees (tree-form) scattered all over the country which could be sufficient natural resources for supply of mulberry leaf to feed several thousand boxes of silkworm eggs and to produce approximately 500 tons of fresh cocoons at the national level. However, the country needs to gradually shift and promote its on-going traditional sericulture industry development pattern as a commercially-oriented sericulture industry development activities on the long term basis in order to establish its development as an economically viable agro-industry. An integrated national sericulture development plan should be formulated as a primary priority by Sericulture Experiment Station (SES)-Vratza and Agrarian university - Plovdiv in collaboration with the Ministry of Agriculture and other relevant agencies in order to successfully implement the proposed national sericulture development plan based on short/medium/long term. In view of the present institutional capacities, it would be technically ideal to set the short/medium/long term with different period of 3/5/7 years for each term. The proposed national sericulture development plan should be implemented based on such a short/medium/long term development strategy by strengthening the institutional capacities, renovating basic infrastructure, improving relevant technologies on various areas of sericulture. It is also essential that the government authorities concerned should provide SES-Vratza with more financial and administrative support to follow up necessary activities for sericulture industry development at the both regional and national level. In the meantime, the government's effort should be made to obtain available fund from possible donors such as UNDP, JICA, CIDA, KOICA, GTZ etc. and to generate new projects for follow up activities to support sericulture industry development at the both regional and national level. The present comparatively low quality with high costs of raw silk produced in the country is considered as one of the big obstacles for external potential market development. Therefore, internal market development should be followed by potential external market development since external market demand are mainly high quality of raw silk/silk yarn/silk allied products. After relevant technologies on silk processing being updated during potential local market development, external market could be explored with upgraded quality products. However, SES-Vratza's and the "Bulgarian silk" J.S.C. on-going development activities, particularly on cocoon/silk processing should be continuously strengthened to solve sericulture farmers' market problems on the local consumption of cocoons. Successful establishment and operation of a cooperative young silkworm rearing system/demonstration farms should be completed within a period of three years since they are considered as the essential components to promote sericulture industry as an economically viable agro-industry and to benefit sericulture farmers with substantial income resources. In-service training/extension programme should be planned and implemented by SES-Vratza and Agrarian university – Plovdiv to train extension workers and selected farmers through their participation in operation of demonstration farms'

activities, instead of training them only in lecture rooms. The already published by the scientists of SES-Vratza and Agrarian university – Plovdiv training materials and manuals could be used as a training material during in-service training courses. Multiplication of essential quality materials such as mulberry saplings and silkworm eggs is also one of the very important components to maximize their inputs and outputs of relevant activities for cocoon/raw silk production. Therefore, SES-Vratza's and Agrarian university – Plovdiv's effort should be geared toward strengthening of their R & D activities on the above-mentioned components. In order to increase a productivity of mulberry leaf per mulberry tree, cultivation technology should be improved to increase the present average annual yield of 10-15 kg per tree to 20 kg, so that 25 mulberry trees could feed silkworm larvae equivalent to one box of silkworm eggs. Two to three typical models of infrastructures for silkworm (young/advanced) rearing houses and others should be also designed to renovate existing silkworm rearing rooms at the farmers' level and consequently to increase a productivity of cocoon per box of silkworm eggs up to 30-35kg fresh cocoons per box

Considering the present average level of farmers' low income earned from cocoon production, the proposed target of their average annual income from one hectare of mulberry plantation should be increased to US$2000-2500, which could be considered to be a reasonable target of their income for sustainable development in the future. However, traditional sericulture farmers' income should be increased to approximately US$400-500/household as a target for their income by using existing mulberry trees (75-80 trees) located around their houses.

Keywords: sericulture, Bulgaria, revival, development

Chapter 1. Introduction

The sericulture is one of ancient and economically effective sub - branches of agriculture in Bulgaria. The historical manuscripts manifest that the sericulture was practiced as early as during the first Bulgarian kingdom (7^{th}-11^{th} century A.D.), but it was especially strongly developed in the end of 19^{th} and first half of 20^{th} century, when in some years the fresh cocoon production reached up to around 3000 t. There could be mentioned several periods, when the sericulture in Bulgaria had a great progress. The first one is the period from 1830 to 1865. A part of it coincidences with the big damages, caused to sericulture in France and Italy by the pebrine disease, enforcing the egg-producers to manufacture in Bulgaria and export up to 750-900000 boxes of disease-free silkworm eggs annually. The second period was during 1895-1910 - after the economical crisis from 1890-1895. In 1896 the Sericulture Experiment Station in Vratza was established, which is one of the first research institutes in the field of agriculture in Bulgaria and one of the oldest sericultural and silk station in the world. During its more than one century old existence the station has worked actively in all the fields of sericultural science and production and contributed considerably in the increasing of managerial, technical and technological level of cocoon production in the country.

From 1920 to 1930, just after the First world war there was also a period of big sericulture expansion in Bulgaria.

During the first half of 20^{th} century the cocoon production was centralized completely in private family farms, and a part of these farmers were members of cooperatives, dealing with cocoon purchasing, processing and selling dry cocoons and raw silk. A similar activity was practiced by many private entrepreneurs, exporting the dried cocoons to Italy due to the lack of well developed silk reeling industry at that time in Bulgaria. A part of the cocoons

produced in the country in amount about 200 t annually were processed by the sericultural farmers themselves by reeling on manual tools, called “dolap”, silk twisting, degumming, dyeing, weaving silk fabrics on handlooms and hand-made knitted commodities manufacture. The bigger portion of these home-made silk handcraft products was used for the family needs only. However after 1930 many commercial silk reeling enterprises have been created very fast and the cocoons produced are processed into the country. During a short period of time a considerable silk industry was created, including about 1500 silk reeling basins, with a total capacity for processing of about 3000 t fresh cocoons annually and 480 power looms, having an annual capacity of about one and half million meters silk fabrics. After the change of political and economical system in 1944 the cocoon production had remained in the producer’s households, while the mulberry sapling and silkworm egg production, cocoon purchasing and processing was taken by the government.

A next favorable period of sericulture development in Bulgaria are the years after the Second World War – 1945 - 1955, in 1953 the cocoon production reached 3019 t, what is still considered as a record in the history of Bulgarian sericulture. This favorable period with some fluctuations continued until the beginning of 1990s. Considering the high social importance of sericulture as a branch, providing job opportunities and income resources to thousands of rural households, during the period 1950-1990 the sericulture farmers in Bulgaria used to receive free of charge from the government mulberry saplings, young silkworm larvae, disinfectants and perforated paper for bed cleaning. The bigger portion of the costs for cocoon purchasing were paid by the government as a subsidy, resulting in comparatively low and stable price of the raw silk and silk commodities, allowing considerable selling at the local as well as international market. During the period 1975-1990 with an average annual production of 1200-2000 t fresh cocoons Bulgaria occupied the first place in Europe and 7^{th}-8^{th} place in the world per capita.

However after 1990 unfortunately the cocoon production in Bulgaria has started to decline due mainly to the sharp drop of raw silk price at the international market as well as the changes of political and economical system during the transition period.

By the same time the sericulture is one of the few agricultural branches, capable to provide without big investments and for a comparatively short period of time incomes to the farmers, while the cocoon and raw silk processing – opening new working places. With the near joining of Bulgaria to European Union it is expected to dispose new favorable opportunities for cocoon production increase through the subsidies, provided by European funds.

Bulgaria has a high potential for sericulture industry development in terms of favourable agro-climatic and socio-economical conditions. However, sericuluture industry development in the country has been inactivated with rapid change of its political and economical system and a large portion of sericulture farmers has consequently given up cocoon production activities thus to loose their job opportunities and income resources.

Bulgaria has one of the extraordinary advantages for sericulture development, having more than 1.3 million existing mulberry trees (tree-form) scattered all over the country which could be sufficient natural resources for supply of mulberry leaf to feed several thousand boxes of silkworm eggs and to produce approximately 500 tons of fresh cocoons at the national level.

However, the country needs to gradually shift and promote its on-going traditional sericulture industry development pattern as a commercially-oriented sericulture industry development activities on the long term basis in order to establish its development as an economically viable agro-industry.

An integrated national sericulture development plan should be formulated as a primary priority by Sericulture Experiment Station (SES)-Vratza and Agrarian university - Plovdiv in

collaboration with the Ministry of Agriculture and other relevant agencies in order to successfully implement the proposed national sericulture development plan based on short/medium/long term. In view of the present institutional capacities, it would be technically ideal to set the short/medium/long term with different period of 3/5/7 years for each term.

The proposed national sericulture development plan should be implemented based on such a short/medium/long term development strategy by strengthening the institutional capacities, renovating basic infrastructure, improving relevant technologies on various areas of sericulture.

It is also essential that the government authorities concerned should provide SES-Vratza with more financial and administrative support to follow up necessary activities for sericulture industry development at the both regional and national level.

In the meantime, the government's effort should be made to obtain available fund from possible donors such as UNDP, JICA, CIDA, KOICA, GTZ etc. and to generate new projects for follow up activities to support sericulture industry development at the both regional and national level.

The present comparatively low quality with high costs of raw silk produced in the country is considered as one of the big obstacles for external potential market development. Therefore, internal market development should be followed by potential external market development since external market demand are mainly high quality of raw silk/silk yarn/silk allied products. After relevant technologies on silk processing being updated during potential local market development, external market could be explored with upgraded quality products. However, SES-Vratza's and the “Bulgarian silk” J.S.C. on-going development activities, particularly on cocoon/silk processing should be continuously strengthened to solve sericulture farmers' market problems on the local consumption of cocoons.

Successful establishment and operation of a cooperative young silkworm rearing system/demonstration farms should be completed within a period of three years since they are considered as the essential components to promote sericulture industry as an economically viable agro-industry and to benefit sericulture farmers with substantial income resources.

In-service training/extension programme should be planned and implemented by SES-Vratza and Agrarian university – Plovdiv to train extension workers and selected farmers through their participation in operation of demonstration farms' activities, instead of training them only in lecture rooms. The already published by the scientists of SES-Vratza and Agrarian university – Plovdiv training materials and manuals could be used as a training material during in-service training courses.

Multiplication of essential quality materials such as mulberry saplings and silkworm eggs is also one of the very important components to maximize their inputs and outputs of relevant activities for cocoon/raw silk production. Therefore, SES-Vratza's and Agrarian university – Plovdiv’s effort should be geared toward strengthening of their R & D activities on the above-mentioned components.

In order to increase a productivity of mulberry leaf per mulberry tree, cultivation technology should be improved to increase the present average annual yield of 10-15 kg per tree to 20 kg, so that 25 mulberry trees could feed silkworm larvae equivalent to one box of silkworm eggs.

Two to three typical models of infrastructures for silkworm (young/advanced) rearing houses and others should be also designed to renovate existing silkworm rearing rooms at the farmers' level and consequently to increase a productivity of cocoon per box of silkworm eggs up to 30-35kg fresh cocoons per box

Considering the present average level of farmers' low income earned from cocoon production, the proposed target of their average annual income from one hectare of mulberry plantation should be increased to US$2000-2500, which could be considered to be a reasonable target of their income for sustainable development in the future.

However, traditional sericulture farmers' income should be increased to approximately US$400-500/household as a target for their income by using existing mulberry trees (75-80 trees) located around their houses.

Chapter 2. Follow-up activities of the "International Workshop on Revival and Promotion of Sericultural Industries and Small Enterprise Development in the Black, Caspian Seas and Central Asia Region", Tashkent, Uzbekistan 11 - 15 April 2005.

❖ Activities at the governmental level.

*****Bulgarian Ministry of Agriculture and Forestry (MOAF) highly supports the participation in the prepared by BACSA regional project for sericulture revival in the Black, Caspian seas and Central Asia region countries. The Ministry will participate in implementing the project through technical and operational activities of the Sericulture Experiment Station in Vratza and Agrarian university – Plovdiv, mobilizing the capacity of local NGOs and the private business. Considering that Bulgaria has one of the richest sericultural genetic resources as well as highly experienced research and technical staff the Ministry proposes also the establishment of a Regional center for training, sericulture germplasm preservation, silkworm egg production and distribution, which could serve BACSA region as well as African and Near East countries.

*The SAPARD program open a special budget line for farmers training courses in the field of sericulture, which will start in May 2006.

*The "National fund agriculture" under MOAF took decision to support the sericulture farmers by providing 1 US$ subsidy on each kilo fresh cocoon produced. For the purpose the cocoon purchasing companies should make contracts with the fund.

*MOAF approved the prepared "National strategy for sericulture development in Bulgaria".

❖ Activities at the level of research institute (station).

*SES-Vratza prepared and published a sericulture training manual, which has been disposed to the Sericulture association and all the interested in sericulture.

*SES-Vratza prepared and published a monograph about the silkworm genetic resources in Bulgaria, which will be distributed to all BACSA countries as well as the leading sericulture research institutes in the world.

*SES-Vratza produced 22000 mulberry saplings of highly productive varieties, which shall be sold to potential mulberry sapling producers in order to plant mother plantations.

*SES-Vratza produced 1100 boxes of the new highly productive silkworm hybrids, bred at the station.

*SES-Vratza produced 5000 cardboard frame mountages for selling them to the new sericulture farms.

*SES-Vratza organized a 20 days training course in silkworm rearing with young people from the orphan homes through PHARE program.

- **Activities at private business and field level.**

A private Joint Stock company, named "Bulgarian silk", Sofia was completely registered in May 2005, having main target activities the realization of the national project for sericulture revival and development, increase the cocoon and silk production in Bulgaria in order to reach production of about 3.5 million meters of silk fabrics around 2010-2012 and the country to occupy one of the first places in silk production in the EU. The project will provide about 25000 new working places, preferably to people, owners of small pieces of land, socially weak, unemployed, from all over the country. For a short time the company prepared a business plan in Bulgarian and English languages, and made contacts with Bulgarian and foreign commercial banks for getting loans for project funding. However the Bulgarian banks required a special guarantee from the government, hence the company directed its efforts to contacting foreign banks.

A contract with the American financial-consultancy company EFMC, having office for Europe in Switzerland was signed. After evaluating the sericultural project and making a field survey in Bulgaria EFMC took a decision to search loan sources for the project financing. EFMC succeeded to provide from an American bank a loan in amount of 36.9 million US$, having 10 % interest, one year grace period and a repayment period of 9 years. These loan conditions are considered as very advantageous. However the loan is still not released because of some problems in the local banking system. The "Bulgarian silk" company hopes to solve these problems until the spring of 2006. By the same time "Bulgarian silk" made a lot of efforts to prepare the necessary conditions for the start of project in the spring of 2006. The experts prepared and the company's ruling board approved the necessary requirements, which the candidates to participate at this project should meet. The document has been agreed with the MOAF and Ministry of Finance. The conditions for purchasing of mulberry saplings have also been set. The company identified 72 potential mulberry sapling producers, with a total capacity of 10 million sapling during the next five years. The producers will be trained at SES-Vratza through SAPARD programme.

The company developed business plans of several bigger companies which are going to plant around 1000 ha mulberry plantations. Continued the work on identifying suitable companies which shall implement the project at the different regions of the country. In cooperation with the SES-Vratza and a private company, producing light-type buildings the "Bulgarian silk" company is going to develop and test in 2006 a module light-type silkworm rearing house, aiming to decrease considerably the initial inputs in establishment of new modern sericulture farms.

The company plans to buy the necessary cocoon drying machines and import from China fully automatic silk reeling machines in 2006 and 2007.
If the loan is released until the end of February 2006 the company will start the cocoon production in Bulgaria in May.

- **National meetings and conferences.**

A National meeting-discussion on the problems of sericulture revival and development in Bulgaria was organized as a follow up activity of the Tashkent workshop by Dr D. Grekov, National coordinator of BACSA for Bulgaria and Dr P. Tzenov, President of BACSA on 14 June 2005 at the Agrarian university of Plovdiv. The meeting was organized under the patronage of the Minister of Agriculture and Forestry, Mr. N. Kabil.
The meeting aimed to get together all the people in Bulgaria, working in the field of sericulture from research, production of mulberry saplings, silkworm eggs, cocoons, raw silk, fabrics and silk garment.
The following institutions were represented at the meeting:

Ministry of agriculture and forestry;
Black, Caspian Seas and Central Asia silk Association, (BACSA);
Agrarian university, Plovdiv;
Thracian university, Stara Zagora;
Forestry university, Sofia;
Sericulture Experiment Station, Vratza;
Sericulture Experiment Station, Harmanly;
Bulgarian Sericulture Association, Sofia;
J.S. company "Bulgarian silk", Sofia;
J.S. company "Danube silk", Ruse;
J.S. silk reeling and processing company "Svila" (silk), Haskovo;
The meeting was attended also by many private businessmen, interested in silk production, mulberry saplings producers and sericulture farmers.
The basic reports presented were as follows:
1.Present state, problems and strategies of sericulture revival and development in Bulgaria, by Dr D. Grekov and Dr P. Tzenov
2.Information about the created "Black, Caspian seas and Central Asia Silk Association (BACSA) – targets, structure, future activities, by Dr P. Tzenov
3. The project of Bulgarian Sericulture Association (BSA) and the newly created J.S. company "Bulgarian Silk" for sericulture revival and development in Bulgaria, by Mr. S. Beshkov, President of BSA
4.Conception for silk textile branch development in Bulgaria for the period 2005-2010, by Ms. M. Dimitrova, Director of the silk textile company "Danube silk", Ruse

After presentation the reports a detailed discussion on the problems and the strategies for sericulture revival in Bulgaria was conducted.

The meeting issues and decisions:

The major critical constraints, facing Bulgarian sericulture revival are:

- Lack of sufficient government's financial supports since the sericulture industry is taken into account as one of the minor sectors in agro-industries with recent industrialization and urbanization.
- In Bulgaria the cocoon/silk production has declined to a critical stage.
- At the field level the silkworm rearing houses and equipment are unsuitable, the silkworm rearing technology is traditional and primitive, both leading to low cocoon yield per box, low cocoon quality and too high labour expenses.
- The cocoon drying and fully automatic silk reeling machines remained in the country have very big capacity and can not be used economically effective in processing small amount of cocoons produced now.
- Lack of enough market for mulberry saplings, silkworm eggs, cocoons, raw silk and silk allied products.
- At present, the absence of commercial company capable to purchase and process the fresh cocoons from the farmers, appears to be the main critical limiting factor for the increase of silk production.

The strategy for sericulture revival in Bulgaria should include the following major components:

1.Creation of a country network for silkworm larvae distribution, cocoon purchasing, drying, assorting and storage, silk reeling and processing: The already created in March 2005 J.S. company "Bulgarian silk" consists of 12 regional companies (share holders), covering all the sericultural regions in the country for future larval distribution to the farmers, cocoon purchasing, drying, assorting and storage. Between the branch companies of Bulgarian silk and the Bulgarian Sericulture Association have already been signed contracts, determining their relationships. The conditions for finance the sericulture farmers for establishment of new mulberry plantations and silkworm rearing houses are approved by the Executive committee of BSA. A business plan has been prepared and submitted to 4 trade banks with the suggestion for a loan in amount of 30 million euro, necessary for the project for sericulture revival in Bulgaria realization; (recently the loan enquiry was directed to an American bank and the negotiation process is very advanced).

2.Gradual renovation of mulberry plantations and improvement of the silkworm rearing facilities and technology;

3.Establishment of an effective extension service system for sericulture;

4.Promotion creation of farmer's groups/companies, having a close circle of production from the cocoons to the ready silk handcrafts garments;

5.Improvement the international cooperation, especially with the neighboring countries: As a follow up of the international workshop, held in Tashkent, Uzbekistan and the further visit of a delegation of BSA in Greece and Turkey in May 2005, agreements for mutual technical and business relationships were signed between BSA and cocoon/silk processing companies from Greece and Turkey. The companies from Greece and Turkey also gave their agreement to take part in the planned Bulgarian Trade silk house for selling the silk products, produced in Bulgaria; By the initiative of Greece a trans-border regional sericulture development project, under the name "Thracia", including Bulgaria, Greece and Turkey with the participation of BACSA will be prepared and submitted for financing to the European Union. For making the draft project proposal it is necessary a financing, which could be possibly provided by FAO and/or other donors; Considering the comparatively high fresh cocoon yield by one box of eggs obtained at the field level in Turkey during the last few years it is worthily to test the Turkish hybrid silkworm eggs in the next year in Bulgaria; In the future it is worthily to adopt also the Turkish experience in establishment of specialized silk goods market in Bulgaria, like those one, has been functioning in Bursa since 1456;

The meeting took the following decisions and recommendations:

- The sericulture revival and silk textile development to be included into the governmental national development plan for the period 2005-2010;(already done)
- The Bulgarian Sericulture Association (BSA) should present the sericulture revival project to the new government (after the parliament elections on 25 June 2005) as a highly social project, which is able to provide opening of thousands new working places with comparatively small investments, thus it is worthily to be highly supported and guaranteed by the government;(already done)
- The BSA to make suggestion to the government for a low-interest purposive crediting of the companies, dealing with cocoon/silk processing;(already done)

- The BSA to make suggestion to the government for providing subsidy for training of sericulture farmers; (already done, the first three courses on mulberry propagation and cultivation are scheduled in early 2006)
- Development of a workplan for re-starting the work of silk reeling factory "Svila" in Haskovo in the next year;
- The main efforts of BSA and the silk processing companies should be directed in providing market for the Bulgarian silk products, especially through attracting foreign companies, having experience and silk markets;
- Until September 2005 the companies "Bulgarian silk", "Danubian silk" and "Svila" to make agreement for the amount of cocoon production in 2006 as well as a business plan for the cocoon processing up to raw silk/silk allied products, and the BSA to submit a suggestion to the National fund "Agriculture", under the Ministry of Agriculture and Forestry for providing subsidy to the cocoon farmers in 2006;
- The mulberry saplings, produced at the national research centers in sericulture to be especially used for planting only maternal plantations, necessary for further mulberry vegetative propagation by cuttings;
- Every year in June to organize an open demonstration day in some of sericulture research centers;
- To make a working group, having representatives of all parts of sericultural chain, which shall have a meeting in September 2005. (the meeting was postponed for December)

Chapter 3. National strategy for sericulture revival and development in Bulgaria

3.1. Brief description of the present situation of sericulture in the country, including the major statistical figures, silk trade, level of science and conservation status of sericulture genetic resources, silk handcrafts cottage industries, etc.

During the period 1950-1990 in Bulgaria due to the strong governmental support the prices of the raw silk, fabrics and garments produced were comparatively cheap and competitive at the world market, thus with an average annual production of 1200-2000 t fresh cocoons Bulgaria had occupied the first place in Europe and 7^{th}–8^{th} place in the world. However, after 1990, with the change of political and economical system the cocoon/silk production have declined sharply to a critical stage. Now the main constraints for Bulgarian sericulture revival are the lack of sufficient government's financial supports, absence of commercial company, capable to purchase and process the fresh cocoons from the farmers, the majority of sericulture farmers still rely on traditional tall mulberry trees for the feed of silkworms, most of them are wild or hybrid, having much inferior quality and quantity of the leaves, the application of the bi-cropping system and centralized young silkworm rearing, which could promote sericulture as an economically viable agro-industry are nearly not practiced, at the field level most of the silkworm rearing houses and equipment are unsuitable, the silkworm rearing technology is traditional and primitive, leading to low cocoon yield per box, low cocoon quality and too high labour expenses, there is a lack of enough market for mulberry saplings, silkworm eggs, cocoons, raw silk and silk allied products. By the same time Bulgaria still has very high potential for sericulture development due mainly to the big social importance of sericulture as a source of occupation and additional incomes for the rural population, availability of well developed sericultural science, comparatively rich genetic resources, own production of high quality silkworm eggs, the interest of the foreign private investors from Italy, France, Germany etc. in Bulgarian silk industry, the opportunity to provide subsidy for increase the

fresh cocoon price through the European commission, still available 1.3 million tall mulberry trees and more than 10000 farmers households, having facilities and experience in the cocoon production.

3.2. Major constraints for sericulture revival and development, as focused on development of silk handcrafts cottage industries

- One of the big constraints is the lack of sufficient government's financial supports since the sericulture industry is taken into account as one of the minor sectors in agro-industries with recent industrialization and urbanization.
- Decreased number of the students and young researchers in sericulture.
- The majority of sericulture farmers in Bulgaria rely on traditional tall mulberry trees for the feed of silkworms instead of the cultivated low-stem type mulberry plantations. Most of the trees are wild or hybrid, having much inferior quality and quantity of the leaves compared to those of the cultivated trees and the quality of mulberry leaves also affects vigour, resistance to silkworm pathogens and development of silkworms.
- The application of the bi-cropping system which could easily increase farmers' income and promote sericulture as an economically viable agro-industry is nearly not practiced.
- In Bulgaria the cocoon/raw silk production has declined to a critical stage.
- At the field level the silkworm rearing houses and equipment are unsuitable, the silkworm rearing technology is traditional and primitive, both leading to low cocoon yield per box, low cocoon quality and too high labour expenses.
- The cocoon drying and fully automatic silk reeling machines remained in the country have very big capacity and can not be used economically effective in processing small amount of cocoons produced now.
- Lack of enough market for mulberry saplings, silkworm eggs, cocoons, raw silk and silk allied products.
- At present, the absence of commercial company capable to purchase and process the fresh cocoons from the farmers, appears to be the main critical limiting factor for the increase of silk production.

3.3. The preconditions/prospects for sericulture revival and development and importance of sericulture in the country

It is considered that out of the all European countries, Bulgaria has the highest and the most qualitative potential for sericulture development. The country is situated very near to the developed western Europe countries, who are one of the biggest market for silk and its allied products.

Since in most of EU member countries the sericulture is not practiced, the Bulgarian sericultural farmers will not be in strong competition with the farmers from EU after joining the country in 2007. On the contrary, Bulgaria could supply raw silk for the textile industry of Italy and France as an alternative source to the import from China.

On the other hand now the EU conducts a sericulture promotional policy by giving subsidy for establishment and maintenance of mulberry plantations as well as a subsidy amounting to 133.26 EUR for every box of silkworm eggs reared. The purpose is by sericulture promotion

to provide occupation to the population of the under-developed regions of EU, decrease of unemployment, migration, stabilizing the local economy and the communities in the rural area and improvement the conditions for work and life.

Now there are available about 1.3 million single mulberry high/middle stem trees all over Bulgaria. These trees are enough to produce around 500 t fresh cocoons annually. There also are in Bulgaria many farmers, having experience and tradition in this activity, who are ready to take up sericulture again, the well developed science in the field of sericulture, could provide own production of mulberry saplings and silkworm eggs.

3.4. Strategy for sericulture revival and development during the period 2006-2010 (5 years)

3.4.1. Rationale, backgrounds and justification of the strategic approach

PURPOSES OF THE STRATEGY:

- To reach in 2010 in Bulgaria an annual production of about 500 t of fresh cocoons, 60 t raw silk, quality 2A – 4 A, 10 t thick denier raw silk and 30 000 boutique silk handcrafts.
- To decrease the unemployment and migration of the local population by opening 8000 new working places and providing additional annual incomes to the sericulture farmers in amount of 3 500 000 EUR after the joining of Bulgaria to the European Union.
- To stabilize the rural economics and communities and improve the conditions for work and life.
- Improvement of the ecological environment by development of an ecologically clean and nearly wastes-free industry such as sericulture.
- Providing currency incomes for the country and increase the gross national income.
- Creation of technical basis and human resources for further increase of fresh cocoon production to 1500 t and high grade raw silk production to 150 t after 2010 in Bulgaria.

3.4.2. Possible financial sources to realize the strategy

- Foreign donors like EU, KOICA, JAICA, UNDP, FAO etc.
- Loan budget line for establishment of mulberry plantations, open by the State fund "Agriculture", under the Ministry of agriculture and Forestry (MOAF).
- Loans from the National Fund for Environment Protection, under the Ministry of Environment and Waters.
- Subsidy from "SAPARD" program (funded by the EU and operated under the State fund "Agriculture"), measure 03 "Development and diversification of the economical activities", sub-measure № 4–Sericulture.
- Subsidy from the state fund "Agriculture" for increase the fresh cocoon purchasing price.
- Governmental subsidies for R&D through the MOAF.
- Bank loans.
- Foreign and/ or Bulgarian private investors.

3.4.3. Strategy for national implementing agencies

- Ministry of Agriculture and Forestry (MOAF) in implementation for strategy execution arrangements with the National Center for Agrarian Sciences in Sofia, Sericulture and Apiculture sub-division in MOAF, the Local Extension Service Offices in all the sericultural regions.
- Ministry of Economics and Industries
- The Agrarian University in Plovdiv, the Thracian University in Stara Zagora and the Forestry University in Sofia
- The provincial administration
- The mayors
- The Bulgarian Sericulture Association.
- Private investors.

3.4.4. Strategic activities (what and how should be done) and budget estimation

1. Creation of a country network for silkworm larvae distribution, cocoon purchasing, drying, assorting and storage, silk reeling and processing.

For the purpose, the "Bulgarian silk" J.S.C., Sofia has been created. The company will operate in all the country regions. In addition the companies "Svila" – Haskovo and "Danube silk" –Ruse will also be involved in the silk industry development activities. These companies will take not only the cocoon purchasing and processing, but they also will organize the centralized egg incubation/young silkworm larval rearing, organize a network of cocoon purchasing centers in the main production regions during the silkworm rearing seasons. Each company will be equipped with incubatories, young silkworms rearing houses, cocoon storage houses, cocoon drying machines, deflossing machines, and the relevant equipment, such as trays, cages etc.

These companies will deal also with the silk reeling. Most of the high quality raw silk produced will be exported to some EU member countries (Italy, France, Greece), Japan and Korea and the rest will be processed to silk fabrics or sold at the local market.

2. Gradual renovation of mulberry plantations

It is necessary to change gradually the type and the varieties of mulberry plantations from high stem single trees of wild variety to low stem, high density, garden type, easy for harvest, and labour saving.

In order to improve gradually (for a period of 10 years) the varieties and the proportion between high stem single trees: low-cut plantations it is necessary to have an annual production of about 130 000 mulberry saplings of highly productive varieties, such as Kinriu, Kokuso 20, Kokuso 21, Kokuso 27, Vratza 1, Tbilisuri, and Vratza 18. This production can be realized, following the technology of hardwood cutting method of mulberry propagation. Since the SES-Vratza do not have a so big production capacity, the Agrarian university of Plovdiv and some private producers should also be engaged.

The purpose for establishment of about 2000 comparatively bigger sericulture farms, each one having 0.5 ha mulberry plantation during the period 2006-2010 will require an additional

production of 350 000 saplings in 2007 and total 3 million saplings in 2008 and 2009 .This production can be realized only if the bud grafting method of propagation will be widely used.

For this target, the mulberry sapling production should be very much increased, by entering of some private producers and/or associations into this business in order to reach a capacity of about 1.5 million saplings/year.

The newly established mulberry plantations should be low-stem (0.5-0.7m), with 0.8-1.5m inter-tree and not less than 1.5 m inter-row distance. For mechanized soil processing the inter-row distance should be not less than 3 m. In the plantations, having an inter-row distance 1.5-2 m, the soil in the inter-rows will not be processed, because of the overshadowing and mulching, thus saving costs.

If the country could reach the above mentioned mulberry saplings capacities of production, it would allow to plant about 1000 ha low-stem plantations during the period 2006-2009.

One big resource for mulberry leaf yield nearly double increase is the **grafting of old mulberry trees**, which is practiced in order to improve the yield quantity and quality of old wild or hybrid mulberry trees. The best results are obtained by using the spring bud "T" grafting and "under bark" scions grafting. The trees are prepared previously in the winter, or just before the grafting, by pruning all the branches and leaving only 8-10 one-year old shoots. Before grafting the shoots are cut at 15 -20 cm above the base and then the "T" grafting is made at 5-8 cm above the base by grafting one bud on each shoot. In the "under bark" method the stock shoots have a length of 15 -20 cm and the scion is put on the top of the stock shoot, under the bark. Usually the grafting is made in April. Time to time all the new wild/hybrid sprouts of the old tree are cut. For the purpose the farmers could be trained to make the grafting by themselves or in each region a working group of 2-3 skilled workers may be formed to graft gradually the old trees.

3. Improvement of the silkworm rearing facilities and technology

Now the farmers have enough buildings, which after some reconstruction could be successfully used as silkworm rearing houses after some appropriate reconstruction. By the technical help of R&D units most of the farmers could make by themselves the rearing equipment, such as rearing trays, straw bottle brush mountages etc..

Some other additional measures would be:

- Promotion of the autumn silkworm rearing aiming to achieve a balance of cocoon production 60 % from the spring crop and 40 % from the autumn crop. A system for the 2nd crop during autumn season should be established and operated to supply young silkworm larvae in time. In the meantime, mulberry cultivation methods should be accordingly developed in order to supply suitable quality mulberry leaves for both young and advanced larvae.
- For field adaptability test of imported silkworm varieties for 2nd crop in autumn season, it may be worthwhile to importing a few more different hybrid silkworm varieties and to try them for 2nd crop compared with local varieties
- More sufficient financial and technical supports should be also provided in order to expand more number of demo-farms to the main sericultural areas and to increase productivity of cocoon yields per box of silkworm eggs at the national level.

- Effort should be made to provide sericulture farmers with better mounting frames to improve reelability of cocoon. For the purpose an annual production of 200 000 cardboard frame mountages and 25 000 sets of perforated paper for bed cleaning shall be realized.
- To adopt labour saving technology for 4^{th} and 5^{th} instar silkworm rearing at the field level in order to decrease the labour expenses from 5-6 h/kg fresh cocoons to about 3 h.

4. Establishment of an effective extension service system for sericulture

This system will include the Sericultural Experiment Stations in Vratza and Harmanli, the three National state universities, having sericulture sub-divisions in Plovdiv, Stara Zagora and Sofia, the National service for advices in agriculture, under MOAF with its branches in the country as well as extension workers, appointed at the private cocoon/silk processing companies. For that purpose about 15 state extension workers must be appointed at the National service for advices in agriculture and another 30 extension workers should be hired at the private companies.

The other measures will be:

- During the period 2007-2009 the stations and universities to conduct 6 training courses in order to train the extension service workers (45 persons) and 300-400 farmers in the modern techniques of mulberry and silkworm rearing, cocoon production and processing and the management of sericultural farm.
- During the same period to create 200 model demofarms, each one for rearing of 5 boxes silkworm eggs annually (3 boxes in the spring and 2 boxes in the summer-autumn season) and production of 150-180 kg of fresh cocoons each. Every farm to be supplied in free of charge with 600 cardboard frame mountages and 700 mulberry saplings of highly productive varieties.
- In 2007 and 2008 to open two model centralized young silkworm rearing centers, each one having a capacity of 500 boxes/stage.

5. Establishment of comparatively bigger sericultural farms

The main purpose of these farms is to provide stable supply with high quality cocoons at lower production costs.

In 1997-98 the Bulgarian Sericulture Association, with the active participation of the researchers from the stations and universities worked out a project, aiming to turn the sericulture as a basic livelihood for lend less, small land holders and poor rural families through establishment of bigger family sericultural farms. This project could also give the opportunity of some private companies to organize bigger silkworm rearings, hiring workers.

The candidates to participate at this project should have at least 0.5 ha own land, as well as a building, having capacity for 7-8 boxes of silkworm eggs/stage.

The Sericulture association has made many efforts to provide funding for this project during the recent years, however still the project is at its donors searching phase.

By the same time, funding for establishment of such kind of bigger cocoon production farms is provided by the SAPARD program, under MOAF. However due to different reasons, still no any candidate has been financed.

For establishment of a sericultural farm, having 0.5 ha mulberry plantation and 75 m^2 rearing house, the following investments are necessary:

Mulberry saplings:	1700 EUR
Mulberry planting and cultivation up to the 4th year:	800 EUR
Reconstruction of the building, supply with rearing equipment:	4000 EUR
TOTAL:	**6500 EUR**

The farm will grow 15 boxes of silkworm eggs annually, in 3 stages, namely spring (May/June, 8 boxes), summer (July/August, 3 boxes) and autumn (September/October, 4 boxes), producing 450 kg fresh cocoons/year.

7.Promotion creation of farmer's groups, having a close circle of production from the cocoons to the ready silk handcrafts garments.

These farmer's groups could be created through a special project, financed by the European commission, some other foreign donors, Bulgarian government or some private investors. Other way is the farmers by themselves to create the group, as a voluntary association, where each member takes part with his/her own capital.

One farmer's group will be gathered from one or a cluster of villages. The target is the farmer's group to produce silk handcrafts, using inferior quality cocoon, cottage type industry and more labor. By this way all the cocoons produced at country level will be utilized, the good quality ones for reeling high grade raw silk by the fully automatic machines and the inferior cocoons-for silk handcrafts production. The farmer's group should have the necessary buildings, and to be equipped with cocoon drying machines, equipment for cocoon preservation and assorting, cocoon deflossing machines, cottage type machines for silk reeling, winding, doubling, twisting, equipment for silk yarn degumming and dyeing, machines for spooling, warping, coning, handlooms and/or knitting machines, sawing machines.

NECESSARY INVESTMENTS:

1. Creation of a country network for silkworm larvae distribution, cocoon purchasing, drying, assorting and storage, silk reeling and processing.

- **Silkworm egg incubatories: 4 x 15 000 EUR =60 000 EUR**
- **Centralized young silkworms rearing houses: 4 x 30 000 EUR = 120 000 EUR**
- **Cocoon deflossing machines: 18 x 2000 EUR = 36 000 EUR**
- **Cocoon drying machines: 200 000 EUR**
- **Equipment for cocoon storage and assorting: 20 000 EUR**
- **Automatic cocoon cooking machines: 4 x 16 500 EUR = 66 000 EUR**
- **Fully automatic silk reeling machines (400 ends): 4 x155 000 EUR = 620 000 EUR**
- **Boilers for industrial steam: 4 x 10 000 EUR = 40 000 EUR**

- **Equipment for raw silk bundling, packing and storage: 15 000 EUR**
- **Erection of the silk reeling machines: 15 000 EUR**
- **Rent for the buildings: 50 000 EUR**
- **Miscellaneous: 20 000 EUR**

TOTAL: 1 262 000 EUR

2. Renovation of mulberry plantations.

- **520 000 saplings x 1 EUR = 520 000 EUR**
- **planting and cultivation up to the 4th year: 250 000 EUR**

TOTAL: 770 000 EUR

3. Improvement of the silkworm rearing facilities and technology.

- **Cardboard frame mountages: 800 000 pieces x 2.5 EUR = 2 000 000 EUR**
- **Perforated paper for bed cleaning: 80 000 sets x 3 EUR = 240 000 EUR**

TOTAL: 2 240 000 EUR

4. Establishment of an effective extension service system for sericulture

- **45 extension service workers x 250 EUR x 36 months = 405 000 EUR**
- **Expenses for the extension service (travel, stationer, communication etc.): 85 000 EUR**
- **Training courses: 6 courses x 60 participants x 60 EUR = 21 600 EUR**
- **Cardboard frame mountages for the demofarms: 200 farms x 600 mountages x 2.5 EUR = 300 000 EUR**
- **Perforated paper for the demofarms: 200 farms x 6 sets x 2 years x 3 EUR = 7200 EUR**
- **Mulberry saplings for the demofarms: 200 farms x 700 saplings x 1 EUR = 140 000 EUR**
- **Support to the demofarms for innovation of the rearing house and equipment: 200 farms x 1300 EUR = 260 000 EUR**
- **Model centralized silkworm rearing houses: 2 x 80 000 EUR = 160 000 EUR**
- **Establishment of silk testing laboratory: 140 000 EUR**
- **Foreign consultancy help: 10 p/m x 6500 EUR = 65 000 EUR**
- **National consultants: 10 p/m x 1000 EUR = 10 000 EUR**
- **Overseas training: 10 persons x 6000 EUR = 60 000 EUR**

TOTAL: 1 653 800 EUR

5. Establishment of comparatively bigger sericultural farms.

- **2000 farms x 6500 EUR = 13 000 000 EUR**

TOTAL: 13 000 000 EUR

6.Creation of farmer's groups, having a close circle of production from the cocoons to the ready silk handcrafts garments.

- **5 farmer's groups x 60 000 EUR = 300 000 EUR**

TOTAL: 300 000 EUR

GRAND TOTAL: 19 225 800 EUR

WAYS OF STRATEGY FUNDING:

Activities	**Source of funding**	**Budget in EUR**
Creation of a country network for silkworm larvae distribution, cocoon purchasing, drying, assorting and storage, silk reeling and processing	Private investors	**1 262 000**
Renovation of mulberry plantations	MOAF, subsidy	**770 000**
Supply of sericulture farmers with perforated paper and cardboard frame mountages	MOAF, subsidy	**2 240 000**
Appointment of 15 extension service workers	MOAF, subsidy	**135 000**
Appointment of 30 extension service workers	Private business	**270 000**
Expenses for the extension service	MOAF, subsidy	**28 000**
Expenses for the extension service	Private business	**57 000**
Training courses; cardboard frame mountages and perforated paper, mulberry saplings for the demofarms; support to the demofarms for innovation of the rearing house and equipment; model centralized silkworm rearing houses; establishment of silk testing laboratory; foreign consultancy help; national consultants; overseas training	Regional project "Improvement of Income-Generation Options Based on Revival of Sericultural Industries and Promotion of Small Silk Enterprise Development in Eastern Europe and Central Asia", financed by foreign donors and Bulgarian government	**1 163 800**
Establishment of bigger sericultural farms	SAPARD program; project financed by foreign donors	**13 000 000**
Farmer's groups for production of silk handcrafts	Private investors; foreign donors; Bulgarian government	**300 000**
TOTAL		**19 225 800**

3.4.5. Workplan

Activities	2006	2007	2008	2009	TOTAL
Creation of a country network for silkworm larvae distribution, cocoon purchasing, drying, assorting and storage, silk reeling and processing	creation	created	created	created	created
Production of mulberry saplings (pieces)	25 000	350 000	1 500 000	1 500 000	3 375 000
Production of cardboard frame mountages (pieces)	20 000	700 000	700 000	700 000	2 120 000
Production of perforated paper (sets)	2400	20 000	30 000	30 000	82 400
Appointment of extension service workers (number)	0	15	15	15	45
Training courses (number)	0	2	2	2	6
Innovation of rearing houses and equipment in the demo farms (number of farms)	0	100	100	0	200
Establishment of model centralized young silkworms rearing houses (number)	0	1	1	0	2
Establishment of a silk testing laboratory	0	0	1	0	1
Foreign consultancy (p/m)	0	3	4	3	10
National consultancy (p/m)	0	3	3	4	10
Overseas training (number of persons)	0	2	4	4	10
Establishment of sericulture farms, having 0.5 ha mulberry plantation	0	500	750	750	2000
Farmer's groups for production of silk handcrafts (number)	0	1	2	2	5
Silkworm egg production (boxes)	2500	11 000	20 000	20 000	53 500
Fresh cocoon production (t)	15	50	250	500	825
High grade raw silk production (t)	1.5	5	25	60	91.5
Low grade raw silk production (t)	0.3	1	5	10	16.3
Silk handcrafts (pieces)	0	720	2400	30000	33120
Number of sericultural households	375	1 250	5 500	10 000	10 000
Number of new working places opened	0	2500	5000	8000	8000
Gross incomes of sericulture farmers	37500	175000	1750000	3500000	5462500
Net incomes of sericulture farmers	30000	140000	1394125	2788250	4352375

3.4.6. Economical analyses on the sericultural production at the end of development period: at the levels of farmers, commercial enterprises dealing with cocoon and silk

1.Sericulture farmers

EXPENSES (the labor not included):

1.Mulberry cultivation: 12 500 EUR

2.Silkworm eggs: 20 000 boxes x 8.00 EUR = 160 000 EUR

3.Silkworm egg incubation and centralized 1st and 2nd instars larval rearing: 20 000 boxes x 8 EUR= 160 000 EUR

4.Formalin for disinfection: 38 500 l x 0.50 EUR=19 250 EUR

5.Perforated paper for bed cleaning: 20 000 sets x 3 EUR = 60 000 EUR

6.Heating of the rearing house, paper, mulberry leaf transportation: 20 000 boxes x 15 EUR = 300 000 EUR

TOTAL: 711 750 EUR

INCOMES FROM THE COCOON SELLING: 500 000 kg x 7 EUR = 3 500 000 EUR

The fresh cocoon purchasing price per kg is formed as 1 EUR, paid by the commercial company, plus 6 EUR, provided as EU subsidy.

Positive financial result (payment of the farmers labor): 2 788 250 EUR

The labor expenses for production of 1 kg fresh cocoon are 3.5 h: 3.5 h x 500 000 kg = 1 750 000 h : 8 h = 218 750 man days.

2 788 250 EUR : 218 750 man days = 12.75 EUR/ man day

2. Commercial companies, dealing with cocoon purchasing, processing and silk reeling

Productional costs:

- Cocoon purchasing: 500 000 кg x 1 EUR = 500 000 EUR
- Cocoon drying, preservation and assorting: 200 000 EUR
- Silk reeling and production of raw silk 2A – 4 A grade: 600 000 EUR
- Reeling the 2nd and 3rd grade cocoons and production of grade less raw silk: 70 000 EUR
- Rent for the buildings: permanent – 5 000 м 2 x 1.50 EUR x 12 месеца = 90 000 EUR; temporary centers for cocoon purchasing-1500 м 2 x 2 EUR x 1 месец = 3000 EUR

- Bank loan re-payment, together with the interests: 400 000 EUR (3 years gratis period, 5 years term for re-payment, 10 % annual interest)
- Interests for short-term loans: 45 000 EUR
- Miscellaneous: 15 000 EUR

TOTAL: 1 923 000

INCOMES:

SELLING OF DRIED COCOONS SECOND AND THIRD GRADE: 40 000 kg X 2.5 EUR = 100 000 EUR

SELLING OF RAW SILK 2A-3A GRADE: 60 000 kg X 35 EUR = 2 100 000 EUR

SELLING DEFFECTIVE COCOONS AND SILK WASTES: 15 000 kg X 1.50 EUR = 22 500 EUR

TOTAL: 2 222 500 EUR

PROFIT: 299 500 EUR

3. Farmer's groups, producing silk handcrafts

Productional costs:

- Buying 2nd and 3rd grade dried cocoons: 40 000 kg X 2.5 EUR = 100 000 EUR
- Reeling the cocoons and production of grade-less raw silk: 10 000 kg raw silk x 7 EUR = 70 000 EUR
- Silk winding, doubling, twisting, degumming, dyeing, spooling, warping, coning : 10 000 kg x 17 EUR = 170 000 EUR
- Silk fabrics weaving/knitting, ready garment production: 30 000 garment x 8 EUR = 240 000 EUR
- Repayment a loan with the interest (3 years gratis period, 5 years term for re-payment, 10 % annual interest): 90 000 EUR

TOTAL: 670 000 EUR

INCOMES: 30 000 ready garment x 25 EUR = 750 000 EUR

2000 kg defective cocoons and silk wastes x 1.50 EUR = 3000 EUR

TOTAL: 753 000 EUR

PROFIT: 83 000 EUR

Based on the successful achievements of this strategy implementation, following 2nd and 3rd three-year projects could be implemented for further expansion of sericulture development activities at the national level. The targets of the 2nd and 3rd three-year project could be designed depending on the outputs of the previous projects and the provision of financial supports from the government and any possible donors.

If the 1st/2nd/3rd three-year projects could be successfully implemented as per working schedule, the national sericulture development could be rehabilitated to the level of the early 1990s, that approximately 20 000 sericulture farm households will be involved in silkworm rearing activities to produce 1500 tons fresh cocoons in the effective year of 2011.

For the effective implementation of the above-mentioned projects, there should be the prerequisite conditions-such as an integrated national strategy and plan, finding donors who will finance the project, the government financial/administrative supports and the strengthening of the institutional capacity.

Chapter 4. Major Problems and Issues, and Recommendations

At present, the absence of commercial company, capable to purchase and process the fresh cocoons from the farmers, appears to be the main critical limiting factor for the increase of silk production.

The sericulture is one of the few branches of agriculture in Bulgaria, which is able to provide good incomes to the farmers, without big investments and for comparatively short time as well as to create huge job opportunities and income resources.

Taking into account the big social importance of sericulture as a source of occupation and additional incomes for the rural population, all Bulgarian governments after 1990 have considered it as a very high priority sub-branch of agriculture. It was not occasionally that sericulture has been included in the measure for diversification of agriculture activities, financed by the pre-joining European Union (EU) programme SAPARD.

Since the problems of Bulgarian sericulture are complex, for their solving it is necessary to provide comparatively big financial resources, mainly private investments.

In spite of the many constraints, facing Bulgarian sericulture industry development during the recent 15 years, the sericulture still appears to have a big potential for revival and bright prosperities for development.

After the raw silk price at the international market reached its bottom of 18 US$/kg in 1995 it started gradually to increase, reaching about 30-34 US$/kg for 3A grade raw silk in 2001. However in 2002/2003 the Chinese started again to sell raw silk at a price of 16-18 US$/kg. The experts in this field however expect that the raw silk price will go up again in the near future. Some European countries like Italy and France, whose silk textile industry is dependant completely on the import of raw silk and silk yarn from China are very interested in finding some alternative silk producers, who could provide a stable supply with high grade raw silk at reasonable prices.

Chapter 5. BACSA Development Strategies

After a successful implementation of sericulture revival and development projects, the fresh cocoon production in the region could reach 80 - 100 000 t/year, raw silk production – 10 000 – 12 000 t/year and about more than 2 million farmer's households would get income from sericulture and could probably earn approximately US$450-500 per crop/family and also

expect to have a potential for possible income of more than US$1500 - 2000 per hectare and year from mulberry plantations. The annual sericulture farmer's gross incomes at the regional level could reach US$ 200 - 300 million. Another about half of million people will be hired in the cocoon/silk processing industry sector, getting salaries of US$ 30 - 40 million /year. The project implementation would contribute to decrease of unemployment in the region, which is still comparatively too high. In the future the high grade raw silk production in BACSA region will be able to completely meet the needs of EU silk textile industry and to break their high dependence on a raw silk import mainly from China. By this way the EU silk industry development will be sustainable with a stable and close source of high grade raw silk. Due to the stable supply of high quality silk at reasonable prices, huge number of workers in Italian, French, Spanish etc. silk textile industries sector shall preserve their working places. Therefore the social effect of this project will benefit both the silk producing and consuming countries.

The donor assistance is needed to strengthen the technical and managerial capacities of the participating countries in making substantial sericulture revival and development within a short period by an established provision of training, advisory services, exchange of information and genetic resources.

In order to successfully rehabilitate the on-going traditional sericulture in the region as an economically viable agro-industry in the future, the BACSA region countries should strengthen their close collaboration for the effective role of the Black, Caspian Seas and Central Asia Silk Association (BACSA) as a network between them and conducting regular meetings/or symposium(s). These activities could thus assist each other with their advanced technologies, experience and genetic resources of mulberry and silkworm. These proposed immediate targets could be effectively achieved with substantial technical and financial assistance of the prepared regional project to be funded from any possible donors such as multilateral or bilateral assistance.

Follow-up activities of Tashkent Workshop and national strategy for sericulture revival and development in Georgia

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ABSTRACT

Sericulture in Georgia has always been considered as an important source of building the country's economy, providing for the reasonable use of labor resources, and creating income-generating activities. In the middle of the 19th century, Georgia annually produced 6.0-6.5 tons of silkworm cocoon, which is considered to be a record to the present day. In the 1960s, the annual yield of silkworm cocoon in Georgia made 4.0-4.4 thousand tons and the revenues from the sector exceeded 15-16 mil US dollars. Around 100-120 thousand households were involved in sericulture, and 5-6 thousand people in the cocoon/silk processing business. The difficulties faced around the world in sericulture were supplemented by the spread of micoplasmic dwarf leaf disease of mulberry in western Georgia in 1964, and in Kakheti (in eastern Georgia), in 1992. The disease spread rapidly around the country leaving around 16 mil mulberry plants damaged, which, in turn, lead to the catastrophic fall of cocoon production.

Georgian selectionists raised and revealed disease resistant mulberry species and forms, the spread of which shall be paid considerable attention. After several years of stoppage of cocoon production, in 2005, an investor was identified and first steps were taken towards the revival of the given industry. For the purposes of conducting investigation in spring, silkworm eggs were imported from Japan and 600 boxes of silkworm were fed. The cocoon yield and quality are up to the standard. Each kg of fresh cocoon was estimated at 2.25 USD, which has further increased the interest in the given industry among village population and created conducive grounds for its revival. The scientific-research work revived in the Educational-research Institute of Sericulture, particularly in the area of selection and genetics. Steps were taken for the preservation of the silkworm collection and its further application for selection purposes. A pilot and selective plantation was built over 4 ha, grafting pilot and seed farming lands were arranged, thousands of elite plantings were grown, etc. Georgia has amazing and unique old sericulture museum and library. They could be used as a part of training in sericulture and silk processing for participants from BACSA member countries as well as from African and Near East countries.

Key words: sericulture, silk, Georgia, revival, strategy

Chapter 1. Introduction

Sericulture in Georgia has always been considered as an important source of building the country's economy, providing for the reasonable use of labor resources, and creating income-generating activities. It has always been a subject of constant care. High-quality Georgian silk has always been greatly appreciated on the international market. Considering the strategic importance of sericulture, invaders always tried to destroy mulberries together with vineyards to finally erase the local economy and subjugate the country.

Georgian silk deserved particular approval and earned medals at the international exhibitions held in Turin in 1850 and in London in 1862. The thread produced from Georgian silkworm species (*Mziuri-1, Mziuri-2*) was in 1998 used by *Tsisartkela* silk weaving factory for making fabrics which, on the decision of the European Quality Committee, received the Platinum Star (the highest reward) at the exhibition held in Spain.

Georgian silk held the first place in terms of quality, and the second/third in terms of quantity among the countries of the Soviet Union.

In the middle of the 19th century, Georgia annually produced 6.0-6.5 tons of silkworm cocoon, which is considered to be a record to the present day. Though, import of silkworm eggs in 1860s, brought about hereditary disease *Pebrine*, which seriously affected the industry. Therefore, the issue of import of silkworm eggs shall be considered with great care.

The Caucasian Sericulture Station was established in Tbilisi in 1887 to bring the industry out of crisis, which was the only scientific institution of its kind in the Russian Empire and enjoyed wide popularity around the world. The scientific-research Institute of Sericulture is a legal heir of the Caucasian Sericulture Station.

Sericulture was widely spread and popular. Cocoon production was an important source of income for many village households. The development of sericulture was, apart from geographic location and natural conditions, stimulated by lack of lands and resulting growth of unemployment. Unfortunately, high rate of surplus labor appears to be even more acute nowadays, which reinforces the need of reviving the industry.

Sericulture provides opportunities for employing women, the elderly and adults, which in turn stimulates the development of work skills among the youth and their involvement in household labor.

Considering the above-mentioned, priority should be given to the employment of village households as a way of improving their budgets. Sericulture can play a significant role in creating income-generating jobs and improving social conditions of people.

The capacity of silk production in Georgia is determined by free labor resources and the existing feeding base.

In the 1960s, the annual yield of silkworm cocoon in Georgia made 4.0-4.4 thousand tons and the revenues from the sector exceeded 15-16 mil US dollars. Around 100-120 thousand households were involved in sericulture, and 5-6 thousand people in the cocoon/silk processing business. It is noteworthy that rapid development of artificial fiber in the 1960s reduced the request for natural silk around the world, though only temporarily.

The difficulties faced around the world in sericulture were supplemented by the spread of micoplasmic dwarf leaf disease of mulberry in western Georgia in 1964, and in Kakheti (in eastern Georgia), in 1992. The disease spread rapidly around the country leaving around 16 mil mulberry plants damaged, which, in turn, lead to the catastrophic fall of cocoon production.

Georgian selectionists raised and revealed disease resistant mulberry species and forms, the spread of which shall be paid considerable attention.

Improvement of the feeding base and accelerated revival of the industry are the primary tasks to be addressed for the development of sericulture. According to our estimates, village communities failed to reimburse the damages inflicted by the reduction of cocoon production with other produce. The situation will most likely remain unchanged in the future. This is a problem which shall be taken into account when making decisions about the development of this field and estimating the recovery of costs and percentage share of revenues from sericulture against the overall revenues in the country.

The objective of this report is not to make a detailed analysis of the fall or rise of sericulture but rather to illustrate the developments that have taken place in Georgia since the Tashkent conference.

Chapter 2. Follow-up activities of the "International Workshop on Revival and Promotion of Sericultural Industries and Small Enterprise Development in the Black, Caspian Seas and Central Asia Region", Tashkent, Uzbekistan 11 - 15 April 2005.

The following measures were taken in Georgia after the international Tashkent conference held in 2005:

- scientific-industrial conferences and meetings were held with the stakeholder institutions, farmers and investors to familiarize the latter with the transactions of the Tashkent symposium;
- the work conducted revealed that the regional and other administrative officials take measures for developing sericulture as the latter is justly considered by them as an important source of income and improvement of living conditions in rural areas;
- the recommendations proposed by BACSA, providing opportunities for the development of the industry, received full-fledged support among rural communities and investors;
- after several years of stoppage of cocoon production, in 2005, an investor was identified and first steps were taken towards the revival of the given industry.

  For the purposes of conducting investigation in spring, silkworm eggs were imported from Japan and 600 boxes of silkworm were fed. The cocoon yield and quality are up to the standard. Each kg of fresh cocoon was estimated at 2.25 USD, which has further increased the interest in the given industry among village population and created conducive grounds for its revival;
- scientific-research work revived in the educational-research Institute of Sericulture, particularly in the area of selection and genetics. Steps were taken for the preservation of the silkworm collection and its further application for selection purposes. A pilot and selective plantation was built over 4 ha, grafting pilot and seed farming lands were arranged, thousands of elite plantings were grown, etc;
- a wide array of measures (exhibitions, presentations, etc) were taken for the revival of traditional silk manufacturing (tapestry/goblins, scarves, hats, etc).

The above-mentioned allows to assert that there are sufficient preconditions in Georgia for reviving sericulture.

Chapter 3. National strategy for sericulture revival and development in Georgia

3.1. Background

Sericulture in Georgia was adopted in the 5th century A.D, during the reign of King Vakhtang Gorgasaly. Samples of Georgian silk fabrics were exhibited in Turin(Italy) in 1850 and London in 1862 and got medals. However after 1860 the pebrine disease had caused very high larval mortality and cocoon production was nearly stopped.

In order to overcome the crisis in the sector a Caucasian Sericulture Station was established in 1887 at Tbilisi. The station was the first one opened in the Russian Empire. In 1930 the Soviet Union government reorganized the station as Trans-Caucasian Sericulture Research Institute. At that time in the institute's system were included also the experimental stations in Ganja (Azerbaijan), Yerevan (Armenia), Vinitza and Pjatigorsk (Russia). After 1959 the institute was included into the Georgian Agrarian university as Education - Research Institute of Sericulture.

At the beginning of the 20th century more than 90 % of the silkworm eggs reared in Georgia were imported. At that time the Caucasian sericulture station and the silkworm breeders associations formed plaid a very important role in sericulture rehabilitation after heavy pebrine incidence. In some Georgian provinces sericulture appeared to be the main source for income for the rural population. The silk reeling factories were too primitive and their annual capacity was enough to reel only 40-45 % of the cocoons produced, but the rest part was exported to Russia, Italy and France. The amount of fresh cocoon production was not stable, namely in some years it reached 2000 – 2500 tons, but in other years it dropped to only 300-800 t.

After the establishment of Soviet power in Georgia a rapid increase of cocoon/silk production occurred. For example the fresh cocoon production in 1920 was 819 t, in 1925 – 2129 t and it reached 4147 t in 1939.

The Georgian Silk Corporation ("Sakabreshumi") was established by the Ministry of Agriculture in 1930 and since then has taken charge of all administrative affairs concerning the production of cocoons.

The Corporation have dealt with organization of training courses with the farmers every spring, production of mulberry saplings and silkworm eggs, operation of extension service, centralized silkworm egg incubation, cocoon purchasing, drying and storage. Georgian State Silk corporation consisted of 41 district branches, 70 cocoon dryers, 5 F_1 silkworm egg production factories and 2 P_3-P_1 egg production stations. The main income for the Corporation was derived from the sell of dried cocoons to silk reeling factories.

During the period 1921 – 1932 was established a network for cocoon purchasing and drying, silkworm egg production factories, silk reeling and processing factories were built, the practices for centralized egg incubation (1927) and the summer-autumn silkworm rearings (1930) were adopted.

During the second world war the cocoon production declined to 1800 – 2500 t /year. However after the war the cocoon production started to increase again and reached its peak of 4400 t in 1964.

After that due to the mulberry dwarf leaf disease appeared in Georgia the cocoon production declined dramatically to a half of production in 1964.

Until 1990 Georgia occupied one of the leading positions for cocoon/silk production in the former Soviet Union. In 1990 the Georgian Silk Corporation still served approximately 100 000 households (400 000 people) who were involved in the cocoon production.

In addition there were 5 silk reeling factories with a total capacity of 160 tons raw silk/year and 2 silk weaving factories. As to the quality of Georgian raw silk it held the first place in the Ex- SU.

However after 1991 when the country got independence from Russia the cocoon/silk production have declined dramatically and stopped completely in the last 2 years.

The production figures are presented below in Table 1.

Table 1.

Various production figures in Georgia

Year	number of mulberry trees (million)	silkworm eggs produced (boxes)	fresh cocoon production (t)	fresh cocoon price (US$/kg)	raw silk production (t)	number of sericulture households
1964	15.6	346000	4400	3	518	120000
1970	4	144320	2600	3	300	110000
1975	3.5	144000	1700	3	200	110000
1980	5	180720	1800	6	210	65000
1985	12.3	180000	2000	6	235	65000
1990	18.5	92880	1556	6	180	52000
1991	19.1	135000	1592	0.6	188	53000
1992	18	122000	1124	0.6	130	37500
1993	15	52000	506	0.6	58	20240
1994	10	26000	260	0.6	30	10400
1995	8.3	5700	48	1	5.6	2400
1996	7	12560	53	1	6	2650
1997	6	3280	17	1	1.9	1500
1998	5	1840	8	1	0.92	400
1999	4.9	1680	23	1	2.65	1150
2000	4.7	-	-	-	-	-
2001	4.5	-	12	1	1.4	600
2002	4.3	-	-	-	-	-
2003	4.2	-	-	-	-	-
2004	4	-	-	-	-	-
2005	4	-	12	2.5		350

3.2. Reasons for decrease and temporary stop of cocoon/silk production in Georgia.

The main reasons are as follows:

*** Decrease the number of mulberry trees.**

In 1964 for the first time appeared a mulberry disease, called “dwarf leaf” which for about 5 years swept away nearly 80 % of the mulberry trees in the country. Later new mulberry varieties, tolerant to this disease and measures to control it were developed by the sericulture institute.

After 1991 most of the trees were just cut by the farmers due to low cocoon purchasing price.

*** Loss the traditional silk markets in Russia and Baltic countries.**

*** In 1995 all the silk reeling and processing factories in Georgia were privatized.** Currently they are under reorganization and they are looking for investors.

*** In 1999 the silk reeling factories stopped completely their work and fresh cocoon purchasing from the farmers respectively.** The reason was that the price of 1 kg dried cocoons for export was 4 US$ FOB Georgia, while about 5-6 US$ CIF the customer, hence too high. The selling price of raw silk was 14-16 US$/kg and couldn’t cover the costs for production.

*** The raw silk quality** was too low due mainly to the poor silkworm egg production system and old silk reeling machines.

*** The purchasing price of fresh cocoons** was comparatively low , namely 1 US$/kg while the farmers expected that it would be at least 2-3 US$/kg.

The main physical parameters in Georgia and those desired for an economically viable silk production are presented below in Table 2:

Table 2.

Some physical parameters in sericulture

Parameters	In Georgia	Desired
Amount of fresh cocoon necessary to produce 1 kg dried cocoon (kg)	2.7	2.5
Amount of dried cocoon necessary to produce 1 kg raw silk (kg)	3.5	2.8
Mulberry leaves necessary to produce 1 kg fresh cocoon (kg)	20	16
Mulberry leaf yield per 1 ha rain - fed garden (kg)	6000	16000

Although the problems causing gradual decline and finally stop of cocoon/silk production in Georgia are complex **the most important ones are the poor silkworm eggs quality and raw silk quality.**

3.3. Evaluation the present status of sericulture in Georgia

3.3.1. Governmental support to the sector.

The government provides the annual budget of the Sericulture coordination department and Educational – Research Institute of Sericulture. Now it is expected that the government will issue a special decree for rehabilitation and development of sericulture.

Sericulture development has been put into the main priorities of Georgian government.

3.3.2. Sericulture Coordination Department under MOA.

Under this department are also the Sericulture museum and library, both established in the end of 19th century.

The Georgian Silk Museum preserves the Caucasian silk collections as well as silk collections from 61 countries, representing all the stages of silk production from the mulberry tree seeds to silk products.

The museum was founded in 1887 by Mr. N. Shavrov (Director) as a part of Caucasian Sericulture Station. There are in 4 meters height semi - hermetic cases made of mulberry tree wood containing collections of cocoon samples from 19th and 20th centuries in glazed cells.

About 5 thousand silkworm breeds from different sericulture countries, most of them as a part of the collection of Lyon silk museum are preserved.

A wide range of Caucasian folk family craft specimens can be seen in the museum: carpets in different colors, dyed by natural dyes, “jejimi”, ribbons, scarves, “daraya” and “kanaus” type fabric, different ornaments, hand loom models and such subsidiary tools as spindles, spools and combs.

French, Russian, Georgian fabrics as well as collection of the German silk lace are represented as the first samples of manufactory. The Museum preserves the part of the first donations: from the experimental laboratory of the Lyon’s silk museum, from the Sericulture Stations in Montpellier, Gerts and Padua, from the St. Peterburg Imperial Botanical Garden and from the noble Georgian families.

Sericulture is presented in a thematic sequence, beginning with the mulberry tree and the silkworm biology to the technological process of silk reeling and weaving. The Georgian silk museum took part in exhibitions since 1890.

In 1997, 1999 and 2001 on the initiative of the European textile Network and supported by the Georgian Textile Group the International symposiums under the motto: ”Caucasus – a bridge between East and West” were held. Since 1998 the museum has been entered on the list of the European Textile Network and regular exhibitions.

The sericulture library was established also in 1887. The library fund includes 39000 units in 26 languages. They were published in more than 80 foreign cities and are dated to the last four centuries. The earliest book was published in ancient Greek language in 1601. The library furniture is also unique.

It could be concluded that Georgia has amazing and unique old sericulture museum and library. They could be used as a part of training in sericulture and silk processing for participants from BACSA member countries as well as from African and Near East countries.

3.3.3. Education – Research Institute of Sericulture

Since 1959 the institute functions as a part of State Agrarian University of Georgia. Such a form of educational – research organizations was considered as an optimal model of association planned to connect organically the educational –pedagogical activity and the scientific – research activity, to achieve more intense inclusion of professors – teachers and students in the research activity and vice versa, to enable the leading researchers to participate in the educational process, to improve the quality of education and research activity and to elevate the level of preparation of specialists.

Under the Agrarian university there is a Sericulture college, including Sericulture Education Department and Sericulture Research Institute. In the institute's structure there are 5 research departments, Zonal experiment station in Kutaisi and 2 mulberry plantations. The director of the institute acts also as dean of the college. Before we trained 25 students annually, but the number of students decreased very much now. After 4 years course the students obtain bachelor diploma for agronomist –sericulturist. It is possible to get also masters degree (2 years course after bachelor) and PhD (3 years course after masters) degrees in sericulture. The annual fee for foreign students (both undergraduate and postgraduate) is 500 US$. The training is conducted in Georgian and Russian.

The staff of the institute consists of 74 researchers, 16 of them are PhD holders. During the period 1930-2002 22 mulberry varieties and 25 silkworm breeds, 3 prthenogenesis lines, 18 F_1 hybrids and 4 hybrids between parthenogenesis lines and ordinary breeds have been selected at this institute.

31 volumes of scientific papers, more than 1000 articles, various textbooks, guides, instructions, methodical manuals were published.

More than 2200 scientists, sericulturists and agronomists were trained. Dozens of PhD thesis were also defended.

3.3.4. Mulberry saplings production and the existing plantations

The main method for sapling production is by grafting. The technology implemented is right and appropriate. There was problem in the surviving of the grafted plants, because 14-15 % of them could survive and as a result the rest 85 % were planted as seedlings.

Now the costs for production of one sapling by the grafting method are around 05.-0.8 US$.

It has been identified that the saplings, produced by cuttings method are more sensitive to dwarf leaf disease. In the past more than 1 million saplings were produced annually by the grafting method mainly. During the recent years the saplings production has been stopped. However the Sericulture institute has the necessary facilities and human resources to revive this production if necessary.

More than 90 % of the mulberry trees existed are situated in the Western part of Georgia.

Georgia occupied the first position in the former Soviet Union with the highest share (about 50 %) of good highly productive mulberry varieties at the field level. During the Soviet times about 350 ha and 250000 single trees were planted annually. The dwarf leaf disease was discovered on only few trees for the first time in 1963 at the Kutaisi Regional Sericulture Experiment Station in Western Georgia. Until 1968 the disease spread already in 20 provinces and then infected the mulberry trees in whole Western Georgia, destroying more than 10 million trees out of the total 12.7 million. For the fast spread of the disease helped that the basic mulberry variety at that time, called "Georgia" appeared to be very sensitive to the disease.

The disease attacks whole the crown of the tree. The disease is spread by infected saplings or cuttings through the mulberry cicada Hishimonus sellatus Uhler. The disease agent is micoplasma like organism.

The disease manifests the following symptoms: the leaf size get smaller, the infected leaves have oblong and protuberant shape, the leaves look like wrinkled. The infected leaves become pale-green or yellow – green. The infected shootlets have shorter internodal distance and their length is also much shorter than the healthy ones. Sometimes it could be observed together infected and healthy shoot at one same tree. The symptoms of the disease absent at the beginning of vegetation period. The first symptoms appear in May on the top leaves of the shoot. In highly infected trees the shoots and branches get dry and even all the tree dry later. The disease decreases markedly the leaf yield of the infected trees and the harvest of seedlings and saplings in the nurseries.

Some of mulberry varieties are very sensitive to the disease, but some are comparatively tolerant.

On the tolerant varieties the symptoms of this disease appear in much less extent, mainly as wrinkles on the leaf surface.

Measures for the disease control: 1. In the regions where the disease appears for the first time the infected trees must be eradicated and burnt. 2. The production of mulberry saplings and cuttings in the infected regions must be forbidden. 3. To plant in the infected regions only tolerant to the disease mulberry varieties. 4. In the infected regions to start earlier the spring rearing and not to make summer-autumn rearing. 5. To treat 3 times (second half of May; July; September) the trees and saplings in the nurseries by insecticide against the mulberry cicada.

Now the most popular varieties in the country are the Georgian Imereti 90, Saamo 91, Racha 9, Racha 10, Egrisi, Novogruzinskii 2, the Japanese Oshima, Ichinose, Kairio Roso, Rokoko Jaso and the Chinese Roso.

In Georgia planting of peas as inter cropping in the mulberry gardens used to be popular, because the crop was harvested during the first decade of May or before mulberry pruning. Other inter crop was soybean, combined with maize.

A big problem in some regions was that the mulberry plantations were too far from the rearing houses. In some case the mulberry leaves were transported from 300 – 350 km.

Other problem now is the comparatively too high state tax (15-18 US$/ha) for the land planted with mulberry, while the acceptable tax should be 1.5 – 2 US$ only. For example Georgian silk corporation has some mulberry plantations, left as forsaken because they can not afford to pay the too high land tax.

Now about 4 million mulberry trees are available in Georgia. Nearly 50 % of them are of highly productive good varieties which has been very good achievement for the country. The form is middle to high stem (1.5 – 2 m height). Only about 20 % of the trees were planted as compact plantations. Most of the single trees are situated near the fences of the farmer's yards. The average leaf yield per one single tree is about 10-12 kg.

It has been proved by Sericulture institute that the most suitable type of plantation for Georgia is low stem- 40-60 cm, 3/1.5 m and 2200 trees per ha. In each 4-5 years one year should be without autumn rearing for giving rest to the mulberry trees.

The main characteristics of some Georgian mulberry varieties are presented in Table 3.

Table 3.

Characteristics of some Georgian mulberry varieties

Varieties	Parameters	
	Leaf size(cm)	Leaf yield per ha in kg
Iverija	32X20	12000
Gruzniish 4	20X18	11000
Imeruli 1	17X20	9800
Imeruli 2	21X17	9800
Gurija 10	20X15	6500
Gurija 20	15X11	8000
Kolheti 85	20X18	7300
Rioni	20X16	9300
Digomskaja 125	19X16	9500
Tbilisuri 2	21X17	7500

3.3.5. Silkworm egg production

Two P_3-P_1 egg production stations in Thelavi and Tzulukidzevi were opened in 1958 and 1960 respectively. It improved markedly the quality of parental eggs. Now 2 P_3-P_1 egg production stations and 4 F_1 egg production factories still remain, but all of them are not functioning. A part of the technical staff is still preserved. The ongoing relevant technology for maintenance of the parental pure lines is theoretically correct but practically incorrect with some modification applied due to the lack of finances. As a result the pure lines have been deteriorated and now they can not be used for egg production. The Pasteur's cellular method with isolation of only 3 mother moths for egg laying together is practiced for a safe pebrine control.

The average annual capacity of one silkworm egg production factory was 15-40000 boxes of F_1 eggs.

Currently the old silkworm pure lines are completely withdrawn from the P_3-P_1 egg production stations due to their low productivity, but instead of them new lines are not introduced. Correspondingly no any hybrid silkworm eggs from the new lines is prepared and a certain vacuum has been formed.

Now the system for testing of newly bred silkworm hybrids is not very perfect. Before the testing was made at 5 different places but now it is made at 2 places only.

The main productivity characters of newly bred silkworm lines and commercial hybrids in Georgia are presented in Tables 4 and 5.

From the data presented in Tables 4 and 5 it could be concluded that the newly bred at Sericulture institute silkworm lines and commercial hybrids demonstrate a comparatively high productivity at laboratory level.

Table 4.

Main productivity characters of the newly bred silkworm pure lines in Georgia

Characters	**Asga**	**D-6**	**D-7**	**D-1**	**D-3**	**PK-43** (parthen)	**PK-31** (parthen)	**PK-33** (parthen)
Hatchability (%)	94.30	96.30	97.50	95.90	93.80	91.40	91.50	92.12
Larval duration (days)	30	29	29	28.50	29	29.30	30	30
Pupation ratio(%)	97.30	94.60	94.40	91.90	91.60	96.90	98.30	96.60
Fresh cocoon weight(g)	2.02	2.02	2.15	2.40	2.20	2.03	1.90	1.81
Shell percentage (%)	23.90	22.00	23.90	24.90	22.80	21.20	21.80	22.18
Single cocoon filament length(m)	1279	1230	1348	1581	1525	1210	1112	1091

Table 5.

Main productivity characters of the newly bred F1 silkworm commercial hybrids in Georgia

Characters	**D1 x D3**	**PK 31 x ASGA**	**PK 43 x D6**	**PK 43 x D7**	**PK 33 x ASGA**
Hatchability (%)	97.00	97.60	96.20	95.50	97.90
Larval duration (days)	27	30	28	28	30
Pupation ratio (%)	95.00	98.00	96.20	95.80	98.60
Fresh cocoon weight (g)	2.08	2.00	1.96	1.92	2.03
Shell percentage (%)	23.00	23.40	23.20	24.00	23.50
Single cocoon filament length (m)	1546	1266	1506	1533	1303

3.3.6. Silkworm rearing houses, equipment and fresh cocoon production

In Georgia the silkworm rearing has always been practiced as an additional activity. The principle basic traditional cultures are grapes, wheat, maize, tea, fruits and vegetables. The domestic animals grown by the farmers are cows, horses, donkeys, pigs, goats, sheep, hens, ducks and turkeys.

The principal industrial and technical means are ploughs, manual cultivators, manual sprayers and small tools. For soil cultivation they use their own pushing power as horses, buffalo and ox. When treating soil they use tractors, hiring them from private owners, which is too costly and not every farmer could afford it.

In Georgia, the centralized egg incubation and giving newly brushed larvae to the farmers was initiated in 1927. The lowest labor expenses reached in Georgia at big rearing in state farm were about 155 h/box of silkworm eggs or 5.2 h/kg fresh cocoon. However the average for the country labor expenses per 1 kg fresh cocoons were as high as 8-10 h.

Since the beginning of 1970's efforts have been made to adopt the centralized young silkworm rearing in Georgia but due to some management mistakes and difficulties they couldn't achieve any success.

It was estimated that the optimal volume of silkworm rearing for Georgia was 2 boxes/family.

Sometimes the silkworm egg hatchability was too low. The larval mortality due to diseases like NPV, flachery and muskardine was about 15 %.

All the farmers used natural mountages only, made by branches of some trees or grasses, which resulted in 20-27 % defective cocoons. Even the share of bottle brushed mountages made by straw was negligible.

There were 2 organization forms of silkworm rearing in Georgia. The first one was when each member family of the State cooperative farm reared 1-2 boxes at their home. This type of silkworm rearing was prevailing and the share of big silkworm rearings at State cooperative farms with 10-20 boxes each was 1-2 % only in Georgia.

It should be underlined that with the small silkworm rearing units at the farmers houses the sericulture appeared to be an exception from the completely cooperative agriculture in the former SU. According to the communist ideology a lot of efforts were made by the government to organize big silkworm rearing farms, but they failed because the costs made sustained a loss of about 30 %, compared with the gross income from selling the fresh cocoons.

During the Soviet time the cocoons produced by the farmers were not paid based on their value, but the State cooperative farm paid wages to the farmers according to the working days. After the middle of 70's the payment system has been changed and the farmers started to receive the price of cocoons minus the costs for silkworm eggs, chemicals and paper. Generally at the SU period the government paid more attention to the quantity than the quality of the cocoons.

The production costs of fresh cocoons were too high because of high labor expenses, low cocoon yield per box, low cocoon quality, the remoteness of mulberry trees from the rearing houses.

The summer – autumn silkworm rearing had been started to be practiced since 1931, however the cocoon yield was very low. It starts usually in the second half of August. Usually the summer-autumn silkworm rearing had been practiced only in these years when the plan for cocoon production couldn't be fulfilled by the spring rearing. The Sericulture institute made a

20 years research work, resulting in working out of appropriate technology for summer-autumn rearing.

More than 60 % of the Georgia's territory is hilly and mountainous. In most of these regions the climatic conditions are suitable for mulberry cultivation and harvesting for silkworm feeding. Even though the government tried to adopt sericulture in these regions they failed because mainly to the lack of experience for larval rearing in the local farmers and poor extension services.

However in the recent years the farmers from the Western subtropical region of Georgia started to deal with more profitable agriculture crops, like tea, citrus etc. and gave up sericulture. So now the Eastern part and the hilly / mountainous area of the country have bigger potential for sericulture development than the Western part. In these potential sericulture regions of Georgia the most suitable type of mulberry plantations would be as single high/middle stem trees, situated along the streets and around the peasant's yards. Since the land in Georgia is generally not sufficient for the needs of rural population, some small (0.1 - 0.5 ha) compact low/middle stem mulberry gardens could also be established nearby the villages.

The costs for production of 1 kg fresh cocoons in Georgia have been estimated as follows:

Labor: 4 h (1/2 man day) x 2 US$ =1 US$

Mulberry leaves: 0.6 US$

Silkworm eggs: 0.162 US$

Paper: 0.08 US$

Leaf transportation: 0.05 US$

Amortization of the building: 0.25 US$

Total: 2.142 US$

However the farmers do not have any expenses for the mulberry trees because they are old and planted by the State cooperative farms. They also do not have costs for amortization because they grow the silkworm larvae in their living houses during the young ages and in some lighter buildings such as sheds, attics etc. during the last 2 instars. Therefore the real costs are 1.29 US$/kg fresh cocoons.

If the average purchasing price is 2 US$/kg a farmers family, producing 100 kg fresh cocoon would receive for their labor 162.8 US$. The labor costs for production of 100 kg fresh cocoons are 50 man days or the payment for one man day is 3.26 US$. Hence if the purchasing price of fresh cocoon in Georgia will be determined as 2 US$/kg the silkworm rearing would be profitable for the farmers. However in the recent years the cocoon price was 1 US$/kg only and couldn't cover the costs for their production. The price was also subsequently affected by its devaluation of the local currency whilst farmers waited several months for payment what forced most of the farmers to give up sericulture.

The average fresh cocoon yield per box is about 20 kg, but some good farmers obtain up to 35 – 38 kg/box.

The average gross monthly income of one farmer's family is about 30-40 US$ and they are ready to grow silkworms if the purchasing price of fresh cocoons would be higher than 2 US$/kg.

3.3.7. Fresh cocoon purchasing and processing.

The branches of Georgian silk company deal with the two major activities (cocoon purchasing and processing). The buildings for silkworm egg incubation and cocoon preservation are old but comparatively well preserved and suitable for the purpose. However the cocoon dryers are of very old type, having the lowest temperature at the beginning and the highest at the end of drying process, what deteriorates the cocoon reelability.

In Georgia a complete cocoon drying has always been practiced. The reasons were the too high air humidity and lack of enough space for preservation of incompletely dried cocoons.

The dryers capacity is from 1 to 5 t/day/dryer.

The costs for production of 1 kg dried cocoon, if the fresh cocoon price is 2 US$/kg estimated are as follows:

Fresh cocoons: 2.7 kg x 2 US$ =5.4 US$

Drying costs: 1 US$

Total: 6.4 US$

These costs could be decreased by decreasing the amount of fresh cocoon needed to produce 1 kg dried cocoon. In this case the costs would be:

Fresh cocoons: 2.5 kg x 2 US$ =5 US$

Drying costs: 1US$

Total:6 US$

The specific problem of Georgia is that the drying costs were abnormally high, reaching 3-4 US$/kg dried cocoons. The reasons were the very old dryers, high price for the fuel, high depreciation costs, high tax for the land and the old debts.

3.3.8. Raw silk reeling and twisting.

The company “Chicnaury J.S.C. in Telavi dealt with dried cocoon purchasing, silk reeling and twisting.

The company is 100 % private and stopped completely its activity in 2000. The reason on stopping of the work was attributed to the high cost of silk production which was US$23 per kg while the one customer from Iran found, suggested only 16.5 US$/kg.

The silk reeling machines are very old “Batalia” system, from the 30’s of the last century. The silk winding, doubling and twisting machines are Soviet made and also old. Might be after fixing, about 30-40 % of the machines available could be used but by these machines is not possible et all to produce high quality silk.

The costs for production of 1 kg raw silk if the costs for 1 kg dried cocoons were 6 US$ are as follows:

Dry cocoon: 3.5 kg x 6 US$ =21 US$

Reeling costs: 8.45 US$

Total: 29.45 US$

These costs could be decreased by higher raw silk percentage and in this case they would be:

Dry cocoon: 2.8 kg x 6 US$ =16.8 US$

Reeling costs: 8.45 US$

Total: 25.25 US$

It could be concluded that the lowest costs for production of 1 kg raw silk in Georgia now and for a period of 3-5 years ahead are 25.25 US$/kg. Including the commercial margin that means 29 US$/kg raw silk.

The raw silk quality depends mainly on:

1. Cocoon quality. The cocoon quality depends on:

*genetic potential of the silkworm hybrid for giving higher shell weight (more than 400 mg), higher shell ratio (more than 21 %), high reelability (more than 80 %), long single cocoon unbreakable filament length (more than 800 m), high raw silk percentage (more than 38 % based on the dry cocoon weight).

*optimal silkworm rearing conditions

*appropriate technology for cocoon drying and assorting

2.Use fully automatic silk reeling machines

Unfortunately all the major factors in Georgia were too far from the desired. The genetic potential of the local hybrids was too low, the rearing technology wasn't the optimal and the silk reeling machines were of the old Italian "Batalia" type. As a result the raw silk quality and its market price were also too low.

3.3.9. Silk weaving and fabrics production.

The joint-stock company Tbilsilk "Tsisartkela" was founded in 1929 and it appeared to be one of the biggest enterprises of weaving industry of Georgia. The factory has silk twisting, weaving, degumming, dyeing, printing and finishing. This company used to produce and still is able to produce materials for dress, suit, lining, coat, decorative etc. with different width, made from different raw materials. The pure silk materials produced by the company were rendered with gold medals and diplomas on prestige international exhibitions. Before the company used to produce about 22 million linear meters of fabrics, and out of them 660000 m pure raw silk fabrics. The capacity of fabrics processing and finishing is for about 3 million meters.

In 1998 the factory manufactured a fabric from the yarn made of Georgian cocoon of silkworm breeds Mziuri 1 and Mziuri 2. At the international exhibition, organized in Spain this fabric, by the resolution of the European quality committee, was granted the highest prize - Platinum Star.

For the last 10-12 years the company has nearly stopped its production due to absence of any markets. However the company has preserved the machines and equipment for the entire cycle of technological process and a part of the highly qualified engineer and technological staff.

The company was completely privatized through buying the main part of shares by the managerial team. Together with the lack of markets the company suffers by old debts to the government and lack of working capital. According to them some foreign investors showed their interest to invest money and to provide market for production of silk/rayon fabrics.

Since this company saved their techniques and human resources for production of silk fabrics, if they solve their market and financial problems the company could be considered as a potential buyer of the raw silk produced in Georgia.

The estimated costs for production of 1 linear meter undecorated silk fabrics are as follows:

Raw silk: 0.080 kg x 29 US$ =2.32 US$

Transportation: 0.008 US$

Auxiliary materials: 0.008 US$

Operating costs:

Salary: 0.11 US$

Fuel: 0.05 US$

Electricity: 0.03 US$

Water: 0.008 US$

Depreciation: 0.046 US$

“branch” costs: 0.03 US$

factory costs: 0.023 US$

others : 0.008 US$

Total:2.64 US$

The costs for production of 1 linear meter of decorated silk fabrics are as follows:

Raw silk fabrics: 1.03 m x 2.64 US$ = 2.72 US$

Aux. Raw material: 0.039 US$

Operating expenses: 0.039 US$

Total: 2.80 US$

3.4. Present annual capacity for production.

Although the cocoon/silk production in Georgia have been stopped during the last several years the country managed to preserve most of the human resources, the infrastructure, machines and equipment.

According to the Georgian sericulture experts now the country has the following potential for production:

-incubatories: 60000 egg boxes/year

-farmers who have mulberry trees, rearing houses and equipment: 5000

-capacity for cocoon drying and storage: 1500 t fresh cocoons/year.

-capacity for raw silk production: 100t/year(low quality).

-capacity for silk fabrics production: 800000 m/year.

3.5. Sericulture genetic resources

There are 92 mulberry varieties maintained at Sericulture Institute, including 26 Georgian, 25 Japanese, 8 from Uzbekistan, 17 from Azerbaijan, 6 Russian, 6 Ukrainian, 1 Bulgarian and 1 Italian.

The Sericulture institute tested 239 mulberry varieties for their tolerance against the dwarf leaf disease. The tested varieties were from the SU republics (Georgia, Azerbaijan, Uzbekistan, Ukraine, Russia) as well as from Japan, Europe, China and Korea. Their tolerance was tested by using natural disease incidence in Western Georgia region and artificial infection as well.

The varieties were distributed in 4 groups according to their tolerance, namely tolerant (up to 10 % infected); comparatively tolerant (up to 25 % infected); moderately sensitive (up to 50 % infected) and highly sensitive (more than 50 % infected). Out of the 239 varieties tested 25 appeared as tolerant, 84 as moderately tolerant, 72 as moderately sensitive and 57 as highly sensitive. The tolerance to the disease was expressed as fast regeneration of the infected trees and giving approximately normal leaf yield.

It was detected that the tolerant varieties generally manifest smaller size of the cells, bigger amount of physiologically active cells, more fibre content in the shoots.

Each mulberry variety in the collection is maintained in volume of 10 trees, 3/3 m planted having 1 m stem height. The trees are bottom pruned every year, during the period 20.05. – 05.06.

Before there were 130 silkworm accessions maintained as genetic resources at the Sericulture Institute. However now due to lack of sufficient finance the number of silkworm accessions available is 56, including 32 Georgian, 8 Chinese, 6 Ukrainian, 5 from Uzbekistan, 4 Japanese and 1 Indian. Both mulberry and silkworm genetic resources are maintained by correct methodologies.

3.6. Strategy for sericulture revival and development in Georgia

In the end of 2004 the Georgian government submitted officially to FAO a draft TCP project proposal on revival of sericultural industry with a request for funding. This project is still under evaluation in FAO.

After a successful implementation of sericulture revival and development project in Georgia the fresh cocoon production could reach 2500 - 3000 t/year, raw silk production – 300 - 400 t/year and about half million farmers would get income from sericulture and could probably earn approximately US$450-500 per crop/family and also expect to have a potential for possible income of more than US$1500 - 2000 per hectare and year from mulberry plantations. Another about 15000 people will be hired in the cocoon/silk processing industry sector, getting salaries of US$ 1.5 – 2 million /year. The project implementation would contribute to decrease of unemployment in the country, which is still comparatively too high.

FAO assistance has been requested to strengthen the managerial and technical capacity of Educational-Research Institute of Sericulture (ERIS) – Tbilisi, the Georgian Silk Corporation “Sakabreshumi” – Tbilisi and farmers for developing a disease-free silkworm egg and cocoon production system, effecting in high raw silk quality production, which corresponds to the international market standards and promotion of silk handcraft production.

OBJECTIVES OF THE ASSISTANCE

The objectives of the project are to assist improvement of the silkworm egg and silk quality, diversification of silk commodities produced in Georgia aiming to explore markets for the silk products and to revive cocoon/silk industry by means of introducing improved technical and managerial systems in the silkworm egg/cocoon/raw silk production and in mulberry cultivation.

EXPECTED OUTPUTS

1. Strengthened technical and managerial capacities of ERIS – Tbilisi for disease-free silkworm egg production, mulberry cultivation for high yield of leaves, silkworm disease control and cocoon quality control.

2. Improved basic infrastructure of silkworm rearing houses/equipment at both institutional and field level.

3. Establishment of three "model farms" in order to transfer commercially-oriented managerial and technical methodologies to sericulture farmers.

4. Providing modern cocoon dryers and a fully automatic silk reeling set (200 ends), consultancy, training and equipment for production of high grade raw silk 3A – 4 A.

5. Recommendations for achieving 3A and 4A raw silk quality through improvements at the institute/farmers/cocoon purchasers/silk reelers levels.

6. Providing consultancy, training and handloom set for processing the inferior quality cocoons into hand – woven silk fabrics and silk handcrafts.

7. Recommendations for an improved operational system for local cocoon/silk marketing.

WORK PLAN

1. Nomination of National Project Co-ordinator (NPC). Identification of one international consultant in silkworm breeding/egg production and two national consultants in the silkworm rearing technology, facilities and equipment and moriculture for multi-cropping system. (July 2006)

2. An international consultant (team leader) will be fielded to the project in September 2006 (as early as possible) and make a primary surveys to assess fact – findings at the field level for further discussions on work plan and implementation etc. to accomplish the proposed project objectives.

3. One national consultant in silkworm rearing will be recruited to assist ERIS, "Sakabreshumi" and the demonstration farms in establishing a local cocoon marketing system and to provide advice on technology improvements in silkworm rearing technology and management.(May and June ; September and October 2007)

4. One international consultant in silkworm breeding / egg production will be fielded to the project in May / June 2007 and March/ April 2008 in order to assist the ERIS in establishment of modern disease – free silkworm egg production system.

5. One national consultant in moriculture will be recruited to assist ERIS in improving relevant technologies for mulberry cultivation and establishing multi-cropping system at the field level (May and June; September and October 2007).

6. The list of essential equipment and materials will be finalised in consultation with the international consultant (team leader) for further processing and procurement (September 2006).

7. Three demonstration farms will be established and operated in consultation with international and national consultants (May 2007-April 2008).

8. One international consultant in silk reeling and processing will be recruited to assist ERIS and "Sakabreshumi" to provide advice on technology improvements in silk reeling

factories and silk testing facilities, and on potential internal and external raw silk/silk allied products markets (May 2007 and April 2008).

9. In-service training on various aspects of sericulture will be organized under the technical guidance of the international consultants and the national counterpart staff (May/June and October/November 2007; March/April 2008).

10. A "study tour" will be arranged to send two government officials to China and Thailand (October 2007).

11. Technical backstopping missions by FAO staff should be provided at both the beginning and the end of the project period, to assess on-going activities, review the work plan and evaluate outputs.

CAPACITY BUILDING

The project focuses on capacity building through formal and informal training activities. National counterparts and consultants will gain further valuable expertise through interaction with international consultants.

INPUTS TO BE PROVIDED BY FAO

Personnel

- One international consultant in silkworm breeding and egg production for 5 p/m in 3 visits (US$40 000).
- One international consultant in silk reeling, processing and potential cocoon/silk market development for a period of 2 p/m in 2 visits (US$16 000).
- One national consultant in moriculture for a period of 4 p/m (US$4000).
- One national consultant in silkworm rearing technology, facilities and equipment for a period of 4 p/m (US$4000).
- Two technical backstopping missions from FAO Headquarters (Rome)

Official Travel

- Up to US$ 5 000

Materials and Supplies

- Up to US$ 12 500

Equipment (see Annex 1 for details)

- Up to US$ 128 000

General Operating Expenses

- Up to US$10 000 including preparation of terminal statement

Direct Operating Expenses

- Up to US$ 17 370

Training (US$28 500)

- Study tour:

Two technical staff (managerial level) in silkworm breeding/egg multiplication and cocoon/silk reeling and processing will be sent to China and Thailand for seven days in each country in order to become acquainted with advanced technical and operational system of relevant areas.

Air-ticket	2 x US$3 500	= 7 000
DSA	2 x US$150 x 15 days	= 4 500
Fees	2 x US$1500	= 3 000

- Farmer's Training Workshops (US$ 14 000)

PROJECT BUDGET COVERING FAO INPUTS

(in US$)

Country: **Georgia**

Project Title: **Revival of sericultural industries through silk commodity and business development in Georgia**

Project Number: **TCP/GEO/……**

	US$
International Personnel	56 000
National consultants	8 000
Supervisory Technical Services (STS)	24 630
Standard Supervisory Technical Services (7 500)	
Supervisory Function of Lead Technical Units (1 170)	
Field Visits by Technical Officers (14 960)	
Thematic Evaluations (1000)	
Sub-total Personnel	**88 630**
Official Travel	5 000
General Operating Expenses	10 000
Materials and Supplies	12 500
Equipment	128 000
Direct Operating Expenses	17 370
Training	28 500
TOTAL	**290 000**

Chapter 4. Major Problems and Issues, and Recommendations

The main constrain now is the critical decline of the cocoon/silk production for the last several years due mainly to lack of markets, destroy of silkworm egg production and extension service system. Even though Georgia still have managed to preserve the infrastructure for cocoon production, if this situation continues longer all will be lost irreparably. Therefore the most urgent problem for the country is to restart the cocoon/silk production.

Other problems, facing Georgian sericulture revival and development are:

- Lack of sufficient computers, internet and security system at the sericulture museum and library.Some of the old and precious books need for innovation to be preserved further.
- The dwarf leaf disease, which infected mostly the plantations in the Western Georgia in the past now has started to appear in the Eastern part of the country.
- The existing in the past system for extension work in sericulture has been destroyed.

Even though the cocoon/silk production in Georgia has temporary been stopped for the last several years the country still has very high potential for sericulture development based on the following grounds:

- long tradition and experience in sericulture and favourable climatic conditions allowing to produce high quality bivoltine cocoons.
- availability of more than 4 million mulberry trees all over the country, which are enough for production of about 1500 t fresh cocoon/year and 180 t raw silk/year.
- the sericulture science and genetic resources are still preserved.
- the still preserved network for silkworm egg/larvae distribution, cocoon purchasing, drying, assorting and storage.
- Georgia is comparatively near to the big European market for high quality raw silk in Italy and France and could be created as an alternative source.
- there is still preserved national tradition in Georgia for making hand - made silk fabrics on hand looms.
- the wages in Georgia are still too low and the unemployment is very high , especially in the rural areas.

Chapter 5. BACSA Development Strategies

Since the main activities of a future possible regional project would be exchange of training of the participating countries, exchange and testing sericulture germplasm resources, techniques and methods it could be considered that Georgia can be included in this project because of the following reasons:

- There are old and comparatively big sericulture research institute, having highly qualified and experienced research staff.
- Georgia has unique sericulture museum and library.
- Georgia has comparatively rich sericulture genetic resources.

It could be concluded that Georgia has what to share with the other project participating countries.

Chapter 6. Annexes

Annex 1

EQUIPMENT, SUPPLIES AND MATERIALS NECESSARY TO BE PROVIDED THROUGH A TCP PROJECT

A. EQUIPMENT	**US$**
Automatic formalin sprayers (2)	3 500
Digital balances with software(2)	8 000
Computers with accessories and software(5)	5 000
Small-scale cocoon dryers(2)	15 000
Set of fully automatic silk reeling machine(200 ends)	80 000
Set of handlooms, warp and weft winder and sectional wrapper	7 000
Microscopes (5)	2 500
Equipment for demo farms	7 000
Sub-total	*US $ 128 000*

B. SUPPLIES AND MATERIALS	
Chemical reagents	2 500
Disinfectants	1 500
Dried cocoons for testing	6500
Others (literature, etc.)	2 000
Sub-total	*US $ 12 500*

Follow – up activities of Tashkent Workshop and National strategy for sericulture revival and development in Greece

By

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Second Executive Meeting of Black, Caspian seas and Central Asia Silk Association (BACSA), 9 March 2006, Bursa, Turkey

Food and Agriculture Organization, Rome, Italy

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ABSTRACT

After the dramatic declining of the sericulture worldwide, a regain tendency is being observed in the last few years in Greece. This was mainly triggered by the programmed changes in the agricultural policy within the European Union, in combination to the increasing demand for natural and biological products. These facts reflect directly to changes in the up to date structure of the crops which in many cases lead to replacement of traditional annual crops and push the farmers to seek other options for their activities. Silkworm rearing still remains as a promoted activity in the European Union and on top of that the replacement of traditional annual crops by perennial ones, like trees, including mulberry, is promoted as well. The above reflect to a combined support of silkworm rearing and bring Greece to a beneficial position since sericultural activity, by means of silkworm rearing, is restricted only in the south temperate part of Europe. Taking in consideration that the silk reeling and processing industry can be subsidized as well within the European and national development programs, it becomes obvious that sericulture farmers and silk processors, especially in traditional sericulture areas, could re-gain the ground of the field, ensure a reasonable income through it, contribute to resolution of unemployment problems and provide to the consumers high quality products under reasonable prices. The demand for silk products both, in Greece and Europe, appears steadily growing and is mainly covered by imports since the local production doesn't cover it. This creates also opportunities for the development of silk product processing and distribution centres, which could activate the local production of silk products, give additional reasons for the development of the local sericulture and create connections with other countries where such activities exist. Greece, due to its geographic position and its membership in the E.U. could successfully be involved in such activities, both, alone or in cooperation with other countries. Pointing to these topics an International Workshop on Revival and Promotion of Sericultural Industries and Small Enterprise Development in the Black, Caspian seas and Central Asia Region was supported by FAO and held in Tashkent, Uzbekistan 11-15 April 2005. During the workshop an association concerning these topics was established, under the acronym BACSA., which Greece became a member of. Follow – up activities after that took place in Greece, at governmental, scientific and private sector's level. Through these activities the importance of sericulture for the country was underlined, useful information was provided to the farmers and the private sector and the role of Greece in connection to BACSA and the Black and Caspian Seas Region was investigated and promoted.

Key words: sericulture, silk, Greece, revival, development

Chapter 1. Introduction

After the dramatic declining of the sericulture worldwide and in Greece as well, a regain tendency is being observed in the last few years in Greece. This was mainly triggered by the programmed changes in the agricultural policy within the European Union, in combination to the increasing demand for natural and biological products. The programmed new directions in the European agricultural policy reflect directly to changes in the up to date structure of the crops, changing mainly the subsidies system, which in many cases leads to replacement of traditional annual crops, like the industrial ones, and push the farmers to seek other options for their activities. Silkworm rearing still remains as a promoted activity in the European Union, subsidised by €132 per box of reared silkworm eggs, under the condition of presenting a minimum quantity of cocoons produced per box. In the other hand the replacement of traditional annual crops by perennial ones, like trees, including mulberry, is promoted as well within the European Union, being subsidized. The above two subsidies reflect to a combined support of silkworm rearing, both as direct rearing and as mulberry cultivation as well. Sericultural activity though, by means of silkworm rearing, is restricted, due to climatic conditions, only in the south temperate part of Europe, and from this point of view Greece can be considered as one of the most suitable for rearing European regions. Taking in consideration that the silk reeling and processing industry can be subsidized as well within the European and national development programs, it becomes obvious that sericulture farmers and silk processors, especially in traditional sericulture areas, could re-gain the ground of the field, ensure a reasonable income through it, contribute to resolution of unemployment problems and provide to the consumers high quality products under reasonable prices. The demand for silk products both, in Greece and Europe, appears steadily growing and is mainly covered by imports since the local production doesn't cover it. This creates also opportunities for the development of silk product processing and distribution centres, which could activate the local production of silk products, give additional reasons for the development of the local sericulture and create connections with other countries where such activities exist. Greece, due to its geographic position and its membership in the E.U. could develop such centres being concerned in processing local and imported raw materials and distributing their and other imported silk products either locally or within the E.U. The Black and Caspian Seas Region could be a good partner to the above proposed centres since there exist all the range of the silk industry and the small silk enterprises.

Chapter 2. Follow-up activities of the "International Workshop on Revival and Promotion of Sericultural Industries and Small Enterprise Development in the Black, Caspian seas and Central Asia Region, Tashkent, Uzbekistan 11-15 April 2005"

2.1. Activities at the Governmental level

At the governmental level and apart of the routine promotion of sericulture, it has to be underlined that after an initiative of the ministry of Agricultural Development, Greece recently became officially a full member of the International Sericultural Commission, something which brought the country into the family of all sericultural countries. As a full member, Greece participated to the XXth International Congress of the Commission, held in Bangalore, India on December 15-18, 2005. In this Congress a paper was presented orally, under the title "**Sericultural activities in Greece, Back round – recent situation – aspects and prospects"** by the authors Kipriotis Evripidis, M.Sc. (National Agricultural Research Foundation (N.AG.RE.F.), Komotini Agricultural Research Station Merarhias Serron 18, Komotini 69 100, Greece) and Tzitzinakis Marios (Ministry of Agricultural Development, Animal Production Directorate, Kapnokoptiriou str, Nr 6, Athens, Greece.). Simultaneously

to the presentation, some information was given to the congress attendants, about the Black, Caspian seas and Central Asia Silk Association (BACSA) creation during the International Workshop held in Tashkent, Uzbekistan, under the FAO support.

In addition to the above, a "Silk Festival" had been financed for second time by the prefecture of East Macedonia and Thrace in Greece and the Municipality of the Soufli town in northern Greece, which is situated in an area highly activated in silkworm rearing and silk processing. The festival was organized by the Municipality and was held in the Soufli town during the last week of August 2005. It has been promoted very well and the participation from regions all over Greece was very high. It would be a very good idea this festival to be organized next year in cooperation with BACSA and with the participation of other Black, Caspian seas and Central Asia countries, in order to represent a first contact point between people, trait and silk products, as it has been suggested during the Tashkent, Uzbekistan International Workshop. It would be also a very good idea this festival to be organized every year in another Black, Caspian seas and Central Asia country, starting from the neighbouring countries, Bulgaria and Turkey.

The governmental policy around sericulture continued, giving support to silkworm farmers by providing information, free silkworm eggs and administration support for the silkworm and mulberry subsidies. Due to these efforts the reared silkworm egg boxes per year were increased by 140% the last five years and 1.000 hectares of new mulberry plantations had been established.

Due to promotion and efforts of the Ministry of Agricultural Development an interest has been created among private businessmen around silkworm egg production and the first official license was given to one of them. It is expected that these people in cooperation with the Greek institutes and Universities could be successfully involved into these business.

2.2. Activities at the level of the Komotini Agricultural Research Station

The routine research activities of the Komotini Agricultural Research Station were continued normally. The silkworm germ bank had been maintained and besides that selection has been applied upon the maintained silkworm pure lines. Besides the applied selection a crossing program is being followed and a series of silkworm hybrids are produced through crosses between the maintained silkworm pure lines. These hybrids are being tested for evaluation and the most successful of them will be proposed for distribution. Besides the above tasks the maintained in the station mulberry varieties had been evaluated, concerning their adaptation to the local environment, and useful information has been prepared for the benefit of the farmers.

Among the other activities of the station some comparative tests of Uzbek, Chinese, Turkish and Greek silkworm hybrids had been performed for their evaluation and further distribution to the Greek silkworm rearers. Very interesting and useful results had been obtained through these tests and they will be repeated for the next year as well. Concerning future activities, two research project proposals of a total budget of € 100.000, had been composed and submitted for approval, one to the Greek General Secretariat of Research and Technology and the other to the M.AG.RE.F. head division. The first was under the title "TESTING AND INTRODUCTION OF SOME BULGARIAN HIGHLY PRODUCTIVE SILKWORM (BOMBYX MORI L.) LINES AND HYBRIDS IN GREECE ", in cooperation with the Sericulture Department of the Plovdiv Agricultural University, Bulgaria. and the other under the title "MAINTENANCE, SELECTION AND IMPROVEMENT OF SILKWORM AND MULBERRY GENETIC MATERIAL", held alone by the Komotini Research Station.

Furthermore two important publications had been promoted by the Komotini Agricultural Research Station. The first was a 320 pages Sericulture Training manual in English, by the authors Dr Dimitar Grekov, Sericulture Department of the Plovdiv Agricultural University, Bulgaria, Kipriotis Evripidis M.Sc., Komotini Agricultural Research Station, Greece and Dr Panomir Tzenov, Vratza Sericulture Experiment Statio, Bulgaria. The second was a 38 pages monograph in Greek, by Kipriotis Evripidis M.Sc., Komotini Agricultural Research Station, Greece, describing all the silk producing insects.

In addition to all the above, all the contacts with BACSA were held by the Komotini Agricultural Research Station and all the requested information was collected, processed and sent. The main point of interest was the collection of detailed data concerning the tendencies of the Greek market around silk and silk products, its fluctuations and needs, etc, in order to be presented in the BACSA web site and in the Bursa, Turkey meeting.

2.3. Activities at private business level

At the last five years a remarkable mobility has been observed at the private business level in Greece. This mobility includes actions at the level of primary production, thus silkworm rearing, silkworm egg production and silk processing. Concerning the silkworm rearing, as it was briefly mentioned previously, although the number of involved farmers remained at the same levels for the last five years, a remarkable increase was observed upon the reared silkworm egg boxes, reaching a total number of 4.500 boxes yearly, which reflects to approximately 15 boxes reared per farmer, in contrast to the previous years where the reared boxes were 2-3 per year/per farmer. For the same period, 1.000 hectares of new mulberry plantations, with high producing imported varieties, had been established. In connection to the above it has to be mentioned that remarkable improvement is being noted around silkworm rearing technology. New modern rearing installations have been created in several Greek areas, providing sufficient space and facilities for rearing up to 400 boxes yearly. These new installations provide a total covered area of 6,500 M^2 and are situated in Soufli, Serres and Viotia areas. They have been developed by the private sector and information is given in the attached annex. Concerning the silkworm egg production, as it was mentioned, a private farmer has been involved into this field after getting the necessary license from the Ministry of Agricultural development and provided to the local market three commercial silkworm hybrids. These hybrids had been tested for their effectiveness in the Sericulture Laboratory of the Athens Agricultural University and the Komotini Agricultural Research Station and thereafter had been distributed to the farmers by the Ministry of Agricultural development for the spring rearing of year 2005. Another person from the private sector is already interested to get involved in silkworm egg production. In the field of silk processing the most important thing which has to be mentioned is the final arrangement of the necessary formalities for the Soufli Municipal Enterprise cocoon reeling plant operation. This fact will benefit remarkably the Greek silkworm industry by all means. In the first step it will contribute to higher cocoon prices for the farmer, since the produced cocoons will be processed locally with lower cost, compared to the previous one which was formed by reeling the cocoons in neighbouring countries like Bulgaria. This parameter will reflect to increasing number of silkworm rearers and further more to better supply with raw silk to the Greek industry. Simultaneously to this reeling unit, another one coming from the private sector, is already in operation. This one numbers 450 terminals and provides raw silk to the rest activities of the same person, who is involved in silk fabric production (see annex).

2.4. Field level activities

As it has already been mentioned, the main interesting point in the field activities is the establishment of 1,000 hectares of new mulberry plantations. These have been installed with

imported high producing mulberry varieties and are expected to contribute to further increase of the silkworm rearing in Greece. In this point it has to be underlined that due to the changes in the agricultural policy within the European Union there appears an increasing interest for replacement of other crops with mulberry. As it was previously mentioned this action is subsidised and in addition gives opportunities for silkworm rearing and remarkable improvement of the farmer's income. As it comes out of the existing applications for mulberry field installation through the European Union subsidies, for the next five years there will be installed in Greece 200 hectares of new, modern, mulberry field yearly. This fact in turn will is expected to increase the sericultural activities by 100%.

2.5. National meetings and conferences

No national meetings and conferences around Sericultural topics had been held in Greece for the year 2005.

Chapter 3. National strategy for sericulture revival and development in Greece

Arising through the rules of the free market and trait competition, the role of the Greek State has to be very distinctive, concerning actions for the support of several production and trait activities and besides that it has to be adopted to the general European Union directions. So the hole national strategy concerning the sericulture revival and development is based upon the above described directions and supports and more precisely to:

- Subsidies for primary silkworm rearing
- Subsidies for mulberry field installation
- Subsidies for any sort of new plants of industrial processing
- Financial support of trait through beneficial banking arrangements

All the above actually can be considered as side actions giving an aid to the field around sericulture, silk processing and silk product trait, under the strict condition of the actual competitiveness and the capability of survival of them under the rules of the free market. Of course, and especially for the silkworm rearing part, it is obvious that these actions, for the time being, create excellent conditions for the sericulture development in the country.

3.1. Brief description of the present situation of sericulture in the country

By means of fresh cocoon production Greek sericulture for the last 10 years had followed table 1 and figure 1.

Table 1

Fresh cocoon production in the last decade

Year	Fresh cocoon production tons
1995	15
1996	15
1997	19
1998	14
1999	17
2000	31
2001	36
2002	49
2003	51
2004	60
2005	69

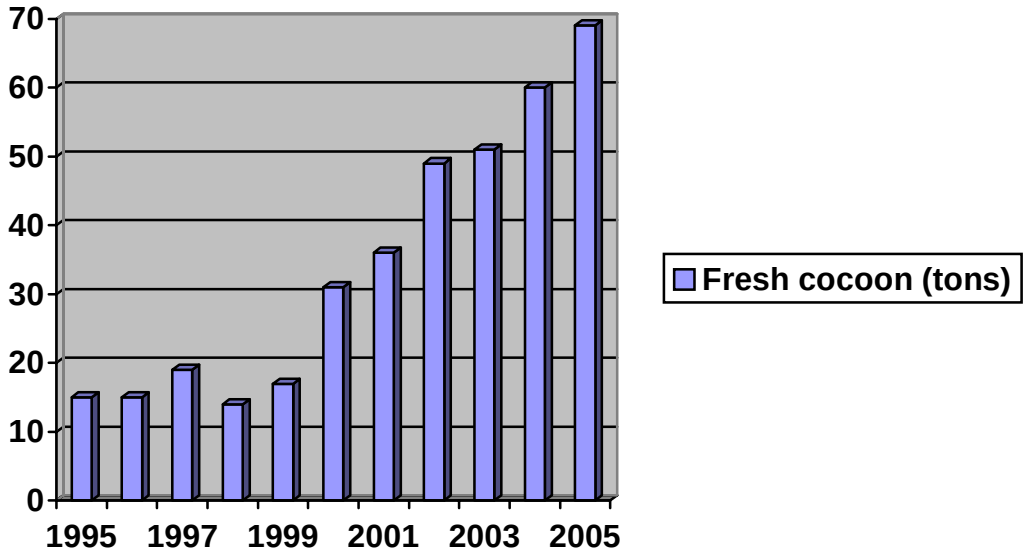

Figure 1. Evolution of fresh cocoon production for the last decade

Obviously the above described production compared to the data of other countries is rather low. It has though to be taken in consideration that the Greek sericulture had reached zero points in the last period and this rate of increasing seems to be very promising.

As far as the number of farmers involved in sericulture for the same period (1995-2005), in combination with the silkworm egg boxes reared, the situation appears in the following table 2.

Table 2

Fresh cocoon production in combination to farmers involved and silkworm egg boxes reared

Year	Number of silkworm rearing farmers	Total silkworm egg boxes reared	Silkworm egg boxes reared per farmer	Total fresh cocoon produced	Fresh cocoon per silkworm egg box kg
1995	240	890	3.70	15,000	16.8
1996	206	950	4.61	15,000	15.7
1997	238	1,020	4.28	19,000	18.6
1998	172	880	5.11	14,000	15.9
1999	188	1,200	6.38	17,000	14.1
2000	290	1,650	5.68	31,000	18.7
2001	275	2,140	7.78	36,000	16.8
2002	317	2,778	8.76	49,000	17.6
2003	324	2.943	9.08	51.000	17.3
2004	311	4.549	14.63	60.000	13.1
2005	277	3.920	14.15	69.000	15.3

As it comes out of the data of this table the number of silkworm egg boxes after a decline around 1995-1997, reaches its previous levels in year 2001 and keeps increasing after that, a tendency which is obvious and is directly connected to the European union subsidies. In contrast to that, from the data of the same table and from figure 2, it comes out that although the number of involved farmers stays stable or slightly increases, the number of boxes reared per farmer increases characteristically, which first of all means that the farmers prefer to rear more boxes of silkworm eggs, looking directly to ensure higher subsidy. In the other hand it has to be considered to this situation the participation of the application to some extend of new and modern technology in the rearing process, something which permits more than one rearing per year, as summer and autumn rearing, and also the rearing of more boxes per farmer. This seek of the farmers to subsidies of course reflects directly to their efforts for efficient rearing with high cocoon production. Since the subsidy is given per box of eggs reared, the farmers main interest is concentrated on the number of boxes reared and not on the rearing results. This is obvious in the data of table 2 and figure 3 from which comes out that as the number of reared egg boxes per farmer increases the produced quantity of cocoon per box decreases.

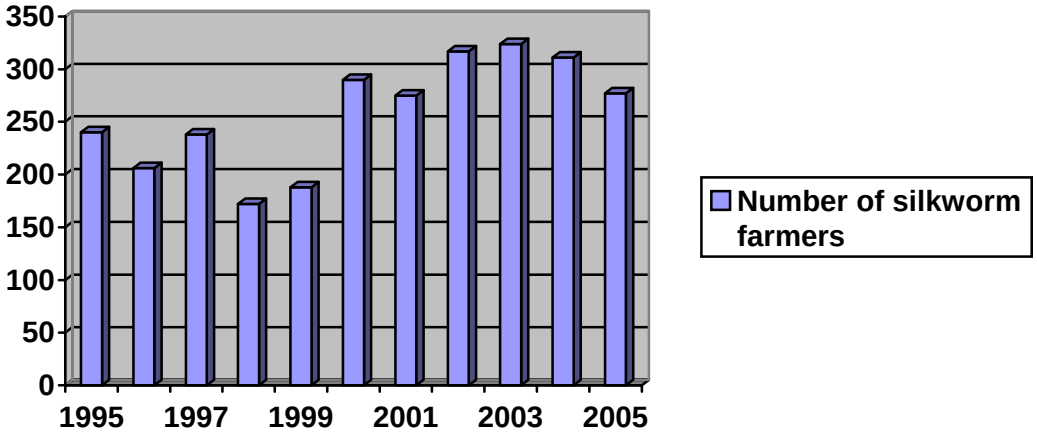

Figure 2. Number of silkworm farmers in the last decade

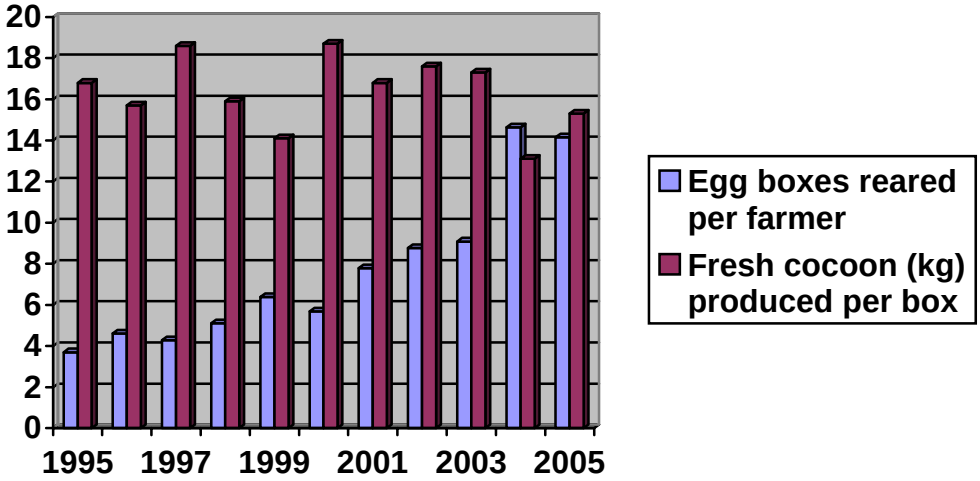

Figure 3. Fresh cocoon produced per box in comparison to number of boxes reared per farmer

As it was mentioned previously the most critical fact, which still affects the sericulture development is the replacement of the mulberry fields by other crops. Today with the support of the European Union new plantations are being installed with imported high productive mulberry varieties and under a plant density and shape which permits high production and low labour demand. By this way, as it already has been mentioned, there have been installed 1.000 hectares of new mulberry plantations, a number which is still small but it can be considered as a good start and it is sure that under the circumstances which are formed by the common agricultural policy of the European Union the installation of new mulberry fields will be continued with higher rates.

The lack of adequate cocoon reeling facilities also still affects negatively the sericulture development in the country. New cocoon reeling plants are necessary for Greece and are expected to affect positively the cocoon prices given to the farmer and develop conditions favourable for expansion of their activities, since the European subsidies combined with higher cocoon prices will form a more attractive income for the farmer and in turn more farmers will be attracted in sericulture. This will drive to a critical number of silkworm farmers which is necessary to be formed, in order to obtain a volume able to get involved in a cooperative organization of the sericultural activities themselves and cocoon processing as well.

According to the Greek National Statistics Bureau the Greek production of silk products for the last twenty years shows some very interesting characteristics which are mainly concentrated to the next points:

- The national production of silk yarn steadily decreased and reached almost zero point in 1987
- In contrast to that the national production of silk fabrics steadily increased and reached peak points in 1993 and after that declined and remained steady around 20 tons per year
- Besides that the national production of combined natural and artificial silk fabrics disappeared after year 1987.

The above facts in combination of the data of table 3 underline the role of silk yarn imports in the country which cover the entire local fabrics production, which of course is meaningless compared to the total silk fabric national consumption.

The silk fabrics produced by the Greek industry cover only a small part of the local market demand which comes from:

- Households as household goods
- Small and medium enterprises as raw material for handicrafts and decoration items
- All kind of enterprises as raw material for clothing production

The consumption of silk fabrics in Greece has rapidly increased the last years and as we see in table 4 in the last twenty years the consumption of such items increased by 3,288.4%. This situation combined to the very low local production of silk fabrics lead to a coverage of the biggest part of the local demand by importation. Presently, especially after 1989, a rapid increase of the silk fabrics import is observed, both in quantity and much more in money value (table 4 and figure 4). From 1984 to 2002 the imported silk fabrics quantities increased by 7,636% in quantity and their value respectively increased for the same period by 15,089%, partly due to the importation of more luxury and expensive items and partly to the adaptation to euro currency. This situation came as a result of the increased consumption of such goods,

but was also affected by the special agreements of the European Union with some far East countries like China, Taiwan, Korea, Thailand, and India, were from big quantities of silk products had been exported to Europe. Of course the role of the increased consumption should be always taken in consideration.

Table 3

Silk yarn imports in Greece (pure silk and silk by products) tons

Year	Imported quantity tons	Year	Imported quantity tons
1984	32.0	1994	26.3
1985	30.5	1995	24.0
1986	36.3	1996	19.5
1987	35.0	1997	17.0
1988	28.5	1998	16.4
1989	26.0	1999	14.0
1990	29.0	2000	15.5
1991	31.0	2001	14.5
1992	33.0	2002	15.0
1993	32.5		

Source: Greek National Statistics Bureau

Table 4

Silk fabrics imports in Greece (from pure silk, silk by products)

Year	Quantity tones	Increment rate (base 1984)	Value €	Increment rate (base 1984)
1984	11	100	450,476	100
1986	13	118	464,563	103
1988	15	136	661,188	147
1990	47	427	2,928,500	650
1992	82	745	5,421,500	1,203
1994	91	827	7,630,220	1,693
1996	133	1,209	9,391,049	2,084
1998	252	2,290	16,875,540	3,746
2000	406	3,690	25,355,832	5,628
2002	840	7,636	51,415,994	15,089

Source: Greek National Statistics Bureau

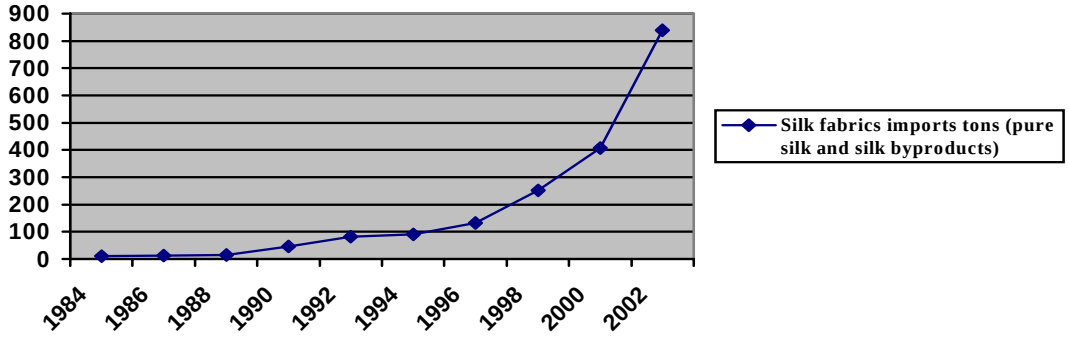

Figure 4. Silk fabrics imports in Greece (1984-2002)

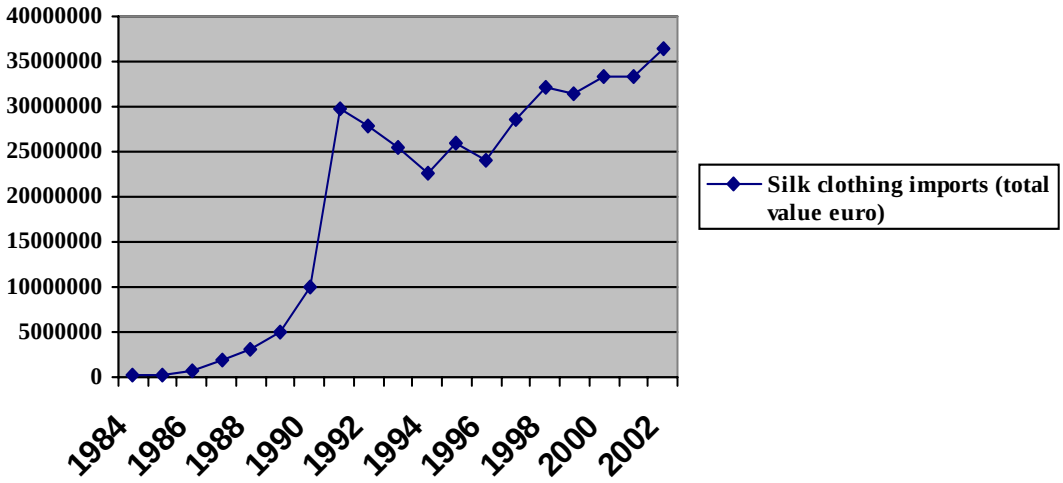

Figure 5. Silk clothing imports in Greece (1984-2002)

3.2. Major constraints for sericulture revival and development

From all the above it comes out that even though Greece has favourable climatic, political and economical conditions for sericulture development there are still some very serious constraints affecting negatively this development, such as:

- Lack of sufficient governmental technical support given by specialized personnel and Institutes
- Lack of sufficient information to the farmer level concerning the benefits of sericulture
- Slow application of adapted modern technology for silkworm rearing and breeding
- Lack of sufficient well established and organized mulberry fields
- Absence of well organized state, cooperative or private mechanisms for the absorption and processing of the produced cocoons
- Absence of sufficient own mulberry and silkworm genetic resources
- Absence of relevant technologies on effective preventive and successful control of various infectious diseases.

3.3. Prospects for sericulture development and importance for the country

All the above described constraints is necessary to be faced through an in long term carefully planed national programming. Nowadays the contributing conditions seem to be favourable for such an action and it is certain that through it sericulture will grow rapidly in Greece, being able to counteract against all problems and provide a remarkable income to the farmer. It is more than certain that the substitution of other traditional crops by mulberry will continue for long, being affected by the European agricultural policy which imposes a gradual declining of the up today subsidies for other traditional crops and thus leading to a decline of the income they could provide. Today already the subsidising of traditional crops, like cotton and other industrial ones, has been disconnected from the produced quantities and it is given as a standard sum according to the last years crop structure of each farmer and independently of what he grows every year. That means that the farmer is getting a standard subsidy and he can choose his next crops according to the income they can provide. In connection to these more farmers will be getting involved in sericulture trying to use in a profitable way their mulberry plantations and simultaneously get benefit from the E.U. subsidies for silkworm

rearing. It is important though some structures to be created in a governmental level, in order to provide the necessary information to the every involved farmers and ensure an efficient use of the mulberry fields and a successful rearing.

3.4. Strategy for sericulture revival and development during the period 2006-2010

As it comes out from all the above the today's prospects for the Greek sericulture seem to be very promising, under the conditions which are formed through the European policies and the increasing demand for quality silk products. The increasing interest of the Greek farmers is already obvious and there remains a central activation in a national level to promote and support sericultural activities. Such an activation should include steps like:

- Development of governmental technical support mechanisms given by specialized personnel and Institutes
- Support to specialized Institutes in order to develop own silkworm and mulberry genetic resources
- Provision of sufficient information upon modern technology for silkworm rearing
- Promotion of the further establishment of organized mulberry fields
- Support of cooperative or private mechanisms for the absorption and processing of the produced cocoons
- Development of mechanisms for the effective preventive and successful control of various infectious diseases.
- Development of a detailed and continuously informed data base – most possibly based upon the BACSA efforts – in order to provide continuous and relevant information to people from industry and trait.
- Active support to all BACSA activities

Chapter 4. BACSA Development Strategies

From the up to date activities of BACSA, since it was established in April 2005, it comes out that it can play a dominant role over all sericultural activities among the participating countries and other countries as well. It is a very important coincidence that FAO supports BACSA and this coincidence is it self a very serious promoting fact. Of course BACSA as a newly established association needs a wide promotion in order to be familiar to all the participating countries and worldwide as well. For this reason and as a first step attention should be given to the following actions:

- Links should be created with the governments of the participating countries through the national coordinators and to a minimal level of the ministries of agriculture.
- Links should be created with the International Sericultural Commission and with other international sericultural corporations.
- Routine meetings of BACSA should be established in combination to international scientific events and any participation to international conferences from now on should be registered as BACSA.
- Some routine ''Silk Festivals'' should be established in the BACSA participating countries starting from the most potential ''Silk product consumers'' in order to bring in touch these consumers with the BACSA countries silk products.

- Participation to international fares as BACSA should be established as well, most possibly starting from the Thessaloniki – Greece International fare "ZOOTECHNIA" or "AGROTICA", held in Thessaloniki, Greece yearly each October and February. This fare has a grate popularity and through it there could be brought in touch all the involved parts like government, farmers, cooperatives, trait, international companies and consumers.
- Apart of the created web site of BACSA attention should be given to periodic publications upon all the activities of it, scientific and other, and wide distribution of these publications to all the involved people.

At this point it has to be underlined that a strong seek for funds and sponsors should be held by all BACSA involved people, in order to be able to support some important research projects and some pilot sericultural actions. Funding like the above will bring in very close contact the production and processing site with BACSA and will contribute to its strong promotion.

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Follow-up activities of Tashkent Workshop and national strategy for sericulture revival and development in Kazakhstan

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Second Executive Meeting of Black, Caspian seas and Central Asia Silk Association (BACSA), 9 March 2006, Bursa, Turkey

Food and Agriculture Organization, Rome, Italy

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ABSTRACT

The sericulture is a traditional branch of agriculture in Kazakhstan.

Rapid development of industrial production of cocoons in Kazakhstan began in the middle of 1980th years where the general area of mulberry plantation has reached up to 1863 hectares, thus producing about 200-300 t fresh cocoon/year. In total the number of mulberry trees has made 3389 thousand pieces. And total gathering of mulberry leaves in the favorable years has reached 6962 tons. One of the reasons resulted in a present critical sericulture condition in Kazakhstan is the absence of any silk reeling facilities. This problem till now is not solved.

The hopes for self-organizing of sericultural industry after elimination of state regulation and management were not justified. Therefore it is necessary to restore the state vertical management of branch, having recreated the structure responsible for sericulture in the Ministry of Agriculture of Republic.

Under orders of the Ministry of Agriculture for formation of the research program on sericulture for 2006-2008 two themes which are prepared will be financed from the republican budget.

The basic purpose of strategy to sericulture development will reveal existing and potential facilities and subjects of high-yielding zoned varieties of mulberry tree occupying with cultivation and deep processing of silk cocoons and creation of a complex of the interconnected modern manufactures, capable to raise and process up to 15 thousand tons of fresh silk cocoons/year. Also definition of the legal, economic and organizational forms allowing to unify in a uniform industrial chain of the enterprise irrespective of patterns of ownership and industrial purpose is very essential.

More significant raise in sericultural production it is possible only after the introduction into operational age of new plantings. By using the existing mulberries it will allow to reach in 2008 a level of production similar with those at the beginning of 1980th years, and by 2010, after the introduction into operational age of the new mulberry plantings of 2005-2006 to reach up to 600 tons of dry cocoons annually, that corresponds with about 240 t raw silk or 2.4 million meters of silk fabric.

Key words: sericulture, silk, Kazakhstan, revival

Chapter 1. Introduction

The sericulture is a traditional sub-branch of agriculture in Kazakhstan.

In 1936 in Chimkent city was organized a Kazakh office on the sericulture. Then the edict of the cabinet of ministers of Kazakh SSR in 1960 organized the provincial experimental station for sericulture, which dealt with the cultivation of mulberry through the development of agrotechnical problems.

The explosion of the industrial production of cocoons in Kazakhstan began in the middle 1980's when the total area of the plantation of mulberry reached to 1863 hectares. Entire quantity of mulberry trees it composed 3389 thousand pieces. However, the production of cocoons in this volume did not supply raw material to a silk processing industry, located in the territory of the republic. The egg production plant it was located in Uzbekistan, silk reeling plant - in Tajikistan, and finished silk thread was transmitted to the Moscow and Cherkass factories for silk processing in Russia.

However, the further policy - economic situation of the country led to sharp reduction in the production of cocoons. Particularly the tendency of the farmers towards obtaining rapid profit led to root out mulberry trees and replacing them they began to sow cotton, wheat, melon and other cultures. As a result historically prevailing sericulture branch proved to be on the face of disappearance. Because of this now the market of Kazakhstan is practically completely filled with imported silk materials. Torn from the processing and the not participating in the distribution from the profit economic subjects are not interested in the commodity the cultivation of cocoon.

One of the reasons, which led to the present critical state of sericulture in Kazakhstan is the absence of silk reeling industry. At the state level no one dealt with organization and adjusting of intergovernmental connections in the territory of the CIS. This problem, until now, is not solved. Hopes for self-organizing of sericulture after the elimination of government control were not realized.

Chapter 2. Proposals for the development of sericulture in the country

For restoring the sericultural branch it is necessary:

- the government to make a decision (order) about the prohibition of cutting down, put off the cultivation of mulberry as the property of state.
- disturbers must be assessed large money penalty, up to the criminal complaint.
- to give strict calculation - inventory the presence of the cultivations of mulberry in the households and the villages.
- to determine the volume of silkworm rearing as egg boxes on what depends the volume of cocoon production.
- to make new mulberry plantations.
- it is necessary to restore the cocoon drying chambers and cocoon purchasing centers.
- to organize silkworm egg incubatories.
- to organize laboratories for determining the cocoon quality.
- to organize scientifically research laboratory on the sericulture.

Chapter 3. Proposals for continuing the collaboration of the countries of region in the nearest future

- to establish closer economic connections between the sericulturists, to form coordination union.
- united customs policy.
- the organization of a common market for goods.
- to carry out marketing service.
- to export cocoons in other countries.
- exchange of information.

Chapter 4. Results of the workshop, carried out in Tashkent during April 2005, obtained in Kazakhstan

- **Action at the government level**

It was developed an innovation- industrial plan for sericulture revival and development in the Southern - Kazakhstan region. According to the plan of sericulture development it was given the task to set down the seedlings of mulberry tree due to the means of those provided for the re-planting.

- **Action at the level of scientific research institute**

By assignment of the Ministry of Agriculture for shaping of scientific research program on the sericulture during the years 2006-2008 are prepared two themes which will be financed from the republic budget. For the widening of the propaganda of sericulture among the population were prepared and published articles in the provincial and republic media.

- **Actions on the level of farmers - sericulturists**

A private entrepreneur began to deal with the cultivation of mulberry trees over an area of 20 hectares. For further development of sericulture is planned in the company the conversion of production on industrial basis, via its specialization and concentration, where the production of cocoons will be combined with their primary processing. In 2005 the director of this company O. Musabay was honored as the best farmer of the year in Kazakhstan.

Chapter 5. National strategy for revival and development of sericulture in Kazakhstan

Silkworm rearing and cocoon production in the southern region of Kazakhstan appear as one of the earliest branches of agriculture. To this contributed the circumstance that into this part of Central Asia the silkworm eggs were introduced as early as in the beginning of the 4th century BC and experience on raisings of mulberry silkworm was accumulated by decades in the adjacent to us regions. In Kazakhstan the bunched plantations of mulberry for the first time began to embed in 1938-1941.

In the cooperative and the state farms to the 1990th the number of single mulberry trees was 1 million and 640 thousand and 1330 ha of plantations, and 61 cooperative farms were occupied by silkworm rearing. The volume of the spring silkworm rearing reached 3942 boxes, each box having 29 grams of eggs. As a result of raisings in 1990 were obtained 224.3 tons of fresh cocoons.

Table 1.

Purchase of the fresh cocoons of mulberry silkworm in Kazakhstan (tons)

Designation of the regions	Years				
	1971-1975	1976-1979	1980	1985	1990
Kazygurtskiy	0.2	1.8	2.5	3.2	3.0
Maktaaralskiy	77.9	98.0	110.7	118.8	106.2
Ordabasinskiy	5.8	5.0	6.1	6.0	40.4
Sayramskiy	29.6	33.4	37.6	38.1	36.6
Saryagashskiy	24.2	28.2	33.2	38.6	5.1
Tolebiskiy	2.5	3.5	4.6	4.9	12.3
Tyul'kubas	17.5	17.6	18.9	20.7	18.1
Turkestan Chimkent	10.7	13.5	15.9	18.2	2.6
Total	168.4	202.0	229.5	248.5	224.3

But, due to the fact that the state and cooperative farms were privatized, and the energy crisis appeared the silkworm rearing declined and most of the mulberry trees were cut down to the firewood. Hopes for self-organizing of sericulture after the elimination of government control were not realized. The sericulturists were not combined into cooperatives, they did not form their coordination union on an example of other countries with the market economy. In connection with this it is necessary to restore state vertical management of branch, after recreating the structure, which corresponds for the sericulture in the Ministry of Agriculture of republic. To the former Chymkent experimental station it was introduced 28 new mulberry varieties.

In 1970-1980 the scientific workers of this station developed the scientifically substantiated methods of conducting of silkworm rearing and increasing the productivity; the creation of the new effective types of mulberry cultivation. However, with scientific works on the evolvement of the new silkworm breeds no one was dealt with. The silkworm breeds used were those created in the Uzbek Sericulture Research Institute in Tashkent.

As it was mentioned above the political and economic situation of the country led to the complete stop of the production of the cocoons of mulberry silkworm. Connections with the scientific organizations were disrupted, and the sericulture division in the station was liquidated. Thus, even the already introduced mulberry varieties were lost. Now for the scientific guarantee of the sericulture branch in the country the Southwestern scientific and industrial center of agriculture has opened a sericulture division since 2006.

Chapter 6. Basic problems for revival and the development of sericulture in the country

To the basic problems, which impede the accelerated restoration and the development of branch can be attributed:

- the absence of investment into the branch;
- the low level of the technical and technological state of sericulture branch;
- moral and physical deterioration of the equipment;
- the decrease of the areas of mulberry cultivation;

- the sharp reduction of the production of mulberry seedlings and saplings;
- the absence of high-quality and with high silk shell ratio silkworm breeds and hybrids;
- difficult financial position of the enterprises for the primary processing of cocoons;
- a deficiency in its own means and the impossibility of their completion due to the credits of banks in view of the absence of ready guarantee property, high rates of interest in the crediting;
- the absence of silk reeling factories on the territory of republic;
- a deficiency in the corresponding recommendations and materials about the modern techniques in sericulture;
- torn from the processing and the not participating in the distribution from the profit economic subjects are not interested in the commodity release of cocoon.

Chapter 7. Favorable conditions, the prospects for development and the value of sericulture in the country

- the southern region of Kazakhstan, where the sufficiency of heat, prolonged vegetal period and soil condition are favorable for the cultivation of the mulberry.
- the presence of market infrastructure in the village;
- the presence of suitable mulberry varieties;
- the presence of the necessary scientific and enlisted potential;
- the presence of the nurseries, where there is a potential possibility of an increase production of mulberry saplings.

At present in the Saryagashskeye region it has begun nursery for the production of planting material, and also cultivation of mulberry trees and production of the cocoons of silkworm. In 2004 were planted low stem plantations according to diagram 4x1 meter over the area of 55 hectares. Furthermore in 6 regions of the Zhambulskeye region are planted 110 thousand pieces of the linear trees of mulberry. The calculations of the economic effectiveness of this branch show that if we restore the sericulture in the republic via laying 1000 hectares of the new productive plantations already in 2007-2008 it would be possible to obtain from 300 to 400 tons of fresh cocoons yearly and up to 500 tons to 2010. The yearly volume of sales will comprise more than two million US dollars with the cost 1 kg of the cocoon of the mulberry silkworm – 4.5 of US dollars. The realization of the selected plan of silkworm rearing will make it possible to reach the growth of the export of agricultural production, an increase of the profitable part in the form of taxes, and also the reduction of the break of the standard of living in the social welfare of rural and urban population by creating the new work sites. Retention and the restoration of ecological balance and the sanitation of environment by re-planting - after planting mulberry trees. At the same time the sericulturists are still preserved in many households, there are experienced specialists and working personnel, are not lost the experience in the cultivation of mulberry and production of the cocoons of silkworm. Thus the restoration of the sericultural branch will make it possible to fill market by domestic silk materials. Furthermore the external market for other countries to make it possible to export the silkworm production also of silk cloths.

Chapter 8. Strategy for the revival and the development of sericulture in the country during the period 2006-2010

8.1. Purposes of strategy

Of the basic purpose of strategy to the development of sericulture will reveal the existing and potential economies and the subjects of those occupying by the cultivation of high-yielding mulberry varieties and to the deep processing of silk cocoons and the creation of a complex of interconnected contemporary production, capable of rearing and of processing to 15 thousand tons of silk fresh cocoons. Certainly, it will require in the initial stage budget fund on the order of 200 mln. tenge per year so that the state it would carry out its organizing responsibility. As a whole during the period 2006-2010 to the laying of the mulberry plantations it will be required a capital investment in volume 600 mln. tenge or the order of 120 mln. tenge per year. Crediting the production of sericulture will be also achieved through the banks within the framework of the measures of the support of domestic commodity producers and development of the small and mid-sized business.

8.2. Executors of strategy in the country

The basic executors of strategy are agricultural formations (peasant – farmer households, private enterprises, Ltd and J.S. companies etc.) dealing with the cultivation of mulberry trees and the production of silk cocoons both the existing and assumed additional enterprises. Auxiliary components of strategy there can be public bodies, financial institutes, enterprises of the suppliers of raw material, energy resources. The supplementing component it must be the participation of the scientific research institutes and universities with the shaping laboratories and the departments which deal with the development of contemporary technologies and methods.

8.3 Activities of strategy

- the production of mulberry leaves
- collection and storage of mulberry leaves
- production of silkworm eggs (factory)
- the production of cocoons
- processing the cocoons
- obtaining raw silk (silk reeling factories).
- obtaining twisted raw silk.
- the production of the silk cloths
- obtaining the associated products from the withdrawals.

8.4. Necessary investments and methods of financing

The necessary investments and methods of financing are the assignment of privilege credits through the banks, for the support of domestic commodity producers and development of the small and mid-sized business.

Table 2.

Plan of the measures for the revival of sericultural branch

№	Designation of measures	The time of fulfillment	Responsible executors
1	The government to accept a decree about the prohibition of cutting and putting off of mulberry trees.	Ist quarter of 2006	The government of republic Kazakhstan
2	To conduct the inventory of all trees of mulberry in all households.	IInd quarter of 2006	The departments of the agriculture of regions
3	Creation of nursery enterprises in the republic	IInd quarter of 2006	LTD OF "A.L.M.", YUZNPTSSKH
4	Planting of the mulberry trees	2006-2007 year	administration for the protection of forests and animal peace, the department of the rural and water management of regions
5	To organize structure in the Ministry of agriculture responsible for the sericulture.	2006 year	Ministry of agriculture
6	To organize the scientific research experimental station of the sericulture	2006-2007 year	South-West agricultural research center
7	To organize centers for cocoon purchasing and processing, equipped with cocoon drying chambers.	2006-2007	LTD «A.L.M.»
8	To build a silkworm egg production plant	2006-2007	LTD «A.L.M.»
9	To develop business project on the development of the sericulture	2006 year	LTD «A.L.M.» YUZNPTSSKH
10	To conduct explanatory work among the population of republic	2006-2010	LTD "A.L.M." and YUZNPTSSKH and the municipalities
11	To organize a silk production cluster	2008-2010	Ministry of agriculture

Chapter 9. Economic analysis of the sericultural production at the end of the period of the strategy (2010) to the level of sericulturists, and also to the level of commercial companies, which carry out the cocoon drying, silk reeling and processing

During the first stage of the realization of strategy it is expedient to bring the existing mulberry plantations into order. This makes it possible to substantially increase productivity of the plantations. Simultaneously with this even on the basis of the pessimistic forecasts for the satisfaction of need in the mulberry base is necessary the planting of new plantations for the purpose of the restoration of the previously available area under the plantation of mulberry. The creation of new plantations requires high expenditures and therefore the volume of the expansion of area cultivation in visible perspective (year 2010) must not exceed

2000 hectares and 3500 thousand pieces of linear trees. This is explained by the fact that these areas can be placed on the same earth, where were located the previously rooted out mulberry groves, i.e., without the significant expenditures for the capital planning of the land in the regions, provided with labor resources, which have work experience with this culture and attached to the processing enterprises already existing in this locality. Thus the level of output of silkworm rearing in the present program is calculated up to 2010. Therefore in the first years of the implementation of the program of the sericulture development actually it is possible to design for obtaining not more than 240 tons of fresh cocoons/year. More significant increase of cocoon production is possible only after the entrance in the operational age of new plantings. Instead of with the existing mulberry groves this will make it possible in 2008 to reach the level of output of production as in the beginning of the 1980th, and to 2010, after the entrance in the operational age of new plantations, established in 2005-2006 to reach up to 600 tons of dry cocoons yearly, that corresponds to 240 t raw silk or about 2.4 million meters of silk fabrics.

Table 3.

Production and the realization of the production of sericulture during the years 2006-2010

Designation of the indices	**Unit of the measurement**	**2006**	**2007**	**2008**	**2009**	**2010**
Quantity of the mulberry trees	thousand pieces	700	2000	3000	4000	5000
The gross yield of the leaves of the mulberry	ton	4200	12000	18000	24000	30000
Production of the cocoons	ton	252	720	1080	1440	1800
Productions of the dry cocoons	ton	84	240	360	480	600
Productions of the raw silk	ton	33.6	96	144	192	240
Productions of the silk cloths	thousand m	336.0	960.0	1440.0	1920.0	2400.0
Selling of the dry cocoons	mln. tenge	50.4	144.0	216.0	288.0	360.0
Selling of raw silk	mln. tenge	111.7	319.2	478.8	638.4	798.0
Selling of silk fabrics	mln. tenge	840.0	2400.0	3600.0	4800.0	6000.0

It is obvious that during the first stage of the implementation of program that prevailing in Kazakhstan will be the type of mulberry "Mankentskiy" and the "Tajik seedless" most stable on the productivity and unpretentious to the conditions of growth and used agricultural engineering. In obtaining of the sufficiently high harvests of cocoons with good outputs of silk the special importance has the silkworm breed. Therefore on the initial stage of program it will be used the existing species of silkworm in the territories of Central Asia. In the second stage of the execution of program the notable position must play new valuable types and

species of domestic selection, and also type and species introduced from other sericultural regions and well appeared themselves with the testing in Kazakhstan. However, the selection process for evolving new mulberry varieties and silkworm breeds and hybrids requires sufficiently much time. Therefore it is necessary to begin works on the evolvement of lines and species of the silkworm as well as mulberry varieties fitted out to the specific conditions of the environment of Kazakhstan.

It is necessary to carry out on strategy of the plan of the development of silkworm rearing in the country:

Industrial rearings on the production of silkworm cocoons it is proposed to produce farmer and other types of enterprises, and also in the individual households. The guarantee of valuable and healthy larval rearing will be achieved by the centralization of the incubation of eggs and young silkworm larvae rearing. Reaching the high indices of harvest and grade of cocoons is connected with obtaining of healthy larvae. In connection with this it is necessary the organization of the centralized incubator houses for hatching 80-100 boxes of silkworm eggs. It is known that the caterpillars of the young ages are extremely sensitive to the changes the condition of environment and are subjected by different infectious diseases. For purposes of protection and creation optimum condition it is expedient to conduct the centralized larval rearing during the young three ages with the creation of optimum hydrothermal regime, nourishment of caterpillars with the application of biostimulants and means of diseases prevention. The following stage is the output of cocoons from the cocoon frames following of pupae stifling and cocoon drying. Therefore it is necessary to establish cocoon drying chambers. The geographical arrangement of republic Kazakhstan creates favorable conditions for the export of cocoons, raw silk and goods from the natural silk into the countries of Europe. Therefore it is necessary to organize processing of the cocoons into the silk threads and the silk commodities after building silk reeling factories.

Chapter 10. Strategies of the development of BACSA

It is necessary on the basis of the analysis of the existing status of sericulture in Kazakhstan the following measures for the development of BACSA to be taken.

- to study and to introduce in each region the modern practices in mulberry cultivation and silkworm rearing.
- to organize regional fund for the need of development of science and technology operating in the sericultural branch.
- to conclude long-term agreements between the countries of region for the guarantee with the qualitative planting materials of mulberry and with the silkworm breeds and hybrids.
- to develop the scientifically substantiated recommendations regarding the optimum relationship of the branches of sericulture.
- to create in each country of the region regional and interregional silk clusters in order to produce capable products, corresponding to the requirements of international standard ISO 9000.

Thus, on the basis, of that above-presented it is possible to make following **conclusions:**

- it is necessary to establish nurseries and to enlarge the mulberry plantations.
- to develop collaboration between the scientific research institutes of sericulture.
- promote the exchange of information between the region countries.

- to introduce in the production the high-yield types of mulberry and species of mulberry silkworm.
- to attract direct investments in the sericultural branch.
- to determine the enumeration of agricultural machinery necessary for the branch and the organization of its release on the region.
- the assignment of credits and to develop the mechanisms of preventing non - target usage of the credits.

The real economic effectiveness of sericulture branch as a result of the implementation of program will actually be more significant than calculated on the strength of the fact that the production produced will be realized in the form of the finished silk article, whose prices are several times higher in comparison with the raw material (cocoon).

Follow-up activities of Tashkent Workshop and national strategy for sericulture revival and development in Tajikistan

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ABSTRACT

The sericulture in Tajikistan is one of the basic and the the most ancient branch of national economy and has deep historical roots. At present the cocoon production in Tajikistan is under the Republican enterprise "Pilla" and the sericulture is supervised by the Ministries of the industry. The Republican Sericulture experiment Station, under the Tadjik Academy of Agricultural Science is undertaking the research work in sericulture.

On the basis of the international workshop, held in Tashkent, Uzbekistan seminars and conferences have been carried out in Tajikistan with participation of cocoon producers, experts and heads of the enterprises engaged in sericulture. In these events were discussed the problems concerning sericultural industry and the possibilities for silk handcraft production development. It is necessary to note, that the cocoon production in 2005 in comparison with 2004 has increased by 3 %, the cocoon quality is improved and the output of raw silk has increased as well. Basically the international workshop carried out in Tashkent in April, 2005 has achieved the success for sericulture growth and development in Tajikistan.

The sericulture in Republic Tajikistan is a special branch both having historical roots and our country is one of the leading republic of the Central Asia in cocoon production, thus making more than 3 thousand tons annually. Principal cause of reduction in manufacture of cocoons in the recent decade is absence of enough funding resources at the processing enterprises and disinterest of farmers. However the demand for production of silk and silk fabrics grows. First of all, it is necessary to provide qualitative improvement of the forage reserve of sericulture (mulberry plantations) on the basis of creation/introduction of highly productive and perspective mulberry varieties and expansion of plantations on their basis. Meanwhile the share of highly productive varieties in the mulberry trees in Tajikistan is no more than 1 %. With this purpose the increase in volumes of planting of mulberry from 2500 thousand pieces in 2005 up to 3100 thousand pieces in 2015, and increase the area of mother mulberry plantations from 80 ha in 2005 up to 100 ha in 2015 is stipulated.

Scientists - breeders should conduct a hard work on creation and introduction in the branch high-yielding and having high silk shell percentage silkworm breeds and hybrids.

The "Pilla" enterprise plans to increase the hybrid silkworm egg production in Tajikistan up to 60-70000 boxes (1 box=29 g). For the solving of the above-stated problems it is necessary to direct sericulture heads and experts for studying the best practices in advanced countries as Japan, China, Korea, India and others.

Key words: sericulture, silk, mulberry, eggs, Tajikistan, strategy

Chapter 1. Introduction

The sericulture in Tajikistan is one of the basic and the the most ancient branch of national economy and has ancient historical roots. One of specificity of the branch consists that it is subdivided into a number of other sub-branches which are:

- moriculture, dealing with cultivation of mulberry plantings with the purpose of obtaining high-quality leaves serving as a forage for the silkworm larvae.
- silkworm egg production which tasks are the obtaining high-quality silkworm eggs.
- silkworm larvae rearing with a view of obtaining fresh cocoons.
- preparation and primary processing of cocoons.

At present the only one cocoon producer in Tajikistan is the Republican enterprise “Pilla” and the sericulture is under the supervision of Ministries of the industry.

The sericulture development in Tadjikistan has a centuries-old history. Historical sources testify that manufacture of silk in the Central Asia existed 4000 more years ago. Since the first half of the 1st century A.D. and till 15-th century between China and Europe there was a trading way which passed through the countries of the Central Asia. In 1877 after issue of the book "China" which author was the German historitian Ferdinand Rihtgofen (1833-1905), this way began to be named “Silk road”. It has played a big role in economic and cultural development of peoples of China and the Central Asia and, in particular, rendered positive influence on sericulture development in the states of the Central Asia.

Chapter 2. Follow-up activities of the “International Workshop on Revival and Promotion of Sericultural Industries and Small Enterprise Development in the Black, Caspian Seas and Central Asia Region”, Tashkent, Uzbekistan 11 - 15 April 2005

For achievement of the purposes of this workshop the government of Republic Tajikistan at sessions has arranged about elimination of lacks and problems of sericultural branch and has set the task of the Ministry of the industry and the Ministry of Economics quickly to prepare the program of sericulture development during 2006-2015. In given time is developed the program and handed it for the statement to the government of Tajikistan.

For sericulture development the Government of republic each year allocates the certain sum from budgetary funds which are spent for selection of mulberry varieties and silkworm breeds.

The government of Tajikistan is ready to cooperate in sericulture development with the countries, members of BACSA as well as with the advanced countries such as Japan, China, India, Korea and Vietnam. The problems, mentioned in the international workshop have been introduced to the scientific institutes engaged in sericulture in Tajikistan. In our republic basically it is raised the silkworm Tetrahybrid -3. It is a hybrid, which quality indicators in many respects concede to the best world hybrids and does not provide the needs of silk reeling industry. In this connection the government set the task to breed new silkworm breeds according to the world standards. On the basis of the international workshop with participation of cocoon producers, experts and heads of the enterprises engaged in sericulture, seminars and conferences have been carried out. In these events were discussed the problems concerning sericultural industry and the possibilities for silk handcraft production development. It is necessary to note, that the cocoon production in 2005 in comparison with 2004 has increased by 3 %, the cocoon quality is improved and the output of raw silk has increased. Basically the international workshop carried out in Tashkent in April, 2005 has achieved the success for sericulture growth and development in Tajikistan.

Chapter 3. The status of sericulture presently

The sericulture in Republic Tajikistan is special branch both having historical roots and our country is one of the leading republic of the Central Asia in cocoon production, thus making more than 3 thousand tons annually. This branch includes also cultivation of mulberry, silkworm egg production, cocoons production and their primary processing.

The biggest fresh cocoon crop in the republic has been obtained in 1991 which has made 4528 tons. At the same time unfortunately, for last years the cocoon production decreased. In 1995 in republic 3150 tons of cocoons have been made, and in 2005 the volume of cocoon production has made 3244 tons.

Also volumes of silkworm eggs produced at the factories have decreased, especially at the Hodjents' (Ходжентском) egg factory.

Principal cause of reduction in manufacture of cocoons is absence of money resources at the processing enterprises and disinterest of farmers. Thus demand for production from silk and silk fabrics grows.

Now domestic sericultural industry is in a crisis condition. For an exit from this condition and increase of efficiency of branch at the present stage it is necessary a scientifically proved program of sericulture development for 2006-2015.

In Tajikistan some projects such as reconstruction of the forage reserve, mulberry and silkworm selection and modern technology of qualitative silk production are necessary to develop. It is especially necessary to make reconstruction of silkworm rearing technology, requiring a solid state support.

The industrial base of sericulture in Republic of Tajikistan is characterized by the following figures:

Table 1

Number of sericultural households in Tajikistan

Regions	**Number of households**
Хатлонская region Согдийская region РПП Total number of sericulture farmers in the country	28296 27055 5380 60731 x 5=303655 303655

Table 2

Number of silkworm egg boxes reared during the period 2001-2004 (one box = 29 g)

Regions	**2001**	**2002**	**2003**	**2004**	**2005**
Total for the whole country	62898	62645	62894	61206	60256
Согдийская region	28376	27005	27055	27076	26579
Хатлонская region	27309	28063	28326	27390	26970
РПП (enterprise)	7213	7427	7513	6740	6707

Table 3

Fresh cocoon production in Tajikistan during the period 2001-2005

Regions	Cocoon production in ton				
	2001	**2002**	**2003**	**2004**	**2005**
Total for the whole country	3045.6	3265	2690	3134.3	3244
Согдийская region	1559.6	1691	1093	1606.7	1696
Хатлонская region	1181	1231	1243	1225.1	1237
РПП (enterprise)	305	343	354	302.5	311

First of all, it is necessary to provide qualitative improvement of the forage reserve of sericulture (mulberry plantations) on the basis of creation/introduction of highly productive perspective mulberry varieties and expansion of plantations on their basis. Scientists - breeders should conduct a hard work on creation and introduction in the branch high-yielding and having high silk shell percentage silkworm breeds and hybrids.

Chapter 4. Strengthening of the forage reserve

Manufacture of qualitative cocoons depends on amount and quality of mulberry leaves. Efficiency and caloric content of leaves first of all depends on agrotechnical works, and also moisture of leaves and other elements.

During the last years due to various reasons the forage reserve of the sericulture was considerably reduced, that had led to decrease in quality of cocoons and volumes of their production.

The further sericulture development is impossible without strengthening the forage reserve.
The special great value for development of a modern sericulture in Tajikistan is represented with the forage reserve, the basic on cultivation of highly productive mulberry varieties with high fodder and nutritious advantages which is characterized by the following table:

Table 4

Planting mulberry trees in Tajikistan

Years	Plan, thousands saplings	Really planted, thousands saplings	%
2001	900	545	60.5
2002	1300	845	65
2003	1700	1286	75.6
2004	1700	1211	71.2
2005	2500	1357.3	54.3

Table 5

Establishment of new mulberry plantations in Tajikistan

Years	Plan, ha	Really planted	%
2001	35	8	22.9
2002	45	60	133.3
2003	55	51	92.7
2004	65	42	64.6
2005	80	57	72

Table 6

Number of mulberry trees and plantations in Tajikistan

Regions	Number of mulberry trees, thousands	Out of them in exploitation thousands	Mulberry plantations in ha	Number of trees in the plantations thousands	Out of them in exploitation thousands	Total number of mulberry trees, thousands
In the whole country	23961	20924	2835	7087.5	2658	31048.5
Сугдская region	6905	5476	1851	4627.5	1801	11532.5
Хатлонская region	13150	2148	384	960	313	14110
РПП (enterprise)	3906	3300	600	1500	544	5406

Meanwhile the share of highly productive varieties in the mulberry trees in Tajikistan is no more than 1 % in spite of the fact that on efficiency they in 1.5-2 times surpass the local variety Hasak and hybrids of free pollination, characterized with small leaves. The new plantings are carried out by a low-yield hybrid mulberry and the forage for silkworm larvae does not suffice, despite of expansion of plantations.

For a further sericulture development in Tadjikistan it is necessary to increase considerably productivity of mulberry by replacement of the existing low-yielding varieties and introduction in manufacture of highly productive perspective varieties and hybrids of mulberry.

An advanced industrial sericulture should have high-efficiency forage reserve, based on cultivation of high-yielding varieties, suitable for feeding of larvae in the different seasons.

The Republican Sericulture experiment Station, under the Tadjik Academy of Agricultural Science is undertaking the research work in sericulture. In the station there is 1 ha mother plantation for obtaining seeds and 2 ha collection of 20 promising mulberry varieties.

Under the management of the Sericulture station it is necessary to organize 10 ha seed-mother plantations of mulberry, from them 5 ha in the southern and 5 ha in the northern zones of Tadjikistan. From the mother plantations shall be produced mulberry seedlings and saplings from high-yielding mulberry varieties which are present in the collection of Sericulture station.

By the mother plantations for obtaining mulberry cuttings are produced saplings of high yielding varieties.

In Tajikistan in order to replace the existing trees with new high-yielding varieties and hybrids of mulberry it will need 5-10 years.

With this purpose the increase in volumes of planting of mulberry from 2500 thousand pieces in 2005 up to 3100 thousand pieces in 2015, and the area of mother mulberry plantations from 80 ha in 2005 up to 100 ha in 2015 is stipulated.

In view of that in the last years a wide circulation of pests of mulberry takes place, such as "ognevka", therefore most sharply there is the problem of taking of urgent measures on struggle against harmful insects. Fast growth and distribution of these insects testify that in the near future their distribution can capture all trees of republic. At least triple chemical processing of mulberry is necessary for increase of efficiency of chemical struggle against this pest. But, for the lack of means actions on struggle against these insects have not been carried out. In this connection it's necessary to ask the Government of Republic Tajikistan to consider the given problem and to take necessary measures.

Chapter 5. Development of silkworm egg production

The qualitative silkworm eggs are the basis of sericulture development. The silkworm egg production is an integral part of sericulture. In this connection, it is necessary improvement of selection work in the egg production factories, at the parental lines breeding enterprise of the city of Vahdat and the Republican Sericulture Experiment Station in order to produce silkworm eggs of new breeds and also fuller satisfaction of the country needs. The "Pilla" enterprise plans to increase the hybrid silkworm egg production in Tajikistan up to 60-70000 boxes (1 box=29 g).

Table 7

Planed silkworm egg production in Tajikistan during the period 2006-2015

	2005 real	**2006**	**2007**	**2008**	**2009**	**2010**
For the whole country including:	28500	60000	62000	63000	63800	66000
Душанбинский egg production factory	12500	30000	30000	31000	31800	33000
Ходжентский egg production factory	13000	28000	30000	30000	30000	30800
Вахдат Parental egg station	3000	2000	2000	2000	2000	2200

The Sericulture Experiment Station has a close cooperation with the Uzbek Sericulture Research Institute in Tashkent about selection works and it is in common created new highly productive breeds of the silkworm Tajikistan - 1, Tajikistan - 2 and their hybrid combination, Khojend 1, Khojend 2 and their hybrid combination comes to the end test at the State commission on testing agricultural plants and animal varieties.

The Sericulture station also commonly to carry out research activity on the silkworm breeding with Душанбинском and Худжандском silkworm egg production factories.

In 1980-84 research-and-production work in manufacture of silkworm eggs with the purpose to mechanize the labor-consuming works was started in Душанбинском egg production factory. For introduction the Japanese technologies in the silkworm egg production and rearing Japanese eggs in conditions of Tajikistan a big volume of work was carried out, but the results were not evident. It is necessary to renew and continue the started work. In common corporation with " Asia Silk" and the joint venture " VT Silk " we cooperate about evolving new high-yielding breeds of the silkworm, centralized larval rearing in younger age under a film, repeatedly summer-autumn rearings, preparation of P_1 eggs etc., and some positive results have been obtained.

The silkworm egg production factories in the republic are capable to satisfy the country needs by locally produced silkworm eggs. But, in connection with that the cocoons obtained from the eggs, made on the egg factories of republic, do not meet to the international standards, thus the use of these eggs is very low.

Therefore it is necessary to improve local egg quality, produced at the factories. For this purpose, it is necessary, using new silkworm breeds from Uzbekistan or delivered from other countries to make perspective highly productive breeds. Before full maintenance of sericulture by local silkworm eggs, to continue cooperation with foreign investors and annually to deliver necessary quantity of eggs in the republic. To develop necessary actions on prevention of the infectious disease "pebrine" and other egg diseases in the course of egg production at the factories and the parental egg breeding enterprise of the city of Vahdat. For maintenance of work Ходжентского silkworm egg production factory and the parental egg breeding enterprise of the city of Vahdat in full capacity to make major innovation of the facilities and provide them with new equipment. For maintenance of full functioning breeding sites of the factories and the Breeding enterprise of the city of Vahdat on manufacture pedigree eggs the silkworm parental lines rearing/breeding to be made according to the Decision of the Government of Republic Tajikistan from April, 7, 1999 № 132. And also, with a view of improvement of breeding work and maintenance of manufacture of highly productive silkworm breeds to consider the problem on clearing of the tax of egg factories and the Breeding enterprise of the city of Vahdat and entering of respective alterations and additions into the legislation of Republic Tajikistan.

For realization of these purposes it is necessary to provide factories and breeding facilities with the new process equipment, to arrange on prevention of pebrine infection and other egg diseases.

Chapter 6. Increase in volumes of cocoon production and introduction of new technologies

With a view of satisfaction of needs of silk-reeling manufacture by raw material and increase in export capacity of republic it is necessary to liquidate a crisis situation in sericulture and to return on the advanced positions of former years. But deep crisis does not allow this process of revival to be carried out by fast rates.

To provide gradual increase in volumes of manufacture of cocoons till 2015 in view of an existing forage reserve. For preparation of high quality cocoons and industrialization of manufacture of cocoons to provide silkworm rearing houses/rooms in capacity from 3 to 5 boxes of eggs (1 box=29 g). To ask foreign investors and National bank of Tajikistan to allocate the preferential long-term credit for creation silkworm rearing houses/rooms. In addition, for carrying out of major overhaul of objects and the equipment of sericultural

enterprises annually to transfer 10 percent of the net profit obtained by joint venture " VT Silk" and the joint venture " VT Рохи абрешим ".

With a view of increase in cocoon production and increase of their quality in view of requirements of the world market it is necessary for State unitary enterprise "Pilla" to introduce the new technologies which are meeting the requirements of market economy in manufacture. In this connection studying technology of the advanced countries, such as Japan, China and Korea with a view of purchase of experience is necessary, and with the purpose of maintenance of development of this process to direct experts to these countries for studying experience.

For performance of process of revival and introduction of new technology, creation of complexes for silkworm rearing under “Pilla” enterprise it is necessary to use bank credits, and also budgetary funds

Chapter 7. Scientific maintenance, education of the staff and development the international economic relations

Priority directions of scientific maintenance of sericultural branches are the invention and introduction in manufacture of high-yielding mulberry hybrids and disease-resistant saplings and the breeds of silkworm having high raw silk quality

The research staff of the Sericulture experiment station have set the task for the period on 2005-2015, to introduce in manufacture of breeds of silkworm Т-1, Т-2, Х-1, Х-2, К-3, К-4, annually to increase manufacture seeds of high-yielding mulberry varieties such as "Сурхтут", "Илгор", "Топкросс-2", and "Топкросс-3" to increase the seed production from 35 up to 75 kg/year. For achievement of these tasks to allocate at the republican experimental station in Бабаджан area Gafurovskogo region 10 ha of irrigated land for the organization of an mother plantation field and preparation high-yielding mulberry varieties planting material.

In modern conditions of development of a society selection and placement of personnel in view of requirements of market economy is the determining moment of sericulture development. Heads of areas, chiefs of managements of agriculture, the sericultural and dryings of cocoons enterprises are obliged to involve capable entrants in agrarian University of Tajikistan for preparation of experts for the sericulture branches with higher education. Now at this university a faculty of a professional training in sericulture functions. Also it is planned to direct experts for studying the best practices of sericulture branch to the advanced countries.

With the purpose of development of economic cooperation in sericultural branch, increases in manufacture of cocoons and perfection of economic mechanism “Pilla” company of its branches in Согдийской and Хатлонской areas, managements of areas of republican submission to provide with joint ventures " VT-Silk", " VT Рохи Абрешим " co-production on cocoon/silk processing and silkworm breeding.

With a view of processing the waste cocoons in republic to create a joint venture company. And also to provide creation of a small enterprise on processing cocoons at the enterprise on drying cocoons.

With a view of carrying out of full diagnostics and definition of biological parameters and technology of the silkworm, its egg quality, cocoons and silk qualities, qualities of mulberry saplings and seeds, diagnostics of silkworm and mulberry diseases to create a special

laboratory at the Republican sericulture experiment station. To allocate due to the republican budget necessary means for equipment of the special laboratory by the modern equipment.

Chapter 8. The conclusions

Heavy economic conditions of sericulture branch have negatively affected the further development. Besides in the last years distribution of the new pest of mulberry " Mulberry огневки " which ruthlessly eats leaves of the mulberry has sharply increased, in result growth and development of mulberry shoots stop and decreases for 40-50 % of leaves, in this connection has sharply decreased the forage reserve.

With a view of preservation of an existing forage reserve and maintenance with forages silkworm rearings it is necessary to make planting high-stem trees and to create new mulberry plantations.

Transition national economy of the republic on full independent economic functioning and market economy has put forward a lot of the most complicated problems among which the most important is the providing of silk processing enterprises of republic by enough cocoons.

For the solving of these problems should accept below-mentioned measures:

1. About sericulture development to create complex, economic, scientific and industrial concept on 2006-2015.

2. Widely to introduce in manufacture advanced sericultural experiences of Japan, China, India and other countries.

3. To develop provocative methods in selection of the silkworm for a choice of an initial material and creation of new breeds in view of accumulation of domestic and Japanese experience in sericulture and to use in selection work methods of provocative selection.

To expand subjects of research on studying problems of sericultural economics and management, silkworm physiology, genetics and feeding on artificial diet.

5. For production of high quality silkworm eggs and cocoons and decrease the labor expenses to introduce foreign technologists on silkworm rearing in unison with the world standards.

6. With a view of stimulation the sericulture farmers and improvement of quality of cocoons, and also liquidation of cases of gathering of unripe cocoons to organize in the republic reeling tests of cocoon samples in order to adopt the method of cocoon evaluation, based on their reelability.

7. In order to improve the silk reeling efficiency (raw silk percentage and unbreakable filament length) and the raw silk quality it is necessary to evolve new highly productive mulberry varieties, silkworm breeds and hybrids.

8. In order to increase the interest of cocoon farmers for increase the cocoon production and quality, creation of conditions for transmission of sericulture on an industrial basis is expedient to increase the fresh cocoon purchasing price.

9. To create bigger silkworm rearing farms for cultivation of 50-100 egg boxes/stage.

10. For the solving of the above-stated problems it is necessary to direct sericulture heads and experts for studying the best practices in advanced countries as Japan, China, Korea, India and others.

Follow-up activities of Tashkent Workshop and national strategy for sericulture revival and development in Turkey

By

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Chapter 1. Introduction

In Turkey support given to sericulture by successive governments has increased in recent years. Whether it's because of our realised efforts (as Kozabirlik) in the capital Ankara, or the importance of sericulture in the rural development models has been understood, much more importance has been attached to the support given in this sector.

Chapter 2. Historical background, present status and future prospects of the silk handcrafts cottage industries sector in the country

In these discussions which were carried out by us with the government in Ankara, the support which is given to the sericulture by the United Nations Food and Agricultural Organization (FAO) and, starting with BACSA, all activities directed at increasing the opportunities of regional cooperation in the sector and the facilities provided by regional cooperation for our country were mentioned.

Thus, as a result of our efforts, as from 2006 by the Decree of the Council of Ministers the sericulture was added to the list of "Livestock Farming Support". Within this scope, the supports which had been provided from Treasury resources in previous years will, from now on, be given by the Ministry of Agriculture and Rural Affairs and in the first stage the support will cover a five year period. In this respect, so that we can see our future comfortably in the sericulture sector the production and investment plans will be carried out realistically for the coming years.

As from 2001, realised increases in the fresh silk cocoon production are continuing in a stable way and as can be seen from the table the fresh silk cocoon production for the year 2005 has increased by appromiaxetly % 15 from the previous year, making a total of 169 tons.

YEAR	NO OF VILLAGES	NO OF PRODUCER	SILKWORM EGGS REARED (boxes)	FRESH COCOON PRODUCTION (ton)
2001	213	1,555	2.288,5	46.621,7
2002	327	2,356	3.885,0	100.013,7
2003	280	2,758	5.094,0	169.221,1
2004	278	2,919	5.161,0	143.405,5
2005	278	2,729	5.669,0	160.173,5

On the other hand, as indicated in the table, the purchasing prices of fresh silk cocoon have shown a stable increase over the years and with the aim of supporting fresh silk cocoon producers, direct financial support is provided by the Turkish government for each kg produced every year.

YEAR	GOVERNMENT SUBSIDY ($/KGS)	KOZABIRLIK PURCHASING PRICE ($/KGS)	TOTAL FRESH COCOON PRICE ($/KGS)
2001	2.41	0.68	3.09
2002	3.74	1.36	5.10
2003	4.97	2.13	7.10
2004	5.24	1.56	6.80
2005	6.43	1.89	8.32

The above mentioned support is unreciprocated and aimed at providing a higher income to the producers to persuade them to produce fresh silk cocoon. The support which is about the level of 8-9 USD/Kg for fresh silk cocoon is rather high compared to world countries.

On the other hand, due to our gene sources, Turkey is able to produce polyhybrid silkworm eggs for its own needs. Also in recent years, importance has been given to research and development studies directed at increasing the quality of eggs and in the near future it's planned to do export with neighbouring countries at the rate of their required needs.

On the other hand, we as Kozabirlik, continuing initiatives directed at setting up a silk reeling and twisting plant for all the cocoons produced in the country to be processed. In this respect, a part of the silk needs which are presently being met by importation will be supplied by these plants.

At the end of these meetings realised with the wide support of the FAO, we have an infinite belief that with cooperation opportunities which arise, production oriented technical cooperation opportunities and commercial cooperations based on reciprocated mutual gains will be created. Because of this opportunity, I would first of all like to thank Dr.Lea and Dr. Tzenov and also all those who rendered their services and give them my heartfelt wishes, thank you.

Follow-up activities of Tashkent workshop and national strategy for sericulture revival and development in Ukraine

By

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ABSTRACT

At present, the sericulture structure of Ukraine is represented by Ukrainian Silk Corporation of the Ukraine Ministry of Agrarian Policy and by the Sericulture Institute of the Ukraine Academy of Agrarian Science. The Sericulture Institute provides scientific support of the industry: performs fundamental and applied researches associated with sericulture industry development and trains highly skilled staff. Maintained by the Institute is a silkworm and mulberry gene pool. Ukraine Silk Corporation manages commercial silk enterprises – introduces promising silkworm races and hybrids, raw silk processing non waste technologies, assists in organizing silkworm cocoon and egg growing, in improving feedstuff reserves, etc. In 2005, the silk enterprises of Ukrainian Silk Corporation grew 17,147 kg of silkworm cocoons, of which 3,104 kg were sold to Myrgorod Egg Factory, 14,043 kg to cocoon driers. Egg production was 120 kg. There are no fabric and thread manufacturing facilities. Thanks to strong support from the side of Tashkent workshop participants and BACSA a tendency to improvement of situation in the industrial sericulture in Ukraine was laid down. There has been developed and now under way a departmental program, "Silk of Ukraine", till 2010, which program provides for increase in silkworm cocoon and egg production volumes, feedstuff reserve renewal, the use of state-of-the-art equipment, and unwinding cycle restoration.

Key words: sericulture, Ukraine, revival, development, strategy

Chapter 1. Introduction

At present, the sericulture structure of Ukraine is represented by Ukrainian Silk Corporation of the Ukraine Ministry of Agrarian Policy and by the Sericulture Institute of the Ukraine Academy of Agrarian Science (Fig. 1). The Sericulture Institute provides scientific support of the industry: performs fundamental and applied researches associated with sericulture industry development and trains highly skilled staff. Maintained by the Institute is a silkworm and mulberry gene pool. Ukraine Silk Corporation manages commercial silk enterprises – introduces promising silkworm races and hybrids, raw silk processing nonwaste technologies, assists in organizing silkworm cocoon and egg growing, in improving feedstuff reserves, etc.

In 2005, the silk enterprises of Ukrainian Silk Corporation grew 17,147 kg of silkworm cocoons, of which 3,104 kg were sold to Myrgorod Egg Factory, 14,043 kg to cocoon driers. Egg production was 120 kg. There are no fabric and thread manufacturing facilities.

There is developed and now under way a departmental program, Silk of Ukraine, till 2010, which program provides for increase in silkworm cocoon and egg production volumes, feedstuff reserve renewal, the use of state-of-the-art equipment, and unwinding cycle restoration.

Chapter 2. Follow-up Activities of Tashkent Workshop (April 2005) in Ukraine

Information about to the First International Workshop on Revival and Promotion of Sericultural Industries and Small Silk Enterprise Development in the Black & Caspian Seas Region, as well as its proceedings and creating the Black, Caspian Seas and Central Asia Silk Association (BACSA) were discussed at a meeting of the Learned Council of the Sericulture Institute, as well as at a meeting with the management of Ukrainian Silk Corporation and submitted to the Ukraine Ministry of Agrarian Policy.

Also, Ukraine Prime Minister was submitted a letter of the support of the Sericulture Institute and sericulture industry in the name of the International Workshop signed by 19 representatives of 9 countries.

In pursuance of a Ukraine Cabinet of Ministers' Decree, US$200,000 was allocated for sericulture industry development in 2005 under a budget program, Financial Support of Animal Husbandry and Crop Production.

By a request of the National coordinator of BACSA, the president of BACSA sent an official letter to the Minister of Agrarian Policy of Ukraine Mr. A. Baranovskii, indicating that Ukraine has one of the highest potential for sericulture development in the region, informing him about the role and participation of Ukraine in the regional silk industry revival and development activities.

Chapter 3. National Strategy of Sericulture Revival and Development in Ukraine

Industry Current State. To preserve the sericulture of Ukraine as an industry and its gene pool, urgent measures are taken to preserve and strengthen, in first turn, the state sector, that is to say, egg factories and specialty state-owned silk enterprises. Ukrainian Silk Corporation includes 13 silkworm rearing enterprises, 3 cocoon driers and an egg factory, which are engaged in growing cocoons, their primary processing, and egg production.

During 2004-2005, with the state support of US$100,000 and US$200,000 respectively, 12,682 kg and 17,147 kg of cocoons were grown (i.e., by 35.2% more) respectively (Table 1).

30% of the total cocoon volume was grown by individual farmers. A more increase in production volumes was hindered by unfavorable weather conditions, which affected feed quality thus, in turn, reducing farm productivity.

Table 1

Cocoon Production by Silkworm rearing Enterprises of Ukrainian Silk Corporation in 2004-2005

N	Name of Enterprise	Cocoons Grown, kg	
		2004	2005
1	Baryshevka Sericulture State Farm	2,500	1,911
2	Grenennyky Sericulture Enterprise	2,185	2,249
3	Znamenka Sericulture State Farm	-	41
4	Dobrovelychkovskyy Sericulture State Farm	1,220	1,179
5	Velyka Lepetykha Sericulture State Farm	550	100
6	Gogolivskyy Sericulture State Farm	348	1,106
7	Alexandria Sericulture State Farm	254	1,050
8	Ukrainian Sericulture State Farm	250	-
9	Pologivskyy Sericulture State Farm	-	1,242
10	Gorikhivske State Farm	-	513
11	Zaporizhshovk State Farm	472	1,500
12	Khorol Sericulture State Farm	211	1,452
13	Sakhnovshchyna Association	-	20
14	Kremenchuk Cocoon Drier	3,522	2,276
15	Kyiv Cocoon Drier	992	326
16	Pokrovska Cocoon Drier	-	2,047
17	Myrgorod Egg Factory	178	135
TOTAL		**12,682**	**17,147**

The preservation and maintenance of silkworm gene resources is the responsibility of the Sericulture Institute. The Institute's collection contains 120 silkworm races and strains (42 from Ukraine, 18 from Bulgaria, 15 from China, 9 from Egypt, 11 from Russia, 8 from Japan, 7 from Romania, 5 from Uzbekistan, 2 from India, 2 from Georgia, 1 from France) and 100 mulberry varieties (Ukrainian varieties and forms– 63, Uzbek ones – 11, Japanese ones – 6, Bulgarian ones – 4, Romanian ones – 2, Azerbaijan ones – 1, Russian ones – 6, Georgian ones – 1, Chinese ones – 1, Indian ones – 2, Korean ones – 2, and Italian ones – 1) collected from various countries worldwide for 70 years.

The maintenance and multiplication of silkworm races was aimed at the preservation of the parameters of economically valuable and morphological features of both caterpillars and cocoons corresponding to race descriptions. At the average, the collection pool silkworm races were characterized by caterpillar viability between 72.4% and 89.7%, fresh cocoon

weight between 1.7g and 2.3g, cocoon reelability between 76.9% and 86.6% and cocoon yield between 20.0 kg and 35.7 kg per 1 box (20,000) of eggs. During the last five years, silk ratio of the component races of naturalized hybrids varied between 21.1% and 22.7%.

Science Development Level. Engaged in researches in the sphere of sericulture since 1931 has been the Sericulture Institute of the Ukraine Academy of Agrarian Science. The Institute carries on its activities in the following lines:

1. The development and improvement of the methods of selection and breeding work in sericulture; the creation of new silkworm races and hybrids with high commercial parameters, high-yield mulberry varieties and hybrids;
2. The development and introduction of intensive methods of feedstuff production for silkworm rearings, of processing and improving quality of raw silk, as well as the methods of its assessment;
3. The improvement of egg production techniques, of egg quality;
4. The development of effective and efficient methods of silkworm and mulberry disease and pest prevention and control;
5. The creation and putting into production of machineries for comprehensive mechanization and automation of production processes; and
6. The organization of introducing research results into production and the popularization of achievements of both domestic and foreign science.

During 2001–2005, the Sericulture Institute completed 26 scientific developments protected by author's certificates and patents. The most important developments include:

- New races with high commercial parameters (Silk 1, Silk 2, Ukrainian 22, Ukrainian 23) and high-yield silkworm hybrids, which exceed the naturalized hybrids in silk productivity by 2.5% to 9.3 %;
- 3 new mulberry varieties (Spring, Slobozhanska 1, Merefa) and 1 hybrid (Kirovobad 10×Kharkiv 23), which are characterized by leaf high quality, resistance against diseases and low temperatures and which exceed the naturalized varieties and hybrids in leaf yield 1.5 to 2 times as much ; and
- Nadia fruit mulberry variety;
- 4 efficient process techniques of growing and increasing the productivity of mulberry feed plantations;
- A new method of assessing mulberry resistance against wilt for taking initial forms in the selection process;
- New receptions of increasing of viability and productivity of silkworm by optimization of structural parameters of it cultures;
- 5 highly efficient methods of egg and cocoon disinfection in egg production of Ukraine and 10 methods of the decontamination of rooms, equipment and implements at silk farms; and
- Efficient methods of the assessment and improvement of nonspecific resistance of silkworm races and hybrids against diseases and unfavorable environments using genetic research methods.

3 races and 7 hybrids of the silkworm and 6 new process techniques of silkworm rearing are introduced into production.

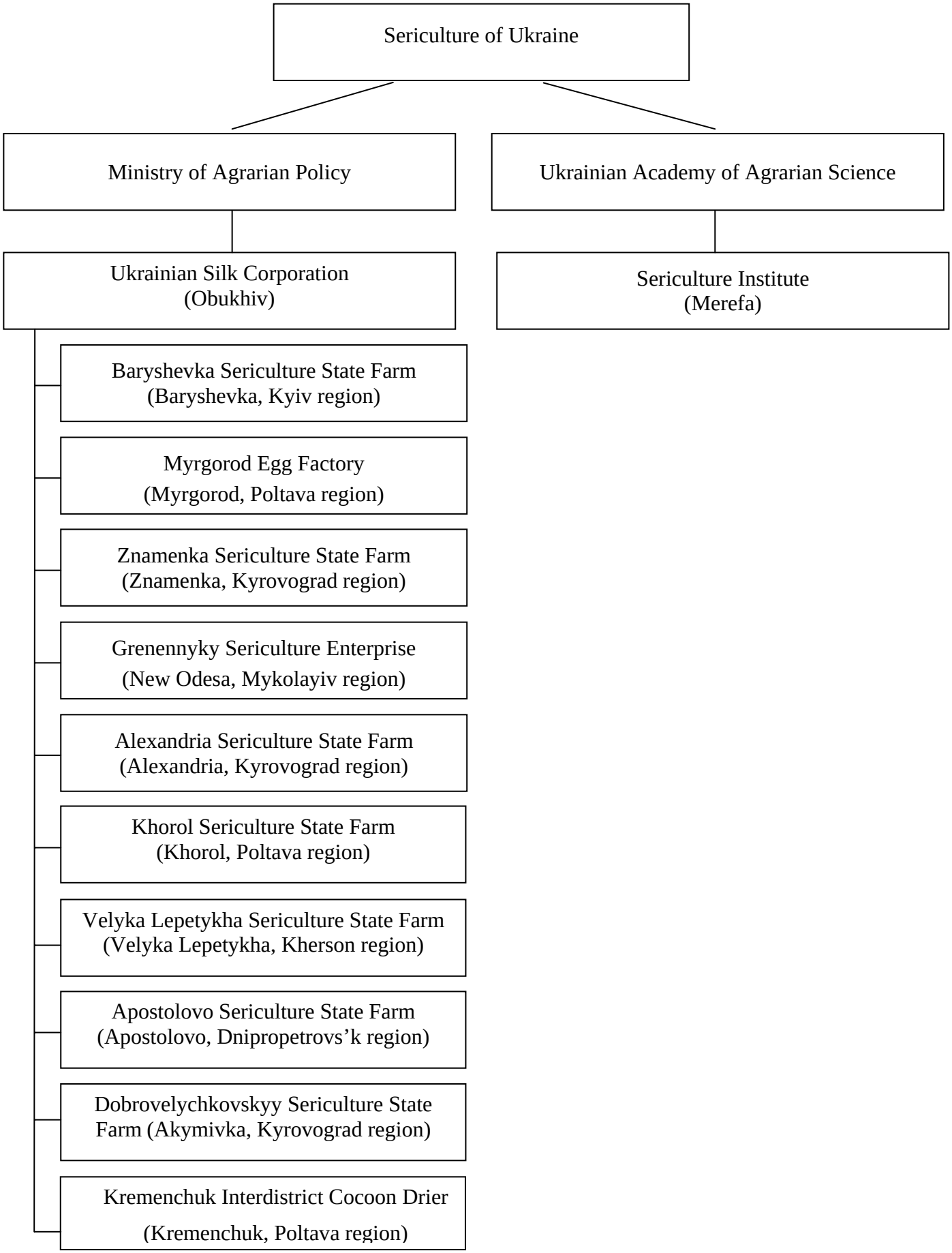

Fig. 1 - Structure of Sericulture Industry of Ukraine

Key Problems of Industry Development. The key problems encountered in the development of the sericulture industry and increase in production volumes include the lack of the required financial state support, reduction in the number of mulberry plantations suitable for exploitation and in feedstuff quality (no budget funds are allocated for uprooting old plantations and planting new ones), worn-out and obsolete equipment, and high prices of energy carriers.

Sericulture Development Strategy. The principal objective of the program of further revival and development of the sericulture industry is to increase the production of cocoons the quality whereof meets world standards. Under the departmental program, Silk of Ukraine, till 2010, cocoon production is planned to be increased up to 60,000 kg (Fig. 2) and egg production up to 300 kg (Fig. 3).

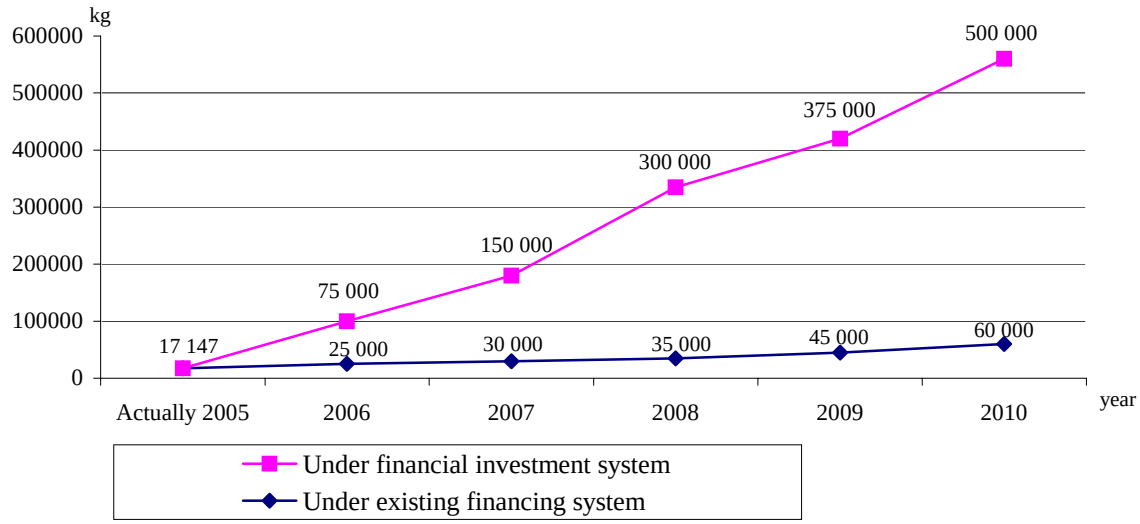

Fig.2 Silkworm cocoon production plan

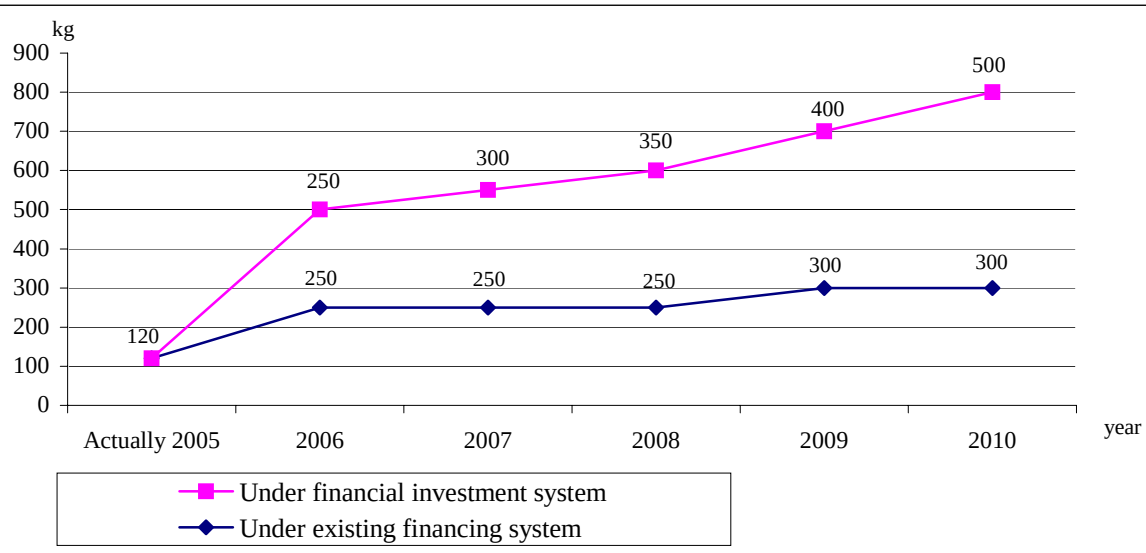

Fig. 3 Silkworm egg production plan

To ensure the fulfillment of the above program, it is planned to:

1. Improve thoroughly the feedstuff reserves through planting new plantations of high-yield mulberry varieties selected by the Sericulture Institute the rejuvenation of existing plantations.
2. Introduce, with the support of the Sericulture Institute, in production new silkworm races and hybrid featuring a raw silk output of at least 40 %, cocoon silk ratio of over 20 %.
3. Arrange large-scale production of the means of mechanization of labor-intensive processes such as machineries for harvesting and chopping mulberry leaves, forming mulberry plantations, and others.
4. Organize mass involvement of individual farmers in the silkworm rearing.
5. Arrange the processing of domestic raw silk and natural silk fabric manufacture at enterprises of the Ministry of Agrarian Policy and Ukrainian Silk Corporation
6. Establish a large-scale commercial production of pharmaceuticals made of silkworm eggs and pupae, which will be used both to treat diseases in humans and as stimulators for pedigree animals.

In implementing the Program till 2010, Ukrainian Silk Corporation has created a mechanized team to uproot old mulberry plantations, which uprooting is now under way at Pervomayskyy Silk Enterprise. Since the cost of uprooting 1 hectare of plantations is over US$1,300 and the total area to be uprooted is 916 hectares, it is impossible to perform this work without additional financial support.

To introduce the present days' world processes of rearing the silkworm, farms should procure high performance rearing lines, which would enable the cost of cocoons to be reduced 2 to 3 times and the competitive ability of Ukrainian raw silk in the world market to be increased. To reequip 16 silk enterprises, 43 rearing lines of US$840,000 worth are required.

The revival of processing enterprises producing thread and fabric would make it possible to improve drastically the financial position of silk enterprises and to saturate the domestic consumer market with natural silk products, as well as to increase the number of jobs in the industry.

During the last five years, Ukrainian Silk Corporation in collaboration with the Zaporizhzhya Medical University, the Dnipropetrovs'k and Donetsk Medical Institutes conducted clinical trials of treating properties of silkworm eggs, which showed favorable results in 86 % of the cases of treating old nonhealing skin ulcers in humans, as well as general improvement in human health.

A laboratory research of a silkworm egg based biologically active additive performed at the National Medical University showed favorable results in reducing insulin dependence in patients suffered from diabetes. Unfortunately, this work is terminated due to lack of funding for these purposes.

Chapter 4. Key Problems and Conclusions

The departmental program, Silk of Ukraine, till 2010, is developed aimed at the revival of sericulture in Ukraine, significant increase in silk product production, the establishment of both overseas and domestic sales markets.

Governmental funding is insufficient for the complete implementation of the program of sericulture industry development in Ukraine, i.e., additional investments are required in the following lines (Table 2):

- Feedstuff reserves;
- Construction;
- Silkworm cocoon production;
- Technical re-equipment of egg production facilities; and
- Creating silkworm cocoon processing facilities.

The implementation of this program would make it possible, thanks to the comprehensive use of the gained scientific and production potential of Ukraine sericulture, to:

- Produce over 500,000 running meters of natural silk fabrics a year,
- Create about 30,000 additional jobs in the country,
- Ensure intended use of 25,000 hectares to 30,000 hectares of lands occupied by mulberry plantations, and
- Produce necessary quantity of silkworm egg-based medical preparations to treat various chronic diseases.
- 2006 Development Plan includes such items as follows:
- Expected government support of industry development and maintenance – about US$400,000;
- Procurement from Moldova of cocoon reeling equipment with potential processing capacity of 50 MT of dried cocoons a year;
- Cooperation with Tajikistan in preparing silkworm eggs; and
- Attraction of both domestic and foreign investments in industry development.

Table 2

Principal Lines of Funding Sericulture Development in Ukraine(Calculations in Euro)

	Funding Required for Sericulture Development		
	Volume	Amount, € mn	Comments
Sericulture Feedstuff Reserves of Ukraine			
Uprooting old plantations, hectare	1300	1.6	
Planting new plantations, hectare	1500	3.6	
Construction			
Construction of present days' rearing houses with energy-conservation processes with full or partial silkworm rearing process mechanization, No. of buildings	40	1.2	
Silkworm rearing process lines, No.	40	0.9	
Mechanization of Caring Mulberry Plantations and Feedstuff Provision			
Mechanical means to care plantations, No.	40	1.3	
Mechanical means to provide feedstuff		2.0	
Mechanical means for sericulture industry		0.5	Sericulture Institute
Selection activities		0.5	Sericulture Institute
Egg Production Facilities			
Re-equipment of Egg Factory	1	1.8	
Processing Silkworm Cocoons			
Creating processing facilities based on specialty farms	1	2.3	
Technical re-equipment of silkworm cocoon primary processing facilities, No.	3	0.3	
Total capital investments, € mn		16.0	

The Silk Industry Achievements of the Republic of Uzbekistan according to results of the First International Workshop on revival and promotion of sericultural industries and small silk enterprise development in the Black & Caspian seas region, (Tashkent, Uzbekistan; 11–15 april 2005) and perspectives of its development

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Food and Agriculture Organization, Rome, Italy

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ABSTRACT

Sericulture - one of the potentially important sectors of an agrarian industry of Uzbekistan. At transition to the new form of managing day-to-day amount of the farmers who will be engaged at sericulture increases.

Now about 450 000 home facilities are engaged in silkworm larvae cultivation and more than 2 million people earn their living in the silk industry and in sphere of its trade. As a whole sericulture and silk industry provides more than 20 % of the general income of the population of Republic. Now are functioning in the Republic 14 silkworm egg production factories, 3 P_3-P_1 pure-line egg production stations, 10 specialized sericultural farms producing 30 tons of pedigree cocoons and more than 20 millions of mulberry tree seedlings. As a whole, the Republic makes annually more than 16 thousand tons of fresh cocoons or 6.5 – 7.0 thousand tons of dry cocoons. For this purpose 320-350 thousand boxes of silkworm eggs are necessary (1 box = 29 g). Actually at silkworm eggs enterprises of the Republic are prepared 160-175 thousand boxes. Silk-reeling factories at capacity of 1600 tons manufacture 800-1300 tons of raw-silk. 6 silk-weaving factories make about 2.5 millions metres of silk fabrics.

Enterprises of silkworm egg production are in a pitiable condition. Existing in Uzbekistan 14 factories at annual capacity about 600 000 boxes of silkworm eggs, in 2005 have made only about 240 000 boxes, that makes less than 50 % of required volume of the country in silkworm eggs. A missing part (more than 50 %) of eggs the association " Uzbek ipagi " annually provides by importing silkworm eggs of bad quality from China.

By the beginning of 2005 the fodder base of Republic consists of 109964 thousand pieces of linear plantings and 38116 hectares of mulberry tree plantations. The productivity of leaves at linear plantings from each tree makes 2.7 kg of leaves, and at muberry plantations 3.4 tons/hectare, that is a low parameter.

Now all efforts are directed on rise of manufacture. At 6 silk-weaving enterprises of the association the cotton fabrics are made. Volume of fabrics manufacture increases from year to year and by 2005 has made 72018 thousand m^2.

The similar picture is traced on volume of consumer goods manufacture, which has reached in 2005 4368.6 mln. sums or about US$ 4051.0 thousand.

Now structure of association includes 6 joint ventures on silk processing, which have made in 2005 production for the sum of 2438.5 mln. sums or US$ 200.6 thousand, which is completely delivered on export.

In the branch production export growth is annually increased. In 2005 this parameter has achieved US$16.321 mln.

According to the decision of the Government 25 investment projects are prepared. Gradual realization of them by 2010, by direct foreign investments and credits for a total sum about US$ 31.2 mln. will be carried out technical reequipment of 10 silk-reeling and 5 silk-weaving factories, that will give an opportunity to organize 9 new factories on manufacture of ready products, increase of manufacture volume of industrial production in 3.5 times, volume of export in 5 times, creation in addition more than 5.7 thousand new workplaces.

Key words: sericulture, development Uzbekistan

Chapter 1. Introduction

The sericulture development of the Republic of Uzbekistan has a long history. There is an information on existence of sericulture and silk-weaving on the territory of the Republic 4000 years ago in the Fergana valley, on sources of the Zaravshan river, and also in the south of the Republic.

For 1500 years (II part of I century and XV century) existed the Great Silk Road form western China to Europe, going through the countries of all Asia and including territory of modern Uzbekistan, especially ancient cities like Samarkand and Bukhara.

In territory of Central Asia, especially on a line of the Great Silk Road - Samarkand, Shahrisabz, Bukhara, Turkestan and Fergana valley was widely advanced sericulture, silk-reeling and silk-weaving with application of gold embroidery elements.

In the beginning of 20^{th} century silkworm eggs were delivered from the countries of Europe, manufacture of cocoons and their processing were carried out by a handicraft way, and the silk fabrics, basically, were bought by foreign firms of the European countries. In the Republic was absent cocoon-reeling and silk-weaving industries.

In 1923, after establishment of Turksilk company manufacture of own silkworm eggs and after creation of silk-reeling factories manufacture of raw-silk were begun.

In 1922 the first scientific station of sericulture in Tashkent was created and later in 1927 the station was transformed into the Central Asian Research Institute of Sericulture(CARIS), nowadays renamed to the Uzbek Research Institute of Sericulture (URIS). Before independence of Uzbekistan the institute was the main scientific coordinating Centre in the former Union.

Till 1991on the former Union territory Uzbekistan was on the first place on annual silkworm egg manufacture, about 600 thousand boxes (29 g/box) and fresh cocoons in volume 32-35 thousand tons.

In connection with disintegration of the Union which has entailed behind self infringement of social and economic mutual relations, easing of the control has had a negative effect on silkworm egg manufacture. Distribution of illnesses during feedings, infringement of technology, realization of delayed payment for cocoon production to the manufacturers etc. gradually have resulted in reduction of made cocoons quantity. To the present time 16300 tons of fresh cocoons are made.

Despite many problems of the transitive period from the centralized economy to free market system, the Government of Uzbekistan has managed to save a basis of cocoon and raw-silk manufacture. The country now is considered to be the third largest manufacturer in the world after China and India and remains the first manufacturer in the world per head of the population.

Condition of silk branch. Sericulture - one of the potentially important sectors of an agrarian industry of Uzbekistan. At transition to the new form of managing day-to-day amount of the farmers who will be engaged at sericulture increases. Now about 450 000 home facilities are engaged in silkworm larva cultivation and more than 2 millions people earn their living in a

silk industry and in sphere of its trade. As a whole sericulture and silk industry provides more than 20 % of the general income of the population of Republic.

All organizations engaged at sericulture and a silk industry of the country are incorporated in the "Uzbek ipagi" association, where the enterprises of all technological process, form silkworm eggs manufacture and till manufacture of the ready goods - silk, mixed fabrics and ready-to-wear clothes are vertically incorporated.

In "Uzbek ipagi" association there are enterprises, which prepare and initially process cocoons: 13 joint-stock regional unions, which include 122 cocoon drying enterprises, 14 silkworm egg factories, 3 parental (P_3-P_1) silkworm egg breeding stations, 10 farms for mulberry sapling production, 7 silk-reeling factories, and also 6 joint venture enterprises, Uzbek Scientific Research Institute of Sericulture, "Shoyi" (silk) Research Institute, 8 auto-enterprises, 6 silk-weaving factories, Margilan mechanical factory.

At this time there are 14 silkworm egg factories, 3 pure-strain sericultural stations and 10 specialized sericultural farms producing 30 tons of pure-strain cocoons and more than 20 millions of mulberry tree seedlings. Totally our Republic produces more than 16 thousands tons of fresh cocoons or 6.5-7.5 thousands tons of dry cocoons a year. For this purpose it is necessary to produce 320-350 thousand boxes of silkworm eggs. Actually at factories of the Republic prepare 160-175 thousands of boxes. Silk-reeling factories with an output of 1600 tons produce only 800-1300 tons of raw silk; 6 silk-weaving factories produce about 2.5 millions meters of silk fabric.

Silkworm egg manufacture enterprises are in a pitiable condition. Existing in Uzbekistan 14 factories at annual capacity of about 600 000 boxes of silkworm eggs, in 2005 have made only about 240 000 boxes, that makes less than 50 % of needed silkworm eggs amount. The missing part (more than 50 %) of it "Uzbek ipagi" provides by import of law qualitysilkworm eggs from China.

In silkworm egg production enterprises of Uzbekistan, owing to occurrence of illnesses the specific output of silkworm eggs from 1 kg of fresh cocoons makes only 33-35. Last years, because of easing the control after illnesses, the level of pebrine pest sharply has increased. In some factories, according to results of microanalysis, the level of pebrine pest reaches 30-50 %. Besides, by results of Governmental control, 20-25 % of prepared silkworm eggs are rejected.

The occurrence of especially dangerous illness – pebrine pest is connected to an inadequate level of feeding rooms disinfection realisation, stock and equipment, infringement of breeding material selection technology, by not observance of the technological rules at industrial silkworm eggs preparation at the factories, out-of-date microscopic engineering both low staff qualification etc. By the beginning of 2005 the fodder base of Republic consists of 109964,1 thousand pieces of linear plantings and 38115,9 hectars of mulberry tree plantations. The productivity of leaves at linear plantings from each tree makes 2,7 kg of leaves, and at muberry plantations 3,4 tons/hectar, that is a low parameter.

It is necessary especially to note, that because of easing attention to the sericulture branch fodder mulberry tree plantings were considered "ownerless", a level of agro-technics sharply has worsened, especially the system of branch-cutting. For this reason many plantings have an extremely inconvenient for operation form.

Now by the pest ***Glyphodis pylailis Walker*** are struck more than 41547 thousand pieces of linear plantings and 5011 hectars of mulberry tree plantations. Because of unsufficient acceptance of sruggle measures with the pest, area of its distribution continues to extend, brings serious damage and can even result in destruction of existing mulberry plantings.

In the whole development of silk branch of Uzbekistan now is before a range of old and new problems of cocoon, raw silk and silk products manufacture and selling volume preservation. The arisen situation consists in the following:

- too poor quality of made cocoons and raw-silk resulting in low cost at the internal and external markets;
- existing material base of science being old and unsufficient for decision of arising questions and problems of the branch;
- loss of silkworm eggs production volume and silkworm cocoon crop because of deseases;
- poor harvest of mulberry leaves, accompanying by the large expenses of work at cultivation and operation;
- absence of silkworm breeds, generically stable against illnesses and climatic conditions of their cultivation, that results in made silkworm eggs quality decrease, not appropriate to the international standards;
- absence of equipment for silkworm larva cultivation and high labour expenditures in aggregate resulting in a poor harvest of cocoons from each box and as a result in high cost of manufacturing;
- preservation of old technological manufacture process and control system, and also absence of the commercial approach at production;
- unsufficient quantity of the qualified training staff, absence of technical council, educational materials and visual aids, training and improvement of professional skills of the staff, marketing study and distribution of the new information;
- weak coordination among sericulture branch and other sectors such as forestry, public health services, environment, with the purpose of additional support reception from the Government, non-governmental organizations and private sector;

The short offers on development prospect of the Republic's silk branch. The decision of the problem interfering economic development of silk branch is possible by creation of the national silk branch support program by the State, directed on strengthening of internal potential of sericulture, strengthening of scientific and technical opportunities of research insti-

tutes, improvement of manufacture control system, rise of an economic efficiency at preparation of high-quality free from illnesses silkworm eggs of highly productive hybrids, allocation of the additional ground areas for creation of new types of highly productive mulberry tree plantations, maintenance of existing fodder base protection from cabin also protect them from illnesses and pests, correct organization of silkworm larva feeding realization and preparation of cocoons in the new form of managing farms, realization of silk-processing enterprises modernisation, creation of uniform politics of the received income distribution between the subjects of branch and attraction of the foreign investments.

The offer on cooperation among countries of the region in the near future. Silk culture in many countries of region was one of the basic branches of agriculture. According to the data, in 1990-92 in the countries of Commonwealth of the Independent States (CIS) was made 53,3-56,5 thousand tons of fresh cocoons. Thus the countries annually made cocoons in the following order: Azerbaijan -5543,2 t, Georgia - 1918,8 t, Kazakhstan -266,5 t, Kirghizia - 1119.3 t, Moldova -213,2 t, Russia -906,10 t, Tadjikistan -4477,20 t, Turkmeniya -5223,40 t, Uzbekistan -32299,8 t and Ukraine -1332,5 t.

The disintegration of the Union which has entailed behind self infringement of social and economic mutual relation, has not bypassed by the party and silk industry of the countries of CIS. In some of them the production has decreased almost twice. In many countries the existence шелководства and at all has stopped.

With the purpose of achievement of the goals set on the first international symposium on revival and development of sericulture industry and handicraft manufacture of silk in the countries of of the Black, Caspian seas and Central Asia regions in April, 2005 (Tashkent), were discussed perspectives of its development through cooperation in the following directions:

- Creation of the regional scientific - coordination centre on an exchange of experience by the scientists and experts, introduction of advanced technology directed on restoration and development of silk industry.
- Genetic resources exchange realization, development of the interstate program on new highly productive silkworm and mulberry strains and hybrids breeding and mulberry plantations protection from distribution of wreckers and illnesses.
- Creation of the regional centre of personnel training and improvement of silk industry experts' professional skills.
- Adjustment and expansion of the trade-economic relations between the countries of region, study of the silkworm egg, planting material, engineering and technology, etc. export and import markets.
- Establishment intergovernmental connections and every possible attraction of financial support directed on restoration and development of silk branch.

Chapter 2. Achievements of the silk industry of Uzbekistan according to results of the Rirst international symposium in April, 2005 (Tashkent)

Last years, due to the initiative of the President of the Republic of Uzbekistan Islam Karimov, attention on the part of the state, the purposeful job on silk production manufacture and export potential of the enterprises of branch increase is carried out. That is proved by a number of the government decisions.

The decision of the Cabinet of the Republic of Uzbekistan of March 15, 2000 №96 "About measures on strengthening fodder base and increase of volumes of sericulture production" and of April 5, 2002 №118 " About measures on the further silk branch development of the Republic of Uzbekistan ". They are directed on maintenance of the further silk branch development, strengthening of fodder base and increase of cocoon manufacture, strengthening of sericulturists' material interest, and also increase of made production quality.

On results of the "First international symposium on revival and development of silk industry and silk handicraft manufacture in the countries of regions of the Black, Caspian seas and Central Asia " held in April, 2005 (Tashkent), the President of Republic of Uzbekistan I. A. Karimov has charged the Cabinet to study and to establish productivity of economic reforms in the silk branch and practical measures on its further steady development maintenance.

According to the given order on April 30, 2005 under presidency of the prime Minister of the Republic the session was held, where the productivity of held economic reforms in silk branch was discussed and the plans of economic development of silk branch today and in the long term were planned.

Sericulture fodder base development. The inventory of mulberry tree plantings (on May 1, 2005 in the Republic there are 46.7 ths hectares of plantations and 97,4 mln pieces of linear plantings) determined the unsatisfactory condition of them and volume shortage of fodder base. The following instructions are given on these facts:

- To ministerial council of the Republic Karakalpakstan and Local authorities to develop and ratify measures on mulberry tree plantations and linear plantings creation, in view of unsuitable plantations replacement and expansion of landings ensuring needs in mulberry leaves taking into consideration prospective growth of cocoons manufacture.
- To develop rules about the mulberry plantations transfer order on balance of territorial procuring organizations of the "Uzbek Ipagi" association, and also about the reserving order of mulberry linear plantings for farms.
- To prepare and to introduce the an appropriate decision project of the Cabinet to the Republican Centre of Plants Protection and agro-chemistry of Agriculture and Water Facilities Ministry, to ensure in 2005 organization of three time processing of deseased mulberry trees.
- To the Republican Centre of Plants Protection and agro-chemistry to carry out a complex of measures on struggle with pests.

Domestic silkworm egg production development. For today the need in silkworm eggs for manufacture of cocoons is satisfied by domestic breeds and hybrids less than on 50 %. It is explained by absence of demand on cocoons made from domestic silkworm eggs.

To the Research-and-Production Center of agriculture and Uzbek Scientific Research Institute if Sericulture it is necessary in a month's time to develop and to present, according to the Order of the President of March 18, 2005 № P-2167, to the Cabinet for approvement a complex of effective measures directed on creation of new high-yield mulberry tree breeds, selection and breeding of new domestic highly-productive silkworm eggs breeds and hybrids, realization of which will allow, since 2007, completely to supply needs of cocoon producers in domestic silkworm eggs.

Contract fulfilment. In 2005 in the Republic were prepared 16,3 thousand tons of fresh cocoons, that corresponds to a level of 2004.

Association “Uzbek ipagi" together with Ministerial council of the Republic Karakalpakstan, local authorities and Ministry of a agriculture and water facilities in fortnight term is entrusted to result a level of the contracting in conformity with volumes authorized by the decision of the Cabinet of April 5 2002 №118 and to supply advancement of their production.

To the association "Uzbek ipagi" is given the order to organize conclusion of contracts in volumes established by the appropriate decision of the Cabinet. It is entrusted to commercial banks to provide when due hereunder distribution of credits for cocoon manufacture advancement.

Financial improvement of the “Uzbek Ipagi” system enterprises. In the whole enterprises financial condition is stays difficult. In this connection with this by State committee on demonopolization, support of a competition and business together with the " Uzbek Ipagi " association is given the order to develop and to ratify measures on financial improvement of the economically insolvent enterprises of association.“Uzbek ipagi” association also needs to:

-to develop the complex measures ensuring increase of saturation of silk fabrics home market of export by production with high added cost.

-to develop an international presentation of investment attractiveness program of the industrial enterprises and measures on foreign investments attraction in branch.

Elaboration of branch development program for the 2005-2010 period. Association "Uzbek ipagi" together with the Ministry of agriculture and water facilities, Ministry of economy, Ministry of finances, Ministry on external economic connections, Committee on economic inconsistency of the enterprises, Local authorities have to develop for the Cabinet’s consideration a package of the documents including measures on the further perfection of “Uzbek ipagi” association activity, and also a complex program of silk branch development for the period 2005-2010, providing:

- gradual expansion and condition improvement of fodder base, increase of fresh cocoons manufacture and improvement of their qualitative parameters with orientation for the maximal processing inside the country;

- restoration and development of highly productive silkworm eggs domestic manufacture;

- creation of the cocoon manufacturers stimulation system;

- complex of measures directed on improvement of a financial condition of the economically insolvent enterprises, with reduction of their number, including prolongation till July 1, 2008 given by the decision of the Cabinet of 9.09.2003 №390, delay on payments in the budget and non-budget funds of the enterprises and organizations of "Uzbek ipagi"association;

- perfection of silk branch enterprises taxation system, including clearing sold to agricultural enterprises silkworm eggs and dry cocoons from the VAT;

- attraction of the direct foreign investments for equipment renewal of silk-reeling and silk-weaving manufactures, finishing of ready production quality up to conformity to the world standards, expansion of assortment of made production and saturation by them of a home market;

-increase of an export potential of branch by expansion of production with added cost.

Chapter 3. Conditions and national strategy of silk branch development of the Republic of Uzbekistan

Now functioning in republic 14 silkworm egg factories, 3 parental (P_3-P_1) silkworm egg breeding stations, 10 specialized sericultural farms producing 30 tons of pure-strain cocoons and more than 20 millions of mulberry tree seedlings. Totally, the Republic in 2005 has made 16300 tons of fresh cocoons or more than 6,0 thousand tons of dry cocoons. At silk worm egg production enterprises were prepared 160-175 thousand boxes of silkworm eggs, 7 silk-reeling factories at capacity of 1600 tons actually make 800-1300 tons of raw-silk, 6 silk-weaving factories make about 2,5 millions metres of silk fabrics.

The reception of high-quality cocoons in many respects is caused by quantity and quality of mulberry tree leaves. A crop and nutritiousness of a leaf, in turn, depend on mulberry breed, plantation type, agro-technics level, and also presence of a moisture and other elements in it.

The inventory of mulberry treeplantings is carried out. By May 1, 2005 in the Republic is present 46.7 thousand hectares of plantations and 97,4 mln. pieces of mulberry tree linear plantings. The leaf productivity at linear plantings from each tree makes 2,7 kg, and at mulberry tree plantations 3,4 t/ha, that is a low parameter.

The fodder base of sericulture for today basically consists of the hybrid forms and local population "Khasak". The created perspective mulberry tree breeds in manufacture make about 3-5 % of the general area of plantations.

It is important, that to more than a half of mother seed plantations for today updating is necessary, as the seed material not completely satisfy the modern requirements.

As a result of intensive exploitation and after the expiration of time mulberry planting grow old, the productivity of leaves is reduced.

It is necessary especially to note, that because of easing attention to the sericulture branch fodder mulberry tree plantings were considered "ownerless", a level of agro-technics sharply has worsened, especially the system of branch-cutting. For this reason many plantings have an extremely inconvenient for operation form.

Now by the pest ***Glyphodis pylailis Walker*** are struck more than 41547 thousand pieces of linear plantings and 5011 hectars of mulberry tree plantations. Because of unsufficient acceptance of sruggle measures with the pest, area of its distribution continues to extend, brings serious damage and can even result in destruction of existing mulberry plantings.

Last years, due to the initiative of the President, attention on the part of the state the purposeful job of silk production manufacture increase and increase of an export potential of the enterprises is carried out, its prooved by a number of government's decision.

As a result of the international symposium on revival and development of silk industry held in April, 2005 in Tashkent, according to the order of the President and the Cabinet the program of steady development of silk branch is developed:

Development of sericulture fodder base. According to the given program by ministerial Council of Republic Karakalpakstan and local authorities are developed the measures on sericulture plantations and also linear plantings creation are authorized in view of unsuitable plantations replacement and expansion of plantings ensuring need in mulberry leaves in view of prospective growth of silkworm cocoon manufacture.

In 2005 creation of new mulberry tree plantations on 4 ths ha for 5 months is stipulated, i.e. are planted 1,7 ths ha (42,5 %). Left 2,3 ths ha it is planned to plant in the autumn. It will ensure needs of branch in mulberry leaves, stipulated by the decision of the Cabinet of April 5, 2002 №118.

It is recommended to create mulberry plantations from a number of regioned and economically-valyable mulberry tree breeds: Tadjik seedless, Pioneer, October, Surkh-tut, Uzbek, Winter-stable, Mankent, Golodnostepskiy -6 and SANIISH-33, mulberry hybrids Topcross-2, Topcross-3 and Uzbekistan (table 1) and provide their reproduction in specialized sericulture facilities according to the table 2 (diagram 1, 2 and 3).

These breeds are propagated by crossing the new parental mulberry forms of the received hybrids giving in the first generation a homogeneous selection material, distinguished by high efficiency and nutritiousness of leaves. The leaf productivity of mulberry hybrids considerably exceeds a control hybrid on the average of 42,6 - 76,6 %. At account of cocoon output from each hectare of plantings at new hybrids excess from the control 84,8 - 103,1 %, similar dynamics is traced concerning raw-silk output.

Table 1. Economically-valuable attributes of regioned mulberry varieties, recommended by commission for further duplication in sericultural facilities of the "Uzbek – ipagi" association.

Vegeta-tion du-ration, days	Leaf shape	Average leaf size, sm	Leaf pro-ductivity from 1 hectar, tons	Leaf out-put, %	Cocoon out-put from 1 plantation hectar, kg	Duplication mehtod	Optimal scheme of laying	*Recommended feeding regions
1	2	3	4	5	6	7	8	9
Tadjic seedless								
209-220	**blade**	**17,0 x 14,5**	**11,9**	**46-53**	**1070**	**grafting**	**4 x 0,5 m**	**1,4,7,8**
Khasak – control								
			8,5		710			
Pioneer								
211	**Integral**	**17,0 x 12,8**	**10,48**	**36-38**	**870**	**grafting**	**4 x 0,5 m**	**3,10,12**
Khasak – control								
			6,44		540			
October								
220	**Integral**	**13,8 x 19,8**	**9,45**	**34,5**	**930**	**grafting**	**4 x 0,5 m**	**8**
Khasak – control								
			6,05		620			
Surkh-tut								
210-216	**Integral**	**16,0 x 13,0**	**8,94**	**38-42**	**820**	**grafting**	**4 x 0,5 m**	**12**
Hybrid - control								
			7,02		620			
Uzbek								
206-210	**Integral**	**18,2 x 15,1**	**11,06**	**36-38**	**990**	**grafting**	**4 x 0,5 m**	**2,12**

Table 1 continuation

1	2	3	4	5	6	7	8	9
Tadjic seedless – control								
			8,50		740			
Winter-hardy								
216	**Integral**	**18,7 x 16,5**	**11,50**	**44**	**970**	**grafting**	**4 x 0,5 m**	**7,11**
Tadjic seedless – control								
			7,10		600			
Mankent								
217	**Integral**	**18,0 x 14,0**	**9,31**	**50**	**870**	**grafting**	**4 x 0,5 m**	**7,11,12**
Pioneer – control								
			6,74		610			
Golodnostepskiy-6								
220	**Integral**	**18,0 x 12,2**	**11,21**	**34**	**1070**	**grafting**	**4 x 0,5 m**	**1,4**
Tadjic seedless – control								
			9,84		860			
SANIISH-33								
215	**Integral**	**12,2 x 8,1**	**18,75**	**50**	**1570**	**grafting**	**4 x 0,5 m**	**3**
Tadjic seedless – control								
			17,33		1180			

Table 2. Manufacture of a planting material in the Republic of Uzbekistan for the period of 2005 - 2010

Farms	2005		2006			2007			2008			2009			2010		
	Seedlings, mln pieces	Hybrid seedlings, ths pieces	Seedlings, mln pieces	Hybrid seedlings, ths pieces	Grafted seedlings, ths pieces	Seedlings, mln pieces	Hybrid seedlings, ths pieces	Grafted seedlings, ths pieces	Seedlings, mln pieces	Hybrid seedlings, ths pieces	Grafted seedlings, ths pieces	Seedlings, mln pieces	Hybrid seedlings, ths pieces	Grafted seedlings, ths pieces	Seedlings, mln pieces	Hybrid seedlings, ths pieces	Grafted seedlings, ths pieces
Khujabad	3,1	700	3,5	1000	50	4,0	1300	91,0	5,0	1500	135	7,0	2000	240	10,0	2500	345
Bukhara	6,5	1400	7,0	1600	80	8,0	1800	126	10,0	2000	180	14.0	2500	300	20,0	3000	450
M. Ulugbek	1,5	300	2,0	500	25	2,5	600	42,0	3,5	800	72	5,0	1000	120	8,0	1500	225
Namangan	8,0	1200	8,5	1500	75	9,0	1700	199	11,0	1900	171	15,0	2100	252	20,0	2700	405
Samarkand	2,0	250	2,5	500	25	3,0	600	42,0	4,0	800	72	6,0	1000	120	10.0	1500	225
Urgench	2,0	950	2,5	1200	60	3,0	1300	91,0	4,0	1500	135	6,0	1700	204	10,0	2000	300
Turkul	10,0	1880	11,0	2000	100	12,0	2200	154	14,0	2400	216	16,0	2700	324	20,0	3000	450
Shahrisabz	1,5	150	2,0	500	25	2,5	600	42,0	3,5	800	72	5,0	1000	120	6,0	1200	180
Tashkent	4,0	1500	5,0	1800	90	6,0	1900	133	7,0	2000	180	9,0	2200	264	10,0	2500	375
Fergana	2,0	300	2,5	500	25	3,0	600	42,0	4,0	800	72	6,0	1000	120	7,0	1200	180
Gulistan	5,0	500	5,5	800	40	6,0	1000	70,0	7,0	1200	108	10,0	1500	180	13,0	2000	300
Fergana parental (P_3-P_1) silkworm egg breeding stations	6,0	400	6,0	600	30	7,0	700	49,0	8,0	900	81	9,0	1000	120	9,5	1200	180
Jarkurgan	3,0	650	4,0	800	40	5,0	1000	70,0	6,0	1200	108	9,0	1500	180	12,0	2000	300
In total	54,6	10180	62,0	13300	665	71,0	15300	1071	87,0	17800	1602	117	21200	2544	155,5	26300	3945

Note: the grafting of seedlings is carried out by an initial material of breeds Tadjik seedless, Uzbek, Surkh-tut, SANIISH-33, Pioneer, October, Mankent, Winter-hardy and Golodnostepskiy-6.

Diagram 1. Mulberry tree seedlings production at specialized sericultural farms of the Republic

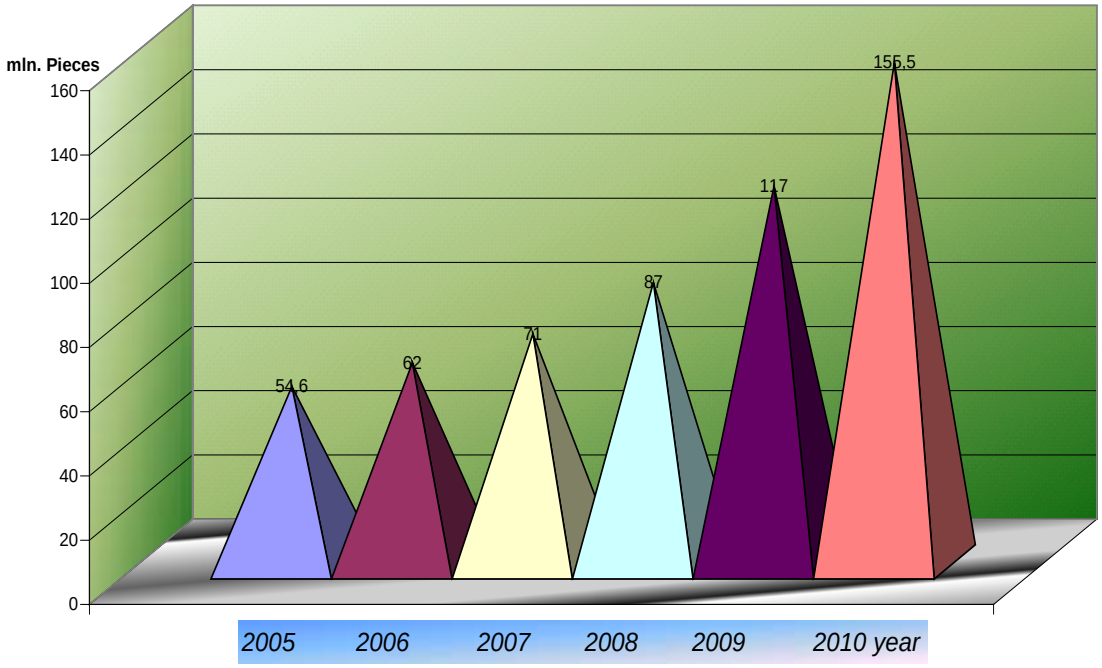


Diagram 2. Mulberry tree seedlings production plan at specialised sericultural farms

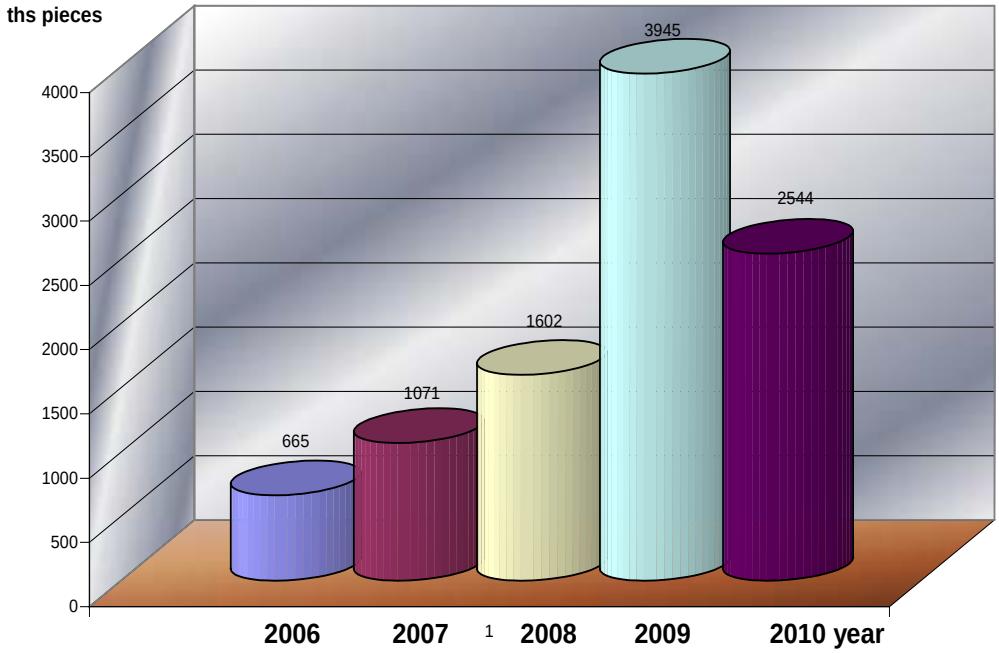
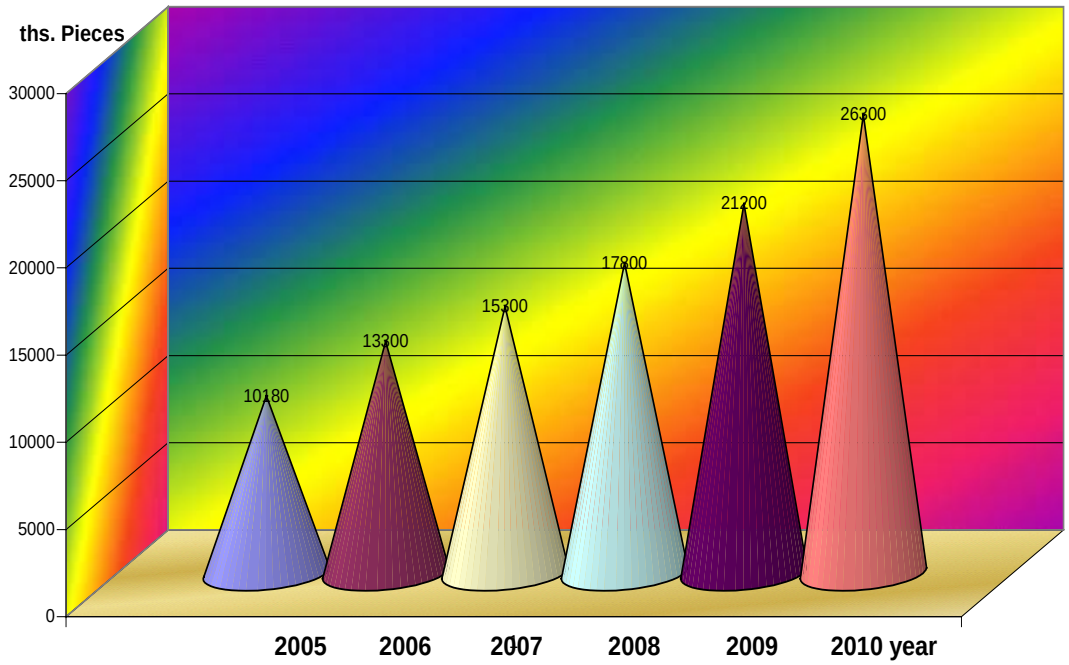


Diagram 3. Hybrid seedlings production dynamics at specialised sericultural farms of "Uzbek ipagi " association



Despite of labour input of vegetative duplication the new mulberry breeds differ by high leaf productivity and nutritiousness. The output of fresh cocoons from each hectare of used plantations of these breeds makes within the limits of 8,7 - 15,7 centners, that exceeds control variants on 32,3 - 61,7 %.

The rules of the transfer order of mulberry tree plantations on balance of territorial procuring organizations of the "Uzbek ipagi" association, and also about the order of reserving of linear mulberry plantings for farms are developed. The rules provide:

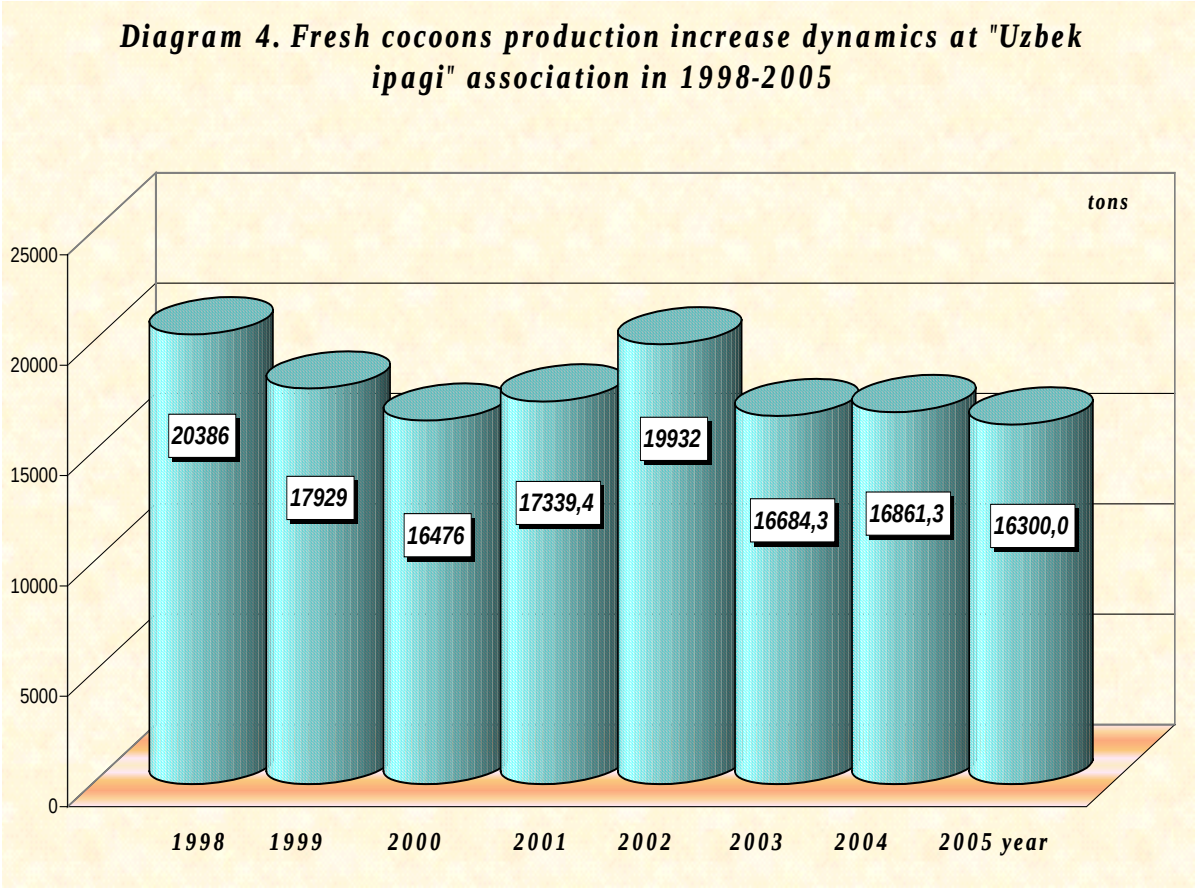
-On end of commissions on farms reorganization to pass in long-term rent (50 years) to procuring organizations of the "Uzbek ipagi" association mulberry tree plantations, with an opportunity of sub-rent to farms, or creation of a special industrial infrastructure on care of mulberry plantings;

-Reserving for farms linear mulberry plantings taking place on border or near to the sowing areas along with the contracts of land rent;

-With the purposes of an appropriate care maintainance for mulberry tree plantings the opportunity of cancellation of the appropriate contracts is provided at regular decrease of mulberry tree productivity during three years.

As stimulation of farms at a care of plantations they are authorized to use land between the trees for sowing agricultural cultures at the own discretion for the subsequent realization, and also the mechanism of mulberry tree leaves realization on a paid basis is studied.

Development of domestic silkworm eggs production. The release of products from natural silk requires manufacture of high-quality raw material. In this case it would be desirable to note, that made cocoon production from silkworm hybrids, nowadays existing in Republic, does not fully satisfy needs of the industry. Application of out-of-date silkworm egg production technology, feeding of larvas of out-of-date silkworm breeds and hybrids, occurrence of illnesses and etc. resulted in the tendency of qualitative and quantative cocoon production volume reduction (diagram 4).



It is known, that the successful development of sericulture first of all depends on a condition of silkworm egg manufacture, in particular from quantity and quality of hybrid eggs made. Existing in Uzbekistan silkworm egg production factories at annual capacity about 600 000 boxes, in 2005 have made only about 240 000 boxes, owing to occurrence of illnesses the specific output of silkworm eggs from 1 kg of fresh cocoons makes only 33-35. In some factories, by results of the microanalysis, the level of pebrine reaches 30-50 %. Besides, by results of State control, 20-25 % of prepare silkworm eggs is rejected. Prepared volume makes less than 50 % of required volume of the country in silkworm eggs, a missing part (more than 50 %) the association "Uzbek Ipagi" is annually compelled to provide by import of bad quality silkworm eggs from China.

The regulated technological process, established at these enterprises, of hybrid silkworm eggs manufacture, usual to 40-s, is imperfect, since is based on manual selection of pedigree cocoons, use of a weight principle of cocoons division on sex, application of isolative paper bags for laying silkworm eggs by butterflies, that does not provide qualitative selection of pedigree cocoons on, growth of efficiency duplicated breeds and, naturally, silkworm egg quality.

Prepared breeding and industrial silkworm eggs does not provide needs of republic in silkworm eggs and lags behind on quality of foreign analogues. Hence, the reception of high-quality hybrid silkworm eggs, first of all, is connected to necessity radically change existing technology of egg production. In the long term development of sericulture branch of Uzbekistan is directed basically on manufacture of high-quality cocoons, satisfying requirement of the international market, first of all it depends on presence in manufacture of highly productive silkworm breeds and hybrids, highly effective technology of silkworm egg manufacture, i.e. from quantity and quality of made hybrid silkworm eggs.

During many years in branch was no breed-change, in manufacture were reared breeds and hybrids with low productive parameters.

The scientists of Research Institute of Sericulture, improving selection process of new breeds and hybrids, for short time have developed 19 pure breeds and 25 industrial hybrids of silkworm. The new hybrids were passed to State test, from them 14 hybrids, passed tests and were accepted to regionization.

In connection with the assignment of the Cabinet by the Uzbek research-and-production centre of an agriculture together with Uzbek Research institute of sericulture from available 14 domestic hybrids by results of tests are selected 9 hybrids (Uzbekistan 5, Uzbekistan 6, Turon 1, Ipakchi 1 x Ipakchi 2, Ipakchi 2 x Ipakchi 1, Bahor 1, Bahor 2 and Khotira) with most best parameters on efficiency and quality answering the world standards and the measures on improvement of selection work and creation of new breeds and hybrids of domestic silkworm eggs, development of new technologies of its preparation (table 3 and 4) and are carried out.

The introduction in manufacture of new national hybrids appreciablly adds productivity of cocoons, thus the specific expenditures of cocoons and totally of labour is reduced, reeling of cocoons of new domestic selection surpass base industrial hybrids on silk-containance on 4.4 %, high sorts of cocoons -9,4 and thus the specific expenditures of dry cocoons for reception of one kg of raw-silk is reduced on 20,4 absolute %.

At observance of agro-technical conditions, these national hybrids are capable to give a stable high crop of cocoons with good technological parameters.

According to the developed measures on preparation of elite and superelite material of national silkworm hybrids on at parental (P_3-P_1) silkworm egg breeding stations and silkworm egg factories of Republic by 2008 should reach 19500 boxes (table 5 and 6).

The volume increase industrial silkworm eggs manufacture is planned by new national silkworm hybrids. On silkworm egg enterprises of association "Uzbek ipagi" by 2008 volume of prepared silkworm eggs should fully satisfy needs of silk branch (table 7 and diagram 5.)

Diagram 5. Industrial silkworm eggs production plan in the Republic

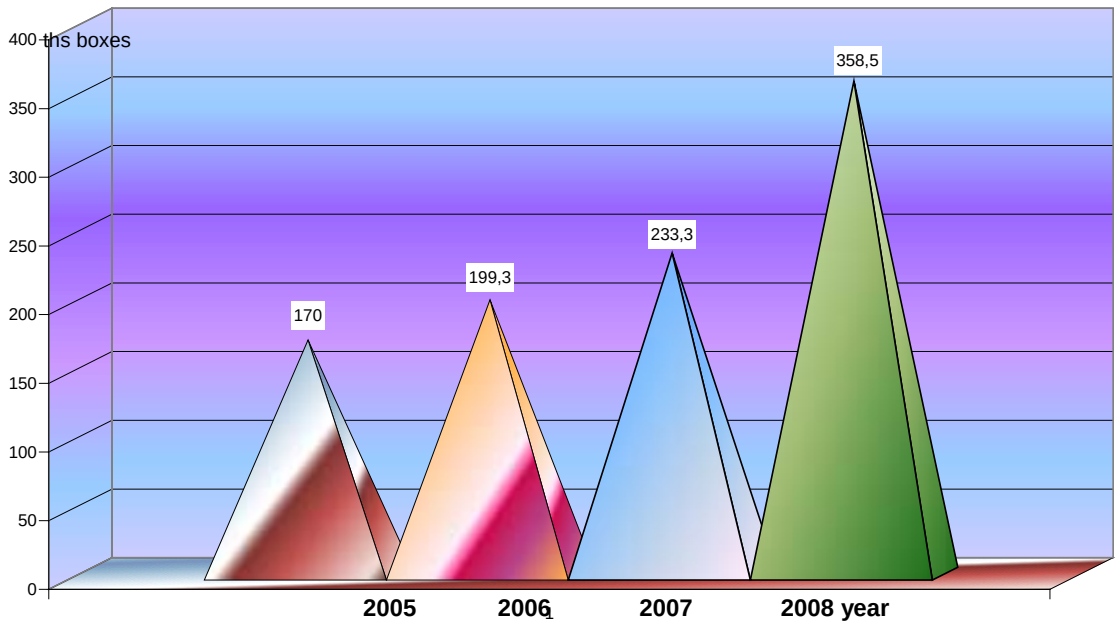


Table 3. Economically-valuable attributes of silkworm hybrids recommended by a commission for the further breeding on silkworm egg production enterprises of the "Uzbek ipagi " association(Regionised the introduced hybrids).

Quantity of silk-worm eggs in 1 g, pieces	% hatc hing	Larva period du-ration, day	Viabil-ity, %	Weight		Silk shell %	Co-coon yield capac-ity form 1 g of larva	Weigh t of 1 dry co-coon, g	Raw silk output, %	Cocoon reeling, %	DNKN, m	Cocoon filament metric number, m/g	Linear density of cocoon filament m/teks	Specific cocoon con-sumption, kg	Total philament length, m	*Regions recom-mended for feedings
				Co-coon, g	Silk shell, mg											
Uzbekistan 5																
1636-1750	96,5	27	87,0	2,06	486	23,6	4,10	0,780	42,1	83,8	791	3096	323	2,53	1415	1-8-10-12
Uzbekistan 6																
1740-1820	95,0	27	88,0	2,02	474	23,7	4,08	0,870	41,0	83,6	812	3105	322	2,32	1390	1-8-10-12
Turon 1 (100% male)																
1536-1564	99,5	26	74,2	1,9	484	25,5	326	0,700	44,1	84,2	892	2710	369	2,42	1575	2,12
Ipakchi 1x Ipakchi 2																
2335-2356	95,6	29	80,4	1,80	450	25,0	3,35	0,923	39,1	90,2	1076	3222	379	2,49	1427	1-4,6-8, 10,11
Ipakchi 2 x Ipakchi 1																
2390-2398	95,4	29	85,6	1,72	432	24,0	3,57	0,924	38,7	93,5	1017	3020	344	2,67	1233	1-4,6-8, 10,11
Marked-1 x Marked-2																
1726-1803	96,4	30	96,2	1,87	443	23,8	4,40	0,866	44,6	88,32	1141	3228	320	2,67	1292	12
Marked -2 x Marked-1																
1760-1790	95,0	30	92,6	2,11	527	25,0	4,25	0,836	45,52	86,42	1068	3291	328	2,70	1235	12

* Note: the given data is average on Institute and State tests results. KR -1, Andizhan – 2, Bukhara – 3, Dzhizak – 4, Kashkadarinskai – 5, Navoi – 6, Namangan – 7, Samarkand – 8, Surkhandarya – 9, Syrdarya – 10, Sashkent – 11, Fergana – 12, Khorezm - 13

Table 4. Economically-valuable attributes of silkworm hybrids recommended by a commission for the further breeding on silkworm egg production enterprises of the "Uzbek ipagi " association(Regionised the introduced hybrids).

Quantity of silk-worm eggs in 1 g, pieces	% hatc hing	Larva period du-ration, day	Viabil-ity, %	Weight		Silk shell %	Co-coon yield capac-ity form 1 g of larva	Weight of 1 dry co-coon, g	Raw silk output, %	Cocoon reeling, %	DNKN, m	Cocoon filament metric number, m/g	Linear density of cocoon filament m/teks	Specific cocoon con-sumption, kg	Total phlament length, m	*Regions recom-mended for feedings
				Co-coon, g	Silk shell, mg											
Turon 2 (100% male)																
1532-1560	98,3	26	74,5	2,00	508	25,4	3,43	0,774	41,1	82,0	847	3040	328	2,27	1510	7,12
Bahor 1																
1708-1740	96,5	27	81,3	2,01	480	24,0	3,77	0,970	40,3	82,0	943	2885	347-352	2,34	980	2,10,12,13
Bahor 2																
1674-1768	96,0	27	85,0	1,90	456	24,0	3,34	0,970	35,8	88,1	920	3000	290-330	2,28	1042	2,10,12,13
Khotira 1																
1687-1690	98,6	27	84,6	1,90	456	24,1	3,70	0,933	35,8	88,7	920	3000	290-300		1037	1,13
Yozgi 1																
1746-1836	91,6	32,7	92,6	1,60	385	23,9	2,16	0,996	43,5	86,0	985	2801	280-357	2,51	1202	11
Yozgi 2																
1827-1975	93,9	33,0	82,6	1,6	371	23,2	2,07	0,972	39,0	80,7	952	2650	280-377	2,20	1021	11

Note: the given data is average on Institute and State tests results.KKP - 1

Andizhan - 2 Samarkand – 8 Bukhara - 3 Surkhandarya - 9

Dzhizak - 4 Syrdarya - 10 Kashkadarinskai - 5 Tashkent - 11

Navoi - 6 Fergana - 12 Namangan - 7 Khorezm - 13

Table 5. The preparation plan of elite and superelite material of national (regionised and introduced) silkworm hybrids for breeding at parental (P_3-P_1) silkworm egg breeding stations and silkworm egg production factories of the Republic for the period 2005-2008

Year	Pedigree silk-worm eggs volume, box	Uzbekistan-5 and Uzbekistan-6					Ipakchi-1 x Ipakchi-2, Ipakchi-2 x Ipakchi-1			Turon-1	
		Hybrid name	Orzu	Yulduz	Asaka	Marhamat	Hybrid name	Ipakchi-1	Ipakchi-2	Orzu	S-8
2005											
Family											
Layer feeding, pieces			300	300	300	300		300	300		
Superelite, pieces			250	250	250	250		200	200		
Elite, box		Orzu x Asaka	4200				Ipakchi-1	1050	1050		
		Yulduz x Marhamat	4200				Ipakchi-2	1050	1050		
	1400		8650	250	250	250		2300	2300		
2006											
Family											
Layer feeding, pieces			300	300	300	300		300	300		
Superelite, pieces			250	250	250	250		200	200		
Elite, box		Orzu x Asaka	4200				Ipakchi-1	1050	1050		
		Yulduz x Marhamat	4200				Ipakchi-2	1050	1050		
	14000		8650	250	250	250		2300	2300		
2007											
Family											
Layer feeding, pieces			300	300	300	300		300	300	200	100
Superelite, pieces			250	250	250	250		200	200	100	150
Elite, box		Orzu x Asaka	4200				Ipakchi-1	1050	1050	350	400
		Yulduz x Marhamat	4200				Ipakchi-2	1050	1050		
	15000		8650	250	250	250		2300	2300	450	550
2008											
Family											
Layer feeding, pieces			300	300	300	300		300	300	200	100
Superelite, pieces			250	250	250	250		300	300	200	300
Elite, box		Orzu x Asaka	4450				Ipakchi-1	1500	1500	500	500
		Yulduz x Marhamat	4450				Ipakchi-2	1500	1500		
	18000		9150	250	250	250		3300	3300	700	800

Table 6. The preparation plan of elite and superelite material of regionised silkworm hybrids for breeding at parental (P_3-P_1) silkworm egg breeding stations and silkworm egg production factories of the Republic for the period 2006-2008

Year	Volume of prepared pedigree silkworm eggs, box	Bahor-1, Bahor-2			Khotira-1				Turon-2	
		Hybrid name	Tizim -22	Tizim-23	Hubrid name	Line-34	Tash-kent-8	SANI-ISH-30	Yulduz	S-8
2006			20	20					10	10
Family			10	10					4	6
Layer feeding, pieces		Line-22 x Line-23	210						100	150
Superelite, шт		Line-23 x Line-22	210							
Elite, box	700		430	10					104	156
2007			20	20					10	10
Family			10	10					4	6
Layer feeding, pieces		Line-22 x Line-23	210						100	150
Superelite, pieces		Line-23 x Line-22	210							
Elite, box	700		430	10					104	156
2008			25	25		10	10	10	10	10
Family			40	40		20	20	20	4	6
Layer feeding, pieces		Line-22 x Line-23	300		Tash-8xS.30	250			100	150
Superelite, pieces		Line-23 x Line-22	300		Lin-34xTash-8	250				
Elite, box	1500		640	40		520	20	20	104	156

Table 7. Industrial silkworm eggs preparation from the new national silkworm hybrids at silkworm egg enterprises of "Uzbek Ipagi" association for the period of 2005-2008 (in thousand pieces)

On regionized introduced hybrids				
Hybrid name	2005	2006	2007	2008
Uzbekistan-5	45	49	56	90
Uzbekistan-6	45	50	57	90
Ipakchi-1 x Ipakchi-2	33	43	52	80
Ipakchi-2 x Ipakchi-1	33	43	62	80
Turon-1			1	1
Pedigree	14	14	15	18
Total	170	199,3	233,3	358,5
On new hybrids recommended by commission				
Bahor-1		0,22	0,22	0,34
Bahor-2		0,22	0,22	0,34
Turon-2		0,26	0,26	0,26
Khotira-1				0,54
Total		0,7	0,7	1,5

Table 8. The task on manufacture of fresh cocoons in regions of the Republic of Uzbekistan for the period 2006-2010

Region names	**Years**				
	2006	**2007**	**2008**	**2009**	**2010**
Karakalpakstan	720	750	780	310	935
Andizhan	3070	3205	3340	3475	4010
Bukhara	2725	2845	2965	30S5	3560
Dzhizak	500	520	540	560	645
Kashkadarya	2330	2430	2530	2630	3035
Navoi	780	815	850	SN5	1020
Namangan	2800	2920	3040	3160	3650
Samarkand	2330	2430	2530	2630	3035
Surkhan-Darya	1060	1110	1155	1200	1385
Syr-Darya	440	460	480	500	575
Tashkent	1165	1215	1265	1315	1515
Fergana	3025	3155	3290	3425	3950
Khorezm	2055	2145	2235	2325	2683
Total:	**23000**	**24000**	**25000**	**26000**	**30000**

Contract fulfilment. In 2005 in the Republic were prepared 16,3 thousand tons of fresh cocoons, that corresponds to a level of 2004.

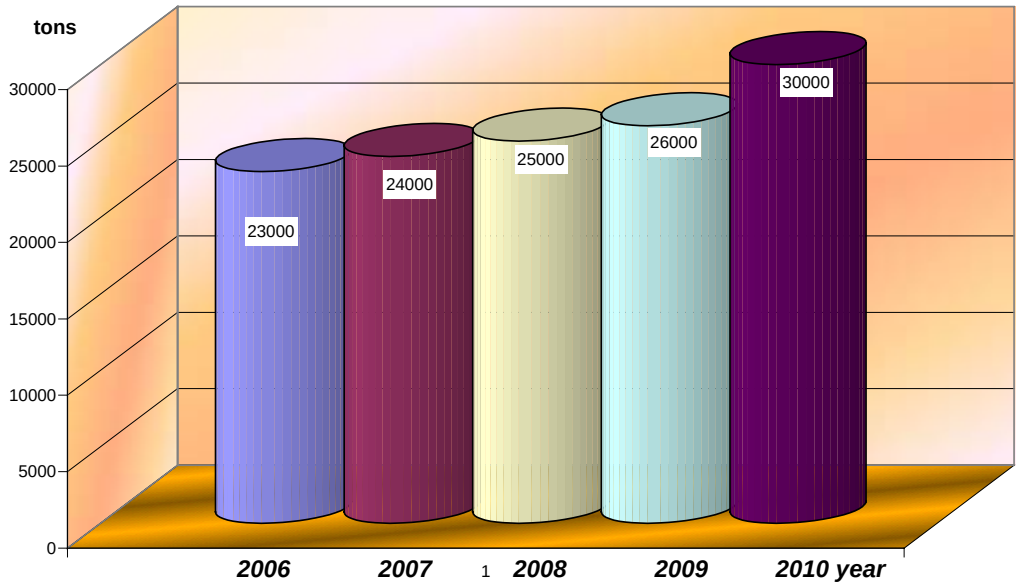
General cost of prepared cocoons makes 13,2 mlrd. sums. From them for today is paid to cocoon-producers 7,3 mlrd. sums (59 %), including at the expense of the allocated credits for the sum 1,6 mlrd. sums.

The left finances for final payment to the cocoon-producers in the sum 5,4 mlrd. sums will be refined at the expense of the proceeds from realization of a part of dry cocoons and strings of raw-silk on export.

According to the decision of the Cabinet of April 5 2002r. №118 the silk branch by 2010 should make of 30 000 tons of fresh cocoons, including in 2006 manufacture of 23000 tons of cocoons (table 8 and diagram 6) is planned.

With the purpose of task fulfillment of the 2006 plan given by Government the"Uzbek ipagi" association together with local authorities and Ministry of a agriculture and water facilities have concluded the contracts with 43072.0 farmers and 1273.0 facilities. The commercial banks are ready to give when due hereunder distribution of the credits for cocoon manufacture advancement.

Diagram 6. Task on fresh cocoons production in the Republic during 2006-2010



Organization and realization of repeated silkworm feedings.

In conditions of economy transfer on the market relations before sericulture branch the important task is put to increase silkworm cocoon manufacture and volumes of export.

Climatic conditions of Uzbekistan favour to manufacture of cocoons on all extent of mulberry tree vegetation. At the appropriate care of plantings it is possible to receive fodder leaves from spring till deep autumn.

The decision of the given problem is possible at organization of repeated silkworm larva feeding. Thus prime tasks are:

- Creation of the specialized plantations for different rearing seasons and realization of agro-technical care and operation of mulberry trees;
- Application of repeated rearing technology, consisting of silkworm eggs incubation agro-technics, rearing of siklkworm larvas of young(1-3) and older (4-5) stages, mounting of cocoons, harvesting and delivery of cocoons;
- Application of ways of larva protection from illnesses by use of antiseptics and biological stimulators and protection of mulberry plantings from pest.

The realization repeated rearing in specialized capital rearing houses with application of science achievements, will allow to remove dependence of sericulture on season, its dissociation, to increase manufacture of high-quality cocoons in 2-3 times with smaller expenses and in a result considerably to increase efficiency af sericulture and to lower its cost price.

As against to spring, repeated rearings pass in less favorable feeding conditions and external environment. In particular, at higher temperature and low humidity of air, the contents of nutritious elements and moisture decreases, that results in deterioration of leaves assimilation.

To begin rearing in the summer and autumn is possible at any time, however it is necessary to create favorable hidro-thermal modes and to have such forage, which on qualitative structure would correspond larva's stages.

For reception of a high crop of cocoons the large importance has correct definition of rearing terms, as for each silkworm larva stage there should correspond mulberry leaves шелковицы of the certain stage. In this case larvas grow quickly, normally develop and make full-weight cocoons with high silk-containance. In order to use fodder base in a better way and create necessary conditions for rearing depending on a season of year, silkworm egg hutching should be in the most favorable terms, in view of zone features of sericulture areas.

In view of climatic conditions of Uzbekistan, depending on zones situation, more suitable for silkworm larva cultivation at summer-autumn rearing season and creation of special mulberry tree plantations and premises, the probable opportunity of repeated rearing realization is created on separate regions of Republic (tab. 8).

Table 9. Settlement parameters of fresh cocoons preparation opportunity at repeated realization of silkworm larva feedings

Name of regions	Quantity of boxes fed, pieces	Actually in spring prepared fresh cocoons, tons	Possible volume of larva feedings, pieces of boxes	Opportunity of fresh cocoons preparation (at average productivity of 45 kg /box) at repeated feedings, tons	Expected cost of the prepared cocoons at repeated feeding at the price of 810 sums for 1 kg breed-mix, ths sums*	Expected profit in view of the charges (23,25 % per box of feeding realization), ths sums
Andijan	42000	2237,4	3904	175,680	142300,8	109215,9
Namangan	34014	1729,0	3544	159,480	129178,8	99144,7
Fergana	33200	1250,3	3428	154,260	124950,6	95899,6
Tashkent	20623	1144,4	2212	99,540	80627,4	61881,5
Dzhizakh	3036	152,6	255	11,5	9315,0	7149,3
Sirdarya	6650	306,8	417	18,774	15207,0	11671,3
Kashka-darya	19032	956,0	1488	66,96	54237,6	41627,4
Total			**15248**	**686,2**	**555817,2**	**426589,7**

*** US$ 1= 1200 sums**

At 10 % use of existing fodder base according to recommended new technology, volume of repeated rearing on republic can make 15248 boxes, at reception on the average from each box till 45 kg of cocoons, it is in addition possible to prepare 686,2 tons of fresh cocoons for the sum 555 817 200 sums. In view of a deduction of the charges on reeling realization, the expected pure profit from repeated feedings makes 426 589 700 sums.

Financial conditions of the "Uzbek ipagi" association system enterprises. Totally financial condition of the enterprises is still difficult. In this connection by State committee on demonopolization, support of a competition and the businesses together with association "Uzbek ipagi " developed and authorized measures on financial improvement of the economically - insolvent enterprises of association.

13 enterprises are in the plan of measures. At 11 enterprises in 2005 the financial sources will be refined at the expense of manufacture increase and realization of ready production, collecting debits, realization through a stock exchange of the real estate of objects, not used in manufacture, and good-material assets, reduction of the non-productive expenditures etc., that will allow to stabilize their financial condition.

Cocoon Processing. The quality of cocoon raw material depends on observance of cocoon primary processing technology, conditions of transportation, storage etc.

In manufacture the reception of unripe cocoons takes place, the technology of their transportation and storages is broken. At reception of fresh cocoons the rules on preparation and primary processing of cocoons are not observed.

For processing cocoons in Uzbekistan is present 546 drying equipments, including СК-150К - 415 pieces, КСК-4,5 -51 pieces, chamber (mechanical) -8 pieces, import 8 pieces, box type such as "Simplex" -55 pieces and steam killers-9 pieces. The congestion of units last years on the average makes 44,0-54,0 %.

Naturally, at long operation the existing units, being power-intensive, often fail, the deficiency of spare parts takes place.

In the world in silkworm cultivation and accordingly in manufacture of silk 50 countries are engaged, from which 2 give more than 90 % of world productions - China -75 % and India - 19 of %. Further places occupy accordingly Brasil and Uzbekistan.

By 1998 manufacture of rew-silk filaments in Uzbekistan has made less than 500 tons. After acceptance of concrete measures on the part of government and reorganization of silk branch, with the purpose of transition to a qualitatively new stage of development volume of manufacture by 2001 has increased almost in 2,5 times. Now all efforts are directed on rise of manufacture.

Besides natural silk fabrics production in 6 silk-weaving enterprises of the association the cotton fabrics are made. Volume of fabrics manufacture is increased from year to year and by 2005 makes 72018 ths m^2. The similar picture is traced on volumes of consumer goods manufacture, which have achieved in 2005 4368,6 mln. sum or about US$ 4051,0 ths.

Now structure of association includes 6 joint ventures on processing silk, which have made in 2005 production for the sum 2438,5 mln. sum or US$ 200,6 ths which is completely delivered on export.

In branch the growth of production export is annually increased. In 2005 this parameter has achieved US$16,321 mln.

Attraction of foreign investments and adjustment of trade-economic relations.

Work on increase of economic potential of branch is going on all production phases, from increase of fodder base for preparation of raw cocoon material, industrial processing of cocoons down to manufacture of ready fabrics, their advertising and progress in the international market. The trade-economic connections with companies from the countries of Europe and South-east Asia are adjusted. Production of silk industry of Uzbekistan is delivered to such countries as Japan, Italy, Switzerland, China, India, Singapore etc. Is created and successfully functioning joint Uzbek-Chinese enterprise "Khveshen-Bukhara Co Ltd " on manufacture of 180 tons of raw-silk strings of a 3A class annually for export. Together with the Japanese firms "Marubeni" and "Kanebo" is created JV "Silk Road" on manufacture of 156 tons of a silk yarn, which is completely sent on export and, in opinion of the experts, on quality does not concede Chinese and Brazilian.

Rhythmically work and ship delivery of production on export joint ventures "Tonmen", "Khadan", "Nubajakhu", specializing on processing silk wastes.

One of major directions of association's activity is the attraction of the foreign investments in branch, mainly direct, with the purpose of quality increase of raw silk material processing, modernization of the silkweaving enterprises, manufacture of competitive ready production and increase of export volumes.

With participation of the foreign investors the projects of silkweaving manufactures modernization at the following enterprises are developed:

According to the decision of Government 25 investment projects of gradual realizations of them till 2010 are prepared by the direct foreign investments and credits for a total sum about US$ 31,2 mln. and realization of 10 silk-reeling and 5 silk-weaving factories modernization, which will let organization of 9 new manufactures on release of ready products, industrial production manufacture volume increase in 3,5 times, volume of export in 5 times, in addition creation of more than 5,7 thousand new workplaces.

With the Italian firm " Jaminola group " the work on the project of silk-weaving manufacture modernization on joint-stock company "Atlas" is going on in Namangan, total cost of which makes 54 mln. euro. The circuit of financing is fulfilled and the consent of the Italian bank " San Paolo IMI" on financing of the project and insurance agency "Sache" on insurance of the demand line of credit is received. The general capacity of the modernized manufacture will make 250 tons of raw-silk strings and 8,5 mln. meters of ready silk fabrics.

Began its activity joint venture "Solanateks" on processing 1 344 tons of a cotton - fibre per one year and production of 1 246 tons of a cotton yarn, that will allow to supply needs of the branch in yarn for fabrics manufacture. The total cost of the project makes US$ 2 mln. The given manufacture in addition will create in Namangan 213 workplaces.

The construction of factory on silk wastes processing and production of 1 mln. pieces of ready knitted products from silk and mixed yarn per one year in the Andizhan region by the direct investments of "Uelay group" firm (China) in amount of US$ 5 mln. Besides that US$ 6 mln. of US will be attracted as free aid from Government of Peoples Republic of China on creation of an industrial complex with the completed silk processing (from manufacture of fresh cocoons and finishing with ready products manufacture) in the Andizhan region.

The realization of complex measures on new joint ventures cereation and modernisation of the enterprises of silk branch by foreign investments attraction will allow considerably to increase an export potential of association "Uzbek ipagi", having changed structure of export by increase of production densities with high added cost in total amount of export.

Chapter 4. The basic problems, conclusions and recommendations

Sericulture of Uzbekistan now is economically not profitable branch of agriculture for the following reasons: too poor quality of made silkworm eggs, cocoons and raw-silk, that doesn't satisfy present needs of the market; absence of the stable silk market, that results in decrease of cost on made production; the existing material base of a science is old and unsufficient for the decision of arising questions and problems of branch; losses of made silkworm eggs volume and crop of cocoons because of silkworm and mulberry tree illnesses presence;a poor harvest of mulberry tree leaves accompanying by the large expenses of work at cultivation and operation; absence of silkworm breeds, generically stable against illnesses and climatic conditions of their cultivation, that results in decrease of made silkworm eggs quality not appropriate to the international standards; absence of breeding houses and equipment for silkworm larva cultivation and high labour expenditures, in aggregate resulting in a poor har-

vest of cocoons from each box and as a result high cost of manufactures; preservation of traditional technological process of manufacture and control system, and also absence of the commercial approach at production; unsufficient amount of the qualified training staff, marketing study, absence of technical council, educational materials and visual aids, training and improvement of professional skills of the staff and distribution of the new information.

In connection with the situation there is a necessity for development of state program on revival and development of silk branch following next basic directions:

1. Expansion and improvement of fodder base conditions; replacement of low - productive mulberry breeds and hybreeds by more productive ones; replacement less productive linear plantings by highly productive mulberry plantations and realization of their protection from the agricultural pests and illegal cutting.

2. Transfer of parental (P_3-P_1) silkworm egg breeding stations and silkworm egg factories to a new regulated technological process of hybrid silkworm egg manufacture, ensuring needs of regions in high-quality eggs, competitive to foreign analogues.

3. Transfer of sericulture on economically favourable technology of silkworm breeding, allowing manufacture of cocoons during all of the vegetative period of mulberry tree; realization of centralized silkworm larva rearing of younger ages and further rearing of them in specialized sericulture farms;

4. Creation of complex measures directed on improvement of a financial condition of the economically insolvent enterprises, with reduction of their number and perfection of the silk branch enterprises taxation system, including release of sold to agricultureal enterprises silkworm eggs and dry cocoons from the VAT;

5. Attraction of the direct foreign investments for re-equipment of silk-reeling and silk-weaving manufactures, quality increase of ready production up to conformity to the world standards, expansion of production assortment, saturation by them of a home market and increase of an export potential of branch by expansion of production with added cost share.

Chapter 5. BACSA development strategy

With the purpose of achievement of silk branch revival and development in the countries of Black, Caspian seas and Central Asia regions the following strategy of joint action is offered:

1. Creation of information gaining, processing and interchange centre concerning the arisen problems in branch, achievements in the field of science, realisation of marketing researches and services.

2. Creation of the regional centre on scientists' and experts' experience exchange, introduction of advanced technology promoting to an exchange of genetic resources, joint program development on breeding of new highly productive silkworm and mulberry breeds and hybrids, protection of mulberry tree plantations from wreckers and illnesses distribution.

3. Creation of centres on industrial silkworm hybrids testing with the purpose of revealing the most adapted hybrids for breeding in region.

III. Plenary session in scientific sections

Section 1. Moriculture: Mulberry selection, propagation and cultivation

Study on the Comprehensive Development and Industrialization Technology of Mulberry

By

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Abstract: ***To select excellent fruit mulberry varieties by collecting mulberry resources, establishing fruit mulberry garden and testing their qualities, construct mulberry material base according to the standard of green food, map out good agricultural practice (GAP) of mulberry by researching high output green cultivation technology, develop and produce industrially series products such as mulberry juice, mulberry wine, mulberry sauce, mulberry pigment, etc. using mulberry fruit as the main material, and set up relative material quality standard, standard operation procedures, enterprise product standards, packing and transporting standard. Guiding with the market and leading with the processing enterprise, to merge cultivation, processing, production, and sale into an organic whole to realize the mulberry industrialization.***

Key Words: mulberry, comprehensive utilization, industrialization

Introduction

Mulberry is the fruit of *Morus alba* L. It served as food and medicine from ancient times till now, and it was recognized as one of the materials could be used as food and medicine by Chinese Ministry of Health. According to theories of traditional Chinese medicine, mulberry is sweet in taste and cold in nature, owns such functions as promoting the production of body fluid to quench thirst, invigorating the liver and kidney, nourishing yin and supplementing blood, improving eyesight and tranquilization, etc. In modern medicine, it can enhance immunological function, promote the growth of hematopoietic cell, prevent arteriosclerosis, and improve metabolism. A long-term moderate intake of mulberry or its products could prolong your expectant life.

Most studies about mulberry were in China, and there were few researches on mulberry in other countries. The research of mulberry included pharmacological action, clinical use, and development of product. We fully utilized the *food and medicine* resource, developed it as an industrialization, and achieved good results in varieties selection, base construction, high-output cultivation, product development and manufacture, etc. Advances in the research and development of mulberry are introduced as following.

1. Fundamental research on mulberry

1.1. Chemical constituents

Fresh mulberry contains lot of water, some invert sugar, free acid, vitamins, coarse fiber, protein, amino acids and active substances. The contents of macro-chemical constituents, vitamins, minerals and amino acids were showed in table 1~3[1]. Main active substances in mulberry are rutin, myricetin, morin, tannin, anthocyanin (cyanindin), etc. [2]. In mulberry seeds, there are lipids and amino acids. Main fatty acids include linoleic acid, palmitic acid, oleic acid, stearic acid, linolenic acid, myristic acid, palmitoleic acid, etc. [3]. Vitamins and anchocyanin in dry mulberry dropped significantly.

Table 1. The contents of macro-chemical constituents (%) in mulberry juice

Soluble solid state material	Total sugar	Total acid	Protein	Fat	Minerals
6.6	4.5	0.56	1.17	2.15	0.47

1.2. Pharmacological actions

Many studies showed that mulberry owns such pharmacological actions as enhancing immunological action, anti-mutagenesis, anti-ageing, hypoglycemic activity, hypocholesterolenic activity, hepatoprotective activity, anti-AIDS, decreasing activity of Na-K-ATP on membrane of red cell, etc. [4].

Table 2. The contents of vitamins (mg/L) in mulberry juice

Vitamin	Contents
V_C	46
V_{B1}	0.4
V_{B2}	0.8
V_{B6}	0.2
Folic acid	0.1
Nicotinic acid	12
β-carotene	0.3
K	1590
Fe	11.37
Ca	73.8
P	317

Table 3. The contents of free amino acids (mg/100ml) in mulberry juice

Free amino acids	Contents	Free amino acids	Contents
ASP	267.4	MET	4.84
THR	7.70	ILE	6.30
SER	9.44	LEU	8.89
GLU	73.2	TRY	7.51
PRO	0.30	PHE	8.52
GLY	5.39	LYS	6.49
ALA	15.6	HIS	3.82
CYS	3.11	ARG	26.5
VAL	9.00	Total	463.6

2. Utilization of mulberry

2.1. In medicine and pharmacology

In clinic, mulberry is widely used as Chinese material medica. It also used as main material in the production of Chinese patent drugs as mulberry soft extract, mulberry granule preparation, oral mulberry liquid, etc.

2.2. In food industry

Mulberry fruit was widely used in food industry to develop mulberry juice, mulberry milk beverage, mulberry wine, mulberry sauce, mulberry ice cream, etc., and to produce mulberry pigment as food additive.

2.2.1. Mulberry juice

Many research institutes had tried to develop mulberry juice. As mulberry is easy to rot and mildew, cannot resist pressing, it is hard to store in room temperature. Fresh keeping of raw mulberry juice was being the main obstacle in mulberry juice pressing. Furthermore, most processing factories were constructed in city, while the main producing region of silkworm and mulberry in mountain areas with poor economy and communication. It is not convenient to transport fresh fruit. So there is no mulberry juice in the market in long term. In view of such situation, the Sericulture Research Institute of Guangdong Academy of Agricultural Sciences (GAAS) successfully developed mulberry juice by setting up mulberry fruit base, getting raw juice locally, and storing raw mulberry juice in low temperature.

2.2.2. Mulberry wine

Dong Yuxin developed mulberry wine by soaking mulberry with edible alcohol[5]. We produced mulberry wine by fermenting 100% mulberry juice[6]. Fermented mulberry wine with fresh mulberry juice is bright in color, rich in nutrition constituents, and full-bodied. The content of anthocyanin is five times of that in red wine, while resveratrol two times. So fermented mulberry wine is a health fruit wine and could compare favorably with red wine.

2.2.3. Mulberry ice cream

Tong Hanqing developed mulberry ice cream adding fresh mulberry juice to common ice cream[7]. Mulberry ice cream, has attractive color, possesses balanced nutrition constituents, can clear summer-heat, and is an ideal food in summer.

2.2.4. Mulberry pigment

Mulberry fruit, rich in natural red pigment, is an ideal resource for the production of edible red pigment. Mulberry red belongs to anthocyanin, its color changes from deep rose color to blue-black under pH 0.54~13. It is bright deep rose color under pH 3.0 and pink, opera pink, cyanine, deep aubergine purple, and blue-black under pH 5.0, 7.0, 9.0, 11.0, and 13.0, respectively. It has different absorption spectrum under different pH, λmax is 537.5~538.5nm under pH 3.0 and becomes smooth as the increase of pH. It will change its color to weak coffee color and sky-blue color and produce sediment when it meets Fe^{3+} and Pb^{2+}, respectively [8]. We increased the color value by 30 times or so compared with that reported previously by chromatogram, laid the foundation for the practical utilization of mulberry red pigment.

Furthermore, mulberry can be used to produce mulberry milk beverage [9] and mulberry sauce [10].

3. Industrialization of mulberry

Mulberry was used as medicine from ancient times, recorded in almost every ancient and modern Chinese material medica books, and listed in all editions of China Pharmacopeia. Its health and nutritional functions are believed by the masses. China has a long times of silkworm and mulberry civilization, so mulberry owns good masses' fundamental. And it is rich in nutritional constituents, delicious in sweet and sour taste, mild in activities and almost no toxicity, products produced from mulberry have advantage in quality and function, should be competitive and have bright future in market. Many mulberry products were finding favors in customers' eyes.

We regard mulberry as a special food resource and developed series products, practiced whole route quality control from raw material to products according to demands of green food, and formed primarily mulberry industry. Development of mulberry fruit gave impetus to the comprehensive utilization of silkworm and mulberry sources, stabilized silkworm and mulberry industry, and brought progress to mountain area economy

Comprehensive development technology of mulberry included varieties selection, green high-output cultivation, series products development and product quality control.

3.1. Construction of mulberry resources garden

If want to improve economic profit of mulberry industry, there must be good fruit mulberry resources. We have studied mulberry varieties from the founding of the institute, and selected two good breeds, e.g. "Tang 10×Lun 109" (hybrid mulberry) and "Da 10" (seedless mulberry), that laid the foundations for comprehensive development of mulberry source.

In order to develop successively mulberry industry, cooperate the produce of mulberry goods, and select different varieties to meet different products, we strengthened the collection of mulberry resources and constructions of germ plasm resources of mulberry in recent years. We have collected 18 fruit mulberry varieties from Guangxi, Jiangsu, Xinjiang, Gansu and Russian, set up mulberry resource garden primarily; we are doing variety test with 25 mulberry resources. The route of mulberry varieties selection are as following: collect mulberry resources→set up fruit mulberry resource garden→study their features and do variety test→select good mulberry resource.

3.2. Construction of mulberry base

As mulberry is difficult to store, there is no peasants to cultivate mulberry as fruit, and there are few mulberry sold in market, so mulberry was listed in the third generation of fruit waited to develop. In order to provide enough raw materials and guarantee the quality of mulberry products, we constructed 100 ha mulberry base in Doumen, Zhuhai, and Huadu, Guangzhou before the industrial production of series products. Another aim to set up base is to attract peasants to cultivate fruit mulberry by demonstration of good agricultural practice of mulberry, realize the form of "enterprise + farmer" and provide abundant materials for mulberry industry.

3.3. Green high-output cultivation technology of mulberry

Factors influencing the quality of mulberry fruit include mulberry variety, climate, base site, cultivation technology, collect, etc., in which cultivation technology is one of the important factors under the same variety and climate.

In order to ensure the homogeneity of mulberry and conform to standard of green food, we mapped out good agricultural practices (GAP) of mulberry. This GAP contains general guiding principle and standard operation procedure (SOP), covers the selection of base site, germ plasma resource, use of fertilizer and pesticide, irrigation, etc. To guarantee mulberry

quality, base sites are selected in areas where has no pollution background and doesn't near main highway, and soil, water and atmosphere are tested in advance; utilization of fertilizer adhere to the Principle of Fertilizer Utilization in the Production of Green Food, while utilization of pesticide abide by the Principle of Pesticide Utilization in the Production of Green Food, and pesticide banned in GAP are not be used.

In order to get the maximum output in limited acreage, we bring forward green high-output cultivation technology, and now are doing experiment in small scale.

3.4. Comprehensive development of mulberry products

The Sericultural Research Institute of GAAS began to develop mulberry products from 1980s. After two decades of research with great concentration, series mulberry products were developed and some of them have been produced in large scale, and that laid good foundation for mulberry industry. Main mulberry products include mulberry juice, mulberry wine, soft mulberry extract, mulberry sauce and mulberry red pigment.

As for the industrial processing of mulberry products, standard operation procedures were worked out. Industrial production technology of mulberry products comprises production and fresh keeping technology of raw mulberry juice, production technology of mulberry juice, wine, sauce, soft extract and red pigment. Mulberry juice was certificated green food by the Ministry of Agriculture in 2000.

3.5. Quality control of mulberry products

For the sake of product quality, standard of every mulberry product was laid down, and whole course quality control from raw material to end product was implemented.

Besides location of base, climate is another important factor influence the quality of mulberry fruit. Climate is different in every year, so the quality of mulberry fruit varies from year to year. The main indices of mulberry quality are sugar content, ratio of sugar and acid and red pigment content. During the production of raw mulberry juice and before the manufacture of mulberry products, the quality of raw mulberry juice is checked, and formula changed accordingly.

In order to improve and perfect product standards, anthocyanin is being tested to list as one of quality index according to the character of mulberry. Modern detecting instruments, e.g. HPLC, will be used construct fingerprint spectrum of mulberry in which comprises of several main chemical constituents. Total extract, got by adequate extract and isolation procedure and can represent mulberry, is tested by HPLC or ^{1}HNMR to form the fingerprint spectrum of mulberry. Quality of raw material and products could be evaluated by calculating the ratio of mulberry total extract. It provides the likelihood for mulberry products into international market. [11]

3.6. To nurture *fist* products (the most competitive products)

As mentioned above, there are many products developed from mulberry, if they are all produced industrially, it will be aimless shooting and couldn't acquired expected profit. Therefore, key products must be nurtured in the industrialization of mulberry. According to current consuming direction, mulberry juice and wine can be nurtured as fist products in the mulberry industry, and mulberry red pigment can be produced adequately.

Beverage industry has achieved great progress in recent ten years, and annual output was up to 200 million tons in 2000. The beverage variety structure changed radically from aerated beverage ruling all the land ten years ago to 10 types of beverage presently. Though aerated beverage is also the main beverage in the market, the consumption of vegetable and fruit juice will increase rapidly as the change of people's living life and the boosting of national

economy. As mulberry fruit is rich in juice (no less than 50% in common varieties, more than 60% in seedless mulberry), sweet and sour in taste, and hard in fresh keeping, it is one of the fruits mostly suitable for the production of fruit juice. Mulberry juice should have a bright future in market.

Presently, alcoholic drink industry is suffering three changes (from high alcoholic content to low alcoholic content, distilled liquor to fermented wine, and grain alcoholic drink to fruit wine). Mulberry wine is conformity with the policy of alcoholic drink, and its whole quality is compared favorably to ordinary red wine, so it will attract more consumers if advertising strengthened and its features acknowledged by consumers.

Pigment is an important sort of additive. As consumers acknowledge the toxicity of synthesized pigments and are eager for more green foods, the demands for natural pigments are increased continuously, and consumers have more confidence in natural pigments. All of this provides a good environment for the research and development of natural pigment. Ripe mulberry fruit, contains a great deal of red pigment, is a good resource for the production of red pigment. Red pigment can be regarded as an item in mulberry industry.

In order to nurture famous products, we have registered brand for them.

3.7. To strengthen basic research on mulberry

Up to now, most chemical constituents in mulberry researched are common nutritional components as total sugar, total acid, protein, fat, amino acids, vitamins, minerals, etc., and there is no systemic research on chemical constituents of mulberry. Pharmacological activities are studied in complex prescription (with more than two medicines) and not in single medicine. In order to strengthen fundamental research on mulberry, we brought in talents who engaged in food, medicine, agricultural products processing, etc., and they are carrying out research on these aspects to increase scientific and technological contents of mulberry products.

4. Conclusions

Mulberry industry will be difficult into rapid expansion stage limited by raw materials in short time, and it could be improved by the steady construction of base and research on fundamental items.

In mulberry industry, products as mulberry juice, wine and pigment will be developed as *fist* products firstly.

Guangdong has advantage in developing mulberry industry. Because it belongs to tropical or subtropical region with abundant sunlight and long frostless time, and most of its areas are frostless around year. Mulberry can grow rapidly and bear more fruits. The fruits are better that that produced in inner land.

Mulberry industry will lead by one or two fist product(s), bring along the development of variety selection, cultivation, base construction, processing, etc., and forming a large industry in the end.

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Mulberry fruits for food industry

By

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Abstract: ***Vegetal sericulture bio-resources may constitute raw material source in an integrated development system, especially in the food industry, pharmaceutical and cosmetic products. Starting with 2001, in Romania there were initiated researches concerning the utilization of by-products and wastes from sericulture. Some of them had the aim of utilization of mulberry fruits in food industry, respectively in the sweet products industry. These researches had the following objectives:***

- ***mulberry evaluation for fruits products, with economic importance;***
- ***physical-chemical characterization of mulberry fruits as raw material for food industry: powder of dried mulberry fruits, mulberry juice, oil of mulberry seeds;***
- ***elaboration of technical proceeds for mulberry fruits processing and preserving, in order to be used in food industry;***
- ***obtaining of new food products from mulberry fruits and their physical-chemical characterization.***

Keywords: mulberry fruits, food industry, powder from dired mulberry fruits, semi-finished sweet products

Introduction

Vegetal sericulture bio-resources may constitute raw material source in an integrated development system, especially in the food industry, pharmaceutical and cosmetic products.

The "Moriculture" is an agriculture technology for mulberry to obtain primary products with high economic value, for the processing of various industrial products – leaves, fruits, roots, shoots and others.

Inventoried, preserved and protected mulberry germoplasma in Romania counts 64 varieties (from China, Japan, Italy, France, ex-USSR and Romania) offers the possibility of their evaluation and selection for the establishment of mulberry exploitations destined to fruit production.

The benefic properties of mulberry fruits for food and human health are very well known, but due to their perishable nature, these are not processing in industrial system.

Material and method

During 1999-2003, in Romania there were initiated researches concerning the utilization of by-products and wastes from sericulture. Some of them had the aim of utilization of mulberry fruits in food industry, respectively in the sweet products industry.

These researches had the following objectives:

- evaluation for fruits products, with economic importance, for 12 mulberry varieties by productivity (t/ha);
- physical-chemical characterization of mulberry fruits as raw material for food industry; powder of dried mulberry fruits, mulberry juice, oil of mulberry seeds;
- elaboration of technical proceeds for mulberry fruits processing and preserving, in order to be used in food industry;
- obtaining of new food products from mulberry fruits and their physical-chemical characterization.

Results and discussion

The evaluation of the 64 mulberry varieties from our collection made evident the economic value of 12 varieties which have a large fruits production (more than 10 t/ha), enough to justify the production expenses and to obtain a profit equal with the profit of other fruits culture, harvested in the same season.

These 12 mulberry varieties present the following physical and productive characteristics (Table 1.):

Table 1.
Physical and productive characteristics of mulberry varieties for fruits production

Variety	Color	Medium weight of fruit (g)	Tasty	Ratio of juice extraction (%)	Productivity (t/ha)
Eforie	black	4.25	sweet	65.00	15
Olteni	dark-purple	4.75	sweet	60.00	14
Orsova	black	1.89	sourish	70.00	15
China 1	black	1.93	sweet	65.00	16
China 32	black	2.36	sourish	65.00	12
Ucraina 107	white	2.07	very sweet	70.00	18
Ucraina 9	black	2.18	sweet	70.00	14
Lombardia Pink	white	1.41	very sweet	65.00	12
Ichinose	black	2.31	sourish	60.00	13
Kokuso 21	purple	2.51	sourish	65.00	15
Ken Mochi	black	2.15	sweet	60.00	12
Wasemidori	black	1.96	sweet	70.00	11

Fresh mulberry fruits as raw material for food industry, have the following chemical composition (Table 2.):

Table 2.
Chemical composition of fresh mulberry fruits

Characteristics	MU	Method of analysis	Type of mulberry fruits		
			White	Pink	Black
Humidity	%	RST 2213/4	77.85	76.39	75.65
Direct reducing sugar	%	RST 2213/12	21.81	8.99	16.91
Total sugar	%	RST 2213/12	21.88	17.20	16.92
Saccharose	%	RST 110	0.08	8.64	absent
pH		RST 2213/9	5.84	5.92	5.45
Raw protein	%	RST 21/83	0.41	0.47	0.43
Cellulose	%	RST 9597/5	0.90	0.98	0.93
Total ash	%	RST 2213/6	0.63	0.67	0.68
Raw fat	%	RST 2213/11	0.58	0.61	0.63
C vitamin	%	RST 59-60/80	0.40	0.44	0.39
Fe	mg/100g	RST 2213	0.72	0.68	0.73
Zn	mg/100g	RST 8342/5	0.15	0.14	0.16
P	mg/100g	RST 2213	19.70	20.1	19.6
K	mg/100g	RST 2213	170.0	168.8	171.1
Ca	mg/100g	RST 2213	13.20	13.40	13.20

RST – Romania Standard

The fresh mulberry fruits also contain carotene as vitamin A – 174 mg, thiamine 9 mg, nicotinic acid 0.8 mg, riboflavin 184 mg, vitamin C 13 mg/1000 mg.

Due to the perishable nature of mulberry fruits, these must be processing by technical, industrial proceeds, which preserve their nutritive and gustative qualities. The main factor of the perishable nature of mulberry fruits is their high water content.

To decrease the water content from mulberry fruits, in food industry are usually applied different drying technologies as natural drying by solar action, artificial drying as hot air drying, atomization and lyophyllizing.

The researches demonstrated the economic advantages of natural drying by using solar dryers, frequently applied for apples, plums, apricots and pears drying.

Summarized, the dried fruits obtaining technology consist in:

- harvesting – sorting – pretreatment with KOH 0.1% - repeated washing – solar natural drying during 2 days – drying in shade during 7-10 days - artificial drying with hot air.
- harvesting – refrigeration – artificial drying at constant temperature of 80^{o}C during 20-30 hours or more till the obtaining of a 15% humidity of mulberry dried fruits.

The dried mulberry fruits modify their dimensions, weight and chemical composition (as water content), keeping the other traits unchanged, as shown in Table 3. and Table 4.

Table 3.
The physical characteristics of dried mulberry fruits

Variety	Color	Medium weight of fruit (g)	Tasty	% Dry substance from fresh substance
Eforie	black	0.63	sweet	27.07
Olteni	brownish	0.90	sweet	19.46
Orsova	black	0.57	sourish	29.98
China 1	black	0.39	sweet	20.23
China 32	black	0.56	smoked-sourish	23.53
Ucraina 107	brownish	0.66	very sweet	32.16
Ucraina 9	black	0.46	sweet	29.67
Lombardia Pink	brownish	0.46	sweet	32.46
Ichinose	black	0.56	sweet	21.08
Kokuso 21	black	0.66	sweet	26.21
Ken Mochi	black	0.65	sweet	29.99
Wasemidori	black	0.45	sweet	23.13

The drying ratio of mulberry fruits presents values between 3.09% at Lombardia Pink variety and 5.13% at Olteni variety, respectively.

From 100 kg fresh mulberry fruits result 235.29 kg dried mulberry fruits of 15% humidity.

Table 4.
The chemical characteristics of dried mulberry fruits

Component (%Dry substance)	Values	
	White mulberry fruits	Black mulberry fruits
Humidity	7.47	7.47
Total sugars	46.38	46.38
Direct reducing sugar	36.82	46.38
Saccharose	9.56	absent
Protein	10.46	10.46
Fats	6.00	6.00

The mulberry fruits are recommended to be use in sweet products, children favorites, these being an important protein supplement by their protein content, beside the sugar. The black mulberry fruits, containing only direct reducing sugar, are indicated in special products destined to persons with restriction nutritional diets.

The refrigeration during 1-3 months, followed by the artificial drying of mulberry fruits, is effectuated at a lower humidity than the humidity of fresh mulberry fruits. The refrigeration and the drying have a benefic effect on the microbial presence of processed fruits, as shows the following table:

Table 5.
The microbiological exam of frozen or dried mulberry fruits

Characteristics	MU	Method of analysis	Mulberry fruits	
			Frozen	Dried
Excherichia coli	no./g	RS ISO 7251-96	absent	absent
Salmonela	presence/25 g	RS ISO 6579/97	absent	absent
Bacillus cereus	no./g	ISO 7932/97	10	absent
Yeasts and moulds	no./g	RST 12964/91 RST 12965/91	2.0 x 100	1.0x10

The dried mulberry fruits may be used in food industry as powder (pulvis) to obtain sweet products, in accordance with the following technological scheme:

- grinding in the mill with discs or cutter-hammers – sifting (fineness control) – packing and labeling.

The preserving conditions of mulberry fruits powder require dried places with low constant temperatures (under 10^{o}C), separately of other products with strong aromas, free of diseases and pests.

The mulberry powder has a pleasant, sweet and aromatic taste. Due to the content of sugars and other thermic unstable chemical components, it does not support sever thermic treatments. The mulberry powder is utilized together with other raw materials – vegetal fats, saccharose and glucose syrup – in obtaining of semi-finished sweet products, as the fat cream from mulberry fruits powder, composed in:

- mulberry fruits powder – 45%;
- vegetal fat – 22%;
- cacao – 5%;
- sugar – 15%;
- glucose syrup – 13%.

The sugar and the glucose syrup are used under the fondant form.

The physical-chemical characterization of the cream from dried mulberry fruits powder is the following:

- humidity – 6.2%;
- total sugar – 42%;
- direct reducing sugar – 27%;
- fat – 35.4%.

The fat cream from dried mulberry fruits powder may be used as padding for sweets and chocolate products, the most indicated being the specialties of chocolate.

This cream may be also used in pastry cakes as padding, in quantity of about 50%. The mulberry fruits powder give stability and commercial color to these products.

The mulberry fruits powder may be used to obtain sweet products destined to a special segment of population, corpulent persons and diabetics; (functional foods) in this case the cream is prepared with a sweeter that replaces the sugars, indicated being the malitol (inositol), that does not determine the modification of the technology.

The recipe for the type of products is the following:

- mulberry fruits powder – 35%;
- vegetal fat – 10%;
- paste of fat kernels – 25%;
- malitol (inositol) – 30%;
- almond aroma – 0.02%.

The products with special destination will be manufactured in special spaces appropriated for dietetic products, in which the classic sweeter, as sugar and glucose, are not manipulated.

By processing the fresh mulberry fruits there can also be obtained other products destined to the food industry:

a) the juice of fresh mulberry fruits – non-alcoholic drink, obtained by pressing, with an extraction ratio of 60-70%; The juice clarifying can be effectuated by sedimentation, at 5-6^{o}C temperature during 48 hours, by filtration through two types of sieves with diameter of 2 mm and 1 mm respectively or by centrifugation of the fresh juice.

The conservation of clarified juice is realized by the following methods:

- pasteurizing by juice warming at 72^{o}C;
- vacuum concentration.

b) the syrup from fresh mulberry fruits is a non-alcoholic drink, to which is added at least 50% sugar. The obtaining proceeding comprise the following operations: the syrup extraction by pressing, clarifying by filtration, sugar adding in proportion of ½ and the solution mixing, boiling in order to dissolve the sugar, fermentation control using 2% citric acid as antiferment, cooling and clarifying by sedimentation;

c) the vegetal oil from mulberry seeds obtained by extraction with an organic solvent or by mechanical pressing; this oil presents a liquid form, of intense yellow color, specific taste, inodorous, cu 0.88% acidity expressed as oleic acid, with the following composition of fat acids: palmitic acid 9.45%DM, stearinic acid 4.30%DM, oleic acid 6.88%DM, linoleic acid 79.36 %DM and linolic acid – traces.

The research results demonstrated the economic potential of the mulberry varieties for fruits, as source of raw material for the food industry, in the obtaining of sweet products, including some products with special destination.

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Influence of biostimulant on body height and development nursering mulberry

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Abstract: ***Ecological crisis has become quite apparent in the epoch of scientific-technical progress. "Ecological revolution" is realized before our eyes and the global problem of "Bio Terrorism" threatens the whole world. Distributions of plant diseases, which significantiy damage both annual and perennial crop saving and plantings and drastically decrease the harverst, are the result of namely the environment pollution. Now the big attention is given protection of plants by safe means for environment. In this direction in institute sericulture the Georgian state agrarian university for enriching biological process in plants the additional forage which is rich biologically awake matters, is applied by vitamins, trace substances and proteins.***

In qualit addition forages we use up biostimulant which it is prepared from a natural, non-polluting component. It easily assimilate plants and it is not toxic. Biostimulant as antibacterial preparations - increases immunodefence of an alive organism and as protein the rich preparation considerably increases economic parameters. Preseeding processing of seeds of agricultural crops in solution in our biostimulant, considerably increases an assemblage of rootlets of plants, and also an emergence rate and germinating capacity of seeds and enables to receive high yield. At deficiency of mineral elements and trace substances there is a depression of a physiological state and on this the sensibility of plants to disease increases, and in case of use of an additional forage stability of plants to bacterium and to fungal disease increases.

Key words: mulberry, biostimulant,

In the era of the scientific-technical progress the ecological crisis has become vivid. "Ecological Revolution" is taking place in front of us. In the situation of modern international progress there is a real danger of pollution of foodstuff due to the multiple bacteria and viruses distributed in the environment thanks to "bio-terrorism". Toxic substances from the polluted environment, from infected plants can quite easily fall in human body and adversely affect his health.

Taking into consideration the above stated situation the study of plant diseases and its quality is the urgent and most important task.

The issue of death of cells of the host-plant as a result of action of parasite microorganisms has been in the center of attention of researchers for a long time already. It is proved that plant diseases, which are incited by toxic compounds, bacteria and viruses quite easily infect human beings. Bacterial and fungus diseases greatly damage both annual and perennial crops and sharply decrease the yield. Bacterial and fungal diseases are characteristic to apple, pear, peach, quince, almond, plume, mulberry, poplar as well as vegetables and vegetables cultures: beet, strawberry, cucumber, tomato, raspberry; flowers: rose, chrysanthemum.

At the deficit of mineral elements, namely lack of microelements, the plant suffers physiological depression, as a result of which plants become very sensitive to diseases, while the treatment of seed of agricultural crops by the liquid of bio-stimulator prior to its sowing significantly heightens the germination energy of seeds, capacity of sprouting and enables us to receive high yield.

As a result of multiple research studies carried out at the Scientific Research Institute of Sericulture of the Georgian State Agrarian University pursuing improvement of biological processes and economic indices the additional nutrient has been used in sericulture and mulberry economy. It is the bio-stimulator, which is rich in biologically active compounds, vitamins, microelements and proteins.

Our biological stimulator was obtained on the base of natural, ecologically pure components. It was tested in animals and plants. As the antibacterial preparation it improves the immunity of live organisms and as the preparation rich in proteins, while using as an additive to the fodder –it significantly increases their economic indices.

The above stated preparation was used for treatment of mulberry seed and seeds of vegetable cultures. We used 0,1 and 0,01 % solutions of bio-stimulators, since as a result of initial experiments they gave the best indices.

Percentage of diseases in seedlings germinated as a result of treatment of seeds in 0,1% solution of bio-stimulators decreased markedly (by 10,2%). The index of morbidity of saplings is 73%. As to the percentage of morbidity of seedlings grown from seeds treated by 0,01% solutions of bio-stimulators the index of decrease of diseases of seedlings is almost equal 8,5-8,3%.

Effect of bio-stimulator results in the increase of plant resistance and plant growth. Simultaneously they are easily consumed and assimilated by plants, are non-toxic, condition changes in structural and biochemical processes in the plant organism, strengthen protective reactions of plants and increase resistance-stability of plants against diseases.

For the experiments we took both low and high vitality mulberry and vegetable seeds, in 5-5 g quantity each, for 4 reiteration and treated by the 0,1 and 0,01 % concentration solutions of the tested preparations, at 24 hr exposition. Experiments were carried out at the laboratory conditions, in thermostat, at 35-37^{o}C temperature.

To determine the optimal concentrations and to obtain the high percentage index for seed germination energy and sprouting capacity we prepared various concentration liquids and placed preliminarily weighted seed in those solutions, in 5-5 g quantities, by 24 hr exposition. After that period we dried the seed and placed it in thermostat, with Petri cups, where the humid chamber was created. Each cup contained 100 seeds, at 4 reiteration. On the sixth day the germination percentage was recorded, on the tenth day the capacity of sprouting was registered. Experiment was repeated several times and optimal concentration of the mixture was defined, while after germination the grown part of seedlings and diameter of root neck were measured.

The obtained data are presented in the Table 1.

Table 1.
Effect of Biological Compounds on the Growth and Development of Mulberry Seedlings

No	Ver-sion	Treatment of Mulberry Seed											
		Germination energy		Sprouting capacity		Increase of seedling height, cm		Diameter of root neck, cm		Increase of seedling height, cm		Diameter of root neck, cm	
		Liquid Concentration											
		0,1%	0,01 %	0,1%	0,01 %	0,1%	0,01 %	0,1%	0,01 %	0,1%	0,01 %	0,1%	0,01 %
1	Asma No 1	78,3	80,0	83,5	86,3	61,3	63,2	0,57	0,61	60,7	67,1	0,60	0,68
2	Asma No 2	75,2	77,6	80,2	82,4	61,7	64,9	0,61	0,64	60,5	67,1	0,60	0,69
3	Cont-rol (warettr eat-ed seed)	70,0		80,7		40,2		0,52		41,4		0,53	

Proceeding from the obtained results we can conclude that:

- As a result of treatment of mulberry seed and vegetable crop seed in the solution of ecologically pure bio-stimulator the resistance of plants against diseases is increased, that is, its immunity is increased;
- Seed germination energy and sprouting capacity are significantly increased compared to the control version;
- Likewise significantly is increased the growth of seedling and diameter of root neck, compared to the control version;
- The best result was given by the treatment of seed in 0,01% solution of bio-stimulator;

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Comparative effects of wild and recombinant baculoviral insecticides on mp *glyphodes pyloalis* wlk. And mulberry silkworm *bombyx mory* l.

By

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Abstract: ***Baculoviruses are insect selective biological pesticides that have been used for the protection of forest and agricultural plantings for a long time. They are not infective in humans, animals or plants and are highly selective in terms of their infectivity in various insect species. In nature they regulate susceptible, the overgrowth of insect populations. Unfortunately, they have not found wide application because of their slow speed of insect killing and narrow host specificity. Genetically modified (GM) baculoviral constructs have been generated carrying transgenes (e.g. genes encoding hormones, enzymes/enzyme' inhibitors, insect selective toxins, etc.) that dramatically improve the insecticidal efficacy of the wild type baculovirus. These GM baculoviruses have been tested in large-scale field trials and shown to be highly effective. In the present work the efficacy of wild type and GM baculoviral insecticides were tested against the mulberry pyralid (MP) Glyphodes pyloalis Walker. This insect, an recent invasive species, is a serious pest of mulberry plantations in Uzbekistan. Wild types baculovirus preparations of Autographa californica multicapsid nucleopolyhedrovirus (AcMNPV), Spodoptera exigua multicapsid nucleopolyhedrovirus (SeMNPV) and recombinant AcMNPV (AcAaIT) expressing an insect-selective toxin from the North African scorpion Androctonus australis were used in this study. The MP larvae originated from Tashkent and Fergana provinces and were reared under the same laboratory condition as mulberry silkworm Bomyix mori L. on mulberry leaves or specially designed artificial diet. MPs treated with AcMNPV or SeMNPV showed mortality rates that reached 70% for 7-12 days post infection respectively. The best killing effect (70 % on 3rd day and 100% on 9th day after infection) was observed for AcAaIT treated larvae of the MP. Thus, the efficacy of AcAaIT was further tested in other larval instars of the MP. The highest mortality following AcAaIT treatment was found in young instars (first and second), whereas third and fourth instars were more resistant to AcAaIT. These results are similar to those obtained in our preliminary studies. An intermediate effect was observed in natural mixtures of larvae at different instars. The appearance of abnormal imagos was found in AcMNPV and SeMNPV treated larvae which increas the efficacy of wild type baculoviruses. In simultaneous experiments, the beneficial silkworm was also treated with the above mentioned baculoviruses (AcAaIT, AcMNPV, and SeMNPV). Cases of mortality resulting from these baculoviruses at normal feeding of insects by infected mulberry leaves and artificial diet were not observed. Our findings suggest that biological control strategies by insect-specific and high pathogenic GM baculoviral agent AcAaIT shows potential for selective control of a serious pest of sericulture in Uzbekistan. We are conducting further studies of the potential of recombinant baculoviruses in integrated pest management strategies.***

Key words: Mulberry pyralid, *Glyphodes pyloalis* Wlk., GM baculoviral pesticide, biocontrol, safety, mulberry silkworm, *Bombyx mori* L.

Introduction

Uzbekistan is one of the world's cocoons and silk producer (previously, the main exporter of cocoons and raw silk in the former Soviet Union). The MP *Glyphodes pyloalis* Walker (Lepidoptera: pyralidae, synonyms: leaf roller *Margaronia pyloalis* Walker or *Diaphania pulverulentalis* Hamson) is a serious pest of mulberry trees and cause a huge damage to sericulture in Uzbekistan. The appearance of this pest was first documented in Surkhan-Darya province in the middle of 90th years of last century. The leaf roller very quickly spread from its natural habitat within the Surkhan-Darya province (and, partially in Kashka-Darya province) to become endemic in the provinces of Fergana valley, Syr-Darya and Tashkent provinces (1). It is predicted to enter in sericultural farms near Tashkent city (now a clean zone).

MP is an significant pest of mulberry planting in Japan (2,3), Formosa (4), Burma (5), India (6-8), Malaysia (9) and China (10).

The use of chemical insecticides for the control of the leaf roller has not been effective and further does not give the expected result (11). Irreparable consequences have resulted from the use of chemical insecticides including the elimination of entomophages that are active against the leaf roller, resulting in increased populations of the leaf roller (12). Taking into account these secondary and tertiary effects of chemical pesticides application, we believe that chemical means of plants protection should be used reasonably and rationally, especially in our Central Asian region where the basic population of the Republic is densely concentrated in oasis zones of the agro-industrial complexes. By exploring modern biotechnological approaches, highly effective bioinsecticides, e.g. - entomopathogenic microorganisms (viruses and bacteria), have been developed that are highly target specific and environmentally bening (13-15). Several of these biopesticides are currently in use as supplements to chemical pesticides. Additionally, these biological pesticides offer an alternative control strategy should significant resistance develop to the chemical insecticide. Advanced achievements in genetic and protein engineering, in microbiology, virology and toxicology have played an important role in creation of bioinsecticides of last generation (16).

In our preliminary researches in 2003-2005 we created experimental and material bases for the mass cultivation of insects that will be used as hosts for the production of entomopathogenic microorganisms. These microorganisms are being developed for practical use in pests control. Moreover, we have identified potential natural enemies of the mulberry leaf roller - entomophages (brakon, golden-eye /lacewing/ and - some as yet unidentified dipteran species (17). Unfortunately, our initial screenings did not identify any endogenous viruses which stimulate diseases in the MP. We did, isolated a strain of *Bacillus thuringienses* that is highly pathogenic against the leaf roller, but unfortunately this *B. thuringienses* strain was also pathogenic against the mulberry silkworm(17).

Materials and methods

MP larvae of different instars of natural distributions were collected and transferred from the infected territory of Bekobad region of Tashkent province in July – October period. Some experiments are carried out directly in the infected zone of Fergana province. MP larvae of different instars have been brought to the laboratory from infected territory. They were fractionated to groups of young (first – second) and middle (third – fourth) instars. Elder instars larvae (fifth – sixth) were kept for formation of laboratory generation. Before pupation the larvae reached 1.5 cm length.

MP larvae were brought together with affected leaves from infected mulberry plantations in that period when damage becomes evident – in the middle of July – beginning of August. These larvae were a mixture of different instars. There were both new hatched and adult larvae and also pupae. Among them sick, dead, infected and partially et by natural entomophags larvae were found among brought material. This mixture was divided to 2 groups: 1) inert, sick, dead larvae and 2) health once. Polyhedron-containing larvae have not been revealed among the first group. Though microbe patogenes and entomophag larvae have been revealed [17]. The group of healthy larvae was fractionated by instars. MP larvae of young instars (first – second) till 0.5 cm and middle instars (third – fourth) till 1.0 cm have a green colour. In last (fifth or sixth) instars their length reaches 1.5 cm and they become rose-red. Samples of young and middle instars larvae were taken for tests on entomopatogenic effect of virus preparations. Elder instars larvae were used for rearing of insects' laboratory line. Originally was impossible to obtain them in laboratory conditions due to dry climate or other factors. MP females did not lay eggs on mulberry tree twigs. We could obtain eggs' lay and new generations of insects only using mulberry tree of mini-cultures, keeping certain life support conditions, design of cage and adding fecundity increasing stimulators to liquid nutritious media. The laboratory generations (up to 5 generations) were obtained using both mulberry tree leaves and artificial diets.

Artificial diet for MP was originally ellaborated on the base of early developed diet for mulberry silkworm [18,19] which further was significantly simplified. Three samples of diets with increased nutritious and mass-productive properties have been selected from 12 experimental diets. Using mulberry leaves we obtained larvae with mass before pupation – 30-32 mg and length up to 15 mm, then using artificial diet the mass was till 60 mg and more with length up to 22 cm. Also rearing methods including all seasonal of laboratory colonies of MP have been developed. Moreover, the artificial diet allows to support its constant composition all over the year, gives similar production at mass rearing and is convenient for infection by entomopathogenous agents.

Mulberry silkworm larvae of "Orzu", "Ipakchi 1" and "Ipakchi 2" strains were reared in laboratory conditions using mulberry tree leaves and artificial diets [18-20].

Wild type purified baculovirus preparations *Autographa californica* WtAcMNPV (3000 PIBs/ml), AcMNPV ($4x10^8$ PFU/ml), of *Spodoptera exigua* SeMNPV (10^9 PFU/ml), and recombinant AcAaIT ($4x10^8$ PFU/ml) have been kindly given by Entomology Department, University of California, Davis, California, USA. Target and non-target insects larvae of different age were orally infected through a diet adding to fixed weight of a diet (natural or artificial) the appointed amount of diluted in double distilled water (dd H2O) up to10^6 – 10^7 PIBs or BV/ml solutions of initial preparations. The same diet moistened with identical amount of distilled water was given to control groups of insects. The state, development and the fact of insects death in variants of experiments were recorded within every days after an infection. Dead larvae were collected and stored at –20^{o}C. Frozen larvae when necessary were defrozen, homogenizated with 10 volumes (W/V) of dd H2O and filtered through naylon filter for use in infection of insects by homogenates.

The phenomenon of cannibalism has been found out at keeping of larvae in starvation before infection with virus preparations. Therefore the larvae were used in experiments without preliminary starvation. This phenomenon and also an opportunity of consumption by MP the legums seeds, this unequivocally shows that this pest possesses considerably more wider feed specialization than monophagous insects as mulberry silkworm and can replace mulberry leaves in critical conditions on others crops that can strengthen its danger to an environment and an agriculture.

Artificial nutritious diets for insects were prepared according to the descriptions in works [18,20] with some modifications (for MP larvae) from local materials, components and chemicals of specialized companies "Dyets", "Sigma-Aldrich", "Fluka", etc. was used as a solvent.

Results and discussions

MP larvae were brought together with affected leaves from infected mulberry plantations in that period when damage becomes evident – in the middle of July – beginning of August. These larvae were a mixture of different instars. There were both new hatched and adult larvae and also pupae. Among them sick, dead, infected and partially et by natural entomophags larvae were found among brought material. This mixture was divided to 2 groups: 1) inert, sick, dead

The first experiment was carried out with larvae collected on plantations and wild (AcMNPV) and recombinant (AcAaIT) baculovirus preparations. As it follows from Tabl. 1 AcAaIT killed MP larvae faster than AcMNPV both caterpillar and larvae of third – fourth instars. At that velocity of death of younger instars is much more faster. These results are similar to those obtained in our preliminary studies [21]. The dynamics of mortality is represented in detail on Fig.1. LT_{50} for middle instar is 1.44 h for AcMNPV virus and for AcAaIT virus is 108 h. At that a lethal ratio time 50% LT_{50} = LT_{50} AcMNPV/ LT_{50} AcAaIT is 0.75. At that the doze of preparation per one larvae was 105 PIBs/ g of mulberry leaves.

It is more difficult to evaluate the doze young instars larvae, because of not all leaves have been eaten (before drying). But the efficacy of the preparations was higher, than in experiment with larvae of third-fourth instars.

The next experiment (Fig. 2 a,b) was carried out with MP larvae of different instars. We affected by high purified wild Wt AcMNPV, "non-toxic" AcMNPV (C_6) and "toxic" AcAaIT and also by baculovirus preparation from *Seodoptera exigua* – SeMNPV. And as in the first experiment the fastest was the "toxic"virus preparation AcAaIT effected on young instars larvae (first – second). "Non-toxic" AcMNPV and SeMNPV acted much more slowly (Fig. 2a and 2b). SeMNPV. LT_{50} of AcMNPV is 108 h, and LT_{50} of AcAaIT is 54 h. LT_{50} for young instar larvae ((first – second) is 0.50. AcAaIT acted slowly on MP larvae of third-fourth instars. While the recombinant virus acted more effective on the mixture of MP larvae (Fig. 2b).

In the other experiment we used young larvae (3^{d} -4^{th} day after hatching, the beginning of second instar) with application of artificial diet, selected as the best in preliminary tests. The same baculovirus preparations in the same concentration (10 PIB per 1 g of AD and 300 PIBS/g of diet (for Wt AcMNPV) have been used in these experiments. It is shown by the results (Fig. 3) that as in previous experiments the 'toxic" AcAaIT acted faster but AcMNPV and SeMNPV acted more effectively. Preliminary testing experiments of homogenates of larvae dead in the experiment 2 as a result of action of wild and recombinant virus preparations have been carried out too. In this experiment wild AcMNPV was more effective, while AcAaIT acted slowly, but SeMNPV was less effective (Fig. 4). It is necessary to note that in this experiment the latent phase of developments of disease is more expressed, than at use of pure preparations (Fig. 1-2). Certainly the experiments which have been carried out in this direction further will be studied in details before to proceed to broadened laboratory and field tests. For example, it is necessary to study effect of such factors of a real environment, as temperature, humidity (more likely dryness) and insolation, since during the dry and hot period ("Saraton"season) MP population grows stronger and further till the end of autumn causes the maximal damage. In this preliminary research it has been found out that in all

studied tests (except for dead larvae homogenate) recombinant bioinsecticide AcAaIT effected significantly faster and with bigger affecting force on MP larvae (especially on young larvae) than wild type preparations. We have begun researches against this dangerous pest of mulberry plantations with use of such classical samples insecticides, showing economic benefit especially in developing countries. But we hope to find more effective ones among newly developed and tested baculoviral preparations [21]. On the other hand we are going to induce a specific wild virus (NPV or GV) in MP larvae *Glyphodes pyloalis* Walker its latent form by different biotic and abiotic conditions for creation in future on its base high effective recombinant biopesticide. So, already long-drawn out useless and unsafe chemical struggle against this dangerous pest can lead to irretrievable damage to Uzbekistan sericulture.

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Table 1
Effect of wyld type and recombinant baculovirus preparations on young and middle instars mulberry piralyd larvae

Variations	Mortality for five days
Control (ddH2O)	
Young instar larvae (first-second)	17%
Middle instars larvae (third-fourth)	9,2%
AcMNV	
Young instar larvae (first-second)	50%
Middle instars larvae (third-fourth)	33%
AcAaIT	
Young instar larvae (first-second)	80%
Middle instars larvae (third-fourth)	50%

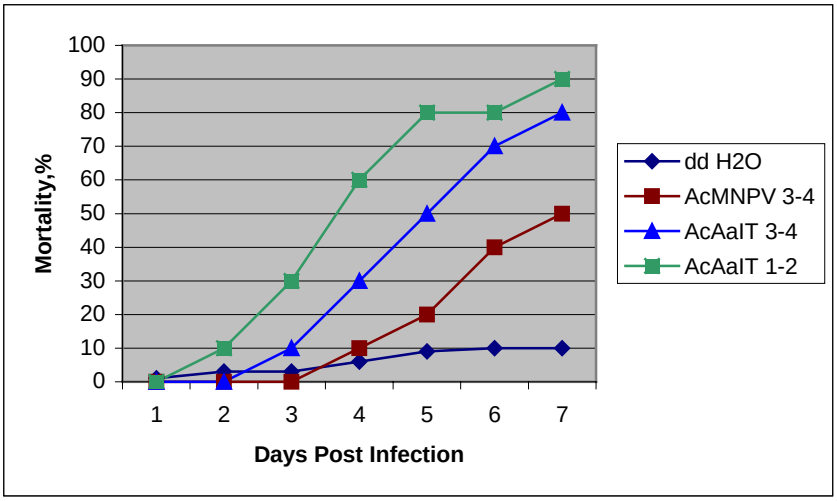

Fig.1. Entomopatogenic property of bakulovirusis AcMNPV and AcAaIT in post infection days for MP *Glyphodes Pyloalis* Wlk.of different instars.
Dose of preparations - 10^5 PIBs/g mulberry leaves.

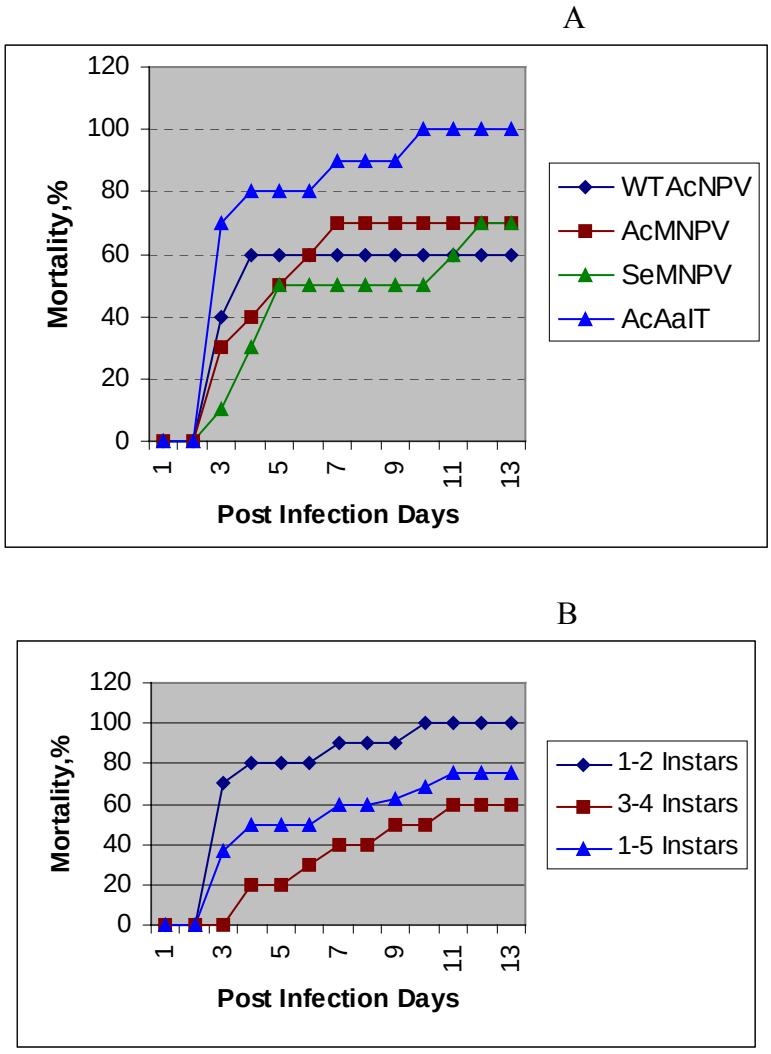

Fig.2. Effect of wild types (WtAcNPV, AcMNPV, SeMNPV) and recombinant (AcAaIT) bioinsecticides on MP larvae of 1-2 instars (A) and AcAaIT on larvae of different instars (B)

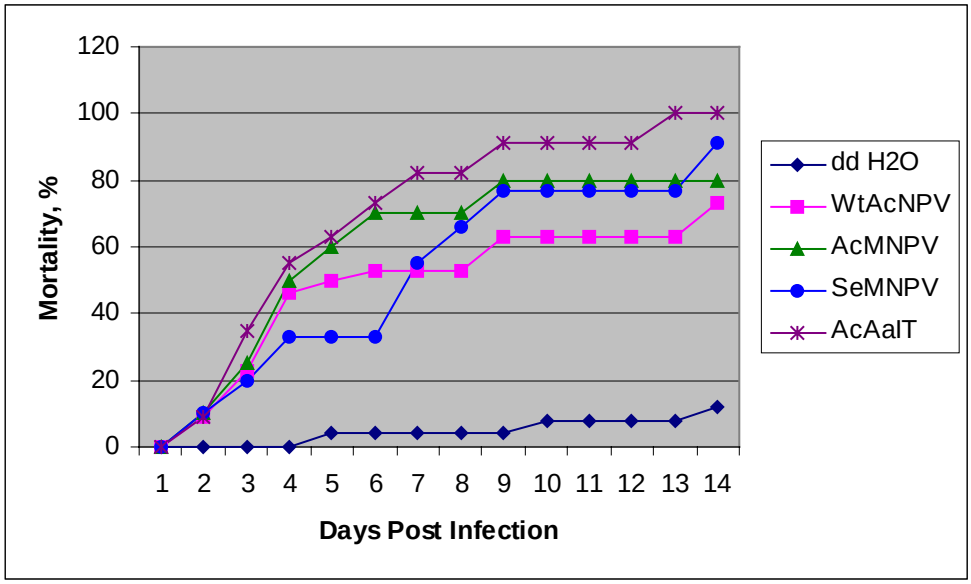

Fig.3. Influence wild type and recombinant baculoviral pesticides on MP larvae of second instar reared by artificial diet.
Dose of WtAcNPV – $3x10^2$ PIBs/g of AD and dose of other pesticides - 10^5 PIBs/g of AD.

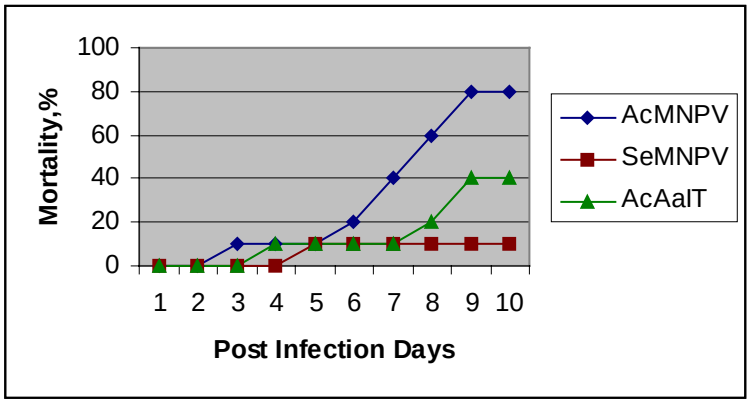

Fig.4. Effect of homogenates of killed MP larvae by appointed baculoviral pesticides on mortality of MP larvae of 1-2 instars. Homogenates preparation and use was described in ”Material and methods”

Results of research on disease of "curly leaf" of mulberries

By
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Abstract: ***One of the sources of distribution of an infection is cutting of sick plants and a sick landing material. Illness is not transferred through ground and seeds. The optimum temperature for development of the activator is 25-30^0 to C. High humidity of ground promotes distribution of disease.Negative influence of the increased dozes of nitrogen and its application is established on development of disease. The most effective way of struggle against is establishing of steady grades. Operation (exploitation) of a mulberry trees is the most provocative factor for the development of disease.***

Key words: mulberry, diseases, temperature, soil, grafting, fertilizer, grade, operation.

In conditions of Georgia, among illnesses of a mulberry rather nocuous and dangerous appeared curly small-leaf which sharply reduces crop of a sheet and an output of a standard landing stuff, and also at a strong degree of disease invokes mass destruction of plantations of a mulberry of acquisitive varieties. Illness of contagious character a mycoplasma of the nature. Distributors of disease are silkworm farm cicada -Hishimonus sellatus Uhler and an infested stuff (KaKulia, 1972, N.D.Tulashvili, Giorgadze, 1972, Chaduneli, 1972).

Illness for the first time has been marked in 1963 in the Western Georgia it was quickly distributed and has accepted menacing character. Now illness covers also some areas of East Georgia. The geographic range of its diffusion constantly increases.

Symptoms of illness - are described in the foreign and domestic literature (Kicci, 1959; okabe Kokha, 1960; Kakulia 1966; Icine, 1971, etc.). By our researches it is established, that disease begins with a top of propagated and is gradually distributed to its establishment. On leaves first attributes of disease show as stippling, subsequently leaves are deformed. Lengthways vein shrivel, braided, because of what leaves accept concave orbicular the form. The struck leaves abortive, thin and fleecy.

Growth branches is considerably reduced. On strongly infested arbors they short and thin. On some acquisitive varieties growth of a top of propagates restrains; sleeping kidneys therefore are formed lateral branch with fine leaves.

Way and conditions of diffusion curly small-leaf mulberries:

1. Influence of temperature on development of illness.

For studying this question, special experiences have been put. Annotators able-bodied seedlings have landed in pots. After the beginning sap ascent in plants a stock it is artificial infested - Georgia. The ambassador sponger stocks pots were located in heat chambers, where be artificial was created constant temperature (+15, 20, 25, 30 35 0 C) by engrafting sick nephrites of a variety for each variant it was provided on 20 plants. Supervision was carried spent within 1, 5 months.

Illness was not showed in conditions of temperature +15 and 350C. At temperature 200C illness has been noticed in 40 days, temperature 250C and 300C - in 22 days. The interest of a lesion at 200C reaches 50 %, at 250C - 300C - 100 %.

In field conditions terms of appearance of first attributes of illness change on years and depends on temperature conditions. Usually in the beginning of vegetation at an expanding of nephrites symptoms of disease are disguised. During the further body height of new propagates when the daily average temperature of air reaches 19-210 0 C, there are strongly pronounced symptoms.

2. Transfer of an infection contamination through bedrock

For specification of this question in region strongly infested arbors undertook bedrock and was fallen asleep in pots which were put in isolators. Regarding pots seeds of a mulberry were sowed, and in a part landed able-bodied nursling. In experience the control variant has been stipulated: seeding of able-bodied seeds in able-bodied bedrock and alighting able-bodied seedlings. In flow of vegetation supervision over exhibiting of illness were carried out. Experience was carried out in flow of two years. As a result of the carried out works it is established, that on an able-bodied stuff the infection contamination through bedrock is not transferred.

By experiences also it is established, that high humidity of bedrock promotes augmentation of degrees of disease and destruction seedlings, accelerates revealing symptoms of illness at an infested stuff.

3. Influence of a scion on diffusion of an infection contamination.

For studying influence of a scion on diffusion of an infection contamination experiences have been put in isolation field conditions. The skilled able-bodied stuff (shanks and seedlings) was made and raised in able-bodied region.

In isolation experience for each variant took on 30 able-bodied seedlings which landed in pots and were mad in isolator. In two months have lead engrafting the rephroses taken from infested don't cuttings of an acquisitive variety Georgia and rather steady variety Oshima.

For a field experiment in the no infected region the brought up stuff have landed in the beginning of March in the infested region and in the beginning of May haven't carried engrafting the nephroses taken from sick varieties. For each variant took on 50 seeding. Both in isolation and in a field experiment the control variant - engrafting of an able-bodied nephros on an able-bodied stock has been stipulated.

Results of experience have shown, that the engrafting infested nephroses produces reduction viability a scion on 17,8 % and its augmentation attack on 33,3 %. As against isolation experience in field conditions in case of engrafting of an health nephros on an able-bodied stock, disease of a scion reaches 27,4 %. It specifies that the bligth in choronomic conditions is distributed also by other ways, those hexapods.

4. Influence of a stock on diffusion of an infection contamination.

With the purpose of studying the specified question have carried out engrafting health nephroses of different varieties of a mulberry on a sick stock. Patients саженцы have landed in pots and have placed in isolators, and in two months have carried out engrafting, control variant - engrafting healthy nephroses on an able-bodied stock. It is established, that the sick stock rendered even more negative influence on viability a scion and transfer of an infection contamination, on sick stocks interest viability scions lower and changes in limens of 13,3-46,6 %. On varieties the interest viability a scion has decreased in comparison with the control from 50,1 to 83,4 %.

By experiences it is established, that the highest interest of disease is marked at engrafting on the stock which has been brought up from seeds of a variety Georgia, and the lowest - at engrafting on a stock received from seeds of variety Pocco.

5. Diffusion of illness on various varieties of a mulberry within Epifitote

Diffusion of illness within эпифитотии on various varieties of a mulberry has studied in stationary experiences at the Kuitaisi zonal station sericulture on a plantation incorporated able-bodied seeding. Were tested more than 100 various varieties and forms of a mulberry aboriginal and a no conventional parentage.

In the first year of a bookmark illness was showed only on acquisitive variety hybrid. For the second year illness has been marked on all varieties except for Oshima, Tbilisuri, Azerbaidjan - 10, the Hybrid - 2, gruznish-4 and Iveria. On other varieties the interest of diffusion of disease changes from 5,9 - up to 75 %. For the third year illness more or was less distributed to almost all varieties of a mulberry. Intensity of its development and diffusion of an infection contamination on different varieties is various. These data confirm a popular belief in the literature, that stability to disease curly little-left is a characteristic attribute of a variety

(Epro 1929; Kakulia, 1969; Shablovskaia, 1972).

In conditions of Georgia under M.A.Kakulia's management within epiphyte at the kutaisi zonal station sericulture on fields with various varieties of a mulberry rather steady 9 varieties - Oshima, gruznish-4, tbilisuri, the Hybrid - 2, Iveria, Ukrainuli - 7, Russian, Japanese, ПС-9 and a. so.

Steadier varieties have field practical stability. In most cases they are carriers of micro plasma in a latent form, but do not reduce the productivity.

Various intensity of a lesion of the same varieties of a mulberry in dependence on erect ash value, but also in limens of the region that is obviously caused by action of different ecological factors is established.

6. Influence of operation on disease of a mulberry.

Questions of operation of a mulberry have got the special urgency in a kind of diffusion in Georgia diseases curly little-left. In Japan where identical disease for a long time is distributed, operation of arbors counted a principal cause of disease. After an establishment of contagious character of disease (Isshie 1965) it became obvious, that operation is not a first cause, but breaking normal ability to live of plants, considerably accelerates diffusion of disease.

The experience carried by us shows, that operation of a mulberry is the most provocative factor for development of disease curly little-left, the more strongly operation breaks normal ability to live of plants and reduces productivity of a mulberry, the its stability to diseases more decreases. In region diffusions of disease observance of optimum terms of carrying out of operation of a mulberry is necessary.

It is established, that overdue spring operation and carrying out of summer operation considerably is especial increases intensity of disease of a mulberry.

Winter cutting annual branch on a short thorn and operation of annual propagules in the autumn season is the most effective agro technical action not only for augmentation of crop of a sheet, but also for sharp decrease of disease curly little-lift.

In 1975-1990 we had been investigated new systems of operation which basically have been constructed on a principle of rotation, i.e. alternating of terms and methods of operation of a mulberry on years.

As a result of the lead researches it is established, that at alternating different terms and means of operation of a mulberry the crop of a sheet considerably increases, its quality is enriched;

arbors are maintained with identical intensity that to a lesser degree renders a negative after-action of operation on body height and development of plants the next years.

7. Influence of mineral fertilizing on disease of a mulberry.

For an establishment of influence of fertilizing on development of disease curly little-lift in the Western Georgia (the Kutaisi experimental station sericulture) it has been lead two long-term a field experiment. Experience is lead to 1982-1986 on the tree-podsolic bedrock described by significant no saturation of the establishments (5.05-8.5 %), sour reaction (4.8-5.0 pH), the small contents of a humus and mobile forms of nitrogen and a phosphoric acid. In experience 1 influence of nitrogen, phosphorus and potassium separately on development of illness was studied, and in experience 2 along side with other questions the combined doses of mineral fertilizing (N, P, K) were studied.

Fertilizing was brought on both fields in the following order: nitrogen - annually, phosphorus and potassium of times in two years. Definition of interest of infection rate and development of illness was carried out on the standard procedure.

Frequencies of experiences quadruple, in frequency of 10 registration plants. Experiences were carried out on rather steady varieties of a mulberry - Oshima, Iveria and Kutaturi.

By experiences it is established, that increase of a sensibility of plants to disease is promoted by the factors intensifying a neoplasm of young members and fabrics. On a background of nitrogenous fertilizing illness shows earlier and more strongly, than in the other variant of experience. On not fertilized background infection rate of arbors nettlehead compounded 21,7 %, and on a background only clean nitrogen of 25,0 %. Application P and To separately and in a combination promotes the general resistance of plants, development of illness appreciably decreases, however long entering under mulberries of one phosphoric and potash fertilizing has not affected positively on gaining of crop of a sheet the next years.

Experiences have shown, that at joint entering mineral fertilizing under a mulberry (N, P, K) the crop of a sheet in all variants of experience considerably raises. The augmentation of crop basically depends on doses of nitrogen in an admixture of phosphorus-potash fertilizing. So for example, at identical dose P, to augmentation of doses of nitrogen from $_{N60}$ up to $_{N90}$ on hectare, has caused increase of crop on 4, 1-5 %. At augmentation of doses of nitrogen up to $_{N120}$ the kg on hectare, crop of a sheet has increased by 11, 0-17, and 6 %.

Conclusions

1. Curly little-lift mulberries is a contagion which is easily distributed at a breeding by vegetative members of a mulberry (shank of sick plants and a sick landing stuff).

2. Illness is not transferred through bedrock and seeds.

3. Optimum temperature important for diffusion of disease is 25-300C. The raised humidity of bedrock and air promotes augmentation of intensity of disease.

4. In a findings of investigation rather steady varieties of a mulberry are revealed: Oshima, Pocco, nezumigaesi, gruznish-4, the Hybrid - 2, etc. In most cases they are carriers of illness in a latent form, but do not reduce the productivity in flow of some years.

5. The most provocative factor for diffusion of illness is the operation of the mulberry which have been especially carried out to the summer seasons. In zone diffusions of disease observance of optimum terms of carrying out of operation of a mulberry is necessary.

6. It is established, that at young age of a plant are more acquisitive to pathogen, and in the adult they show pathological resistance disease-producing factors.

7. The raised doses of nitrogen (N) and its application in separateness and in a combination raise intensity of diseases. Application P and K promote the general resistance of plants.

Section 2. Silkworm Bombyx mori L.

2.1.Silkworm rearing and feeding

Comparative performance of shoot and leaf silkworm rearing technology in Uttar Pradesh conditions

By

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Abstract: ***An experimental study was carried out find the performance of silkworm Bombyx mori L. to compare the improved method of shoot rearing with leaf rearing technology in the north Indian state of Uttar Pradesh. Twenty five disease free layings (dfl's) of silkworm race SH6 X NB4D2 were brushed each for shoot and leaf rearing treatments. The larvae were mass reared till third moult, thereafter reared in five replicates(300 larvae each replicate) till the onset of spinning. Data were collected for the parameters viz., hatching percentage, total larval duration, ERR by number and by weight(kg), single cocoon weight, single shell weight, and shell ratio percentage. The observations (Data) processed and analyzed by using statistical tools like simple percentage, and ANOVA were used to find out the variations between shoot and leaf rearing. The study reveals better results in yield wise in shoot rearing when compared to leaf rearing of silkworm Bombyx mori L. in Uttar Pradesh conditions.***

Keywords: Bombyx mori L., Shoot rearing.

Introduction

Sericulture provides tremendous opportunity for employment to the rural people and arrests migration to urban areas. Sericulture also provides opportunity for utilizing the waste and dry lands and provides handsome income to the rural poor and marginal farmers (land holding of 1 to2 acres). When nothing could be grown in a land having economic viability, sericulture was found to be highly successful.

In India, sericulture has already made a good ground in the recent past through a face-lift from the low cocoon production of 20-25 kg/100 in the fifties to a moderately high production of 45-50 kg/100 dfls in the eighties. In fact, this has been possible through the research contributions of CSR & TI Mysore, KSSRDI, Bangalore towards introduction of improved mulberry varieties, development of silkworm rearing management and practices under tropical condition as well as introduction of productive silkworm breeds. The research contributions have helped the spread of sericulture over the wide agro-climatic areas in India.

Sericulture has been an ancient industry in India and major importance was givento it during the British regime in South India. Tipu Sultan the king of Mysore especially gave the impetus, encouragement and organized development of Sericulture in the erstwhile state of Mysore.

In north India the state of Jammu and Kashmir, Bengal and North of Uttar Pradesh (Dehradun) developed Sericulture. Although India has made considerable progress in the field of sericulture, it has been occupying a place next to China in the quantum of production.

Sericulture in India is going through a phase of transformation from low productivity to high productivity and from high cost of production of low cost of production. In this direction the shoot feeding method developed by KSSRDI, Bangalore is one such achieving the twin objectives of high productivity and reduced cost. The shoot feeding method is quite popular in Karnataka owing to its labour saving and simple method. The same technique could be extended in other parts of the country. In this direction it becomes necessary to study its feasibility of this technique in different localities. Thus, the present experiment was under taken especially to study the application of shoot feeding technology and its feasibility under the conditions of Uttar Pradesh - the largest state in India in terms of population (17 crores) and to project the scope for development of sericulture.

Objectives of Study:

I. To study the silkworm rearing performance under shoot feeding method in comparison with the normal leaf feeding method under UP conditions.

II. To study the cocoon parameters under shoot and leaf feeding methods.

Materials and Methods

The present research work was carried out in the Department of Applied Animal Sciences B.B.A.U. Lucknow. It was carried out in the monsoon season of year 2005 (During the month of September). In the study, a total of 50 Dfl's of race SH6 × NB4 B2 was procured from Regional Sericulture Research Station Sahaspur, Dehradun Central Silk Board.

There after the Dfl's were divided in two separate treatment of 25 Dfl's each for shoot and Leaf feeding. Then the eggs were black boxed, after two days the larvae were brushed (hatching % noted). The larvae were mass reared till 3rd instar following standard rearing practices (Krishnaswami, 1978 b) for young age rearing. Later the larvae were reared into five replications (Shoot and Leaf feeding) adopting shoot feeding method advocated by Sekharappa et. al. 1991. Each replicated contained 300 larvae.

The larvae were separately reared on the leaf and shoot feeding stands till the onset of spinning. Rearing performance was observed and data recorded in respect of LARVAL DURATION, SINGLE COCOON WT., SINGLE SHELL WT., and ERR BYNO. and ERR BY WT. The data were then subjected to statistical analysis following standard methods of significance tests.

Significance tests both students 't' test and Analysis Of Variance methods were employed for finding the significant differences between the two methods for different rearing parameters. The results are presented in Table 1.

Results and Discussion

On comparative analysis of the data in Table 1 presented the results obtained are as indicated below:

The average larval duration under shoot feeding method is found to be 25 days and 2 hours where as the same under leaf feeding is recorded at 25 days and 4 hours. This difference of 2 hours between the two methods is not found statistically significant. Single cocoon weight measured in grams was found to be 1.58 and 1.54 on an average in respect of shoot and leaf feeding methods. The difference of these 0.02 grams is also not found statistically significant. Coming to the single shell weight measured in centigrams is found to be 32.32 and 29.91 on

an average in respect of the shoot and leaf feeding methods. The difference of 2.41 centigrams is also not found statistically significant. The effective rate of rearing by weight was observed to be 12.61 and 12.23 in respect of the shoot and leaf feeding methods. Here the difference 0.38 kg is not found statistically significant.

Significant differences are found in respect of shell ratio and ERR by number. The shell ratio was recorded as 20.46 and 19.40% respectively under shoot and leaf feeding methods. The difference of 10.06%is found to be statistically significant at at a significance level of 5%. The mean effective rate of rearing by number is observed as 7991 in shoot feeding method as against 7947 in leaf feeding method and the difference of 44 is found to be highly significant (p=0.01). This result is in conformity with the observations made by V.G. Maribashetty and B.M. Sekharappa 2004; Sekharappa et. al 1997, that the cocoon characters and ERR will be better in shoot feeding.

It is observed that among the parameters wherein non-significant differences are obtained the values in respect of shoot feeding method are found higher over the leaf feeding method. This implies clear trends among these characters with regard to the superiority of the shoot feeding method. The results obtained corroborate the observation of Venkatareddy et. al (1994), Chickavenkateshappa (1987), Muraleedara (1990) and Sekharappa et. al. (1991) where in an increased cocoon yield of 5 kg/100 dfls. was recorded in shoot feeding method.

Shoot feeding method has other distinct advantages also. It has become handy for the serculturists to reduce the labour cost, to produce better cocoons having improved reelable characters, easy method of rearing of worms, maintenance of freshness in the feed etc. The solitary experiment conducted in the monsoon climatic conditions of Uttar Pradesh region has thus sent signals that the farmers in this region can also employ the shoot feeding method economically. This experiment has also sent signals for extension of this study for further establishment of the supremacy of the shoot feeding method over leaf feeding method over broad database.

Conclusion

The trial made in the present study has indicated viewpoints about the advantages of the shoot feeding method over the traditional leaf feeding method. Shoot feeding is especially advantageous in silkworm rearing with regard to better crop management, better yields, cost reduction and better post cocoon characters. In the different climatic conditions like that of Uttar Pradesh. Significant increases in cocoon shell content and output of cocoons are observed. In addition to this, other cocoon characters have also scored higher than the leaf feeding method. Further establishment of the supremacy of the shoot feeding method has to be made in wide database in the region. Scope for further extension of the studies is also visualized from the present study.

Future Line of Work

i. Extend the study of comparative performance with, Bivoltine × multivoltine, Bivoltine×Bivoltine hybrids of silkworm by adopting shoot feeding method.

ii. Study disease management, feed efficiency (leaf consumption) and reeling parameters using shoot-feeding method in the region.

iii. Study the shoot feeding method and its feasibility at farmers level in the region.

iv. Study the economics of shoot feeing method at the farmers Conditions of the region.

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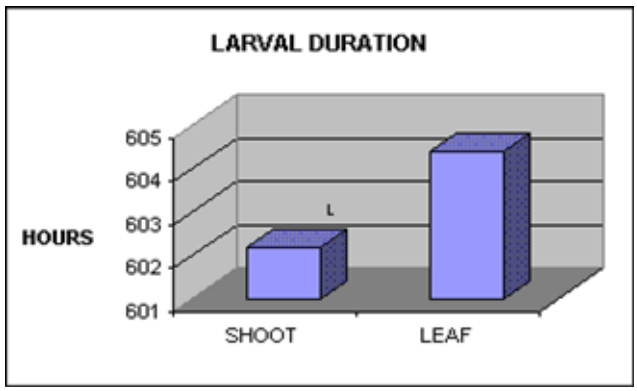
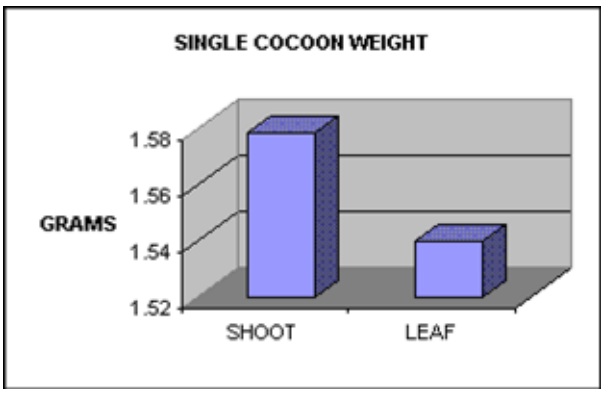
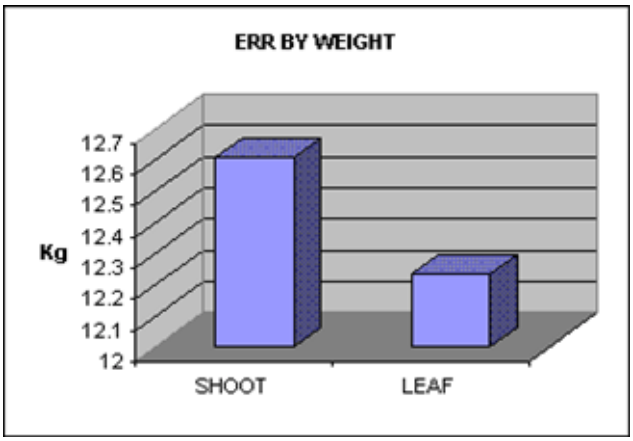
Table 1. Comparative rearing performance under shoot feeding and leaf feeding methods

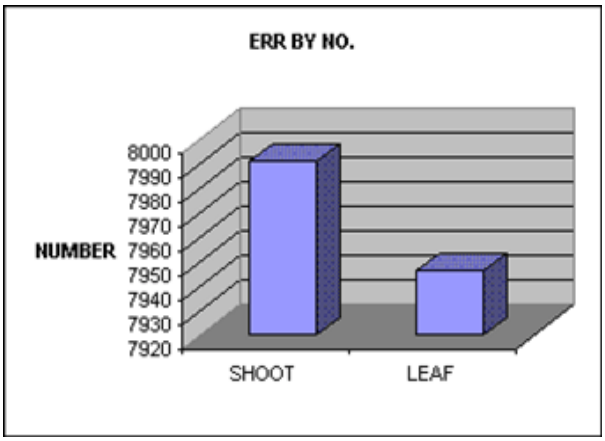
REPLICATES	LARVAL DURATION (h)		SINGLE COCOON WT.(g)		SINGLE SHELL WT. (cg)		SHELL RATIO %		ERR BY NO.		ERR BY WT. (kg)	
	SHT	LEA	SHT	LEA	SHT	LEA	SHT	LEA	SHT	LEA	SHT	LEA
R1	599	600	1.52	1.51	30.20	28.14	19.86	18.63	8000	7936	12.16	11.98
R2	590	610	1.55	1.53	30.14	29.14	19.44	19.04	7995	7959	12.39	12.17
R3	612	610	1.61	1.54	34.00	30.11	21.11	19.50	7984	7956	12.85	12.25
R4	610	602	1.61	1.54	33.12	30.15	20.57	19.57	7985	7945	12.85	12.23
R5	600	600	1.60	1.58	34.14	32.00	21.33	20.25	7992	7937	12.78	12.54
MEAN	**602**	**604**	**1.58**	**1.54**	**32.32**	**29.91**	**20.46**	**19.40**	**7991**	**7947**	**12.61**	**12.23**
SD	8.96	5.18	0.04	0.03	2.00	1.43	0.80	0.61	6.76	10.60	0.31	0.20
SE (m)	4.01	2.32	0.02	0.01	0.90	0.64	0.36	0.27	3.02	4.74	0.14	0.09
CV%	1.49	0.86	2.59	1.66	6.19	4.78	3.93	3.14	0.08	0.13	2.49	1.65
STAT SIGNFI	NS		NS		NS		S		HS		NS	
LSD 5%	–		–		–		1.04		12.96		–	
LSD 1%	–		–		–		–		18.85		–	

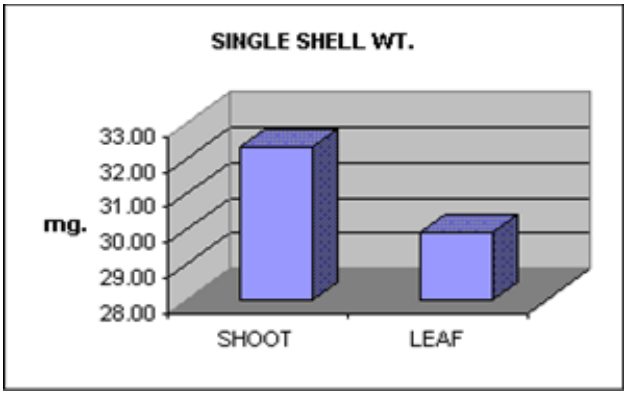
Note: SHT – Shoot Feeding Method; LEA- Leaf Feeding Method; NS - Not a significant difference; S-Significant difference at 5% level; HS- Significant difference at 1% level

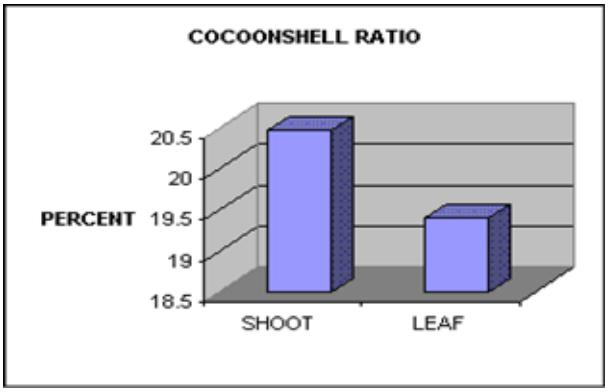

LARVAL DURATION
HOURS
605
604
603
602
601
SHOOT
LEAF


SINGLE COCOON WEIGHT
GRAMS
1.58
1.56
1.54
1.52
SHOOT
LEAF


ERR BY WEIGHT
Kg
12.7
12.6
12.5
12.4
12.3
12.2
12.1
12
SHOOT
LEAF


ERR BY NO.
NUMBER
8000
7990
7980
7970
7960
7950
7940
7930
7920
SHOOT
LEAF


SINGLE SHELL WT.
mg.
33.00
32.00
31.00
30.00
29.00
28.00
SHOOT
LEAF


COCOONSHELL RATIO
PERCENT
20.5
20
19.5
19
18.5
SHOOT
LEAF

"Silkworm Excreta" A Potential Animal Source Poultry Feed Supplement

By

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Abstract: ***Under tropical conditions commercial silkworm rearing generates lot of silkworm excreta especially during late age. This is generally put back to mulberry garden as manure. Right now the soya meal / fishmeal are the most commonly used poultry feeds. The purpose of this experiment was to exploit the possibility of supplementing the vegetable based poultry feed with animal protein source utilizing the silkworm litter, an abundant natural resource which would otherwise go as waste. Hence, in the present study we monitored the effect of fortification of poultry feed with Silkworm excreta on growth and development of broiler birds. The fortified poultry feed extrafoliated at different concentrations (1, 2, 3, 4 & 5 %) to the finisher feed was fed to 3 weeks old broiler birds till 6th week. Fortified poultry feed at 1 % could significantly enhance broiler biomass at 6th week. This technology is low cost, ecofriendly and leads to value addition of silkworm litter.***

Keywords: Silkworm excreta, Poultry, Broiler Biomass, Recycling of natural resources, Value addition

1. Introduction

Sericulture is an agrobased industry with immense potential both on economic and social fronts and is a major livelihood of marginal and submarginal resource poor farmers. India is the second largest silk producer in the world contributing to about 16 % of the world's raw silk production. The industry provides employment to more than 6 million people specially empowering livelihood for woman community in the country. Besides this, the industry is generating maximum foreign exchange by selling silk as well as bye products.

Waste is wealth, nothing goes waste in Sericulture. Since, 1970's the silkworm faeces is being utilized by Chinese to produce paste chlorophyll, sodium copper chlorophyllin, phytol, carotene, triacontanol and pectin etc. Infact, Chinese earn more income from byeproducts rather than the main product silk. For example the sericulture farmer could get the income of 3,00,000 RMB (Rs. 24,00,000) by selling 1000 tonnes of silkworm faeces alone (Zhu & Xu, 2004). The studies conducted by Lee, et al., (1990) from Korea indicated that chlorophyll derivative-A extracted from silkworm excreta could be used as a photosensitizer (650 nm) for photodynamic therapy of cancer tumors (specially cytotoxic *in vitro*).

In India one hectare Sericulture farm can generate annually an approximate quantity of 12-15 MT waste comprising of silkworm litter, left over leaves, soft twigs and farm weeds. This waste has a tremendous value of nitrogen (280-300 kgs), phosphorous (90-100 kgs) and potash (150-200 kg) as well as micronutrients like iron, zinc, copper etc (Das et al., 1997) but not put to proper use.

Presently Indian Sericulture industry is passing through a lean phase, and there is a need to boost the income of sericulturists by effectively utilizing the bioresources particularly the silkworm excreta. Silkworm litter contains 16 percent protein (Sugun Rajiv and Vijaykumar,

1996) as against 5.7 percent in wheat, 13.2 percent in paddy husk and 18.3 percent in wheat bran respectively. The silkworm excreta in the present study contain 9.13 per cent protein. However, no efforts have been made to utilize the protein rich silkworm excreta in poultry. Hence, a preliminary study was carried out to find out the effect of fortification of poultry feed with silkworm excreta on the quantity and quality of biomass produced.

2. Material and Methods

The experiment was conducted at Department of Sericulture in collaboration with Poultry Unit of UAS, Dharwad, Karnataka, India. One day old Vencobb (broiler strain) chicks procured from Venkateshwar Hatcheries, Limited Bangalore, were reared in deep litter system following standard procedures.

The silkworm litter collected from silkworm rearing bed was shade dried, sieved to separate from unfed dried leaves, soft twigs, lime powder etc. This was mixed @ 10, 20, 30, 40 and 50 g / kg with normal poultry finisher feed to arrive at 1, 2, 3, 4 and 5 percents respectively (T1, T2, T3, T4 & T5). Normal poultry feed served as check. Four replications were maintained with 20 birds per replication. The extrafoliated poultry feed was fed to broiler birds from IV to VI week. Observations were recorded on initial bird weight (III week), weekly and final body weight (VI week), quantity of feed consumed and litter conditions etc. Based on the preliminary study 2nd rearing was conducted during February 2005 by extrafoliating poultry feed with 1% silkworm excreta. On the 42nd day representative samples from both the groups were slaughtered and weight of carcass, edible and non-edible parts were taken on an electronic balance. The extrafoliant (Table 1) and the chickens were subjected to biochemical analysis. Organoleptic test was conducted for acceptance and negative clinical effects if any. The data were subjected to statistical analysis as per Gomez and Gomez (1984).

3. Results

Results related to effect of fortification of poultry feed with silkworm excreta on weekly gain and food consumption is presented below.

Fortification of poultry feed with silkworm excreta could significantly enhance the weight of broiler bird. At IV week all the treatments induced non-significant but higher weight compared to check (277.10 g), T4 recording maximum weight of 336.75 g. Broiler weight differed significantly at V week. T5 recorded maximum weight of 685 g but was on par with T4, T1, T2 and T3 with 680.75, 676.00, 668.00 & 651.90 g respectively. Birds which received no extrafoliant weighed only 621.10 g. Final broiler bird weight taken at VI week differed significantly. T1 with 1043 g (plate) was significantly superior to T5 (989.00 g) and check (973.10 g) but was on par with T4, T3 and T2 (1035.75, 1028.90 & 1023.10 g) respectively (Table 2a). The percent increase in weight gain at the end of the VI week is presented in Fig.

Feed fortification at lower concentrations (1-3 %) did not affect the litter condition of the poultry bed but, at higher concentrations (4 and 5 %) the litter turned damp leading to formation of clumps / flaxes.

In the 2nd rearing extrafoliant could increase the broiler biomass by 4.23 per cent compared to check (Table 2b). The weight of different parts of the broiler viz., carcass, lever, heart and gizzard was more in extrafoliant than control (Table 2c). The chicken produced out of extrafoliated feed recorded higher Iron (24.30 ppm), Na (7.00 %) content and fat body (4.45 %) as compared to control (Table 2d).

Organoleptic test revealed no change in dressed chicken colour and was more muscular, palatable and acceptableFurther, there was apparent visibility of the subcutaneous fat and no negative clinical effects were produced among the tested members.

4. Discussion

It was interesting to note that, extrafoliation of poultry feed with silkworm excreta at 1 percent enhanced the broiler biomass by 7.18 per cent.

When feed containing 5 percent silkworm litter of white cocoon producing variety was given to hens, xanthophyll content of the egg yolk increased up to 0.03144 mg while that of yellow cocoon producing variety by 0.01726 mg. When the litter content was increased to 20 percent the xanthophyll content increased to maximum of 0.0176 mg. Further, when the feed mixed with silkworm pupae was supplied to rabbits the fat deposits in their body increased and the fur growth was significantly better (Aruga, 1994). Shivashankar and Ashoka (1997) opined that use of silkworm litter as feed cum fertilizer in fresh water prawn culture could improve the production rate of prawns (701.55 kg/ ha/180 days). These reports are more or less comparable with present investigation wherein, protein rich silkworm excreta extrafoliated at 1 percent could enhance the broiler biomass.

The chicken produced out of fortification of poultry feed recorded 4.45 percent fat body this is probably attributed due to presence of higher (2.84 %) lipid in feed supplement and can be removed during dressing. However the chicken was more muscular recorded higher content of Na and Fe.

In the present investigation, fortification of poultry feed at higher concentration led to damp bed and formation of clumps / flaxes and is probably due to higher fibre content (11.17 %) in the feed supplement as against 9.9 and 8.1 % in wheat bran and paddy husk respectively as reported by Majumder (1997). Effect of fortification of poultry feed with silkworm excreta on enhancement of Broiler biomass is being reported for the first time. This enables effective recycling of Sericulture waste especially silkworm excreta mainly the whole process ecologically sound leading to value addition.

There is great potential to supplement the conventionally used soya meal based poultry feed with silkworm excreta presently going as huge natural waste into value added product particularly in the changing global scenario and market trend influenced by WTO and GATT. Further, large-scale and repetitive trials on effect of extrafoliation are in progress. The biochemical analysis of the extrafoliant and revealed higher fat / oil content and there is scope to use the extrafoliant especially in starter feeds which contain high protein low energy crumbs. There is need to study the effect extrafoliation of layers also. There is need to extrafoliate throughout the rearing period to see its effect on layers and chicken production.

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Table 1. Biochemical constituents of extrafoliant

TESTS	**EXCRETA**
Moisture	07.21
Total ash	16.01
Protein	09.13
Fat/oil	02.84
Fibre	11.17
Sand silica	05.16
Sodium, as Na	00.07
Potassium, as K	01.95
Phosphorus, as P	00.20
Iron, as Fe	00.10
Calcium, as Ca	02.93
Magnesium, as Mg	00.38

Table 2a: Effect of extrafoliant on weight gain of broiler bird (Race: Ven cobb) April – 2003

Treatments	Initial (III week) wt. (g)	IV week (g)	V week (g)	VI week (g)
T1	647.00	316.00	676.00 [a]	1043.00 [a]
T2	615.90	295.10	668.00 [a]	1023.10 [ab]
T3	645.00	290.90	651.90 [ab]	1028.90 [ab]
T4	645.25	336.75	680.75 [a]	1035.75 [ab]
T5	652.00	298.00	685.00 [a]	989.00 [bc]
Control	640.90	277.10	621.10 [b]	973.10 [c]
C.D.	--	NS	41.235	46.963

Table 2b: Effect of extrafoliant on weight gain of broiler bird
Race: Ven cobb **Season: February 2005**

Treatments	Initial (III week) weight (g)	Final weight (g)	Weight gain (g)	Per cent increase
T1	0.728	2.221	1.972	4.23
Control	0.707	2.057	1.892	--
C.D.	--	--	NS	

Table 2c: Effect of fortification of silkworm excreta on weight of different organs

Parts	CONTROL (g)	Fortified (g)	Per cent increase
Broiler weight	1687	2267	34.38
Carcass	980	1331	35.82
Lungs	7	11	57.14
Heart	10	13	30.00
Lever	35	41	17.14
Kidney	6	10	66.66
Gizzard	42	46	09.52

Table 2d: Effect of extrafoliant on biochemical constituents of broiler

Tests	FORTIFIED	Control
Moisture (%)	74.39	75.97
Total ash (%)	01.13	00.97
Protein (%)	17.12	20.29
Fat/oil (%)	04.45	02.82
Fibre (%)	--	--
Sand silica	--	--
Sodium, as Na (%)	00.07	00.06
Potassium, as K (%)	00.24	00.30
Phosphorus, as P (%)	00.17	00.19
Iron, as Fe (ppm)	24.3	19.6
Calcium, as Ca (ppm)	7.5	10.4
Magnesium, as Mg (%)	143.6	162.6

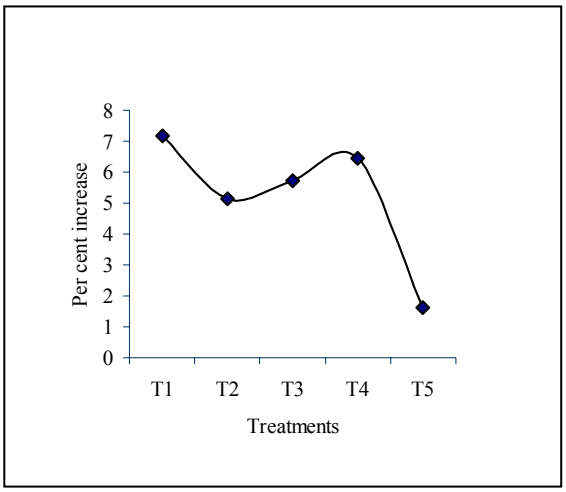

Fig. 1. Percent increase in weight gain (VI week) as influenced by fortification of poultry feed

Plate. Effect of supplementation of Silkworm excreta on broiler size

New way of increase of viability of the parental silkworm lines at summer and autumn silkworm rearing

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Introduction

Production of high-quality and competitive cocoon products meeting the present requirements of the international silk market is a problem of current importance of silkworm breeding branch of Uzbekistan for today. It is necessary to improve production of cocoons not only in the seasons of more favorable climatic conditions of spring, but in conditions of a summer and autumn.

With the purposes of more complete satisfaction of demands of the branch in a qualitative industrial hybrid grain and effective use of capacities of grain firms of the republic the task of a gradation transition to production of industrial grain also in the summer-autumn seasons is posed. Many explorers have shown, that the grain prepared in summer and autumn differs by a heightened survival rate of embryos as the term of their estivation is reduced to 120 days instead of 180 days at preparing of grain from vernal cocoons. In this aspect it is necessary to point out especially that the period of estivayion of a grain from summer-autumn cocoons does not coincide with wearisome heat in June – August months.

It is necessary to mark, that in technology of summer-autumn fattening there is a number of the negative aspects, in particular, in this period nutrient properties of leaves are essentially degraded, and fattening itself is passes on a background of heightened temperature. These factors just result in a powerful decrease of vitality of silkworm. In the present article the writers touch upon a question of preparing of a qualitative grain at repeated fattening of the caterpillars of silkworm with application of fodder second helping.

As vitality practice and results of long-term researches of the scientists show, each animal or vegetative organism shows the maximum potentials in growth and development only if there is optimum conditions of their keeping and feeding for the given organism.

Quantity of a feed, in this case of leaves of mulberry tree and their nutritiousness are a determinal factor of increase of productive properties of silkworm cocoon.

The basic motive of a decrease of productivity of cocoons, reproductive parameters and technological properties of cocoons at carrying out summer-autumn fattening of caterpillars of silkworm cocoon is the considerable loss of protein, moisture and other materials in leaves of mulberry. The loss of a moisture from leaves in the season of summer heat, as a result brings to decrease of eating up and assimilability of a leaf by the caterpillars, and the shortage of protein and moisture entails of weakening of silk synthesis process in silk-detaching gland. Thus, there is a necessity of enrichment of a forage, first of all, by proteins, moisture and other ingredients boosting of assimilability of mulberry leaves.

As for application of the fodder components the wide experience is accumulated in cattle breeding industry, where a great number of researches is dedicated to effective ennoblement of forages of cattle and poultry by enrichment them by different sources of azote vitamins, micro elements, and also with biologically energetic drugs. The interesting enough results are received by R.M.Medeubaev (1994) on usage of cotton yeast. The researches of V.Gotlib,

B.Yulin, M.Petrov (1989) are dedicated to application of ammonia as the fodder component, where assimilability increase contribution almost twice.

K.K.Karibaev (1996), having included the polyferment fodder component in a ration of 4 month calves has achieved useful increase of intensity of growth within the limits of 7,1-19,0 percents. The processing of a forage by electropolarized water also increase overweight of the calves and intensity of growth (K.K.Karabaev, K.Gulyamkadirov and others, 1996) at the expense of the best digestion of a forage.

Application of three vitamines (K.I.Tashev 1991), fractions of cotton wastes (U.R.Rajabov and others, 1990; Z.M.Ashurov etc., 1996), pupas of silkworm as the fodder components (S.G.Azimov etc., 1996) notably increased productive properties both cattle and poultry, the increase of vitality and improvement of genesial properties is in particular traced.

The searches of scientific in the field of increase of productivity of fattening of silkworm were conducted basically in a sphere of application of materials of a chemical origin as the fodder components.

On the first research stages the possibilities of using of micro substances were studied (F.N.Mamedova, 1970; B.A.Parpiev, M.G.Holmatova, 1990). The big attention paid to analysis of organic silicon compounds in business of enrichment of a forage of the caterpillars (U.N.Nasirillaev, V.M.Dyakov, B.A.Parpiev, B.T.Azizov, 1986; S.T. Jivetina, A.A.Jivetin, G.Ya.Lamm, 1986). The good effect is received (A.Abdurahimov, B.A.Parpiev, T.Hafizov, 1985) at application of biostimulants of an organic origin (H.Abdurahimov, U.K.Ahmedov, B.A.Parpiev, 1981), biologically active materials synthesized from leaves of a cotton (B.Nasirillaev, U.K.Nadjimov etc., 1993).

Analyzing the works of the forerunners in a part of enrichment of a forage it is necessary to note, that the experience mainly were conducted in vernal more favorable weather conditions for silkworm vegetation. Surely, here it is necessary to mention also that drugs, proposed by the authors are expensive, therefore their mass usage results in to strong increase of the cost price of cocoons.

As against researches of the authors cited by us and other writers, the primary task of our experiments was the survey of cheap and accessible sources for enrichment of fodder leaves of mulberry in a less favorable summer season of silkworm feeding, with the purpose of breeding of tribal cocoons suitable for preparing of an industrial hybrid grain.

Brief methodic of experiments

Our researches are dedicated to integrated analysis of a capability of broad usage of azote, micro elements and antiseptic agents as the fodder component with the purpose of increase of productive and genesial property of silkworm cocoon in the summer-autumn season of fattening of the tribal caterpillars of silkworm cocoon. In the given article the outcomes of experiments demonstrating change of viability of a tribal stuff at the expense of enrichment of leaves of summer-autumn vegetation by a padding source of azote, micro elements and antiseptics are set up.

For researches the pure breeds Orzu, Asaka and Marhamat, selection lines, Line 9 and Line 10, and also elite hybrids Orzu x Asaka, Yulduz x Marhamat, Line 9 Asaka and Line 10 and Marhamat were taken.

Each treatment was formed 25-30 laying of a grain. Came out from ovums the caterpillars were parted into two equal parts. The first part of the caterpillars from III-age up to cocoon waving received leaves of mulberry, enriched by nitrogens and micro elements in a complex

with antiseptic drug - potassium permanganate, second part was fattened under the generally accepted conditions of silkworm feeding without no processing of leaves.

Outcomes of experiments and their discussion

The great importance in silk worm breeding has preservation of livestock of the caterpillars and their protection against illnesses as in vernal, and summer-autumn season of silkworm feeding. The bringing as much as possible livestock of the caterpillars before waving of cocoons, doubtlessly provides obtaining anticipated productivity of cocoons from unit of fattened caterpillars. Naturally, at a low vitality of the caterpillars the productivity of cocoons headily decreases, that is involved in the negative consequences at production of hybrid industrial grain.

As was said above, in hot conditions of Uzbekistan, in the summer-autumn season of silkworm feeding, the considerable loss of a moisture and nutrient matters in leaves of mulberry is watched. The deficit of a moisture and nutrient materials negatively has effected for growth and development of the caterpillars and in a development of such relevant signs as vitality and genesial properties of a tribal material.

In a tab. 1 the outcomes of the conducted researches are resulted, where the efficiency of complex application of azote and micro elements in combination with antiseptic drugs in maintenance of safety of the caterpillars and pupas is legibly traced.

Table 1. Influence of enrichment of leaves of mulberry and their antiseptic refinement (experience) in the summer-autumn season of silkworm feeding to vitality of the caterpillars of silkworm

Name of breeds and hybrids	Caterpillars vitality, %			
	Experience	Control	Concerning control, %	Veracity of a difference between versions, P_d
Pure breeds				
Orzu	79,6 ± 2,5	71,6 ± 2,6	111,2	0,999
Yulduz	79,5 ± 3,1	71,2 ± 4,2	116,6	0,992
Asaka	80,2 ± 4,1	72,6 ± 3,8	110,5	0,999
Marhamat	81,8 ± 3,4	74,8 ± 4,6	109,3	0,993
Average	80,3	72,5	110,7	
Selection lines				
9 line	83,1 ± 3,5	76,1 ± 4,3	1019,2	0,996
10 line	81,9 ± 2,0	75,1 ± 0,7	109,0	0,996
Average	82,5	75,6	109,1	
Elite hybrids				
Orzu x Asaka	87,1 ± 1,8	81,7 ± 2,1	106,6	0,945
Yulduz x Marhamat	86,0 ± 1,7	75,9 ± 3,3	113,3	0,997
9 line x Asaka	87,2 ± 2,6	80,3 ± 2,1	108,5	0,999
10 line x Marhamat	86,3 ± 1,6	80,4 ± 2,5	107,3	0.996
Average	86,6	79,6	108,8	

As it visible from the results of conducted summer-autumn fattening of the caterpillars of 4 breed, 2 lines and 4 elite hybrids in experiment version high enough parameters of vitality on

compare with parameters of control version conducted without application of the fodder components.

In less favorable conditions of summer feeding the viability of elite hybrids has appeared much above, than of pure breeds and lines of silkworm cocoons. It means, that the hybrid caterpillars are stable against unfavorable conditions of fattening in the hot season of summer.

The vitality of perspective and zoned breeds at a customary method of a feeding on the average made 72,5 percents, whereas this parameter was equal to 80,3 percents in experience version. Positive dynamics of viability was watched also on lines 9 and 10 (75,6 % against 82,5 %).

The enrichment of silkworm leave by azote and micro elements with application of antiseptic agents has increased viability of elite hybrids up to 86,0-87,2%, i.e. the outcomes close to parameters of vernal season of tribal fattening of the caterpillars of silkworm cocoons are reached.

Excessively high level of temperature in combination to under parameters of eat up and assimilability of summer leaves, as a rule results to increase of the content of ill caterpillars. Elevation of a forage and its refinement in pink manganese solution from pathogenic microbes promoted the best safety of the caterpillars, that confirms by a difference in viability between experimental and control versions at pure breeds 10,7 %, at selection lines 9,1 %, and at tribal hybrids 8,8 %.

The evidence of favorable influencing of new technology of tribal fattening can be outcomes of the analyses of pupas of the obtained cocoons (tab. 2). As a result of a feeding of the caterpillars by mulberry leaves, enriched by azote and micro elements in combination with processing of a leaf by antiseptic agents reduction of a number of ill pupas at breeds Orzu, Yulduz, Asaka and Marhamat have taken place notably.

Table 2. Contents of ill pupas in cocoons in experimental and control versions of a feeding of the caterpillars

Name of breeds and hybrids	Percent of ill pupas		
	In experience	In control	Referring experimental version, %
Pure breeds			
Orzu	7,2 ± 1,1	13,6 ± 2,1	188,8
Yulduz	5,9 ± 1,1	10,4 ± 1,7	176,2
Asaka	3,5 ± 0,3	6,2 ± 0,7	177,1
Marhamat	3,8 ± 0,9	7,7 ± 1,3	202,6
Average	5,1 ± 0,8	9,5 ± 1,2	186,2
Elite hybrids			
Orzu x Asaka	3,6 ± 0,8	4,6 ± 0,5	127,1
Yulduz x Marhamat	2,4 ± 0,8	12,9 ± 3,9	537,5
Average	3,0 ± 0,6	8,7 ± 2,8	290,0

The data of tab. 2 with all evidence demonstrate that fact, that the new technology of repeated tribal fattening, founded on enrichment and elevation of less nutrient leaves of mulberry of summer vegetation, provides essential increase of vitality of pupas. The share of ill pupas in a prototype version has made on pure breeds 5,1 %, on elite hybrids (components of zoned hybrids Uzbekistan 5 and Uzbekistan 6) 3,0 %. The tribal cocoons, received in control version contained ill pupas in 1,8-3 times more, than in an experimental version.

Conclusion

Summarizing set up it is possible to conclude, that designed within the framework of complex researches on increase of efficiency of repeated fattening the new technology of breeding of tribal cocoons decides a main problem of production of a grain in the summer-autumn season – receiving of high viable and qualitative cocoons suitable for curl.

A main distinctive feature of new technology is the maintenance of safety of the caterpillars and pupas at the expense of processing of leaves by the fodder components and antiseptic.
The actual capability of breeding of tribal cocoons suitable for preparing of an industrial hybrid grain in the hot season of summer and autumn and by that to promote to a solution of a problem of more full maintenance of need of a branch in a grain is demonstrated.

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2.2. Silkworm genetics and breeding

Evaluation of single and complex silkworm *Bombyx Mori* L. Hybrids based on silk productivity

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Abstract: ***Raw silk productivity per day of Vth instar and its heterosis in F$_1$ was studied in 18 straight and reciprocal industrial crosses, incl. eight single, eight three-way and two four way hybrids, created from original parent lines, incl. AC and Vratza$_{35}$ from Japanese type and TV and Mereffa$_2$ from Chinese type. Tested F$_1$ hybrids were characterized with comparatively high silk productivity per day of Vth instar. AC × Mereffa$_2$ single hybrid, AC × (TV × Mereffa$_2$) three-way hybrid and (AC × Vratza$_{35}$) x (TV × Mereffa$_2$) four way hybrid had the highest value of this trait, (3.20 – 3.29 cg), (3.26 – 3.28 cg) and (3.23 – 3.29 cg), respectively and exceeded the control Super$_1$ x Hessa$_2$ hybrid with 13.88 – 17.08 %.***
It was determined that majority of the hybrids demonstrated comparatively high heterosis vigour over MP within the limits of 11.74 – 25.98 % and over BP within 8.31 – 23.68 %.

Key words: silkworm, lines, hybrids, silk productivity, cocoon shell weight.

Introduction

Hybrid composition in silkworm *Bombyx mori* L. is one of the main factors for intensification of cocoon and raw silk production. At the same moment not always high fresh cocoon productivity correspondents to high raw silk productivity (Rajhavendra Rao et al., 2004).

Since silk is the ultimate product required for commercial purpose in textile industry many scientists have paid special attention on methods for evaluation of silkworm hybrids based on silk productivity (Udupa and Gowda, 1988; Singh et al., 1994; Bhargava et al., 1996; Ramesh Babu et al., 2001; Rajhavendra Rao et al., 2004).

The aim of the present study was to evaluate some different kind silkworm hybrids on the basis of silk productivity for identifying of the best ones for further use in sericulture.

Material and Methods

Experimental and theoretical work was done at the Sericulture Experiment Station, Vratza, Bulgaria during the summer rearing season.

Object of our experiment were four new original silkworm lines, incl. AC and Vratza$_{35}$ form Japanese type and TV and Mereffa$_2$ from Chinese type and 18 industrial F$_1$ crosses created with their participation, incl. eight single, eight three way hybrids and two tetra (four way)-hybrids.

All lines and hybrids were reared in 4 replications of 200 individuals, counted after second larvae moult.

Raw silk productivity per day was calculated through the formulae of Udupa and Gowda (1988):

Cocoon shell weight (cg) = $\frac{\text{Cocoon shell weight of 25 male + 25 female cocoon (cg)}}{50}$

ERR (%) = $\frac{\text{number of cocoons harvested}}{\text{number of larvae after second moult}} \times 100$

where: ERR – Effective rate of rearing percentage.

Silk productivity per day (cg) = $\frac{\text{ERR \%} \times \text{Cocoon shell weight (cg)}}{5^{th} \text{ instar larval duration (days)}}$

Midparent heterosis (MPH) and better parent heterosis (BPH) were calculated as per the formula of Bhargava et al. (1993):

$$\frac{F_1 - MPH}{MPH} x100 \qquad \frac{F_1 - BPH}{BPH} x100$$

Results and discussion

Compared data for Effective rate of rearing percentage (ERR%), cocoon shell weight, Vth instar larval period and silk productivity per day are presented in Table 1.

It is evident that effective rate of rearing, calculated as percentage of total number of cocoons harvested with alive pupa and number of counted larvae after second moult varied in wide limits, from 90.34 to 92.37 % for initial lines and from 94.24 to 97.50 % for F_1 hybrids.

From all initial lines comparatively the highest ERR percentage was obtained in AC × $Vratza_{35}$ (92.37 %), TV (92.26 %) and AC (92.11 %), and the lowest one in $Mereffa_2$ and $Vratza_{35}$, 90.34 % and 91.91 %, respectively.

In average for straight and reciprocal crosses of tested F_1 hybrids AC × TV, (AC × $Vratza_{35}$) × TV and (AC × $Vratza_{35}$) × (TV × $Mereffa_2$) were distinguished with the highest ERR percentage, 96.74 %, 96.44 % and 96.55 % compared to 93.69 % for control single $Super_1$ x $Hessa_2$ hybrid.

In respect to cocoon shell weight, which characterizes the absolute content of silk in cocoons and has a big contribution for raw silk productivity set up AC × $Vratza_{35}$, $Vratza_{35}$, TV × $Mereffa_2$ and AC had the highest values, namely 25.39 cg, 25.11 cg, 23.90 cg and 23.20 cg, respectively and TV had the lowest cocoon shell weight - 21.05 cg.

It was determined that (AC × $Vratza_{35}$) × $Mereffa_2$, AC × (TV × $Mereffa_2$), (AC × $Vratza_{35}$) × (TV × $Mereffa_2$) hybrids and their reciprocal crosses had the highest cocoon shell weight, 27.39 – 27.70 cg, 27.65 – 27.71 cg and 27.25 – 27.62 cg, respectively and exceeded he control Super1 x $Hessa_2$ hybrid with 12.14 – 14.03 %. We explain the comparatively low values of the shell weights with the unfavourable environmental conditions during the summer season in Bulgaria, such as high temperature (27-28 ^{o} C), high humidity (80 %) and lower nutritive content of the mulberry leaves.

One of the main and at the same time the most complicated trait for prognostication of silkworm *Bombyx mori* L. productivity is the silk productivity per day. It is in functional dependence on other silkworm characters (silkworm viability, Vth larval instar duration, cocoon shell weight). Therefore silk productivity per day of Vth instar is an integral quantitative character for combining and integrating of already discussed characters, which are formed its essence. In this aspect AC × $Vratza_{35}$, $Vratza_{35}$ and TV × $Mereffa_2$ were distinguished with the highest silk productivity per day, 2.90 cg, 2.88 cg and 2.73 cg, respectively.

The highest productivity per day was obtained in AC × $Mereffa_2$ single hybrid and its reciprocal cross (3.20 – 3.29 cg), followed by AC × (TV × $Mereffa_2$) three-way hybrid (3.26 – 3.28 cg) and (AC × $Vratza_{35}$) × (TV × $Mereffa_2$) tetra-hybrid (3.23 – 3.29 cg), which exceeded the control $Super_1$ × $Hessa_2$ hybrid with 13.88 – 17.08 %.

From the data in Table 2 is evident that heterosis in F_1 concerning silk productivity per day trait over MP value varied from 11.74 to 25.98 %, and over BP value from 8.31 to 23.68 %, respectively.

In our opinion the heterosis manifestation in tested F_1 single and complex hybrids concerning silk productivity was due to over dominant inheritance with contribution of the better parent (Petkov et al., 2004).

Conclusions

Tested single and complex (three-way and four way) silkworm hybrids were characterized with comparatively high silk productivity

AC × $Mereffa_2$ hybrid and its reciprocal cross had the highest productivity per day (3.20 – 3.29 cg), followed by AC × (TV × $Mereffa_2$), 3.26 – 3.28 cg. and (AC × $Vratza_{35}$) × (TV × $Mereffa_2$), 3.23 – 3.29 cg, which exceeded the control $Super_1$ x $Hessa_2$ with 13.88 – 17.08 %. The majority of tested hybrids were distinguished with high heterosis in F_1 over MP value (11.74 to 25.98 %) and 8.31 to 23.68 %, respectively over BP value.

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Table 1. Productivity of silk in parent's lines and their hybrids

Lines and hybrids	ERR %	Cocoon shell weight cg	5^{th} instar larval period days	Silk productivity per day cg
AC	92.11	23.20	8.03	2.66
$Vratza_{35}$	91.91	25.11	8.01	2.88
$Super_1$	92.07	22.62	8.07	2.58
TV	92.26	21.05	8.02	2.42
$Mereffa_2$	90.34	23.03	8.04	2.59
$Hessa_2$	92.04	22.55	8.13	2.55
AC × $Vratza_{35}$	92.37	25.39	8.09	2.90
TV × $Mereffa_2$	92.08	23.90	8.05	2.73
AC × TV	95.98	26.85	8.08	3.19
TV × AC	97.50	26.40	8.05	3.20
AC × $Merefa_2$	96.83	27.40	8.07	3.29
$Mereffa_2$ × AC	95.78	27.01	8.09	3.20
$Vratza_{35}$ × TV	95.46	27.31	8.05	3.24
TV × Vratza35	96.49	26.35	8.07	3.15
$Vratza_{35}$ × $Mereffa_2$	96.36	27.20	8.05	3.26
$Merefa_2$ × $Vratza_{35}$	94.24	26.65	8.04	3.12
(AC × $Vratza_{35}$) × TV	95.78	26.95	8.14	3.17
TV × (AC × $Vratza_{35}$)	97.09	26.65	8.09	3.20
(AC × $Vratza_{35}$) × $Merefa_2$	95.58	27.70	8.13	3.26
$Mereffa_2$ × (AC × $Vratza_{35}$)	94.88	27.39	8.10	3.21
AC × (TV × $Merefa_2$)	96.07	27.65	8.11	3.28
(TV × $Merefa_2$) × AC	95.04	27.71	8.09	3.26
$Vratza_{35}$ × (TV × $Merefa_2$)	95.21	27.60	8.11	3.24
(TV × $Mereffa_2$) × $Vratza_{35}$	95.25	26.80	8.08	3.16
(AC × $Vratza_{35}$) × (TV × $Mereffa_2$)	96.95	27.62	8.13	3.29
(TV × $Mereffa_2$) × (AC × $Vratza_{35}$)	96.14	27.25	8.10	3.23
$Super_1$ × $Hessa_2$	93.69	24.30	8.11	2.81

Table 2. Manifestation of heterosis for silk productivity character

Hybrids	F_1 value	Mid parent value	Better parent value	Heterosis over	
				MPH %	BPH %
AC × TV	3.19	2.540	2.660	25.59	19.92
TV × AC	3.20	2.540	2.660	25.98	20.30
AC × $Merefa_2$	3.29	2.625	2.660	25.33	23.68
$Mereffa_2$ × AC	3.20	2.625	2.660	21.90	20.30
$Vratza_{35}$ × TV	3.24	2.650	2.880	22.26	12.50
TV x $Vratza_{35}$	3.15	2.650	2.880	18.87	9.38
$Vratza_{35}$ x $Mereffa_2$	3.26	2.735	2.880	19.20	13.19
$Mereffa_2$ × $Vratza_{35}$	3.12	2.735	2.880	14.08	8.33
(AC × $Vratza_{35}$) × TV	3.17	2.660	2.900	19.17	9.31
TV × (AC × $Vratza_{35}$)	3.20	2.660	2.900	20.30	10.34
(AC × $Vratza_{35}$) × $Mereffa_2$	3.26	2.745	2.900	18.76	12.41
$Mereffa_2$ × (AC × $Vratza_{35}$)	3.21	2.745	2.900	16.94	10.69
AC × (TV × Merefa2)	3.28	2.695	2.730	21.71	20.15
(TV x $Mereffa_2$) x AC	3.26	2.695	2.730	20.96	19.41
$Vratza_{35}$ × (TV × $Mereffa_2$)	3.24	2.805	2.880	15.51	12.50
(TV × $Mereffa_2$) × $Vratza_{35}$	3.16	2.805	2.880	12.66	9.72
(AC × $Vratza_{35}$) x (TV × $Mereffa_2$)	3.29	2.815	2.900	16.87	13.45
(TV × $Mereffa_2$) × (AC × $Vratza_{35}$)	3.23	2.815	2.900	11.74	11.38
$Super_1$ × $Hessa_2$ (Control)	2.81	2.565	2.580	9.55	8.91

Study on main productive characters of some silkworm *Bombyx Mori* L. Romanian hybrids tested in Bulgaria

By

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Abstract: ***Six Romanian F_1 hybrids were evaluated at the Sericulture Experiment Station– Vratza, Bulgaria. It was determined that AB × AC was especially perspective hybrid for rearing in Bulgarian conditions because of its characteristics, eggs hatchability (99.23 - 99.28 %), pupation ratio (94.67 - 95.20 %), larval period duration (678 - 700 h), fresh cocoon weight (2359 - 2401 mg), shell weight (489 - 515 mg), filament length (1277 - 1285 m), filament weight (401 - 404 mg), filament thickness (2.80 - 2.85 denier), reelability of cocoons (90.95 - 91.06 %), raw silk ratio (41.97 - 42.05 %) and cocoon yield per one box of silkworm (44.120 - 45.053 kg), respectively.***

During the period of 2006 - 2007 the hybrid will be included in governmental industrial examination in connection to its recognizing as original and introducing into practice in the future.

Key words: hybrids, silkworm, *Bombyx mori* L., cocoon weight, filament weight, cocoon yield

Introduction

Private farms are the main form of organization of sericulture in free market conditions and used silkworm hybrids are one of the most essential elements of technology for intensification of cocoon production. In this aspect the problem of general and adaptive merits of used silkworm hybrids improving in connection to their productivity and ecological plasticity increasing has arisen markedly. According to many scientists during the last 10-15 years studies on selection of F_1 silkworm hybrids, having a high heterozis expression have been accelerated to such a degree, that in developed sericultural countries almost all cocoon production is based on industrial manner of organization (Osawa and Harada, 1994; Petkov, 1995; Bharagava et al., 1996; Datta et al., 2000). The aim of the present study was to evaluate some Romanian F_1 silkworm hybrids for cocoon production in Bulgaria.

Material and Methods

The experimental and theoretical work was done at the Sericulture Experiment Station in Vratza, Bulgaria.

The object of our experiment were six Romanian industrial F_1 hybrids (straight and reciprocal crosses).

Individuals from original Bulgarian hybrid $Super_1 \times Hessa_2$, introduced in a mass into practice were used as control

All hybrids were reared in four replications with 200 larvae, counted after second moult.
Data obtained for the biological characters of larvae and technological characters of cocoons and silk filament were statistically analyzed thought dispersion's analysis (Lidanski, 1988).

Results and discussion

Compared data for main silkworm biological characters which characterize the productive potential of tested Romanian hybrids are presented in Table 1.

It is evident that all Romanian hybrids demonstrate comparatively high eggs hatchability (97.69 - 99.33 %).

The highest values of this character were recorded in AC × AB hybrid (99.23 – 99.28 %), which exceeded the Bulgarian $Super_1 \times Hessa_2$ standard with 1.35 – 1.40 points.

Silkworm pupation ratio, determined as relation of number of cocoons with living pupa toward individuals counted after second moult was also comparatively high 94.40 - 96.00 %. In average for straight and reciprocal crosses the highest values of this character were marked in $B_1 \times B_{75}$ hybrid, which exceeded statistically the control with 0.80 - 1.87 points.

There were not considerable differences between tested Romanian hybrids and Bulgarian control in connection to larval period duration except for straight cross of AB × AC hybrid.

Fresh cocoon yield from one box of silkworm eggs (20 000 ± 200 viable eggs) was comparatively high (40.107 - 43.253 kg) compared to 43.040 kg for $Super_1 \times Hessa_2$ standard.

In our opinion the lower value of this general economical character in tested Romanian hybrids in Bulgarian condition was due to lower values of cocoon weight character. Nevertheless, AB × AC hybrid represents a definite interest because of its cocoon yield (41.120 – 43.253 kg).

Compared data for cocoon weight and shell ratio are presented in Table 2.

Majority of tested Romanian hybrids were characterized with comparatively high cocoon weight (2101 – 2268 mg) compared to 2264 mg for the control. Notwithstanding, all tested hybrids yielded to $Super_1 \times Hessa_2$ hybrid with 78 - 163 mg, except for AC × AB cross.

In regard to shell weight, character with pointed contribution for raw silk productivity set up, the values observed were comparatively high (433 – 459 mg).

AC × J_{90} Romanian hybrid had the highest shell weight (455 - 459 mg), compared to 454 mg for Bulgarian $Super_1 \times Hessa_2$ standard.

All tested Romanian hybrids were distinguished with 0.18 - 1.34 higher shell ratio compared to control.

Data for average values of most important filament technological characters are shown in Table 3.

It is evident that majority of Romanian hybrids were characterized with comparatively long and thin filament, 1249 - 1285 m and 2.71 - 2.85 denier, respectively in comparison to 1278 m and 2.81 denier for $Super_1$ x $Hessa_2$ control.
Further most of the Romanian hybrids demonstrated high values of filament weight (383 - 404 mg), good reelability of cocoons (90.57 - 92.04 %) and raw silk ratio (41.97 - 42.76 %).

Conclusions

Romanian AB × AC hybrid is especially perspective hybrid for rearing in Bulgarian conditions because of its behavior and value of main economical characters, eggs hatchability (99.23 - 99.28 %), pupation ratio (94.67 - 95.20 %), larval period duration (678 – 700 h), fresh cocoon weight (2359 - 2401 mg), shell weight (489 - 515 mg), filament length (1277 - 1285 m), filament weight (401 - 404 mg), filament thickness (2.80 - 2.85 denier), reelability of cocoons (90.95 - 91.06 %), raw silk ratio (41.97 - 42.05 %) and cocoon yield per one box of silkworm eggs (44.120 - 45.053 kg), respectively.

During the period of 2006 - 2007 the hybrid may be included in governmental industrial testing in connection to its recognizing as original and introducing into practice.

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Table 1. Silkworm biological characters

Hybrids	Eggs hatchability %		Pupation ratio %		Larval period h		Fresh cocoon yield per 1 box kg	
	$\bar{x}$	± D	$\bar{x}$	± D	$\bar{x}$	± D	$\bar{x}$	± D
$B_1 \times B_{75}$	98.58	+ 0.70	96.00	+ 1.87	671	- 5	43.133	- 0.815
$B_{75} \times B_1$	98.97	+ 1.09	94.93	+ 0.80	673	- 3	43.407	- 0.541
AB × AC	99.28	+ 1.40	94.67	+ 0.54	700	+ 24	44.120	+ 0.172
AC × AB	99.23	+ 1.35	95.20	+ 1.07	678	+ 2	45.053	+ 1.105
AC × J_{90}	97.69	- 0.19	95.47	+ 1.34	670	- 6	43.227	- 0.721
J_{90} × AC	99.33	+ 1.45	94.40	+ 0.27	674	- 2	43.707	- 0.241
$Super_1 \times Hessa_2$	97.88	-	94.13	-	676		43.948	-
GD at P 5 %	0.49		0.59		6.06		0.328	
P 1 %	0.75		0.88		9.03		0.497	
P 0.1 %	1.21		1.42		14.87		0.799	

Table 2. Fresh cocoon weight and shell ratio

Hybrids	Fresh cocoon weight mg		Shell weight mg		Shell ratio %	
	$\bar{x}$	± D	$\bar{x}$	± D	$\bar{x}$	± D
$B_1 \times B_{75}$	2301	- 87	477	- 27	20.73	- 0.38
$B_{75} \times B_1$	2322	- 66	479	- 25	20.63	- 0.48
AB × AC	2359	- 29	489	- 15	20.73	- 0.38
AC × AB	2401	+ 13	515	+ 11	21.45	+ 0.34
AC × J_{90}	2339	- 49	507	+ 3	21.68	+ 0.57
J_{90} × AC	2362	- 26	511	+ 7	21.63	+ 0.52
$Super_1 \times Hessa_2$	2388	-	504	-	21.11	-
GD at P 5 %	42		13		0.42	
P 1 %	56		18		0.57	
P 0.1 %	74		25		0.72	

Table 3. Silk filament technological characters

Hybrids	Filament length m		Eggs hatchability %		Pupation ratio %		Larval period duration h		Cocoon yield per 1 box of silkworms, kg	
	$\bar{x}$	± D	$\bar{x}$	± D	$\bar{x}$	± D	$\bar{x}$	± D	$\bar{x}$	± D
$B_1 \times B_{75}$	1271	-7	383	-16	2.71	-0.10	92.03	+1.02	42.76	+0.59
$B_{75} \times B_1$	1281	+3	394	-5	2.77	-0.04	90.57	-0.44	42.46	+0.29
AB × AC	1285	+7	401	+2	2.80	-0.01	90.95	-0.06	41.97	-0.20
AC × AB	1277	-1	404	+5	2.85	+0.04	91.06	+0.05	42.05	-0.12
AC × J_{90}	1270	-8	391	-8	2.77	-0.04	92.04	+1.03	42.66	+0.49
$J_{90} \times$ AC	1249	-29	387	-12	2.79	-0.02	90.87	-0.14	42.01	-0.16
$Super_1 \times Hessa_2$	1278	-	399	-	2.81	-	91.01	-	42.17	-
GD at P 5 %	47		11		0.05		0.47		0.42	
P 1 %	63		15		0.07		0.72		0.67	
P 0.1 %	83		21		0.10		1.16		0.75	

Study on influence of some genetic and non-genetic factors on variability of main productive characters in genetically sex-limited silkworm *Bombyx Mori* L. lines

By

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Abstract*: Influence of some genetic and non genetic factors on variability of main quantitative selection characters in five new created genetically sex-limited at larval stage silkworm lines was analyzed.*

It was determined that environmental factor did not significantly influence on variability of main productive characters in pure lines and in hybrid forms, created with their participation.

The influence of "line", "mother form" and "father form" genetic factors on variability of tested selection characters gives us enough preconditions for detailed analysis of crossbreed effects. Equivalence of recorded genetic effects in mother and father forms could be examined as main reason for evaluation of combine ability at planned diallel experiment.

Key words: silkworm, genetic factors, non genetic factors, variability

Introduction

Determination of influence of genetic and non genetic factors on variability of main quantitative selection characters, which set up productivity of cocoon and raw silk in pure lines and races and in hybrid forms, created with their participation has a great importance in silkworm genetics and selection (Petkov, 1995).

In this aspect crossbreed effects values give information for gene action, which controlled separate quantitative character and afford an opportunity for prognostication of hybrid productivity (Jeong, W., 1990; Abbasov, 1993; Petkov, 1995; Legay, J., 2000).

The aim of the present study was to determine the influence of genetic and non genetic factors on variability of main quantitative selection characters in newly created genetically sex – limited for larval markings silkworm hybrid forms.

Material and Methods

Experimental and theoretical work was done at the Sericulture Experiment Station, Vratza, Bulgaria.

Object of our experiment were five newly selected sex-limited silkworm lines ($B_{2/6}$, $BTV_{2/64}$, $TBV_{2/24}$, $XB_{2/22}$ and $TV_{3/2}$).

All lines as well as their hybrids were reared in the spring season by standard techniques (Petkov and Penkov, 1980) in four replications with 200 silkworm larvae each in equal part for two sexes, counted after the second moult.

The main silkworm characters – eggs hatchability, pupation ratio, larval period duration, fresh cocoon weight, shell weight, shell ratio, filament length and cocoon yield per one standard box of silkworms (20 000 ± 200 viable eggs) were analyzed.

Main statistical parameters Mean, S.D., and C.V. were determined through poly-factor dispersion's analysis (Hinkovski, 1975). Used linear dispersion method has the following analytic description:

$$Y_{ijklm} = g_i + l_j + s_k + d_i + e_{ijklm}$$

where: y_{ijklm} - vector of observations for tested characters;

g_i - year's effect (fixed), i = 1..5 for pure lines and i = 1..4 for hybrid combinations;

l_j - line's effect (fixed), j = 1..6;

s_k - father's effect in hybrid combinations (fixed), κ = 1..6;

d_i - mother's effect in hybrid combinations (fixed), i = 1..6;

e_{ijklm} - effect of residual variation NID ~ (0, I σ^2_e).

/normal distribution with mean = 0 and error's dispersion = 1.

All calculations were done with LSMLWM & MIXMDL software, (Harvey, 1990).

Results and discussion

Compared data for influence of "line" and "year" factors on variability of pure lines main productive characters are presented in Table 1.

It is evident that "line" factor effect determines to a great extent variability of tested characters. "Line" factor influenced significantly on all tested characters, except for shell ratio. In our opinion insignificant differences in average values of shell ratio in pure lines are due to that it is synthetic character, and there is a relation of shell weight with cocoon weight. In opposite of this tendency differences in influence of "year of experiment" factor were significant only in the silkworm pupation ratio, larval period duration, fresh cocoon weight and yield of cocoons per one box of eggs.

Used linear dispassion's models for poly-factor analysis of silkworm quantitative characters were comparatively well adequate and coefficient of determination (R^2) varied from 54.13% for filament length to 75.53% for fresh cocoon weight characters. The lowest R^2 was obtained at shell ratio character - 24.49 %.

Hybrid forms characters were distinguished from pure line's ones only by their genetic part (Table 2). "Line" factor which appears as basic one for variability of controlled characters in pure lines, in hybrid forms, created with their participation was conditionally divided between their parent lines. This division has its own meaning mainly because of purposes of the study on evaluation of some crossbreed parameters.

In analogy with pure lines "mother line" and "father line" factors had significant influence on all tested hybrid forms, except for shell ratio character.

"Year of investigation" factor as non genetic (environmental) did not influence on variability of tested characters. This was due to a great extent of traditional and conservation breeding and strictly observing of silkworm rearing technology.

In contrast to influence of different factors in pure lines, in hybrid forms with their participation this influence had relatively lower level of adequacy and coefficients of determination varied from 24.69% for shell ratio to 43.44% for fresh cocoon weight character.

This could be explained first at all with uniformity of genetic effects of "mother line" and "father line" which despite its conventionality burden the analysis model.

Results from statistical analysis of influence of separate classes of registered factors on tested characters are shown in Table 3. Values of linear contrasts of particular mean toward general character value were determined.

$BTV_{2/64}$ and $TBV_{2/24}$ lines had the highest influence and proved differences were obtained at 7 of tested characters.

Influence of separate lines on variability of eggs hatchability, silkworm pupation ratio, larval period duration, fresh cocoon weight and shell weight was relatively higher. Only shell ratio character was not influenced during the period of investigation. In our opinion this could be explained with conservatism of this character toward influence of endogenous and ekzogenous environment conditions for silkworm rearing.

Data for influence of separate years on variability of tested characters are presented in Table 4. It is evident that result has followed logically tendency for proved effect of years in general variability analysis (F – statistic), presented in Table 1. In this aspect 2002 and 2003 had comparatively higher influence compared to 2004 on character variability and significant differences were obtained in the fresh cocoon weight, shell weight and cocoon yield per 1 box of silkworms. Larval period duration, fresh cocoon weight, shell weight and cocoon yield were the most variable characters during the period of investigation while eggs hatchability, shell ratio and filament length had higher indifference toward separate years influence.

Influence of "mother line" on tested characters in hybrid forms (Table 5) was significant in $TBV_{2/24}$ while in $BTV_{2/64}$ and $TV_{3/2}$ proved differences were obtained in 3 of 5 tested characters.

In $TBV2_{/24}$ "father line" effect had significant influence on all tested characters while in $BTV_{2/64}$ line effects only on cocoon yield character and in $XB2_{/22}$ and $TV_{3/2}$ lines only fresh cocoon and shell weight characters (Table 6).

Information for influence of separate classes on "year" factor effect on variability of tested characters is shown in Table 7. It is evident that from genetic factors only "year" factor does not influence significantly on variability of tested silkworm characters.

Conclusions

"Year of investigation" environmental factor had not influenced significantly on variability of main productive characters in pure lines and in hybrid forms created with their participations.

The influence of "line", "mother line" and "father line" genetic factors on variability of tested quantitative selection characters gives us enough preconditions for detailed analysis of crossbreed effects. Equivalence of recorded genetic effects in "mother line" and "father line" could be examined as main reason for evaluation of combining ability at planned diallel experiment.

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Table 1. Influence of "line" and "year" factors on variability of tested characters

Characters	Lines		Years		R^2 (%)
	n	F–statistic	n	F–statistic	
Eggs hatchability, %	5	5.32 ***	3	1.28	62.91
Pupation ratio, %	5	18.21 ***	3	2.36 *	70.81
Larval duration, h	5	2.02 *	3	7.88 **	56.97
Fresh cocoon weight, mg	5	8.12 **	3	2.06 *	75.53
Shell weight, mg	5	5.31 **	3	1.11	66.22
Shell ratio, %	5	0.24	3	1.41	24.49
Filament length, m	5	4.31 **	3	0.11	54.13
Fresh cocoon yield per 1 box of silkworms, kg	5	12.39 ***	3	4.84 **	65.39

(F – statistic, *** P < 0.001; ** P < 0.01; * P < 0.05)

Table 2. Influence of "parents" and "year" factors on variability of productive characters in tested hybrid forms

Characters	Mothers		Fathers		Years		R^2 (%)
	n	F–statistic	n	F–statistic	n	F–statistic	
Fresh cocoon weight, mg	5	15.09 ***	5	4.91 ***	3	0.14	43.44
Shell weight, mg	5	13.51 ***	5	3.15 **	3	0.41	35.89
Shell ratio, %	5	0.23	5	0.26	3	1.14	24.69
Filament length, m	5	5.76 ***	5	6.01 ***	3	0.08	30.93
Fresh cocoon yield per 1 box of silkworms, kg	5	13.16 ***	5	3.88 **	3	0.16	40.84

(F – statistic, *** P < 0.001; ** P < 0.01; * P < 0.05)

Table 3. Influence of different classes on line's effect at productive characters in tested pure lines

Line	Eggs hatchability %	Pupation ratio %	Larval duration h	Fresh cocoon weight mg	Shell weight mg	Shell ratio %	Filament length, m	Fresh cocoon yield per 1 box of silkworm eggs kg
LS average	98.28	93.86	688.2	2271.2	503.6	22.17	1296.6	41.904
$B_{2/6}$	98.01 *	94.01 *	682 *	2226 *	499 *	22.42	1276 *	41.02
$BTV_{2/64}$	97.96 *	94.13 *	691 *	2305 *	508 *	22.04	1309 *	42.51 *
$TBV_{2/24}$	98.33 *	94.17 *	683 *	2317 *	517 *	22.31	1311 *	42.91 *
$XB_{2/22}$	98.67 *	93.33 *	695 *	2209 *	488 *	22.09	1288	40.69 *
$TV_{3/2}$	98.41 *	93.67 *	690 *	2299 *	506 *	22.01	1299	42.39 *

(F statistic, * $P < 0.05$)

Table 4. Influence of different classes on year's effect at productive characters in pure lines

Years	Eggs hatchability %	Pupation ratio %	Larval duration h	Fresh cocoon weight mg	Shell weight mg	Shell ratio %	Filament length, m	Fresh cocoon yield per 1 box of silkworm eggs kg
LS average	98.28	93.86	688.2	2271.2	503.6	22.17	1296.6	41.904
2002	98.03	93.63	686	2255 *	491 *	21.71	1288	41.37 *
2003	98.64	94.27 *	692	2283 *	511 *	22.38	1306 *	42.45 *
2004	98.17	93.68	687	2276	509	22.36	1296	41.89

(F statistic, * $P < 0.05$)

Table 5. Influence of different classes on mother's effect at productive characters in hybrid forms

Mothers	Fresh cocoon weight mg	Shell weight mg	Shell ratio %	Filament length m	Fresh cocoon yield per 1 box of silkworm eggs kg
LS average	2341.00	521.2	22.26	1322.8	42.882
$B_{2/6}$	2276 *	513 *	22.54 *	1307 *	42.09
$BTV_{2/64}$	2377 *	529 *	22.25	1344 *	43.37
$TBV_{2/24}$	2399 *	539 *	22.47 *	1349 *	43.96 *
$XB_{2/22}$	2281 *	504 *	22.10	1301 *	41.81 *
$TV_{3/2}$	2372 *	521	21.96 *	1313	43.18 *

(F statistics, * $P < 0.05$)

Table 6. Influence of different classes on father's effect at productive characters in hybrid forms

Fathers	Fresh cocoon weight mg	Shell weight mg	Shell ratio %	Filament length m	Fresh cocoon yield per 1 box of silkworm eggs kg
LS average	2341.00	521.2	22.26	1322.8	42.882
$B_{2/6}$	2265 *	508 *	22.43	1309 *	41.99 *
$BTV_{2/64}$	2345	528	22.52	1338	43.21 *
$TBV_{2/24}$	2462 *	537 *	21.81 *	1341 *	43.78 *
$XB_{2/22}$	2254 *	501 *	22.23	1295	42.41
$TV_{3/2}$	2379 *	532 *	22.36	1327	43.02

(F statistics * $P < 0.05$)

Table 7. Influence of different classes on year's effect at productive characters in hybrid forms

Years	Fresh cocoon weight mg	Shell weight mg	Shell ratio %	Filament length, m	Fresh cocoon yield per 1 box of silkworm eggs kg
LS average	2341.00	521.2	22.26	1322.8	42.882
2002	2282	507	22.22	1308	42.043
2003	2342	526	22.46	1327	43.247
2004	2399	531	22.13	1333	43.356

(F statistics * $P < 0.05$)

Study on inheritance and transgressions of some productive characters in silkworm *Bombyx mori* L. Hybrid forms with participation of genetically sex-limited lines

By

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Abstract: ***Inheritance in F_1 as well as degree and frequency of positive transgressions in F_2 for some productive characters in Bombyx mori L. hybrid forms with participation of genetically sex-limited lines were studied. Over dominance (d/a > 1) with contribution of a parent with higher value of certain character was determined for inheritance of cocoon and shell weight characters.***

Positive transgressions for cocoon and shell weight in F_2 hybrid forms created with participation of genetically sex-limited for larval markings lines vary in wide limits. Variability of genetic parameters, which characterize the degree and frequency of transgressions depended on different levels of parental line productivity. Combination of positive transgressions for cocoon weight and shell weight in F_2 allows selecting silkworm individuals as ancestors of future lines with higher productive potential.

Key words: silkworm, *Bombyx mori* L., inheritance, sex-limited lines, transgression.

Introduction

Studies on inheritance and positive transgressions in the characters, which determine the productivity of cocoons and raw silk represents a big interest for increasing efficiency of silkworm *Bombyx mori* L. selection programs (Petkov and Long, 1987; Petkov, 1995; Petkov et al., 1999).

There is limited data on manifestation of transgressions in the most important quantitative selection characters in hybrid generations with participation of sex-limited lines in specialized literature.

The aim of the present study was to determine the inheritance in F_1 and degree and frequencies of transgressions in F_2 for some of the main productive characters in *Bombyx mori* L. hybrid forms with participation of genetically sex-limited at larval stage lines in connection to selection of individuals with high productive potential.

Material and methods

Experimental and theoretical work was done at the Sericulture Experiment Station, Vratza, Bulgaria.

All tested hybrids were reared during the spring season by standard techniques of Petkov and Penkov (1980).

$Vratza_{2003}$ and $Vratza_{2007}$ from Japanese type and $Vratza_{2002}$, $Vratza_{2006}$ and $Vratza_{2012}$ from Chinese type were used for creation of new populations.

Inheritance of cocoon weight and shell weight characters were studied in six straight and reciprocal hybrid combinations.

Character inheritance in F_1 was determined through genetic parameters additiveness (a), dominance (d) and their ratio (d/a) according to Mather and Jinks (1949).
Degree and frequency of transgressions in F_2 hybrid forms were determined according to Petkov (1995):

$$D_t = \frac{\bar{x}_{\max} F_2}{\bar{x}_{\max} HP} 100(\%)$$

where: D_t - degree of transgression;

$\bar{x}_{\max} F_2$ - maximal value of character in average of the best 3 individuals in F_2;

$\bar{x}_{\max} HP$ - maximal value of character in average of the best 3 individuals for the best parent (high parent - HP).

$$F_t = \frac{A}{B}$$

where: F_t - frequency of transgression;

A - number of hybrid individuals exceeded the best parent (in average of the best 3 individuals);

B - number of analyzed individuals from separate hybrid forms.

Results and discussion

Compared data of fresh cocoon weight and cocoon shell weight average population's values in parent (P_1 and P_2) and F_1 hybrid generations as well as the inheritance of these characters in F_1 are presented in Table 1.
It is evident that cocoon weight inheritance in all tested F_1 hybrids was due to over dominance, d/a = 1.47 - 12.88 with contribution of the parent with higher value (HP).
The results for shell weight inheritance were analogical (d/a = 1.09 - 12.43).
Our results were in full agreement with those of other authors, who have studied F_1 silkworm hybrids from not-sex-limited initial lines (Petkov, 1995; Petkov et al., 1999).
Manifestation of transgression in *Bombyx mori* L. is determined by the degree of expression of certain productive character in hybrid combination of the best parent and by number (frequency) of positive transgressed individuals in the populations (Petkov, 1995). Because of significant variability of cocoon and shell weight character values in female and male silkworm individuals, the degree and frequency of positive transgressions are presented individually for two sexes (Table 2).
It was determined that manifestation of positive transgressions of cocoon weight character in hybrid combinations varied in comparatively wide limits by degree and by frequency, as well.
According to Petkov (1995) the variability of genetic parameters, which characterize the degree (Dt) and frequency of transgressions (Ft) in F_2 depends on different level of productivity of parental races and lines. In our case degree of positive transgressions varied from 9.28 % to 35.35 % for female individuals and from 9.07 % to 37.08 % for male one. Frequency of transgressions also fluctuated, from 5.33 % to 20.04 % for female and from 3.98 % to 21.08 % for male individuals, respectively.
Comparatively the highest degree and frequency of transgression were determined in $Vratza_{2003}$ × $Vratza_{2006}$, $Vratza_{2007}$ × $Vratza_{2012}$ hybrid forms and their reciprocal crosses, because one of the parental lines, $Vratza_{2003}$ and $Vratza_{2007}$, respectively was characterized with comparatively lower values of cocoon weight compared to their partners. Over 26 % of individuals from these combinations exceeded the HP for cocoon weight, with 12.07-20.04 %

for female and 11.91 - 21.08 % for male individuals, respectively. $Vratza_{2002}$ x $Vratza_{2003}$ hybrid form and its reciprocal cross was distinguished with comparatively low transgression for cocoon weight character, because of crossing between lines with relatively equal values of character.

The results obtained for shell weight transgressions were analogical and we could explain this with high and positive correlation between these characters (Petkov, 1995; Petkov et al., 2005). The highest degree and frequency of transgression were determined in $Vratza_{2007}$ × $Vratza_{2012}$ and reciprocal cross, where 29.61 - 35.55 % of female and 30.15 - 31.43 % of male individuals exceeded HP with 27.36 - 28.28 % and 26.61 - 27.11 %, respectively for female and male individuals.

Number of selected for grainage production elite cocoons (Table 3) varied from 16.08 % to 30.01 % for female and from 16.97 % to 31.11 % for male one. This is evident that there is good combination between high values of cocoon weight with high shell weight. Because of this correlation the selection in the next generations could be carried out only by one of these characters (Petkov, 1995)

From the data in Table 3 it is evident that optimal variation of cocoon weight during selection of new highly-productive genetically sex-limited for larval markings hybrid populations is between 2288 - 2837 mg for female individuals and from 1958 to 2837 mg for male individuals. For shell weight this variation is between 468 and 593 mg for female and from 462 to 579 mg for male individuals.

Conclusion

Over dominance (d/a > 1) in inheritance of cocoon and shell weight characters, with contribution of the parent with higher value (HP) was determined.

Expression of positive transgressions for cocoon and shell weight characters in F_2 hybrid forms created with participation of genetically sex-limited for larval markings lines varied in wide limits. Variability of genetic parameters, which characterize the degree and frequency of transgressions depends on different level of parental productivity. Combination of positive transgressions for cocoon weight and shell weight characters in F_2 hybrid forms allows selecting individuals as ancestors of lines with higher productive potential.

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Table 1. Inheritance of cocoon weight and shell weight character in F_1

Crosses	n	Traits and genetic parameters					
		P_1	P_2	F_1	a	d	d/a
Fresh cocoon weight, mg							
$Vratza_{2002} \times Vratza_{2003}$	60	2129	2111	2236	9	116	12.88
$Vratza_{2003} \times Vratza_{2002}$	60	2111	2129	2196	9	76	8.44
$Vratza_{2003} \times Vratza_{2006}$	60	2111	2201	2222	45	66	1.47
$Vratza_{2006} \times Vratza_{2003}$	60	2201	2111	2254	45	90	2.00
$Vratza_{2007} \times Vratza_{2012}$	60	2132	2212	2295	40	127	3.18
$Vratza_{2012} \times Vratza_{2007}$	60	2212	2132	2307	40	135	3.37
Shell cocoon weight, mg							
$Vratza_{2002} \times Vratza_{2003}$	60	471	449	476	11	16	1.45
$Vratza_{2003} \times Vratza_{2002}$	60	449	471	472	11	12	1.09
$Vratza_{2003} \times Vratza_{2006}$	60	449	442	477	3.5	31.5	9.00
$Vratza_{2006} \times Vratza_{2003}$	60	442	449	489	3.5	43.5	12.43
$Vratza_{2007} \times Vratza_{2012}$	60	459	492	514	16.5	38.5	2.33
$Vratza_{2012} \times Vratza_{2007}$	60	492	459	500	16.5	24.5	1.78

Table 2. Transgressions in F_2 for fresh cocoon weight and shell weight

Crosses	Analyzed cocoons		Dt %		Ft %	
	♀	♂	♀	♂	♀	♂
Fresh cocoon weight, mg						
$Vratza_{2002} \times Vratza_{2003}$	30	30	9.28	9.07	4.32	3.98
$Vratza_{2003} \times Vratza_{2002}$	30	30	11.09	12.04	5.33	4.97
$Vratza_{2003} \times Vratza_{2006}$	30	30	28.17	26.33	12.07	11.91
$Vratza_{2006} \times Vratza_{2003}$	30	30	31.18	30.95	16.01	15.77
$Vratza_{2007} \times Vratza_{2012}$	30	30	35.35	37.08	20.04	21.08
$Vratza_{2012} \times Vratza_{2007}$	30	30	33.14	29.88	18.18	17.99
Shell weight, mg						
$Vratza_{2002} \times Vratza_{2003}$	30	30	18.17	19.44	20.11	19.18
$Vratza_{2003} \times Vratza_{2002}$	30	30	16.29	15.88	12.31	13.44
$Vratza_{2003} \times Vratza_{2006}$	30	30	3.55	2.98	3.04	2.67
$Vratza_{2006} \times Vratza_{2003}$	30	30	4.01	3.13	4.71	5.03
$Vratza_{2007} \times Vratza_{2012}$	30	30	27.36	26.61	35.55	31.43
$Vratza_{2012} \times Vratza_{2007}$	30	30	28.28	27.11	29.61	30.15

Table 3. Variation of cocoon weight and shell weight in some elite individuals with optimal combination of characters

Crosses	Elite cocoons %		Cocoon weight mg		Shell weight mg	
	♀	♂	♀	♂	♀	♂
$Vratza_{2002} \times Vratza_{2003}$	16.08	16.97	2349-2683	1988-2226	471-534	468-517
$Vratza_{2003} \times Vratza_{2002}$	17.11	17.43	2288-2594	1958-2201	468-531	462-522
$Vratza_{2003} \times Vratza_{2006}$	27.27	28.06	2333-2666	1977-2218	473-553	470-541
$Vratza_{2006} \times Vratza_{2003}$	28.13	28.05	2362-2698	1991-2245	481-567	477-555
$Vratza_{2007} \times Vratza_{2012}$	30.01	31.11	2398-2705	2042-2273	505-593	495-581
$Vratza_{2012} \times Vratza_{2007}$	29.73	30.04	2429-2837	2057-2288	498-581	490-568

Study on main productive characters of silkworm *Bombyx Mori* L. Hybrids of parthenoclone × ordinary or sex – limited line type

By

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Abstract: ***New type silkworm hybrids with participation of ameiotic parthenoclones as mother forms and ordinary or genetically sex-limited for larval markings lines as father forms were selected and tested.***

$CGNL_4$ hybrid was created by crossing ameiotic parthenoclone as female form and E_{5a} line as male form. It is characterized with high values of main economical characters, namely 97.49 % eggs hatchability, 94.67 % silkworm pupation ratio, 2385 mg fresh cocoon weight, 515 mg shell weight, 21.59 %shell ratio, 1361 m filament length, 422 mg filament weight, 2.79 denier filament thickness, 92.98 % reelability of cocoons and 43.73 % shell ratio. Cocoon yield per 1 box of silkworm eggs (20 000 ± 200 viable eggs) of new hybrid (44.44 kg) exceeded $Super_1$ x $Hessa_2$ Bulgarian standard with 1.20 %.

Key words: silkworm, *Bombyx mori* L., hybrid, sex-limited lines, parthenoclones.

Introduction

Production of F_1 hybrid silkworm eggs for industrial cocoon production with participation of ordinary genetically non sex-limited races and lines is technologically complex and difficult process. Difficulties proceed from the necessity of preliminary sex discrimination of *Bombyx mori* L. cocoons (pupae or moths after the emergence) before mating of moths for avoiding crossing inside the breed.

Used till now methods and manners for mechanized cutting of cocoons and dividing of pupa manually or mechanized trough apparatus working on the basis of existed biological dependent differences between weight in two sexes are also expensive and inaccurately (Zakirova, 1978; Strunnikov, 1986; Petkov, 1995).

Because of this a lot of resources are invested during the last years in silkworm sex regulation in advanced Sericultural countries. In this aspect *Bombyx mori* L. is a unique object for creation and using not only of sex-marked at different development stages races and lines but also ameiotic (unisexual) parthenoclones (Strunnikov, 1986, 1987; Strunnikov et al., 1986; Mano et al., 1988; Petkov, 1995; Petkov and Nacheva, 1996; Malinova et al., 1996; Petkov et al., 2000, 2004).

The aim of the present study was to submit the results from testing of main productive characters of new silkworm hybrids from "parthenoclone × ordinary or genetically sex-limited line" type.

Material and Methods

Experimental and theoretical work was done at the Sericulture Experiment Station, Vratza, Bulgaria.

Four new F_1 silkworm hybrids, incl. three $CGML_1$ (E_{11} × $Vratza_{2003}$), $CGML_2$ (Yoana × $Vratza_{2003}$) и $CGML_3$ (P × $Vratza_{36}$ × $Vratza_{2007}$) obtained with participation of E11, Yoana

and P parthenoclones and $Vratza_{2003}$ and $Vratza_{2007}$ genetically sex-limited lines and one $CGNL_4$ ($Hessa_2$ × $Super_1VP$) × E_{5a}) three-way hybrid, with participation of ordinary E_{5a} line were evaluated.

Bulgarian $Super_1$ x $Hessa_2$ hybrid was used as control. All hybrids together with control were reared and tested in 4 repetitions with 200 individuals, counted after second larval moult.

Data of silkworm biological and cocoon and filament technological characters were analyzed statistically (Lidanski, 1988).

Results and discussion

Compared data for main silkworm biological characters, which characterize productive potential of tested hybrids are presented in Table 1.

It is evident that all newly created and tested for the first time in Bulgaria original silkworm F_1 hybrids with participation of parthenoclones as female forms and ordinary or sex-limited lines as male forms demonstrate comparatively high eggs hatchability, 97.17 - 97.66 % compared to 97.88 % in $Super_1$ × $Hessa_2$ standard.

Silkworm pupation ratio of tested hybrids from new type is also comparatively high - 94.67 - 96.27 %. $CGML_1$ and $CGML_3$ had the highest value of this character with underlined contribution for fresh cocoon productivity set up, 96.27 % and 94.93 %, which exceeded the control value with 2.14 and 0.80 points, respectively.

In relation to larval period duration new $CGML_2$ and $CGNL_4$ hybrids had prolonged with 18 – 26 h and $CGML_3$ had with 21 h accelerated development compared to $Super_1$ × $Hessa_2$ control.

Productivity of tested hybrids, measured with fresh cocoon yield per 1 box of (20 000 ± 200 viable eggs) was comparatively high 37.893 - 44.440 kg and only $CGNL_4$ hybrid exceeded significantly control with 0.492 kg (1.12 %).

Proceeding from the simplified technology for producing of F_1 industrial silkworm eggs from this kind of hybrids because of ignoring of preliminary dividing of cocoons at pupae stage and non-admission of contamination of F_1 hybrid eggs with pure line ones we evaluate the achievement from selection activity as very perspective.

Compared data for cocoon weight and shell ratio of fresh cocoons are shown in Table 2.

It is evident that all tested hybrids, except for $KGML_3$ were characterized with comparatively high cocoon weight, which varied from 2204 mg to 2385 mg, compared to 2388 mg in $Super_1$ × $Hessa_2$ control.

As analogy to cocoon weight character high shell weight values were determined in tested hybrids, 485 - 515 mg. These high values determined comparatively high shell ratio of fresh cocoons (21.59 - 22.10 %), which inform us for relative silk content in the fresh cocoons.

Information for main filament technological characters is presented in Table 3.

It is evident that majority of hybrids from new type were distinguished with comparatively long and thin filament, 1245 - 1361 m and 2.79 - 2.91 denier, compared to 1278 m and 2.81 denier in $Super_1$ × $Hessa_2$ control.

Two of tested hybrids $CGML_2$ and $CGNL_4$, exceeded the control in respect to filament weight, cocoon reelability and silk ratio characters with 5 - 23 mg, 0.60 - 1.97 points and 0.25 - 1.56 points, respectively.

Conclusion

New type silkworm hybrids with participation of ameiotic parthenoclones as mother forms and ordinary of genetically sex-limited for larval markings lines as father forms were studied. $KGNL_4$ hybrid was created by crossing of ($Hessa_2$ × $Super_1VP$) hybrid with participation of ameiotic parthenoclone as female form and E_{5a} line as male form.

It is characterized with high values of main characters with economical importance, namely 97.49 % eggs hatchability, 94.67 % silkworm pupation ratio, 2385 mg fresh cocoon weight, 515 mg shell weight, 21.59 % shell ratio, 1361 m filament length, 422 mg filament weight, 2.79 denier filament thickness, 92.98 % reelability of cocoons and 43.73 % raw silk ratio. Cocoon yield per 1 box of silkworm eggs (20 000 ± 200 viable eggs) of new hybrid (44.44 kg) exceeded $Super_1$ x $Hessa_2$ Bulgarian standard productivity with 1.20 %.

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Table 1. Silkworm biological characters values

Hybrids	Eggs hatchability %		Silkworm pupation ratio %		Larval period duration h		Fresh cocoon yield per 1 box of silkworm eggs kg	
	$\bar{x}$	± D	$\bar{x}$	± D	$\bar{x}$	± D	$\bar{x}$	± D
$CGML_1$	97.58	- 0.30	96.27	+ 2.14	676	-	41.180	- 2.768
$CGML_2$	97.17	- 0.71	94.73	+ 0.60	694	+ 18	40.487	- 3.461
$CGML_3$	97.66	- 0.22	94.93	+ 0.80	655	- 21	37.893	- 6.055
$CGNL_4$	97.49	- 0.39	94.67	+ 0.54	702	+ 26	44.440	+ 0.492
$Super_1 \times Hessa_2$	97.88	-	94.13	-	676	-	43.948	-
GD at P 5 %	0.58		0.67		8.04		0.444	
P 1 %	0.77		0.89		10.69		0.591	
P 0,1 %	1.02		1.18		14.15		0.781	

Table 2. Fresh cocoon weight and shell ratio values

Hybrids	Fresh cocoon weight mg		Shell weight mg		Shell ratio %	
	$\bar{x}$	± D	$\bar{x}$	± D	$\bar{x}$	± D
$CGML_1$	2204	- 184	487	- 17	22.10	+ 0.47
$CGML_2$	2207	- 181	485	- 19	21.98	+ 0.35
$CGML_3$	2061	- 327	441	- 63	21.40	- 0.23
$CGNL_4$	2385	- 3	515	+ 11	21.59	- 0.04
$Super_1 \times Hessa_2$	2388	-	504	-	21.63	-
GD at P 5 %	63		26		0.46	
P 1 %	84		35		0.61	
P 0,1 %	111		46		0.81	

Table 3. Filament technological characters values

Hybrids	Filament length m		Filament weight mg		Filament thickness denier		Reelability of cocoons %		Silk ratio %	
	$\bar{x}$	± D	$\bar{x}$	± D	$\bar{x}$	± D	$\bar{x}$	± D	$\bar{x}$	± D
$CGML_1$	1233	- 45	398	- 1	2.91	+ 0.10	89.28	- 0.73	41.98	- 0.19
$CGML_2$	1255	- 23	404	+ 5	2.89	+ 0.08	91.61	+ 0.60	42.42	+ 0.25
$CGML_3$	1245	- 33	399	-	2.88	+ 0.07	91.95	+ 0.94	42.01	- 0.16
$CGNL_4$	1361	+ 83	422	+ 23	2.79	- 0.02	92.98	+ 1.97	43.73	+ 1.56
$Super_1 \times Hessa_2$	1278	-	399	-	2.81	-	91.01	-	42.17	-
GD at P 5 %	32		13		0.06		0.51		0.53	
P 1 %	43		17		0.08		0.68		0.70	
P 0,1 %	56		23		0.11		0.90		0.93	

Mulberry silkworm industrial parthenoclones and breeds used as male component in hybrids

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Abstract: ***The paper considers the results of 3 years stationary experiments on mulberry silkworm parthenoclones and the breeds used as male component in hybridization, which were bred in collaboration with other laboratory and were zoned in Georgia since 1999.***

The above referred parthenoclones and the breeds used in hybridization as a make component, by their biotechnology indices are convincingly better than the standard.

Key words: silkworm, Bombyx mori L., parthenogenesis, breeding

Introduction

The great Russian scientist, academician B.L. Astaurov devoted his whole cognitive life to the development of theoretical bases and practical realization of the methods of development of artificial parthenogenes. He was the first researcher in the former Soviet Union who elaborated the methods of ameiosic high temperature parthenogenesis development and experimental androgenesis of mulberry silkworm. In the first case only the female generation and in the second one, only the male generation is obtained (1,2,3).

Studies of acad. B.Astaurov were further developed by academician V. A. Strunnikov. Under his direct supervision and participation were developed the methods of parthenogenesis development of grain taken from moth abdomen and laid as well as the not fecundated grain remaining in the abdomen, under the effect of low and combined (low + high) temperature (4).

For many years experiment for the creation of industrial parhhenoclones and clone-breed hybrids and for the creation of biotechnology of partheno-grainage were performed at the Scientific-Research Institute of Sericulture of the Georgian State Agrarian University jointly with the Laboratory of Development of Cytogenetics and Sex Regulation of the Institute of Development Biology of Academy of Sciences of Russia. The head of the Laboratory, academician V.Strunnikova participated in the work personally.

Methods and Material

The following methods were used for the parthenogenesis development of mulberry silkworm: High temperature, ameiosic partheno-stimulation method developed by B.L.Astaurov and the low temperature meosic partheno-stimulation developed by V.A.Strunnikov as well as the methods developed by the authors of the paper dealing with live moth partheno-stimulation.

During high temperature ameiosic partheno-stimulation the non fecundated grain taken from moth abdomen, of 12-24 hrs age, is treated in 46^{o}C water for 18 minutes and after its drying

is placed at +16-17^{o} C and 90-95% humidity conditions for 2-3 days. Then the grain is stored at the regular regime. As a result the female generation is obtained..

During low temperature partheno-stimulation the non fecundated grain taken from moth abdomen is placed at –11^{o}C for 30 minutes and then is kept in regular regime. As a result, homozygous male generation is obtained.

During partheno-stimulation of live moths, moths were placed in 46^{o}C water for 18,5 minutes. Moth died and then grain was taken from its abdomen. As soon as the grain was dried it was placed at 16-17^{o}C temperature and 90-95% humidity and kept in the regular regime. As a result only female generation was obtained.

Experimental Results

As a result of joint activity the authors obtained 3 parthenoclones, 4 clone-breed hybrids and 3 regular, 3 bisexual breeds participating as male component in hybridization, which were zoned in Georgia according to the order of the Ministry of Agriculture (No 2-96 of 16.04.99). Biotechnological indices of the above stated parthenoclones and breeds are given in Table 1 and 2.

Table 1. Biological indices of 3 years stationary experiments on mulberry silkworm parthenoclones and breeds participating in hybrids as male components

N	Parthenoclones and breeds Indices	PK-31	PK-33	PK-43	ASGA	D-6	D-7	Iveria standard
1	Number of grain per gram, pcs	1760	1780	1618	1740	1660	1668	1580
2	Grain reanimation, %	91,5	92,1	91,4	94,3	96,3	97,3	93,5
3	Number of worm per gram, pcs	2428	2500	2473	2406	2350	2326	2307
4	Duration of worm feeding, day	30	30	29,3	30	29,0	29,0	29,5
5	Worm vitality, %	98,5	96,6	96,2	97,3	96,6	94,4	92,7
6	Cocoon outcome per gram worm, kg	4,67	4,61	4,86	4,72	4,48	4,72	4,13
7	Average mass of live cocoon, gram	1,90	1,91	2,03	2,02	2,02	2,15	1,92
8	Silk capacity of live cocoon, %	21,9	22,7	21,2	23,9	22,0	23,9	19,5
9	Cocoon outcome from live air-dry cocoon	42,7	42,2	43,5	43,9	43,3	43,5	40,1

As is seen from Table 1, parthenoclones (PK-1, PK-33 and PK 43) by their embryo vitality lag behind the standard by 1,5-2,0%, which for parthenoclones is a regular phenomenon. As to the worm vitality, parthenoclones are better by 4,5-5,5 %, while the breeds used as the male components - exceed by 1,7-4,6 % the standards. The highest index with the view of worm vitality is inherent to parthenoclone PK-31 (98,5%) and the breed ASGA (97,3%).

Parthenoclones and breeds used as male components are distinguished by good yield of cocoon, compared with the standard. The difference in cocoon yield per gram worm equals to 0,4-0,7 kg, which, calculated against one box of worm (19 g worm) equals to 7,6-133 kg.

According to the live cocoon silk capacity the parthenoclones are better than the standard by 2,1-3,6%, while the breeds used as male components - by 2,9-4,8 %. According to the index of the yield of air-dry cocoon from live cocoon parthenoclones PK-43 (43,5%) and the breed ASGA (43,9%) are distinguished, while in standards this index equals to 40,1 %.

Thus, parthenoclones and breeds used as male components, by their biological indices clearly exceed the standard and mainly meet the demands of normative documents.

Table 2. Technological indices of mulberry silkworm parthenoclones and breeds participating as male components

N	Parthenoclones and breeds Indices	PK-31	PK-33	PK-43	ASGA	D-6	D-7	Iveria standard
1	Silk capacity of air-dry cocoons, %	47,2	47,2	46,9	48,4	48,5	49,2	46,4
2	Yield of raw silk, %	41,7	41,3	41,5	43,5	42,9	43.8	393
3	Silk thread unwinding capacity, %	88,2	87,7	86,6	89,9	87,8	90,0	87,5
4	Length of cocoon thread, m	1112	1091	1210	1279	1230	1348	1167
5	Thread metric number	3287	3385	3173	3084	3587	3157	3411
6	Approximate output of raw silk per gram worm, gram	707	673	686	807	692	690	600

As is seen from the technological indices given in Table 2 the air-dry cocoon silk capacity compared to the standard is higher in the breeds used as male components than in parthenoclones, which as was stated above, is the regular phenomenon, since parthenoclones consist of only female sex individuals and they are characterized by heavy mass. This situation refers also technological indices, such as the output of raw silk made from air-dry cocoon, which is within the limits of 31,4 – 41,7 % in parthenoclones, while in the breeds – 42,9-43,8%. In standards it equals to 39,3%.

Silk thread winding capacity in parthenoclones and pure breeds have great advantage. According other technological indices the preference of parthenoclones and breeds used as male components compared to the standard is apparent. Parthenoclones PK-31 and PK-34 lag behind the standard only by one index –length of cocoon thread.

Conclusion

1. Parthenoclones: PK-31, PK-34, PK-43 and breeds used as male components in hybridization: ASGA, D-6 and D-7 (on the base of 3-years stationary experiments) by their technological indices are better than the standard and they, in the principle, meet the demands of normative documents.
2. Application of parthenoclones has more advantage than application of common bisexual breeds. They don't need costly breeding-selection jobs necessary for preservation of generations.
3. Separate individuals of parthenoclones are genetic copies and in the generation give absolutely homogeneous individuals, which don't need sorting in practice.

4. Participation of parthenoclones in hybridization as a female component results in the formation of a set of compensating genes, which conditions increase of heterosis (4).
5. One of the flaws of parthenoclones is that in-breed propagation in generations for a long period, is accompanied by parthenogetesis depression, and that it is necessary once in 5-10 years to replace parthenoclones, and this should be done by scientific institutions..
6. In the present day conditions it is better to prepare parhenogenetic cellular elite grain in scientific institutions and supply with it, on contractual principles, the grainage factories for production of clone-breed hybrid grain.

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Highly productive mulberry silkworm clone-hybrids

By

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Abstract: ***Highly productive mulberry silkworm clone hybrids PK-31 x Asga, PK-33 x Asga, PK-43 x Digomi-6 and PK-43 x Digomi-7 were bred by joint efforts of the Laboratory of Cytogenesis and Sex Regulation of the Institute of Development of Biology of the Academy of Sciences of Russia and Department of Selection-Grainage of the Scientific-Research Institute of Sericulture of Georgian State Agrarian University. The just deceased Academician V.A.Stunnikov took active part in this work from the very beginning. Clone-species hybrids were first zoned in Georgia. They are characterized by high heterogeneity as a result of which cocoon yield increases by 18-20%. Female components of clone hybrids (parthenogenes) are bred by the ameiosic and meiosic parthenogeneic development methods. They don't need sorting and separation of cocoons into sexes at the grainage factory, increase 2,5 times hybrid industrial grain yield and provide high profitable functioning of grain factories.***

They yield excess harvest of raw silk thread per box worm compared with the standards: PK-31 x Asga and PK-33 Asga – yields at about 2,7-3,0 kg; PK-43 x Digomi-6 –2,5-3,0 kg, while PK-43 x Digomi-7 – yields 2,8-3,5 kg..

Clone hybrids, compared with the ordinary hydrides are characterized by other favorable properties too. Technological processes of preparing the grain are simplified and what is most important industrial grain of 100% purity, without admixtures of original breeds, is obtained. F_1 generation of hybrid grain, as a rule, is characterized by homogeneity of cocoon form. Grain never suffers from Pebrine disease since it is prepared by the cellular method.

Clone hybrids were zoned according to the Order of the Ministry of Agriculture and Food of Georgia (No 2-96 of 16.04.1999).

Key words: mulberry silkworm, partheno-clone, clone-hybrids, heterosis, ameiosic and meiosic parthenogenesis

Introduction

As is universally known industrial sericulture is based on the application of hybrids, since compared to the pure strains they are characterized by higher productivity and vitality. For preparation of industrial hybrid grain it is necessary to separate the breed material (cocoon) into sexes, which is realized by special devices and is very labor consuming. Alongside with it there are great errors in defining sexes too.

Separation into sexes of the mulberry silkworm cocoon and preparation of industrial hybrid grain of 100% purity is provided by the application of high temperature ameiosic and low-temperature meiosic development methods elaborated by Russian scientists acad. B.L.Astaurov and acad. V.A.Strunnikov (1,2,3,4).

Experimental works for the creation of industrial clone-hybrids have been performed for many years at the Training-Research Institute of Sericulture of the Georgian State Agrarian University jointly with the Laboratory of Cytogenetics Development and Sex Regulation of Institute of Biology Development of AS Russia. The head of the Laboratory, the worldly known scientist, now deceased acad. V.A.Strunnikov took active part in this work.

At the joint activity, alongside with breeding of the parthenoclones the industrial clone-hybrids were developed: PK-31 x ASGA, PK-33 x ASGA, PK-43 x D-6; PK-43 x D-7, which after certain testing at the relevant competition held for state hybrid testing network, was zoned in Georgia, according to the Order of the Ministry of Agriculture of Georgia (No 2-96, 16-04-99).

Methods and Material

Clone hybrid of mulberry silkworm is obtained by crossing of parthenoclone with common bisexual breed as a result of which only the hybrid of straight direction is obtained and the reverse direction breed can't be obtained.

As to the male component, the male sex can be easily obtained with great accuracy by the apparatus method in the grainage factory, since male sex is used twice and three times for crossing and it is needed in less quantity.

Propagation of initial parthenoclones and their preservation in generations is realized by high temperature ameiotic method, low temperature meiotic method and the method of partheno-stimulation of live moth.

Experimental Results

Tables 1 and 2 give the results of 3 years stationary experiments on mulberry silkworm clone-hybrids at spring feeding.

Table 1.Biological characteristics of mulberry silkworm clone-hybrids according to 3-years stationary experiments carried out at the Institute

N	hybrid Indices	PK-31 x ASGA	PK-33 x ASGA	PK-43 x D-6	PK-43 x D-7	Iveria x Tbilisuri (standard)
1	Number of grain per gram, pcs	1836	1843	1660	1676	1592
2	Grain reanimation, %	97,5	97,9	96,2	95,5	95,7
3	Number of worm per gram, pcs	2450	2516	2556	2555	2356
4	Duration of worm feeding, day	30	30	28	28	28
5	Worm vitality, %	98,0	98,6	96,2	95,8	89,3
6	Cocoon outcome per gram worm, kg	4,83	4,74	4,73	4,75	4,04
7	Average mass of live cocoon, gram	2,0	2,03	1,96	1,92	1,99
8	Silk capacity of live cocoon, %	23,4	23,5	23,2	24,0	18,6
9	Cocoon outcome from live air-dry cocoon	42,3	42,7	45,0	44,5	41,2

Table 1 shows that clone-hybrids are far better than the standard (Iveria x Tbilisuri) by grain reanimation and worm vitality. By the length of feeding period only two clone-hybrids (PK-31xASGA and PK-33xASGA) lag behind the standard by 2 days, while the length of feeding of two (PK-43 x D-6 and PK-43 x D-7) clone-hybrids are equal and amount to 28 days.

Clone-hybrids yield 14 kg more cocoon per box worm (19 g) compared with the standard. According to the silk capacity of live cocoon they exceed the standard by 4,5-5,5%. Yield of live air-dry cocoon in case of clone-hybrids exceeds that of the standard.

Clone-hybrids are clearly better by their technological indices as well compared with the standard.

Table 2. Technological characteristics of industrial mulberry silkworm clone-hybrids according to the mean indices of 3-years stationary experiments conducted at the Institute

N	Hybrid Indices	PK-31 x ASGA	PK-33 x ASGA	PK-43 x D-6	PK-43 x D-7	Iveria standard
1	Silk capacity of air-dry cocoons, %	50,0	49,0	51,9	50,0	47,5
2	Yield of raw silk, %	44,6	43,8	45,6	44,2	39,4
3	Silk thread unwinding capacity, %	89,2	89,1	90,3	87,7	87,2
4	Length of cocoon thread, m	1266	1303	1506	1533	1320
5	Thread metric number	3208	3306	3447	3547	3543
6	Approximate output of raw silk per gram worm, gram	804	780	750	725	560

Analysis of Table 2 shows that clone-hybrids according to the aid-dry cocoon silk capacity exceeds by 1,9-4,4% the corresponding index of standards, but their preference is better expressed in major indices such as the yield of raw silk thread from air-dry cocoon. This index in clone-hybrids is within 43-8-45,6 %, while in standard it equals to 39,4 %. Difference in these indices equals to 4,4-6,2 %. Likewise is great the excess yield of raw silk thread per box (19 g) worm. It reaches 3,1-4,6 kg.

Conclusion

1. Mulberry silkworm clone-hybrids by their embryonic and postembryonic vitality are far better than standard. With this in view the clone-hybrids PK-31 x ASGA and PK-33 x ASGA are most distinguished. These indices reach 98% and fully meet the demands of current normative documents. Most of other biological indices are also at the level of current normative acts.
2. Clone-hybrids are characterized by better technological indices compared with the standard. Silk capacity of air-dry cocoon and output of raw silk thread as well as yield of raw silk per box (19 g) worm are higher than in standard. In the best case, these indices correspondingly reach: 51,9 and 45,6% and 4,6 kg. At large, clone-hybrids, by their technological indices not only are better than the standard but meet the demands of normative documents.

3. Cocoon of F1 generation of clone hybrids is characterized by maximum phenotypic homogeneity, which has great significance during further treatment of cocoon.
4. Cocoon of the clone participating as female component in clone-hybrids doesn't need sorting by factory method and 80-90% of total quantity of cocoon is selected for further grain storing, instead of 40-45%, which increases twice the yield of industrial grain. Alongside with it, clone consists completely of female sex individuals and respectively the yield of industrial hybrid grain will increase twice and because of it the grainage factories immediately become highly profitable enterprises.
5. Since all individuals of the clone are female, its cocoon doesn't need the separation in sexes at the factory, while separation of male individuals is easily achieved by the apparatus method.
6. Preparation of industrial hybrid grain from clone hybrid is performed by 100% purity (instead 30-40%) and application of such grain in industrial feeding will increase cocoon yield and quality by 18-20%.
7. Thus by the creation of clone hybrids characterized by high vitality and productivity and by their distribution in industry we can replace costly cellular grainage technology with more simple and reliable biotechnology of parthenograinage.

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2.3. Silkworm egg production

Integrated production and durable management of a reproduction sericultural family farm

By

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Abstract: ***A project destined to sericiculture rehabilitation in Romania is running within a research programme between 2005 and 2008.The project is based on the long experience existing in sericiculture in the country, on the high value silkworm races and hybrids, mulberry varieties and on the tradition in the domestic silkworm rearing and cocoon processing. The project can be applied in family farms, more exactly in the households having at least 0.5 ha mulberry plantation, 150 s.m. buildings as silkworm rearing house and 2-3 family members dealing with the activities stipulated in the project. The main product is represented by seed cocoons. The yearly production capacity of the family farm is 400 kg cocoons. The cocoons can be partially used for obtaining silkworm eggs (1,000 boxes) or can be sold to specialised reproduction units. Other cocoons could be processed in fibres and traditional and hand-made silk commodities. The production of mulberry saplings is also provided in the project, 0.5 ha being suitable for such a purpose. The expected production is 50,000 saplings. An attractive chapter of the project refers to the arrangement of a workroom for silk cottage processing and development of traditional and silk handicrafts commodities. The fibre combination, the weaving techniques and the types of decorative workmanship are other goals of this project. Fodder recipes for fishes (Sturgeons etc) including among other ingredients: pupae powder, excreta and mulberry leaf powder are also elaborated. The expectations for the average technical performances are the following ones: 6,000 kg leaf yield production/0.5 ha plantation, 35 kg raw cocoon production/box, 400 kg raw cocoon production /0.5 ha mulberry plantation, 15 kg leaf consumption/kg cocoons, 80 % pupation rate, 2.0 g raw cocoon weight, 0.400 g shell weight and 1,200 m filament length. Two variants of farms are experienced within this project as follows: (a) a farm producing reproduction silk cocoons, silk filament and mulberry saplings and also the related secondary products (pupae and rearing wastes) and (b) a farm producing silk worm eggs, silk filament and mulberry saplings and the related secondary products (dried pupae, perforated cocoons, rearing wastes). The expectations for the profit rate is 25-33%. The both variants assure a high productivity and could be recommended to be developed in the country, contributing to the diversification of activities and income sources for the population living in the rural areas, to the rehabilitation of sericiculture.***

Key words: sericiculture, project, seed cocoons, mulberry saplings, handicrafts

Introduction

During the last two decades, the most of countries where sericiculture represents a traditional job are facing a deep decrease of cocoon and silk production. Known as an activity peculiar to rural areas and representing an income source for farmers, sericiculture is brought in the attention of Governments whose efforts are focused to recover this field of activity.

At the world level, sericiculture is practising in farms of various types and management.

A mid-term and long-term national programme set up in India provides, among other measures, the joining of sericicultural farms in order to allow extension services and to apply modern technologies. Also, another purpose is the creation of sericicultural associations between raw material producers and users (reproduction cocoon producers - seed producers ; cocoon producers -spinning mills ; spinning mills - weaving mills) (DANDIN, S.B, 2002).

In Thailand, a new trend in sericiculture management has been noticed. Sericicultural farmers are joining by activity type: young larvae rearing, cocoon producing (SOMYING CHUPRAYON and col. 2002).

The organization of farms of various production capacity where sericicultural activities are combined with other activities (pig growing, cattle farming, mushroom growing etc) are suggested by PETKOV,N. and col., 2004.

Taking into account the local conditions in Bulgaria, GREKOV, D.F. and TZENOV, P.I., 2005, consider that the strategy for a short and mid-term sericiculture rehabilitation has to adopt two farm types as follows: (a) 0.2 ha mulberry plantation, 30 s. m. rearing space, 150-200 kg annual raw cocoon production ; (b) 0.5 ha mulberry plantation, 75 s.m. silkworm rearing house, 450-500 kg raw cocoon production.

A series of technical and management measures have been taken in order to encourage sericiculture rehabilitation in Greece (KIPRIOTIS, E., 2005), Tajikistan (HOMIDY,H. and col., 2005), Ukraine (GALANOVA,O.V. and col., 2005), Turkey (KARAGOZOGLU, A, 2005), Uzbekistan (HOMIDY,H. and col.,2005). Most of the authors mentioned above have pointed out the importance of cocoon processing in a traditional system in order to achieve traditional silk handicrafts, but also other types of commodities where natural silk is combined with other fibres, competitive both in the domestic and international markets.

During the last years, in the majority of the sericicultural states, a special attention has been paid to wastes and sericicultural secondary products (vegetal remains and excreta, pupae, unspinning cocoons, wastes coming from cocoon spinning (KANG,S.R. and col.,2002; ZI RAN HUANG,2002).

In Romania, sericiculture has been practising for years both within peasant households rearing silk worms without using any specific technical endowment and within state sericicultural farms specialised in silk cocoon production, destined to cottage industry. The state farms were well endowed with 50-100 mulberry plantations and rearing buildings where 20-50 ton cocoons were achieved. The last type of production farms was not effective, as large sized farms were not suitable to the seasonal character of sericicultural production and not able to assure permanent employment as well as due to the lack of integrated activities.

At present, the state farms are dissoluted as land has been given back to the old owners, spinning and weaving mills processing cocoons in natural silk products were closed. Under these circumstances, sericiculture development has to be approached in a different way.

Within this framework, research and development in the field of sericiculture will be running between 2005 and 2008 within a project destined to the rehabilitation of sericiculture in Romania based on a new concept.

The project aims to recover silk worm rearing in Romania and is based on the experience existing in the country in this field of activity, but also on the existence of high value biological material represented by silkworm races and hybrids and mulberry varieties, rearing technologies and a long tradition in silk processing in handicrafts.

The project objectives are the following ones:

* Organization of a pilot sericicultural farm endowed with the corresponding investment needed for running the basic activity (reproduction biological material) and marketing of the secondary products resulting from the basic activity;
* Economic optimization of the reproduction farm by the use of secondary products;
* Setting up the technology for producing the reproduction biological material (silk cocoon and mulberry seeding material) for obtaining new types of natural fibres, for achieving a new type of forage for aquaculture.

Material and methods

The activities which will be running within the project are based on the following:

- methods and techniques specific for producing biological reproduction material (selection based on biological and technological criteria, pure breed reproduction or inbreeding);
- traditional methods and biotechnologies for multiplying the vegetal sericicultural genetic fund (Morus sp.) represented by cutting, Chinese layering, seeding ;
- specific techniques for achieving new textile structures of natural silk and other fibres (mohair, wool) with a novelty character;
- textile techniques and technologies for processing, painting, weaving, knitting, finishing the raw material from textile wastes;
- methods for determining the nutritive value of the forage recipes and food conversion in body weight.

The analysis of the economic results of the experiment variants will be made by the comparison method among variants (profit rate).

The following activities will be achieved within the project:

Activity 1. Silk worm rearing for producing of cocoons with the following use:

1st Variant:

- 300 kg cocoons (75 % of annual production) for producing 1,000 boxes of silk worm eggs;

- 100 kg cocoons (25 % of annual production) for producing fibre and fabrics in the cottage industry;

- 15 kg pupae used as a component in fodder recipes for fishes set up within this project.

2nd Variant:

- 300 kg cocoons are sold to the egg producing units;

- 100 kg cocoons are processed in fibres used for handicraft producing;

- 300 kg dried pupae are used for producing fodder for fishes.

Activity 2. Producing mulberry seeding material

Using 0.5 ha land surface, according to the applied technology, 50,000 mulberry saplings or 5,000 layerings are expected to be achieved. Mulberry saplings are destined to be sold in the market.

Activity 3. Silk cocoon processing in handicraft industry

It is followed the activity of producing traditional silk handicrafts, using natural silk in combination with other fibres. The fibre combination and its processing technology will be established along the project running.

Activity 4. Secondary sericicultural products processing

Pupae, excreta and mulberry leaves could be used for producing fodder for fishes, based on specific recipes set up within this project.

The material used for the activities and variants mentioned above is represented by:

- silk worm eggs (P1) - 12 boxes distributed for the two rearing series as follows: 8 boxes for Spring series and 4 boxes for Summer-Autumn series ;
- mulberry leaves (6,000 kg) obtained from 0.5 ha plantation ;
- mulberry seeds (10 kg) producing 50,000 mulberry saplings in a 0.5 ha plantation;
- sericicultural equipment;
- special equipment for silk cocoon processing in handicrafts;
- 150 s.m.rearing space, organised within the existing buildings (houses temporary destined for this purpose, sheds, storehouses etc) or could be built new rearing houses. In the both cases, it is required to assure the corresponding arrangements imposed by the growing technology. A part of these spaces could be also used as a weaving mill in the simple variant, handicraft industry.

Expected results

- **Technical performances**

In a family farm, endowed with:

- 0.5 ha mulberry plantation
- 0.5 ha mulberry nursery
- 150 s.m. rearing space
- specific sericicultural equipment
- equipment for the traditional processing of silk cocoons in handicrafts,

the following technical performances are expected:

- mulberry leaf production /0.5 ha: 6,000 kg;
- silk cocoon production/box: 35 kg ;
- silk cocoon production/0.5 ha: 400 kg;
- leaf consumption/kg cocoons: 15 kg ;
- pupation rate: 80 %;
- raw cocoon weight: 2,.0 g ;
- silk shell weight: 0.400 g.

- **Financial performances**

In order to carry out the planned activities, the following costs are estimated:

- total investment - Euro 12,000, with an annual quota of Euro 3,000 ;
- annual operating costs Euro 32,120 (1st variant) or Euro 30,950 (2nd variant).

The products sale will result the following incomes:

- Euro 46,725 (1st variant) or
- Euro 42,394 (2nd variant)

The expected profit is:

- Euro 11,605 (1st variant) with 33.04 % profit rate ;
- Euro 8,444 (2nd variant) with 24.87 % profit rate.

- **Social Impact of the Project**

- creation of new vacancies and maintaining the rural population in villages ;
- reduced risk for environment polluting ;
- energy low consumption;
- natural silk is an ecological product, consumers prefer natural products.

- **Cultural Impact of the Project**

- the creation revival of traditional handicrafts within the peasant household ;
- improving consumer taste and refinement.

Conclusions

1. The major project objective is to establish the scientific and economic fundamentals for setting up a family sericicultural reproduction farm under the condition of integrated production and management.
2. The project beneficiaries are represented by the individual authorised producers and family sericicultural farms owning the following minimum endowments:

- 1 ha arable land, of which 0.5 ha destined for mulberry plantation for silk worm feeding and 0.5 ha mulberry nursery ;
- 150 s.m. rearing space available in the own household;
- 2-3 family members representing labour force.

3. The economic efficiency for the two variants is expressed by profit rate: 33 % for the 1st variant and 25 % for the 2nd one.

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Section 3. Silkworms as biological models

Anti-Oxidation of Cultured *Cordyceps militaris* Growing on Silkworm Pupa

By

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Abstract: ***Cordyceps, one of the well-known traditional Chinese medicines, consists of the dried fungus C. sinensis growing on the larva of caterpillar. It is commonly used as a tonic of restoring vital body functions. In order to evaluate the pharmacological effects of C. militaris, the anti-oxidation and antiaging effect of cultured C. militaris growing on pupa of silkworm Bombyx mori, were investigated. The results showed that the contents of lipofusin in myocardium were reduced and the SOD activity in the liver were elevated in a dose-dependent manner while no effect was observed for blood GSH-Px activity and liver MDA content in mice perfused with the cultured C. militaris compared to those untreated mice. Furthermore, the average life span, maximum life span and 50% death time of the fruit flies treated with cultured C. militaris were markedly prolonged. The results suggest that the cultured C. militaris growing on pupa of silkworm possesses anti-oxidation and delay senescence activity.***

Keywords: *Cordyceps militaris*, Senescence delay, Anti-oxidation

Introduction

Cordyceps, one of the most valuable traditional Chinese medicines, consists of the dried fungus *C. sinensis* growing on the larva of caterpillar. It is also known as ‘‘summer-grass and winter worm’’ because of its appearance in different seasons. The parasitic complex of the fungus and the caterpillar is found in the soil of a prairie at an elevation of 3,500 to 5,000 meters. It is commonly used in China for over two thousands years to improve the function of kidney and lung for the treatment of fatigue, night sweating, hyposexualities, hyperglycemia, hyperlipidemia, asthenia after severe illness, respiratory disease, renal dysfunction and renal failure, arrhythmias and other heart disease, as well as liver disease (Zhu *et al*., 1998). Recent studies have demonstrated its multiple pharmacological actions in potentiating the immune system (Xu *et al*., 1992) and the antitumor activity (Chen *et al*., 1997). The anti-oxidation activity of *Cordycepes* was also reported and it was indeed used commonly in China for preventing aging and improving physical performance (Yu and He, 1998; Zhu *et al*., 1998).

However, the natural *Cordyceps* (Wild *C. sinensis*) is rare and very expensive. In China, the life cycle of *Cordyceps* has been extensively examined with the aim of developing techniques for isolating fermentable strains of *C. sinensis*. To date, several mycelial strains have been isolated from natural *Cordyceps,* and they could be manufactured at a large scale by fermentation technology (Yin and Tang, 1995). The mycelial fermentation products have

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been demonstrated to have a stronger pharmacological efficacy than the natural *Cordyceps* (Yu and He, 1998).

In addition, *C. militaris*, alias North aweto, is a typical species of *Cordyceps* family. *C. militaris* has been considered as a substitute of *C. sinensis* because there is no significant difference in the chemical composition and physiological function between *C. sinensis* and *C. militaris* (Pang *et al*., 1996; Gong *et al*., 1997). In order to evaluate the pharmacological effects of *C. militaris*, the antiaging effect of *C. militaris* growing on the pupa of silkworm *Bombyx mori,* was investigated. The current study examined its effects of *C. militaris* on the content of lipofuscin, lipid peroxidation, the activity of SOD (Superoxide dismutase) and GSH-Px (Glutathione peroxidase) in senile mice and the life span of *Drosophila melanogaster*.

Materials and Methods

Cultured *C. militaris*

The *C. militaris* growing on silkworm pupa were obtained via artificial cultivation as described previously (Gong *et al.*, 1994). In brief, the silkworm pupa (Breed Su5 × Su6) inoculated with fungi *C. militaris* were incubated for 40 days under imitating naturally ecological environment of the aweto (20 – 22 □, relative humidity ≥ 95%, natural light). The cultured *C. militaris* was dried at 60 □ and ground into powder.

Mice preparation

Male Kunming mice at 10 months old were purchased from Animal Center of Chinese Medical Science Academy. The significant diversity of the body weights of mice was not showed among all groups with T test ($P < 0.05$).The mice were divided into three experimental groups randomly and were perfused with cultured *C. militaris* at doses of 0.05, 0.1, 0.3 g/kg/day for 50 days, respectively. Control group was treated with distilled water only.

Determination of lipofuscin

The content of myocardium lipofuscin was measured according to the method of Chen (1996) after mice were sacrificed by decapitation. Myocardium lipofusin was extracted with chloroform and methanol mixture (2:1) and measured using spectrophotometer at 360 nm of excitated wavelength and 450 nm of emission intensity. A solution of 0.1 μg/ml of quina in 0.1 M sulfuric acid and the mixture of chloroform and methanol (2:1) were used as the standard and blank control, respectively. The content of lipofuscin was expressed as μg/g of tissue and calculated as follows: myocardium lipofuscin content (μg/g) = **Error!**× CQ × **Error!**; where SFI, BFI and QFI were the fluorescence intensity of sample, blank and standard control, respectively. CQ was the concentration of quina; V was the volume of homogenate; W was the weight of sample.

Determination of superoxide dismutase (SOD) activity

Ten percent of liver tissue homogenate was prepared with Tris-HCl buffer (0.1 M, pH 8.2) and separated by centrifugation at 13,000 rpm for 10 min at 4 □. The supernatant was used for the measurement of SOD using the enzymatic method as described previously (Marklund and Marklund, 1974). In brief, the inhibition of auto-oxidation of pyrogallol in alkaline (pH 8.2) was measured as a function of time. The rate of inhibition was determined and 50%

inhibitory concentration was calculated. The amount of enzyme required to obtain 50% inhibition was considered as one unit of SOD activity.

The stock pyrogallol solution (45 mM) was stored at 25 □. The assay mixture contained 4.5 ml of Tris-HCl buffer (0.1M Tris-HCl, 1mM EDTA-Na_2, pH 8.2) and 0.5 ml of the liver supernatant. The blank contained 4.5 ml of assay buffer and 0.5 ml of water. The absorbance of each sample was measured at 325 nm before addition of pyrogallol. The increase in absorbance was measured every 30 sec for 4 min. SOD activity was expressed as U/mg liver.

Lipid peroxidation

Malondialdehyde (MDA) production was used as an index of lipid peroxidation. It was determined by the thiobarbituric acid (TBA) assay of Mihara and Uchiyama (1978). Ten percent of liver homogenate was prepared with the solution (pH 7.4) containing 0.15 M KCl and 5 mM Tris-maleate. One ml of homogenate was mixed with 2.0 ml TCA-TBA (0.335% TBA in 50% trichloroacetic acid) and then was separated by centrifugation at 1,500 rpm for 10 min. The supernatant was heated in a boiling water bath for 8 min, and cooled down to room temperature. The absorbance of the sample was measured at 535 nm. All values were expressed as pmoles MDA/mg liver.

Determination of glutathione peroxidase (GSH-Px) activity

The activity of glutathione peroxidase (GSH-Px) was determined by quantifying the rate of oxidizing reduced glutathione (GSH) to oxidized glutathione (GSSG) by hydrogen peroxide (Mills, 1959). The reaction mixture contained 0.4 ml of 1 mM GSH in 0.4 M phosphate buffer (pH 7.0), 0.4 mM EDTA, 0.5 % of 0.01 M sodium azide and 0.4 ml of sample (A mixture of 10 µl blood and 1ml distilled water). After 10 min of incubation at 37 □, 0.2 ml of prewarmed hydrogen peroxide (1.5 mM) was added and incubated for another 3 min. It was then mixed with 4.0 ml of meta phosphoric acid precipitating solution (1000 ml of solution contains 16.7 g of HPO_3, 0.5 g of EDTA and 280 g of NaCl) and centrifuged at 3,000 rpm for 10 min to obtain a protein free filtrate. The GSH in the protein free filtrate was then determined by mixing 2.0 ml of filtrate with 2.5 ml of 0.4 M Na_2HPO_4 and 0.5 ml of 5,5' dithiobis - (2 - nitrobenzoic acid) (DTNB) reagent (DTNB: 0.4mg/ml, sodium citrate: 1%). Absorbance of this solution was measured at 412 nm. A blank was carried through the incubation simultaneously with the samples since non-enzymatic GSH oxidation by hydrogen peroxide occurs during incubation. An enzyme unit of activity was defined as a decrease in 1 mM GSH per min after the decrease in 1 mM GSH per min of non-enzymatic reaction was subtracted. GSH-Px activity was then expressed as U/mg liver.

Test on *Drosophila melanogaster* life

One control and three treatment groups were carried out. The control diet contained 10% corn flour, 10% brown sugar, 1.5% agar, 0.3% benzoic acid, 1% dried yeast powder, and 77% water; pH 7.0). The treatment diets contained 0.2%, 1.0% and 5.0% of the cultured *C. militaris*, respectively. *D. melanogaster* were purchased from Life Science College of Peking University. Eight hr after hatching, the *D. melanogaster* adults were collected and narcotized with ether. Each group had 100 male fruit flies and 100 female fruit flies and they were divided into test tubes of 25 each, respectively. The flies were kept at 25 ± 1 □ and the survived and died fruit flies were counted every day. The average life span, maximum life span and half death time were calculated.

Results and Discussions

Fatty acids are important components of biological membranes, in which they serve as building blocks. The unsaturated fatty acids, in particular, impart desirable properties upon the fluidity of membranes. However, these fatty acids are sensitive to oxygen induced damage mediated by lipid peroxidation, and thus may lead to a decrease in the membrane fluidity and disrupt membrane structure and function (Machlin and Bendich, 1987; Slater *et al*., 1987). The amounts of malondialdehyde (MDA) and lipofusin produced in tissues were used as indexes of lipid peroxidation. To evaluate the anti-oxidation effect of the *C. militaris* growing on the pupa of silkworm *Bombyx mori*, lipid peroxidation in the liver and lipofusin content in myocardium were assessed in senile mice treated with cultured *C. militaris* at different doses for 50 days. Table 1 shows the results of the effects of cultured *C. militaris* on MDA level in the senile mice liver, there was no difference observed in the content of liver MDA among the senile mice treated with the cultured *C. militaris* at the different dosage and control. However, the contents of myocardium lipofusin were reduced by 22%, 13%, and 12%, respectively, in the senile mice treated with the cultured *C. militaris* at doses of 0.05, 0.1, and 0.3 g/kg/day, respectively, as compared with control mice.

Generation of free radical molecules can lead to damage or destruction of a variety of tissues. Consequences of excessive reactive oxygen species are lipid peroxidation, oxidation of proteins and damage to DNA (Gotz *et al*., 1994). Generally, Cells are equipped with anti-oxidants for the prevention of free radical damage. For example, GSH-Px and SOD, along with other non-enzymatic anti-oxidants, serve as detoxifying system to prevent cell damage. Anti-oxidant enzymes play a pivotal role in preventing oxidant-induced cell damage. Therefore, the effects of *C. militaris* on liver SOD and blood GSH-Px were investigated in senile mice which were perfused with cultured *C. militaris* at the different doses for 50 days. In comparing with the untreated group, SOD activity was increased by 16□ ($P < 0.01$), 19□ ($P < 0.01$), and 28□ ($P < 0.001$), respectively, in mice treated 0.05, 0.1, 0.3 g/kg/day (Table 3). However, no significant difference was observed in GSH-Px activity (Table 4). There was no significant difference in body weight among the different treatment groups and control group (Table 5).

It has been suggested that free radical damage to cell leads to the pathological changes associated with aging, and the improved antioxidant status may have antiaging and postponing senescence effects (Horwitt, 1986; Packer, 1995; Halliwell, 1996). *Cordycepe* has been commonly used an agent for anti-aging and improving physical performance (Yu and He, 1998; Zhu *et al*., 1998), which are thought to be a result of anti-oxidation activity of *Cordycepes* (Yamaguchi *et al*., 2000; Li *et al*., 2003; Wang *et al*., 2004). In the present study, we investigated the antiaging function of the cultured *C. militairs* growing on the silkworm pupa by assessing the life span of *D. melanogaster* treated with *C. militairs*. The average life span, maximum life span and 50% death days of both the male and female fruit flies were markedly prolonged in comparison with the untreated fruit flies (Tables 6 and 7). The average life span, maximum life span and 50% death days were prolonged 12% ($P < 0.05$), 8% ($P < 0.05$), and 8 days for the male fruit flies and 8% ($P < 0.05$), 6% ($P < 0.01$), and 3 days for the female flies, respectively, when the flies were raised with diet containing 1.0% of the cultured *C. militaris*. The results of this study imply that the cultured *C. militaris* has a function of postponing senescence.

In summary, results of the present study showed that the content of lipofusin of myocardium were significantly reduced, and the SOD activity of liver were obviously elevated in the senile mice treated with the cultured *C. militaris* compared to those of the untreated mice, respectively. The average life span, maximum life span, and 50% death days of the fruit flies were significantly prolonged by feeding flies with diets containing the cultured *C. militaris*.

Therefore, we can conclude that the *C. militaris* growing on the silkworm pupa possesses anti-oxidation and delay senescence activity.

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Table 1. Effects of *Cordyceps militaris* growing on silkworm pupa on the content of liver MDA in senile mice

Group	Dose (g/kg/day)	mice	MDA□pmol/mg□	P value
Control	0	12	34.6 ± 7.1	-
Cordyceps militaris	0.05 0.1 0.3	12 12 12	40.4 ± 12.9 40.0 ± 11.3 37.8 ± 8.8	0.1890 0.1730 0.3485

Table 2. Effects of *Cordyceps militaris* growing on silkworm pupa on the lipofuscin content in senile mice myocardium

Group	Dose (g/kg/day)	mice	Lipofuscin (μg/g)	P value
Control	0	12	33.3 ± 4.6	-
Cordyceps militaris	0.05 0.1 0.3	12 12 12	26.0 ± 4.9*** 28.9 ± 5.2* 29.2 ± 4.6*	0.0001 0.0350 0.0375

*: vs control $P < 0.05$□***: vs control $P < 0.001$.

Table 3. Effects of *Cordyceps militaris* growing on silkworm pupa on liver SOD activity in senile mice

Group	Dose (g/kg/day)	mice	SOD (U/mg)	P value
Control	0	12	26.7 ± 2.7	-
Cordyceps militaris	0.05 0.1 0.3	12 12 12	30.9 ± 3.4** 31.8 ± 5.2** 34.2 ± 3.5***	0.0028 0.0067 0.000007

: vs control, P < 0.01□*: vs control, P < 0.001.

Table 4. Effects of *Cordyceps militaris* growing on silkworm pupa on blood GSH-Px activity in senile mice

Group	Dose (g/kg/day)	mice	GSH-Px (U/mg)	P value
Control	0	12	24.4 ± 3.9	-
Cordyceps militaris	0.05 0.1 0.3	12 12 12	24.4 ± 2.4 23.2 ± 2.7 24.2 ± 3.0	0.9899 0.3999 0.8957

Table 5. Effects of *Cordyceps militaris* growing on silkworm pupa on the body weights of mice

Group	Dose (g/kg/day)	mice	Body weight (g)	P value
Control	0	12	46.8 ± 2.9	-
Cordyceps militaris	0.05 0.1 0.3	12 12 12	46.6 ± 2.6 47.2 ± 2.3 46.4 ± 2.8	0.8542 0.7217 0.7001

Table 6. Effects of *Cordyceps militaris* growing on silkworm pupa on the life-span of *Drosophila*

Dosage (%)	Sex	n	Average life span (days)	P value	Maximum life span (days)	P value
0%	♂	100	56±17	-	87 ± 3	-
	♀	100	60±16	-	90 ±3	-
0.2%	♂	100	62±18*	0.0211	91 ± 4*	0.0101
	♀	100	63±18	0.1169	94 ± 3*	0.0150
1.0%	♂	100	63±16**	0.0037	90 ± 4	0.1565
	♀	100	65±19*	0.0442	95 ± 2**	0.0011
5.0%	♂	100	64±16***	0.0008	91 ± 3**	0.0046
	♀	100	66±19*	0.0140	99 ± 3***	3.2×10^{-6}

*: vs control P < 0.05□**: vs cotrol P < 0.01□***: vs control P < 0.001.

Table 7. Effects of *Cordyceps militaris* growing on silkworm pupa on the life-span of *Drosophila*

Group	Sex	n	Average body weight (mg)	50% death time (days)
0%	♂	100	0.83	54
	♀	100	1.00	56
0.2%	♂	100	0.84	58
	♀	100	1.01	58
1.0%	♂	100	0.85	62
	♀	100	1.00	59
5.0%	♂	100	0.85	61
	♀	100	1.01	58

Expression of chemosynthesized *EGF* in *Bombyx mori* and its function per os

By

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Summary: ***Based on the codon bias of silkworm (Bombyx mori), modified human epidermal growth factor (hEGF) gene was chemosynthesized and named as CSEGF whose deduced amino acid sequence is identically same as that of hEGF. Also the recombinant baculovirus Bm-BacCSEGF was generated. In pupa of silkworm, the EGF expression level reached 28.4μg per milliliter pupa hemolymph. Further more, the expressed CSEGF in pupa was directly used to produce the lyophilized pupa powder whose final concentration of EGF reaches 140μg/g, of which obvious function of plerosis per os performed on acute gastric mucosa lesion induced by acetic acid, and it improved the growth of kidney cell of nude mouse, too.***

Keywords: Chemosynthesized *EGF*(CS*EGF*); Gene expression; *Bombyx mori*; gastric mucosa repair

Introduction Human epidermal growth factor (hEGF), identical to human *β*-urogastrone, is a mitogenic polypeptide comprising 53 amino acids and containing three intramolecular disulphide bonds that are required for biological activity (Carpenter & Cohen, 1979).

Experimental evidence supports a role for EGF on gut maturation, because EGF leads to increased growth of the gastric mucosa in neonatal rats, but not to functional maturation (Johnson & Guthrie 1987; Jansson & Skarland, 1990). Anti-EGF antiserum retards the growth of the gastrointestinal tract in newborn mice (Zschiesche,1989). EGF given to adult rats following excision of their salivary glands protects against stress ulceration, presumably either by decreasing acid secretion or by increasing production of cytoprotective factors (Konturek et al, 1991) through polyamine synthesis (Brzozowski et al,1991). In humans, Walker-Smith er al (1985) have reported that the use of EGF in the treatment of children with congenital microvillus atrophy increases small intestinal cell proliferation. In adults EGF expression and its receptor have been demonstrated in many cancers (ToiM et al, 1990; Gullick, 1991), and in the stomach EGF has also been shown to be produced by a novel cell lineage following ulceration, where it may have a cytoprotective and growth promoting role (Wright, 1990).

On aspect of growth and function of the intestinal mucosa, how ever it is influenced by a wide variety of factors, including luminal nutrients, digestive secretions, hormones, GI peptides, pancreaticobiliary secretions, and indigenous bacteria. A variety of studies have shown that EGF is capable of stimulating the growth of several types of cells including intestinal epithelial cells in vitro (Cohen and Taylor 1974; Gospodarowicz et al, 1978; St. Hilaire, 1981)

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and in organ culture (Gallo-Payer and Hugon, 1985; Beaulieu et al, 1985). Still EGF has been reported to inhibit acid secretion, exert a trophic effect on gastroduodenal mucosa, and accelerate gastroduodenal ulcer healing (Türkyılmaz *et al*., 1998; Tarnawski and Jones, 1998; Y. LI *et al*.,1999), and oral EGF is capable of modulation mucosal protein levels and stimulation enterocyte hydrolase expression during repair of the intestional mucosa (Bryon et al, 1993). In addition, recombinant baculovirus are able to infect live insects to produce foreign protein efficiently in insects itself besides expressing target gene in insect cells *in vitro*, so the baculovirus expression systems using nucleopolyhedrovirus (NPVs) have been used to produce many proteins, and applied to express the large-scale production of useful proteins in silkworm (Maeda, 1994). To improve expressing h*EGF*, mainly based on the codon bias of *B. mori* we designed and chemosynthsized a new nucleotide CS*EGF* which encodes identical core fragment of h*EGF*. So it was deduced that CS*EGF* could be efficiently expressed and the expressed amino acid sequence should be identically same as the native hEGF. Although it is known that translated EGF needs not post-modification at protein level to enable its activity, for those proteins need post-modification eukaryotic expression system is superior. Further more silkworm is edible directly in China unlike *E. coli*, when *EGF* is expressed in silkworm it can be used to make drug directly. On the other hand, the more interesting thing is if what we expressed CS*EGF* still has physiological activity when it was given perloral. In following experiments, we expressed CS*EGF* in *B. mori*, and the *B. mori* in which CS*EGF* was expressed was directly lyophilized to feed Sprague-Dawley rats (SD rates) which suffered acute gastric ulcer induced by acetic acid, then those procedures of stomach were examined.

Methods

Genetic manipulation

Plasmid extraction, restriction enzyme digestion, ligation, transformation and identification described by Joseph Sambrook (2001) were used with some modifications.

Synthesized modificational *EGF* (CS*EGF*)

CS*EGF* was artificially synthesized. It based on both he sequence of h*EGF* released from GenBank (Accession number: X04571, core fragment from 3347 to 3505) and the coden preference of B. *mori* (http://www.kazusa.or.jp/codon/) was designed as follow:

(1)AACAGCGACAGCGAATGCCCGTTGAGCCACGACGGCTACTGCTTGCACGACGG
CGTGTGCATGTACATTGAAGCGTTGGACAAATACGCGTGCAACTGCGTGGTGGGC
TACATTGGCGAACGCTGCCAATACCGCGACTTGAAATGGTGGGAATTGCGCTAA
(162).

The nucleotide encodes identical amino acid sequence of h*EGF*. To synthesize feasible CS*EGF* with cutting sites we synthesized 4 primers firstly.

EGF-F1:
GGATCCAACAGCGACAGCGAATGCCCGTTGAGCCACGACGGCTACTGCTTGCAC
G

EGF-R1:
GCACGCGTATTTGTCCAACGCTTCAATGTACATGCACACGCCGTCGTGCAAGCAG
TAGCCG

EGF-F2:
TGGACAAATACGCGTGCAACTGCGTGGTGGGCTACATTGGCGAACGCTGCCAATA
C

EGF-R2:
GAATTCTTAGCGCAATTCCCACCATTTCAAGTCGCGGTATTGGCAGCGTTCGCC

And secondly EGF-F1, EGF-R1 and EGF-F2, EGF-R2, the two pairs of primers were used as primers to make first round PCR respectively. The PCR mixture contained 5μl 10×PCR buffer, 3μl 25mM $MgCl_2$, 1μl 10mM dNTPs mixture, 2μl 25mM either EGF-F1 and EGF-R1 mixture or EGF-F2 and EGF-R2 mixture, 0.5μl Taq polymerase and 38.5μl water. The amplification used was as follows: preheating at 94ºC for 1 min; 30 cycles of denaturation at 94ºC for 1 min, annealing at 55ºC for 1 min, and extension at 72ºC for 1 min; and finally a terminal extension at 72ºC for 10 min. After that the second round PCR was performed. The PCR conditions were the same as described above except for using the mixture of two first round PCR productions as the primers.

Reclaiming the last PCR production from LMP gel and cloning it into pGEM-T vector, then we sequenced 10 clones to screen the right one.

Construction of recombinant baculovirus transfer vector

The CS*EGF* digested with *Bam*H I and *Eco*R I was cloned into pBacPAK-His to generate transfer vector pBacPAK-His-CSEGF.

Forming recombinant baculovirus

BmN cells were cotransfected with pBacPAK-His-CSEG and linear Bm-BacPAK6 DNA cut by *Bsu*36 I through lipofectin. Then recombinant virus Bm-CSEGF which does not express β-galactosidase was obtained by screening white-coloured plaque (Maeda, 1989, Luckow VL and Summers MD, 1988) and PCR identification. Plaque assay was repeated twice to obtain a purified clone. The recombinant virus Bm-CSEGF was propagated on BmN cells.

Collection of samples of the hamemolyph from *B. mori* larvae and pupa

The recombinant virus Bm-CSEGF at 10^6 PFU was used to inject into the fifth instar *B. mori* larvae and pupa. Haemolymphs were collected at 120h post-inoculation, and the haemolymph samples were stored at -20ºC. Distilled water and Bm-BacPak6 were used to make control groups.

Effect of expressed CSEGF in B. mori to kidney cells of nude mouse

Lyophilized powder of CSEGF expressions from *B. mori* pupa was dissolved in appropriate water, and centrifuged at 12000rpm for 10min, then the supernatant was appropriately diluted for later using.

The kidney of 1 day old rat was cut into very small pieces and digested by 1% trypsin for 0.5h at 37ºC. Cultured in 1640 growth media (containing 10% FBS) for two generations, the cells were generated to 1640 sustaining media (containing 2% FBS) which contained 70ng/ml expressed CSEGF. The control group contained nothing of expressed CSEGF.

Plerosis on acute gastric mucosa lesion induced by acetic acid

Preparation of expressed CSEGF for instillation through mouth

To prepare CSEGF instillation solution, 3g lyophilized powders made of *B. mori* pupa in which CS*EGF* was expressed were added to 100ml saline, in which EGF concentration roughly equaled 3μg/ml. The instillation solution was stored at 4ºC.

Animal test model

SD rats (about 300g/per rat) were deprived of food but had free access to tap water 24h before ulcer induction, then 2ml 10mM acetic acid was instilled into stomach through mouth directly. The lesion of stomachs was surveyed by vivisections. All 37 SD rats were randomly divided into 3 groups. The first group, one SD rat was used to describe the normal tissue of stomach. As soon as instilled acetic acid, the rat was vivisected. The second group (control group) consisted of 21 rats, 1ml saline was instilled into the stomach of every rat daily. At 24h and 48h post of acetic acid instillation, three rats were vivisected respectively to observe their pathological progress. At third day, sixth day and ninth day post of acetic acid instillation, every five rats were vivisected to record the scores as the control. The third group had 15 rats, every rat was instilled through mouth with 1ml expressed EGF daily, and at third day, sixth day and ninth day post of acetic acid instillation, every five rats were vivisected respectively (treatment group).

Standards of accumulation score of gastric mucosa leison

Gross observation standard is as follow: 0 point for normal, 1 point for local congestion, 1 point for pit punctate bleeding, 1 point for punctate erosion, 3 points for linear erosion.

Pathological section (stained with HE) observation standard is described as: 0 for normal, 1 for lesion on epithelial surface, 2 for congestion and edema in topper mucous, 3 points for congestion, bleeding and edema in middle/lower mucous, 4 points for deranged gland structure or necrosis in topper mucous, 5 points for deep ulcer or necrosis.

The scores were the accumulation of the points.

Results

Synthesized CSEGF and hEGF

The synthesized CS*EGF* and h*EGF* are described as follow:

CS*EGF* (1) AACAGCGACAGCGAATGCCCGTTGAGCCACGACGGCTACTGCTTGCAC

h*EGF* (1) AATAGTGACTCTGAATGTCCCCTGTCCCACGATGGGTACTGCCTCCAT

CS*EGF* (1) GACGGCGTGTGCATGTACATTGAAGCGTTGGACAAATACGCGTGCAAC

h*EGF* (1) GATGGTGTGTGCATGTATATTGAAGCATTGGACAAGTATGCATGCAAC

CS*EGF* (1) TGCGTGGTGGGCTACATTGGCGAACGCTGCCAATACCGCGACTTGAAA

h*EGF* (1) TGTGTTGTTGGCTACATCGGGGAGCGATGTCAGTACCGAGACCTGAAG

CS*EGF* (1) TGGTGGGAATTGCGCTAA

h*EGF* (1) TGGTGGGAACTGCGCTAA

The difference between nucleic acid of CS*EGF* and h*EGF* reaches 20%. Both CS*EGF* and h*EGF* encode same amino acid:
NSDSECPLSHDGYCLHDGVCMYIEALDKYACNCVVGYIGERCQYRDLKWWELR.
But as we desired the optimized CS*EGF* should be expressed in *B. mori* much efficiently.

Screen of recombinant virus Bm-Bac-CSEGF and identification of expression products

pBacPAK-His-CSEGF and Bm-BacPAK6 linearised by *Bsu* 36 I cotransfected BmN cells. Plaque assay was used to screen recombinant virus, and then PCR identification was taken to amplify the fragment from total DNA of infected cells. The size of the fragment from infected cells is as same as it from transfer vector (Fig. 1).

SDS-PAGE analysis of *B. mori* hemolymph infected by recombinant virus at 120h post infection exhibits that there is a protein at a size about 10kDa which is theoretically similar to the size of EGF, but no band was found from *B. mori* hemolymph infected by wild virus (Fig.2), which means the exterior gene CS*EGF* was successfully expressed in *B. mori.*

ELISA detections

The recombinant protein CSEGF was highly expressed in *B. mori* larva at 28.4μg/ml at 120h postinfection by ELISA detection (Fig.3). In *B. mori* pupa at 72h, 96h and 120h postinfection, the recombinant preotein CSEGF were detected by ELISE, and the concentration of CSEGF were 0.61, 6.2 and 33.07μg/ml respectively (Fig. 4).

Effect of CSEGF expressed in B. mori to the kidney cells of nude mouse

The kidney of one day's old nude mouse was cut into very small pieces and digested with trypsin at 37ºC for 30min. first 3 generations were cultured in 1640 growth medium. And then the medium was replaced by 1640 maintaining medium with 70ng/ml CSEGF expressions. The control group was cultured in 1640 maintaining medium without CSEGF expressions. 24h after the media were replaced, the cells were examined under microscope. The cells growed well in the medium with CSEGF expressions, while the cells almost lead to death in the medium without CSEGF expressions (Fig.5).

Plerosis on acute gastric mucosa lesion of SD rats

The SD rats with acute gastric mucosa leison induced by acetic acid took CSEGF 1ml once a day by peroral continuously for 10 days. Table 1 shows the results of gross observation. During observation period the accumulation scores of control group have a tendency toward increase while the treat group obviously decrease. Among 5 rats treated for 10 days, 3 rats' gastric mucosa lesion could not been seen, that reveled that peroral lyophilization pupa powder containing CSEGF expression products was significantly able to rehabilitate acute gastric mucosa induced by acetic acid.

Table 1. Gross observation of acute gastric mucosa lesion and rehabilitation

Date	No.	Control			Treatment		
		Scores	Total scores	Mean	Scores	Total scores	Mean
DEC 11	1	1	3	1	-	-	-
	2	1					
	3	1					
DEC 12	1	1+1	9	3	-	-	-
	2	1+1					
	3	1+1+3					
DEC 14	1	1+1+3	12	2.4	1	8	1.6
	2	1			1+1		
	3	1+1			1		
	4	1+1			1+1		
	5	1+1			1+1		
DEC 17	1	1+3	13	2.6	1	7	1.4
	2	1+1			1+1		
	3	1+1			1+1		
	4	1+1			1+1		
	5	1+1+1			0		
DEC 20	1	1+1	17	3.4	0	2	0.4
	2	1+1+1+3			0		
	3	1+1			0		
	4	1+1+3			1		
	5	1+1			1		

Table 2. Pathological section observation of acute gastric mucosa lesion and rehabilitation

Date	No.	Control			Treatment		
		Scores	Total scores	Mean	Scores	Total scores	Mean
DEC 11	1	0	4	1.33	-	-	-
	2	1					
	3	1+2					
DEC 12	1	1	7	2.33	-	-	-
	2	1+2					
	3	1+2					
DEC 14	1	1+4	26	5.2	0	8	1.6
	2	1+3+4			0		
	3	1+3			2		
	4	4			3		
	5	1+4			3		
DEC 17	1	1+2+4	27	5.4	0	6	1.2
	2	1+4			0		
	3	1+4			1		
	4	1+2+4			2		
	5	1+2			3		
DEC 20	1	1+3	22	4.4	0	2	0.4
	2	1			0		
	3	1+2+4			0		
	4	2+3			2		
	5	1+4			0		

Pathological sections of control group presented that at the first day of acetic acid induction variety pathological changes could be observed from rats' gastric mucosa, and the aggravations of gastric mucosa lesion lasted. But treatment group exhibited the rehabilitation function of CSEGF while the expression proteins per os were given day by day (Fig.6). Roughly the rehabilitation processes via pathological section observation were similar to that via gross observation, which further confirmed the plerosis in cells level. This results support that oral EGF is capable of modulating mucosal protein levels and stimulating enterocyte hydrolase expression during repair of the intestinal (Petschow *et al*. 1993).

Conclusions

The CS*EGF* expressed in *B. mori* was directly lyophilized, which was used to orally treat acute gastric mucosa of rats. From the experiment results which performed medical function we supposed that expressed CSEGF in *B. mori* could enter rat's blood by taking CSEGF expression, and maintain functional activity. Actually we also examined changes of EGF in rat blood before and after the expressed CSEGF in *B. mori* was feeded. EGF could not be detected before the expressed CSEGF was given and in 4h EGF concentration was 238pg/ml showed by our ELISA examining system, it indicated CSEGF had entered blood. But still we can neither know how and where CSEGF entered blood peroral, nor explain it theoretically. Maybe there existed a kind of molecular mate in *B. mori* which helped expressed CSEGF enter.

Still there exists another advantage of this expression system. The expression product needs not to be purified, and can be directly taken orally.

The experiment results are exciting, once a day we will know the exact pathway where some proteins directly enter blood through digestive system. And this expression system can be used to express more foreign genes which have special medical function for easily taking but injection.

Acknowledgement

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1 2 3

Fig. 1. PCR amplification of DNA of recombinant viruses
1. Bm-Bac-CShEGF; 2. pBacPAK-His-CShEGF; 3. Bm-BacPAK6

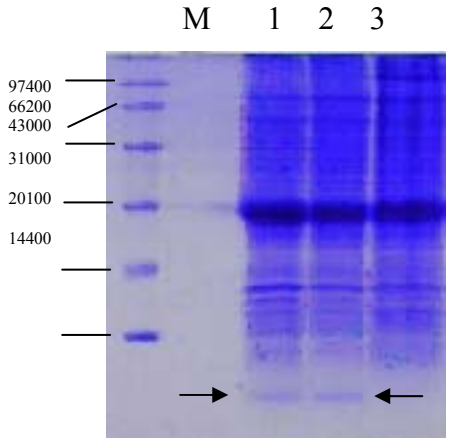

Fig.2. SDS PAGE analysis of hEGF expressed in hemolymph of *B. mori*
M:Marker 1. and 2: hemolymph infected with Bm-Bac-CShEGF; 3: hemolymph infected with BmBacPAK6

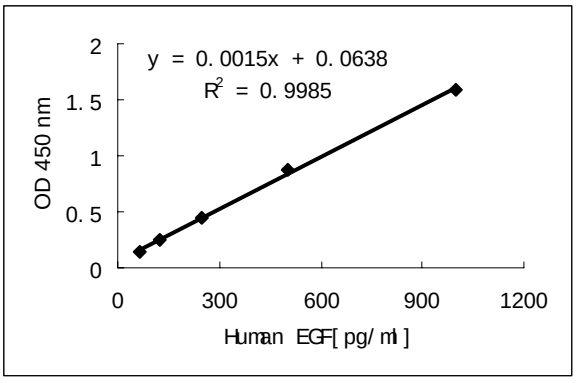

Fig.3. ELISA standard curve of hEGF

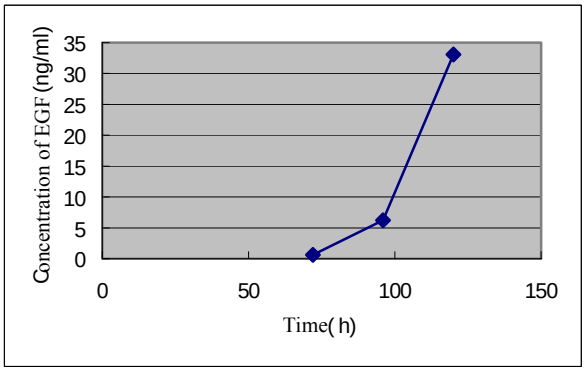

Fig. 4. Expression phase of CSEGF in B. mori pupa

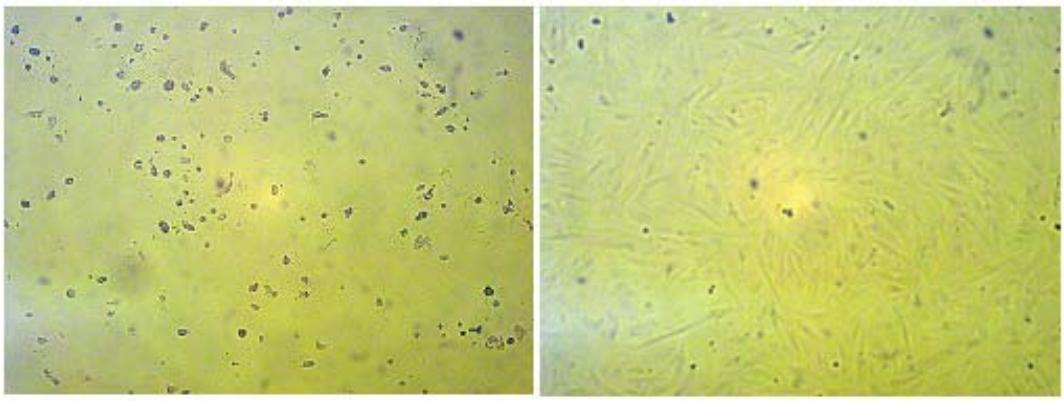

Fig.5. Growth comparison of kidney cells
Left: Without CSEGF; right: with CSEGF

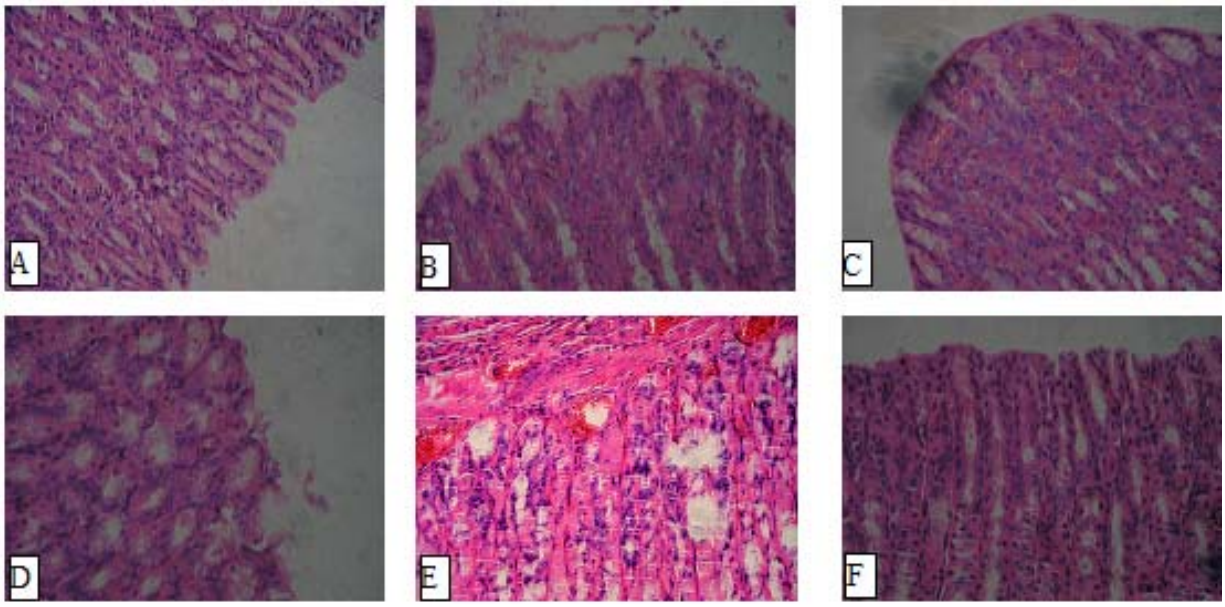

Fig. 6. Gastric mucosa lesion induced by acetic acid
and its rehabilitation by expressed CSEGF per os
A: Normal; B: Mucosa lesion; C: Mucosa edema; D: Mucous grand disorder; E: Mid/lower layer mucosa bleeding; F: Rehabilitation and hyperplasia.

Immunoregulation function of Antifically *Cordyceps militaris* growing on pupae of silkworm *Bombyx mori* for mice

By

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Abstract: ***The immunoregulation function of Cordyceps militaris from pupa of silkworm Bombyx mori was investigated. Results showed that Cordyceps militaris could enhence the phagocytic function of macrophages in abdominal cavity and significantly elevate NK cells activity in mice, but it couldn't increase mice serolysin. The affection of Cordyceps militaris on the levels of DTH in the mice induced by dinitrofluorobenzene and that on mice body weight and the ratio of viscera/body in weight couldn't be observed. The results indicated that Cordyceps militaris have an effect on immunoregulation.***

Key words*:* Bombyx mori Cordyceps militaris Immunoregulation

1. Introduction

Cordyceps militaris (L.) Link, alias North aweto, is the model species of family *Cordyceps*. It has been considered that *C. militaris* could be the substitute of *C. sinensis*, because there is not essential difference between *C. sinensis* and *C. militaris* in chemical composition, and the functions of *C. militaris* were very similar with those of *C. sinensis*[1, 2]. The mass artificial products of *C. militaris* has been produced successful via the pupae of silkworm *Bombyx mori* inoculated with fungi *C. militaris* under imitating natural ecological environment of the aweto. The pharmic analysis showed that the chemical compositions of *C. militaris* growing on pupae of silkworm are similar with those of the wild aweto (*C. sinensis* growing on caterpillar), further more the content of 3'-Deoxyadenosine from *C. militaris*, one active composition of aweo, was as 3 times as that of *C. sinensis*[3], Toxicity study of *C. militaris* from silkworm pupae showed its better safety[4]. Because immunoregulation is the one of important function of aweto[5], we employed mice as experiment animals, so as to survey the immunoregulation function of *C. militaris* from silkworm pupae, the experiment results showed us that *C. militaris* could take great immunoregulation role.

2. Materials and methods

2.1. *C. militaris* growing on silkworm pupae

C. militaris growing on silkworm pupae were obtained via artificial cultivation [3]. The powdered of *C. militaris* from silkworm pupae were used as experiment materials after dried at 60℃.

2.2. Experiment animals

The standart female Kunming mice (certification NO: YIDONG NO:22- 9601017) were purchased from Experiment Animal Center, Medical Inspection Institute of Zhejiang province, the weight per mouse was 20±2 g.

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2.3. Dosages

3 experiment groups were poured 0.17, 0.33, and 1.00 g (*C. militaris*)/kg (mouse), and distilled water was used to treat control group once daily for 30 days.

2.4. Measure of mice serolysin

After the mice were filled with *C. militaris* by orally for 25 days, the suspension for accumulated sheep red blood cells (SRBC) of 0.22% (V/V) was injected to the mice. 5 days later, the serum which had been collected from the mouse was diluted with equal volume physiological saline water continuously. 100μ L of the diluted serum and 0.5% SRBC were added to the well of hemagglutination plate, incubated at 37℃ for 3 hours to observe the degree of hemocyte coagulating, and to measure the potency of antibody.

2.5. Experiment for phagocytosis of mouse abdominal cavity macrophage

The mice were filled with *C. militaris* by orally lasting 30 days, each mouse was injected to abdominal cavity with 1 mL of 20% of red blood cell suspension of chicken, and then, the mice were executed, and injected with 2 mL physiological saline. Being dropped the fluid of abdominal cavity on glass slide and incubated at 37℃, 30 min, it were fixed with acetone∶methanol (1∶1), dyed with Giemsa， followed by microscope inspection. The ratio of phagocytosis and phagocytic index were calculated according to 100 phagocytic cells.

2.6. Mice DTH (delayed type hypersensitivity) experiment induced by DNFB

The mice were filled with *C. militaris* by orally every day, after that 50 μ L dinitrofluorobenzene (DNFB) solution (10 mg/mL) was smeared on the belly of mouse (24 hours before smearing, the hair of mice were depilated, area was about 3 cm×3 cm). 5 days later, 10 μ L of DNFB solution was smeared on the mouse right ear, and 24 houses later. After being executed, the ear was cut off, and the ear flat of 8 mm in diameter was taken with puncher, its weight was measured.

2.7. Detection of activity for NK cell

The spleen was taken out, broken gently with tweezers in Hanks solution, the cell suspension was made. The cells were washed and counted, finally, adjusted the cells density to 5×10^6 cell / mL with full medium RPMI1640 as effector cell. Additionally, the YAC-1 cells (target cell) were washed with Hanks solution for 3 times, and adjusted cell density to 1×10^5 cell / mL with full medium RPMI1640. Putted 100μL cell suspension of target cell and the effector cell respectively into U-type 96 wells plate. In natural release well for target cell, target cell 100μL and medium 100μL were putted into, in the biggest release well for target cell, target cell 100μL and 1% NP40 100μ L were added into; 3 repeat wells in each above-mentioned groups were mounted. The cells were cultured in 5% CO_2 at 37℃ for 4 hours, 100 μL of suspension was taken out from each the well, and putted into flat-bottomed 96 wells plate, 100μL of the mixed substance solution (Lactolithium, 5×10^{-2} mol/L; Nitrotetrazolium blue chloride, 6.6×10^{-4} mol/L ; PMS, 2.8×10^{-4} mol/L, and NAD, 1.3×10^{-3} mol/L) of lactate dehydrogenase (LDH) was added, 3 min later, 30μ L of HCl (1 mol/L) was poured, value of optical density (OD_{490}) was measured, and activation for NK cell was calculated as well.

2.8. Ratio of weight for viscera to body

The mice were filled with *C. militaris* by orally, 1 time every day, for 30 days. Then animals were executed, the weight of thymus gland and spleen were measured to calculate the ratios of weight for thymus gland or spleen to body.

3. Results and analysis

3.1. Effects of silkworm *C. militaris* on the serolysin level of mouse

The mice were infused with different dosage of silkworm *C. militaris* into stomach for 30 days, the serolysin level of mouse was investigated, and the result was showed as Table 1. No significant difference could be detected among the mice treatment with silkworm *C. militaris* among three different dosage groups and the control group in the serolysin level(variance analysis, P>0.05).The result showed the level of antibody of the mice treatment with silkworm *C. militaris* against SRBC were not elevated.

Table 1. Effects of silkworm *C. militaris* on the serolysin level of mouse

Group	Number of animals	Serolysin level
Control	10	174.5±24.3
0.17g/kg	10	191.5±33.8
0.33g/kg	10	176.5±21.6
1.00g/kg	10	185.7±33.7
F		0.76
P		0.52

3.2. Effects of silkworm *C. militaris* on the phagocytic function of mouse abdominal cavity macrophage

After treatment with different dosage of silkworm *C. militaris* for 30 days, the mice´s phagocytic capabilities of mouse abdominal cavity macrophage were investigated. The results were showed as table 2. Ratio of phagocytosis of which mouse abdominal cavity macrophage phagocytize chicken´s red cell elevated when the mice were infused with silkworm *C. militaris* of low, middle high dosage into stomach. The significant difference of the ratio of phagocytosis was revealed comparing with those of control mice (q test, $P < 0.05$), while the Phagocytic index of macrophage of mice treated with silkworm *C. militaris* was not increased obviously.

Table 2. Effects of silkworm *C. militaris* on the phagocytic function of mouse macrophage

Group	Number of animals	Ratio of phagocytosis (%)	Phagocytic index
Control	10	33.9±7.10	0.76±0.24
0.17g/kg	10	48.89±12.07*	1.02±0.40
0.33g/kg	10	53.50±14.48*	1.15±0.42
1.00g/kg	10	39.30±10.69	0.83±0.31
F		6.48	2.64
P		0.001	0.06

*，q Test: Compared with control P<0.05

3.3. Effects of silkworm *C. militaris* on the levels of DTH in the mice induced by DNFB

Effects of silkworm *C. militaris* on the levels of DTH in the mice induced by DNFB were investigated by using ear tumefaction method. The results were showed in table 3. No significant difference could be found in the weight difference between left ear and right ear among three different dosage groups and control group (variance analysis, $P>0.05$). It indicated that the ability of DTH in mice induced by DNFB when the mice were treated with silkworm *C. militaris* had no change, it could be presumed that silkworm *C. militaris* had weak function while its T lymphocyte being stimulated to sensitive lymphocyte with antigen´s stimulability.

Table 3. Effects of silkworm *C. militaris* on the levels of DTH in the mice induced by DNFB

Group	Number of animals	Weight difference between left ear and right ear
Control	10	7.89±2.40
0.17g/kg	10	8.80±2.76
0.33g/kg	10	9.54±2.75
1.00g/kg	10	9.97±3.39
F		1.02
P		0.39

3.4. Effects of silkworm *C. militaris* on the activity of NK cells

The activity of LDH was measured to estimate the activity of NK cells of the mice, the activity of mice NK cells were increased obviously in all groups treated with silkworm *C. militaris*, the significant difference was revealed comparing with those of control mice (q test, $P < 0.05$).

Table 4. Effects of silkworm *C. militaris* on the activity of NK cells

Group	Number of animals	Activity of NK cells
Control	10	26.04±1.87
0.17g/kg	10	45.69±2.15*
0.33g/kg	10	50.15±5.95*
1.00g/kg	10	47.31±2.68*
F		95.22
P		3.5E-17

*, q Test: compared with control $P<0.05$

3.5. Effects of silkworm *C. militaris* on ratio of weight for viscera to body in mice

The ratio of viscera and body weights in mice was showed in table 5, no significant difference was revealed in the ratio of weight for thymus or spleen to body between treatments and control group (q test, $P < 0.05$).

Table 5. Effects of silkworm *C. militaris* on the rate of viscera and body weights in mice

Group	Number of animals	weight ratio of thymus/body (mg/g)	weight ratio of spleen/body (mg/g)
Control	10	1.91±0.42	5.50±1.05
0.17g/kg	10	2.58±0.86	6.40±0.75
0.33g/kg	10	2.95±1.04	5.36±1.20
1.00g/kg	10	2.28±0.93	5.69±2.05
F		2.74	1.17
P		0.06	0.34

3.6. Effects of silkworm *C. militaris* on the body weights of mice

The mice weight were showed as Table 6.No significant discrepancy were revealed on mice weight in initial stage, middle stage and final stageduring experiment, comparing with those control mice.

Table 6. Effects of silkworm *C. militaris* on the body weights of mice

Group	Number of animals	Body weight before treatment	Body weight during treatment	Body weight after treatment
（H_2O） Control	10	19.4±1.5	28.2±2.6	29.4±3.6
0.17g/kg	10	20.0±1.5	27.8±3.1	31.2±3.4
0.33g/kg	10	19.4±0.2	27.0±2.3	28.8±2.4
1.00g/kg	10	20.0±1.7	27.0±2.7	27.1±3.6
F		0.49	2.79	2.66
P		0.69	0.05	0.06

4. Discussions

It is known that there is not essential difference between *C. sinensis* and *C. militaris* in chemical compositions; it implied that the biological functions of *C. militaris* are similar with that of *C. sinensis*. Jiang xiaolu´s researches indicated that *C. militaris* possess antagonism to immunosuppression caused with cytoxan [6]. It had be shown that the level of peripheral blood T lymph cell subgroup CD3, CD4 and CD4/CD8 raised apparently, while those of CD8 declined when hepatitis B patients were cured with silkworm *C. militaris*. Those results showed that silkworm *C. militaris* takes better immunoregulation role[7]. Xu tingwan´s researches reported that extracellular polysaccharidan of an artificial *C. militaris* could improve humoral immunity and raise the serolysin level of mice even its immunity function had been inhibited, which immunity function had been inhibited [8]. Without finding the function of elevating serolysin level of the mice treated by silkworm *C. militaris*. We supposed that silkworm *C. militaris* had weak elevation on antibody level in immunized mice. DNFP is a kind of semiantigen. After the belly of mice was smeared with DNFP, the DNFP combined with the skin protein and become complete antigen, thereby it stimulated T lymphocyte to sensitive lymphocyte and DTH was caused. The function of silkworm *C. militaris* on that the elevation of the ability of DTH in mice caused by DNFB was not revealed in our experiment, it could be presumed that the function of silkworm *C. militaris* was weak on stimulating T lymphocyte to sensitive lymphocyte. After the mice were infused

with silkworm *C. militaris* into stomach, Ratio of phagocytosis of the mice abdominal cavity macrophage was elevated. It showed that the function of macrophage was strengthened, and the ability of nonspecific immunity function was enhanced. NK cell is one of composition of nonspecific immunity in cellular immunity system, it can be regarded as killing cell directly and playing an important role, NK cell can against tumor well, it is the first line of defence for organism antitumor, whose function is prior to that of T cell. Sun´s research showed that the stroma of artificially cultured *C. militaris* can improve the activity of NK cell obviously [9]. Silkworm *C. militaris* elevated the activity of mice NK cell apparently also in our experiment, and we conclude that silkworm *C. militaris* can enhance nonspecific immunity, and play antitumor role.

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RNAi based on the DNA vector inhibiting BmNPV multiplication

By

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Abstract: ***RNAi based on DNA vector is able to inhibit the activity of the gene effectively in a longer period. With the ie-1 promoter, the constructed DNA vector of RNAi transcribed dsRNA in the cell to form hairpin which is the complement of the region from +19~+446 of ie-1 gene of Bombyx mori nucleopolyhydrovirus. Experiments demonstrated the inhibition of the DNA vector against Bombyx mori nucleopolyhydrovirus both in vivo and in vitro, and showed potentially prevention and curing ability of the RNAi technique against Bombyx mori nucleopolyhydrovirus in molecular level.***

Keywords: DNA vector; RNAi BmNPV ie-1

1. Introduction

Depending on dsRNA, RNAi (RNA interference) is the phenomenon of inhibiting the activity of homologous gene which is the complement of dsRNA(Fire, 1998), also one of immune system to prevent genome functionally from invasion of genetic elements such as transposon.and virus (Cogoni, 2000). RNAi commonly exists in organisms, and the phenomenon has been found in protozoa, nematode, fungus, insects as well as mammal. The biochemistry and genetics researches have showed that RNAi consists of initial period and effective period. During initial period dsRNA forms active 21~23nt short interfering RNAs (siRNAs) by the function of RNase III, and the siRNAs combines ribozyme compound to form RNA-induced silencing complex (RISC), which recognizes and degrades complementally homologous mRNA so as to inhibit the activity of corresponding gene during effective period (Hammond, 2001). RNAi has been used in several model animals as a powerful tool and a flexible measure to inhibit virus from multiplication. Sharooky etc.(2002) synthesized the complement siRNA of HBV replicon, found the siRNA might especially inhibit HBV RNA from replication in Huh-7 cell. The siRNAs, complement of core region of HBV genome, was designed by Keisuke Hamasakia etc.(2003) to strongly inhibit hepatitis B virus (HBV) replication and protein synthesis in HuH7, HepG2 cells which seductively indicates the outlook of therapy for hepatitis B. Recent researches have approved that the siRNA could also inhibit HIV multiplication and viral production (Miguel, 2002; Jean-Marc Jacque, 2002). For the reason of an important factor to control the insect populations and being able to express heterologous gene in cells, the insect baculoviruses have been widely concerned. The genome of insect baculovirus is a kind of circular dsDNA and about 130kb in length. Several genomes of insect baculoviruses have been sequenced completely, the functions of most part genes have been ascertained as well. The application of RNAi on the field of baculovirus molecular biology is just starting. It was documented by Victo Julian Valdes (2003) that the dsRNA, which is the complement of both in vitro transcription

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essential duplication gene *ie-1* and *gp*64, inhibited *Autographa californica* nucleopolyhedrovirus (AcNPV) strongly from multiplication, and the inhibition effect of the RNAi corresponding to ie-1 dsRNA is prior to that of gp64. The siRNA of iap3 gene of *Orgyia pseudotsugata* nucleopolyhydrovirus (OpNPV) inhibited the function of iap3 gene very well (John, 2003). All of those exhibit the huge potential of RNAi technique on inhibition of duplication of baculoviruses and functional study of the genes. Silkworm nuclear polyhedrosis infected by *Bombyx mori* nucleopolyhydrovirus (BmNPV) breaks out frequently during raising silkworm and causes poor harvest. So far there is no effective method to inhibit the virus in vivo, and RNAi technique may give a new efficient molecular method to cure nuclear polyhedrosis, but there is still no involved report in inhibition duplication from BmNPV. The effect by introducing siRNA synthesized or transcripted in vitro to the cells has the durative limitation, the recent development of RNAi technique based on DNA vector revealed that the vector could instantly or stably produce target dsRNA in cells via the availability of RNA polymerase III promotor, and the sustaining dsRNA can inhibit the activity of target of the gene in a longer period (Brummelkamp, 2002). We constructed the RNAi DNA vector which transcripted the complement dsRNA of ie-1 gene of BmNPV in cells to explore the feasibility of inhibiting BmNPV from multiplication. As the expectation, the DNA vector with RNAi inhibited BmNPV from multiplication effectively both in vivo and in vitro.

2. Materials and methods

2.1. Materials

BmNPV, Bm cell, *E*.coli TG1, pGEM-3Zf(+), pBluescript SK II(+) came from Agricultural School of Science and Technology SuZhou University; *Eco*RI, SmaI, BamHI, EcoRV, Taq DNA polymerase, ligase were booked from TAKARA Ltd; TC-100, fetal bovine serum (FBS), lipofectin are the products from Gibco BRL company; silkworm strain, Haoyu and Qiufeng×Baiyu were donated by Xushuguan silkworm eggs reproduction farm of Jiangsu province (China).

2.2. BmNPV propagation

Bm cell(10^6/ml) was inoculated by 5μl solution of BmNPV, incubated at 27°C, 5 days later the supernate was collected as virus storage solution.

2.3. Extraction of BmNPV DNA

BmNPV DNA was extracted referring to Maeda (1985),

2.4. Primers

According to the ie-1 gene sequence of *Bombyx mori* nucleopolyhedrovirus T_3 strain (accession number: L33180) on GenBank, the primer P1:5′-TTCGAATTCGATTTGCAGTTCGGGAC-3′ (the A of initiation codon ATG of ie-1 was defined as +1, equal region of ie-1 from –632~-616), P2: 5′-TTCGGATCCAACGCGTCGTACACCAG-3′ (equal the region of ie-1 from +19~+35), P3: 5′-ATCCCGGGACCACACTTTGTGAATC-3′ (equal the region of ie-1 from +430~+446), P4: 5′- ACGATATCACCACACTTTGTGAATC-3′ (equal the region of ie-1 from

+430~+446) were synthesized respectively by Shanghai Shangon Ltd. Underline means the cut site of *Eco*RI, *Bam*HI, *Sma*I, *Eco*RV respectively.

2.5. PCR amplification

50μl reaction mixture PCR contained 1μl virus DNA(20ng/μl), 5μl 10×PCR buffer, 5μl $MgCl_2$(25mmol/L), 0.5μl each primer(2μmol/L), 2μl 4dNTPs(2.5mmol/L for each), 1μl Taq DNA polymerase(5U/μl) and 35μl ddH_2O. The amplification program used was as follow: preheating at 94°C for 4 min, 35 cycles of denaturation at 94°C for 50 S, annealing at 50°C for 50 S, and extension at 72°C for 50 S, and finally a terminal extension at 72°C for 10 min. PCR product was purified by using DNA Clean-up Kit (V-gene biotech company).

2.6. Cloning

Digestion, ligation, transformation and plasmid extraction were performed according to Sambrook(1989). The clone strategy was illustrated in Figure 1. The amplification of ie-1 from the region of –632~+446 with primers P1/P3 was reclaimed, and cut by *Eco*R I/*Sma* I, then cloned it to pBluescript SK□(+) to form pSKIE-2 vector. The RNAi $pSKIE_{13}$-IE_{24} vector was produced by reclaiming the amplification of ie-1 from the region of +19~+446 with primers P2/P4, cutting it with BamH I/EcoR V and cloning into the sites between *Eco*R I and *Sma* I of pSKIE-2 vector. After the $pSKIE_{13}$-IE_{24} vector being amplified with primer P2, cutting by *Bam*H I, pGEM-3Zf-IE-3 vector was constructed by cloning it into the site of pGEM-3Zf(+) vector.

2.7. RNAi inhibiting the virus from duplication and multiplication

2.7.1. Plaque assay

2μg $pSKIE_{13}$-IE_{24} DNA with 4μl Lipofectin was used to transfect Bm cell(10^6/ml) according to reference (Possee, 1992), 12h later, the cell was inoculated with the 105 times diluted virus storage solution, and washed 2 times in 4h with TC-100 (serum free), then coved with TC-100 medium containing 2% lower melting point agarose and 10% FBS. The plaque was counted at 5 d post-incubation at 27°C, the control group was without $pSKIE_{13}$-IE_{24} DNA during the experiment.

2.7.2. Viral titer was detected with vive pupa

2μg $pSKIE_{13}$-IE_{24} DNA with 4μl Lipofectin was used to transfect Bm cells (10^6/ml), 12h later, the cell was inoculated with 1μl virus storage solution. The supernatant of the cell medium was collected at 5 d post-inoculation, the control group was treated with double distilled water without $pSKIE_{13}$-IE_{24} DNA. The supernatant of two groups were defined as BmNPV-RNAi-1 and BmNPV-CK-1 respectively, both were diluted 10 and 100 times respectively. Hurt inoculation with $4^{\#}$ insect needles bedewed with each diluted virus solution was performed to Haoyu pupaes at the 2^{nd} day of pupal stage, respectively. Incubated at 25°C for a week, the hemolymph of the pupaes was taken out, and microscope examination was used to survey polyhedron so as to judge whether the pupaes had been infected.

2μg $pSKIE_{13}$-IE_{24} DNA with 4μl Lipofectin was used to transfect Bm cells (3×10^6/ml), fortnight later, the cells were inoculated with 5μl 10^5 times the diluted virus storage solution. The supernatant of the cell medium was collected at 3 d post-inoculation. It was defined as BmNPV-RNAi-2. So did pGEM-3Zf-IE-3 DNA as BmNPV-CK-2. Both were diluted 10 and 100 times respectively. Every 5μl diluted virus was injected into pupaes (Qiufeng×Baiyu)

respectively. Incubated at 25°C for 5 days, individual pupa's hemolymph was surveyed under microscope. Polyhedron was still the signal of being infected.

2.7.3. Effect of RNAi inhibition by different viral titer.

2μg $pSKIE_{13}$-IE_{24} DNA with 4μl Lipofectin was used to transfect Bm cells (3×10^6/ml), at 24h post-infection, the cells were seeded to 96-well plate (200μl/well). The virus storage solution was diluted serially into 7 grades from10^{-3}~10^{-9}. Every 10μl diluted virus solution was taken to inoculate the cells in a well individually. Every inoculation had a repetition. After 5 days in culture at 27°C, the concentration of the polyhedron was surveyed on blood cell counting chamber.

2.7.4. In vitro inhibition effect of pSKIE13-IE24 to viral propagation

12h post-injection in $pSKIE_{13}$-IE_{24} nude DNA with 0.05μg/pupa, the 2 days' old pupa (Huayu) was inoculated with 4# insect needles bedewed with the virus storage solution. At 25°C one week post-inoculation, the haemolyphm from the pupaes was taken out to check infective effect depending on polyhedron under microscopy examination. Instead of $pSKIE_{13}$-IE_{24}, distilled water was used to the control.

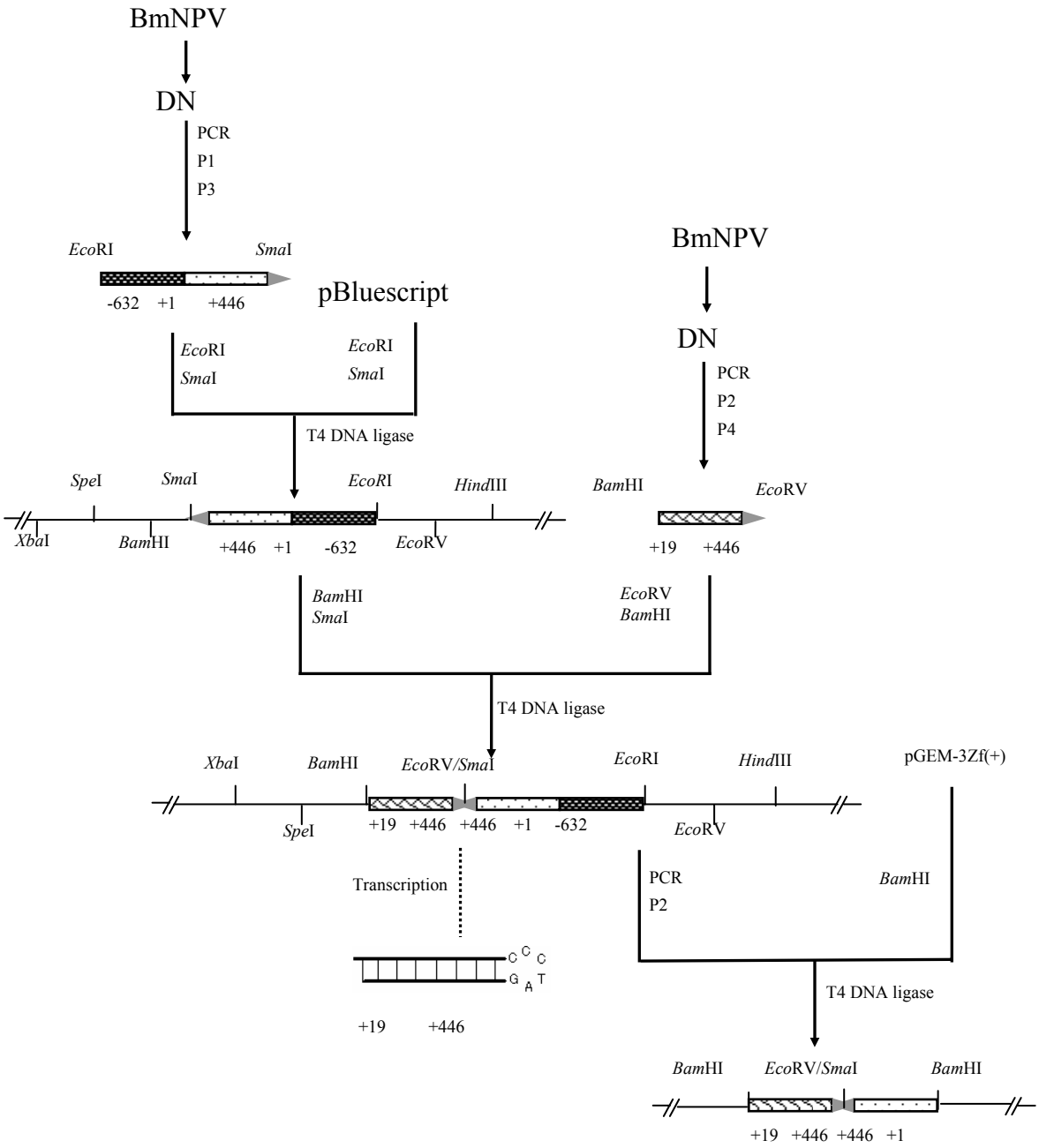

Fig. 1. Constructional strategy of RNAi DNA vector

3. Results and Analysis

3.1. Effect on viral plaque number after cells being transfected with pSKIE13-IE24

At 12h post-transfection with pSKIE$_{13}$-IE$_{24}$ DNA, the cells were inoculated with virus. The plaques were quantified in 5 days. Only one plaque was found in the treated group, and 9 plaques in the control. Experiments represented that after being transfected with pSKIE$_{13}$-IE$_{24}$ viral multiplication and propagation had been inhibited and reducing viral reproduce, which finally resulted less plaque from forming.

3.2. Examination of viral titer in vive pupaes

12h post-transfection with pSKIE$_{13}$-IE$_{24}$, the cells were inoculated with virus. The viral titer was detected with the pupaes in 3 days. Figer1-1 shows the results. The incidence rate was

much lower compared with the control that represented that viral multiplication was strongly inhibited also in cells transfected with $pSKIE_{13}$-IE_{24}. Inoculated virus at fortnight post-transfection with $pSKIE_{13}$-IE_{24}, the vive pupaes was assayed to detect the viral titers in 3 days. Table 1-2 shows that the cells at 2 weeks post-transfected with $pSKIE_{13}$-IE_{24} maintained the inhibition against viral multiplication and propagation.

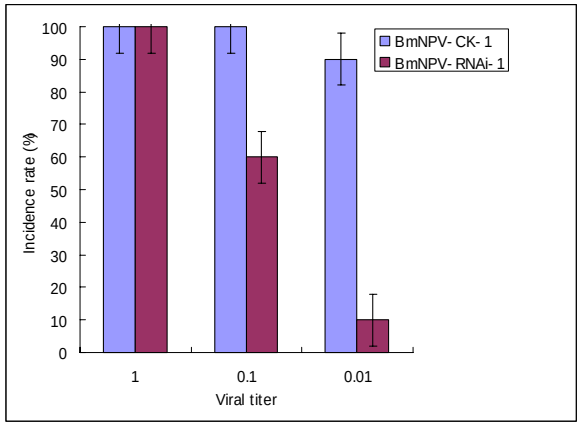

Fig. 1.1. viral titer detection in vive pupaes

2μg $pSKIE_{13}$-IE_{24} DNA with 4μl Lipofectin was used to transfect Bm cells (10^6/ml), 12h later, the cell was inoculated with 1μl virus storage solution. The supernatant of the cell medium was collected at 5 d post-inoculation, the control group was treated with double distilled water without $pSKIE_{13}$-IE_{24} DNA. The supernatant of two groups were defined as BmNPV-RNAi-1 and BmNPV-CK-1 respectively; both were diluted 10 and 100 times respectively. Hurt inoculation with $4^{\#}$ insect needles bedewed with each diluted virus solution was performed to Haoyu pupaes at the 2^{nd} day of pupal stage, respectively.

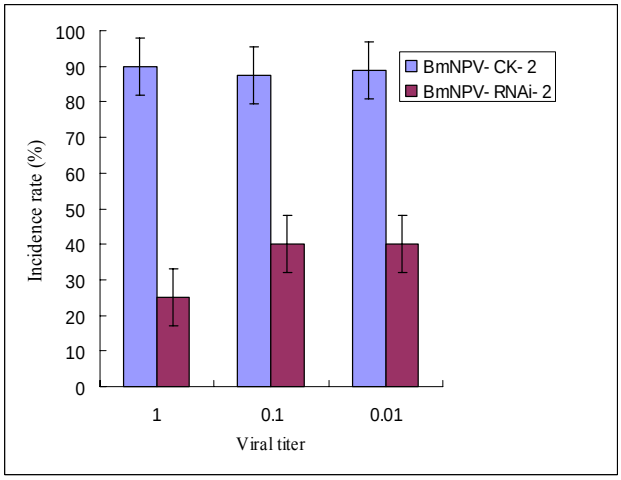

Fig. 1.2. viral titer detection in vive pupaes

2μg $pSKIE_{13}$-IE_{24} DNA with 4μl Lipofectin was used to transfect Bm cells (3×10^6/ml), fortnight later, the cells were inoculated with 5μl 10^5 times the diluted virus storage solution. The supernatant of the cell medium was collected at 3 d post-inoculation. It was defined as BmNPV-RNAi-2. So did pGEM-3Zf-IE-3 DNA as BmNPV-CK-2. Both were diluted 10 and

100 times respectively. Every 5μl diluted virus was injected into pupaes (Qiufeng×Baiyu) respectively.

3.3. Effect of RNAi inhibition against viral titers

Respectively transfected cells with pSKIE$_{13}$-IE$_{24}$ and pGEM-3Zf-IE-3 DNA were inoculated in virus with different titer. Table 1 showed the concentration of polyhedron in cell culture medium at 5 d post-inoculation. When cells were inoculated with virus which the titer is lower than 10-6, hardly formed polyhedron.

Table 1. The effect of RNAi inhibition with viral titers

Viral titer	The concentration of polyhedron (polyhedron/mm)	
	pSKIE$_{13}$-IE$_{24}$	pGEM-3Zf-IE-3
10^{-3}	150	450
10^{-4}	125	200
10^{-5}	63	188
10^{-6}		125
10^{-7}		150
10^{-8}		100
10^{-9}		125

3.4. Effect of pSKIE13-IE24 inhibition against viral propagation in vivo

Injected in pSKIE$_{13}$-IE$_{24}$ with 0.05μg/pupa and inoculated with the virus storage solution in a week, the incidence rate of pupaes (Haoyu) was 84.6%, meanwhile which of control was 100%. It represented that pSKIE$_{13}$-IE$_{24}$ inhibited viral propagation and multiplication not only in cultured cells but in the body of pupa also.

4. Discusion

Silkworm nuclear polyhedrosis is a common infective disease in raising silkworm. The main strategy to prevent silkworm nuclear polyhedrosis is absolute disinfection, eliminating source of infection, strengthening management through whole procedure, enhancing resistance of silkworms against viruses and selecting species of high resistance against viruses, but no way to cure if silkworms gets infection. Several research evidences demonstrated that the viral produce could be inhibited in cultured cells by RNAi technique. Victor Julian Valdes (2003) initially documented the dsRNA could inhibited the viral multiplication strongly in the body of animals; therefore the possibility of molecular treatment for silkworm nuclear polyhedrosis is existing. Our studies summarized that the constructed RNAi DNA vector where the sequences of ie-1 from +19~+446 were combined in a reverse tendem could transcribe hairpin RNA under the promoter of ie-1 gene and inhibit BmNPV from duplication in *vivo* and in *vitro*. It has been approved that long dsRNA had the same RNAi effect of short dsRNA, but in mammals only did dsRNA of 21~23nt exert RNAi effect (Hammond, 2001), the dsRNA longer than 30nt might result nonspecific expression inhibition (Manche, 1992). Victor Julian Valdes' study (2003) illustrated that the long homologous dsRNA of ie-1 gene inhibited AcNPV in cells from duplication. Our study supported that the long hairpin dsRNA(>325bp) of ie-1 gene transcribed in cell based on DNA vectors inhibited BmNPV in cells from duplication. The higher performance of inhibition against lower viral titer has been showed in our experiments, the lower efficiency of inhibition against higher viral titer might be resulted from what inhibition efficiency of RNAi was covered up. It implied the increasing copies of

dsRNA might enhance the inhibition virus from multiplication; although the silencing effects of in vitro synthesized dsRNA are generally limited in time and space, the RNAi technology based on DNA vector can produce siRNA stably in cells, which might provide the opportunity to silence gene in a longer period (Brummelkamp, 2002). The experiment result of that fortnight post-transfection with $pSKIE_{13}$-IE_{24} in cells the duplication of BmNPV still had been inhibited strongly also showed that $pSKIE_{13}$-IE_{24} transcribed dsRNA in cells in a longer period. Normally in mammal cells, the candidate promoter is that of RNA polymerase III when the RNAi research based on DNA vector was carried out. We used immediate early promoter which exerts promoter activity in host cells dispensing with viral factors to construct RNAi DNA vector $pSKIE_{13}$-IE_{24}, and the vector inhibited the virus from propagation well in cells which approved that ie-1 promoter can be used as the promoter of constructed RNAi DNA vector.

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Influence of the temperature factor on modificative changeability of nucleic acids and orientation of metabolism process change during silk worm egg development

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Abstract: ***According to modern notion nucleic acids play a conducting role in realization of specific biosynthesis of macromolecules, provision of morphogenesis processes and hereditary information. Study of nucleic acids role in regulation of adaptation process in ontogeny, during growth and development is of great interest. Now data on changeability of nucleic acids exchange and the role of them in cellular macromolecules metabolism and adaptation process of animals is not complete. As to insects and in particular silk worm: information is absent at all.***

The DNA metabolism speed in silkworm egg embryonic development subjected to high-temperature influence, in process of development increases by 17,6 %, in non-fartilized eggs on the fifth day after egg-laying on 33 %, in the diapause period it is unsignificant on 5,2 % and at a embryogenesis stage in process of germ development of at hatching has made 53,7% accordingly. In the second phase of stressful reaction (in 48 hours after thermal loading) the specific activity of silk worm egg DNA in process of its embryonic development is reduced in comparison with the control. Only at silk worm hatching the reduction of DNA metabolism speed was not revealed. The DNA activity at this stage and in 48 hours after stressing action remained still a little above (on 23,6 %), than with the control.

The RNA metabolism speed in embryonic development of silk worm eggs shows similar change, at an exchange of DNA under the influence of high temperature (table 1), only intensity of a RNA exchange on different stages of silk worm egg development surpasses a DNA exchange. At non-fertilised egg it surpasses on 2,5 times, diapausing silk worm egg - 2,4 times, and at hatching the difference increases in 2,37 times accordingly. The DNA synthesis goes from the very beginning of nucleus splitting.

The RNA specific activity in the second phase of stressful reaction depending on silk worm egg development term specifically decreases. For example, if at non-fertilized silk worm egg the specific RNA activity at influence of high temperature reduces on 13,1 %, after its fertilisation on the third day it achieves 16,5%, and in the diapause period on the fifth day the RNA activity inhibits only on 6,12 %.

Further after removal of diapause and next days of silk worm egg embryonic development the braking of RNA synthesis considerably increases, on the 8th day it achieves 32,4 % accordingly.

The consideration of RNA metabolism speed under stress during hatching out of eggs, showed similar change in an exchange of this nucleic acid with DNA, the intensity of RNA

exchange is similarly increased by 16,4 %. The specified changes of nucleic acids activity on different terms of silk worm egg development at high-temperature influence are connected, apparently, to the chemical thermoregulation mechanism, in close contact with change of power processes in embryonic cells owing to active participation of its separate composite parts in progressive organism's thermoproduction decrease. The general nucleic acids concentration under high temperature influence from one stage of development to another is essentially reduced, on the third day after fertilisation is reduced on 22,6 % accordingly. At a diapause stage changes in metabolism speed of major biopolymers were not observed, that apparently is connected to a condition of rest ensured by the blocked system of development. After diapause removal nucleic acids synthesis speed continues to be reduced, only on the 4^{th} day of embryonic development, when there is a sharp change in formation of embryonic bodies in nucleic acids reduction for some time is diminished. Further and the total activity of nucleic acids by the 8^{th} day, when there is a complete formation of bodies, is reduced on 23,8 % accordingly. During larva's hatch out the nucleic acids exchange as a whole sharply raises, thus the parameter of experiment variant exceeds on 19,4 % control variant. Change of nucleic acids metabolism reaction under sublethal temperature influence at different stages of embryonic development and display of its effect on silk worm phenotypic attributes indicate on original dependence of phenotypic parameters display. The biological parameters (silkworm hatching, viability, cocoon weight and cocoon shell weight) of silkworms practically have identical display character. In process of nucleic acids concentration decrease, the biological parameters reduce also.

Keywords: Nucleic acids, DNA, RNA, metabolism, high-temperature, silk worm, eggs, embryonic development, specifically decreases, chemical thermoregulation mechanism.

According to modern notion nucleic acids play a conducting role in realization of specific biosynthesis of macromolecules, provision of morphogenesis processes and hereditary information.

As metabolic activity of an organism is in strict dependence on such macromolecules as ferments and nucleic acids, the adaptation processes should be reduced, so that the functions of macromolecules were performed with such speeds, at which the vital processes of organism would proceed satisfactorily, despite of impediments on the part of environment.

Mechanisms of biochemical adaptation can be subdivided to two classes: compensative and exploitative. The adaptation of the first type can be determined as " elimination mechanisms of harm, caused by the factors of environment " [1,2].

The changes in an exchange of nucleic acids and proteins observable at stress, concern, on all probability, to the compensative type of reactions. The adaptive reorganization of metabolism which is necessary for overcoming of stressful damages by animals depends on intensity and orientation of nucleic acids and proteins biosynthesis processes, accumulation of them in tissues.

The thermal influence has a specific effect on exchange of proteins and nucleic acids in various organs of animals depending on a stage of their development.

One of stress symptoms is the negative balance of nitrogen, muscular exhaustion, deterioration of wound healing and etc. The biological sense of such changes is that at a high strain of adaptive mechanisms the plastic material transfers into power for realization of adaptive reactions. Under the influence of endocrine shifts there is a formation of

carbohydrates from non-carbohydrate predecessors, mainly from amino acids, formed at disintegration of protein. As a result the level of glucoze in blood increases.

The interest to alteration of protein exchange as basic plastic material of an organism in connection with a problem of overheating has appeared a long time ago. On this question in the literature there are rather not numerous and inconsistent data which have appeared per last decade. Equally it concerns also exchange of nucleic acids at influence of high temperature on animals. The study of serum proteins metabolism in blood of rabbits at overheating with the help of ametionin has revealed suppression of protein synthesis on 40 % in blood and on 50 % in liver with simultaneous increase of proteins disintegration speed on 30 %. The further works on organism and tissue levels have confirmed infringements in an exchange of fibers and of nucleic acids in organs of animals under high environmental temperature influence. [3, 4]

Study of nucleic acids role in regulation of adaptation process in ontogeny, during growth and development is of great interest. Now data on changeability of nucleic acids exchange and the role of them in cellular macromolecules metabolism and adaptation process of animals is not complete. As to insects and in particular silk worm: information is absent at all.

Materials and methods of research

Now for quantitative definition of nucleic acids in cells and tissues of alive organisms are in use two groups of methods: biochemical and citospectrophotometrical. For researches were used biochemical methods of DNA and RNA quantitative definition developed by Shmit-Tangauzer [5] and modernized by Sevastianova and etc. [6].

The essence of a method consists in use alkaline hydrolysis for DNA and RNA division. Nucleic acids were determined by the two-wave spectrophotometry method.

Research of lethal thermal influence effect on nucleic acids exchange in non-fertilized fresh laid in the period of estivation and embriogeny of silk worm eggs have been carried out as follows: Silk worm eggs of one batterfly are divided into three equal parts. The first part is not exposed to heat - processing and is saved as the control. The second part after thermal processing at 42^0C within 3 hours is saved in a place with the control according to the accepted technology of silk worm egg storage. and the third part is divided into two parts: The first part immediately after thermal processing is exposed to biochemical research. The second part of the same preparation till the expiration of 24 hours after thermal processing is exposed to the analysis.

0,2-0,3 g of silk worm eggs were placed in centrifuge test-tube and extracted a lipid mix by acetone-chloroform (5:1, v/v) in cold codition, three times 15 ml each within 20 minutes each time. After centrifugation at 3000 rev/min within 10 minutes a sediment 3 times was processed by a mix of chloroform - metanol (1:1, v/v 10 ml each) at heating within 20 minutes, then was processed by a boiling ether.

In order to extract acidsoluble low-molecular compounds, degreased tissue remnant was processed 2-3 times by cold 0,3 n. $HClO_4$ 10 ml each (control measurement of a sour extract absorbtion by spectrophotometr at $\lambda 260$ *мμ*). Each time samples were centrifuged (3000 rev/min for 10 minutes at low temperature).

For removal of an uric acid from the remnant at first it was washed out by distilled water from an acid (up to pH 7,0), then by the phosphate buffer (pH-7,2) (control - measurement of absorbtion spectrum of wash out water at λ 290 *мμ*) and at the end again by distilled water. After that the remnant was washed out by a mix of a spirit-ether (3:1, v/v) 2-3 times 5ml each; by an ether and was dried in thermostat at -37° C.

Concentration of DNA and RNA was determined by the method of Tzaneva and Markova, modified by Galkin and Berdintzev [7]. For this purpose the tissue remnant was incubated 0,5 n. KOH at 37° C within 18 hours (on 5-10 mg of dry weight of a researched material 1ml 0,5 n. KOH). To cooled hydrolyzate was added cold concentrated $HCI0_4$ up to pH 1,0. A formed sediment was deleted by centrifugation (3000 rev/min, 10 minutes) and twice washed out with 0,5 n. $HCI0_4$. Supernatant united and lead up to certain volume, adding 0,5 n. $HCIO_4$.

DNA was extracted fom the sediment by hot 0,5 n. $HCI0_4$ at 96° C, first time -45, second -20 minutes. As a control at spectrophotometry of a RNA solution served 0,5 n. KOH, processed by an identical method, and of DNA solution -0,5 n. HCI04.

Quantity of RNA and DNA was counted according to formulas:

$$P = \frac{K[E\lambda - E\lambda o] \cdot V}{W \cdot 1} \qquad (1)$$

K was defined from the equation:

$$K = \frac{Mr}{e(P) \cdot (r - 1)} \qquad (2)$$

Designations:

λ- first length of a wave appropriate to a maximum of nucleic acid absorption (260 *мμ* for; RNA and 268 *мμ* for DNA)

λ_0 -second lengths of a wave, at which optical absorption of albuminous hydrolyzate is the same, as at λ

V - extract volume (ml)

W - tissue sample (mg)

1 - ditch thickness (sm)

M - nuclear weight of phosphorus

e (P) - molar extinction coefficient for phosphorus RNA or DNA E_{260}(P) for RNA the authors accept equal to 10 130; E_{286}(P) for DNA -8782

R- ratio size of optical density of a pure nucleic acid solution in 1n. $HCl0_4$ at a wave length λ to optical density at a wave length λ_0.

Simultaneously with it the definition of the second wave length is carried out *(λ_0)*, having prepared alkaline hydrolyzate from proteins of researched samples.

Research results

Proceeding from this we investigated metabolism speed of major biopolymers – nucleic acids in fresh laid, diapausing and in embriogeny silk worm eggs in conditions of thermal influence within 3 hours at 42^0C. The received results are submitted in the table 1.

Table 1. Change of the nucleic acids concentration in silk worm eggs at influence of high temperature, mkg/egg

Stages of silk worm egg development	Phosphorus concentration					
	DNA M±m			**RNA** M±m		
	Control	Immediately after processing	After 48 hours	Control	Immediately after processing	After 48 hours
Before fertilisation	0,17±0,03	0,20±0,02	0,15±0,01	0,38±0,01	0,50±0,01	0,33±0,01
24 hrs	0,16±0,02	0,20±0,01	0,14±0,02	0,49±0,01	0,68±0,04	0,45±0,03
48 hrs	0,16±0,01	0,22±0,009	0,13±0,03	0,52±0,03	0,74±0,02	0,47±0,03
72 hrs	0,18±0,02	0,24±0,03	0,15±0,02	0,55±0,01	0,79±0,01	0,46±0,01
Diapausing (120 hrs)	0,19±0,03	0,20±0,01	0,19±0,01	0,49±0,02	0,84±0,01	0,46±0,02
After removal of development beginning diapause	0,23±0,01	0,36±0,03	0,21±0,02	0,55±0,03	0,87±0,02	0,43±0,03
On the 2nd day of development	0,27±0,03	0,42±0,03	0,25±0,03	0,65±0,04	0,95±0,02	0,49±0,01
On the 4th day of development	0,68±0,02	0,78±0,01	0,62±0,03	0,80±0,03	1,82±0,12	0,59±0,02
On the 6th day of development	0,54±0,01	0,83±0,02	0,47±0,01	0,77±0,02	1,94±0,09	0,54±0,01
On the 8th day of development	0,52±0,03	1,05±0,03	0,46±0,01	0,74±0,01	2,05±0,15	0,50±0,04
Larva's hatch out	1,06±0,01	1,63±0,03	1,31±0,04	1,46±0,01	2,52±0,12	1,70±0,03

Note: the distinctions are authentic at $p < 0,05$.

As it can be seen from the table: concentration of DNA and RNA in silk worm eggs increases several times during their developmen. In 12 hours after откладки the genes of phosphorus RNA came to 70 % of total nucleic acids phosphorus. After 72 hours from the moment of silk worm egg laying general concentration ofnucleic acids phosphorus of nucleic grow by 23,6 %. The phosphorus concentration of nucleic acids during pre-diapause period slightly raises, remains constant during diapause and sharply increases at the incubation period, reaching its maximum to the moment of larva's hatching out.

The similar results were received at silkworm [4, 8, 9, 10], *Antheraea pernyi* [11], *Tribolium confusum D*. [12, 13] and Colorado bug [14]. The nucleic acids concentration increase during embryonic development of silk worm is explained by growth of a germ and multiplication of cell number. The DNA metabolism speed in silkworm egg embryonic development subjected

to high-temperature influence, in process of development increases by 17,6 %, in non-fartilized eggs on the fifth day after egg-laying on 33 %, in the diapause period it is unsignificant on 5,2 % and at a embryogenesis stage in process of germ development of at hatching has made 53,7% accordingly. In the second phase of stressful reaction (in 48 hours after thermal loading) the specific activity of silk worm egg DNA in process of its embryonic development is reduced in comparison with the control. Only at silk worm hatching the reduction of DNA metabolism speed was not revealed. The DNA activity at this stage and in 48 hours after stressing action remained still a little above (on 23,6 %), than with the control.

The RNA metabolism speed in embryonic development of silk worm eggs shows similar change, at an exchange of DNA under the influence of high temperature (table 1), only intensity of a RNA exchange on different stages of silk worm egg development surpasses a DNA exchange. At non-fertilised egg it surpasses on 2,5 times, diapausing silk worm egg -2,4 times, and at hatching the difference increases in 2,37 times accordingly. The DNA synthesis goes from the very beginning of nucleus splitting. The RNA synthesis immediately after fertilisation is expressed rather poorly, but in process of development it increases. Concerning this Kaulenas M. S. [15] noted, that in process of *Ascaris lumbricoides* egg development there is no noticeable pRNA synthesis until nucleolus do not become visible in nucleuses.

The RNA specific activity in the second phase of stressful reaction depending on silk worm egg development term specifically decreases. For example, if at non-fertilized silk worm egg the specific RNA activity at influence of high temperature reduces on 13,1 %, after its fertilisation on the third day it achieves 16,5%, and in the diapause period on the fifth day the RNA activity inhibits only on 6,12 %. Further after removal of diapause and next days of silk worm egg embryonic development the braking of RNA synthesis considerably increases, on the 8^{th} day it achieves 32,4 % accordingly.

The consideration of RNA metabolism speed under stress during hatching out of eggs, showed similar change in an exchange of this nucleic acid with DNA, the intensity of RNA exchange is similarly increased by 16,4 %.

Oppression of the important polymers synthesis in different tissues under effect of increased temperature on the other animals [16, 17, 18,19, 2].

The specified changes of nucleic acids activity on different terms of silk worm egg development at high-temperature influence are connected, apparently, to the chemical thermoregulation mechanism, in close contact with change of power processes in embryonic cells owing to active participation of its separate composite parts in progressive organism's thermoproduction decrease.

It is known, that the action of high temperatures, laying on the border with damaging and pernicious, renders strongest influence on processes of development, for this or that alive object at the certain moment of its life cycle. Even in relation to the same kind of animals or plants: temperature, high for some stage of development, can appear optimum or even low for other stage of development. For example, staying under the temperature of 46°C for 1 hour is obviously fatal for non-fertilized silk worm eggs.

Usually the top life limit of organisms with active vital functions living in a moderate climate lays between 30 and 42^0. In environment temperature increase process beyond tolerance limits there is a change in a chemical nature, effecting vital functions processes. After achievement of temperature within the limits of $42\pm0,5^0$ at the overwhelming majority of the alive forms already begin to go with significant speeds thermal denaturation processes of protoplasmic proteins and the phenomena of thermal destruction are observed.

According to this it is most important to emphasize, that the irreversible pernicious high temperature effect is preceded by a phase of convertible damages (paranecrosis, parabiosis, thermal ossification, thermal coma), and directly before it, as a general rule, the protective adaptive reactions as though personifying mobilization of all vital forces of alive system on struggle with imminent danger are observed. At alive systems which are in a condition of active vital functions, thus the culmination acceleration, previous to an oppression, of all processes of vital functions and condition of excitation is observed. At immobile or blocked alive systems, which are in a condition of readiness for active development renewal, that non-fertilized eggs, diapausing germs, immobile spores, buds, bulbs, tubers, etc are like, under influence of sublethal heating awake a condition of rest, vital functions activation and stimulation of subsequent development.

Typical and vivid examples of similar stimulation by sublethal influences of high temperature on silk worms are thermal artificial partogenesis and thermal diapause elimination [20,21,22] Astaurov, 193б,, in; 1940, 1948 a). 193б, б, в; 1940, 1948 a).

Taking into account a role and importance of nucleic acids in adaptive process regulation in ontogeny, growth and development, metabolism of cellular macromolecules of alive creatures, including silkworm, realization of research in a direction of definition of silkworm adaptive reaction, through display of its фенотипических attributes was continued (table 2).

Table 2.Effect of lethal temperature influence at different development stages of silk worm eggs and display of silk worm's biological attributes.

Silk worm egg development stages	Concentration		Total concentration of nucleic acids	Hatching, %	Viability, %	Cocoon weight, g	Cocoon shell weight, mg	Cocoon shell, %
	DNA	RNA						
Before fertilisation: experiment	0,15±0,01	0,33±0,01	0,48±0,04	89,2±3,51	75,4±5,56	2,2±0,67	485±0,32	22,0±0,45
control	0,17±0,03	0,38±0,01	0,55±0,01	96,8±6,70	85,5±4,33	2,3±0,43	492±0,44	21,4±0,34
24 hrs: experiment	0,14±0,02	0,45±0,03	0,59±0,03	90,0±4,31	78,5±5,67	2,3±0,34	502±0,56	22,0±0,74
control	0,16±0,02	0,49±0,01	0,65±0,04	95,8±5,53	88,5±3,33	2,2±0,22	489±0,33	22,2±0,65
48hrs: experiment	0,13±0,03	0,44±0,03	0,57±0,01	76,5±2,21	72,5±5,66	2,2±0,23	480±0,45	21,8±0,55
control	0,16±0,01	0,52±0,03	0,68±0,03	97,5±6,23	87,5±4,33	2,1±0,41	500±0,32	23,8±0,52
72 hrs: experiment	0,15±0,02	0,43±0,01	0,58±0,02	72,0±4,51	65,5±7,66	2,0±0,56	475±0,44	23,7±0,33
control	0,18±0.02	0,55±0,01	0,75±0,01	96,0±2,31	85,5±6,22	2,2±0,54	498±0,49	22,6±0,47
Diapausing (120 час.): experiment	0,19±0,01	0,46±0,02	0,65±0,04	93,5±3,23	85,0±4,27	2,3±0,52	490±0,61	21,3±0,44
control	0,19±0,03	0,49±0,02	0,68±0,03	95,5±5,63	82,4±6,87	2,2±0,26	492±0,34	22,3±0,46
After removal of diapause: experiment	0,21±0,02	0,43±0,03	0,64±0,04	78,0±4,32	68,5±7,66	2,3±0,24	472±0,56	20,5±0,56
control	0,23±0,01	0,55±0,03	0,78±0,02	97,3±6,44	85.3±4,33	2,2±0,53	490±0,41	22,2±0,62
On the 2nd day of development: experiment	0,25±0,03	0,49±0,01	0,74±0,01	80,0±6,42	68,5±7,33	2,2±0,33	475±0,26	21,5±0,26
control	0,27±0,03	0,65±0,04	0,92±0,02	97,0±5,41	82,4±5,33	2,1±0,67	498±0,33	23,7±0,54
On the 4th day of development: experiment	0,64±0,03	0,59±0,02	1,23±0,04	83,5±5,82	78,5±6,33	2,1±0,76	506±0,42	24,1±0,34
control	0,68±0,02	0,80±0,03	1,48±0,03	95,8±6,11	86,5±4,43	2,3±0,34	492±0,32	21,4±0,39
On the 6th day of evelopment: experiment	0,47±0,01	0,54±0,01	1,01±0,01	72,0±6,80	59,5±8,02	2,2±0,67	472±0,41	21,4±0,47
control	0,54±0,01	0,77±0,02	1,31±0,02	96,5±4,55	87,5±3,22	2,2±0,52	490±0,23	22,2±0,36
On the 8th day of development: experiment	0,46±0,01	0,50±0,04	0,96±0,03	68,5±5,92	60,5±6,98	2,3±0,72	475±0,32	20,6±0,39
control	0,52±0,03	0,74±0,01	1,26±0,02	95,6±2,35	85,6±4,32	2,2±0,43	500±0,44	22,7±,0,48
Larva's hatch out: experiment	1,31±0,04	1,70±0,03	3,01±0,01	96,5±6,38	92,5±4,82	2,3±0,21	562±0,46	24,4±0,54
control	1,06±0,01	1,46±0,01	2,52±0,03	97,6±3,46	87,5±5,32	2,3±0,33	498±0,31	21,6±,0,33

As it is visible from the data, the general concentration of nucleic acids under high temperature influence in embryonic development of silk worm faces specific changes (fig. 1). The metabolism speed of biopolymers in non-fertilised silk worm eggs and in the subsequent stages of its development, fertilisation and complete pigmentation end under action of sublethal temperature reduces unsignificantly. The suppression of nucleic acids synthesis speed has approximately identical character. And at diapause stage the change in metabolism speed of major biopolymers is not observed, that apparently is connected to a condition of rest ensured by blocked development system.

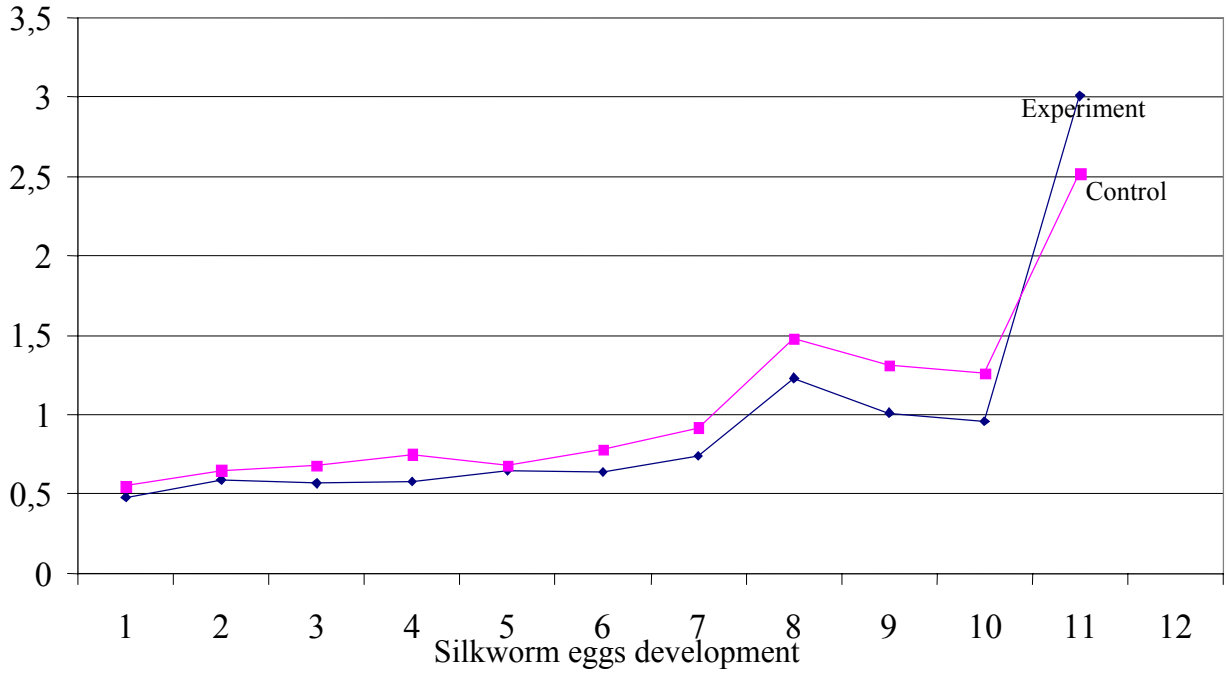

Fig. 1. Change of nucleic acids general concentration under influence high temperature in silkworm

Where: **1**. Before fertilisation; **2**. 24 hrs; **3**. 48 hrs; **4**. 72 hrs; **5**. Diapausing (120 час.); **6**. After removal of diapause; **7**. On the 2nd day of development; **8**. On the 4th day of development; **9**. On the 6th day of development; **10**. On the 8th day of development; **11**. Larva's hatch out.

Continuing research on influence of sublethal temperature on important biopolymers metabolism speed influence on subsequent embryonic stages of silk worm development, we see sensitivity of nucleic acids to high temperature after diapause removal.

The general nucleic acids concentration under high temperature influence from one stage of development to another is essentially reduced, on the third day after fertilisation is reduced on 22,6 % accordingly. At a diapause stage changes in metabolism speed of major biopolymers were not observed, that apparently is connected to a condition of rest ensured by the blocked system of development. After diapause removal nucleic acids synthesis speed continues to be reduced, only on the 4th day of embryonic development, when there is a sharp change in formation of embryonic bodies in nucleic acids reduction for some time is diminished. Further and the total activity of nucleic acids by the 8th day, when there is a complete formation of bodies, is reduced on 23,8 % accordingly. During larva's hatch out the nucleic acids exchange as a whole sharply raises, thus the parameter of experiment variant exceeds on 19,4 % control variant.

Change of nucleic acids metabolism reaction under sublethal temperature action at different embryonic development stages and display of its action on silk worm phenotypic attributes (table 2) point on original dependence display of phenotypic parameters both from change of one special nucleic acid separately and from their general concentration. All researched basic biological silk worm parameters (silkworm hatching, viability, cocoon weight and cocoon shell weight) have particularly identical character of display. For example on those embryonic stages, where an intensive cell fission takes place, which is accompanied by direct participation of nucleic acids, in process of nucleic acids concentration decrease the biological parameters reduced (fig. 2 and 3).

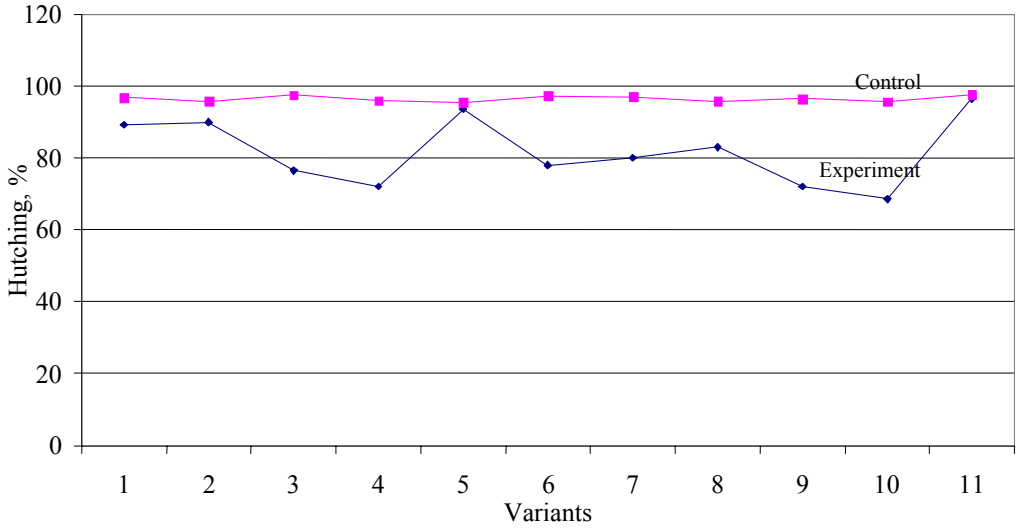

Fig. 2. Influence of nucleic acids concentration change under action of high temperature in embryology on silkworm hutching

Where: **1**. Before fertilisation; **2**. 24 hrs; **3**. 48 hrs; **4**. 72 hrs; **5**. Diapausing (120 час.); **6**. After removal of diapause; **7**. On the 2nd day of development; **8**. On the 4th day of development; **9**. On the 6th day of development; **10**. On the 8th day of development; **11**. Larva's hatch out.

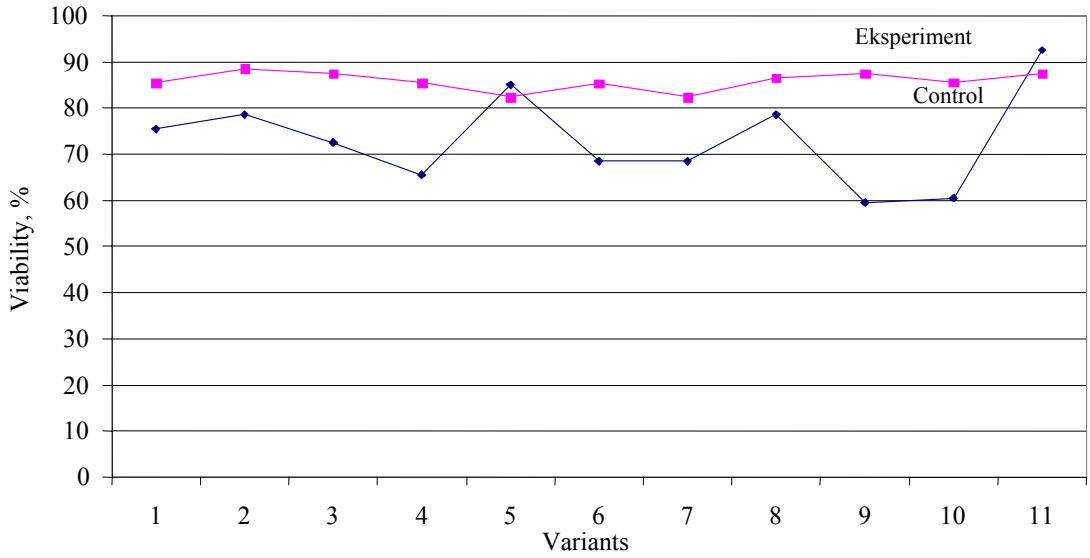

Fig. 3. Influence of nucleic acids concentration change under action of high temperature in embryology on silkworm viability

Where: **1**. Before fertilisation; **2**. 24 hrs; **3**. 48 hrs; **4**. 72 hrs; **5**. Diapausing (120 час.); **6**. After removal of diapause; **7**. On the 2nd day of development; **8**. On the 4th day of development; **9**. On the 6th day of development; **10**. On the 8th day of development; **11**. Larva's hatch out.

The rise of speed of nucleic acids synthesis under the high temperature effect at the time of silk worm larvae hatch out is probably connected to silk worm metamorphosis process, where naturally transformation of norm reaction of an organism to influences of this or that adverse factor takes place. That can be seen on organism's adaptivity by direct display on metabolism of separately taken processes occurring in organism. In this case action of sublethal temperature is accompanied by stimulation of nucleic acids metabolism process and thus increase of biological parameters especially of cocoon shell weight (fig. 4).

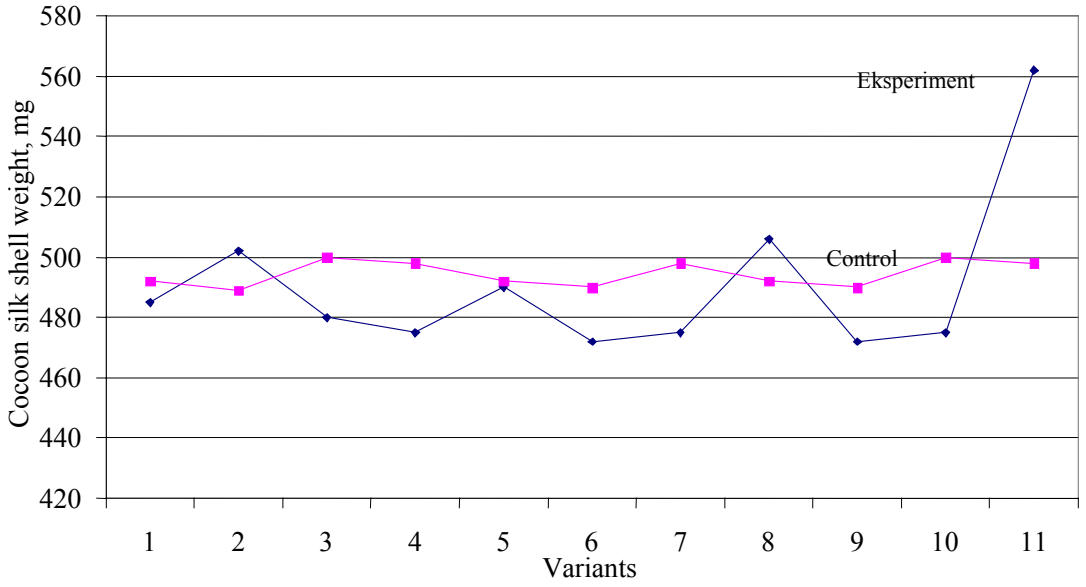

Fig. 4. Change of nucleic acids general concentration under influence of high temperature on cocoon silk shell weight

Where: **1**. Before fertilisation; **2**. 24 hrs; **3**. 48 hrs; **4**. 72 hrs; **5**. Diapausing (120 час.); **6**. After removal of diapause; **7**. On the 2nd day of development; **8**. On the 4th day of development; **9**. On the 6th day of development; **10**. On the 8th day of development; **11**. Larva's hatch out.

The analysis of the data on intensity of nucleic acids synthesis in different terms of silk worm egg development allows to make the conclusion that the stressful reaction of silk worm eggs, caused by high temperature, considerably influences an exchange of both DNA, and RNA. The change character is shown specifically depending on term of silk worm egg development: DNA activation immediately after thermal processing and inhibition of its intensity in 48 hours. The alteration character of an RNA exchange at silk worm egg is similar to DNA.

Change of nucleic acids metabolism reaction under sublethal temperature influence at different stages of embryonic development and display of its effect on silk worm phenotypic attributes indicate on original dependence of phenotypic parameters display. The biological parameters (silkworm hatching, viability, cocoon weight and cocoon shell weight) of silkworms practically have identical display character. In process of nucleic acids concentration decrease, the biological parameters reduce also.

The rise of speed of nucleic acids synthesis under high temperature influence at larva's exit from an egg is probably connected with metamorphosis process, where naturally there is a change of organism reaction norm to influence of this or that adverse factor, that is shown on silk worm adaptive reaction.

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Establishment of BmHc cell line from *Bombyx mori* and its sensitive to Ca^{2+} and 20E

By

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Abstract: ***To study signal transduction path way in intracellular after treatment with lipopolysaccharide (LPS) and 20-hydroxyecdysone (20E), a hemocytes cell line from B. mori. BmHc, was established in TC-199 medium. The BmHc cell line is consist of all types of hemocytes include prohemocytes, spherulocytes, oenocytoid, granulocytes and plasmatocytes etc. Doubling time of the cell line is about 30hrs. All cells growth on the surface of flasks, part of the cells adheres to the wall. The experiment of sensitive to virus like nuclear polyhedral virus (NPV) and Nosema bombyx is planning to take. LPS elicited hemocytes to synthesis antibacterial proteins and peptides and prompted cells to uptake more Ca^{2+} to take part in active cell proliferation. Flu-3 AM study with TCS-SP2 laser scanning confocal microscopy showed that Ca^{2+} distributed on the cell membrane in 30min after treatment but some of them were on the signal path way to the nuclear of the cell. While under the same condition, the membrane of the cells was only weakly stained with Flu-3 Am after treatment with 20E. Flu-3 Am were specifically congregated on the membrane of the cells that indicates Ca^{2+} and calmodulin significantly coupling with G-proteins and IP3 path way. It elicited and opened Ca^{2+} channel. A relatively stable change of [Ca^{2+}] in the cells when 20E was added to the culture medium that indicated 20E is not an effective enhancer for sensitive Ca^{2+} channel on the cell membrane.***

Keywords: Cell line; Hemocytes; *Bombyx mori*; LPS and 20E

Hemocytes of *Bombyx mori* are consist of six types of cells that circulate in the hemolymph. They play a key role in insect immunity against invasion of bacteria, virus, parasites, wounded and natural enemies. When microorganism invades the body of *B. mori*, the hemolymph is the first barrier to keep it from diseases. Once a target is recognized as foreign, hemocyte-mediated defense responses are regulated by signaling factors and effect molecules that control cell adhesion and cytotoxicity (Lavine, M.D., Strand M.R. 2002).

To study signal transduction path way in intracellular after treatment with lipopolysaccharide (LPS) and 20-hydroxyecdysone (20E), a hemocytes cell line from *B. mori.* BmHc, was established in the Laboratory of Molecular and Biology of Sericulture, Department of Sericulture, College of Animal Science, South China Agricultural University. In addition, to detect the distribution of Ca^{2+} in the cells after treatment with LPS and 20E, TCS-SP2 laser scanning confocal microscopy (LSCM, Leica equipment ltd., Germany) performed all procedures.

Material and Method

1.1 Materials

Animals: *Bombyx mori* 7532.

Medium: TC-199 insect culture medium (GIBCOBRL®, life technologies); Fetal Bovine Serum from Sino-American Biological Company (SABC).

Flu-3 AM from Sigma (work concentration 1mmol/L in DMSO). LPS and 20E from Sigma (work concentration 4mg/mL in distilled water).

.

1.2 Methods

1.2.1. The BmHc cell line establishment

The animals of *Bombyx mori* 7532 were reared on high quality leaves after hatched. The hemocytes were collected in the 5th instar on ice-cold eppendroff tube after rinsed in 75% of ethanol. The pellets of hemocytes washed with 0.1mmol/L pH7.0 PBS for several times and centrifuged at 500 rpm/min. Serum-free TC-199 medium was added into the tube for suspension at the last time and distributed into the culture flasks. One month later, the hemocytes were cultured with TC-199 and plus 5-10% of Fetal Bovine Serum. All procedures were operated with sterilized appliances and on super-clean platform in the sterilized room. The medium changed every week and passed the next generation after the cells growth full of flaks.

1.2.2. The morphology of the BmHc cell line

From the primary culture of hemocytes to the establishment of BmHc, a Leica convert microscopy with contrast phase was used to observed the morphology of the cells and photo-taken.

1.2.3. Scanning with TCS-SP2 laser scanning confocal microscopy

The cultured BmHc cells were suspended in TC-199 medium. After incubation with Flu 3-AM for 30min in a small container on slides which rinsed in 10% of poly-lysine for 5min previously, the culture medium was washed away and background was eliminated as soon as possible using 0.1mmol/L phosphate buffer solution (PBS).

2. Results

2.1. Descriptions of the BmHc cell line

Cell types: All types of hemocytes could be detected under convert microscope include prohemocytes, spherulocytes, oenocytoid, granulocytes and plasmatocytes etc. (Fig 1-3).

Original: The hemocytes from 5th instar of *Bombyx mori* 7532.

Medium: The hemocytes were kept in TC-199 with 200U/mL of penicillin but free

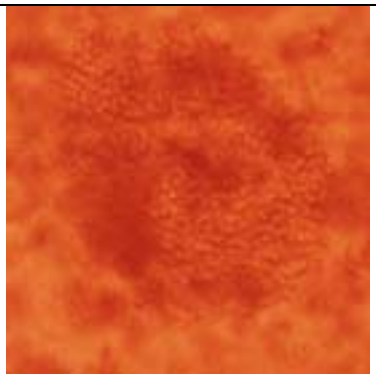

Fig 1. The primary culture of hemocytes from *Bombyx mori* agglomerated under convert microscopy. (20×10)

Fig 2. The hemocytes cell line (BmHc No. 2-7) under convert microscopy. (40×10)

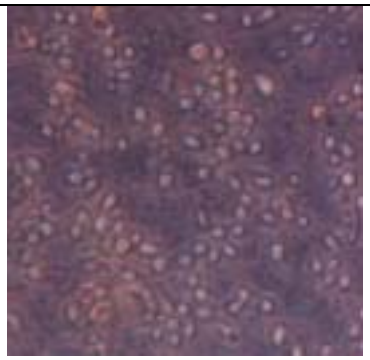

Fig 3. The generations of BmHc cell line (BmHc No. 3-5 and No.4-8) under convert microscopy (40×10). The BmHc cell line includes prohemocytes, spherulocytes, oenocytoid, granulocytes and plasmatocytes as shown above.

of Serum for stabilization and 5-10% Fetal Bovine Serum was added in the stage of proliferation.

Biological Characters: Doubling time of cells is about 30hrs. All cells growth on the surface of flasks, part of the cells adheres to the wall. The experiment of sensitive to virus like nuclear polyhedral virus (NPV) and *Nosema bombyx* is planning to take in coming days.

2.2 Detection with TCS-SP2 laser scanning confocal microscopy

2.2.1 Distribution and location of Ca^{2+} in the hemocytes after treatment with LPS and 20E

BmHc cells uptake Ca^{2+} in the medium in the life cycle for their proliferation. LPS elicited hemocytes to synthesis antibacterial proteins and peptides. Fig 4 showed that Ca^{2+} distributed on the cell membrane in 30min after treatment but some of them were on the signal path way to the nuclear of the cell.

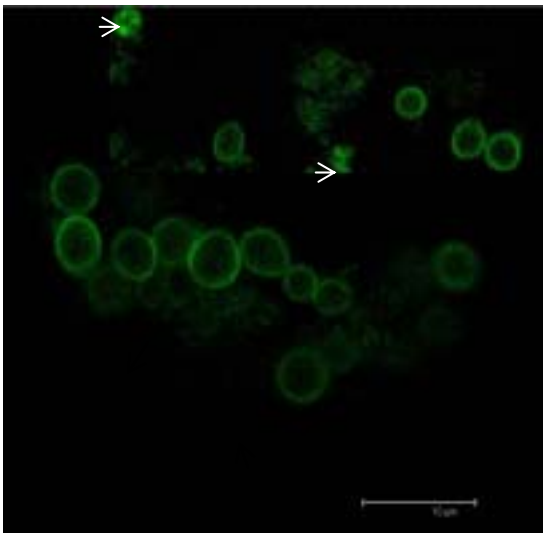

Fig 4. LPS induced BmHc cell line loaded with Flu-3 AM indicates cells were surrounded with Ca^{2+} at the membrane significantly under TCS-SP2 laser scanning confocal microscopy (LSCM, Leica equipment ltd., Germany) (scan mode: XYZ; Visible AOTF:488nm.) Arrow in up-window indicates Ca^{2+} distributed into inner cell not only membrane. Control with no LPS induction showed slightly weak (data not shown). Bar equal to 10μm. Flu 3-Am loading time: 30min. Temperature: 25±1□.

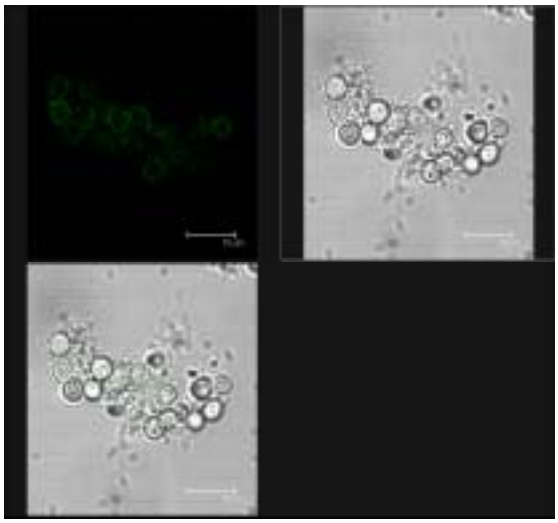

Fig 5. Distribution of Flu-3 AM on the cells induced by LPS. Up left window indicates fluorescence on the cell membrane, right indicates the cells under light, and low window indicates some Flu-3 AM on the membrane under TCS-SP2 LSCM (Leica equipment ltd., Germany) (scan mode: XYZ; Visible AOTF:488nm.) Arrows indicate Flu-3 AM on the cell membrane. Bar equal to 10μm. Flu 3-Am loading time: 30min. Temperature: 25±1□.

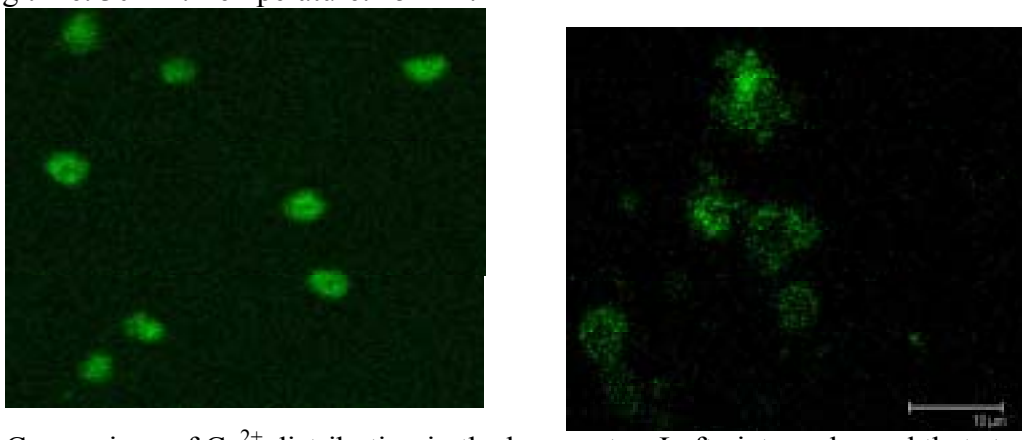

Fig 6. Comparison of Ca^{2+} distribution in the hemocytes. Left picture showed that stronger flurenscence on the membrane and even to the nuclear of hemocytes after treatment with LPS; while right window showed that membrane of the cells were also weak stained with Flu-3 Am indicated ecdysone receptor and ultraspiracle. Control with no induction showed more slightly weak (data not shown). Flu 3-Am loading time: 30min. Temperature: 25±1□.

2.2.2 The change of Ca^{2+} concentration in the hemocytes after treatment with LPS and 20E

The concentration of Ca^{2+} ([Ca^{2+}]) in the cell changes every second in cell proliferation. LPS and 20E elicited Ca^{2+} channel opened to the environment and exchange substances. So, influx of Ca^{2+}on the membrane also changed. TCS-SP2 laser scanning confocal microscopy provide a way to measure the [Ca^{2+}] in the cell (Fig 7-8).

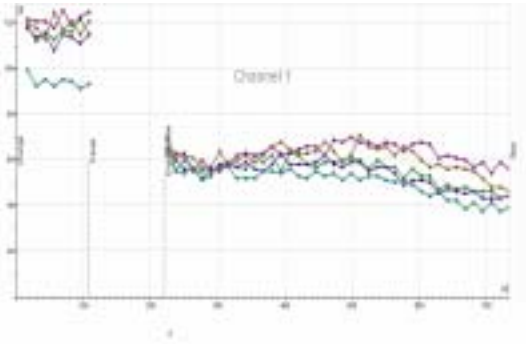

Fig 7. [Ca^{2+}]in the cells varied after the hemocytes were treated with LPS. Five curves present five individual cells under TCS-SP2 laser scanning confocal microscopy (LSCM, Leica equipment ltd., Germany). Control with same volume of distilled water showed no concentration change (data not shown). (Scan mode: XYZ; Visible AOTF: 488nm.)

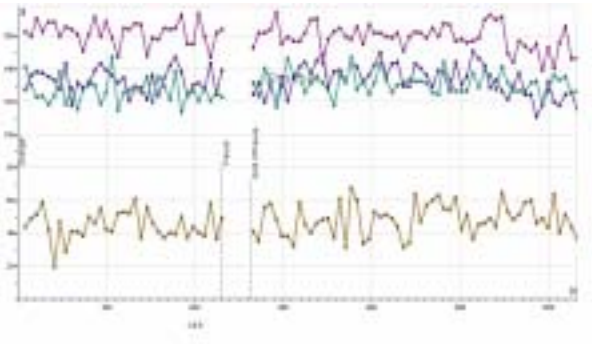

Fig 8. [Ca^{2+}] in the cells varied after the hemocytes were treated with 20E. Four curves present four individual cells under TCS-SP2 laser scanning confocal microscopy (LSCM, Leica equipment ltd., Germany). Control with same volume of distilled water showed no concentration change (data not shown). (Scan mode: XYZ; Visible AOTF: 488nm.)

3. Discussion

According to the study reports, taxonomy of insect hemocytes remains a puzzle (Ye Zhufeng and Chen Zhangfu, 1998; Fu Jitao, Liu Zhaoliang, Lin Erjun *et al*., 2005; Feller, S.K., Rybczynski, R. and Gilber, L.I. 2005). Multiplication of hemocytes in the hemolymph of insect seems to be largely due to the self-renewal of granulocytes because only prohemocytes, granulocytes and rarely spherulocytes undergo mitosis.

Under individual microculture, prohemocytes of *B.mori* change into plasmatocytes and granulocytes, and the daughter granulocytes differentiate into spherulocytes (Yamashita &. Iwabuchi, 2001).

Our results showed that all of cultured prohemocytes, granulocytes and spherulocytes underwent mitosis. The further cloning experiment would be taken to get morphological and characteristically uniform cells. The work will greatly prompt the study on signal transduction path way of individual cell.

LPS is one component of bacterial cell wall which actively involved in triggering gene expression of antibacterial proteins in the hemocytes and fat body in *B.mori*. Miller (2004) exposed hemocytes to LPS evokes formation of hemocyte microaggregates and this cellular action is mediated by prostaglandins but not by lipoxygenase pathways. LPS elicited hemocytes to synthesis antibacterial proteins and peptides and prompted cells to uptake more Ca^{2+} to take part in active cell proliferation. The results showed that isolated hemocyte preparations challenged with LPS formed more hemocyte microaggregates than unchallenged preparations in a dose dependent manner.

LPS binding protein on the cell membrane of *B.mori* is a pattern recognition molecule that recognizes the lipid A portion of LPS and participates in a cellular defense reaction. Recently, it has been demonstrated that medfly hemocyte srespond to LPS/*E.coli* by changing their morphology and inducing the activation of several signaling path ways, such as mitogen activating protein (MAP)kinases, phosphatidylinositol-3kinase (PI-3K) and *Rho* path

ways(Lamprou *et al*.2005). MAP kinases appeared to control both phagocytosis and melanization, since they regulate prophenoloxidase-activating proteinases secretion, a prerequisite for the conversion of proPO to active PO(Mavrouli *et al*. 2005).Ling Erjun (2006) reported that immulectins are members of the C-type(calcium-dependent) lectin superfamily, and they function as humoral pattern recognition receptors in innate immunity of the tobacco horn worm *Manducasexta*. The results (Fig 4-6) showed that Flu-3 Am were specifically congregated on the membrane of the cells that indicates Ca^{2+} and calmodulin significantly coupling with G-proteins and IP3 path way. It elicited and opened Ca^{2+} channel which gave rise of decrease of [Ca^{2+}] in the cells because of Ca^{2+} free in PBS (Fig 7), no matter a slight placid peak presented in the record interval.

When 20E was added to the culture medium, it stopped cell proliferation and induced formation of epithelial-like aggregates during cell cycle (Auzoux-Bordenave, S., Hatt, P.J. and Porcheron, P. 2002).

As well known, Ca^{2+} plays an important role in signal transduction path way (Dedos, S.G., Fugo, H.1999; Birkenbeil, H., Dedos, S. G. 2002 ;). Dedos (2003) reported a regulatory mechanism that involves cAMP-mediated activation of Ca^{2+} influx through sensitive Ca^{2+} channels. There is a tightly regulated cross-talk mechanism between the two signaling cascades of Ca^{2+} and cAMP.

The data showed that a relatively stable change of [Ca^{2+}] in the cells when 20E was added to the culture medium (Fig 8). The phenomenal suggested that 20E is not an effective enhancer for sensitive Ca^{2+} channel on the cell membrane but exerts its effect through ecdysone receptor and ultraspiracle. In accordance with the results of Auzoux-Bordenave, S. (2002), Ca^{2+} channel not open under 20E induction that cause no concentration change in the cells. Therefore, it stopped cell proliferation.

Acknowledgements

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Stage specificity and polymorphism of haemolymph esterases in races and hybrids of silkworm (*Bombyx mori* L.) kept in Bulgaria

By

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Abstract: ***By using Starch gel electrophoresis, a study was made on the stage specificity and polymorphism of haemolymph esterases in races and interracial hybrids of silkworm (Bombyx mori L.) kept in Bulgaria. The expression of ten bands from six esterase zones was detected during ontogenesis. Two of esterase bands were showed in cathode part of the gel. Stage specific expession was established. Intraracial and interracial polymorphism was observed. Based on the same stage specific expression and polymorphism, the existence of correspondence between esterase bands from four esterase zones determined by Starch gel electrophoresis and PAGE was suggested.***

Keywords: *Bombyx mori* L., electrophoresis, haemolymph esterases

Introduction

The establishment of suitable biochemical markers for analyzing the degree of genetic heterogeneity of different races and families is a prerequisite for increasing the selection effectiveness. With the case of mulberry silkworm *Bombyx mori* L. different isoenzymic groups have been studied (Marcato et al., 1990; Ratna et al., 1991; Kanekatsu et al., 1993; Eguchi, 1995; Asano et al., 1997). Polymorphism was ascertained in the group of non-specific esterases from different tissues (Egorova et al., 1985; He, 1995; Krishnamurthy et al., 1997; Stoykova et al., 1998; Stoykova et al., 1999; Stoykova 2001; Staykova et al., 2004). The studies of esterase polymorphism from the haemolymph of races of mulberry silkworm and their hybrids kept in Bulgaria are very poor and small (Shabalina, 1990; Stoykova et al., 2003; Staykova et al., 2005). The method of electrophoresis in starch gel was not used in these studies. For that reason we aimed to study the stage specificity and polymorphism in the expression of the haemolymph esterases in different races and hybrids *B. mori*, kept and raised in our country through electrophoresis in starch gel.

Material and Methods

As a total 960 specimens of sixteen races kept in Bulgaria and designated as P14, P15, 19, 20, B517, T106, T108, M1, M2, UK17, UK18, UK19, UK20, Tashkent12, Tashkent15 and Tashkent16 as well as the interracial F_1 hybrids P14xP15, P15xP14, M1xM2, M2xM1, UK17xUK19, UK19xUK17, UK18xUK20 and UK20xUK18 were studied. The race B517 is polyvoltine, while all others are monovoltine. Haemolymph esterase spectra were analysed at various stages of silkworm development (larva - 1st to 5th instar, spinning larva, pupa - 1st -2nd day, 5th-6th day, 8th-10th day and imago). Individual samples as well as mixed ones from equalized number of specimens per race or hybrid were used for 1st, 2nd, 3rd and 4th larval instars. Only individual samples were used during later developmental stages.

The haemolymph was isolated by pricking one of the larval abdominal legs or the thorax of the pupa or the imago, collected in a tube containing a small amount of phenylthiourea. The samples were mixed 1:1 with distillated water. 10μl of each sample was applied into the gel. The electrophoretic separation involved using 13% starch horizontal gels at 2.5 mA/cm for 5 hours, 0.05 M tris–EDTA–borate gel buffer, at pH 8.1 and 0.3 M sodium–borate electrode buffer at pH 8.9 (Smithies, 1955, modified by Dobrovolov, 1973). The nonspecific esterases were visualized in 1.1 M tris–chloride buffer at pH 8.0. α- and β-naphthylacetate were added as substrates and Fast red TR salt as a dye. The starch plates were differentiated in 5% acetic acid.

Results and Discussion

In the course of ontogenesis in the haemolymph of studied races and hybrids of silkworm, by means of Starch gel electrophoresis we ascertained total ten esterase bands, distributed in six zones - BES As, BES Bs, BES Cs, BES Ds, BES Es and BES Fs. Eight of the fractions we visualized in the anode gel part, and two fractions – in the cathode one (Fig.1). We observed stage specificity in the expression both in interracial and intraracial polymorphism.

Stage specificity

In mixed and individual haemolymph samples of larvae 1st and 2nd instar by means of Starch gel electrophoresis we didn't establish esterase bands (Fig.1). From 3rd larval instar to the end of individual development we observed a stage-specific expression of esterases in the following zones:

- esterases from BES Bs zone are expressed from 4th larval instar to the middle of pupal period;
- weak expression of esterase BES Cs was ascertained only in 4th larval instar (only in mixed haemolymph samples of individuals from B517 race);
- esterase activity in zone BES Es is observed after 4th larval instar (in the spectra of some races and hybrids);
- esterases from zones BES Fs are expressed only in 4th and 5th larval instar.

Esterases from zones BES As and BES Ds is observed in the spectra of the individuals from all analyzed races and hybrids, in all stages of ontogenesis (from 3rd larval instar to imago), as well as in the case of larvae from 3rd instar these esterase bands are visualized only in mixed haemolymph samples. The highest intensity in the process of ontogenesis exhibits fraction BES As. The availability of esterases from all zones (excluding BES Cs, which is specific for polyvoltine race B517) we ascertained in 5th larval instar. The number of esterase bands during this period may vary from three to eight in the various individual spectra, which sustains the established from different authors by means of other electrophoretic techniques different number of esterase fractions in the haemolymph of different races of silkworm (Eguchi et al., 1965; Yoshitake, 1970; Egorova et al., 1977; Eremina, 1985; Egorova et al., 1985; Shabalina, 1990; He, 1995; Stoykova et al., 2003).

Polymorphism

By means of comparative electrophoretic analysis in starch gel we ascertained interracial and intraracial polymorphism in the expression of esterases from four zones - BES Bs, BES Ds, BES Es and BES Fs (Table 1; Fig. 1, 2, 3).

In zone BES Bs, in the spectrum of larvae and pupae from the races P14, P15, 19, 20, B517, T106, M1, M2, UK17, UK18, UK19, UK20, Tashkent12, Tashkent15, Tashkent16 and their F_1 hybrids, we visualized the bands BES B_{1s} and BES B_{2s} – each one separately or in

combination of both together. In the spectrum of studied individuals from T108 race there was present fraction BES B_{2s}.

In zone BES Ds we visualized three fractions - BES D_{1s}, BES D_{2s} and BES D_{3s}. Bands BES D_{1s} and BES D_{2s} we observed as separate or in combination with the individuals from races 19, 20, M2, Tashkent12, Tashkent15 and hybrids P14xP15, M1xM2 and UK18xUK20 (straight and reciprocal). The presence of BES D_{1s} and BES D_{3s} we ascertained with the individuals from races B517 and T108. The three esterase fractions from zone BES Ds we visualized in the spectrum of races T106, M1, UK17, UK19, Tashkent16 and hybrids UK17xUK19 and UK19xUK17 – in combination of pairs or as separate ones. In the case of studied individuals from races P15 and UK20 we ascertained only fraction BES D_{1s}, and with the individuals from P14 and UK18 – only fraction BES D_{2s}.

In zone BES Es we ascertained one fraction - BES E_{1s}, but only in the spectra of some individuals from the races 19, M1, M2 and Tashkent15, as well as the hybrids M1xM2 and M2xM1. This band is with different intensity (stronger or weaker) with different individuals. With the case of all other races and hybrids the esterase activity in zone BES Es is absent.

In zone BES Fs we ascertained two fractions with mobility to the cathode - BES F_{1s} and BES F_{2s}. Only in the spectra of some larvae from the races P14, P15, B517, T108, M1, M2, UK20, Tashkent15 and the hybrid UK20xUK18 these two bands are expressed separately or in combination of two together. With other individuals from the same races and hybrids, both bands are missing. In the spectrum of the race T106 we ascertained only BES F_{1s}, and in the spectra of 19, UK17, UK18, UK19 and hybrids UK18xUK20 and P14xP15 we visualized only fraction BES F_{2s}, but only with some individuals. The respective bands are absent from the spectrum of other individuals from the same variants. With the races 20, Tashkent12 and Tashkent16, and the hybrids P15xP14, M1xM2, M2xM1, UK17xUK19 and UK19xUK17 we did not ascertain esterase fractions in zone BES Fs.

Fraction BES As is present in the spectra of all studied individuals from all races, and fraction BES Cs – only in the spectrum of B517.

The expression and division of the established through electrophoresis in starch gel esterase fractions give us reason to assume genetically determined polymorphism with two codominant alleles in zone BES Bs and three codominant alleles in zone BES Ds. The expression of two esterase bands in zone BES Fs, is probably a result of two codominant alleles, and the absence of esterase activity in this zone is probably a result from third – null allele. We assume that the absence of esterase activity in zoneBES Es, is also a result of null allele.

The observed stage and race specificity in the expression, as well as the ascertained polymorphism, give us reason and grounds to admit a correspondence between the ascertained earlier by means of electrophoresis in polyacrylamide gel (PAGE) fractions BES A, BES B_1 and B_2, BES D_1, D_2 and D_3, and BES E_1 (Stoykova et al., 2003), as we established in the present study fractions respectively BES As, BES B_{1s} and B_{2s}, BES D_{1s}, D_{2s} and D_{3s}, and BES E_{1s}. We assume that the esterases from the respective zones are products of one and the same loci. By means of starch gel electrophoresis in the haemolymph spectrum we ascertained also esterase bands with mobility to cathode.

In this study we didn't establish differences between the esterase spectra of the individuals from both sexes, by virtue of which we confirm what we established through PAGE (Stoykova et al., 2003). Having compared the results obtained through both types of electrophoresis – in starch gel (in the present study) and in the polyacrylamide gel (Stoykova et al., 2003), we may summarize that both methods are appropriate for study of genetically determined polymorphism by the non-specific esterases from the haemolymph of mulberry

silkworm. Through electrophoresis in polyacrylamide gel are visualized the fractions from polymorph zone BES C, and through electrophoresis in starch gel – the fractions from polymorph zone BES Fs. By means of PAGE it is possible to analyze the spectrum also in the initial larval instars – 1st and 2nd.

On the basis of all said, we conclude that the non-specific esterases from the haemolymph of the studied races and hybrids of mulberry silkworm *B. mori* L., kept in Bulgaria, demonstrate specific polymorphism as a result of the polygenic control, on which basis intraracial comparisons may be done, as well as the degree of interracial heterogeneity to be determined.

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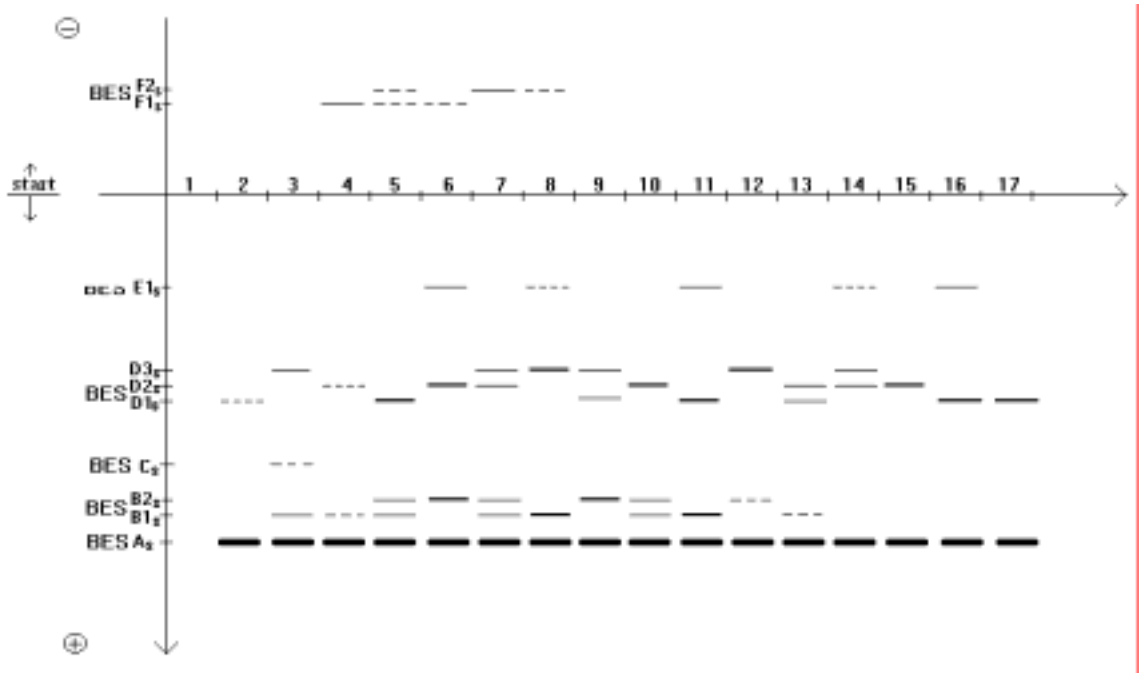

Fig. 1. Esterase spectra of silkworm haemolymph during the ontogenesis (13% Starch gel electrophoresis): 1 - 1st and 2nd larval instar; 2 – 3rd larval instar ; 3, 4 – 4th larval instar; 5, 6 – 5th larval instar 1st-4th day; 7, 8 – 5th larval instar 5th-8th day; 9 – spinning period; 10, 11 - pupae 1st-2nd day; 12, 13 - pupae 5th-6th day; 14, 15 - pupae 8th-10th day; 16, 17 – adults; 1÷3 – mixed samples; 4÷17 – individual samples.

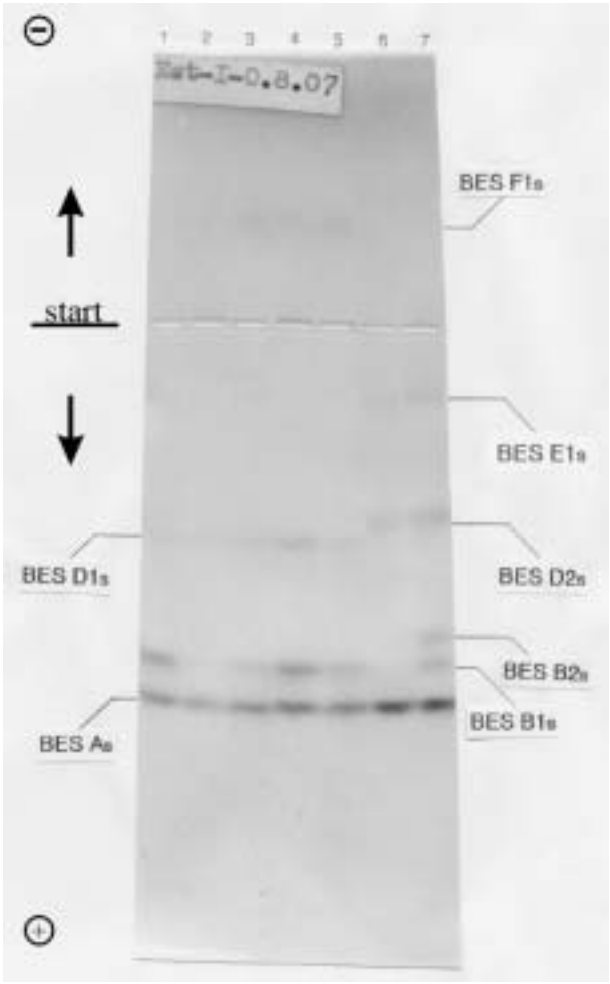

Fig. 2. Esterase spectra of silkworm haemolymph (13% Starch gel electrophoresis) – 5th larval instar (1, 3, 4, 5, 7) and pupae 8th-10th day (2, 6): 1, 2 - race UK19; 3÷5 – race M1; 6, 7 - race 20.

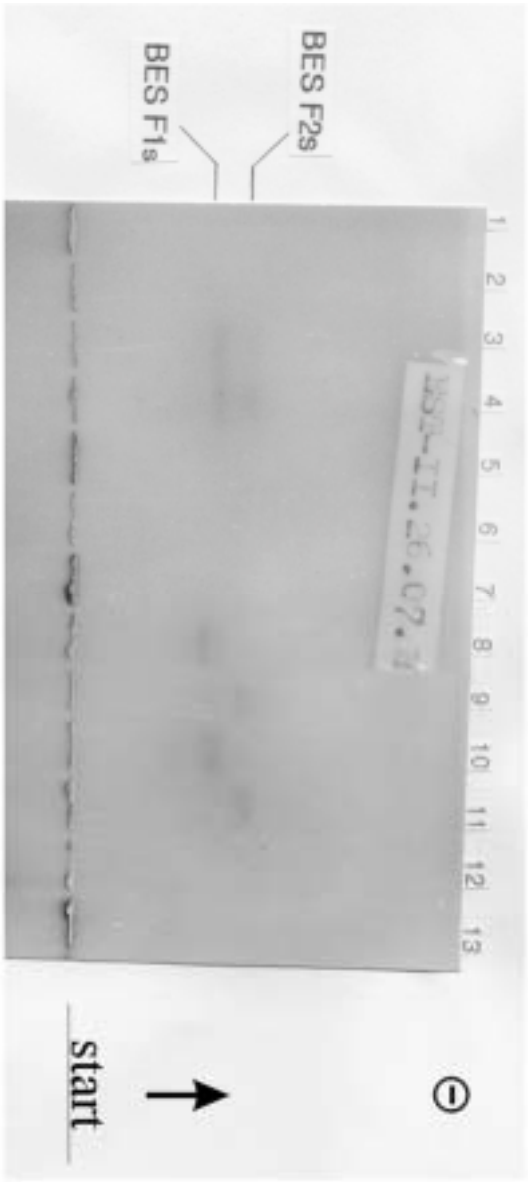

Fig. 3. Esterase spectra of silkworm haemolymph in cathode part (13% Starch gel electrophoresis) - 4th larval instar (1, 9, 11) and 5th larval instar (2÷8, 10, 12÷13): 1÷3 – race B517; 4÷10 – race M1; 11 – race UK20; 12, 13 – hybrid M2xM1.

Table 1. Specific expression of haemolymph esterases from polymorphic esterase zones of the studied races and hybrids *B. mori* L.: (+) - expression, (–) - absent expression

Race	Polymorphic esterase zone							
	BES Bs		BES Ds			BES Es	BES Fs	
	BES B_{1s}	BES B_{2s}	BES D_{1s}	BES D_{2s}	BES D_{3s}	BES E_{1s}	BES F_{1s}	BES F_{2s}
P14	+	+	–	+	–	–	+	+
P15	+	+	+	–	–	–	+	+
19	+	+	+	+	–	+	–	+
20	+	+	+	+	–	–	–	–
B517	+	+	+	–	+	–	+	+
T106	+	+	+	+	+	–	+	–
T108	–	+	+	–	+	–	+	+
M1	+	+	+	+	+	+	+	+
M2	+	+	+	+	–	+	+	+
UK17	+	+	+	+	+	–	–	+
UK18	+	+	–	+	–	–	–	+
UK19	+	+	+	+	+	–	–	+
UK20	+	+	+	–	–	–	+	+
Tashkent12	+	+	+	+	–	–	–	–
Tashkent15	+	+	+	+	–	+	+	+
Tashkent16	+	+	+	+	+	–	–	–
Hybrid								
P14xP15	+	+	+	+	–	–	–	+
P15xP14	+	+	+	+	–	–	–	–
M1xM2	+	+	+	+	–	+	–	–
M2xM1	+	+	+	+	–	+	–	–
UK17xUK19	+	+	+	+	+	–	–	–
UK19xUK17	+	+	+	+	+	–	–	–
UK18xUK20	+	+	+	+	–	–	–	+
UK20xUK18	+	+	+	+	–	–	+	+

Section 4. Post cocoon technology and by products: Cocoon drying and storage, silk reeling, gradation, silk handcraft cottage industries etc.

Contributions of INCDTP - Bucharest to the technological development of the silk textile industry

By

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Abstract: ***INCDTP Bucharest, the unique research – development institute in Romania and its partners from scientific research, higher education and textile industry worked together for the technological development of the silk textile industry, from the raw material, to the final textil product. This paper presents some of the results obtained by our institute till now and our research objectives for the future. For the textile silk industry supplying with new silk fiber types, our institute studied the Romanian mulberry, oak and castor oil plant by complex analyzing and technological processing of the silk fibers, including with the patented classical and enzymatic degumming type treatments. Our objectives for the future refer at the elaboration of new textile technologies for the obtaining of some modern silk products for clothes, with ecological and human – friendly character, given by their structures and fibrous compositions.***
Key words: silk, textile, Romania, development

1. The presentation of the National Research – Development Institute for Textile and Leather (INCDTP) - Bucharest

INCDTP is the unique textile research institute from Romania that accumulated a more than 55 years experience in textile research field, closely related with the industrial one, in our country and in other countries, especially from Europe. The main activity is the applied research in textile field and many other fields: industry, medicine, army, agriculture, transports, architecture, etc; expertise: mechanical and chemical textile processing, home textiles, technical textiles (for human body protection, agriculture, architecture, medicine, etc), quality testing and scientific publishing. The structure of INCDTP includes 12 departments for research and research related fields (scientific documentation and publishing), 6 departments for experimental research and pilot production and 6 departments for management and administration.

Our institute elaborates and publishes researches, strategies, prognoses financed by public and/or private founds, and produces technical and medical textiles, testing apparatus. INCDTP continuously searches for new partners as: research institutes, universities, SME's, textile plant producers, fiber-yarn producers and collaborates and manages many international projects, as:

FP V: BENTEX "Technology Management Benchmarking in the Textile Industry across Europe": The main aim of the project was the textile SME's supporting by Benchmarking data base implementation and FP 5 results utilization; there were contacted 1000 textile SME, realizing a data base from 450 benchmarking audits. Partners: Greece (coordinator), Belgium, Portugal, Germany, Spain, Italy, Czech Republic, Lithuania, Romania.

FPVI: FASHION NET: "Net work intermediaries to foster research and innovation in SMEs in the fashion industry system";
COSERAD: "Communication system for improving efficiency of RTD activity in the European Union"
ITE: BENTEX 2;

COST ACTION 628 "Life – cycle Assessment of Textile Product, Eco-efficiency and Definition of Best Available Technology of Textile Processing". The main aim of the project was the elaboration of an eco-index for the textile products and processings, by:

a) Life cycle assessment;
b) Eco-design and textile recycling;
c) Eco-efficiency and Best available technology indexes.

COST ACTION 847: "Textile Quality and Biotechnology*":* The project aim was the development of the textile clean technologies using the enzymatic products for the treatment of the cellulose, protein, synthetic fabrics and residual water. The new textile biotechnologies will be disseminated (know-how) in the textile industry.

LEONARDO DA VINCI: EUREKA – Leather Industry Polyglot Dictionary: The dictionary was realized under the coordination of COTANCE (Confederation of the National Associations of the Leather Industry from CE) with the following partners: EL.KE.DE – Leather Center, Greece; Lederinstitut Gerberschule Reutlingen – Germany; Danish Technological Institute – Denmark; Asociacion de Investigacion de las Industries del Curtide Y Anexas – Spain; Centre Technique du Cuir – France; Stazione Sperimentale Industria Pelli e Materie Concianti – Italy; Centre Technologico des Industrias do Couro – Portugal; British Leather Confederation – England; INCDTP – ICPI Branch – Romania.

EUREKA:
"Synergetic enzymatic effects in fabric preprocessing";
"Production of Bio-resorbable wound covering Textile Materials from Polyester Blends";
"Leather sub products recycling";
"New products and processing for the leather treatment";
"The obtaining of the woven and knitted fabrics with a good behavior at UV radiation and atmospheric conditions";
"A new cloth CAD modem 2D/3D for the cloth geometric modeling";

PHARE:
"The optimization of the determination methodology of carcinogenic amines";

PERFECT LINK: Pan European Federation of Clothing Textile and Leather Industries Networking and Knowledge building programme;

Bilateral cooperation:
Romania–Slovenia: "Textile materials obtained by surface chemical modification";
Romania–Denmark: The clean technologies' implementation in the textile industry of Romania"

Our institute is decided to create one of the most modern technological research infrastructures at pilot scale and works now, after the important improvement of its testing infrastructure, for the re-equipment of its technological pilot – modules with new plants and for the creation of some new ones, as the module for the textile silk fiber processing. We are glad to present you some of our research results obtained in the past and our researches in progress.

2. Contributions of the National Research – Development Institute for Textile and Leather - Bucharest to the development of the silk production and processing

The silk worm growing is traditional in Romania since the beginning of the XVIII century, by the sustaining of the mulberry cultivation and the opening of the first silk processing unit, in Banat region, placed in the South – West of Romania. The cocoon production increased till 8300 tones in 1989 and decreased till 2003, when The Silk Worm Amelioration Program was elaborated by the Govern, to finance this traditional activity and to improve the production (+25%) and quality of the cocoons (in-gauge: + 25%; silky sheath: + 10.5%) and silk fiber (fiber length: + 20%; length density: 2.8 den / -6.67%), by research projects in sericiculture.

INCDTP worked together with the specialists from research institutes, higher education and enterprises from sericulture, biology and textile industry to increase the production and quality of the Romanian silk cocoon and fiber characteristics obtained from three species: *Bombix Mori, Phylosamia Ricini, Antheraea Pernyi*.

The tables 1-3 present reliable values with insignificant annual variations: Table 1- Morphological and technological characteristics; Table 2 - Physical and chemical characteristics; Table 3 – Amino-acid and ammonia content.
Considering the cocoon weight a comparative element (100%), we analyze two parameters: the silky sheath and the spinnable fiber length; the quality of the mulberry cocoons was re-confirmed by the following data extracted from table 1:

Cocoon type:	Cocoon weight, %	Silky sheath, %	Spinnable fiber length, %
Mulberry	100	45-50	39.2-43.5
Oak	100	20-30	8-12
Castor oil	100	38	-

The silk fiber quality was considered by the values of spinnable length, count, tenacity, elongation extracted from table 2:

Silk fiber type:	Length, m	Count, den	Tenacity, cN/den	Elongation, %
Mulberry	774-1048	3.1-4. 5	2.7-5.1	12.2-16.0
Oak	570-1300	3.6-4.9	2.6-4.0	22.0-25.0
Castor oil	-	1.35-1.54	2.75-4.66	21.0-33.0

The mulberry silk fiber presents better values of the length, count and tenacity characteristics and a significant reduced elongation –(24-170%) that indicate a higher cristallinity degree.

The crystalline zones of the silk fiber include four amino-acids (alanine, glycine, serine, and tyrosine) whose total amount in percents was extracted from table 3:

Cocoon type:	Mulberry	Oak	Castor oil
Amount before de-gumming, %	72.17	66.36	73.67
Amount after de-gumming, %	90.18	68.72	83.03

The higher crystallinity of the mulberry silk fiber was confirmed by the amount of alanine, glycine, and serine, tyrosine (90.18%), by the low break elongation values and by the good break resistance values. In contradiction with mulberry silk fiber data, the high amount of alanine, glycine, serine, tyrosine (83.03%) of the castor oil silk fiber cannot be totally correlated with the mechanical characteristics that also reflect the discontinuous, non-uniform fiber structure.

Table 1. The cocoon morphological and technological characteristics

Characteristics	Values / cocoon species		
	Mulberry	Oak	Castor oil
Morphological :			
Longitudinal axe, mm	28.65-33.52	33.5-43.8	21.3-28.5
Transversal axe, mm	15.11-21.53	20.0-25.0	13.2-18.1
Mass, g / cocoon	0.53-0.88	2.0-5.0	0.45-1.12
Volume, cm^3	3.56-8.9	7.7-15.6	5.6-11.3
Cocoon number / kg	2451-1175	490-180	2150-900
Technological :			
Silk amount, g	0.24-0.45	0.6-1.0	0.17-0.43
Spinnable silk amount, g	0.21-0.39	0.24-0.4	-
Chrysals, g	0.25-0.46	1.4-4.0	0.28-0.69
Waste, g	0.013-0.047	0.31-0.54	-
Efficiency at cocoon reeling, %	31.4-36.5	12.0-8.0	-
Total fiber length, m	773.6-1047.8	570.0-1300.0	-
Fiber length at the first break, m	373.3-782.0	100.0-500.0	-
Breaks number at cocoon r eeling	2-4	3-7	-

Table 2. The physical-mechanical and physical-chemical characteristics of the silk fibers

Characteristics	Values / cocoon species		
	Mulberry	Oak	Castor oil
Physical-mechanical :			
Count, den	3.1-4.5	3.6-4.9	1.35-1.54
Break resistance, cN	10.4-13.8	17.0-24.0	4.1-4.6
Break elongation, %	12.2-16.0	22.0-25.0	21.0-33.0
Tenacity, cN/den	2.7-5.1	2.6-4.0	2.75-4.66
Physical-chemical :			
Fibroin, %	74.3-78.8	84.3-80.2	85.35-80.15
Sericine, %	19.8-23.9	9.6-12.6	9.8-12.3
Ash, %	0.7-1.0	2.7-3.1	1.4-3.1
Alcoholic extract, %	0.8-2.6	0.8-1.2	0.64-1.25
NaOH solubility index	1.03-2.73	2.6-2.9	2.8-3.2
Whiteness	58.5-63.1	-	40.0-62.0
Luster degree	0.69-0.75	0.75-0.78	0.84-0.96

Table 3. The amino-acid amount of the silk fiber before and after de-gumming

Amino-acid name	Grams / 100 g silk					
	Mulberry		Oak		Castor oil	
	before de-gumming	after de-gumming	before de-gumming	after de-gumming	before de-gumming	after de-gumming
Alanine	21.22	30.09	35.58	40.35	20.22	31.6
Glycine	28.18	36.33	21.6	25.68	18.0	18.44
Serine	14.9	13.42	7.22	6.73	11.06	10.6
Tyrosine	7.87	10.34	9.37	10.27	8.08	8.08
Total, %	72.17	90.18	73.77	83.03	57.36	68.72

The Bombix and Antheraea silk processing was of classical type for continuous yarns (32-35 den), with three main phases (sorting, spinning, finishing), each one including some operations: steaming, boiling, drying, osmotic treatment, etc; the Phylosamia silk was extracted as de-gummed fibrous mass and spinned as woolen yarns (Nm 28-60, with 80-50% polyester) / worsted yarns (Nm 12-14).

Another interesting research project was the increase of the Romanian cocoon production by Bombix mori worm bio-stimulation with natural (auxine) and synthetic substances (protein steroid: GVT-1; synthetic hormone: a-HJ; terpenoide substance: JTC-1; polypeptide substance: JP-2) with anabolisant – stimulative action.

The products were applied in aqueous emulsion pulverized on silk worms that absorb them by skin; the improvement of the silk biosynthesis was a result of the temporary physiological reactions, without pathological / toxic character or permanent mutations that could generate profound structural modifications of the filaments.

The tables 4-6 reflect the positive effect of silk worm bio-stimulation by the higher quantity of the silk obtained from six lots formed by about 4000 worms of a Romanian Bombix mori polyhybrid.

Table 4. The bio-stimulation products – Quantities applied on Bombix mori worms

Lot number	Bio-stimulation product	Applied quantity, μg / worm
I	None	-
II	JPN-2	10
III	JPN-2	62.5
IV	Auxine	72.5
V	GVT-1	1000
VI	JTC-1	50

The cocoons resulted from each lot were sorted and studied in three categories:

Big: transversal axe > 19 mm;
Medium: transversal axe = 17-19 mm;
Small: transversal axe = 15-17 mm.

The data from table 5 (the cocoon characteristics), table 6 (the filaments characteristics) and figures 1-2 demonstrate the positive influence of the bio-stimulation products from a quantitative viewpoint (the spinnable fiber length, etc).

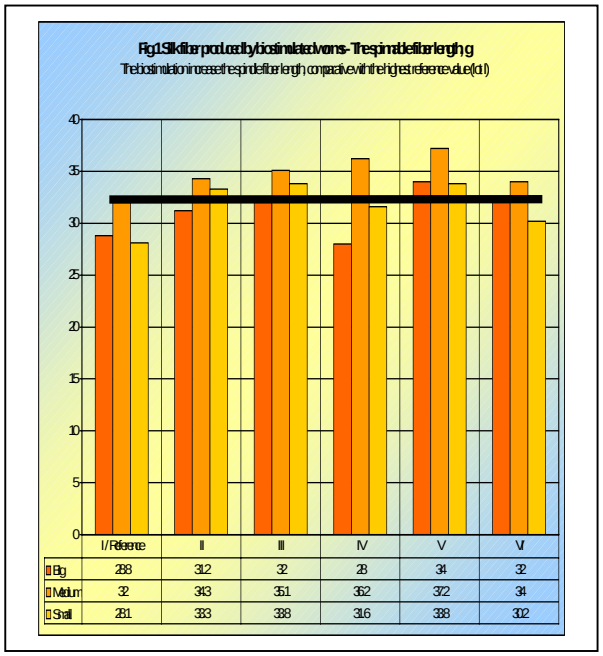
Table 5. Silk cocoon generated by bio-stimulated worms - Morphological and technological characteristics

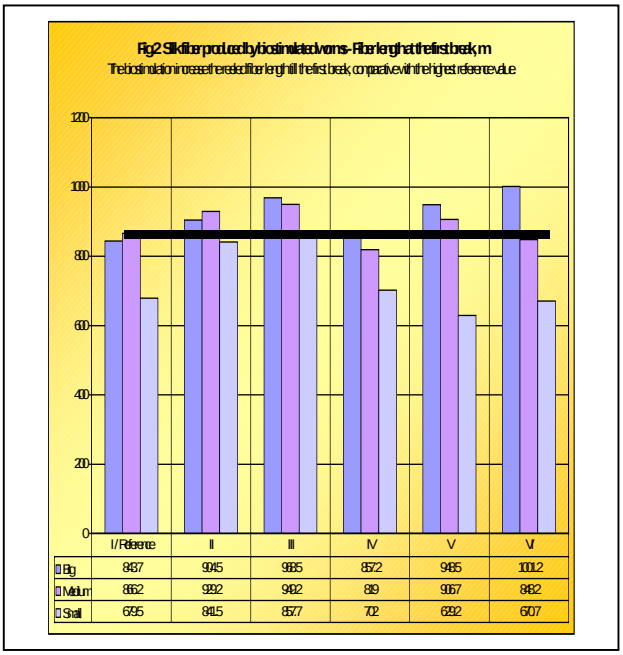
Characteristics	Values / cocoon lots					
Lot	I	II	III	IV	V	VI
Morphological :						
Longitudinal axe, mm						
Big	32.2	32.5	33.4	32.3	31.9	32.9
Medium	31.0	31.2	32.1	31.4	30.9	31.7
Small	28.0	29.4	29.8	28.3	28.3	28.7
Transversal axe, mm						
Big	19.3	19.9	19.9	19.7	19.5	20.0
Medium	18.0	18.3	17.9	18.1	17.5	18.1
Small	15.7	15.8	16.0	15.8	15.9	15.8
Average mass, g / cocoon						
Big	0.9	0.8	1.0	0.9	0.84	0.85
Medium	0.75	0.7	0.8	0.8	0.72	0.7
Small	0.57	0.57	0.68	0.6	0.65	0.6
Cocoon number / kg						
Big	1111	1250	1000	1111	1190	1177
Medium	1333	1428	1250	1250	1389	1429
Small	1754	1754	1470	1667	1538	1667
Technological :						
Silk amount, g						
Big	42.7	44.8	46.4	43.4	46.1	44.5
Medium	43.0	45.8	46.8	40.7	44.9	43.3
Small	45.9	46.8	47.3	38.0	46.9	42.9
Spinnable silk amount, g						
Big	28.8	31.2	32.0	28.0	34.0	32.0
Medium	32.0	34.3	35.1	36.2	37.2	34.0
Small	28.1	33.3	33.8	31.6	33.8	30.2
Chrysals, g						
Big	57.3	55.2	53.6	56.6	53.9	55.5
Medium	56.1	54.2	53.2	59.3	55.1	56.7
Small	54.1	53.2	52.7	62.0	53.7	57.1
Total fiber lenght, m						
Big	870.7	978.7	1091.2	893.0	993.5	1086.7
Medium	949.5	956.2	996.7	938.2	978.2	931.5
Small	776.1	841.5	871.7	774.0	798.2	729.0
Fiber length at the first break, m						
Big	843.7	904.5	968.5	857.2	948.5	1001.2
Medium	866.2	929.2	949.2	819.0	906.7	848.2
Small	679.5	841.5	857.7	702.0	629.2	670.7
Average breaks number at cocoon reeling						
Big	0.3	0.5	0.7	0.4	0.2	0.6
Medium	0.4	0.2	0.4	0.5	0.3	0.4
Small	0.6	0.4	0.5	0.6	0.3	0.4

Table 6. The physical-mechanical and physical-chemical characteristics of the silk fibers

Characteristics	Values / cocoon lots					
Lot	I	II	III	IV	V	VI
Physical-mechanical:						
Length density, den ± p%						
Big	2.7±3.3	2.8± 6.7	3.1±6.7	2.5±2.9	2.7±3.4	3.1±3.5
Medium	2.9±7.0	2.6±5.3	2.7±6.5	2.7±6.7	2.7±3.2	2.7±5.0
Small	2.4±5.5	2.6±7.1	2.8±4.3	2.6±1.5	2.9±1.7	2.8±5.0
CV_{den}, %						
Big	4.6	9.4	9.4	4.1	4.8	4.9
Medium	10.0	7.5	9.1	9.4	4.5	7.0
Small	7.7	9.9	6.1	2.1	2.4	7.1
Break resistence, cN ± p%						
Big	9.0±11.8	8.3±11.4	8.3±10.5	5.8±9.6	6.3±8.0	7.4±11.8
Medium	8.9±9.5	7.1±26.2	5.2±13.5	6.0±10.6	6.6±11.8	9.9±9.3
Small	6.5±13.3	7.1±28.7	6.2±10.0	5.3±9.7	5.1±9.7	5.2±8.9
CV_{rez}, %						
Big	41.9	40.3	37.2	34.1	28.3	41.7
Medium	33.5	36.6	47.7	37.4	41.8	32.8
Small	47.1	40.2	35.2	34.5	34.9	31.4
Break elongation, %						
Big	16.4	19.6	27.8	17.0	23.0	20.0
Medium	22.2	17.2	21.0	18.4	19.4	19.4
Small	17.7	17.2	20.6	24.2	17.4	21.6
Tenacity, cN / den						
Big	3.3	3.0	2.7	2.3	2.3	2.5
Medium	3.0	2.7	1.9	2.2	2.4	3.6
Small	2.7	2.7	2.2	2.0	1.7	1.8
Physical-chemical:						
Sericine, %						
Big	20.6	20.23	18.43	21.27	20.33	21.51
Medium	20.32	20.0	19.21	20.13	19.7	21.0
Small	18.21	18.22	19.2	23.01	18.17	20.03
Fibroin, %						
Big	79.4	79.77	81.57	78.73	79.67	78.49
Medium	79.68	80.0	80.79	79.87	80.3	78.94
Small	81.79	81.78	81.8	76.99	81.83	79.97

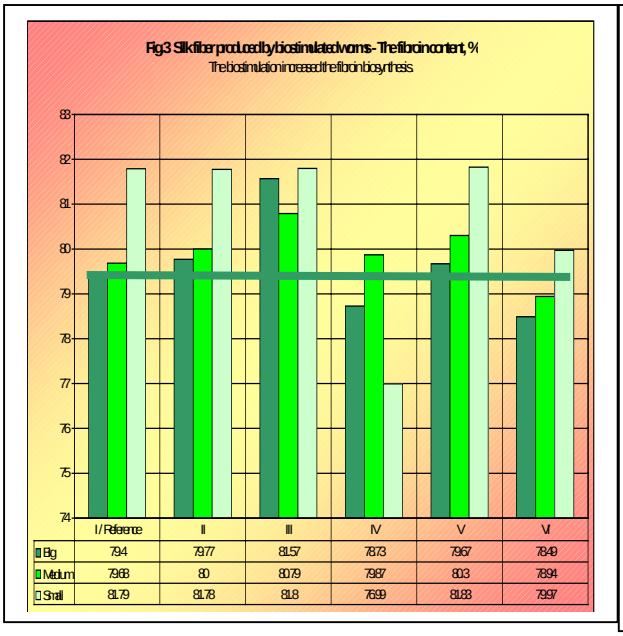
Fibroin molecular mass						
Big	230230	245790	250440	256060	226780	232140
Medium	233670	245890	240270	256840	230580	244850
Small	224180	246150	243620	249630	232110	239030

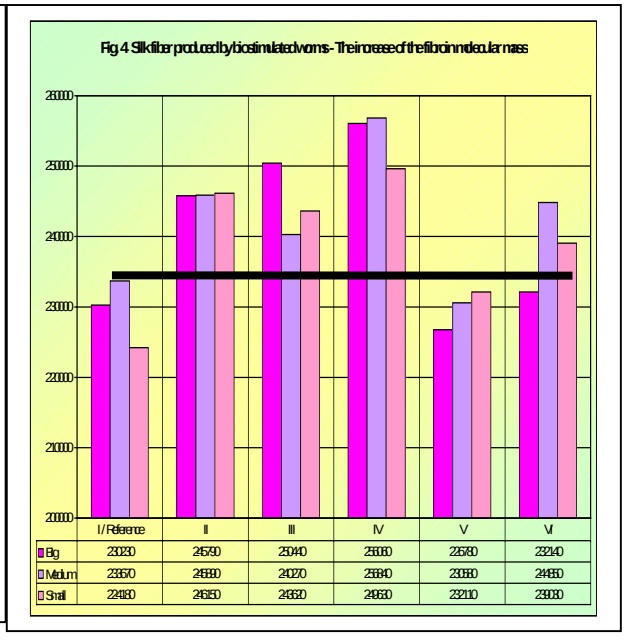


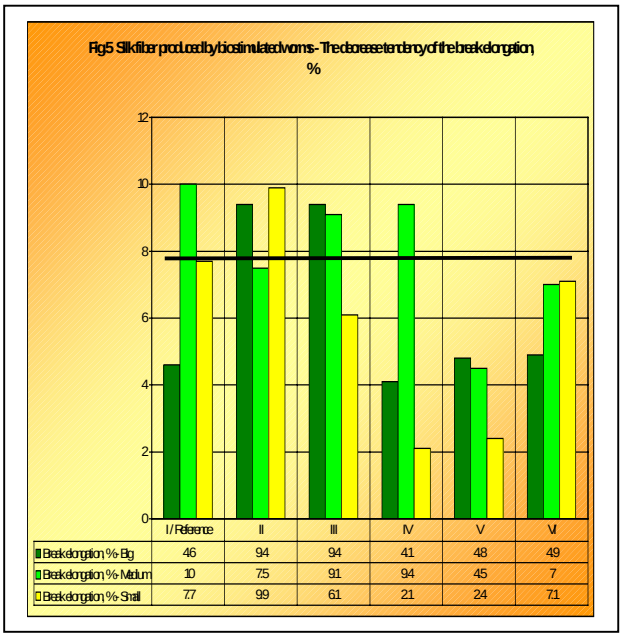


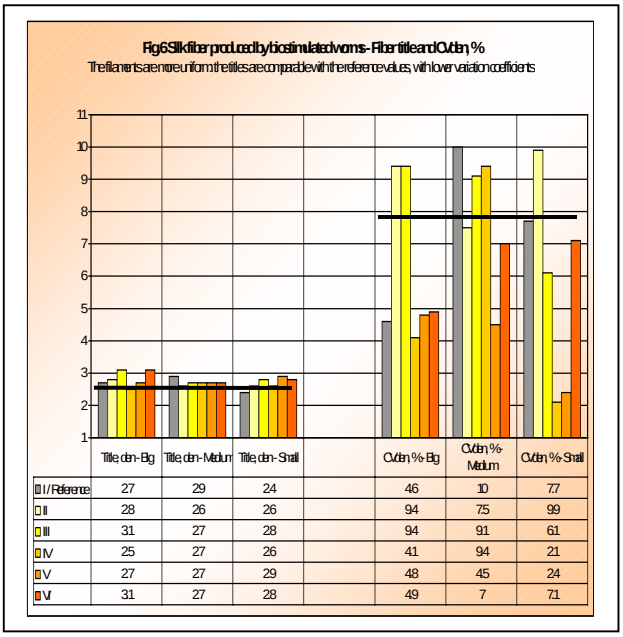
The figures 3 and 4 illustrates the positive evolution of the lots fibroin amount, respectively a very interesting increase of the molecular mass that's partially reflected in figure 5, by the decrease tendency of the elongation.

The fiber count is comparable with the reference one, with a decrease tendency of the variation coefficients (figure 6).









The industrial production infrastructure that serves for this technological experimentation is not functional now, but our institute began to create a new research module for the textile processing of the silk at pilot scale, equipped with new plants for spinning, weaving, knitting, finishing.

The plants will be obtained both by acquisitions and design-production, starting with the reeling machine, shown in total view in the figure 7, and some auxiliary installations: the cocoon boiling installation with three containers (fig. 8), the cocoon brushing installation (fig. 9) and the device for filament addition.

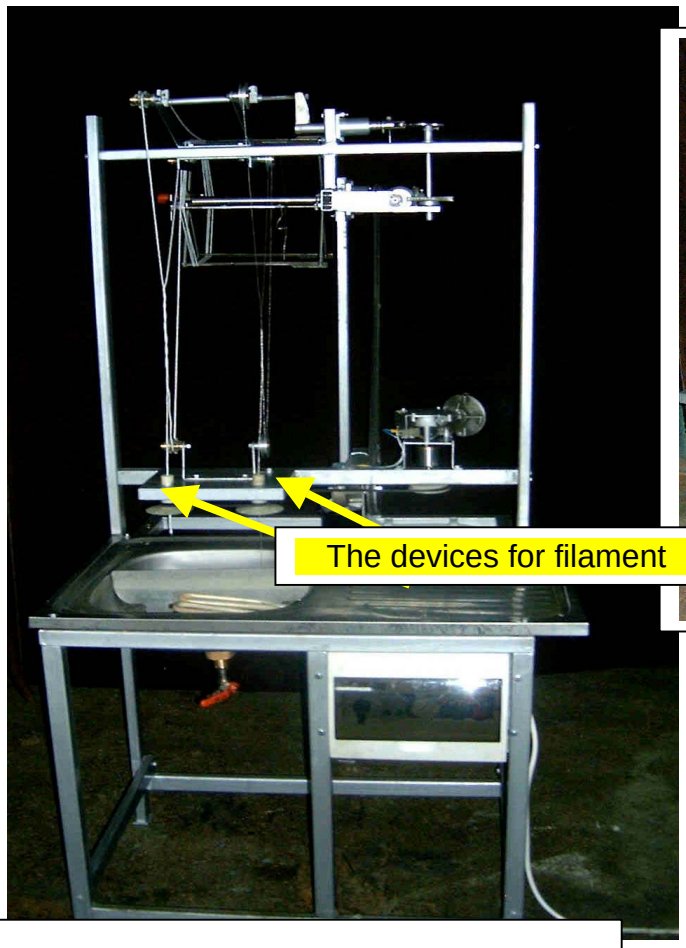


Fig. 7 The reeling machine made by INCDTP
-Total view-

Fig. 8 The cocoon boiling installation

The water temperature is optionally and constant in the three containers put on the work surface. The cocoon are treated at different temperature and transported, from an container to other, inside the perforated stainless basket closed by the cover, shown on top.

Fig. 9 The cocoon brushing installation in work and open position

This reeling machine was successfully experimented and will be completed with a new winding machine from the skein, to flange bobbin, also by designing – realization into new research projects.

Other modern plants for weaving, knitting, yarn and fabric enzyme treating and dying will be procured from performance textile machinery constructors.

3. The INCDTP' research projects in progress in the silk field

Last year, INCDTP started to work at a new research project coordinated by SERICAROM Bucharest, the main research unit in the sericulture field. The aim of our research is to valorize the silk filaments extracted from the cocoons produced into a reproduction silk worm farm, by the elaboration of some new woven and knitted textile structures.

Our task is very difficult, after the closing of the Lugoj spinning mill, so that we'll extract and process the continuous silk filament yarns in our institute and other textile enterprises, on the existing textile plants.

The new silk textile products made of continuous silk filament and other fine yarns will have an ecological and human-friendly character, due to their fibrous composition, rich in natural fibers (51-75% silk, fine wool, Romanian mohair).

The punched cocoons, the main part of the cocoon production will be temporary valorized by handicraft technologies, at the farm; INCDTP will valorize the discontinuous silk fibers extracted at farm, after the completion of the new silk textile processing module with a woolen type spinning installation, at pilot scale.

4. Conclusions

a) INCDTP Bucharest is the unique textile research unit from Romania whose laborious research activity in the silk textile processing field conducted to the reliable data technological obtaining, patents and scientific communications;

b) The closing of the main silk spinning mill in the transition period unfortunately affected the Romanian textile industry and our research activity;

c) INCDTP Bucharest started the creation of a new pilot technological module for the silk textile processing, equipped with modern installations obtained by acquiring and designing in our institute, such as the new reeling machine with the auxiliary installations;

d) The new pilot module will improve our research activity in progress and our future projects that we're waiting with interest to initiate in collaboration with you.

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Preparation of Handicrafts using pierced cocoons and Medleri (Spun silk)

By

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Abstract: ***During the present work various handicrafts namely wall plates, flowerpot, cones, Bouquets, Flower basket, Greeting cards, were prepared using pierced cocoons. Hand fan, Show pieces, Knitting of table clothes, Sweater, Frocks, Necklace, patchwork, Purse, wall plates were prepared using the Medleri spun silk, Festoon, Lamp shade, Hair band, Friendship band, Garlands etc were made out of spinning waste, various defective cocoons, Floss, weaving waste, waste raw silk. Attempt was made to prepare beautiful handicrafts utilizing the bye products of silk industry and to boost the income from sericultural practice using simple techniques and natural skill available with the women folk. Initial efforts have been made to pave a way for popularization of such activities. A planned approach to popularize the art with a special emphasis on training, product diversification, raw material availability and better marketing would certainly go along way in encouraging the new entrepreneurs to come up with a number of new products of utility and artistic value and thus making sericulture practice further attractive.***

Keywords: handicrafts, sericulture bye products, medleri spun silk

Introduction

Sericulture is ideally suited to rural sector; it is a agro based cottage rural industry. It combines both agriculture and industry, it requires the least investment and minimum gestation period, while it provides income through out the year at frequent intervals. It is the only cash crop that guarantees regular returns.

Sericulture is the industry which is suited to all the developing countries, where unemployment and underemployment continue to be a serious problem. It rightly fits into the socio-economic structure of the rural areas and can serve as an effective tool for rural reconstruction benefiting the weaker sections of the society.

Sericulture industry comprises four distinct activities namely; a) cultivation of mulberry b) silk worm rearing c) reeling of cocoons d) weaving of silk. While the first two sectors are agricultural based and last two sectors are industrial in nature. Silkworm rearing is done to produce cocoons either for reeling or for seed purpose. When the larvae spins a cocoon it transforms itself first into a pupa and later emerges as a winged moth in the course of about ten days of spinning the cocoon.

Silkworms being a delicate creature, the silkworm reacts very sensitively to the environmental conditions particularly temperature and humidity. It is also susceptible to a number of diseases which some times take a very heavy toll of worms. The cocoons spun by diseased larvae are inferior and they are used in spun silk industry and some partof such cocoons are used for preparation of handcrafts and decorative items.

In India mulberry leaves and fruits are used in medicines and food, extraction of oil from silkworm pupae, conversion of different silk wastes into useful products using deformed and pierced cocoons in handicrafts etc. are in vogue since ages. The recent studies by the Central Silk Board indicate vast scope for axillary enterprises in this area. It is estimated that there would be a value addition from 10 to 25% in various sectors of post-cocoon with effective management and utilization of the waste.

The different processes of the post cocoon technology involves the various steps; like reeling, re-reeling, twisting, doubling, throwing, weaving etc,. Leading to the manufacture of fabric. These different processes produce a lot of unwanted waste materials along with the main product in every stage of processing; such waste can also be utilized for preparation of handicrafts.

The appreciable returns from these bye-products help the growers, reeler's and traders to keep this end product at competitive level by lowering the cost of production, where the revenue through the bye product acts as additional income. The Grainages produce lot of pierced cocoons after moth emergences which are usually diverted for spun silk production these can be used for preparation of handcrafts which will increase the end product value.

Bye-product utilization and management deserves a special attention which could make sericulture further more attractive, as sericulture industry works as a tool for economic development for rural India. Cocoon handicrafts not only ensure natural instinct to do something special but also to generate additional employment and revenue.

In the present work we have attempted to work out the procedures for preparation of possible decorative items utilizing different categories of waste starting from spinning waste on the mountages till weaving waste by presenting the end product as photographs.

Materials and Methods

Various types of wastes that are produced at different stages right form cocoon to fabric will be used, they are:

1. Spinning waste
2. Defective cocoon : Pierced, melted,irregular shaped, soiled, thin end, double & stained cocoons
3. Floss.
4. Medlery silk : Dyed & undyed silk.
5. Weaving waste.

By using these materials we have made an attempt to create some decorative items as listed below

Waste materials Used	Final Product
1. Spinning waste	a) Wall plate
2. Defective cocoons	a) Flower pot
(i) Pierced cocoons:	b) Cone
	c) Bouquets
	d) Ornamental plants
(ii) Deep stained cocoons:	a) Greeting cards
	b) Rakhi
(iii) Cut or Rat eatten	a) Greeting cards
	b) Rakhi
(iv) Melted cocoons	a) Flower basket
	b) Rakhi

(v) Irregular Shaped or deformed cocoons	a) Rakhi
(vi) Thin end cocoons	a) Wall plate b) Greeting cards
(vii) Double cocoons	a) Show pieces b) Varities of flower pot
(viii) Stained cocoons	a) Wall plate b) Greeting cards
3. Medlery silk * Dyed silk	a) Knitting b) Sweater c) Necklace d) Frock e) Rakhi f) Fan
* Undyed silk	a) Patch work
4. Weaving waste	a) Wall plate b) Purse (hand bag) c) Festoon d) Shade lamp e) Greeting card f) Hair band
5. Medlery Silk and Weaving waste	a) Wall plate
6. Waste Raw silk	a) Friendship band b) Garland

Methods:

1) Wall plate:

Materials required:- Fabric paints, brush, spinning waste.

Method: The filamentous silk waste of uniform size is collected and cleaned. Spinning waste is spread on hardboard with suitable background and painting is done with fabric paints. Depending on the size of the waste available different sized paintings can be prepared.

WALL PLATE

Defective cocoons:
Defective cocoons means those having defect on it or those which are not suitable for reeling process, using defective cocoons one can make beautiful items, different decorative items can be prepared from the defective cocoons, which are categorized as follows.
(i) Pierced cocoons:
Pierced cocoons are those cocoons, from which the moths have emerged. During this process silkworm moths cut the cocoon shell and emerge out. Such cocoons can not be used for reeling as they do not yield continuous filament and are considered as waste used for spun silk production, grainages are the major sources for such cocoons, as after moth emergence these cocoons with be left out. One can make use of such pierced cocoons to make beautiful items as presented below.
2) Flower pot
Materials required: Pierced cocoons, glue, earthen pot, wire, dry grass matter, dye, thermocol, sand, thermocol balls, green crape paper, and scissor.
Method:
-~
Floss is removed from the pierced cocoons and their inner layer is cleaned. The pierced end of the cocoon is uniformly. Cut (as illustration-l figure-3) into three equal parts and a semicircular slit is made at the tip of the petal like that of rose petals. The inner layer of the petals is separated; by separation of layers 2 sepals can be prepared from each pierced cocoon in this manner. The petals are dyed and dried in shade, the ends of each petal is bent and arranged one above the another just like that of a rose flower. From the similar cocoons the sepals are prepared, which are dyed and dried. And by consequently placing sepal at the bottom and arranging the petals one above the other passing through wire a flower can be made out.
Earthen pot is filled with sand and on it some pieces of thermocol is placed and then flower twigs are arranged in the pot to give it an attractive finishing is done by placing few dry grass twigs and also some coloured thermocol balls.

FLOWER POT

3) Large Cones:
Materials required: Bamboo cone, dry matter, pierced cocoons, dye, wire, thermocol balls, decorative flower, green crape paper, fabric paint, glue, and scissor.
Method:

Flowers are made by the same procedure as already mentioned in the flower pot preparation. These prepared individual flowers are arranged in a bamboo cone. The dry matter is coloured using fabric paint and is arranged in a cone. For decorative purpose thermocol balls are attached using glue on the dry matter and a fancy flower is then placed on the cone, such sort of preparations require arrangement skills for final presentation

Large and Small cones

ILLUSTRATION - 1

Fig. 1
Raw pierced cocoon

Fig. 2
Cleaned pierced cocoon

Fig. 3
Slitting of the cocoon to make petals

Fig. 4
Separating the layers of cocoon

Fig. 5
Curling of patals using GI wire

Fig. 6
Drying curled petals

Fig. 7
Sepal

Fig. 8
Arranging the sepals and petals through GI wire

Fig. 9
Finished flower

4) Bouquet:

Large and small bouquet:

Material required: hardboard, pierced cocoon, decorative paper, G I wire, dye, fabric paint, transparent paper, thermocol balls, satin ribbon, decorative flower, glue, scissor, crape paper.

Method:

Individual rose flowers are made as mentioned in flower pot item. These flowers are dyed using different colours. Hardboard of required shape can be prepared; on it white satin cloth is spread and fixed using glue. The flowers and the dry matters are arranged on the hardboard. For the purpose of attraction thermocol balls are sticked using glue. Then the hardboard is covered with the transparent plastic paper and fixed with cellophane tape. Lower portion of the hardboard is covered with decorative paper. Final finishing is done by tying a satin ribbon.

Large and Small Bouquets

5) Greeting card:

Materials required: Deep stained cocoons, cards, glue, and scissor.

Method:

Cocoons are cleaned and rotten portion of the cocoon is cut to remove the remaining portion, which can be cut in to any shape required, it may be flower or doll, etc. These cut materials are fixed on the card using glue, as per the design and pattern required to make greeting cards.

Greeting cards

6) Wall plates: Different types of wall plates can be prepared depending on the material used and the final out come.
Material required: thin end cocoons, floss, glue, dye, thermocol, hard board, scissor, black cloth.
Method:
Hard board is cut in round shape; on it black cloth is attached using glue. Rose flowers are prepared as mentioned in the flower pot item, these flowers are dyed and dried, then attached on the hard board at the center, around the rose flowers dyed floss is attached and for decorative purpose small flowers are made as shown in the figure. These flowers are attached on the floss. And on those flowers thermocol balls are attached, and on the side of the flower leaves are attached, which is also made from thin cocoons.

Wallplates

7) Medlery Silk:
This is a silk which is spun from pierced cocoons; this silk is drawn using a medlery charka. Using this silk some of the articles mentioned below can be prepared.
Dyed medlery silk:
a) Knitting:
i. Round and square table cloth:
Materials required**:** Medlery silk, weaving waste and knitting needle.
Method:
Blue and red colour dyed medlery silk are used. These silk is knitted in alternate lines into a round shape to make it more attractive

Square and round table clothes

8) Purse:

Materials required: knitting cloth, weaving waste, needle,lining cloth, zip.
Method:
Three different colours of weaving waste is collected and made into continous thread.
Knitting is done on the knitting cloth using different colours of thread alteranatively, after the knitting is completed, knitted cloth is stiched in the shape of a bag

Bag

9) Festoon:
Materials required: weaving waste, decorative bells, scissor, needle.
Method:
Weaving waste is tied at both the ends, the threads are tied at certain distance as shown in the photograph. This tying of thread is continued along the length of the weaving waste. At the tips, tiny balls are tied as shown in the photograph to give more attractive appearance to the festoon.

Festoon

10) Lamp shade:
Materials required: steel lamp stand, weaving waste, decorative materials, bells, glue, scissor, silk lace, electrical wire, lining cloth, bulb.
Method:
For the preparation of lampshade the Steel lamp stand and upper frame are fabricated in a work shop according to required size and shape. Then the electrical connections are given to the stand. Bulb is fixed inside the frame. The frame is covered with the lining cloth of the same colour as that of the weaving waste that is used for the lampshade preparation. After

covering the frame with the lining cloth the weaving waste is attached on its upper side. And the lower threads are used for the decoration of the lamp. These lower threads are tied as shown in the photograph. Then the upper portion is attached with the silk lace. For decorative purpose balls are tied and glittering materials are sticked using glue.

Lamp shade

11) Garland:
Materials required: waste raw silk, dye, thread, glue, thermocol balls, waste cocoon.
Method:
While testing the denier or the single cocoon filament length using the epprouvette, the reeled out silk which is of no use can be used to make garlands. Such silk is dyed using desired colours. These garlands are further decorated with cocoon flowers and thermocol balls as shown in the photograph.

Results and Discussion:

In the present work an attempt has been made to prepare some decorative items utilizing different types of wastes ranging from the waste cocoons till weaving waste etc. The final out come of the finished product can be viewed and appreciated from the photographic pictures of each individual items prepared from different types of wastes.

The preparation of handicrafts that too especially "Cocoon craft is an very interesting and income generating way of utilizing sericulture bye product Preparation of handicrafts no doubt is only an skilled process where one can exhibit his/her artistic talent and skill, here rags can be turned into riches and all that it requires is some skill.

For the preparation of the said handicrafts during the present study, except for the pierced cocoons which were purchased from local government Grainage, all other categories of wastes were procured from farmers, entrepreneurs etc. Which they used to throw it as an waste, when such entrepreneurs were shown the finished product the farmers were enlightened and understood the importance of such wastes to be utilized as a raw material for this cottage industry.

There are certain Agencies engaged in training of rural folk and interested people in preparation of handicrafts one such is the "Sericulture Training School at Chennapatna" (near Bangalore) in south India, Which is proving good results in popularizing this craft; it's a place where an opportunity is offered to budding entrepreneurs to exhibit their talent and learn new things through exposure. The school is functioning under the Department of Sericulture; Government of Karnataka this institute educates the skilled woman entrepreneurs to be economically self dependant.

In addition to the production of such value added products from the waste, there are other financial benefits and assured marketing outlets for marketing their product, the persons practicing such cocoon craft can avail 50% subsidy on purchase of pierced cocoons from the state Government grainages. Once an beginning has been made the products start putting in they may be marketed at village Employment Board (panchayat level) Khadi Gramodyog Bhandar, Cauveri, Kaluam Stalls at Janata Bazar and other commercial exhibitions run by the State Government, as nowadays the trend is for ecofriendly and recycled goods these products also find a competitive place in gift galleys etc.

Several aspects of silk in romanian crafts a contemporary research of silk route

By

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I. General aspect of silk in Romania

Situated at the crossroads of major trade routes that connected Europe to the Near East, Romania was exposed to important eastern, as well as western, cultural and artistic trends. Collections museums preserve various old textiles next to more recent ones produced in a peasant environment thus reflecting different aspects pertaining to the artistic and economic life of the Romanian people.

SILK AND CULTURE AREA OF THE MULBERRY TREE

The mulberry origin is in South Asia, where it was mentioned in documents over 3000 years ago. It spread in Europe together with silkworm breeding. It grows in the Far East, especially China and Japan, in south Asia, in the Middle East, in south Europe, reaching the 55th parallel.

Romania's geographical location, its relief, climate, soil, lithological layers and the underground waters have made possible the culture of the mulberry tree.

The ecological plasticity and the high vitality of the mulberry tree account for its existence on the hill areas, in the steppe and silvo-steppe regions, reaching the altitude of 500-600m high. The mulberry tree spontaneously lives in almost every village yard. Its organised culture is done exclusively for its leaves, which is the unique food of the silkworms from the species Bombyx Mori.

II. Documentary aspect about silk in Romania

Written or not, the testimonies, gathered and carefully kept by chroniclers and princes of Wallachia, Moldavia, and Transilvania, or, by personalities who crossed the country and noticed things worth being mentioned, were studied and searched along the centuries by historians, statesmen and scholars who wrote and left valuable books.

Proof of the use and production of silk in the 14th century in the Romanian territory was found in the work of Dimitrie Cantemir (1673-1723), Eudoxiu Hurmuzachi (1812-1874), V.A.Urechia (1834-1901), Bogdan Petriceicu Hasdeu (1836-1907).

Later, these sources, together with personal research were the basis of many studies and works printed and released in the 18Ith, 19th, 20th centuries.

The most important for sericulture belonged to scholar authors, who opened the way to "this very useful occupation" Petre Poenaru, A.D.Xenopol, Petre S. Aurelian, Dimitrie Brandza, Ch.D Drutu left studies which are topical even nowadays pointing out the merit of sericulture of being *knowledge, art, science* and *industry* at the same time.

DATA AND HISTORICAL EVIDENCE OF THE USE AND THE MANUFACTURING OF SILK

On the Romanian territory the processing of the "borangic"(the name of natural silk) was an occupation known for ages, without knowing exactly when it started.

The oldest proof which certifies the existence of silk on the Romanian territory was discovered in 1958, in *Gravan-Dinogetia* on the banks of the Danube,and belonged to the 10th century. The archaeological excavations revealed a hut where, among other things there was a silk clew made of two intertwined waxed filaments, probably used for sewing and two bobbins of plain silk filament, reeled on a thin stick probably used for weaving.

Silkworm breeding became an ordinary occupation much later, especially in the south of Romania. The inhabitants of the Danube areas would pay in 1348 to a monastery "bunches of silk"instead of money, which proves that they had and produced this merchandise. Local producers were permanently hindered in their wish to generalise this occupation by the competition of silk made in the East and traded by the textile merchants. Important quantities of silk were known to pass through the Romanian territories because they were mentioned in the customs documents of the time.

Thus, in 1552 the customs in Transylvania were paid "de centrum Litri Serici, Litras tres", but we can't tell if the silk was local or imported.

By the end of the 18th century the dowry acts often mentioned different silk cloth.

In 1792, Dimitrie Cantemir wrote in Descriptio Moldaviae, speaking about ceremonies, that at the wedding "the guests were offered a valuable cloth headdress or silk cloth..."

In 1793, "borangic" is mentioned in certain documents in Wallachia. The habit of wearing such thin cloth had came come from the eastern people who also gave the cloth the name of "borangic", "burangic" or "borongiuc"

In the notes made by Raicewich in the 18th century and those of Twruton when visiting the Romanian countries in the 19th century is mentioned the great number of white mulberry trees that would feed the silkworms.

Since the beginning of the 19th century the silkworm breeding have started being encouraged by official measures: newspaper campaigns, fund raising, training schools, printing treaties of sericulture.

In 1845, in Moldavia, the state favored the plantation of 600000 mulberry trees, and in 1849 a sericulture association was registered. This occupation has been done until today, especially in the south of Oltenia, south of Moldavia, south of Wallachia, without becoming a real industry though.

III. Aspect of silkworm culture in the village household

Silkworm breeding requires accuracy and patience, attentive and permanent care, skill and knowledge. After the butterflies lay their eggs, they are kept still in an aired area at a temperature of 25'C, after which they can be picked without any danger. This is safely done in autumn, in October or November, when the eggs are less sensitive.

In the village the eggs are kept in a closed cupboard, in the northern room of the house, which is inhabited and which needs to be aired all the time. Air temperature is kept constant at about 10'C.

In spring when the mulberry trees are budding, the hatching, generally artificial, starts. The eggs are placed in a long, pierced box which is kept near a heating source, above which there

is a water recipient meant to evaporate and to wet the atmosphere. In some villages they are kept on the fireplace where a small fire is burning. The eggs become bluish and transparent. After two week incubation, they hatch and, five days later, while the temperature is kept constant at 22'-24'C, the silkworms appear. They have a long and shiny body, 3mm long, covered by brownish hair. Once they appeared, a loose cloth is set over the box, through which the worms will climb, shedding their skin. On the cloth there are mulberry leaves on which the worms will feed for 4-5 days, while their skin becomes smooth and the hair disappears. In the sixth day they don't move anymore, they stand still with the head held high. This was the first age of the silkworms, which start then a new period when they are numb (sleep).

After this rest they start moving again, especially moving the forward part of the body. The skin bursts and is shed, and out comes the worm, regenerated and bigger, with wet wrinkled skin. After resting again it starts avidly eating the mulberry leaves and he gets ready for the second numb stage (sleep) which lasts 6-7 days. Eventually after the fourth rest period, of 7-8 days, it will live longer, up to 21 days.

When the worm has completed its growth it stops eating and starts to spin its cocoon. The cocoon is completed in 24-72 hours at which time the silkworm passes from the form of a caterpillar into an inert chrysalis or pupa.

Now the cocoons are carefully selected and divided into two groups: 1.for reproduction 2.for silk production. The cocoons selected for reproduction (a good quality) are kept in a room at 20'C. In the 20th day will appear the butterflies which will lay their eggs for the following series.

IV. Aspect of silk craft in Romania

SILK FILAMENT PROCESSING IN THE VILLAGE HOUSEHOLD

The cocoons selected for silk production are placed in the sun to arrest the development of the chrysalis and are then dived in boiling water. Through scalding the silk glue (sericin) is made liquid and it will stick the fiber into the layers.

The cocoons are stirred together and are shaken with a rod brush. Thus a thin filament is reeled out of 20 cocoons or a thicker filament out of 30-40 cocoon, which will be spun.

Then follow the processing operations: the drying of the "borangic" filament ends on paper, placing them in a bowl with beans not to get entangled and then reeling the filaments on the spinning wheel into skeins, followed by winding them on bobbins. The filaments thus obtained are used for weaving *thin veils*, or *intertwined,* for *weaving thicker cloth*.

THE ART OF WEAVING AND THE BEGINNINGS OF NATURAL SILK IN ROMANIA

The weaving on the territory inhabited by the Romanians is almost 8000 years old.

The archaeological discoveries have pointed out that the first looms were used since the beginnings of the 6th millennium B.C., during Cris-Starcevo period.

The archaeological excavations point to the existence of silk fabrics since 1060 but silkworm breeding (Bombyx Mori) will only start in the 15th century and develop in the 19th century.

In 1859, at beginning of modern Romania, in Damaroaia, a suburb of Bucharest, was opened a sericulture station and a silk mill to process the cocoons for the weaving mill.

The experience of silkworm breeding and the processing of the silk thread in the peasant's household will improve owing to the scientific knowledge of organized breeding and to the young specialists trained in the European universities.

In 1823 Iosiv Balasovici released the book: "Cocoon growing or how to breed silkworms".

In 1905 the engineer Vasile Dumitrescu published the first book completely written in Romanian, on silkworm breeding.

Between 1927-1928, within the Polytechnical School of Bucharest the first printed courses and handbooks in Romanian, on textile techniques and technologies, came out, under the guidance of engineer Cornel Casassovici.

Superior School of Textiles, founded in 1934, still enjoys a tradition and a quality appreciated all over the world.

Academy of Art in Bucurest, founded in 1949 a Textile Art and Design Department

V. ASPECT OF SILK AND COMMERCIAL ROUTES

CROSSED THE CARPATHIANS FROM 12th TO 18th CENTURIES

The textile handcrafts products, the textile raw materials and the textile technologies represented good merchandise for European trade ever since the Middle Ages.European merchandise which was traded on the Romanian territory from the south to the north of the Carpathians - raw materials, food, handicraft objects, was joined by oriental products - spices, cloth, precious stones and tinctorial plants.

Between the 11th and the 14th centuries the Romanian roads linked the Lower Danube and the Black Sea, through the cols in the Carpathians to the ports of Vicina, Braila, Chilia and Cetatea Alba.

Between the 14th and the 18th centuries the Ottoman Empire exported to Europe hand made traditional handicraft products made of valuable raw materials, in great demand in western Europe.

Silk was processed in centers which are still famous today: Brussa, Istanbul, Amasya, Salonic. In great demand were the gold and silver brocades made in Brussa, which were superior to the Iranian ones from Nahicevan and Sirvan, red Brussa velvet , superior to the Genovese one. Luxury cloth woven with gold and silver "seraser" and "kemha" were made in Istanbul, and thick cloth "cuha" in Salonic. After 1610, the production of this kind of precious cloth decreased because of the wars against Iran and of the competition with the naval trade of the Dutch and the English.

The intense trade with textiles of great artistic value and high technological performance in this period made possible the contacts between the nations of the continent and influenced the cultural development and a common system of values.

THE CARTAGE AND THE DEVELOPMENT OF TRADE IN THE BALKAN AREA

Real centers of cartage were to be found near Brasov: Sacele, Schei, Rasnov, Tohan, Zarnesti. The owners of horses and carts would transport building materials and wood for fire, for the town people, or handicraftsmen's products.

The people in Sacele, used as means of transport for long distances, horses and carts especially designed, called "care mocanesti" (carts of the shepherds).

They became famous traveling all over the country in Transylvania, Moldavia and Wallachia. The best equipped reached as far as the west of Europe, Pesta and Vienna, and the south, Turkey and Macedony.

The routes of the cartage people through the mountain cols of: Predeal, Bran, Oituz, Bratocea, Buzau remained in the memory of the local people.

In the 17th century and the beginning of the following one, they used to be hired by trade houses like that belonging to the merchant Mihail Tumburu, or by professional associations of merchants.

Besides the fact that they would transport the products of the local shepherds: wool, sheepskin, suet, cheese, cheese bladders, plaids, cloth, bags, long-haired shepherd's coat, the largest part consisted in the products of the Brasov handicraftsmen: thick cloth, shoes, furs, belts, rope, bridles, Brasov painted chests,as well as tin and silver vessels *silk weavings*, which they traded at the princely courts in Moldavia and Wallachia.

VI. Aspect of silk trace research in Transilvania

BRASOV AREA (south-east of Transylvania)

In the Transylvanian villages, the basic raw materials usedin fabrics manufacturing were animal fibers (wool, goat hear, *raw silk*) and vegetal fibers (henp, Flax, cotton).In the 19th century, *raw silk* threads replaced cotton in head scarfs(marame).

In the medieval Brasov, the existence of the textile professional associations, the guilds, was registered for hundreds of years. They were known for the fabric they wove –“the grey cloth”. Their production was of couse meant to the trade with Wallachia, Moldavia or Balkanic or Western countries.

The equipment used to process the textile fibres made important technical progress, thus, the spinning machine and later the mechanical Jaquard loom appeared in Brasov.

Before this period, the textile items, family clothing or items used in the farmers' households, for preparing the food, hygiene, or interior decorations, had been hand woven, in a loom. This one was in the house, all the family would work at it, especially in winter time. However, women played the main part. Because of the complexity of this work which relies on patience and skill, it used to be a real domestic industry in the rural economy - a logical sequence of operations to obtain and to process the textile fibres.

Among them, the most important operation is weaving at the loom which ends the technological line of textile processing, turning the thread into the finite product.

INNS AND MARKET PLACES - DOCUMENTARY AND ARCHITECTURAL PATRIMONY

In its development from medieval times to modern times, Brasov was a link between the Balkan area and the western world. Documents reveal that it became a famous commercial town in the Middle Ages, being the place of meeting of Romanian, Greek, Armenian, Turkish, Italian, Polish and German merchants.

As a result, a lot of inns appeared, to shelter the travelers and the horses and carts. They were conceived with a view of an intense commercial activity. A wide range of functions ordered the distribution of the storeys and the fittings. Thus, in the first place came the "boltile" cellars rented to the merchants, as Brasov used to enjoy the warehouse and passage rights since 1369. Near these warehouses, in the patio, there were the market stalls for selling and transactions,

for a longer or for a shorter rest. There were also sheds and stables for horses. There was a pub and upstairs there were the guest rooms which would look out into a long open balcony.

The people who used to come to these *yearly markets* would check in at these inns: ("To the Golden Crown", "To the Green Apple-tree", "To the Golden Sun").They would attend not only the spring market which would open in the first week of April, but also the autumn market which would start after the 1st of November and would last three days. You could find here local merchandise, called "brasovenii"(thick cloth, boots, hats, caps, bags, knives, swords, springs, furs, sheepskin coats, chests) but also imported goods (cotton, stuff, muslin, mohair, *silk*, camel hair belts, carpets, spices, groceries).

THE COSTUME OF "SCHEII BRASOVULUI"

Administratively belonging to the town of Brasov, the district of Scheii Brasovului was always remarked for its way of being a community typically Romanian having a traditional costume of a rare beauty.

Maria Baiculescu points out the features of the woman costumes: "the dresses are wide and made of brocade called sumne, with waistcoats decorated with valuable buttons, with raw *silk* headdresses as thin as the spider's web, beautifully closed with metal buckles with precious stones, with necklaces made of gold coins, wearing *silk satin* cloaks, trimmed with furs, called "malotele".

THE PASSEMENTERIE PRODUCERS OF SCHEII BRASOVULUI

The Schei district of Brasov was known as a powerful center specialized in cord manufacturing. We have documents about the existence of the passementerie producers ever since 1480. In 1798, there are registered manufacturing and and selling braids 600 families.

These cords were made in a little bride tub with little hammers and they were used in adorning thick men cloth. They were made of wool, cotton or *the most expensive ones of silk*, and produced according to a certain pattern. The braids varied in size according to the number of bobbins used or the way they were intertwined. The most wanted were the black, blue, red, yellow and in several colors ones.

SILK AND TEXTILE DOMESTIC INDUSTRY IN SACELE

Sacele is a small town near Brasov, which was made by the union of ten villages with a multi-ethnical population: Romanian, Hungarian and Gipsy. The town lies at the foot of the Baiului mountains, at the southern end of the low land Tara Barsei.

The Museum of Ethnography of Sacele, as it looks today, was opened in 1970, having as ethnographic profile the pastoral specificity of the seven villages: Baciul, Turches, Cernatu, Satulung (the center of the town of Sacele), Tarlungeni, Zizin and Purcareni.

In all the households in Sacele the families would weave wool into male and female clothing. Important quantities of black cloth for "ghebe" and "zabune" for men were sold on the market in Brasov and in the counties of Trei Scaune and Mures, as well as in Wallachia.

NATURAL SILK FABRIC - FLOSS SILK HEADDRESSES

A specific aspect of the textile industry in Sacele is represented by *the weaving of floss silk headdresses* by specialized professional women in Purcareni, Zizin and Satulung. They would receive orders from the women in Scheii Brasovului. The floss silk headdresses were among the most exquisite and smart female ornaments to wear on the head on festival and holiday

times. They were sold permanently at the weekly markets in Brasov, in a place called "clothes market" and even in Wallachia. The floss silk headdress, transparent fabric made of natural silk, would slowly replace the former headdress made of linen or cotton.

Woven in a special loom, out of floss silk thread - local natural silk, on a width of 30-60cm and a length of over 200cm, the decoration followed a distinction in ornaments required by the patterns, which were displayed on the whole surface and were woven in cotton or twisted silk thread, or they simply trimmed the edges.

The ornaments followed the same repertory mainly floral (the Scheii rose, the cornel, the wafer, the lily, the old flower) which give the headdresses the specific features of the region they belong to.

THE LAST HEADDRESS WEAVER OF PURCARENI .

A special feature of the home industry, at the end of the 19th and the beginning of the 20th centuries, is *the raw silk headdress weaving* - called floss silk (borangic).

In the village of Purcareni there were specialised women called "stergarese".

They would receive orders from the Romanian and Hungarian girls and young woman.The headdress is the thin transparent veil which is worn on the head and accompanies the traditional folk costume on holidays. It would replace the white linen or cotton towel worn before the existence of silk in Romania.

Out of the over 100 weavers who used to weave in Purcareni at the beginning of the century, there were only 5-6 left in the 70's. They are: Munteanu Ana and her daughter Munteanu Maria, Stroe Ana, Ciurea Elena, Moroianu Elena, Musat Lucretia and Tarea sisters.

Today, only Suciu Otilia still knows all the stages of the floss silk headdress weaving. She used to weave a lot when she was young and she learned the job from her grandmother, Ana Munteanu's sister-in-law.

"For the warp and weft of 15 floss silk headdresses 350g of floss silk is needed"said Maria Munteanu in an interview in 1972. "They didn't usually weave more than 15-17 headdresses, 2.5 reaches long each. A longer warp is not possible because of the fine thin filaments which get entangled easily and break.

The warping was done by several specialised women."After Moraru Maria came Dusa Valeria, the last weaver of Purcareni, to have woven floss silk.

The floss silk in skeins was reeled on reed pipes and twisted. Then came the warping, "invelitul"- the setting of the warping and the reeling on the roll- and "navaditul".

The warp was made of one filament, as thin as the spider's filament, of a length of 19 skeins with 30 filaments each. Working at these procedures is very meticulous because of the thin filament which has to be twisted and wet during the weaving.

For the weft the filament is double, twisted with a spinning wheel and set with a shuttle.

As George Moroianu puts it in his book "Faces from Sacele" the headdresses were as thin and as white as snow. The headdress for young girls was plain and woven of the thinnest filaments. Those for older women were made of thicker filaments and the background was striped with twisted cotton or silk thread. The two ends were decorated with delicate floral patterns made of white silk thread half a reach long."

The beauty of the floss silk headdresses lies in the thinness, fineness and transparency of the material, the richness, variety and originality of patterns and the unexpected combinations of motifs.

Today the home production of these silk fabrics stopped when the local population gave up the holiday traditional folk costume. Only ethnography museums of Sacele and Brasov give information about the weaving technology, in archive documents and visiting the rich collection of floss silk headdresses with its oldest item from the end of the 19th century.

VII. Aspect of silk in contemporary textile crafts

"MARAMA MUSCELEANA"S.A

The Asociation "Marama Musceleana" from Campulung has kept and preserved the folk tradition from Muscel area of the *floss silk filament* (natural silk made in Romania). Textile craft associates are encouraged and supported to maintain the Romanians tradition of home weaving people.

Wool, silk, linen and cotton fabrics of this region are very well known in Romania for the beauty of the decorative motifs. Textile craft products are made in a perfect technique and the refinement of colours,is especially in the farmers' costumes from Muscel.

Nowadays the weavers work in the workshop of the association or in their own homes in the mountains. In Dragoslavele, Valea Mare, Voinesti are woven with manual looms, with floss silk filaments, the wonderful headdresses (scarves) from Muscel.

They are used by women on holidays and on special occasions with the traditional folk costume. Unfortunately, young girls of today no longer wear the traditional costumes, as they wear town fashion things.

The plain, transparent and strong fabric made of floss silk was experimentally used to restore textiles for the first time in 1981 at the National Museum of Art of Romania. This natural silk fabric made possible the restoring of a child costume, discovered in an archaeological site at Negru Voda Monastery from Campulung. Today the fabric is being used for restoration in textile conservation laboratory

BREAZA AND THE TRADITION OF EMBROIDERY IN THE ROMANIAN HOUSEHOLDS

The small town, Breaza is situated at the foot of the Carpathians, 103km away from Bucharest, on the way that links Bucharest to Brasov. This place is a well-known resort and a famous crafts centre of traditional costumes in the Prahova Valley.

The women here are known to be remarkable creators of fabrics and garments.

The town is today a place where a lot of Bucharesters spend their week-ends and holidays in modern villas or in beautiful old houses remarkable by their architecture which reflects the artistic taste and the skill of the inhabitants.

"The Ethnografical Art Museum of the Upper Prahova Valley"which has rural garments costumes, cloth, towels used in the ceremony of weddings, woolen plaids, wooden notches and domestic hand-made objects.

In almost every house people used to embroider or weave on linen or cotton cloth with cotton thread of different colors, *bright silk thread*, gold and silver thread, the famous "ii" - blouses worn with the traditional costumes on festivals and holidays.

Nowadays, from the very young schoolgirl to the aged grandmothers, the women in Breaza keep on the skill of weaving and embroidering, working at home or in textile workshop - SOCOM Breaza SA.

The beauty of the floral patterned embroidery, with different geometries, displayed on the surface of the blouse, made of thin cotton cloth (panza topita) is known and appreciated in many European textile craft markets

CONTEMPORARY HANDCRAFTS CREATION IN ROMANIA

Romanian contemporary handicraft is a complex domain where the folk artistic traditional heritage meets an activity of old handicraft tradition still alive in many regions of Romania.

Contemporary folk creation enriches and diversifies the creation genres and the range of products, making use of traditional elements, observing the region specificity, on the territory of Romania.

Romanian Handicrafts Union was founded 125 years ago and is one of the biggest private association in the country. Today, a transition economy and a steady market, there are reasons for a new management of 65th local associations with more than 5000 members. Their crafts need a dialog with professional experts in economics, technology, art and design, for a supply, a production improvement. Crafts people are real folk artists and they have cultural and educational part in local communities. Folk art and handicraft articles of the handicraft associations stand proof of the existence of a rich treasure of folk art and ancient traditions of artistic handicrafts.

They have granted conditions for an important production of folk and handicraft value

The production of the handicraft workshops is varied and follows the traditions of the different folk regions of Romania, processing many various raw materials. Genuine folk art products can be mentioned, such as: traditional costumes, rugs, fabrics, glass and ceramic pottery, wooden items, wood and glass paintings, ironmongery.

The contemporary handicraftsmen are trying to make objects that can be useful for the modern : interior design made of wood or metal, vegetal fiber woven items.

In fashion they make different clothes and fabrics gathering natural materials - linen, wool, cotton, *silk* and many others.

Professional association ROMARTIZANA S.C.A. with its specialists in design, ethnology, old technologies and design grants assistance and consultance for obtaining new products in handicrafts. It grants the technological processing of raw materials necessary for handicraft production. It deals with marketing and trading its products in its own shops.

VIII. Aspect of silk in old and new circumstances

“ASTRA” - SIBIU A MUSEUM VILLAGE CRAFTS TECHNOLOGY

The Romanian village, as it looked at 19th century, and the domestic textile industry are preserved and illustrated for the tourists and researched by the specialists from the most varied domains. Here you may meet the millenary culture of the inhabitants of different parts of Romania

VILLAGE FARMHOUSE EQUIPPED WITH WORKSHOP FOR FLOSS SILK PROCESSING

Croici-Matasari,county of Gorj (Olteny)

The house from Croici-Matasari, built in 1888, is a Gorj valuable monument of traditional architecture and belongs to a rural sericultureral centre and the *processing of the natural silk* thread called "borangic"(floss silk) in the south of Romania.

The building was transferred into the museum Astra-Sibiu in 1978 and it illustrates the evolution of the architectural style and of the building techniques, from the one-storied houses to the two-storied houses, made exclusively of oak on a stone foundation with the roof made of oak clapboard.

The ground floor of the monocellular building used to be the pantry. On the first floor the house has two rooms, one used as a kitchen ('caminete') and the other as a bedroom ('hodaie') used in the summertime for sericulture.

Sericulture is done seasonally and it is followed by the domestic industry of processing the floss silk thread.('borangic').

From April to May the silk worms used to be bred until they changed into cocoons, in 'hodaie'. The cocoons processing took place in the 'caminete' using water boiled on the hearth and the reel. The spinning, the warping, the reeling and the weaving took place in the 'hodaie'. after taking out the furniture meant for the breeding of silk worms.The floss silk thread was used to weave the items of the traditional costume (scarves - 'marame' ; blouses - 'ie'), to make the 'carpe' tissues used to decorate the dwelling or sold in other places with tradition in the textile handicrafts. This brought to some villages in the Gorj county the fame of being centres specialised in *producing the floss silk.*

THE COUNTY OF DAMBOVITA AND A VILLAGE DREAMING SILK

The county of Dambovita is situated in the south of Romania, north-west from the capital Bucharest and it stretches on a surface of 3738 square kilometres. Its capital is the town of Targoviste, former capital of Wallachia, economic, commercial, cultural and touristic centre. The relief displays in stairs from north to south. The last level of relief is Targoviste high sub-hill plain.

The mild continental climate, varies according to the relief leading to different micro-climate areas, even at small distances.The county of Dambovita is crossed by three long rivers: the Ialomita, the Dambovita and the Arges and is rich in important natural resources, from deposits of oil to large forests.

Agriculture is done on an area of 229,000 ha, where cereals, vegetables and industrial plants are grown. The natural conditions made possible the vine and the fruit tree growing: the mulberry being quite common in every garden. The pastures and the grasslands stretch on 56,000 ha. and made possible the livestock breeding: sheep, cattle and poultry. In these villages with rich farmhouses sericulture has also developed as a seasonal occupation.

In wintertime when tilling would stop, the young girls used the natural silk thread called "borangic" to weave beautiful tissues and embroidery. The most famous sericulture centres are nowadays in Cazaci, Gaiesti and Nucet. A revival of this handicraft is being tried today in Contesti.

Situated in the river Dambovita valley, the commune counts eight villages and four old orthodox churches. It was mentioned in documents in 1750.

The estates of ancient noblemen Bratianu, Hagiu and Protopopescu are to be found here.

One of the targets of these organisations and of the people in Contesti is the revival of silkworm breeding and mulberry-tree growing in the area.

The hard-working and wise village women in Contesti, still keep in their dowery trunks, or inside their houses, beautiful fabrics of silk floss (local natural silk).

Wearing the traditional folk costume, woven and made within the household, the women in Dambovita area celebrate "Romanian Peasant Woman's Day", every 15th of October.

IX. Aspect of silk in an excelence research proiect

The National University of Arts Bucuharest-Textile Art and Design Department Team is partener in a developing a proiect of CEEX –National Excelence Research Program for the economy and social improvement of small Romanian agricultural farm.

Dircted in a consortium system by Ms. Dr.Ing. Alexandra Matei, six expert teams gives their research, and science for a productiv experimental models for al sericultural farm

General purpose:

In the first stage of the project the textile design team has a challenge in a documentary and research activity for: an experimental, small, flexible, easy and multi-functional textile craft technological line and textile implements.

Using very simple craftsmanship technologies and processing second row materials (produced by a village-farm sericultural activities) to obtain marketable, useful and aesthetic textile products.

Project result:

-Providing economic benefits to countryside farmers.

-Creating alternative economic activities for village people

-To help develop potential craft-related free market economical relationships

-Creating opportunity for vocational and cultural activities

-Opening to knowledge and understanding of a new concept in contemporary crafts - "*Ethnodesign"*

Identification of resources - main textile groups for documentary study and research:

1. Silk fabrics made by traditional handicrafts-ethnographical fabrics and technology.

2. Canonicals textile objects and diversity of technique

3. Industrial silk fabrics and industrial technology

4 Contemporary textile fiber art and artist technique.

Analisys of basic components for textile products in the market.

I. Textile Design Products for Industrial Technology

II. Textile Interior Design and Fashion Design

Textile Crafted Objects – Handmade :

1. A textile craft object- traditional technology and traditional use.

2. A textile craft object - traditional technology and a design intervention for a better integration in contemporary life style - "*Ethnodesign*"

The *Ethnodesign* theoretical approach was developed by a design team working in the art field and design projects for a reassessment of Romanian ethnographic heritage.

The most spread textile crafting technologies spread around the world are:

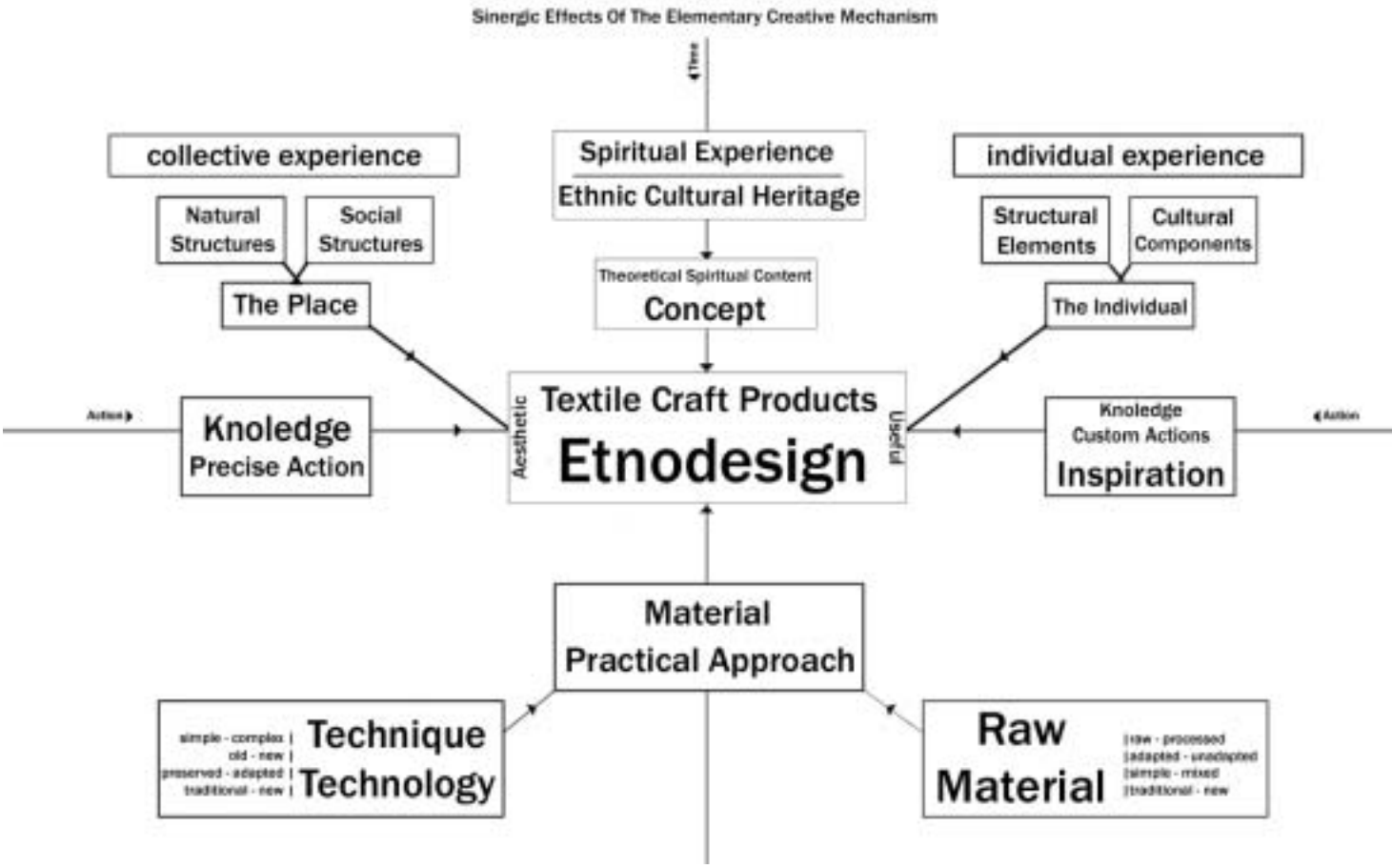
Weaving textile/Embroidery/Lace/Knitwear/Macramé/Sewed Textiles/Printed Textiles/Others

III. Fiber Artists Textile Objects Built with Tactile Materials or Following a Textile Concept with an Authentic Technique

Looking on the Romanian map we discover a marvelous land for sericulture activities:

55% very favorable zones, 30% favorable zones, 15% less favorable zones.

Looking in fact, after a recent multi-disciplinary research campaign, we found only traces and few farmer interested in silkworm breeding.



Section 5. Economy: Domestic and international markets, prices, trading, economic analyses of projects etc

Current situation of Italian sericultural activity and industry

By

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Abstract: ***Italian sericulture has a long tradition; wonderful fabrics, of both ancient and modern make, testify and give honour to this long history of work and creativity. However, beginning with the 20th century, many problems have been affecting the Italian sericulture until the last crisis at the end of the Fifties. Even though many causes contributed, the end of the mass silkworm rearing and cocoon reeling was the result of the after-war industrialization process and of the competition of emerging countries, endowed with low-cost manpower. During the Sixties-Seventies, rearing in the field was almost completely abandoned, so that Italian government decided to preserve indigenous and exotic well-acclimatized silkworm strains and local and exotic well-adapted mulberry varieties, creating both a silkworm and a mulberry germplasm bank at the "Sericulture Specialized Section of Padua", while the competences related to the reeling operations and testing of raw silk were assigned to the "Experiment Silk Station of Milan". In this situation, the Italian silk manufacturing industry, which continued to expand its activity until the Eighties, had to import raw silk from China, in order to satisfy its needs. Over the years, after the end of cocoon and raw silk production, on one hand, a large part of the national technical knowledge on sericulture has been made available to other countries by the means of supporting programmes run on an international co-operation basis and aimed at promoting the expansion of the activity, on the other hand, Italian research has never stopped; in fact, Italian researchers have been working continuously in order to constantly update their technological knowledge. An important research project, financially supported by the Italian Ministry of Agriculture has allowed to carry out in-depth investigations in the field of the moriculture, silkworm rearing techniques (e.g. artificial diet and silkworm transgenic lines), and innovative applications for the silk fibre. A few projects have explored the possibility of reintroducing cocoon production into small, marginal areas of the country. It is also worth noting that Italian cocoon rearing and production has never completely ceased and that Italian farmers have ever been interested in starting again a limited cocoon production, taking into account the EC contribution to the silkworm box, which is currently about 133 €. In the recent years, cocoon production was affected by problems related to the use of Insect Growth Regulators for fruit crops; particularly, the a.i. Fenoxycarb, whose drift arrived on mulberry leaves after orchards treating, caused huge production losses, and discouraged farmers of the Northern Italy from rearing. After several decrees stating restrictions and limitations in the use of the chemical, the Italian government decided to prohibit using Fenoxycarb everywhere in Italy***

and the situation has been constantly ameliorating with regard to cocoon production, even though some illegal use of the chemical may be assumed, on the basis of the symptoms shown by silkworm larvae in some areas closer to orchards. According to the data of the Italian Association of Silkworm Rearers, before 2003 all the silkworm boxes were imported from abroad (mostly China and Turkey). Starting with 2003, the "Sericulture Specialized Section of Padua" has begun a limited production of Italian experimental silkworm boxes, whose 165 were reared in 2004 (producing 3,358.10 kg of fresh cocoons) and 151 (producing 2,971.00 kg of fresh cocoons) in 2005, but an increasing trend may be predictable. By observing the average production of fresh cocoon per box is it understandable that some loss due to fenoycarb-related syndrome has still been affecting cocoon harvest. While on the side of field production farmers should be able to overcome their problems with time elapsing, also given the huge increase in the silk price, recorded in the last month of 2005, with regard to industry the last statistical data, available for the first six month of 2005 are as follows. The raw silk import for the Italian industry, was of 1,082 tons (+ 6.4% in comparison the same period of 2004). The most part of the silk comes from China (704 tons), also through Romania. Furthermore, cocoon waste import raised from 545 up to 679 tons (+24.5%) and it came from China, Germany, India and Thailand. Also silk tissues import increased up to 1,146 tons (+ 32.8% in comparison to the first six month of 2004). Tissue export increased of 24.3% with regard to quantity and 14.5% with regard to its value. In general, the export of silk products from Italy ameliorated of 11.1%, showing a positive trend for the Italian industry at the beginning of 2005.

Key words: sericulture, silk, Italy

A historical introduction

Italian sericulture has a long tradition, whose origin is quite uncertain. Some Authors say that *Bombyx mori* was introduced into Italy from the nearby Byzantine Empire. Others believe that Arabs were the first to introduce sericulture into the Southern regions of Italy. However, the earliest traces appeared shortly before the year 1000, to take root and spread throughout the country over the following two centuries. Besides silkworm breeding and cocoon production, a great passion for silk and its weaving techniques soon arose. Wonderful fabrics, of both ancient and modern make, testify and give honour to this long history of work and creativity. Even though many causes contributed, the end of mass silkworm rearing and cocoon reeling was the result of post-war industrialisation and of the competition of emerging countries, endowed with low-cost manpower. During the sixties and seventies, rearing in the field was almost completely abandoned, so that the Italian government decided to preserve indigenous and well-acclimatised silkworm strains and local and exotic well-adapted mulberry varieties financing the preservation of both silkworm and mulberry germplasm banks at the "Sericulture Specialized Section of Padua". At that time, both the living collections of silkworm strains and mulberry cultivars constituted the Section's "treasure", cumulated over the years, but after the closure of the last Italian silkworm egg production centre in 1978, the silkworm collection was enriched with commercial lines for hybrid egg production, which were the specific property of the above-mentioned centre. On the other hand, all work related to the reeling operation and testing of raw silk, were assigned to the "Experiment Silk Station of Milan".

In this situation, the Italian silk manufacturing industry, which continued to expand its activity until the eighties, had to import raw silk from China, in order to satisfy its needs. Over the years, after the end of cocoon and raw silk production, a large part of national

technical knowledge on sericulture has been made available to other countries, by the means of supporting programmes run on an international co-operation basis and aimed to promoting the expansion of the activity. Furthermore, a few projects have explored the possibility of reintroducing cocoon production into small, marginal areas of the country.

Cocoon production

It is worth noting that Italian cocoon rearing and production has never completely ceased and that Italian farmers have always been interested in starting limited cocoon production again, taking into account the EU contribution for each silkworm box, which is currently about €133.00.

In Italy, silkworm rearers are members of the National Silkworm Rearing Association (N.S.R.A.), which was founded in 1945 as the Association of Cocoon Producers, and re-named in 1951, when it was transformed into a non-profit body.

Mainly the northern regions of Italy were traditionally involved in silkworm rearing. In fact, the N.S.R.A. and the Sericulture Specialized Section of Padua are located in the North of Italy (Venetia). The last reeling plants and the last egg production centre stopped their activities in the same area. Furthermore, in Lombardy, another region in the Northern part of Italy, there are both the major silk industrial district, near the city of Como, and the Experiment Silk Station in Milan. This is to explain that, when the "Fenoxycarb syndrome" begun to affect the whole Northern area of the country in 1989, a severe crisis for Italian sericulture was set in motion. In fact, the phenomenon arose, when the first signals of a renewal in the activity were detectable, because of the interest of the EU in environmentally safe sustainable agriculture, resulting in non-food production. The above-mentioned syndrome, is caused by an Insect Growth Regulator (the active ingredient is fenoxycarb, the commercial name is "Insegar"), whose drift arrives on mulberry leaves after treating orchards. Larvae which are exposed even to very low concentrations of the chemical (a few nanograms) are incapable of spinning their cocoons and transforming into pupae. The insecticide, also affects honey bees. The problem has been protracting for years, because the Italian government, after several decrees stating restrictions and limitations in the use of the chemical, has only recently decided to prohibit the use of fenoxycarb throughout Italy (see table 1).

Table 1.

DECREES AND ORDINANCES OF THE ITALIAN MINISTRY OF PUBLIC HEALTH REGARDING THE USE AND THE COMMERCE OF THE INSECTICIDE INSEGAR (ACTIVE INGREDIENT: FENOXYCARB)

Year	Month/Day	Laws
1988	May, 25th	Decree n. 7478: registration of the insecticide "Insegar"
1991	May, 9th	Ordinance published in the Official Gazette (O.G.) n°. 114 of 17.5.1991: Precautionary measure to forbid the use of the insecticide "Insegar", containing the active ingredient (a.i.) fenoxycarb in the areas where there is silkworm rearing and new restrictions in the use of the chemical whose a.i. is fenoxycarb

1992	April, 27th	Decree published in the O.G. n°. 99 - 29.4.1992: Precautionary interruption in the sale and use of the insecticide "Insegar" in the whole national territory.
1993	June, 25th	Decree published in the O.G. n.°168 - 20.7.1993: Authority to identify exclusive areas, where the insecticide "Insegar"can be used, awarded to Regions and Autonomous Provinces.
1993	July, 30th	Decree published in the O.G. n.° 183 – 6.8.1993: Identification of the whole territory of the Bolzano Province as area where the insecticide "Insegar" can be used.
1993	December, 13rd	Decree published in the O.G. n°. 300 - 23.12.1993: Identification of the areas, where the insecticide "Insegar" can be used.
1994	May, 31st	Ordinance published in the O.G. n.° 131- 07.06.1994: Precautionary interruption of the sale and use of the chemical "Insegar" (registration n.° 7478 of May, 25th 1998) in the whole national territory.
1995	August, 8th	Decree published in the O.G. n° 189 - 14.08.1995: Rules regarding the use of the insecticide "Insegar"
1996	April, 1st	Decree published in the O.G. n.° 83 - 09.04.1996: Use of the insecticide "Insegar" in the autonomous Province of Bolzano.
2002	July, 4th	Decree published in the O.G. n.° 160 - 10.07.2002: Interruption of the sale and use authorization for the insecticide "Insegar" produced by Syngenta Crop Protection company.

From 2002 until now, the situation has been constantly ameliorating with regard to cocoon production, even though some illegal use of the chemical may be assumed, on the basis of the symptoms shown by silkworm larvae in some areas close to orchards.

The huge damage caused to national sericulture can be inferable from the number of silkworm boxes reared before 1989 and after 2002. Table 2 shows the data.

The number of reared silkworm boxes decreased from 1989 to 1996, then begun to increase again, according to the diminished effect of fenoxycarb treatments (limited to the Bolzano Province), on cocoon production and mostly due to the fact that the fruit pests begun to show resistance to the chemical, so that other active ingredients should have been used.

Table 2.

Years	N.° of silkworm boxes reared per year (1989-2005)
1989	3,146.00
1990	2,404.00
1991	2,266.00
1992	2,144.00
1993	1,871.00
1994	1,006.00
1995	897.50
1996	992.00
1997	1,064.00
1998	1,479.00
1999	1,881.50
2000	2,912.00
2001	2,788.00
2002	2,143.00
2003	89.00
2004	165.00
2005	151.00

After 2002, when the chemical was eventually prohibited in the whole Italian territory the number of silkworm boxes begun paradoxically to decrease again; it was caused by organisation problems of the N.S.R.A., which gave, as the first result, the interruption of silkworm box importation from China. In fact, before 2002 almost all silkworm boxes had been imported from China, while, starting since 2003, silkworm boxes have been produced by the Sericulture Specialized Section of Padua, as experimental eggs for Italian farmers. Because of the fact that the Section is a research centre and it is not organised as an egg production centre, the number of boxes, for the three years 2003, 2004, 2005, were very limited, though an increasing trend may be predictable for the future. Furthermore, the average fresh cocoon production (165 silkworm egg boxes produced 3,358.10 kg of fresh cocoons in 2004; 151 produced 2,971.00 kg in 2005) were still affected by the residuals of the fenoxycarb syndrome, as shown by the average cocoon harvest (about 20 kg per box in 2004 and 2005), which was rather low considering good sanitary conditions of rearing and the high quality leaf of mulberry plantations in Italy.

Silk industry

Raw silk imports were about 1,082 tons in the first six month of 2005 (+ 6.4% in comparison to the same period of 2004). Most of the silk came from China (704 tons) and also from Romania. Also cocoon waste imports increased from 545 up to 679 tons (+24,5%) and it came from China, Germany, India and Thailand. Silk tissues imports increased to 1,146 tons (+32.8% in comparison to the first six month of 2004). In the same period, tissue exports increased by 24.3% with regard to quantity and 14.5% with regard to its value. In general, the export of silk products from Italy ameliorated by 11.1%, showing a positive trend for Italian industry at the beginning of 2005.

Table 3 shows export of Italian silk products (comparison years 2003-2004-2005)

Table 3.

PRODUCTS	First 6 months of 2003		First 6 months of 2004		First 6 months of 2005		Variations % 2004-2005	
	Kg	€	Kg	€	Kg	€	Kg	€
Cocoons (dry weight)	815	4,507	724	1,935	1,335	7,986	+ 84.39	+312.71
Raw silk	192,053	2,715,788	318,665	4,453,164	275,821	4,202,009	- 13.44	- 5.64
Silk waste	61,772	449,842	27,090	416,784	41,346	374,529	+ 52.62	- 10.14
Twisted yarn	185,328	6,859,745	283,552	8,586,634	231,763	7,749,113	-18.26	-9.75
Schappe thread	68,526	1,848,827	47,448	1,336,282	72,112	2,267,554	+ 51.98	+ 69.69
Sewing thread	17,938	831,956	15,973	622,336	11,995	561,508	- 24.05	- 9.77
Tissues of pure silk	651,729	92,741,834	705,287	99,825,814	818,898	110,868,929	+ 16.11	+11.06
Tissue of mixed silk	243,795	22,600,319	204,066	21,396,053	311,753	27,858,830	+ 52.77	+ 30.21
Bourrette tissues	15,086	1,952,831	24,934	2,900,078	30,372	3,400,510	+ 21.81	+ 17.26
Woman dresses	42,692	21,202,146	65,647	25,507,628	66,942	31,283,456	+ 1.97	+ 22.64
Blouses	69,120	19,608,228	69,411	17,856,332	86,128	23,114,554	+ 24.08	+ 29.45
Handkerchiefs and pocket-handkerchiefs	35,986	1,368,071	6,603	1,204,392	17,019	1,440,192	+157,75	+ 19.58
Silk foulards	140,073	35,104,913	125,284	34,322,537	134,409	35,343,916	+ 7.28	2.98
Silk ties	394,085	140,281,948	387,206	136,169,445	422,278	145,638,997	+ 9.06	+ 6.95

Trends in Italian research in the field of sericulture

Although Italian cocoon and raw silk production has been at very low levels in the last decades, Italian research in sericulture has never stopped. An important research project, financially supported by the Italian Ministry of Agriculture has allowed to carry in-depth investigations in the field of moriculture, silkworm rearing techniques (e.g. artificial diet and silkworm transgenic lines) and innovative applications for the silk fibre.

Moriculture: Today the interest in moriculture is essentially due to a high potential for its utilization in farming in connection with the guidelines of the future Common Agricultural Policy (CAP) of the European Union, which lays much emphasis on such issues as environmental impact, energy saving, product quality and non-food production.

The exploitation of the flexible properties of the mulberry tree can lead to a dramatic change in the very notion of sericulture by introducing the concept of mulberry multifunctionality, associated to a new production system and a new pipeline of products, on the basis of the following mulberry characteristics:

- the protein content present in leaves and in the apical portion of the branch
- the content in cellulosic fibre of various branch portions
- the polyphenol content of leaves
- the global production of biomass
- the production of fruit
- the resistance to pathogeneous agents.

In Italian environmental conditions protein content varies from 17 to 33% w/w. The flour obtained by dehydration from leaves and the apical portion of the branch can be used to prepare various types of animal food, particularly suitable for monogaster species. The food is highly nourishing and has good biological properties. Average production amounts to 10 t/ha. Defoliated branches of mulberry tree can be used to extract high-resistance cellulose fibre suitable for production of composite materials with addition of small percentages of synthetic resins. The composite materials are characterised by a high biodegradability and could be used in packaging, in the car industry and in the building sector.

The polyphenol content of leaves includes a series of substances that have been used for a long time in herbal practice, but now the attention is mostly focused on the presence of deoxynojirimycin, an aminosugar capable of acting as an antiviral and antidiabetic agent.

The mulberry tree has a favourable environmental impact, which can help control soil degradation phenomena and the alteration of the local entomological fauna. The Italian territory presents vast hilly areas which, due to their low fertility, are no longer utilised for farming purposes and could be the right place for mulberry plantations. These would protect the land and could also be exploited for the production of raw biomass to be used for energy generation.

Another interesting use of mulberry fruits, from both *Morus nigra* and *Morus alba*, could be for the preparation of ice-creams and sweets. There is a strong demand for this kind of fruit, which is not satisfied by current supply.

Finally, it should be considered that the mulberry tree is a typical element of the Italian rural landscape in hilly or plain areas, where, arranged in long rows, it breaks the monotonous succession of modern monoculture.

Sericulture

The genetic heritage currently available consists of about 120 strains, which are part of the history of Italian sericulture. For this reason, their preservation represents a cultural and scientific priority. Rearing for preservation purposes requires the use both of mulberry leaves and of artificial diet, which allows to maintain controlled environmental conditions and avoid any problem of contamination of the leaves by eventual chemicals. The type of diet adopted differs according to adaptability of strains to the artificial food.

New rearing systems were experimented using small metal modules and applying different levels of control on the environmental conditions. Rearing can be run on a continuous basis throughout the year and the cocoon obtained is of a high purity grade, the so-called “biological grade”, which indicates a silk suitable for uses other than textile applications.

Silkworm rearing on an artificial diet under controlled conditions is becoming a common practice in the field of genetic research and for the production of small amounts of fibroin in its native state.

The possibility of using an artificial diet for large scale cocoon production was also explored trying formulations based on low leaf content. Even though this is not the only factor that can guarantee the economic sustainability of such a form of silkworm rearing, it is reasonable to think of it as a crucial aspect.

The preservation of *Bombyx mori* silkworm strains requires continual work to stabilize the genetic profile of each race and keep it unchanged. At the same time, selection has been ameliorating strains year after year. After the introduction of the artificial diet there have been significant changes in various aspects of selection of the various original races available. Recently, the Sericulture Specialized Section of Padua and the University of Padua, (Biology Department, Genetics Section) have conducted joint investigations on the modification of the "clock genes", which regulate important biological mechanisms, such as the length of the life cycle and timing of crucial events like egg hatching, moth eclosion and diapause.

Silk innovative applications: The research work in this field focuses on objectives common to all the research centres concerned with silk all over the world. In Italy there are several research projects in progress, some of which are run by Experiment Silk Station. Silk has been extensively investigated in recent years to experiment and develop innovative applications, thanks to the new analytical techniques made available by molecular biology. So, what by tradition was intimately associated with *Bombyx mori*, is now one of the protein polymers belonging to the large group of fibroins produced by various species of insects and spiders. Exceptional physico-mechanical, chemical and biological properties, biocompatibility and total biodegradability are the qualities that open the way to novel applications for silk fibre. It is well known that the thread spun by *Bombyx mori* consists of two proteins, fibroin and sericin. Both are being investigated but fibroin appears more interesting. There are three main areas of research at the moment:

- new applications for silk obtained by traditional processing,
- silk regenerated by blending with other polymers,
- films and sponges prepared with regenerated fibroin.

The new applications for silk obtained by traditional reeling and soaking of cocoons include:

- Fabrics made with yarns of a low number and various weaves for use in bandaging; there is experimental evidence that the use of silk facilitates the healing process in case of skin diseases (dermatitis).
- Thin short-fibre silk supports in the form of felts or plain-structured fabrics, like gauzes, with adequate interfibre distances; if implanted into epidermic or muscular tissues, they can be colonized and enhance tissue formation and, consequently, regeneration. This process can take place because the inflammatory reactions are negligible. Based on these observations, several studies have been conducted to develop scaffolds for tissue regeneration. This is a promising area of research, there are big expectations, but the applications are still limited.

The second group of innovative applications for silk involves all the forms of fibroin regenerated into fibrous structures. Silk fibroin is a protein polymer with an ordered, packed and highly stable crystalline structure and a fibrous nature. The dissolution of fibroin by chemical methods is rather difficult and requires the breakage of a range of molecular bonds

which will not be restored by bringing it back to solid state. This phenomenon does not permit the formation of structures with the same mechanical properties as the original one. A direct solution to this problem has not been found yet, so, to circumvent it, fibroin is blended with other natural or synthetic polymers that can generate the original mechanical properties or even impart new ones. Here the aim is to obtain fibres with innovative properties avoiding the costly reeling process or to produce silk supports for non-textile uses in the desired form, for example membranes, high-number monofilaments, and so on. Today, several polymer blends are obtained using either natural polymers, such as cellulose and chitin, or synthetic ones, such as polyurethane and polylatic acid. Many of the polymer blends produced are intended for biomedical applications, so this sector is becoming a priority target in the field of the innovative uses of silk.

Finally, worth mentioning are the numerous studies aimed at producing silk-based materials starting from solutions of sole fibroin. The structures currently obtainable are mainly films and sponges, which are often characterised by a metastable behaviour as they get dissolved or degraded in a wet environment. Some investigations show that it is possible to regenerate fibrous materials with remarkable mechanical properties, but so far only under experimental conditions not suitable for large-scale applications. Again, the aim is to obtain silk materials with adequate properties in the desired form for both textile and biomedical uses. An approach that falls into this area of research is the experimentation of processes based on the use of solutions of native fibroin, directly obtained from the glands of the larvae, and of filaments of various sizes and forms.

Appraisal of Sector and Farm Diversification to Sericulture in Guangdong, China

By

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Abstract*: Guangdong Province, located in the south of China has long history of rearing silkworm and planting mulberry. The demonstrative method and the data collected in surveys from the FAO Project Entity 214A1 were implemented and analysed. The successful experiences of developing sericulture in Guangdong were concluded. Many factors influence the sericulture development. Not only are the sericultural science and techniques, farmers educated levels, environment included, but the governmental policy and foreign capital are also considered seriously. Finally there are some recommendations proposed for the newly developing sericulture region.*

Keywords: *Bombyx mori*, Sericulture, silkworm, Guangdong, revival, development

Introduction

Sericulture is one of the traditional advantageous industries in China. In recent years, Guangdong Province, south of China, has succeeded in the strategic transition of the major sericultural area from Pearl River Delta to Leizhou Peninsula, in the west of Guangdong, and to the place of North Guangdong, and to the region of West River Valley in Guangdong.

Guangdong province has built a pre-, mid- and post-production service system and realized the whole year-production of bivoltine white cocoon, which turns out a significant improvement. In addition, related research, teaching and productive branches, in close cooperation, conduct the comprehensive research on selection and breeding of mulberry and silkworm, mulberry planting and silkworm rearing, prevention of diseases and pests, and integrated utilization of sericulture resource, aiming at the goal of high-quality, high-yielding, high-efficiency, laborsaving and low-cost sericultural production.

Great achievements have been gained in multiple aspects, including the breeding of fruit- and leaf-applicable mulberry, the exploration and utilization of mulberry resource, the breeding and application of varieties with high cocoon yield, high silk quality, high propagation coefficient and high resistance, the unceasing rearing technology standardization of good silkworm breeds, the development of sericultural disinfectants and treatment chemicals, and the establishment and propagation of the comprehensive technology system of sericulture.

1. To analyzes the farmer's behavior of mulberry planting and silkworm rearing in China

Farmer's behavior of mulberry planting and silkworm rearing was analyzed in demonstrative method and based on the data collected in surveys.

Firstly, with increasing population and accordingly decreasing arable land, farmers pay more attention to the growth of marginal production.

Secondly, education level of farmers determines the ability to acquire, and to process information and to apply technology. The higher farmers in education level, the stronger their ability to adopt related technology and skills, the more they will be likely to engage in diverse business including sericulture.

Thirdly, capacity of farmer refers to farmer's social capital (social relationship) and chance to do non-agricultural job. The farmers with high capability and wide social relationship prefer high-profit agriculture and are ready to take a time-saving, laborsaving, money-saving and efficient production method.

Fourthly, farmers' knowledge about sericulture not only includes their awareness of sericultural technology, but also of economic value of sericulture. The more they know about sericulture, the more they are willing to conduct sericulture provided that other conditions are unchanged.

Fifthly, relationship between farmer and agriculture-related enterprise and specialized technology association is a major factor affecting farmer's will to conduct sericulture. Oral or official contracts signed by farmers and agriculture-related enterprise will reduce farmers' risk of losing value in sericultural market and protect their benefit in some extent. Meanwhile, related enterprises will give the support in technology instruction, quality requirement and other service to inspire farmers' enthusiasm for sericulture. So does specialized technology association.

Sixthly, sericultural technician acts as the role of instructor. Their appropriate instruction will enhance farmers' knowledge and skills, thus encouraging farmers' behavior of planting mulberry and rearing silkworms.

2. Successful experiences of cultivation, rearing, and business in Guangdong

2.1. Moderate-scale management of household-based sericulture

In this model, managers achieve scale of economy through reasonable allocation and utilization of productive elements, such as land, labor, capital and property. Sericultural production refers to not only planting production but also rearing production, not only outdoors production but also indoors production. It is characterized by season-sensitiveness, labor time aggregation and complicated operation, which sets obstacles to mechanization or half-mechanization. Consequently, the scale of production is subject to area of mulberry fields, labor, rearing technology, rearing room as well as the distance between mulberry fields and rearing room, among which the area of mulberry fields serve as the most important element.

2.2. Village-level technical service system for sericulture

Village-level sericultural technicians are the basic technical group who is responsible for instructing sericultural production and diffusing related technology. As the experts trusted by farmers, they bridge the gap between sericulture stations and sericultural farmers. Facts prove that the village-level technicians play an irreplaceable role in boosting the revenue of

sericultural farmers and promoting sericultural industrialization. Over years, unceasing change on sericulture has a deep impact on the village-level service system. For example, Juegang Town in Rudong County of Guangdong Province succeeded in reinforcing its village-level service system by combining technical and material services.

2.3. Establishment and development of organizations for sericultural economic cooperation

Farmers establish a village-level demonstrative organization for sericultural economic cooperation under the guidance of agricultural administration. The following measures are taken.

Firstly, enacting regulations and designing organizational structure. The rules of the organization are laid jointly by agricultural administration and village committee. The first 3-person board is elected from the candidates recommended by members of the organization. The board is then responsible for acquiring license.

Secondly, encouraging villagers to join in by buying share. By disseminating its policy, goal and management method, the organization encourages farmers' participation on a voluntary basis.

Thirdly, propagating the experience of the demonstrative organization for sericultural economic cooperation. By appropriating dedicated fund for sericultural industrialization, providing policy support and propagating successful experience, the government helps the key sericulture villages build the organizations for sericultural economic cooperation, which are expected to serve as an important means to implement sericultural industrialization, such as pre-ordered sericulture.

2.4. Risk prevention of sericultural production

Typical measures include the application of sericultural technology, the rational arrangement of silkworm rearing, the enhancement of silkworm egg market management and the establishment of sericulture venture fund.

2.5. Establishment of the three supporting systems: management, science and techniques, and service

The management supporting system consists of: (1) Small bank loans to help farmers conduct production. (2) Appropriate subsidy policies to enhance farmers' confidence in handling large-scale management, (3) An effective reward mechanism to award specialized households, to absorb non-governmental investment on sericulture and steer farmers to large-scale management.

The supporting system of science and techniques of sericulture is developed by sericultural science and technology departments and in accordance with the characteristics of large-scale management. It includes the technologies of "early harvest of arid land", large-shed rearing and laborsaving rearing, and the adjustment on silkworm rearing arrangement.

The service supporting system contains: (1) Constructing a robust diffusion network of sericultural science and technology and taking advantage of technician force to spread large-scale management-related technology through all stages of sericultural production; (2) Establishing township- and village-level sericulture technical association to offer farmers materials and technical service; (3) Signing purchase and sale contracts between silk companies and sericultural households on a voluntary, equal and mutual-beneficial basis. In this way, the right and obligation of both sides are clearly specified in the contracts, turning

the previous loose buying and selling behaviors to a close and stable relationship subject to laws, hence coordinating and protecting the benefits of all involved parties.

2.6. Cooperative rearing of the young silkworms

Cocoon purchase companies in the major sericultural area assist specialized sericulture towns and villages in building high-quality stretch production base, and sign purchase and sale contracts with thousands of sericultural farmer households. The pattern is called “Base + Household”. With the financial aid of national cocoon and silk administration and the support from Guangdong Silk Corporate, and from South China Agricultural University, and from the silk companies in Leizhou, Lianjiang and Suixi launched demonstrative sericultural bases to conduct large-scale cooperative rearing of young silkworms. The rearing pattern not only satisfies the bases’ need for grown silkworms-rearing, but also supplies high-quality young silkworms to the nearby silkworm households.

3. Recommendations and the regional developing sericulture strategies

3.1. Highly attention and guidance of the government is vital.

Industrial development is part of social development. How well an industry is developed will directly give rise to two completely different social problems. On one hand, if an industry is in good growth, it will attain an increase in tax revenue, employment opportunity, farmers’ income, consequently contributing to steady social development. On the other hand, malignant competition or unhealthy development may occur to an industry, unless the government macro-steers and supervises the direction of enterprises’ development, especially through establishing and enforcing the industry-related mechanisms, to ensure the healthy competition and development of the companies.

3.2. The crosswise cooperation and capital inflow decide the scale of enterprises and the potential of industrial development

Enhancing the crosswise cooperation is an effective way to expedite the industrial development. Technology and capital are two essential factors for industrial development. While introducing, absorbing and digesting advanced technology, multiple capital sources should be employed for obtaining more fund. Generally, the fund can be raised either by changing capital composition, such as share composition, or by applying for loans from banks and capital support from all levels of governments.

3.3. Technical innovation determines the level of industrial structure

Great attention should be given to both the diffusion and application of technical achievements, and the unceasing technical innovation and improvement. Thus, on one hand, the application of technical achievements may generate large profit for an industry; sometimes it may even bring new development opportunities to the entire industry. On the other hand, an industry will usually experience the transition from the traditional pattern to a high-tech pattern. If a group of outstanding technical personnel can work together to prepare for the innovation on science and technology of the industry, the transition will be smooth and fast, which can significantly enhance the competitive power and advantage. In addition, only by combining with an industry, science and technology can be converted to practical productivity and play a role.

3.4. Diverse business should be conducted in accordance with local circumstance

The pattern of “Company + Production Base + Farmer Household” can reduce farmer's risks on investment and on production and maintain a relatively stable silkworm production

through large-scale management or aggregated production in accordance with local circumstance. As is well known, the Sericulture Industry features high benefit, fast capital turnover, but technology-intensity, strict plan, short lead-time and high risk. Different from other industries that adopt the flow production line, the Sericulture Industry is more subject to climate condition, human-made factors and mutual effect since it addresses biology. Therefore, although investors don't necessarily have specialized silkworm knowledge, the managers are required to be good at technology and management and highly responsible. The larger the production scale, the more strict the requirement for managers.

3.5. The laborsaving comprehensive technology system of sericulture needs to be spread and popularized.

As is mentioned above, the Sericulture Industry is technology-intensive, plan-oriented and of short lead-time and high risk. Even if much investment has been made in the early phase (including the management of mulberry field and silkworm rearing in the early phase), small negligence may cause nothing to be harvested. This is why different farms in the same region vary significantly in the economic benefit of silkworm rearing. It's a saying like, "Rear young silkworms well and harvest the half". The requirements for technology and responsibility are stricter in the larva stage. Because of small rearing scope and easy-implementation of techniques in the larva stage, it is more possible to rear healthy young silkworms and reduce labor and production cost.

The laborsaving comprehensive technology system of sericulture consists of the technologies of laborsaving mulberry cultivation and harvest, silkworm rearing, cooperative-rearing of young silkworms and automatic mounting of mature silkworms as well as the technical regulations on the comprehensive prevention and treatment of silkworm diseases. As the result of combining the latest scientific and technological achievements in different disciplines, the system features high yield, excellent quality and low consumption.

The diffusion and popularization of the system in Guangdong is an effective way to improve the potential of sericultural production and to strengthen the corresponding competitive power against other crop production.

3.6. Conducting the research on sericultural science and the training of specialized personnel, and propagating and popularizing scientific silkworm rearing.

Highly attention to the investment on technology is a necessity to ensure the sustained and deepening development of sericulture in Guangdong. In addition, it is important to lay stress on the cultivation of specialized personnel. Different types of personnel should be trained in varied means to meet the need of different levels.

The production level of silkworms and cocoons varies with regions, companies and farms in Guangdong Province. In most time, the plantation and management of mulberry trees is based on instinct and started rashly without adequate technological reserve, which results in a fair start followed by full crash. Although the farmers with relative weak technology may obtain a fair benefit from silkworm rearing in case of good crop weather, they will usually lack competitive power once encountering bad climate and environment condition or market change. This is an important factor for the durable instable sericultural production.

Therefore, different-level technicians must be well trained to popularize the scientific and technologic silkworm rearing and mulberry plantation. In addition, the training should be conducted for the middle- and short-term technicians of basic production units so that they can play a key role in the front line of production.

3.7. Constructing the technology network of scientific and technologic silkworm rearing and mulberry planting.

The city-, county- and town-level technology diffusion institutes can deliver related information and key techniques of different silkworm-rearing stages to farmers through cooperative-rearing room for the purpose of promoting farmers' technology level and their capability against risks. For some regions with suitable condition and relatively centralized mulberry fields, sericulture associations can be established by farmers under appropriate instructions for information sharing, experience communication, technical training and even the exchange of labor and materials.

3.8. Achieving the integration of sericultural trade, industry and agriculture.

The integrated sericulture has the following functions.

(1) To keep farmers secure about sericultural production, increase their income, stimulate their desire to plant mulberry and rear silkworms. Through the integration of trade, industry and agriculture, silkworm companies tighten the connection with farmers. The pattern of "Company + Farmer" binds companies with farmers and makes them a shared-interest and shared-risk community, thus enhancing farmers' confidence in silkworm production, raising their revenue and stirring up their enthusiasm. Presently, sericulture has become one of the main income sources for farmers in many regions.

(2) To keep cocoon procurement in order. Through the integration of trade, industry and agriculture, the procurement mechanism can be put in order, thus effectively eliminating and avoiding the problems rising. By signing contracts with farmers, companies specify the transaction deadline and devise the uniform standard based on high quality and favorable price. This manner not only reduces conflict and friction, but also intensifies farmers' intention against the cocoon purchase by mongers. Practice proves that, for the regions practicing the integration of trade, industry and agriculture, the cocoon purchase is relatively in order, which indicates that the integrated sericulture plays a role in keeping the purchase mechanism in order.

(3) To promote the scale and specialization of sericulture, the diffusion of advanced technology, and the yield and quality of cocoons. The trade-industry-agriculture integrated business model effectively solves the problem of small and sparse cocoons. Usually, the companies adopting this model rent land, plant a stretch of land, and help large-scale silkworm households develop. In this way, they promote the scale and specialization of sericultural production and offer a way to apply advanced technology and mechanized production, hence improving the yield and quality of cocoons and altering quantity overweighing quality in the past.

(4) To solve the benefit-related problems of trade-industry-agriculture integrated model. Not only does the integrated pattern enhance silkworm production and increase farmers' income, but also it contributes to the effective connection among agriculture, industry and trade so that their loose relationship is tightened with shared benefit. Accordingly, the three parties can acquire more benefit.

4. Conclusion

Based on the research, the major factors affecting sericultural development are concluded as follows.

Firstly, geographic location is the key factor influencing the Sericulture Industry. As is well known, agriculture, including sericulture, is subject to natural resource like water, climate

condition and terrain. The natural condition is the determinant of whether a region can enter and succeed in the Sericulture Industry. Since different areas have varied natural resource that is hard to change or exchange, only those regions with suitable natural condition possibly develop high-profit sericulture by expanding the scale with low cost.

Secondly, infrastructure lays the foundation for sericultural development. It is impossible to open silkworm production without necessary infrastructure. For the poor areas, the infrastructure construction is an effective way to increase market entry possibility.

Thirdly, capital investment plays a critical role in sericultural production. On account of the increasing capital-intensity and more and more uneven capital allocation in agricultural production, an increase in capital investment is a necessity. The government should give the highest priority to the credit service of sericultural regions, which is important to raise farmers' income and reduce the difference between regions.

Fourthly, the quality and participation number of labor is also a significant factor. Generally, rural families are characterized by high population, low revenue and accordingly little education chance. It leads to poor-quality labor that is lack of labor skills and has the weak ability to gear to market changes. With the progress of technology, human resource will play an increasingly important role in the development of rural economy. Accordingly, the education of rural labor will serve as a primary factor to improve the level of mulberry planting and silkworm rearing.

Fifthly, the constraint of land ownership acts as a nontrivial cause to suppress the silkworm production. To increase the income of silkworm workers, land transformation among the poor should be encouraged. The reality is, however, that land is collective-owned and not free to be transformed. Many families are reluctant to give up their land, because the land is secure once economic or political crisis occurs. Therefore, deciding the form of land ownership that best suits land contracting and rent should be taken into consideration to encourage the growth of large-scale sericultural households.

Sixthly, there exist obstacles to industry entry and resource allocation in various industries of rural economy, including mechanism barrier (For example, lack of legal framework for protecting the benefit of sericulture personnel) and economic barrier (For example, fund need to be raised to expand the scale of the Sericulture Industry). These barriers will affect and restrict the development of sericulture. Consequently, the government should enact related regulations and laws to direct, support and protect the healthy development of the Sericulture Industry.

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International Workshop on Silk Handcrafts Cottage Industries and Silk Enterprises Development in Africa, Europe, Central Asia, and Near East, Bursa, Turkey 6 -10 March 2006

Conclusions, recommendations, decisions and follow ups

The workshop participants

Considering that:

1. Sericulture is an important labour-intensive and agro - based cottage industry, providing gainful occupation to a huge number of people in the rural and semi-urban areas in more than 35 countries from Asia, Europe, Africa and Latin America.
2. Silk handcraft cottage industry creates tremendous economic prospect and employment potentiality for the rural people, scoring on every point: one of the highest income from one unit of land, use of less water and drought resistance, income leveller - transfer of income from rich to the poor nationally and internationally, generating high rural employment, gender benign in favor of women-employment, a natural fibre and ecologically harmless, no synthetic substitute and highly demanded at the local market as well as in EU countries, Japan the USA etc., no competitor to food crops.
3. The silk handicrafts sector also employs a large number of people, many of whom work with traditional materials, processes and products, and in remote and backward areas. The economic importance of silk handcrafts is accentuated by the fact of high employment potential, low capital investment, high ratios of value addition and that it is almost wholly artisan based.
4. Even though some of the African countries have traditions and local market for silk handcrafts production, they have short experience and little tradition in sericulture. On the other hand the countries of Black and Caspian seas region should make efforts in their local silk handcrafts industries revival/development in order to utilize the cocoons/raw silk locally produced as a strategy for sericulture rehabilitation and development.
5. **The main constraints** facing the silk handcraft cottage industries in Africa, Europe, Central Asia and the Near East are:
    - the silk production in most of the region countries declined;
    - many weavers specialised in silk fabrics have switched to cotton or synthetic fibres;
    - the traditional silk handcraft cottage industry, producing national style fabrics is now completely inactivated in some of the region countries;
    - abandoning of traditional silk wears;
    - the traditional technologies at the level of reeling, yarn preparation and weaving need of improvement in order to diversify the fabrics and develop potential new markets;
    - using poor management with low investment and technology;
    - lack of new products and new designs to meet market's needs;

- the contribution rate of Iran, Turkey, Egypt and other producers from the region in the silk carpet world market has been decreased significantly within last decade;
- high prices of local silk yarn and high labour costs due to hand made products which use labour intensive;
- the free trade in textiles stimulates the weavers to import cheap raw silk from China rather than use material produced by local farmers.

6. The major challenges facing the sericultural industries development in the new entrants from **Africa** are:
   - irregular and insufficient supply of silkworm eggs;
   - poor quality cocoon;
   - non availability of quality raw silk quality looms, qualified personnel to operate the filatures and other equipment;
   - lack of appropriate tools/implements for the silk handicrafts cottage industry, inadequate knowledge about markets.

7. **The recommendations** for promotion of artisanal / traditional silk handcrafts and cottage industries at the regional levels are:
   - the producers should establish the network to make collaboration among different sectors of supply chain;
   - promote the silk handcraft products as natural and environmental friendly;
   - provide specializations to various outstanding silk craft centers in the leading countries to learn new techniques;
   - improve the knowledge and competency of silk industry management and its workers through seminars, training and education;
   - creation country/regional data base on the silk sector and its monitoring;
   - distribute and increase more advanced type silk reeling devices and machines to region wide to produce uniform quality of yarn;
   - mechanisation in certain areas which do not effect basic skill input but pertain mainly to processing and finishing should be encouraged;
   - modernisation of hand looms and accessories;
   - diversification of products, use of eco-friendly dyes etc;
   - establish local fairs and participate in international fairs to introduce silk handcraft products to the consumers and to make producers able to connect and know the latest development in their industry field;
   - reliance will have to be placed on those silk handcrafts which cater to the common man's needs and tastes for boosting exports;
   - producers should not make cheaper silk products with low quality to compete for the prices but to produce products which satisfy consumers even though they are more expensive;
   - to produce own unique products which are definitely different from other countries.

<u>They decide to:</u>

1. Express formal gratefulness to the Food and Agriculture Organization of the UN, the Government of Republic of Turkey, the Sericultural cooperative Kozabirlik, Bursa and the Black, Caspian Seas and Central Asia Silk Association (BACSA) for organizing the International Workshop on Silk Handcrafts Cottage Industries and Silk Enterprises Development in Africa, Europe, Central Asia, and Near East, Bursa, Turkey 6 -10 March 2006.

2. Recommend the Executive committee of BACSA to take decision for enlargement the radius of action of the Black, Caspian Seas and Central Asia Silk Association to cover the entire region of Africa, Europe, Central Asia and the Near East in terms of exchange of market information through the BACSA web site.
3. Recommend the Executive committee of BACSA to decide opening a special page in its web site on “Silk handcraft cottage industries”.
4. Request FAO to support technically and financially organizing a regional workshop on “Utilization of mulberry and silkworm genetic resources for sericultural enterprises development in Africa, Europe, Central Asia and the Near East”
5. Under the technical supervision of FAO to establish an international “Working group on the global silk handcraft cottage industries and silk enterprises development”. The group will identify and analyze major constraints and strategies for silk handcraft cottage industries development in global aspect.
6. Recommend to the workshop participants and all other interested persons/organizations/companies to use as a framework for further suggestions and discussions the already uploaded on to FAO’s "InPho" Website: "Equipment for Silk Handcrafts Cottage Industries" which will be updated/upgraded as FAO receives comments.
7. The members of the “Working group on the global silk handcraft cottage industries and silk enterprises development” from the region of Africa, Europe, Central Asia and the Near East are:

   Africa:
   Egypt – Mr. H. Mahalawy
   Ghana – Mr. P. Ntaanu
   Madagascar – Mr. Ratianarijaona
   Uganda – Mr. G. Mugieny

   Europe:
   Albania – Mr. A. Xhoxhi
   Bulgaria – Mr. P. Tzenov
   Greece – Mr. E. Kipriotis
   Romania – Ms. D. Tanase
   Turkey – Mr. A. Karagozoglu
   Ukraine: Ms. O. Galanova

   Caucasus and Central Asia:
   Armenia – Ms. A. Azizyan
   Azerbaijan – Mr. B. Abbasov
   Georgia – Mr. Z. Asatiani
   Kazakhstan – Mr. A. Kulametov
   Tajikistan – Mr. M. Karimov
   Uzbekistan – Mr. H. Homidy

   Near East:
   Lebanon – Mr. G. Asseily
   Syria – Mr. M. Othman

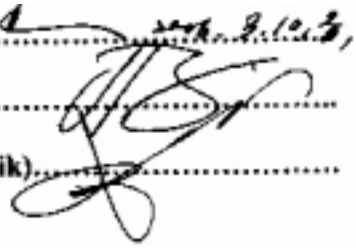
8. Recommend the Africa, Europe, Central Asia and Near East countries to attend two FAO international workshops on silk handcraft cottage industries and silk enterprises development for Asia and the Pacific in 2006/2007 and for Latin America and the Caribbean in 2007/2008.

<u>This document is signed on behalf of the workshop Organizing committee by*:</u>

1) Dr H. Z. Lea (FAO).....

2) Dr P. I. Tzenov (BACSA).....

3) Mr. A. Karagozoglu (Kozabirlik).....



Date: Bursa, Turkey 10 March 2006

BACSA second meeting final document

International Workshop on Silk Handcrafts Cottage Industries and Silk Enterprises Development in Africa, Europe, Central Asia and the Near East, Bursa, Turkey, 6 -10 March 2006

Second Executive Meeting of Black, Caspian seas and Central Asia Silk Association (BACSA), 9 March 2006, Bursa, Turkey

The BACSA executive committee in the forum: **Second Executive Meeting of Black, Caspian seas and Central Asia Silk Association (BACSA), 9 March 2006, Bursa, Turkey** took the following decisions:

1. Express formal gratefulness to the Food and Agriculture Organization of the UN, the Government of Republic of Turkey and Kozabirlik sericultural cooperative, Bursa, Turkey for organizing the "International Workshop on Silk Handcrafts Cottage Industries and Silk Enterprises Development in Africa, Europe, Central Asia and the Near East, Bursa, Turkey", 6 -10 March 2006 & Second Executive Meeting of Black, Caspian seas and Central Asia Silk Association (BACSA), 9 March 2006, Bursa, Turkey.
2. Express formal gratefulness to the Food and Agriculture Organization of the UN for providing financial support in a total amount of US$31000, including expenses for holding the Bursa Workshop and BACSA Executive Meeting – 2006, establishment of BACSA Website, registration of BACSA as legal Entity and printing and distribution of Proceedings of Bursa Workshop.
3. Approves the regional project proposal: "Improvement of Income-Generation Options Based on Revival of Sericultural Industries and Promotion of Small Silk Enterprise Development in Eastern Europe and Central Asia"
4. Authorizes the BACSA President to contact the possible donors for funding the regional project proposal: "Improvement of Income-Generation Options Based on Revival of Sericultural Industries and Promotion of Small Silk Enterprise Development in Eastern Europe and Central Asia"
5. Approves the regional mini-project: "Comparative studies of silkworm hybrids performance for sericultural enterprise development in Black, Caspian seas and Central Asia region" and recommends to all BACSA countries interested to participate in it.
6. Suggests the following three centers, where the comparative testing of silkworm hybrids will be conducted: 1)SES-Vratza, Bulgaria; 2)SRI, Gandja, Azerbaijan; 3)USRI, Tashkent, Uzbekistan.
7. Approves the suggestion for registration of BACSA as a legal entity in Bulgaria, where is residing the present president of association, Dr P. Tzenov.
8. Until May 2006 each BACSA' national coordinator should make efforts to inform the government about the 2nd BACSA executive meeting results and decisions and provide an official "Letter of support" on behalf of the government respective about principle support to the future possible regional project for sericulture revival.
9. Recommends translating in Russian and publish the book "Sericulture Training Manual".
10. Decides the 3rd BACSA executive meeting to be held in the end of September 2006 at Vratza, Bulgaria.

This document is signed by:

BACSA President, Dr P. Tzenov:.....

Vice president for the Caspian sea

and Central Asia region: Dr H. Homidy:.....

Vice president for the Black sea region: Mr. E. Kipriotis:.....

National coordinators:

Albania: Dr A. Xhoxhi:.....

Armenia: Dr A. Azizyan:.....

Azerbaijan: Dr B. Abbasov:.....

Bulgaria: Dr D. Grekov:.....

Georgia: Prof. G. Nikoleishvili(signed by Dr K. Sarajishvili):.....

Greece: Ms. E. Rammou:.....

Kazakhstan: Dr. A. Kulametov:.....

Romania: Dr E. Pau (signed by Dr D. Tanase):.....

Tajikistan: Mr. M. Karimov:.....

Turkey: Mr. A. Karagozoglu:.....

Ukraine: Dr O. Galanova:.....

Uzbekistan: Dr D. Halmatov (signed by Dr H. Homidy):.....

Executive committee Members:

Dr S. Umarov:.....

LIST
of the participants at
International Workshop on Silk Handcrafts Cottage Industries and Silk Enterprises Development in Africa, Europe, Central Asia and the Near East,
&
Second Executive Meeting of Black, Caspian seas and Central Asia Silk Association (BACSA)

Bursa, Turkey, 6 -10 March 2006

Albania

1. Dr A. Xhoxhi (Mr.), BACSA National coordinator

Armenia

1. Dr Anzela Azizyan (Ms.), president, "YANS-SHERAM", Armenia-Brazilian JV LTD CO.
2. Mr. Armen Azizyan, president, ECO – SILK Environment and Health Protection NGO, Erevan

Austria

1. Mr. John Peter Moll, UNIDO, Vienna

Azerbaijan

1. Dr B. Abbasov (Mr.), BACSA National coordinator and expert in Sheki Ipak silk company, Sheki

Bulgaria

1. Dr P. Tzenov (Mr.), BACSA president and Executive director of Bulgarian National Center for Agrarian Sciences, Sofia
2. Dr N. Petkov (Mr.), Director of Sericulture Experiment Station in Vratza under the Bulgarian National Center for Agrarian Sciences, Sofia
3. Dr D. Grekov (Mr.), BACSA National coordinator and Dean of Agronomy college, Agrarian university, Plovdiv
4. Dr T. Staykova (Ms.), assistant professor in the Plovdiv university

China

1. Dr Meng Kui Xu (Mr.), Zhejiang National University, Hangzhou
2. Prof. Dr Y. Miao (Mr.), Zhejiang National University, Hangzhou
3. Dr Yuyun Chen (Ms.), Zhejiang National University, Hangzhou
4. Mr. Ye Wen, Manager, Hangzhou textile machinery factory
5. Mr. Gong Chengliang, Suzhou University, Suzhou
6. Mr. Renyu Xeue, Suzhou University, Suzhou
7.Dr Jiping Liu (Mr.), The Regional Sericultural Training Centre for Asia-Pacific, College of Animal Science, South China Agricultural University, Wushan, Guangzhou

8. Prof. Dr Cao Yang (Mr.), The Regional Sericultural Training Centre for Asia-Pacific, College of Animal Science, South China Agricultural University, Wushan, Guangzhou
9. Prof. Dr Lin Jian Rong (Mr.), The Regional Sericultural Training Centre for Asia-Pacific, College of Animal Science, South China Agricultural University, Wushan, Guangzhou
10. Prof. Dr Xiao Geng Sheng (Mr.), Sericulture institute, Guangzhou
11. Dr Wufu Guan (Mr.), Sericulture institute, Guangzhou

Georgia

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