7th BACSA INTERNATIONAL CONFERENCE

"Organic Sericulture – Now and the Future"

"ORGASERI" 2015

Sinaia, Romania

April 19th – 24th 2015

A B S T R A C T S

of the scientific and technical reports

Black, Caspian Seas and Central Asia Silk Association (BACSA)
Institute for Bioengineering, Biotechnology and Environmental Protection – S.C.BIOING SA, Bucharest, Romania

Sinaia

2015

Table of contents

LEAD PAPER!

The Organic Sericulture in the Context of Biological Agriculture and Organic Textile

By

Prof. Dr. Panomir Tzenov*, Asoc. Prof. Dr. Diliana Mitova, Dr. Eng. Maria Ichim*****

*** President of BACSA and Director of Sericulture and Agriculture Experiment Station, 24 Mito Orozov Str., Vratsa 3000 Bulgaria; e-mail: panomir@yahoo.com**

****Assoc. Prof. in Institute of Agricultural Economics, 125 "Tzarigradsko shosse" blvd., Bl. 1, Sofia 1113, Bulgaria; e-mail: dilianamit@gmail.com**

*****BACSA national coordinator in Romania and General manager, Institute for Bioengineering, Biotechnology and Environmental Protection – S.C.BIOING SA, 10 Prof. Ion Bogdan str., sect. 1, cod. 010539, Bucharest, Romania; e-mail:ichim52@gmail.com**

ABSTRACT

The organic agriculture is a method of production which aims to preserve the natural resources, the health of people and animals. The bioagriculture has a multiple effect on the whole agriculture sustainable development, such as high added value, quickly developing market, free market niches, export potential, preservation of the nature, rehabilitation the soils and preservation of the biodiversity, higher necessity of manual labor, job opportunity and association of marginal and socially weak groups of people. The most common natural fibers used to make clothing are cotton, hemp, ramie, linen, wool, and silk. When evaluating the eco-friendly properties of any clothing garment, must look at how the fiber was grown and produced and also at how the fiber was processed to create fabric and ultimately the clothing garment. For example the organic plants require to be produced without using any pesticides, hormones, fertilizers, sewage sludge-based fertilizers, bio-engineering, ionizing radiation, or any other synthetic or toxic substances. No artificial flavors or colors can added. They should not be irradiated or produced from Genetically Modified Organisms. Both the fiber growing and the fabric manufacturing must be free of harsh, toxic chemicals to quality the garment as being organic and healthy for the consumer and the environment in which it was produced and manufactured. Growing the natural fibers organically is only half the equation to qualify as organic clothing. The manufacturing process is the other half and often the half that is the most abused by toxic chemicals. Organic clothes do not

receive any synthetic chemical finishes or treatments such as moth resistant, fire retardant, easy care, anti-pilling, stain resistant, or wrinkle-free. Dyes used on organic clothing should be either plant / mineral derived or if not of natural origin are environmentally responsible low impact dyes. No heavy metals or other harmful chemicals should be used in the dyeing process. An ethically and environmentally aware approach is extended to all aspects of the organic clothing industry. Fair Trade practices to insure that the farm and garment workers receive a fair and just wage for their efforts are also a cornerstone of the organic clothing industry. The rate of people experiencing a wide barrage of health problems such as rashes, allergies, respiratory problems, and difficulties focusing mentally due to chemical sensitivities has been growing alarmingly. People wouldn't eat a bowl of pesticides drenched in insecticides, so why would they want to cover themself in clothes doused in chemicals? There is another reason why people are becoming excited about organic clothing and that is because of the fashions that are starting to come from some of the hot, new designers turning to eco-fashion. One last important development in organic textile standards has been the development of the Global Organic Textile Standard (GOTS) that begins the process of harmonizing all the different and slightly varying organic textile standards. At first blush, might think that organic should be less expensive to grow because organic doesn't use expensive GMO seeds, expensive petroleum-based fertilizers, or expensive toxic herbicides and pesticides like conventionally grown crops. But organically grown crops still must contend with weeds and fight devouring insects and this all costs money, actually more money than conventional chemical methods which is why conventional methods use all those toxic and deadly chemicals.

Concerning the sericulture if not implement chemical fertilizers and herbicides that means the labor costs for delivery and spreading farm yard manure and for manual weed control will increase. Organic fabrics are more expensive to manufacture. If the organic fabric is manufactured in facilities that also process and manufacture conventional fabrics from conventionally grown agriculture crops, before the organic fiber can be processed in these facilities, all the weaving or knitting machines must be cleaned of all residues from the processing of the conventional fiber. But there is another more significant factor why much conventional clothing is so inexpensive – cheap labor, by exploiting the poorest and most desperate workers and paying incredibly low wages to workers. Fair trade and fair pay for workers are important cornerstones of the organic and natural clothing industry and significantly add to the cost of organic and fair trade apparel. Organic garments are more expensive to ship to distributors, retailers and customer because the market size is so much smaller. Organic clothing retailers find it more expensive to advertise and market. Organic growers, manufacturers and retailers lack the mass buying power and the economies of scale found in the large retail chains.

Presumably organic silk would involve growing the mulberry trees organically, without chemicals, and raising the silkworms humanely and without hormones. Organic and sustainable certification organizations are working on standards for organic silk but they have not yet been finalized and adopted. Only the raw silk, just pure silk fibers without any chemicals or treatments added may be considered as fully organic, of course if mulberry and silkworm have been grown by an organic manner. However there appears the ethical problem that in order to produce high grade raw silk the pupae in the cocoons should be killed.

Generally all the silks, produced from cocoons, without killing the pupae are called peace silk or vegetarian silk. Animal rights organizations are concerned about the destruction of about 4000 domesticated silkworms to produce 1 kg of raw silk. However

if we go in this direction should stop slaughtering of any domestic animals for food and the whole mankind to become vegetarian. In our opinion even organic, in order to remain a viable industry the way of obtaining the raw silk, namely by killing the pupae and then reeling the cocoons should be like it is now. If the pupae will be left to transform into moths and then the moths to pierce the cocoons it will not be possible to produce any good quality filament silk. The properties of filament silk are different from those of spun silk, thus the spun silk can not substitute the filament silk. Many silk fibers are probably already being produced in an organic environment, especially those produced in smaller villages and rural environments. For example in some countries like Bulgaria, Georgia, Turkey etc. most of mulberry trees are located in the villages and are not treated at all by any fertilizers and pesticides. The problem is that these so many trees scattered in many villages can not be controlled by any certifying agency in order to give an organic certificate. Silk fabric when produced by weavers on handlooms has a near zero energy footprint and satisfies most of the guidelines for sustainable fabric production.

Trade organizations are concerned about the exploitive low wages often paid to silk textile workers. However the low wages are paid not only to the silk textile workers, but also to the sericulture farmers. The sericulture in now a days in many countries became a kind of "cheating the farmers" because their labor is paid at too low rates, even much lower than the minimal wages in the respective country. In addition the whole risk of the production is taken by the farmers themselves because any failure in the cocoon crop leads to getting very low incomes, even to an extent that they can not cover their material costs. This is mainly because usually the people who produce the fresh cocoons are different from those who reel the cocoons and the reelers are different from silk twisters and weavers. By this way the fresh cocoons are usually paid at too low prices, irrespective of the fact that the end products are sold sometimes at incredibly high prices. In this respect in our understanding an organic silk production could be organized on a cluster basis, where the payment of labor is sufficiently high due to a fair distribution of the profits throughout the whole production chain.

Domesticated silk fabrics are typically dyed with a mild acid dye or environmentally low impact fiber reactive dyes. Textile acid dye processes typically require high levels of chemicals, many of which have been classified by the Environmental Protection Agency as being of moderate to high concern as carcinogens. In order a silk to be organic no any cleaning or dyeing or finishing chemicals should be used in the silk processing. The main issue that causes concern in determining if silk is organic is the dyeing processes. Some producers use environmentally friendly non-natural dyes that are claimed to be "organic." Real organic silk is dyed by natural dyes. The use of 100% natural dyes made from tree bark, vegetables, grasses and flowers provide the best option for purely organic silk.

Eco-fabrics like organic silk do not contain any added chemicals that kill bacteria, and fight odours. Pure-dyed silk is just colored with dye and not weighted. The metallic salts used to weight silk can cause health risks and problems for some people. Chemical treatments are also added to silk to improve anti-static, water and oil repellency, flame retardant, dimensional stability and other wash-and-wear properties that our easy-care culture seems to expect. Many of these chemicals are also toxic and suspected carcinogens.

Recommendations about Organic Silk Production Development: The government should have a strong policy in organic agriculture, including sericulture; Stable and permanent financial support by the government to organic agri/sericulture; Providing higher subsidy per ha of mulberry under organic cultivation and subsidies per kg of

fresh cocoons or per box of silkworm eggs reared if organically produced; State/EU financial support to organic cocoons and raw silk production investment projects; To develop national strategy for organic silk production; The state policy for organic agriculture, including sericulture support to consider also the specific local agro-ecological conditions as well as the ecological and social effects from bio agri/sericulture; Developing of suitable technologies for organic mulberry leaves production, eco-methods for disinfecting the silkworm rearing houses, equipment and rearing bed disinfectants, natural silk dyes; Economical analyses of organic mulberry leaves/cocoons/raw silk production costs in comparison with the conventional production costs; Dissemination and exchange of information and spreading knowledge in organic mulberry cultivation and cocoon/raw silk production; Improving the coordination and collaboration between the government, NGOs, silk farmers, retailers and processors for organic silk problems solving; Establishment of organic silk clusters, providing sufficient purchasing prices for the bio cocoons and raw silk; Providing governmental/EU support to the organic silk clusters; Creation of organic mulberry leaf, cocoon/raw silk production information data base, available on BACSA web site; Establishing clear rules for organic silk certification and labeling; Involvement of the retail chains in the organic silk trade; Attracting the public attention to the organic silk production and its promoting; State support to the organic silk production and trade by lower VAT rate for the organic silk.

Key Words: sericulture, silk, organic, textile

The Bioagriculture

The organic agriculture is a method of production which aims to preserve the natural resources, the health of people and animals. The bioagriculture is a part of the biomanagement of agriculture and has a multiple effect on its sustainable development, namely:

- Economical: high added value, quickly developing market, free market niches, export potential;
- Ecological: Preserves the nature, rehabilitates the soils and preserves the biodiversity;
- Health: production of healthy and not dangerous biofoods;
- Social: higher necessity of manual labor, job opportunity and association of marginal and socially weak groups of people.

The land under organic agriculture increases very fast in the European union. For example for a period of only 7 years (2003 – 2010) the total agricultural land under organic production increased from about 6 million ha to 9 million ha. The share of areas under conversion from conventional to organic agriculture also increases.

What Are Natural Fibers?

Natural fibers fall into three main groups:

- Vegetable fibers which come from plants such as cotton, hemp, and flax;
- Protein fibers such as wool, alpaca, and cashmere which come from the wool and hair of animals;
- Strong elastic fibrous secretion of silkworm larvae in cocoons which is used to create silk.

The main ingredient in all vegetable fibers is cellulose, a carbohydrate found in all plant life. The most common natural fibers used to make clothing are: cotton, hemp, ramie, linen, wool, and silk.

Natural Fibers vs. Organic Fabric

Most garments that are produced from natural fibers such as cotton are not organic. Conventionally grown cotton is the most chemically treated crop in the world. About one fourth of all toxic chemical pesticides produced each year are used on cotton crops. The damage and destruction to the ecology and wildlife and to the health of farm workers and residents living near cotton fields is enormous. When evaluating the eco-friendly properties of any clothing garment, must look at how the fiber was grown and produced and also at how the fiber was processed to create fabric and ultimately the clothing garment.
For example the organic plants require to be produced without using any pesticides, hormones, fertilizers, sewage sludge-based fertilizers, bio-engineering, ionizing radiation, or any other synthetic or toxic substances. No artificial flavors or colors can added. They should not be irradiated or produced from Genetically Modified Organisms.
Both the fiber growing and the fabric manufacturing must be free of harsh, toxic chemicals to quality the garment as being organic and healthy for the consumer and the environment in which it was produced and manufactured.

Conventionally manufactured fabrics rely heavily upon chemicals to clean and bleach the fibers and to prepare the fibers to be spun into yarns for weaving or knitting. Conventional dyes are often high in dangerous heavy metals and use large amounts of water to flush and clean the fabrics resulting in heavily polluted waste waters. The final stage of the garment manufacturing process is the finishing step. Finishing is often one of the most chemically intensive steps, especially if the garment is chemically treated to be stain-resistant, wrinkle-resistant, odor-resistant, or any of the other treatments that are being called “smart fabrics” to make life easy. All of these labor-saving treatments come at the expense of chemical treatments. That’s why the people’s chemical sensitivities are a growing problem.

Although most people tend to assume that most of what they wear is natural fiber clothing, this is far from the truth. Even if the label on a shirt states that it is 100 percent cotton or wool, it never mentions the amount of chemicals the fabric may have been in contact with up until that point. In fact, the only way to be certain that you are wearing natural fiber clothing is if they are certified to have been created using organically grown elements.

What is Organic Clothing?

Simply, to qualify as being organic, organic textiles are made from raw natural fibers such as cotton, hemp, ramie, wool, silk and alpaca that have been grown without the use of synthetic chemical fertilizers, pesticides, growth regulators or defoliants. Growing the natural fibers organically is only half the equation to qualify as organic clothing. The manufacturing process is the other half and often the half that is the most abused by toxic chemicals. Organic clothes do not receive any synthetic chemical finishes or treatments such as moth resistant, fire retardant, easy care, anti-pilling, stain resistant, or wrinkle-free. Dyes used on organic clothing should be either plant / mineral derived or if not of natural origin are environmentally responsible low impact dyes. No heavy metals or other harmful chemicals should be used in the dyeing process. An ethically and environmentally aware approach is extended to all aspects of the organic clothing industry. This “ethical and environmental

awareness" found throughout the organic clothing industry is one of its more fascinating qualities. To simply be organically grown and manufactured isn't adequate. "Living lightly upon the Earth" is entrenched into the organic clothing industry and market. Fair Trade practices to insure that the farm and garment workers receive a fair and just wage for their efforts are also a cornerstone of the organic clothing industry.

Why Wear Organic?

Just as concern over the harmful effects of insecticides and pesticides in our food supply has given rise to the demand for organic produce and vegetables, concern over the high use of insecticides and pesticides in growing cotton and other natural fibers has given rise to demand for organic cottons and garments free of these and other poisons and carcinogens.
But organic cotton is not the only healthy fabric. The silk has many excellent properties and it may be the most environmentally positive crop, actually improving the condition of the soil. In Europe for example mulberry requires no any herbicides and is naturally resistant to most of insects, fungus, and other pests, that's why mulberry could be grown as an organic crop.
The rate of people experiencing a wide barrage of health problems such as rashes, allergies, respiratory problems, and difficulties focusing mentally due to chemical sensitivities has been growing alarmingly. Many people diagnosed with Multiple Chemical Sensitivities find organic clothing to be essential in reducing their exposure to the vast array of toxic chemicals that we are unknowingly exposed to every day. People wouldn't eat a bowl of pesticides drenched in insecticides, so why would they want to cover themself in clothes doused in chemicals?
There is another reason why people are becoming excited about organic clothing and that is because of the fashions that are starting to come from some of the hot, new designers turning to eco-fashion.

The organic textile standards

Environmentally and socially balanced organic textile standards should have two critical similarities:

- **Lowest practical ecological impact** during the growing and processing of natural, organic fibers into textiles and garments. At the present time, the use of chemical compounds in organic fiber processing cannot be completely eliminated, the types of materials – such as low impact dyes – used for organic fiber processing can be greatly restricted and the use and disposal of the materials is environmentally sustainable to minimize harm to people and the environment.
- **Fair Trade guidelines** that respect and promote a positive social impact for all growers, employees and workers involved in the complete supply chain for bringing sustainable and organic clothing and garments to market. Somehow, it is inconceivable and unconscionable to imagine putting a "green" sustainable label on a garment that was produced through the misery of workers under sweatshop conditions.

The Organic Trade Association (OTA) in the U.S.A. developed "The American Organic Standards for Fiber Processing" which defines four levels of organic labelling:

1. **“100% Organic”**. All components are organically grown and certified, including the sewing threads, and all processes used to manufacture the garment conform to the processing requirements stated in the standard;
2. **“Organic”**. At least 95% (by weight) of the agricultural fibers are organically grown and all processing adheres to the environmental processing requirements given in the document;
3. **“Made with organic (specified fiber products)”**. At least 70% (by weight) of the garment have been organically grown;
4. **“Less than 70% organically produced constituents”**. Maybe it has some organic fiber content, maybe not. All non-organic garment components may be processed and handled without regard to the OTA standards.

For levels 1 through 3, all chemicals used in the manufacturing processes – knitting, weaving, cleaning, scouring, dyeing, and finishing – must conform to the process requirements defined in the OTA document to insure environmental sustainability and must not be carcinogenic, mutagenic, teratogenic, toxic to mammals, or an endocrine disrupter. All degreasers, detergents, surfactants, and soaps for scouring wool and animal fibers must be biodegradable. Synthetic waxes can be used on yarn but they must be water soluble and free of alkyl phenol ethoxylates. All knitting and weaving oils must be water soluble. Any non-organic items in the garment such as button, zippers, elastic yarns or fabrics must be on the list of approved items for which there are no organic counterparts available. The use of chlorine bleach, plastisols, some AZO dyes, formaldehyde and synthetic chemicals for functional finishes (all the “anti-” stuff such as anti-wrinkle, anti-fungal, anti-pilling, anti-odor, etc.) is prohibited. Also, no Genetically Modified Organisms (GMOs), including GM cotton, are allowed in any phase of the process from growing organic fibers to final finishing and packaging.

The Soil Association in the U.K. developed organic textile standards in 2003 that were closely based on criteria established by the International Federation of Organic Agriculture Movements (IFOAM). The Soil Association organic textile standards use a two-tier label. To qualify for the highest organic standard, raw materials must contain at least 95% certified organic materials – excluding accessories such as buttons and zippers. Provided that they are not on the list of toxic and disallowed fibers and components, the remaining 5% of fibers can be non-organic or synthetic if sufficient organic fibers are not available. GMO’s and GM cotton are also banned in the Soil Association organic textile standard.

One last important development in organic textile standards has been the development of the Global Organic Textile Standard (GOTS) that begins the process of harmonizing all the different and slightly varying organic textile standards. The Global Organic Textile Standard was developed by the International Working Group on the Global Textile Standard as part of the International Conference on Organic Textiles (INTERCOT). The Global Organic Textile Standard is a collaborative effort between the Organic Trade Association, Soil Association, International Association Natural Textile Industry (IVN), and Japan Organic Cotton Association (JOCA). GOTS is intended to allow organic textile manufacturers to export their organic fabrics and garments using this one certificate that will be accepted in all the major world markets. Before, manufacturers needed different certificates to market into different countries.

The global market is still ruled by a half dozen slightly varying standards that are generally similar in intent and purpose. Efforts such as the Global Organic Textile Standard are working to unify the differences in a way that will provide meaningful protection to the

environment, all workers from the fields to the factories, and to the health and well-being of the consumer.

The High Cost of Organic Clothing

At first blush, you might think that organic should be less expensive to grow because organic doesn't use expensive GMO seeds, expensive petroleum-based fertilizers, or expensive toxic herbicides and pesticides like conventionally grown crops. But organically grown crops still must contend with weeds and fight devouring insects and this all costs money, actually more money than conventional chemical methods which is why conventional methods use all those toxic and deadly chemicals.

Concerning the sericulture if not implement chemical fertilizers and herbicides that means the labor costs for delivery and spreading farm yard manure and for manual weed control will increase.

Organic fabrics are more expensive to manufacture. If the organic fabric is manufactured in facilities that also process and manufacture conventional fabrics from conventionally grown agriculture crops, before the organic fiber can be processed in these facilities, all the weaving or knitting machines must be cleaned of all residues from the processing of the conventional fiber. Of course, the facility owners add the additional costs for this cleaning and equipment downtime to the production costs for the organic fabrics.

Organic garments are more expensive to manufacture for many reasons. Some of them relate to the relatively small size of the organic clothing market and the need to frequently share manufacturing facilities with conventional clothing. Like the manufacturing process, all sewing machines and work areas must be cleaned of conventional garments and contaminants before being used for sewing organic garments.

But there is another more significant factor why much conventional clothing is so inexpensive – cheap labor that often borders near being sweatshop or indentured. Basically, most large clothing retailers contract with many dozens of clothing manufacturing facilities scattered in developing countries around the world. Many of these facilities exploit the poorest and most desperate workers and pay incredibly low wages to workers who sew long hours under appalling conditions to make those cheap, inexpensive shirts, pants and undergarments that fill the large, mega stores in cities and shopping malls.

Fair trade and fair pay for workers are important cornerstones of the organic and natural clothing industry and significantly add to the cost of organic and fair trade apparel.

Organic garments are more expensive to ship to distributors, retailers and customer. This isn't because they are organic, but because the market size is so much smaller. The large retail chains can deliver a large trailer load of clothes to their stores at significantly lower per-garment prices than it costs for a box or two of organic clothes to some local organic clothing store.

Organic clothing retailers find it more expensive to advertise and market. The huge retail chains can use their enormous marketing budgets and muscle to get the most cost-effective advertising. This, also, is really a small store vs. enormous chain store issue but it figures into the perception of organic clothing being more expensive than conventional clothing.

Organic growers, manufacturers and retailers lack the mass buying power and the economies of scale found in the large retail chains.

An inconvenient truth is that organic and all-natural clothing will always be more expensive than conventional, chemical clothing. The good news is that the price gap will continue to shrink as the market size of organic clothing grows and the economies of scale improve.

What Means Organic Silk?

Even though silk is a natural fiber that has been woven into fabric to dress China's Empresses since 2900 BC silk is just starting to be proclaimed as a "natural" fabric, but how organic, sustainable, ethical and healthy is silk? Presumably organic silk would involve growing the mulberry trees organically, without chemicals, and raising the silkworms humanely and without hormones. Organic and sustainable certification organizations are working on standards for organic silk but they have not yet been finalized and adopted.
Only the raw silk, just pure silk fibers without any chemicals or treatments added may be considered as fully organic, of course if mulberry and silkworm have been grown by an organic manner. Up to this point the raw silk threads could easily be produced to comply with emerging sustainable and organic standards for silk and be manufactured into silk eco-fashion and organic clothing. However there appears the ethical problem that in order to produce high grade raw silk the pupae in the cocoons should be killed.
On the other hand the spun silk is produced from different cocoon/silk wastes, a part of them are pierced cocoons which are waste from silkworm egg production. Generally all the silks, produced from cocoons, without killing the pupae are called peace silk or vegetarian silk. These are the silks from some wild silkworm moths: Not all wild silk is Peace silk, but most still is. This includes Tussah, Eri and Muga silks from India. All three of these species, and a few more, are semi cultivated in India. Tussah is currently cultivated in China. Most cultivation of wild silk produces Peace silk. This is especially true of hand raised, hand processed silks of rural India. It is less true of factory processed Chinese tussahs.
"Ahimsa silk" is the term now current in India. There is a patent in India for Bombyx mori (cultivated) Ahimsa silk. "Ahimsa silk" producing company contracted with local south Indian silkworm egg production mills and buy their pierced cocoons, after that the cocoons are spun and woven in small local mills and villages.

Is silk organic, sustainable, ethical, healthy?

Silk, like other protein fibers coming from living beings such as sheep and alpacas, can easily be created according to organic guidelines as they begin to be approved. And many silk fibers are probably already being produced in an organic environment, especially those produced in smaller villages and rural environments. For example in some countries like Bulgaria, Georgia, Turkey etc. most of mulberry trees are located in the villages and are not treated at all by any fertilizers and pesticides. The problem is that these so many trees scattered in many villages can not be controleed by any certifying agency in order to give an organic certificate.
To boost productions and improve efficiencies, large corporate farms typically use heavy chemicals.
In the same way, the raising of domesticated silkworms and the life of wild silkworms is, by nature, sustainable. Silk fabric when produced by weavers on handlooms has a near zero energy footprint and satisfies most of the guidelines for sustainable fabric production. Silk produced in large powerloomed textiles factories must be evaluated on a company-by-company basis to determine their sustainability.

Ethical silk: Evaluating the ethics of silk is always a more complex and more personal question. Animal rights organizations are concerned about the destruction of about 4000 domesticated silkworms to produce 1 kg of raw silk. However if we go in this direction should stop slaughtering of any domestic animals for food and the whole mankind to become vegetarian. In our opinion even organic, in order to remain a viable industry the way of

obtaining the raw silk, namely by killing the pupae and then reeling the cocoons should be like it is now. If the pupae will be left to transform into moths and then the moths to pierce the cocoons it will not be possible to produce any good quality filament silk. The properties of filament silk are different from those of spun silk, thus the spun silk can not substitute the filament silk.
Trade organizations are concerned about the exploitive low wages often paid to silk textile workers. However the low wages are paid not only to the silk textile workers, but also to the sericulture farmers. The sericulture in now a days in many countries became a kind of "cheating the farmers" because their labor is paid at too low rates, even much lower than the minimal wages in the respective country. In addition the whole risk of the production is taken by the farmers themselves because any failure in the cocoon crop leads to getting very low incomes, even to an extent that they can not cover their material costs. This is mainly because usually the people who produce the fresh cocoons are different from those who reel the cocoons and the reelers are different from silk twisters and weavers. By this way the fresh cocoons are usually paid at too low prices, irrespective of the fact that the end products are sold sometimes at incredibly high prices. In this respect in our understanding an organic silk production could be organized on a cluster basis, where the payment of labor is sufficiently high due to a fair distribution of the profits throughout the whole production chain.

Healthy Silk: While being a comparatively healthy and organic natural fiber, silk, like other fibers containing protein chains such as wools, is an allergen for some people. Silk allergies can cause asthma or allergic rhinitis with symptoms of runny nose and itchy eyes that are similar to hay fever. Medical researchers have found a wide variety of causes for a small number of people experiencing silk allergies: some are allergic to wild silk, some to domesticated silk, and some to micro-fine dust that can be given off by spun silk. Often, the allergies are traced to the diet of the silk worm – such as mulberry or oak leaves – which influence the protein chains found in the silk strands produced by the silk worm.
Some silk allergies come from excessive sericin in silk that has not been adequately degummed. The waste silk, also called silk noil, from damaged cocoons and broken strands is often used as filling in silk duvets and lower quality spun silk fabrics. Sometimes the waste silk / silk noil is not sufficiently degummed resulting in excess sericin in the products that can result in silk allergic reactions for some people.

Dyed Silk: As with any fabric, the dyeing of silk can also create health problems for people with chemical sensitivities. Because silk fibers are highly absorptive, Bombyx mori silk takes dyes exceptionally well and is one reason for the brilliance and luster of dyed silk fabrics. Domesticated silk fabrics are typically dyed with a mild acid dye or environmentally low impact fiber reactive dyes. Textile acid dye processes typically require high levels of chemicals, many of which have been classified by the Environmental Protection Agency as being of moderate to high concern as carcinogens. Textile acid dyeing also typically discharges large amounts of contaminated waste waters that require treatment. Low impact fiber reactive dyes have a much smaller environmental footprint but still create some health problems for the chemically sensitive.
In order a silk to be organic no any cleaning or dyeing or finishing chemicals should be used in the silk processing. The main issue that causes concern in determining if silk is organic is the dyeing processes. Some producers use environmentally friendly non-natural dyes that are claimed to be "organic." Real organic silk is dyed by natural dyes. In addition, with organic silk, the mulberry trees they feed on are grown organically, without pesticides or fertilizers.
The use of 100% natural dyes made from tree bark, vegetables, grasses and flowers provide the best option for purely organic silk.

Eco-fabrics like organic silk do not contain any added chemicals that kill bacteria, and fight odours.
If wish to avoid dyes, the options are raw silk and natural undyed silk.

Weighted Silk: "Weighting" is a textile manufacturing practice peculiar to and particular to silk manufacturing and involves the application of metallic salts to add body, luster and physical weight to silk fabric. The reason for adding metals to silk fabric is to increase the weight of the fabric and, because silk fabric sells by the weight, the extra weight increases the selling price of the fabric. Generally, only the finer and more expensive reeled silks are weighted rather than the less costly spun silks. Some of the different salts of metals used to weight silk include chromium, barium, lead, tin, iron and sodium magnesium.
Weighting can increase the weight of silk by three, four, fivefold or more. Silk can be weighted because it is highly absorptive and the metal salts are easily absorbed into the silk fibers. Silk was originally weighted to make up for the loss of weight caused by degumming which removes the sericin reducing the weight of silk by about 25 – 30 %. Silk is one of the strongest natural fibers but the metals used to weight silk cause it to lose much of its strength and durability if the weighting is not done properly. Pure-dyed silk is just colored with dye and not weighted. The metallic salts used to weight silk can cause health risks and problems for some people.

Finishing Silk: The purpose of the fabric finishing process is to give the fabric its final desired feel, appearance and care properties. A variety of environmental and health hazards can be introduced during the finishing phase of silk fabrics and garments. Water-soluble substances such as starch, glue, gelatin and even sugar are sometimes used to finish silk and provide extra body to the fabric.
Silk creases and wrinkles easily, especially when damp or wet. Some silk clothing manufacturers apply softeners, elastomers, and synthetic resins such as EPSIA – a silicone-containing epoxy crosslinking agent – to increase the dry and wet anti-wrinkling and crease-resistance performance of silk garments. With the family of silicone epoxy crosslinking agents (EPSIA, EPSIB and EPTA) this crease resistance occurs because chemical cross links occur between the silk fibroin strand and the epoxy groups.
Chemical treatments are also added to silk to improve anti-static, water and oil repellency, flame retardant, dimensional stability and other wash-and-wear properties that our easy-care culture seems to expect. Textile chemicals have become an integral and important component of conventional textile and clothing manufacturing. Textile chemicals, also know as textile auxiliaries, have two primary purposes: to increase the efficiency and lower the costs of conventional textile manufacturing; and to create special finishing effects and properties for the clothing.
The first category of textile auxiliaries and chemicals to improve manufacturing efficiencies are used in the spinning, weaving, scouring, bleaching and dyeing processes. Textile manufacturers claim that these textile chemicals can all be washed and removed from the final garments and are used to save time, reduce labor costs and reduce material costs. Environmental impact is seldom considered, especially in garment factories in developing countries, and many of the chemicals are discharged as untreated waste waters into rivers and ground water supplies.
The second category of textile chemicals are used mostly in the fabric and garment finishing processes and are intended to be permanent. These textile auxiliaries are supposed to give clothing special properties such as a smooth silky feel, easy care, mildew resiliency, flame retardant, and easy wear. Many of these chemicals are also toxic and suspected carcinogens.

Organic silk production

If the primary concern is healthy and organic silk then may consider as such the raw silk, noil silk, Muga silks or Eri silks that are undyed or dyed with low-impact, fiber-reactive dyes. The silk fabric should not be weighted or have any easy care or protective finishes. Silks produced in small villages by local weavers are usually the most pure.

If the concern is about the ethics of silk raising then may choose wild silk, spun silk or Eri silks which do not destroy the silk worm to produce reeled silk. Also the silk garments had to be produced according to Fair Trade principles which protect the workers involved in all phases of producing the clothing.

If the concern is about sustainable and eco-friendly silk, then seek silks dyed using low-impact and fiber reactive dyes or vegetable dyes without any finishes. Handloomed silks are the most energy-neutral. Silk is also biodegradable and will decompose gracefully in landfills. Although, given its durability, silk is ideal for recycled ecofashion.

Recommendations about Organic Silk Production Development

- **The government should have a strong policy in organic agriculture, including sericulture.**
- **Stable and permanent financial support by the government to organic agri/sericulture.**
- **Providing higher subsidy per ha of mulberry under organic cultivation and subsidies per kg of fresh cocoons or per box of silkworm eggs reared if organically produced.**
- **State/EU financial support to organic cocoons and raw silk production investment projects.**
- **To develop national strategy for organic silk production.**
- **The state policy for organic agriculture, including sericulture support to consider also the specific local agro-ecological conditions as well as the ecological and social effects from bio agri/sericulture.**
- **Developing of suitable technologies for organic mulberry leaves production, eco-methods for disinfecting the silkworm rearing houses, equipment and rearing bed disinfectants, natural silk dyes.**
- **Economical analyses of organic mulberry leaves/cocoons/raw silk production costs in comparison with the conventional production costs.**
- **Dissemination and exchange of information and spreading knowledge in organic mulberry cultivation and cocoon/raw silk production.**
- **Improving the coordination and collaboration between the government, NGOs, silk farmers, retailers and processors for organic silk problems solving.**
- **Establishment of organic silk clusters, providing sufficient purchasing prices for the bio cocoons and raw silk. Providing governmental/EU support to the organic silk clusters.**
- **Creation of organic mulberry leaf, cocoon/raw silk production information data base, available on BACSA web site.**

- **Establishing clear rules for organic silk certification and labeling.**
- **Involvement of the retail chains in the organic silk trade.**
- **Attracting the public attention to the organic silk production and its promoting.**
- **State support to the organic silk production and trade by lower VAT rate for the organic silk.**

REFERENCES

https://greencotton.wordpress.com/2008/05/21/silk-just-how-green-is-it/
http://www.aytengasson.com/blogs/news/6749964-whats-the-difference-between-organic-and-normal-silk
http://www.thaisilkmagic.com/what-is-organic-silk/
http://www.aurorasilk.com/about.html
http://organicclothing.blogs.com/my_weblog/2007/03/raw_organic_sil.html
http://www.zelenbio.com/page/8/kakvo-e-bio.html

All the abstracts are printed out without any revision!

Organic sericulture session

Technical specifications for organic sericulture presented to the Italian Ministry of Agricultural, Food and Forestry Policies

By

Silvia Cappellozza*, Alessio Saviane*, Paolo Foglia§

*** CRA - Honey bee and Silkworm Unit, § I.C.E.A.**

(oral presentation)

In the textile field GOTS (Global Organic Textile Standard) was developed with the aim to unify the various standards in the ecotextile processing and to define world-wide requirements that ensure organic status of textiles. This standard ranges from harvesting of raw materials through environmentally and socially responsible manufacturing up to labelling. As GOTS requires the uses of certified organic fibers, it is of basic importance to establish technical specifications also in order to produce organic cocoons. Until now these specifications are not existing neither at some country's national level nor at international level. Therefore here we present the first attempt at obtaining the approval of these technical specifications from the Italian Ministry of Agricultural Food and Forestry Policies (MIPAAF), for the production of organic cocoons, according to the procedure laid down in article 42 of EC Regulation 834/2007. The regulatory procedure was defined by ICEA (a private Environmental and Ethical Certification Institute, a Consortium that controls and certifies companies carrying out their activities in respect of people and nature, by defending workers dignity and rights of consumers) in collaboration with CRA - Honey bee and Silkworm Research Unit, Padua seat.

Keywords: organic cocoon production, Global Organic Textile Standards, MIPAAF

Organic Sericulture in Thailand: Current State and Future Developments

By

Siriporn Boonchoo, Kanokwan Kunatham, and Nisanath Churthong

The Queen Sirikit Department of Sericulture
Ministry of Agriculture and Cooperatives; e-mail:
siripornboonchoo@gmail.com

(oral presentation)

Awareness of climate change and other environmental concerns has increased in the last few decades. People are becoming more conscious for their health and environment. Due to a major contributor to carbon dioxide emissions of agriculture practices, the high degree of eco-friendly and organic agriculture are encouraged all over the world. Similar to sericulture industry in Thailand, it has continuously transformed from chemically based technology to organic farming. Both private sector and government sector are taking part in this process. According to the policy support of green economy, the Green Agriculture City Project has been implemented by the Queen Sirikit Department of Sericulture (QSDS)since 2014with the cooperation of others organizations in the Ministry of Agriculture and Cooperatives. The QSDSinitiated several activities under the Green Agriculture City Project across the country such as knowledge development, production improvement, standard compliance, and marketing. Currently, more than 371 rais (approximately 147 acres) are certified Good Agriculture Practice (GAP) Standard and organic standard and estimated to be almost double in 2015. 130 kilograms of organic silk cocoons (Eri silk) and more than 1,900 kilograms of organic silk yarns are produced in 2014. More than 200 kilograms of organic silk cocoons and more than 4,600 kilograms of organic silk yarns are estimated to be certified in 2015. At present, four silk fabric companies are already certified to the GOTS standard - an important standard to ease the EU market penetration and boost the trust of European consumers. The use of eco-label marks also increases in Thai silk industry. Five companies certified the first silk product carbon footprint for handkerchief, scarf, shawl, and fabric in March 2015 and expect to certify more variety of products in the near future.

Carbon Footprinting of Thai Silk Fabric Products

By

Kannika Sonthi[2],Siriporn Boonchoo[1], Kanokwan Kunatom[1], Nakon Mahayosanan[2], Sate Sampattagul[3], LukkanaJareansuk[4]

[2]Office of Sericulture Conservation and Standard Conformity Assessment
[1]The Queen Sirikit Sericulture Center (Chiangmai)The Queen Sirikit Department of Sericulture
[3]Department of Mechanical Engineering Faculty of Engineering, Chiangmai University
[4]Research Unit for Energy Economic & Ecological Management, Chiangmai University

(oral presentation)

Thai Silk Fabric products is one of the main exporting products for Thailand. The flow of awareness about global warming, affect an environmentally sensitive. Social Responsibility And push for sustainable development, more and develop the capacity to compete on a creative economy , a significant value on intangible assets. Including the role of technology and innovation to reflect more market opportunities. In other contexts, the day of the race.Is deteriorating Tournament format changes. Market trends and needs Rapidly changing consumer Patterns or new channels. In the sale of consumer goods and access to these factors, which affect the competitiveness of the textile and apparel world, including Thailand.By such trends as well as opportunities and challenges for development. Textile and Apparel Thailand. It has to be prepared to adapt in order to compete and survive in the competitive and sustainable change. The foundation of knowledge Important in the management of energy and the environment, good for the textile industry is Carbon. Footprint of Products (Carbon Footprint of Product: CFP), a tool to assess the impact. Caused by the emission of greenhouse gases in the manufacturing process of the product. Ranging from the acquisition of raw materials, production processes. Distribution and use of waste products, so it is important to get the correct respondents.And to amend the policy to produce more environmentally sensitive.

To encourage the production of silk Thailand. Produce more environmentally friendly. And product development to the green market. This project was initiated to assess the carbon print of silk products. For the benefit of developing silk Thailand is ready. Develop and enhance the competitiveness of enterprises, Thailand. And have the ability to compete on the world market.

Samples studied were,Hand Woven Fabricssilk naturalcolor (no dyeing).natural dyed silk shawl (Sea almond dyeing) and Silk Pocket Square.

The scope of carbon footprint analysis was B2B and B2C, covering mulberry cultivation, silkwormbreeding,*silk reeling,* the natural silk dyeing, silk weaving, sewing and packaging.and distribution including all related transportation. The primary inventory data were collected by interviewing sericulture farmersand the producing companies of fabric Thai silk. Secondary data from references and national/international databases were used where necessary. The carbon footprinting method is based on PAS 2050:2008.

The analysis of the carbon footprint of silk products found in the case of silk, hand-woven natural number one piece of a 1x1 m (B2B) showed that the total GHG emissions are1.41 $KgCO_2e$. (kg of carbon dioxide. equivalent) by 1.29 $KgCO_2e$.of the manufacturing process and the process is the raw material in the manufacturing process by 0.12 $KgCO_2e$.Factors affecting the emission of greenhouse gases, most of the water used in the process of silk reeling.

Natural dyed silk shawl (Sea almond dyeing) production 1 piece size 60 x 160 cm (B2C)showed that the total GHG emissions are 0.28 KgCO2e. It comes from the production

of 0.06 $KgCO_2e$. And the acquisition.Materials 0.19 $KgCO_2e$. The process is the raw material. Factors affecting the emission of greenhouse gases, most of the dyeing process.

Silk Pocket Square production1 piece size 30 x 30 cm (B2C) showed that the total GHG emissions are 0.22 $KgCO_2e$. It comes from the production of 0.05 $KgCO_2e$. And the process is the raw material 0.15 $KgCO_2e$. . The process is the raw material. Factors affecting the emission of greenhouse gases, most of the transport process.

The analysis of the carbon footprint in the process of silk productionshowed that the total GHG emissions are 7.22 $KgCO_2e$.in the sericulture production which comes from the process of silk to 6.17 $KgCO_2e$. for cocoon production of 1 kgand in the process of planting and field management mulberry only 1.05 $KgCO_2e$. for mulberry production 1 kg.

To produce silks yarn 1 kg (silks degumming) showed that the total GHG emissions are 13.5327 $KgCO_2e$. And in the production of silk fabric 1 kg (no dyeing)showed that the total GHG emissions are 13.5358 $KgCO_2e$.

Therefore, it should find ways to reduce the carbon footprint in the production of Thai silk fabric. Each process Our focus is to reduce the carbon footprint in the process of silkwormbreeding, *silk reeling* and silk degumming silk in terms of energy efficiency improvement.

Knowledge Extension Model of Good Chemical Fertilizer with Organic Fertilizer Application for Increase SericultureProductivity

By

Somying Chooprayoon[1/]Apaporn Khantee[1/]KanokwanWonrawongsomkam[2/]
Lumpan Sarnchantuk[3/]Choomyanut Comwong[4/]Watcharapong khawhom[5/]

[1/]office of Sericulture Research and Development
[2/]Queen Sirikit Sericulture Center Roi-Et
[3/]Queen Sirikit Sericulture Center Chaiyaphum
[4/]office of Sericulture Development and Technology Transfer
[5/]Queen Sirikit Sericulture Center Saraburi
e-mail: csomying@hotmail.com

(oral presentation)

Purposes of this research are to study the efficiency of fertilizers to the yield and quality of mulberry and silk. Also, a good knowledge of the fertilizer to promote sericulture production and increase income of farmers conducted in the year 2013 to 2014.There are two activities in this research, first activity is study knowledge and find the optimum of organic and chemical fertilizers at The Queen Sirikit of Sericulture Centers (Chaiyaphum and Roi-Et).Soil was low fertility andthe acid-alkaline and acidic to neutral. The experiment was design by RCBD and repeated 4 times including 5 treatments is 0-0-0 , 30-15-15 kg/rai of N-P_2O_5-K_2Oและ 30-15-15 kg/rai of N-P_2O_5-$K_2O$with farm yard manure 1, 2 and 4 ton/rai/year respectively. The results showed that the fertilizer spreaders with all the leaves yield is higher rates than using chemical fertilizer alone. Moreover, silk production and toughness increased

but not significantly when feed that leaves to the mulberry silkworms. Therefore, the mulberry leavesfor 1st instar hadhighest nitrogen and amount of phosphorus and potassium was highest in the mulberry silkworm 4th instar and 5th instar. The quality leaves that are appropriate to the needs of silkworms in each stage. The second activity is to transferknowledge from first activity to farmers in 2 groups (Chaiyaphum and Roi-EtProvince) by using fertilizer 30-15-15 kg/rai of N-P_2O_5-K_2O with farm yard manure 1ton/rai/year The results showed that the productivity of farmers was higher productivity. Also, farmers are satisfied in the knowledge that the use of fertilizers has been caused because the revenue increase

ORGANIC SERICULTURE AND MORICULTURE: SMART, ECO-FRIENDLY AND RESOURCE-SAVING APPROACHES

By

Madyarov Sh.R.

Institute of Gene Pool of Plants and Animals. Uzbek Academy of Sciences. 32, Bogi-shamol str., Tashkent , 100125, Uzbekistan. E-mail: shuhm@yandex.ru

Uzbek Research Institute of Sericulture. 1, Ipakchi str., Tashkent. 100055. Uzbekistan.

Mulberry silkworm *Bombyx mori* L being monophagous insect who one among animals was introduced by man in ancient agriculture together with its exclusive fodder plant, mulberry tree *Morus spp.* In a result of human activity these two species underwent significant changes. In this connection sericulture could be referred to ancient biotechnological manufactures along with crop growing, livestock farming, bread baking, vine- and cheese making and other ancient skills.

Up to date silk, leaves, fruits and timber of mulberry were the main products of sericulture and moriculture. Biotechnological approaches which significantly expand the assortment of new products of present-day sericulture called now “organic”, “functional” and “non textile” sericulture are presented in this work.

In the field of fodder base, an artificial diet for silkworm is developed on the basis of local raw material and wastes of agriculture and food industry. This artificial diet provides normal development of insects both in youth and elder instars with obtaining of good quality cocoons. Metabolomic approaches to increase of mulberry silkworm’s productivity are developed. An effective bioreactor by “digestion – soaking” type with use of immobilized enzymes is created on the principle of operation of digestive system of silkworm. The developed artificial diet can be used not only in sericulture but also for intensification of scientific researches. Mulberry silkworm on the artificial diet can be used as test-organism in screening of new chemical compounds and bio-preparations for their physiological activity, for trials in unusual and extremal conditions of environment, space etc , as gene - engineering object, for education.

The methods of ecologically friendly biocontrol of mulberry tree pests in IPM system are developed in organic moriculture. The methods of obtaining of chemical and biological preparations with use of leaves, fruits, stems and other parts of the plant providing wasteless of moriculture are developed too.

Bioprotective drying method of raw-materials and semiproducts of mori- and sericulture is developed in the field of rational use of products of sericulture. Resource-saving technology was elaborated for obtaining fibroin and sericin hydrolysates as well as silky biosorbents, fibroin matrices for drug delivery, proteins, enzymes, genes and viruses engineering and mimicry.

Thereby main topics of organic sericulture and moriculture could be achieved by methods and approaches of present day biotechnology.

References:

Madyarov, Sh.R. (2005) Biotechnological Approaches in Sericultural Science and Technology of Uzbekistan (Review). Int. J. Indust. Entomol. **11**(1) : 13-19.

Madyarov, Sh.R. (2008) Silk fibroin as matrix material for pharmacy, bio- and nanotechnology. Asia-Pacific Congress of Sericulture and Insect Biotechnology. APSERI 2008, Nagoya, Japan, March 21-22, 2008. P-07.

Madyarov Sh. R. (2010) Biotechnological approaches in sericulture and silk technology // Author's abstract Dr. Sci. dissertation. – 2010. – 44p.(Russian)

Madyarov Sh R. The insects as perspective producers of renewable organics // Biotechnology: State of the art and prospects of development: Abstracts VII Moscow Int. Cong., March 19-22. – Moscow, 2013. - P. 421-423.

Madyarov Sh. R., Islamova Sh.K., Umarov Sh.R. Improvement of food value and assimilability of nutritious components of cotton seeds and silkworm cocoons // Ibid. - P. 424-425.

Organic mulberry plantations

By

Z. Petkov

Sericulture and Agriculture Experiment Station, 24 Mito Orozov Str., Vratsa 3000 Bulgaria; e-mail: zmpetkov@gmail.com

(Poster)

In practical terms organic production means: not using mineral fertilizers at the expense of farm-produced natural fertilizers (compost, green manure and mulches); not using herbicides and pesticides, but instead mechanical companion, crop control and cover crop management.

Mulberry plantations which are immediately suitable for organic production exist only in the form of old low-density orchards, without any fertilization or plant protection measures. It is necessary to pass through conversion period, since the use of artificial aids is restricted, and attention must be paid to create an ecological balance, professional training of farmers and minimizing economic losses from temporary crop decrease.

Mulberry tree exploitation continues for decades and mistakes in plantation establishment, e.g. choosing the site and varieties, initial soil preparation, crown forming of young trees and cares in their juvenile period cannot be ignored easy and losses for the farmers will be great. This is especially very important for organic production of mulberry leaves.

This article analyzes the main points that should be kept in mind and activities to be undertaken in the establishment and operation of plantations for organic production of mulberry leaves, namely: criteria for assessment of a site (all the factors associated with climate, location and soil); proper soil preparation which is one of the most important prerequisites for successful organic production; choice of the cultivar and the quality of the saplings; proper planting density and planting systems; protection of the soil when using machinery; soil testing; organic preparation of the soil by green manuring, fallow systems and wild-flower strip mixtures; weed control; disease and pest control.

Keywords: organic, mulberry, plantation establishment

Some biochemical responses of mulberry leaves to different organic media.

A. Vijaya Bhaskara Rao [1] K. Nagalakshmama[2], P. Ramanjaneyelu[3], S. Smitha[4] M. Muthukumaran[1]

[1] Dept. of Ecology and Environmental Sciences, Pondicherry University, India.

[2] Dept. of Sericulture, Sri Padmavathi Mahila university, Tirupati, A.P. India.

[3] Dept. of Sericulture Sri Krishna Deveraya University, Anandapur, A.P. India.

[4]Dept. of Sericulture, S.S.T.N. Govt. Degree college, Kadiri, A. P.India.

Email: avijayabhaskararao@gmail.com

Organic farming is art and science growing crops by using various eco-friendly that are readily available in small and medium forms like cow dung and cow urine, industrial waste, cotton waste kitchen waste to minimize the cost of production. The study is aimed to know the effect of different organic media such as kitchen waste, vermicompost, cow dung, cow urine and mulching independently and combinations on some biochemical responses of mulberry leaves. The quality of leaf is assed on the basis of the analysis on the chemical composition of leaf that is ratio of various components or the quantity of each component. The composition of leaf qualities varies depending upon the environmental and cultivation conditions besides the mulberry varieties. One of the most important quality content is the leaf moisture contents which is maintained the nutritive levels and in turn improves the palatability for silkworm. The biochemical parameters studied are moisture percentage, carbohydrate content, total protein content, Chlorophyll a & b. These parameters were studied in four mulberry varieties under different organic media. The soil of the experiment site was red sandy, clay loam. A field was laid out in kadiri, Anantapur district of Andhrapradesh.The, India in 2 year old mulberry garden planted in pit system with spacing 19X19 cm. The experimental site was utilized only for raising for mulberry by following normal package of practices. Four popular mulberry varieties recommended for rainfed cultivation viz., S13, Ananta, S34, and M5 were used for the experiment. Averaged over the managements, the variety Ananta variety recorded significantly higher values for four biochemical parameters such as moisture percentage, crude protein percentage, chlorophyll a & total chlorophyll in

tender, medium and mature leaves. However, the presence of chlorophyll b and carbohydrate content was medium in Ananta variety. The variety Ananta recorded minimum value for crude fiber in tender, medium and mature values. Among the all treatments straw mulch, vermicompost and cow dung and cow urine were used together was found the best effective and eco-friendly. This can be an alternative package for mulberry cultivation under rainfed conditions in lien of expensive chemical fertilizers.

Some aspects of organic moriculture in Bulgaria

By

Z. Petkov

Sericulture and Agriculture Experiment Station, 24 Mito Orozov Str., Vratsa 3000 Bulgaria; e-mail: zmpetkov@gmail.com

(Poster)

This paper compares the organic and conventional moriculture systems in Bulgarian conditions. Organic agriculture is an alternative production system that avoids the use of synthetic pesticides and fertilizers, and relies on biological pest control and on crop rotation, green manure and composts to maintain soil fertility. Organic mulberry plantations would be able to achieve substantial global cost savings if they reached the maximum level of efficiency that their technological restrictions permit. Limitations imposed on organic moriculture by regulatory and technological determinants have a significant impact on the relative efficiency of mulberry leaves production.
As a summary it can be safely said that mulberry is one of the crops can best fit conducting organic and sustainable agricultural production in Bulgaria. The most important evidences for this statement are the following facts: high receptivity against manure, compost and other organic fertilization; annual production of a significant amount of biomass, suitable for re-use in the plantations in the form of compost; limited disease and enemy's occurrence and control; full use of all mulberry by-products.

Keywords: organic production, moriculture, mulberry

Utilization of forest based food plant, *Ailanthus* species for production of organic eri silk and mitigation of climate changes

By

S.A. Ahmed[1], C.R. Sarkar, M.C. Sarmah, B.Gogoi and K. Giridhar

Central Muga Eri Research and Training Institute, Central Silk Board, Ministry of Textiles: Govt. of India, Lahdoigarh, Jorhat, Assam (India); e-mail: cmerti@rediffmail.com

Eri silk which is also known as "*Ahimsha* (Non-violent) silk" possess excellent thermal properties and exquisite qualities like the natural sheen, inherent affinities for natural dyes and natural vibrant colours mostly produced in the North Eastern States and other states such as Odisha, Uttar Pradesh, Andhra Pradesh, Tamil Nadu and Madhya Pradesh of India. It plays significant role in rural livelihood security and women empowerment. Besides various global environmental issues emerged in recent days affecting eri silk industry, non-availability of sufficient quality leaves throughout the year was felt by primary stakeholders as a limiting factor for commercialization of ericulture. The eri silkworm, *Samia ricini* (Donovan) is highly polyphagous and Castor, *Ricinus communis* Lin. is the primary food plant. Being annual in nature, castor requires high investments in recurring plantation, pest and disease management as the plant is infested by enormous pest and diseases. Production of organic eri silk in castor based system is a challenging phenomenon. Considering these inherent problems, the study was initiated to find out the alternative forest based perennial food plant and the *Ailanthus* tree which is popularly known as 'Tree of Heaven' has been recorded the best perennial food plant to produce organic eri silk. The better rearing performances of eri silk feeding on the leaves of *Ailanthus* species might be contributed by the better palatability of the leaves and significant higher contents of biochemical constituents such as protein, carbohydrate, β-sitosterol, crude fat and phytic acid. The higher survivability in *Ailanthus* fed eri silkworms might be due to rich quassinoids, flavonoids, alkaloid and terpenoids, which are other-wise having the antifungal, anti-bacterial and anti-protozoan properties. Lignin plays significant role in the carbon cycle, sequestering atmospheric carbon found highest in *Ailanthus grandis* as compared to other eri silkworm food plants. *Ailanthus* species being a forest based tree requires zero inorganic inputs, *in situ* and *ex-situ* conservation and utilization of same in ericulture would not only improved production and productivity of organic eri silk but also helps in mitigation of deforestation and ill effects of climate changes.

Keywords: Eri silk, *Samia ricini*, organic silk, *Ailanthus* species.

A focus on the organic eri silk production in North East region of India

By

M.C. Sarmah, B.N. Sarkar, S.A. Ahmed, K. Giridhar

Central Silk Board, India; e-mail: mridulcsbsarmah@yahoo.co.in

Organic silk is the popular as well as important concept in silk industry. Assam located at North Eastern region of India occupies a unique position in the global sericultural map for production highest producer of eri raw silk. A gradual increment of eri raw silk production is noticed in the eri and more than 99 % of total eri raw silk production of India (4236 MT during 2013-14) is produced from the North East region. It is fortunate that most of eri silks produced in Assam is organic in nature, because eri farmers produce silk through organic farming system. In every steps, of both pre and post cocoon section of eri industry, it is observed that only organic farming system followed. Organic farming is the form of agriculture, which includes crop rotation, green manure, compost, biological pest control and mechanical cultivation to maintain soil productivity and control pests on a farm. Organic farming excludes or strictly limits the use of synthetic fertilizers and synthetic pesticides, plant growth regulators, livestock antibiotics, food additives, and genetically modified organisms. In this paper organic farming system in different sector *i.e.*, raising of host plant

and its management, seed production, rearing of silkworm and management for ultimate production of organic eri raw silk are discussed.

Keywords: Eri, Organic silk, organic farming

CONSERVATION OF ERI SILKWORM GERMPLASM AND DEVELOPMENT OF ORGANIC PUPA FOOD

By

B. N. Sarkar, M.C. Sarmah, S. A. Ahmed and K. Giridhar

e-mail: bnsarkarcsb@yahoo.com

The South East Asia is the apex of the natural home silk producing insect which is most rich in terms of silkworm biodiversity. Eri silkworm, Samia ricini (Donovan) is a domesticated multivoltine non-mulberry silkworm and one of the major component of wild (Vanya) silk of India. This insect has been exploited commercially for its silk since time immemorial. Brahmaputra river valley of Assam is considered as original home of cultivated eri silkmoth. The silk produced by eri silkworm is considered economically the third most important silk in the world after mulberry silk and Chinese Tasar. There are two species of eri silkworms available in North - East India, viz., the domesticated Samia ricini (Donovan) and its wild progenitor Samia canningi. Northeastern region of India is rich in genetic resources of eri silkworm and numbers of eco-races are existing in nature. Out of 19 species of eri silkworm under genus Samia all over the world, S. ricini (cultivated), S. canningi (wild) and S. fulva (Jordan) are reported to be found exclusively in India. The rural tribes of north east region of India conducted eri rearing partly for the need of eri pupae as the alternative of source protei.The product of the eri silkworm pupa, which is a natural health food and second most abundant biological polymer in nature, the second largest renewable resource and its distribution, is very wide. At the same time, chitin is also the second largest nitrogen containing natural organic polymer in respect of quantity in nature has good effect for improving the body's immune function, strengthening the immune cell proliferation, lowering cholesterol, preventing atherosclerosis and cardiovascular disease. It can promote the breeding of beneficial intestinal flora, inhibit the breeding of harmful bacteria, improve digestive function; chitin can absorb heavy metals such as copper, cadmium, zinc, uranium, and reduce the accumulation of heavy metals in the body. In the twenty first century, the consumption of organic health food is becoming increasingly popular and with constantly improved health awareness of people, organic health food market has a huge potential. At present in abroad, there has not had production of eri silkworm pupa series of organic health food, the market is still a blank, and therefore we should accelerate the construction of standard production of organic eri pupa protein powder, organic pupa oil and preserved organic eri pupa food. The present paper deals with maintenance of germplasm bank of 26 cultivated eri silkworm eco-races with one wild race of eri silkworm collected from different parts of N.E. India, listing of passport data, morphological characterization, evaluation and development of hybrid and organic eri pupa food.

Keywords: Eri silkworm, germplasm conservation, development, organic pupa food.

Production of Organic Muga Silk An Eco Friendly approach

By

Ranjana Das, K. Neog and K. Giridhar

Central Silk Board, India; e-mail: Drranjanadas2@gmail.com

The muga crop is important sericulture crop as a source of livelihood cuts across the various segments of North East people. With the increase in population our compulsion would be not only to stabilize sericulture production but to increase it further in sustainable manner. With the increase in population our compulsion would be not only to stabilize sericulture production but to increase it further in sustainable manner. The people have realized that a natural balance needs to be maintained at all cost for existence of life and property. Organic farming systems have attracted increasing attention over the last one decade because they are perceived to offer some solutions to the problems currently besetting the agricultural sector. Organic farming has the potential to provide benefits in terms of environmental protection, conservation of non-renewable resources and improved product quality. So, the present paper focuses mainly on the production of organic silk through some package of practices for eco friendly organic silk production in muga. The experiment was conducted in Central Muga Eri Research and Training Institute , Lahdoigarh, Jorhat, Assam. during 2014. All the organic package of practices namely inter crop rotation, minimum tillage practices, manuring through organic materials (*viz*. crop residues, compost, animal excreta like FYM, nitrogen fixing legumes, green manure, off farm organic residues, management of pest and diseases through non-polluting substances like bio-pesticides application of biological control principles including use of sulphur dust, Phytoblighton, and antibiotics derived from fermentation were adopted for maintaining the host plant and also for conducting rearing of muga silkworm. From the study the results showed that by brushing 1000 DFL(Disease Free Laying) in a year 46,691 organic cocoon harvested. The Dfl cocoon ratio was 1: 46.7 against the conventional method (1: 60) Among different cost components, the costs on fertilizer and plant protection chemicals were significantly lower under organic muga silk production than conventional muga silk production. The crop results showed a mixed response. Overall, it is concluded that the unit cost of production is lower in organic silk production of muga. The results conclude that there is ample scope for increasing the efficiency under organic silk.

Keywords:: Efficiency, organic farming, conventional farming, muga silk.

Traditional practices for controlling pests and diseases in muga culture for production of Organic Silk and its future prospects

By

Rajesh Kumar, D. Mech and K. Giridhar

Central Muga Eri Research and Training Institute, Central Silk Board, Ministry of Textiles: Govt. of India, Lahdoigarh, Jorhat, Assam (India); e-mail: rajeshentocmerti.csb@nic.in

Muga silkworm (*Antheraea assamensis* Helfer), which produce golden silk is endemic species and confined to North Eastern part of India. North East India is one of the biodiversity hotspots among 34 biodiversity hotspots of the world, which has many endemic species due to the barrier of Himalayan foot hills and unique climate. As compared to other silkworm, muga silkworm is completely wild in nature and reared outside the laboratory on primary food plants, (Som - *Persea bombycina* and Soalu – *Litsea monopetala*). Insecticide and other chemicals is not used in muga culture. That's why muga silkworm is protected through traditional practices, which produce fully Organic Silk in Assam and Meghalaya states of North East India. There are many traditional practices, which are directly involved to produce organic silk *viz*., wrapping of banana leaves to repel ants from downside to tree and to avoid movement from upside to downside the silkworm, disinfection of rearing appliances through high temperature and smoke, control of red ants by application of rice hull and ash at the base of plant (som/soalu) in rearing field, sealing the borer hole to kill the borer caterpillar inside which cannot come out after plugging with bamboo plug, applying mustard oil cake to the soil before preparation of land for plantations, incomplete weeding of rearing field for maintaining optimum humidity and temperature. All these traditional practices directly involve in producing the organic muga silk. This silk is completely insecticide free. The muga silk is completely organic and insecticide free. In future, all these traditional practices can be validated and applied in systematic manner for protection of silkworm and enhancing the muga silk production.

Keywords: Muga silkworm, *Antheraea assamensis*, organic silk, traditional practices

Scientific – technical reports session

Section 1. Moriculture: selection, propagation and cultivation

Present status of mulberry genetic resources and its utilization in Korea

By

Gyoo-Byung Sung, Yong-Soon Kim, Kee-Young Kim, Mi-Ja Kim, Sang-Deok Ji, Nam-Suk Kim and Pil-Don Kang

National Academy of Agricultural Science (NAAS), Korea; e-mail: truekbs@korea.kr

(oral presentation)

Mulberry is such a sole food crop for silkworm that it is an important plant for sericultural industry. In Korea, with the rapid decrease of sericultural products, mulberry cultivation area for silkworm rearing is also decreasing. However, mulberry cultivation area for fruit production has been increasing rapidly up to 1,800ha in 2013.
Mulberry genetic resources have been collected and maintained in several countries including Korea, Japan China and India. In Korea, More than 600 accessions of both indigenous and exotic origin of mulberry species were maintained at National Academy of Agricultural Science(NAAS). NAAS is responsible for maintaining and conserving the mulberry genetic resources. The genotypes are preserved on the field and greenhouse and are being used to dissect the morphological and agricultural traits to improve mulberry cultivars for beneficial uses.
With the rapid increase of mulberry fruit production, the demand for cultivars suitable for fruit production has been stronger. With use of genetic resources, we are focusing on the breeding cultivars suitable for the mulberry fruit production, eight cultivars were bred until now in Korea.
Among them, four cultivar are tetraploidy created by colchicine treatment, three selected from genetic resources and one by crossing.

Keywords: Mulberry, Mulberry fruits, Mulberry genetic resources

STUDY ON THE MAJOR ECONOMIC CHARACTERISTICS OF MULBERRY FRUITS OF *MORUS ALBA* L. SPECIES

By

Avramova Kr.*, D. Grekov*, P. Tzenov**

***Agricutural University of Plovdiv, 12 Mendeleev Str., Plovdiv 4000 , Bulgaria; e-mail: grekov@au-plovdiv.bg**
**** Sericulture and Agriculture Experiment Station, 24 Mito Orozov Str.,Vratsa 3000 Bulgaria; e-mail: panomir@yahoo.com**

(Poster)

In the current century the man is increasingly demanding ecologically friendly, organic foods. Particular attention is paid to fruit crops that are more unpretentious to the growing conditions, but with characteristics close to, equal or better than the traditionally used by man.

The aim of the study was to identify the major indicators of the mulberry fruits, the time of ripening, fruit coloration and size.

The study was carried out at the Experimental Site of the Agricultural University – Plovdiv during the period 2012-2014. Three groups with three variants in three replications were used in the experiment.

Variants 1 and 2 were selected from different regions of Bulgaria and grafted on the Experimental Site. Variant 3 was of Kinriu variety.

The following traits were studied: shoot length, number of buds, time of flowering, time of ripening, percentage of first ripening, fruit size, duration of the ripening period, percentage of sugars and acids.

It was established that the mulberry fruits were characterized by different colour, size and duration of the ripening period. Sugars and organic acids contents of the mulberry fruits are close to those of grapes and apples.

Key words: mulberry, varieties, fruits, characteristics

Economic efficiency and rooting of disease resistant mulberry cuttings in warm thermal water

By

Giorgi Nikoleishvili, Elgudja Shapakidze, Tina Dalalishvili

Georgian Academy of Agricultural sciences, 0102, Ivane Javakhishvili str. #51; e-mail: Shapakidze-elgudja@rambler.ru

There are many methods of vegetative propagation of the mulberry tree. Therefore we are conducting researches for economic efficiency and possibilities of rooting disease resistant mulberry cuttings (kept during winter).

So after many searches our attention was addressed to cheap source of heating – natural, healing sulphur warm water (Georgia is rich with thermal waters), namely we used water derived from communal baths the temperature of which was 38 ° C.

Outflow water temperature was 28°C in plastic pipes situated in the soil on 40 cm depth, whereas inflow water temperature was 10° C.

Planting of cuttings between plants on the distance of 10-12 cm takes place parallelly to the soil pipes in 15-20 cm depth. Some cuttings should be placed in the soil leaving some buds on the surface; Watering should be organized immediately, as cuttings can be closer contacted to the soil.

Producing of seedlings with own roots is reducing by 2 years and cost by 2.5 -3.0 times comparing to grafted scions.

Using of natural thermal waters in sericulture sector is one of the important activities for fodder base recovery leading to the economic efficiency.

Keywords: Ground, Thermal water, Cuttings, plastic pipes, activities.

Influence of physico-chemical characteristics of soils and the climatic conditions to the Anthriscus culture

By

Maria Ichim, Liviu Ichim

Institute of Bioengineering, Biotechnology and Environmental Protection
S.C. BIOING S.A., Bucharest, Romania
e-mail: ichim52@gmail.com

(Poster)

The objective of the study is to highlight how and to what extent is influenced culture Anthriscus sp. The physico-chemical characteristics of soils and climatic conditions, the two experimental groups. The two groups differ in that one is in the field and the other in the greenhouse. The culture was seen in the period August-October 2014.
The results of analyzes performed to characterize soils in experimental fields (before and after harvesting the plant seeding culture Anthriscus sp.) Were compared with the limit values set inorder no. 756/1997 of the Ministry of Waters, Forests and Environmental Protection for approval regulation mediului.Rezultatele respect pollution assessment obtained demonstrate that soils are polluted and experiments were carried out in adequate conditions of organic farming.
The data obtained correlate with those described in the literature.
Keywords: Anthriscus sp., Physico-chemical soil, the climatic conditions.

Phytochemical data of mulberry fruits and prospect of their use

By

T. Dalalishvili, M. Guliashvili, N. Mamardashvili, T. Revazishvili

Georgian Agrarian University, D.Agmashenebeli alley #240, Tbilisi, Georgia;
e-mail: t.dalalishvili@agruni.edu.ge

For the purpose of food supply of population and receiving high-quality, natural and diverse foodstuff for the international market, it is actual again the purposeful use of fruits. For this goal is necessary selection of objects containing potential quantity of the necessary elements and development of technology for receiving products with the balanced substances necessary for a human organism.
For the research object was selected the widespread in Georgia polyploidy fruit forms of a mulberry varieties:"Khartuta", "Gandjuri" and "Georgia". For the receiving of products of modern direction phytochemical data of their fruits are less studied.
Research objective was the assessment of fruits of the above-noted mulberry varieties according to phytochemical data and their further use in a wide range.
The studied objects are rich with the content of sugar of 13-19%, generally contain glucose and fructose. General acidity of 3,7-6,4%. Contain organic apple, lemon, wine, dairy, oxalic acids. Noted varieties are rich with the total maintenance of antocyanins which are generally presented in the form kuromanine chloride, diglucoside malvydola, delphinidine chloride, penidin-3 glucoside chloride. The content of cellulose -0.5-2.5% that means that these varieties are the objects possessing strong antioxidant action. The mulberry variety "Georgia" is especially prominent in high content of potassium.
The studied objects represent a source of the necessary substances from the nutritious and medical points of view on the basis of what foodstuff of a different kind was prepared : jam,

juice, sauce, masharab, bekmez, mulberry wine and vinegar. The organoleptic and phytochemical analysis of the received products was carried out.

Keywords: variety, antocyanins, cellulose, organic acid, jam, sauce, bekmez

Possibility of multi-purpose use of a mulberry (Morus) and its economic efficiency in the mountain region of Adjara

By

G. Nikoleishvili,T. Dalalishvili, T. Revazishvili, Z.Chitadze, I. Gujabidze

Georgian Agrarian University, D.Agmashenebeli alley #240, Tbilisi, Georgia; e-mail: i.gujabidze@agruni.edu.ge

The mulberry (Morus) in Georgia is spread everywhere, up to the height of 1600 m above sea-level. It differs in specific variety. Specifics of its use changes according the different climatic conditions.

The leading branch of a mountain zone of Adjara is the animal husbandry. Because of shortages of arable lands the local population for additional forage of animals uses coarse leaves of different plants together with branches. Proceeding from research objectives nutritional value of a mulberry coarse leaves, possibility of their use in animal husbandry in the form of an additional forage and economic efficiency was studied.

It was established, that mulberry coarse leaves according reserve of nutrients for 22-29% exceeds hay of forest and field vegetation, and for 50-55% exceeds the corresponding indicator of deciduous plants. On each 100 kg of the coarse leaves of a mulberry, the exit of air - dry leaves makes 450 kg, i.e. 255 kg of nutritious units. The spent operational expenses make 90 USD, product cost makes 0, 35 USD, and profitability - 101%.

Keywords: Leaf, fruit, seed bud, prime cost, profitability

Technology, economic efficiency and production of non-traditional livestock feed out of Mulberry leaves roughened in autumn

By

Giorgi Nikoleishvili, Elgudja Shapakidze, Tina Dalalishvili

Georgian Academy of Agricultural sciences, 0102, Ivane Javakhishvili str. #51; e-mail: Shapakidze-elgudja@rambler.ru

Scientific researches concerning the above problems have not been done in Georgia and in some other countries having Sericulture priorities. In 1994-2014 years we studied the importance and economic efficiency of producing of Mulberry leaf roughened in autumn. Special attention was paid to the problems of strengthening and profitability of sericulture fodder base.

There are 20.0 thousand tons of leaves used for producing 1000 tonnes of live cocoons, whereas in autumn time more roughened leaves are losing in vain. Out of 20.0 thousand tons of roughened leaves in the fall we will have 8,0 thousand tons (40%) of dry substance, or 2.7 thousand tons of valuable food unit. It contains an abundance of dry matter, raw protein, crude fat and other substances.

Above mentioned materials can be successfully produced in the third decade of September, including the phase of loss of leaves; It has been successfully used for feeding grazing livestock, sheep breeding, and fishing. In addition, these foods positively affect the final products (milk, cheese), which is extremely interesting.

Keywords: Sericulture, mulberry leaves, animal feed, protein, quality

Section 2. Silkworm genetics and breeding

Study on some silkworm, Bombyx mori L breeds susceptibility to artificial diet feeding

By

R. Gancheva*, M. Panayotov*, P. Tzenov and V. Sharkova***

*** Faculty of Agriculture, Thraki University, Stara Zagora 6000 Bulgaria; e-mail: r.guncheva@uni-sz.bg**
**** Sericulture and Agriculture Experiment Station, 24 Mito Orozov Str., Vratsa 3000 Bulgaria; e-mail: panomir@yahoo.com**

(oral presentation)

The study has been carried out at the educational and experimental facility of the Silkworm breeding section of the Faculty of Agriculture at Thraki University in Stara Zagora, Bulgaria. The studied 115 silkworm breeds originated from SAES-Vratsa and AF-TrU, and constituted a major part of the genetic bank of Bulgaria, were reared on artificial diet with 25% content of mulberry leaf powder.

In order to detect the susceptibility to artificial diet feeding of the breeds analyzed the larval viability in the 1st, 2nd and 3rd instars was determined.

The results obtained show that 84.35% of the breeds analyzed exhibit over 70% viability in the first instar. In the process of larval growing however the larval viability decreases so that 64.35 % of the breeds tested perform over 70% viability in the second instar while only 39.13% of them in the 3rd instar.

The highest larval viability in the whole three instars and the highest susceptibility to artificial diet feeding, respectively manifest the breeds "E-31", "Line 22", "Ukrainian 20", "Syria 1" and "Vratsa 38", which gives reason to believe that they are the most promising in this direction.

The comparatively high percentage of survival rate established in the majority of the breeds analyzed in the first instar is indicative for the presence of biological potential for rearing them on artificial diet.

Key words: breeds; Bombyx mori L.; silkworms; artificial diet; sericulture.

Testing and Evaluation of New Bulgarian Silkworm, *Bombyx mori L.* Non Sex-Limited and Sex-Limited Commercial F1 Hybrids

By

M. Panayotov*, P. Tzenov, D. Grekov***, Y. Vasileva**, D. Pantaleeva**, K. Avramova*****

*** Faculty of Agriculture, Thraki University, Stara Zagora 6000 Bulgaria; e-mail: panayotov_m@abv.bg**
**** Sericulture and Agriculture Experiment Station, 24 Mito Orozov Str., Vratsa 3000 Bulgaria; e-mail: panomir@yahoo.com**
*****Agricutural University of Plovdiv, 12 Mendeleev Str., Plovdiv 4000 , Bulgaria; e-mail: grekov@au-plovdiv.bg**

(oral presentation)

The study has been conducted during the period 2012 – 2014 at the Thracian University, Stara Zagora, Sericulture and Agriculture Experiment Station, Vratsa and Agricultural university, Plovdiv, Bulgaria. The following F1 silkworm hybrids between Bulgarian pure breeds 19, 1013, Magi 2 and Lea 2 were created and tested simultaneously: 19 x Magi 2, Magi 2 x 19 (sex-limited for larval markings), 1013 x Magi 2, Magi 2 x 1013 (sex-limited for larval markings), 19 x Lea 2, Lea 2 x 19 (sex-limited for cocoon color), 1013 x Lea 2, Lea 2 x 1013(sex-limited for cocoon color). It was detected that the main qualitative characters some of the new hybrids differ from the control and other hybrids were larval body color during the 5^{th} instar, larval markings and cocoon color. The new silkworm hybrids demonstrated comparatively high hatchability, normal 5^{th} instar and larval period duration, significantly higher than the control pupation rate and near or higher than the control fresh cocoon yield by one box of silkworm eggs. The mean fresh cocoon weight and silk shell weight in 4 of the new hybrids (19 x Magi 2, 19 x Lea 2, 1013 x Magi 2 and 1013 x Lea 2) were near to the control, while all the rest performed a significantly lower than the control cocoon and shell weight. In most of the new silkworm hybrids the silk shell percentage was higher of near to the control. In the non sex-limited F1 silkworm hybrids tested the silk shell weight in the females was higher than the males, while in the sex-limited for larval markings and cocoon color hybrids the males had higher silk shell weight than the females. The non sex-limited hybrids performed a bit higher mean silk shell weight values than the sex-limited ones. The dry cocoon weight in most of the new hybrids was near and lower than the control. The filament length was significantly longer than the control in the hybrids 19 x Magi 2, Magi 2 x 19 and 1013 x Magi 2, it was near to the control in 19 x Lea 2 and it was significantly lower than the control in all the rest hybrids. Similar were the results, obtained for the silk filament weight. The differences between the silkworm hybrids tested concerning reelability were insignificant, but the raw silk percentage in the new hybrids was significantly higher or near to the control. The results obtained from the present testing of new F1 silkworm hybrids allow

us to suggest them for state examination, authorization and certificates protection respectively.

Key words: silkworm, Bombyx mori L., F1 hybrids, sex-limited, productivity

Character Analysis of Silkworm Genetic Resources Preserved in Korea

By

Kee-Young Kim, Mi-Ja Kim, Gyoo-Byung Sung, Yong-Soon Kim, Joo-Young Lee, Wantaek Ju, Sang-Deok Ji, Nam-Suk Kim and Pil-Don Kang

National Academy of Agricultural Science (NAAS), Korea; e-mail: applekky@korea.kr

(poster)

In order for further systematic maintenance of silkworm stocks kept in Korea we analyzed character quality of a diverse array of silkworm strains originated from several sericulture-practicing countries. The analysis of about ten qualitative characters from 67 strains (13 of Japanese strains, 15 of Chinese strains, 14 of European strains, 6 of Korean and Tropical strains, and 19 of unknown origin) revealed a significant difference in the ten different qualitative characters among silkworm strains. In the analysis of quantitative characters, Japanese and European strains were highest in hatchability, the Korean and Tropical strains were highest in pupation rate, and unknown origin and Chinese strains were highest in cocoon yield and number of egg laid. With the connection of molecular genetic analysis the current data may provide the advanced ground for further systematic maintenance of valuable genetic resources of silkworms, although more breeds should be investigated for further complete pictures.

Keywords: Silkworm, Qualitative character, Genetic resource

Microsatellite analysis of the European origin silkworm strains (Bombyx mori) preserved in Korea

By

Kee-Young Kim, Mi-Ja Kim, Gyoo-Byung Sung, Yong-Soon Kim, Joo-Young Lee, Wantaek Ju, Sang-Deok Ji, Nam-Suk Kim and Pil-Don Kang

National Academy of Agricultural Science (NAAS), Korea; e-mail: applekky@korea.kr

(poster)

A total of 25 European origin silkworm strains preserved in Korea were typed for eight polymorphic microsatellite loci. We obtained per-locus number of alleles ranging from 2 to 8 with an average value of 6.0, per-locus observed heterozygosity ranging from 0.32 to 1.00, and per-locus polymorphic information content (PIC) ranging from 0.34 to 0.79, indicating that some loci are highly variable. Phylogenetic analysis with the eight concatenated microsatellite loci showed no clustering on the basis of known strain characteristics and origin. A total of 11 strain-specific apomorphic alleles, which discriminate 8 among 25 silkworm strains were obtained from eight loci. These strain-specific alleles, thus, can casually be utilized for the discrimination of applicable strains without any further typing of other loci. Furthermore, a substantial number of homozygote strains, represented by 17 among 49 alleles in eight loci were found. These results collectively suggest that the silkworm microsatellite DNA is actually and potentially important molecular markers for the eventual discrimination of silkworm strains that are preserved as hundreds in Korea.

Keywords: Silkworm strains, Microsatellite, Allele

Status and major characteristics of Korean Authorized Silkworm Varieties

By

Pil-Don Kang, Mi-Ja Kim, Sang-Deok Jee, Nam-Suk Kim, Joo-Young Lee, Gyoo-Byung Sung and Kee-Young Kim

National Academy of Agricultural Science (NAAS), Korea; e-mail: kangpd@korea.kr

(poster)

There was no systematic silkworm test standard or criterion for 60 years since the beginning of Korean sericultural researches in Korea from 1900. The stipulated standard of silkworm breeding test was established in 1964 for higher confidence and data comparison between private breeding organization and foreign research centers. After this, the rule for designation and supply of authorized silkworm varieties was established in 1972 by the necessity of periodical retesting for maintenance of designated authorized silkworm varieties. This guidance referred the qualification, designation and abolition of authorized silkworm varieties. The establishment of this guidance became the foundation of domestic substantiality of Korean silkworm breeding and raising public confidence of Koran varieties in foreign policy. After the establishment of this Sericultural law, 34 domestic authorized silkworm pure lines were bred and supplied and 3 varieties for strong and high yield, 7 varieties for sex-limited varieties, 4 varieties for artificial diet adapted varieties, and 5 varieties for special purpose totally 18 varieties are being supplied in present.

The golden age of cocoon production was from the end of 60s to the middle of 70s, so the breeding goal was developing varieties producing superior raw silk with high yield ratio. During 1970s and 1990s, the goal was changed to breeding sex-limited varieties, strong and healthy races with high larval and cocoon quality, and artificial diet suitable strains by the necessity of labor saving from insufficiency of rural manpower.

The present breeding goals since 1990s is breeding of functional or special use strains. The goals are developing high fineness strain for high quality raw silk production, enlarge bodied

strain for silkworm powder production, naked pupae strains for cordyceps production, sex-limited strains for easy sex identification, yellow silk producing strains, and yellowish green strain.
For the development of strains appropriate to special uses, we introduce various genetic resources for breeding strains proper to the special purposes and continue researches for breeding new high value-added silkworm strains and developing new uses of silkworms.

Keywords: Silkworm, Genetic resource, Silkworm breeding

Evaluation and selection of the mulberry silkworm (*Bombyx mori* L.) in conditions of Poland

By

Małgorzata Łochyńska, Andrzej Wojtaszewski

Institute of Natural Fibres and Medicinal Plants, Poznan, Poland; e-mail: malgorzata.lochynska@iwnirz.pl

(poster)

In 2004 Institute of Natural Fibres and Medicinal Plants started new studies on Polish and foreign biotypes of the mulberry silkworms. The comparison were carried out the best Polish and foreign biotypes: 3 Romanian, 4 Georgian, 1 Japan and 2 Chinese biotypes. All specimens were bred in Polish breeding conditions. The analysis of index values of all studied races carried out the evaluation of breeding effects. After 10 years of breeding research and evaluation, the best biotypes were selected to new Polish hybrids production. The aim of this study is to prepare the best hybrids for sericulture development in Poland.

Keywords: hybrid, biotype, index value, breeding method

THE CONTROLLING OF SEX IN SILKWORM WITH CONSTANT MAGNETIC FIELD DURING MATING

By

SHUKURLUY. H.

Azerbaijan National Academy of Sciences, Shaki Regional Scientific Centre, Shaki, Azerbaijan; E-mail: yusifsh@hotmail.com

Developed a method of controlling the silkworm sex by constant magnetic field (CMF). It is shown that mating silkworm moths CMF increases the relative number of males in the family. Established the dependence of the number of males in the family on the magnetic field. It is shown that this dependence is subject to respect $N = N_0\left(a - be^{-kH}\right)$,

where N - the number of males in the family, N_0 - the total number of mulberry silkworms in the family, k - factor of activation of silkworm eggs with magnetic field, H - the intensity of the magnetic field, $a-$, and $b-$ constants depending on the orientation of mated moths in CMS. Preliminary calculations show that, $k \approx 4{,}02 \cdot 10^{-3}$ *м / А*. When coupling: female moth - head towards the north, males - head toward the south pole of the magnet (N♀♂S), $a \approx 0{,}75$; $b \approx 0{,}25$.

It was partly explained by the approximate mechanism of the effect CMF on the sexual reproduction of the silkworm and a form of sexual reproduction as parthenogenesis - not providing for the merger process haploid sex cells, or gametes, leading to the formation of a diploid cell zygote.

Keywords: oocyte, meiotic spindle, chromosome, kinetochore, tubulin, microtubules, intermediate filaments, metaphase, ovarioles, silkworm eggs, micropyle

Creation and Testing of Silkworm, Bombyx mori L. F_1 Hybrids between Bulgarian and Italian Breeds

By

P. Tzenov*, S. Cappellozza, D. Grekov*****

***Sericulture and Agriculture Experiment Station, 24 Mito Orozov Str., Vratsa 3000 Bulgaria; e-mail: panomir@yahoo.com**
**** CRA, Apiculture and Sericulture Unit of Bologna, Padua seat, Via Eulero, 6A, 35143 Padua, Italy; e-mail: silvia.cappellozza@entecra.it**
*****Agricutural University of Plovdiv, 12 Mendeleev Str., Plovdiv 4000 , Bulgaria; e-mail: grekov@au-plovdiv.bg**

(poster)

The present study aimed to test several F1 hybrids between promising Bulgarian and Italian silkworm pure breeds and had been conducted during the spring seasons of 2010-2011 at the Sericulture and Agriculture Experiment Station, Vratsa, Bulgaria.The pure Bulgarian silkworm breeds Vratsa 35 (Japanese type) and Merefa 2 (Chinese type) and the pure Italian breeds 118 (Japanese type) and 121 (Chinese type) were used as parents of the F1 hybrids Vratsa 35 x 121 and the reciprocal, 118 x Merefa 2 and the reciprocal and Vratsa35x118 x Merefa2x121 and the reciprocal. As a control, the widely adopted Bulgarian F1 commercial hybrid Super 1 x Hesa 2 was used. Two gram of eggs of each silkworm hybrid were incubated and larvae reared together until the end of 2nd instar. At the 3rd instar beginning 4 replicates, consisted of 200 larvae each were counted from each hybrid and further reared until the cocoon spinning. The new Bulgarian-Italian silkworm F1 hybrids, tested in Bulgaria manifest a significantly lower pupation rate than the control, near to the control fresh cocoon weight, silk shell weight, silk shell rate, filament weight, raw silk percentage, higher filament length and lower filament thickness. The fresh cocoon weight and silk shell weight in the new hybrids are comparatively high, namely from 2628 mg to 2756 mg and from 572 mg to 621 mg. After a further adaptation of the Italian pure breeds to Bulgarian climatic and soil

conditions, and improvement of their larval viability respective, the new Bulgarian-Italian F1 hybrids may be suggested for testing at the field level.

Key words: silkworm, Bombyx mori L., F1 hybrids, Bulgarian, Italian, testing

Section 3. Silkworm rearing and feeding

Study on Different Terms of Autumn Silkworm Rearing Beginning in Bulgaria

By

P. Tzenov

Sericulture and Agriculture Experiment Station, 24 Mito Orozov Street, Vratsa 3000 Bulgaria; e-mail: panomir@yahoo.com

(poster)

While the optimum terms of spring silkworm rearing in Bulgaria have already been well studied, the information concerning optimal terms for the beginning of summer-autumn silkworm rearing is too scarce. Actually in Bulgaria if taking one crop only from mulberry it is possible to have the summer rearing during a period, starting from the beginning of July, but it is not clear when should be the latest term to begin the rearing in the autumn. However in the practice, two crops from mulberry are usually taken, that's why when decide the summer-autumn rearing beginning there should be considered also to have enough mulberry shoots growth after the spring bottom pruning. As the spring bottom mulberry pruning in Bulgaria is usually performed from the beginning to the mid of June and considering that mulberry needs of about 3 months to sprout and form new shoots, suitable for top pruning it may be concluded that the beginning of the summer autumn silkworm rearing should not be earlier than the mid of august. On the other hand the mulberry leaf quality after the beginning of October gets quickly worse day by day, therefore the summer autumn rearing period beginning in Bulgaria should be from the mid of August, but it is yet to be investigated until what time in September will still be possible to start the rearing. This study aimed to investigate different terms of summer-autumn silkworm rearing beginning from the end of August to the last decade of September in Bulgaria. The study has been conducted during the period 2007 – 2009 at the Sericulture and Agriculture Experiment Station, Vratsa, Bulgaria. Two Bulgarian F1 commercial silkworm hybrids, namely Super 1 x Hesa 2 and SN1xI1 x M2xN2 were used in the study. The silkworm larvae were reared following the standard method for summer-autumn rearing in Bulgaria, and fed "ad libitum" with mulberry leaves of №106 Bulgarian variety. The mulberry plantation was rain fed only, without any irrigation.
From the results obtained it is concluded that the summer-autumn silkworm rearing in Bulgaria should be started not later than the mid of September. If the autumn silkworm rearing starts after the mid of august there should be obligatory provided a proper heating of the house.

Key words: sericulture, rearing season, summer-autumn, viability, productivity.

ARTIFICIAL DIETS FOR MULBERRY SILKWORM FROM LOCAL MATERIALS

By

Madyarov Sh.R. [1,2], Islamova Sh.K.[1], Umarov Sh.R.[1]

[1]Uzbek Research Institute of Sericulture/
[2] Institute of Gene Pool of Plants and Animals. Uzbek Academy of Sciences.
e-mail: shuhm@yandex.ru

Facility, experimental approaches and methods, corresponding conditions for development of artificial diets (AD), their formulas with new silkworm rearing biotechnology using developed AD were created at the Uzbek Research Institute of Sericulture. Screening of silkworm races for choosing of more adaptable to AD was performed. The selected AD satisfactory by food value and assimilability were tested with use the perspective races, selection lines and hybrids from Institute collection, Pedigree Lab, Genetics and selection Lab and purchased abroad. More nutritious AD, adapted races, and hybrids to developed AD and optimized rearing conditions have been chosen on the basis of experimental results.

Raw materials, by-products and wastes of local food industry and agriculture including sericulture too are components of AD. Resources saving and wastelessness problems in local industry can be solved simultaneously.

The AD for silkworm apart from sericulture can be used for mass propagation of silkworm to produce of animal organics, for manufacturing of biologically active substances and means of oriental medicine as well as in monitoring of environment and for education.

References:

1. Madyarov Sh.R. (2005): Biotechnological Approaches in Sericultural Science and Technology of Uzbekistan (review) // Int. J. Indust. Entomol. V 11, No 1, pp. 13-19.
2. Madyarov Sh. R., Islamova Sh.K., Umarov Sh.R. (2013): Improvement of food value and assimilability of nutritious components of cotton seeds and silkworm cocoons// VII Moscow International Congress “Biotechnology: State of the art and prospects of development”, March 19-22, Moscow, Russia, pp. 424-425.
3. Madyarov Sh. R. Insects as highly effective producers of renewable animal organics // Thev2nd Global Conf. on Entomology, November 8-12, 2013, Kuching, Sarawak, Malaysia, p 219.

Keywords: Silkworm, breeds and hybrids, artificial diet, raw materials, by-products, wastes, local industry, resources saving, biotechnology.

Utilization of silk producing insect *Cricula trifenestrata* (Helfer) in India

By

Amalendu Tikader

Central Silk Board, Ministry of Textiles, Govt. of India, INDIA; e-mail: Tikader.csb@nic.in

Cricula trifenestrata (Helfer) is a wild insect available in abundance in north eastern parts of India. It produces golden colour silk which is comparable with muga silk (*Anthereae assamensis* Helfer) and only available silk being commercially exploited in India. The *cricula* naturally grows with muga silkworm and assumed to be as causative agents to spread disease and pest incidence on muga silkworm. As such *cricula* is considered as a pest of muga silkworm as it feeds and continues life cycle on the same host plant (Som- *Persea bombycina* Kost. and Soalu -*Litsea monopetala* Roxb.) which are the primary host plants of muga silkworm also. The *cricula* silkworm completes 4-5 times its life cycle and thus termed multivoltine and some areas 2 time life cycles termed as bivoltine. The *cricula* is a polyphagous and migrates from one place to another depending on the availability of food plants. The *cricula* silkworm carries the pathogens of different disease like flacherie, graserie, muscardine, pebrine etc. which is also present in semi-domesticated silkworm like muga and where the apprehension of disease carrier of commercially exploited silkworm is and termed as pest of it. But till date there is no fool proof information to prove the same but some information on occurrence of diseases, and pests and symptoms are reported (Tikader *et al,* 2014). The wild silk is available in India and wild moth culture is the tradition of north eastern region and used by the local people for making clothing as well as food. It has also economic bearing on the local inhabitants of north eastern India. Though the life cycle and its present status has been published but its true utilization as commercial venture yet to be exploited in India. The silk of *cricula* is used by many designers as accessories and crafts due to its unique gloss and golden colour in Java. Besides this, the silk of *cricula* is unique, water resistant, heat resistant, non-allergenic and anti-bacterial and reshapable in different shape and sizes. It is also important to note that the rearing occurs in out-door and the silkworm feeds on natural grown plants, the silk produced are expected to be organic which maintains the ecosystem.

The conservation and utilization of sericigenous insect like *cricula* has been highlighted in this paper for optimum utilization and maintaining of ecosystem and source of sustainable livelihood of many ethic group of people of that locality.

Keywords: *Cricula*, wild silk moth, host plants, rearing, disease, pest, utilization

Section 4. Silk reeling and processing

Fibroin content in the silk thread from *Bombyx mori* L.cocoons with different fluorescent characteristics

By

Mihail Panayotov, Radostina Gancheva

Department of Livestock breeding – ruminant and other animals
Faculty of Agriculture, TrakiaUniversity

Stara Zagora-6000, Bulgaria; e-mail: panayotov_m@abv.bg

(poster)

B. mori silk is composed of two main proteins of which fibroin occupies the largest share and is a major contributor to the economic performance of the reeling process.The objective of the present study was to analyze fibroincontent in raw silk (silk thread)from *Bombyxmori*L.cocoons with different (violet, intermediate and yellow) fluorescent characteristics. The subject of study were skeins distinguished by sex and fluorescenceof double and tetra-cross silkworm hybrids. The results obtained show that the ultraviolet fluorescence of cocoons influencesthe phenotypic expression of fibroin content. Reliably lowest is the content of skeins from violet fluorescent cocoons and the highest is that from yellow fluorescent ones. Higher is the fibroincontent of skeins from thedouble-cross hybrids compared to tetra-cross hybrids.The result obtained allow us to conclude that in terms of the effectiveness of reeling is more advantageous to use the cocoons with yellow fluorescence as well as from analyzed double-cross hybrids.
Keywords:*Bombyxmori* L., silk thread,fibroin, ultraviolet (violet, intermediate and yellow)fluorescence.

New technology of reeling silk cocoons

By

N.Baramidze, Z.Tskaruashvili, M. Khucishvili, I. Gujabidze

Georgian Agrarian University, Scientific Research Institute of Sericulture; e-mail: nargizbaramidze@yahoo.com

Sericulture is a branch of ancient traditions in Georgia and it contributed greatly to the economic might of the country and to a matter of material welfare of its population.

Progress of sericulture in Georgia was contributed not only by the favorable geographical location and perfect natural conditions, but also by high demand on Georgian silk on the world market.

Georgian silk always occupied the advanced place in the world thanks to its quality and even today we have such high-grade mulberry silkworm breeds thread of which is distinguished by extreme fineness. High quality fabric such as “crepe chiffon” is made of this thread, which is rather costly on international market. In 1998 at the international exposition held in Spain fabric made of this thread received the supreme award “Platinum Star”. Mulberry silkworm breeds yielding such silk thread “Mziuri”, “Digmuri” are selected by Georgian researchers. Thread length reaches 2000-2500 meters, while according to the world standard it equals to 1500-1700 meters.

Today, irrespective of critical situation created in Georgian sericulture, the Institute of Sericulture continues its active functioning. In recent years highly productive breeds and hybrids resistant to mulberry and mulberry silkworm diseases have been selected; new methods were introduced in feeding mulberry silkworm and new technologies of initial processing of cocoon were developed.

We have developed and practically tested new technology of silk thread production, according to which a farmer (cocoon producer), by the use of special suspension, will be able to start winding of cocoon produced by him on the very third day of commencing cocoon formation. This method will enable us to realize cold winding of live cocoon. Thanks to this new technology silk thread will retain the best properties and the costs made for thread production will be brought to minimum.

Inculcation of regional cocoon thread winding is the prerequisite for starting mass winding of raw cocoon thread. We can obtain not only silk thread exceeding the rate of the earlier obtained by 30%, but also thread from defective cocoon, since suspension developed by us will enable us to reel not only high quality, but also twin-cocoon and cocoon rejected after selection. By cold winding of live cocoon a farmer will save not only transport costs but also costs for cocoon drying and storing.

The part of live cocoon, which will not yield to winding till the moment moth leaves cocoon, can be stored in refrigerator. We have studied the level at which the cocoon must be cooled and the duration of cooling in order to kill pupa and to preserve capacity of cocoon to be reeled, as well as to preserve its natural properties. As a result of long-term observations it was proved that at -5^0 temperature, storing in refrigerator for 8 hours is enough for killing pupa, and special suspension should be prepared just before winding to prevent significant injury to cocoon and thread by killing pupa.

The fact should be emphasized that as a result of initial treatment of live cocoon (that is drying) natural properties of thread suffer worsening and yield is decreased. Therefore it will be expedient to reel thread from live cocoon. As to the comparison of reeling in suspension and in warms water, live cocoon impregnated in suspension at 4^oC showed far better winding capacity than that reeled in warm water.

Thus, the method of preliminary treatment of cocoon by the use of special suspension, developed by us, is practically very significant and economically profitable. Experiments were carried out at the terms of thread winding on individual machines, when 0.2, 0.4 and 1% suspensions were used; cocoon processing duration equaled to 10, 20 and 30 minutes. It should be stated that thread yield wound from cocoon soaked in 1% suspension for 20-30 minutes exceeds by 1,5-7,0% that wound from cocoon wetted in warm water. Thread yield increase is achieved at the expense of decrease of wastes.

Keywords: Silkworm, silk cocoon, silk thread winding, suspension

Section 5. Silkworms as biological models.

New protein studies in Polish sericulture

By

Małgorzata Łochyńska

Institute of Natural Fibres and Medicinal Plants, Poznan, Poland; e-mail: malgorzata.lochynska@iwnirz.pl

(oral presentation)

Institute of Natural Fibres and Medicinal Plants in cooperation with Center of Biocrystallographic Research, Polish Academy of Sciences, Poznan has started oryginal studies on proteins isolated from *Bombyx mori* caterpillars hemolymph. Juvenile hormone-binding protein and PBMHP-12 have been isolated and purified from the haemolymph. A unique clockwise spiral assembly created by six helices is present in the structure. The C-terminal domain folded as a β-trefoil reveals the homology to the domains of *Bacillus sphaericus* toxin and to the main hemaglutinin component of *Clostridium botulinum.* Hemolymph protein could play a role in immune response to fungal infections via glucan-binding as the other 30 kDa lipoproteins.

Keywords: mulberry silkworm, proteins, DNJ, hemolymph, silk fibre

BmAtg5 and BmAtg6 mediate the initiation of apoptosis in response to autophagy induced by 20-hydroxyecdysone or starvation

By

Kun Xie[1, 2§], Ling Tian[3§], Xinyu Guo[1], Kang Li[1, 3], Jianping Li[1], Xiaojuan Deng[1], Zhijun Huang[1], Qingrong Li[4], Qingyou Xia[5], Sheng Li[3], Wanying Yang[1,*] and Yang Cao[1,*]

Laboratory of Insect Molecular Biology and Biotechnology, Guangdong Subtropical Sericulture and Mulberry Resources Protection and Safety Engineering Research Center, College of Animal Science, South China Agricultural University, Guangzhou, 510642, China.

***Correspondence caoyang@scau.edu.cn; yywy@scau.edu.cn**

[§]Kun Xie and [§]Ling Tian contributed equally to this work.

(oral presentation)

Autophagy and apoptosis, which could be induced by common stimuli, play crucial roles in development and disease. The functional relationship between autophagy and apoptosis is complex, due to the dual effects of autophagy. In the *Bombyx* Bm-12 cells, 20-hydroxecdysone (20E) treatment or starvation induced cell death, with autophagy preceding apoptosis at least by 4 h. In response to 20E or starvation, BmAtg8 was rapidly cleaved and conjugated with PE to form BmAtg8-PE; subsequently, BmAtg5 and BmAtg6 were cleaved into BmtAtg5-N and BmAtg6-C, respectively. Reduction of expression of *BmAtg5* or *BmAtg6* by RNAi decreased the proportion of cells undergoing both autophagy and apoptosis after 20E treatment or starvation, in contrast to overexpression of *BmAtg5* or *BmAtg6*. Overexpression of cleavage site-deleted *BmAtg5* or *BmAtg6* increased autophagy but not apoptosis induced by 20E treatment or starvation, whereas overexpression of *BmtAtg5-N* and *BmAtg6-C* was able to directly trigger apoptosis or promote autophagy-mediated apoptosis. In conclusion, being cleaved into BmtAtg5-N and BmAtg6-C, BmAtg5 and BmAtg6 mediate the

initiation of apoptosis in response to autophagy induced by 20E or starvation in *Bombyx* Bm-12 cells, reflecting that autophagy precedes apoptosis in the midgut during *Bombyx* metamorphosis.

Keywords: autophagy, apoptosis, BmAtg5, BmAtg6, BmAtg8, BmtAtg5-N, BmAtg6-C, BmAtg8-PE, 20-hydroxyecdysone, starvation

Regulation of Antibacterial Peptide genes by Starvation in Silkworm, *Bombyx mori*

By

Jie Zhang, Weike Yang, Junfeng Xu, Wanying Yang, Yang Cao, Xiaojuan Deng*

Laboratory of Insect Molecular Biology and Biotechnology, Guangdong Subtropical Sericulture and Mulberry Resources Protection and Safety Engineering Research Center, College of Animal Science, South China Agricultural University, Guangzhou, 510642, China.
***Correspondence：dengxj@scau.edu.cn**

(oral presentation)

The innate immune system represents an ancient and major host defence mechanism that protects insects against invading microorganisms. Antimicrobial peptides (AMPs) are important effector molecules of insect humoral immunity which can inhibit the growth of invading pathogen or even kill them. In insects, the induction of AMPs in response to infection is mainly regulated by the activation of the evolutionarily conserved Toll and immune deficiency (IMD) pathways. Insulin like signaling（ILS）pathway is an ancient evolutionarily conserved cascade reaction which is involved in regulation of growth, development and metabolism in metazoan. As a key downstream regulator of ILS, FoxO transcription factor could regulate multiple genes. In the present study, we used silkworm (*Bombyx mori*) , a Lepidopter
antibacterial peptide expression and its regulation pathway controlled by starvation. Our results showed that the four antimicrobial peptides, *BmcecB6*, *Bmatta1*, *Bmleb3* and *BmdefB* were strongly induced in the silkworm fat body by starvation. *InR* and *Brummer*, the target genes of FoxO, were found to be up-regulated simultaneously. Dual-Luciferase reporter assay showed that the wild-type promoter activity of defensinB was induced significantly by starvation, while there was no response to starvation when all the 7 potential FoxO binding sites in *BmdefB* promoter were deleted. Western blot result showed the phosphorylation of Akt was obviously reduced in Bm-12 cells after starved for 8h, indicating that starvation could inhibit ILS cascade reaction and activate FoxO transcription factor. The localization of FoxO in Bm-12cells was detected when FoxO-GFP was overexpressed in cells. Hoechst staining showed FoxO-GFP was mainly located in the nucleus after the cells were starved for 8 hours, indicating that FoxO was activated by starvation and then entered the nucleus. *BmdefB* expression in fat body was up-regulated significantly when knocking down *InR* expression by RNAi in the 5th instar larvae of silkworm. In summary, the present study revealed that

starvation reduced ILS level and activated FoxO, a downstream transcription factor of ILS, which led to the nuclear localization of FoxO and the up-regulation of AMPs.

Keywords: silkworm (*Bombyx mori*), Insulin like signaling, starvation, FoxO, antimicrobial peptide

Cloning and Expression Analysis of Hsp70 Gene of Beauveria bassiana from the Different Geographical Regions in South China

By

JiPing Liu & XiangLin Li

Guangdong Provincial Key Laboratory of Agro-Animal Genomics and Molecular Breeding，Guangdong Subtropical Sericulture and Mulberry Resources Protection and Safety Engineering Research Center, Regional Sericulture Training Centre for Asia-Pacific, College of Animal Science, Re South China Agricultural University, Guangzhou, 510642, China

(oral presentation)

【Objective】To investagate the function of *Hsp70* from the silkworm pathogen *Beauveria bassiana* in response to high temperature, and to compare the difference of *Hsp70* with the different isolates of *B. bassiana*, which were collected from Guangxi, Guangdong, Hunan and other province in South China, involved in high stress. 【Method】*Hsp70* were cloned and sequenced, and its sequence was analyzed with bioinformatics protocol. The different geographical isolates of *B. bassiana Hsp70* open reading frame (ORF) were obtained through blast with the published datas from NCBI. The spatial-specific expression of Hsp70 in different isolates of *B. bassiana* and the expression patterns of Hsp70 treating under the high stress conditions were determined by real-time RT-PCR.【Result】In this study, the different geographical isolates of silkworm *B. bassiana Hsp70* have high similarity. The analysis of phylogenetic tree was showed that the different isolates *of B. bassiana* located in the same branches and are very close to the typical strain of *B. bassiana*. The RT-PCR results was indicated that the different isolates *of B. bassiana Hsp70* was expressed relatively highest abundance at 38℃ than that of at 28℃, 32℃,35℃,37℃,38℃,39℃,41℃, respectively. At the same time, the different isolates *of B. bassiana Hsp70* expressed are significantly different at 38℃ than that of at 28℃, respectively.【Conclusion】The Hsp70 were cloned and analyzed from the different isolates *of B. bassiana* .The analysis by real-time RT-PCR suggested that Hsp70 played an important role in defending high temperature stress. (This work supported by The Chinese government public welfare industry (agriculture) research of No. 201403064 and Supported by the earmarked fund for Modern Agro-industry Technology Research System of CARS-22-ZJ0205)

Keywords: *Beauveria bassiana*; Hsp70; RT-PCR; expression analysis; silkworm

Difference proteins analysis of diapause termination eggs in *Bomyx mori*

By

Qin Ming-yue, Zhong Yang-sheng, Chen Fang-yan, Wang Ye-yuan, Lin Jian-rong*

Guangdong Subtropical Sericulture and Mulberry Resources Protection and Safety Engineering Research Center, College of Animal Science, South China Agricultural University, Guangzhou, 510642, China
***Correspondence** jrlin@scau.edu.cn

(poster)

Silkworm *Bombyx mori* is a kind of insect with eggs diapauses. The diapause eggs do not develop forward unless after treatment by low temperature or hydrochloric acid. In order to explore the molecular mechanisms of eggs diapause and diapause termination, the proteins expression difference is analyzed through shotgun proteomic analysis method in the 932 breed eggs of non-diapause, diapauses or diapauses termination. The results show that, there are 731 kinds of proteins in the non-diapause eggs produced 4d, and the diapause egg and diapauses termination egg are 555 kinds and 626 kinds respectively. There are 288 kinds common proteins among them. The variant proteins are 307 in non-diapause eggs, 181 in diapause eggs and 202 in diapauses termination eggs respectively. There were 15.1% and 27.7% among total bacteria proteins, respectively. And are about 42.0%、32.6% and 32.3% of their total proteins. The expression profiles of diapause egg-specific protein Adenosine kinase (*BmADK*) are determinated by quantitative PCR in 1~9d eggs of 932 after immediate pickling or acid treatment after refrigeration. The results Showed that *BmADK* may have associated with diapause.

Keyword：Silkworm egg, Diapause, Diapause termination, Proteomics

Proteomic analysis of *Bombyx mori* wing disc response to 20-hydroxyecdysone

By

Jiang Shi-meng, Zhong Yang-sheng, Chen Fang-yan, Wang Ye-yuan, Lin Jian-rong*

Guangdong Subtropical Sericulture and Mulberry Resources Protection and Safety Engineering Research Center, College of Animal Science, South China Agricultural University, Guangzhou, 510642, China
***Correspondence** jrlin@scau.edu.cn

(poster)

Molting hormones have an important role in the metamorphosis of silkworm during development. In order to elucidate its mechanism, the proteins expression difference is analyzed by shotgun proteomic analysis method in wing discs after 20-hydroxyecdysone (20E) treatment. There are 404 kinds of proteins in the wing discs without treated by 20E, and 469 in the one after treated by 20E. There are 337 kinds of common protein among them. There are 67 kinds and 132 kinds of specific proteins in wing disc not or treated by 2 0E respectively. There are 16.59% and 28.14% in its total proteins. Using Real-time PCR technology, the expression profiles of *BmHMGS* are detected in the 5th instar to wandering period. The results showed that the *BmHMGS* are closely related to wing disc development. Western Blot results showed that, the *BmHMGS* can be detected in the wing disc and the fat body during all the 5^{th} instar and wandering period, and the gonad in during the wandering period.

Keyword *Bombyx mori*, Wing disc, Molting hormones, Proteomic analysis

Section 6. Economy: Domestic and international markets, prices, trading, economic analyses of projects etc.

SERICULTURE IN TURKEY

By

Durmus YILMAZ

Kozabirlik Sericulture Cooperative, Fevzi Cakmak cad. Beyta Isham, 43, kat:4, Bursa, Turkey; e-mail: kozabirlik@kozabirlik.com.tr

(oral presentation)

Cocoon production in recent years:

Year	Number Of Sericulturist Families	Reared Silk Eggs (Box)	Fresh Cocoon Production (Kgs)
1990	44.541	80.544,00	2.171.292,00
1994	12.189	17.953,00	455.594,00

2006	2.597	5.698,50	128.944,90
2009	2.358	5.683,00	139.599,60
2010	2.183	5.476,50	128.960,08
2011	2.623	5.808,00	150.646,65
2012	2.572	5.576,00	133.707,10
2013	2.348	5.266,50	121.494,70
2014	1.760	3.738,50	80.054,40

SERICULTURE IN TURKEY: CURRENT SITUATION, RESTRICTIONS AND POLICIES

By

Berrin TASKAYA TOP, Tijen OZUDOGRU, Osman Orkan OZER, Turkay BARS, Kubra POLAT, Zeliha YASAN ATASEVEN, Ilkay UCUM
This paper has been prepared by Dr. Berrin TASKAYA TOP and will be presented by her.
However, in this paper has benefited from the findings of a project which was conducted with the following team.

Republic of Turkey Ministry of Food, Agriculture and Livestock, Agricultural Economic and Policy Development Institute, Eskisehir Yolu 9. Km 1 Nolu Kapı 06800 Lodumlu / Cankaya / Ankara / TURKEY; e-mail: btaskaya@hotmail.com

(oral presentation)

Having 1500 years of history in Turkey, sericulture is mostly done by small scale family enterprises with small scale production.

In Turkey; in the absence of alternative sources of income where agricultural areas are limited, barren and prone and transportation is difficult, sericulture is an important economic activity for the low income producers provides an important alternative for livelihood income.

Turkey producing silkworm eggs free from disease and are one of the few countries which have its own silkworm genetic resources. As of 2014, 37 out of 81 provinces in the fresh cocoons are produced. In terms of climate conditions although Turkey is appropriate for growing mulberry tree and suitable for sericulture, it is mostly done during spring season. For the last two decades fresh cocoon production volume has decreased by approximately 90% due to lower import prices, high return of alternative crops income than the sericulture, excessive and unconscious use of pesticides in crop production, industrialization, urbanization and migration. On the other hand, Turkey is dependent on foreign at raw silk. Related products of silkworm breeding (seed, dry cocoon, raw silk) Zero customs duty is applied on imports into Turkey. Given, in the exports of the same product no subsidies are not provided

For this reason, to encourage production in Turkey, to keep the place where growers and in order to lay claim to sericulture that a cultural product, Silkworm breeding is subsidised by goverment since 2002. Silkworm subsidies are seed (TL/Box) and cocoon (TL/kg) subsidies. Breeding and fresh cocoon subsidies are provided per kg of the amount of cocoons produced. There is no prerequisite to benefit from the support and The amount of subsidy is determined for every year.

The amount of subsidies paid to the silkworm breeders is very vital for the producers. Indeed, 82.4% of revenue in the hybrid business cocoons per box and those in the breeding business consist of 50% of state support in 2014. It is imperative to continue to goverment subsidies for continuity of production and hampering the extinction of the Sericulture.

In this study, The status of the silkworm breeding in Turkey and existing support policies are evaluated. In the study as well as secondary data and conducting surveys with totally 207 producers face to face in provinces constituting 66% of Turkey fresh cocoon production and Bursa in which the silk worms breeding were utilized.

According to findings of the research, There is no other agricultural enterprises operating outside of the 20.7% of sericulture. Most of the business sericulture as well as vegetable or animal activity engaged in to carry out these activities in order to meet the needs of families and they do not receive any income. Indeed, the business of the average annual income of sericulture is 645 Euro and sericulture’s share of total agricultural income is 54.7%. The average number of enterprises they open is 2.17, the average yield is 25.26 kg / box.

The absence of manufacturers' feeding house and shortage of mulberry tree and labor are the most important causes affected the production of the cocoon. The low price of cocoons and reduction of labor due to youth’s moving away from production are the responsible factors for the release of the silkworm**.**

Keywords: Sericulture, Kozabirlik, silkworm subsidies and cocoon.

Country Report Switzerland 2015

By

Ueli Ramseier

Swiss Silk - Vereinigung Schweizer Seidenproduzenten, Bergfeldstrasse 5 CH - 3032 Hinterkappelen, Switzerland; e-mail: u.ramseier@bluewin.ch

Background: The association Swiss Silk, founded in 2009 as a private initiative, aims at reintroducing silk production in Switzerland. Today 30 farmers, 5 silk processors along the chain of production and 120 private persons and institutions are members of the association. Swiss Silk does not receive any support from the Swiss government.

Production: Based on 2 hectares of mulberry trees (mainly Kokusa 21, low stem cut) as feeding basis, Swiss Silk made intense testing of silk worm rearing, silk reeling and industrial processing. In September 2014 the quality has been developed as far, that first products under the label *weisbrod*, has been launched on the Swiss market. Ties and foulards are the first products; due to limited quantity only the weft (trame) is so far made of silk from Switzerland, counting for about 60% of the weight. The main challenges ahead are the further increase of quality and quantity of raw silk and the establishment of a robust chain of production for industrial processes. In addition, more partners in the market have to be identified.
The training of the farmers remains a main tasks of Swiss Silk in order to address the challenges mentioned above. At least twice a year Swiss Silk organises peer learning events for farmers. Swiss Silk has also produced a producer's manual.

Outreach: The market entry had an enormous response in the media. More than 80 articles in news papers and magazines, 3 television and 4 radio emissions both in Switzerland and abroad underlined the interest of the public in a European based silk production.

Contact: Swiss Silk – Producers Association, Hinterkappelen, Switzerland **www.swiss-silk.ch** and **www.facebook.com/pages/Swiss-Silk/**

New technologies in Georgian sericulture

By

Elgudja Shapakidze, Giorgi Nikoleishvili, Nargiz Baramidze

Georgian Academy of Agricultural sciences, 0102, Ivane Javakhishvili str. #51; e-mail: Shapakidze-elgudja@rambler.ru

(poster)

The analysis of recent years of Georgian Sericulture and natural silk production shows its poor state which needs to undertake reasonable radical measures in order to maintain the sector, otherwise sericulture is expected to be completely extinguished.
The important measures in the field to avoid the crisis are the following: To increase the quantity and quality of food base; Mulberry silkworm breeding of high-yielding varieties with low costs; Adoption and implementation of new mechanization and automation of time-consuming process in sericulture.
Implementation of new technologies on the basis of the ruining of borders between the silkworm cocoons maker (agriculture, farmers) and producer (Industry). Therefore, it is

possible for farmers to produce and take on the market final product - silk thread. A technological process in this case of mulberry silkworm feeding scheme is changing.
Thus, in modern conditions (restoration and development of Georgian sericulture in the initial stage) to determine the scope of activities on farms: food production and processing; Mulberry silkworm feeding, cocoon producing, cleaning, receiving of pure silk thread.

Keywords: Technology, mechanization, machine cleaning of cocoons, silk thread.

Sericulture enterprises integration, profit and distribution

By

Giorgi Nikoleishvili, Tamaz Kunchulia, Elgudja Shapakidze

Georgian Academy of Agricultural sciences, 0102, Ivane Javakhishvili str. #51; e-mail: Shapakidze-elgudja@rambler.ru

(poster)

In past times Sericulture in Georgia was mainly developing on cooperative basis. First cooperative was established in 1895, which passed wages to the employees according to realization of dry cocoon. Income dividends were given to both sericulturists and other cooperative members, It was discovered form of vertical integration in sericulture.

At present, the share of total income of the sericulture sector takes the final product manufacturers, next share comes to production of reeling raw unprocessed threads and the farmer – producer of live cocoon is left without profit.

It will be very difficult to develop Georgian sericulture according to mentioned scheme, therefore, relevant changes in it should be made.

Considering the interests of the field prospective working activities are implementing about the methods of integrated enterprises income distribution, which can be successfully applied in other fields of agriculture.

Keywords: Sericulture, Integration, Cooperation, Financial income, Economic efficiency.

Sericulture production potential in Georgia, its use and economic efficiency

By

Givi Japaridze, Giorgi Nikoleishvili, Elgudja Shapakidze

Georgian Academy of Agricultural sciences, 0102, Ivane Javakhishvili str. #51; e-mail: Shapakidze-elgudja@rambler.ru

(poster)

Using of recourse potential (industrial, economic, natural, biological) of Sericulture economic efficiency development in Georgia should be reviewed as continuous process.
Under the sericulture industry potential is considered the land fund, water, labor and other facilities.

Saving the ecological balance in sericulture means to regulate existing obstacles between the mulberry plant and silkworm relations.

Following elements are defined as Sericulture industry potential: Mulberry silkworm, silkworm accommodation, labor resources and technical facilities, technological system, organizational and economic systems. In addition, each of them has specific requirements.

Keywords: Sericulture, Industrial, Economic, Natural, Technological system.