

SERICULTURE: A SUSTAINABLE ALTERNATIVE FOR THE AGRICULTURAL SECTOR IN CUBA



Authors: María del Carmen Pérez Hernández, Yamila Martínez Zubiaur,
Adileidys Ruiz Barcenás.

Speaker: Dr Prof. Yamila Martínez Zubiaur. Titular Research and Member of Cuban
Academic Science

Sheki , April 2017

Email for contact : mariacp@infomed.sld.cu



In 2011, the National Sericulture Project emerged in order to produce bioproducts for the medical-pharmaceutical, cosmetic and biotechnological industries



Three main lines are developed



The mulberry (*Morus alba* L.) for feeding the silkworm

Silkworm rearing (*Bombyx mori*)

Obtaining cocoon derivatives

The mulberry (*Morus alba* L.) for feeding the silkworm



✓ Established mulberry cultivars .



Origin	Cultivars	Area (Hectare)	No. of plants
China	Gui Sang You 62	12.78	220 084
	Gui Sang You12	4	70 798
	Guangdong 11	2.62	38 788
Spain	Murcia	5.36	72 704
Costa Rica	Tigreada	1	172
	Criolla	9,37	178 175
Total		35,13	580 549

✓ Development of different methods of propagation



Cutting and seed propagation



94-96% of germination



At present, there are around 30 ha planted by seeds at the project's facilities and around 390 kg of seeds have been produced for other purposes with the consequent replacement of imports.

✓ Influence of mulberry harvest



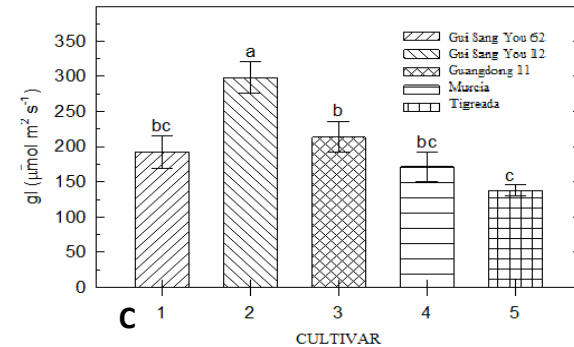
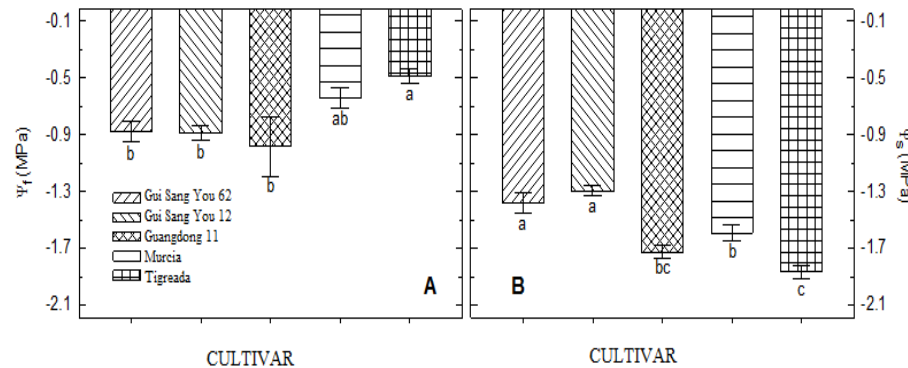
Vegetative and root development in different cultivars .



These results showed that harvesting right after **4 months of planting** the plot under Cuba's conditions (with irrigation and fertilization) did **not affect vegetative and root development.**

Cultivar	Harvest	Ave. number of roots	Ave. Root length (m)	Ave. Number of branches	Stem height (m)	Height to the 1st. leaf from the soil (m)	Ave. Number of leaves	Ave. Weight of the leaves	% of leaves weight
Gui Sang You 62	No	39	40.8	2.00	2.65	1.57	44.75	5.12	38.1
	Si	48	45.2	4.75	1.56	0.37	77.25	4.88	55.4
Guangdong 11	No	58	64.7	4.25	2.94	1.40	171.75	4.38	43.1
	Si	46	63.6	6.40	1.51	0.50	109.00	3.50	56.5

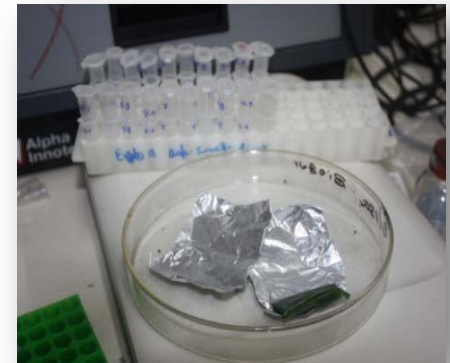
✓ Physiological indicators



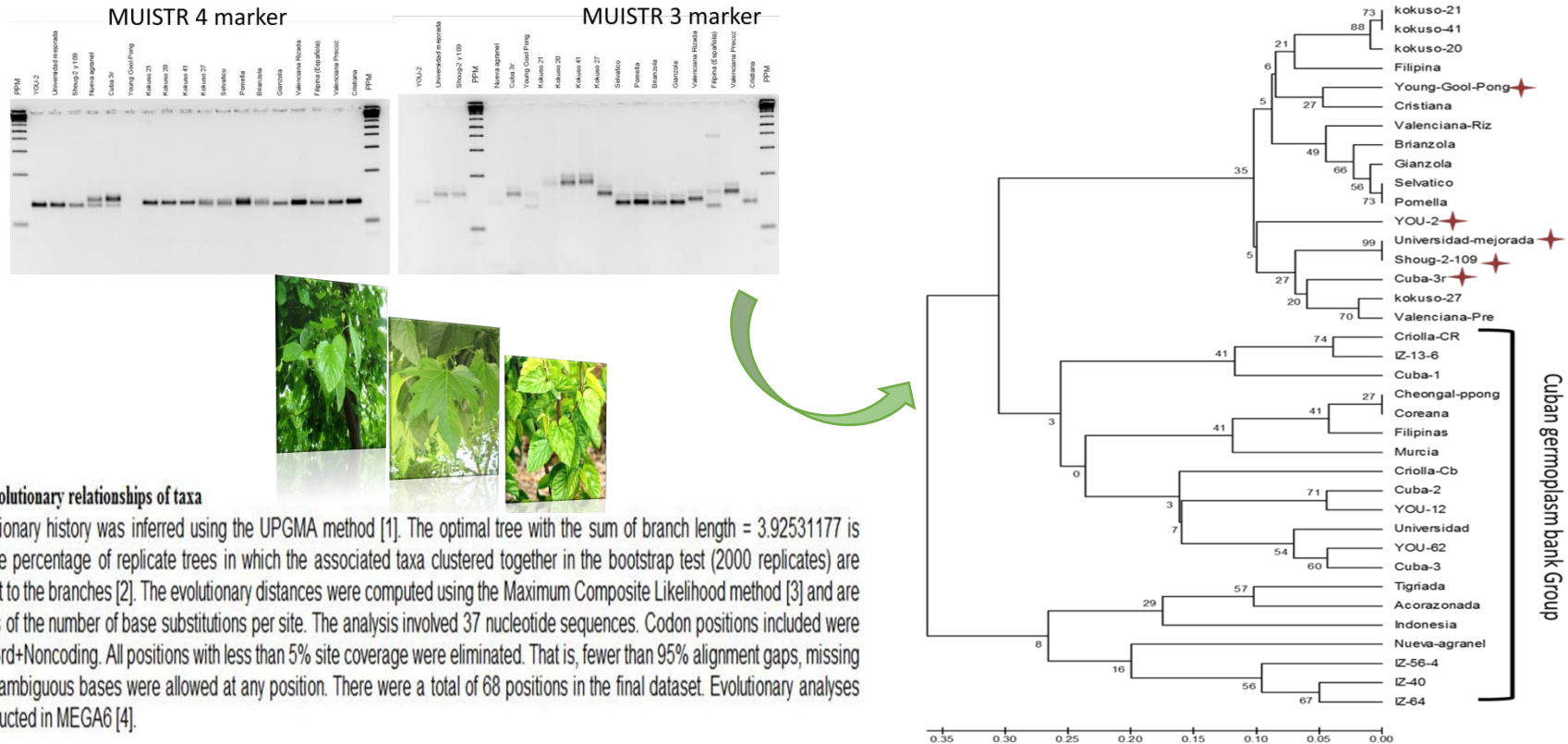
Evaluation of physiological indicators (A) **foliar water potential** (Ψ_f), (B) **foliar osmotic potential** (Ψ_s) and (C) **stomas conductance**.

The **highest values of water potential** were attained with the **Criolla or Tigreada**

The **low levels of stomas conductance** found in the **Tigreada** this suggest that the plant is able to make a stomas adjustment to avoid the loss of water by transpiration showing a better adaptation to low water availability, This cultivar was one of the first introduced in the country in 1996 from Costa Rica and consequently is better adapted.



✓ Molecular characterization of mulberry (*Morus alba* L.) using SSR markers



- Cuban cultivars are more related to Korean and Chinese cultivars than cultivars from Japan, Italy and Spain.
- The Cuban cultivars 'Cuba 2' and 'Cuba 3' propagated from Chinese parents retain the genomic characteristics of their selection.

ALL CULTIVARS WERE USED TO FEED THE SILKWORMS IN CUBA

Silkworm rearing (*Bombyx mori*)



✓ Evaluations of eggs from different countries



Bombyx mori L. is considered an exotic organism in Cuba, it is subjected to biosecurity regulations.

Eggs origin studied: Colombia, Brazil, Spain, Italy, India, Bulgaria, China (Liangguang 2), Korea and Thailand (Chul Thai 1, Chul Thai 6, Chul Thai 7).

The best origin were :



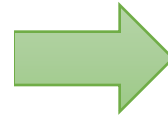
Duration of feeding Period (day)	Hatching (%)	Mulberry consumption (Kg/box)	Single Cocoon weight (g)	Weight percentage of the shell (%)	Cocoon length (mm)	Cocoon wide (mm)	Cocoon production per box (Kg/box)	Raw silk (%)
21	95	728.4	Origin: Thailand breed: Chul-Thai 6					
			1.91	22	34.7	20.8	36.1	25
			Origin: Thailand breed: Chul-Thai 1					
21	95	810.5	1.79	23	31.4	18.6	35.1	24.2
			Origin: China breed: Liangguang 2					
			1.41	20	23.4	14.4	29.2	19.7

these breeds showed a shorter rearing cycle under Cuba's environmental conditions, from 21-28 days to **21-23 days**, which makes possible to develop up to **9 rearing per year**.

✓ Establishment and broad of facilities for silkworm rearing.



“Adapted houses” with rearing capacity for 10 boxes. Currently used for young silkworms.

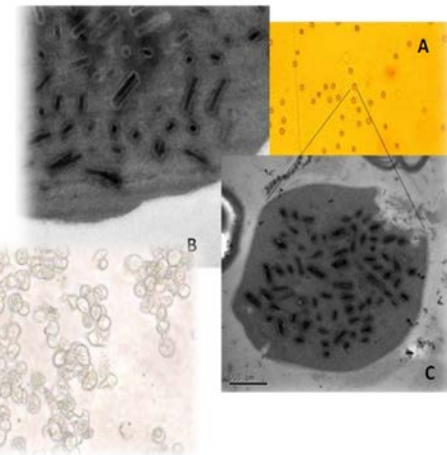


“The Tunnels” with a rearing capacity for 40 boxes in 9 cycles.



✓ Detection and management of diseases

BmNPV is the main diseases that affect the silkworm rearing. Diagnostic protocols were established by PCR and molecular hybridization that allowed detecting the disease from the 3rd instars.



Obtaining cocoon derivatives



✓ Evaluation of the cocoon quality according to standards parameter



Breed	Quality indicator	Measuring unit	Value of the standard	Result of the test	Classification
Chul Thai 1	Cleanness	points	$\geq 96.5 < 97.5$	99.0	6 A
	Neatness	points	$\geq 92.00 < 94.00$	93.0	6 A
	Silk yield of gross cocoons	%	-	46.62	47
	Non-broken filament length	m	$\geq 300 < 1000$	913.8	91
	Rush upon cocoon per 10 000 m	time	≤ 3	0.4	I
TOTAL RESULT			6 A 4791		
Chul Thai 6	Cleanness	points	$\geq 96.5 < 97.5$	97	4 A
	Neatness	points	$\geq 92.00 < 94.00$	93	4 A
	Silk yield of gross cocoons	%	-	37.92	38
	Non-broken filament length	m	$\geq 300 < 1000$	536.4	53
	Rush upon cocoon per 10 000 m	tiempo	≤ 3	2.0	I
TOTAL RESULT			4 A 3853		
FC 2	Cleanness	points	$\geq 96.5 < 97.5$	98.0	6 A
	Neatness	points	$\geq 92.00 < 94.00$	94.50	5 A
	Silk yield of gross cocoons	%	-	39.36	39
	Non-broken filament length	m	$\geq 300 < 1000$	494.3	49
	Rush upon cocoon per 10 000 m	time	≤ 3	0.8	I
TOTAL RESULT			5 A 3949		

This is a “quality plus” value proving that under Cuba’s climatic conditions and with the rearing technology used, there is a potential to develop and produce **high quality silk**.



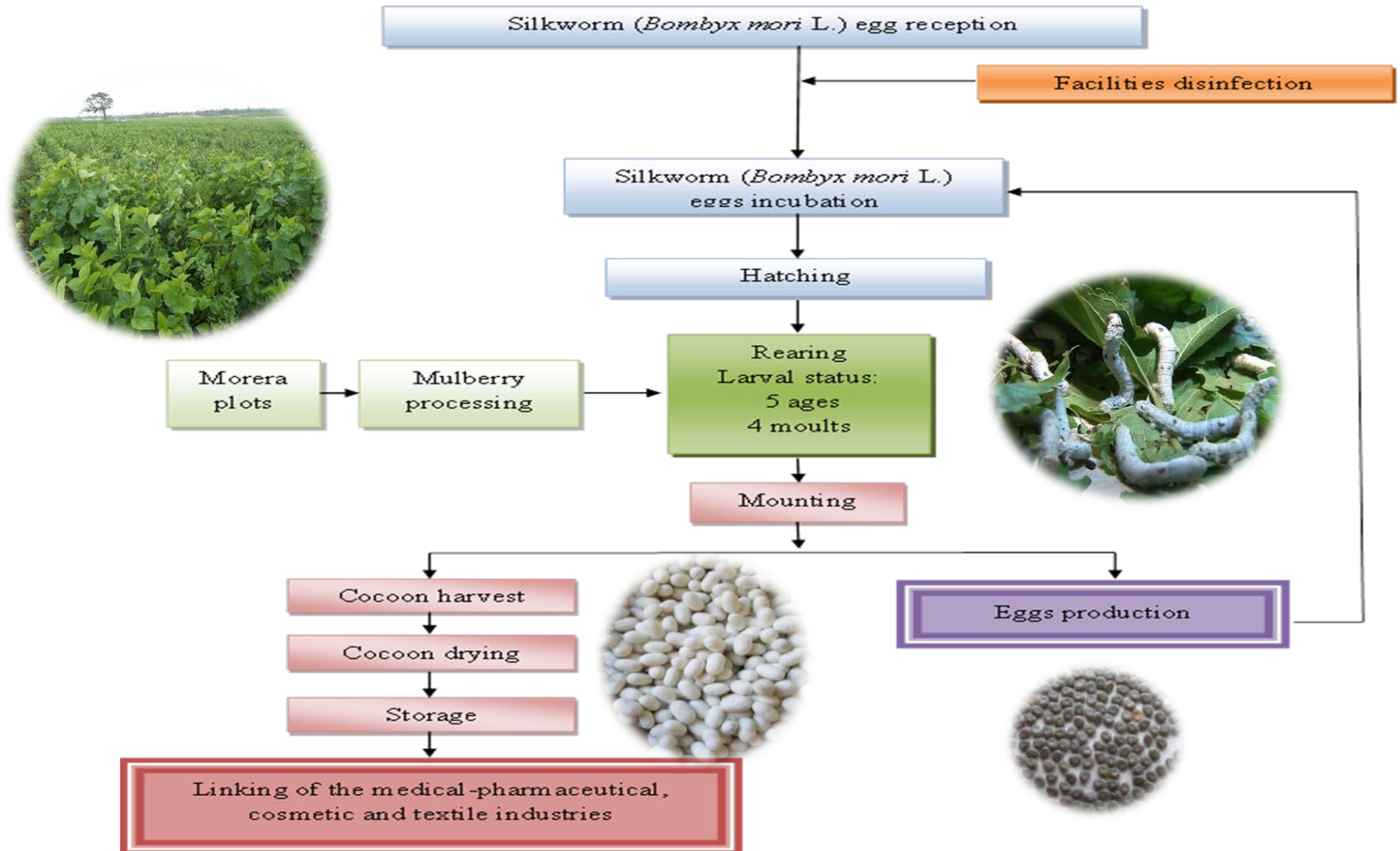
✓ Obtaining and evaluation of Silk protein hydrolyzed

- The product obtained showed quality according to requirement to cosmetic industry when it was compared to Hidrosilk (imported product).

- The stability and toxicity assays confirmed its stability at temperatures below 30°C, for more than 1 year. This product classifies as no skin and eye irritant.



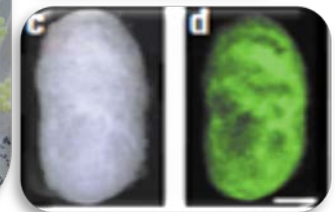
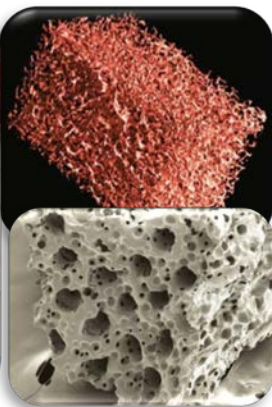
✓The results allowed establishing a scheme to assume large scale sericulture on scientific foundations and methodologies that guarantee its sustainability.





Research in:

- To obtain **fibroin** and **chrysalis oil** .
- Expression of **proteins of pharmaceutical interest in silkworms** (*Bombyx mori*) from genetic modifications to it.
- To establish the condition for the national production silkworms eggs.



Thank you

