

6TO CONGRESO INTERNACIONAL DE SERICULTURA Y BIOTECNOLOGÍA DE INSECTOS EN ASIA-PACÍFICO APSERI-2109.

PROYECTO: *CONTRIBUCIÓN A LA REDUCCIÓN DE LA POBREZA EN LA REGIÓN DE AMÉRICA LATINA Y EL CARIBE A TRAVÉS DE LA SERICULTURA CON ENFOQUE SUSTENTABLE Y AGREGADO DE VALOR LOCAL.*

PROGRAMA: UE (CONVOCATORIA DE EUROPEAID)

ENTIDAD EJECUTORA PRINCIPAL: INTI DE ARGENTINA

ENTIDAD CO-SOLICITANTE: EEPF INDIO HATUEY

ENTIDADES PARTICIPANTES:

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INICIO DEL PROYECTO: 2017

FIN DEL PROYECTO: 2020

MSC. MARLENE PRIETO ABREU

LATINOAMÉRICA Y EL CARIBE
PROYECTO
seda



Participantes: MSc. Marlene Prieto Abreu y Lic. Dayron Martin Prieto

- **País visitado:** India
- **Período de la visita:** 01-06 de marzo de 2019
- 1. **Objetivos del viaje:** Participar en el 6to Congreso de Sericultura y Biotecnología de Insectos de Asia Pacífico (APSERI 2019).
- 2. **Universidad(es) o institución(es) visitadas:** Instituto Central de Investigación y Formación en Sericultura (CSRTI)
 - Participación en sesiones de presentaciones orales y posters, de los avances en la Sericultura a nivel mundial.
 - Visita de campo a los productores de capullos y al CSRTI.

Participantes por región en el Congreso

- Asistieron delegados de todos los continentes
- Latinoamérica: Paraguay y Cuba
- África: Kenya y Uganda
- Región de Eurasia: fue la más representada, con el liderazgo de China, India y Japón
- Se recibió información actualizada del funcionamiento de la Sericultura en el mundo, especialmente el crecimiento de los dos líderes productores (China y la India), y el descenso de la actividad en otros países como Japón y Corea del Sur, debido a la competencia con otras industrias

Principales Temáticas de interés abordadas en el Congreso

- Control de plagas en la morera (India)
- El manejo de un amplio banco de germoplasma de variedades de morera adaptadas a diferentes condiciones climáticas (India)
- el procesamiento con microorganismos de las pupas de los gusanos de seda para desolorizarlas (China)
- el procesamiento de las pupas de los gusanos de seda para la producción de quitina (India)
- **Tendencias**
- Sistema integral (diversificación de actividades agrícolas en el ciclo de la Sericultura) (China)
- La sericultura como destino turístico
- Promoción de las razas bivoltinas

Sericultura en la región Mysore (India)

- la sericultura es una actividad complementaria al cultivo de la caña y del arroz.
- predominan las fincas de los pequeños productores
- capacidades de cría de 2 a 3 cajas
- se realiza alimentación dos veces al día
- cuentan con una variedad de morera con alta capacidad de producción de biomasa, V2: 70 t de biomasa por ha
- diferentes condiciones de manejo agronómico: distancias entre surcos y plantas, altura del corte
- fertilización química a base de sodio y potasio después de cada cosecha
- entrega a los productores las larvas en segunda edad y variedades de morera para establecer en el campo
- el estado de la India contrala el funcionamiento del mercado de capullos, con un mecanismo de precio según la calidad

Integración de estrategia agroecológicas en la sericultura para incrementar el beneficio del trabajo equitativo en áreas rurales. Marlene Prieto, Dayron Martin, Giraldo J. Martin

Integration of agroecological strategies in sericulture to increase the benefit of equitable work in rural areas

Marlene Prieto Abreu, Dayron Martín Prieto, Giraldo J. Martín Martín

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Objective

Sericulture in the PERSIH utilizes a technology package that harmonizes its operation in agroecological farms. *Bombyx mori* rearing has been traditionally used to obtain silk threads, and process wastes could be transformed into products with agricultural applications. This work presents the performance of the main residues during a silkworm rearing cycle, the quantities of the generated products and their economic impact. As feed for 35 000 larvae from polyvoltine hybrids, 38 mulberry rows (*Morus alba*, variety: University, 85 m long and 0.4 m between plants) were used. A total of 34.4 kg of fresh cocoons were produced, equivalent to 13.8 kg of dried cocoons, 6.3 kg of cocoon shell, 7.25 kg of pupae and 150 g of blot. The cycle generated 200 kg of dried mulberry branches, equivalent to 80 kg of biochar, which functions as organic-mineral fertilizer and feed for monogastric animals. Twelve kilograms of wrapping paper were made from the rearing beds, which were recycled to produce 266 folds of craft paper for packaging. One hundred kilograms of mulberry leaves were generated, after anaerobic digestion, which were utilized as pig feed and nutrient source to activate the biochar. The silkworm excreta was composted, mixed with the plant waste from the mulberry cultivation area and with sheep excreta. The integration of agroecological strategies in the sericulture cycle, generates added value to the silk cocoon production.

Materials and methods

Mulberry silage preparation

Wastes from mulberry green forage were partially dehydrated and ground. Later, they were pressed in a plastic tank and incubated under anaerobic conditions during 45 days. The biomass was bacterially digested which increases nutrient solubility, to be applied as feed for monogastric animals or soil fertilizer.

Mulberry biochar preparation

Mulberry branches were dehydrated under sunlight and partially burnt with fire, avoiding complete ash formation. The biochar was activated with nutrient solutions from mulberry silage and applied to mulberry fields.

Compost

Degradable residues generated during the silkworm breeding and in the mulberry field, were mixed on the soil. Soil microorganisms and water were applied to accelerate the process.

Artisanal paper

Residual paper was cut into small pieces and imbibed in tap water during 24 h. The material was ground to obtain a pulp, to which acetate glue was applied. The pulp was deposited between two cloths, pressed and dried at ambient temperature.

Results



Biochar preparation as organic-mineral fertilizer



Silage preparation to increase nutrient solubility



Compost preparation as organic fertilizer



Intercropping food crops between mulberry rows.
Row characteristics: length 30 m, distance between rows 1 m. Production per row, radish: 500 plants, lettuce: 220 plants; other plants under study: kidney bean



Artisanal paper preparation as packaging material

Rearing	Production	Residues	Subproducts	Applications
40 000 larvae	34.4 kg fresh cocoon	200 kg mulberry branches	80 kg biochar	Organic mineral fertilizer, monogastric feed
6 200 plants	13.8 kg dried cocoon	12 kg bio cover paper	266 folds of artisanal paper	Packaging
	6.3 kg shell	50 kg mulberry leaves	mulberry silage	Monogastric feed
	7.25 kg pupae	Silkworm excreta	compost	Organic fertilizer

Sericulture



Conclusions

- The integrated model of sericulture with agroecological practice allows to generate new jobs and income to families in rural areas.
- Intercropping food crops in mulberry fields increases productivity and improves life quality.

Bibliography

- Fernanda R. Oliveira, Anil K. Patel, Deb P. Jaisi, Sushil Adhikari , Hui Lu, Samir Kumar Khanal (2017). Environmental application of biochar: Current status and perspectives. *Bioresource Technology*.
- Jérôme Henneaux (2012) Efecto del biocarbón combinado con fertilizantes orgánicos y microorganismos benéficos sobre el desarrollo, productividad y resistencia de las plantas, Turrialba, Costa Rica. *Magister Scientiae en Agricultura Ecológica*.

Caracterización parcial del hidrolizado de sericinas del capullo de seda. Su posible aplicación en el sector agropecuario. Dayron Martín, Nancy Altunaga, Félix Ojeda, Marlene Prieto.



Partial characterization of the sericin hydrolyzate of the silk cocoon, possible applications in the agricultural sector

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Abstract

The silk thread is extracted mainly from the cocoons made by the *Bombyx mori* larvae, which in a cooking process, are softened or degummed to provide softness and shine to the textile fiber known as silk. In the aqueous solution, a family of proteins called sericins is enriched, along with other compounds, whose mixture has antioxidant, moisturizing, healing, immuno-modulating and antimicrobial properties. In this work, different methods of degumming are evaluated, consisting of four chemical treatments and two physical ones, which can be carried out under controlled laboratory conditions or in an artisanal way. It is verified that the treatment in alkaline conditions is the one of higher yield of extraction of silk cocoon mass, without affecting the reeling characteristics of the textile fiber. Protein solutions have a heterogeneous electrophoretic migration pattern in SDS-PAGE (sodium dodecyl sulfate-polyacrylamide gel electrophoresis), related to partial degradations of the primary structure of proteins, and maintain their antioxidant capacity to inhibit the free radical 2,2-diphenyl-1-picrylhydrazyl (DPPH). To evaluate how the sericin hydrolyzate (SH) could influence the management of bacterial and fungal infections, as well as the nutrition of animals and plants, is recommended.

Materials and methods

SH preparation. The crusts of the silk cocoons were treated with solutions at a rate of 1 g / 30 ml of I) Distilled water, II) Water from the tap, III) Distilled water pH 7.4, 120 mM NaCl and IV) Distilled water pH 11.5, 120 mM NaCl. Boiling solutions: the extraction solutions I, II, III and IV were introduced in glass beakers, three replicas of each one, and placed on a heater at 100°C, with magnetic stirring, until reaching the boiling state. Then, 5 grams of shell were imbibed in each solution, and they were kept under stirring for 20 min. Solutions in the autoclave: the extraction solutions I and IV were introduced in glass beakers and the shells were imbibed, with three replicas for each treatment, which were treated at 120°C, 103.25 kPa, during 20 min. Then, the shells were squeezed and the SH was obtained, the shells were incubated in the stove at 60°C until completely dehydrated.

Characterization of SH. The preparations extracted from the shells were evaluated quantitatively and qualitatively. The total soluble proteins were quantified by the Lowry method in buckets, using the Bovine Serum Albumin as standard, from 0 to 2 mg / mL. The electrophoretic migration in SDS-PAGE of 10-30 µg of proteins was evaluated, using silver nitrate staining. The DPPH free Radical Inhibition assay was performed in cuvettes using distilled water and BSA as controls. Simple ANOVA was performed with 0.05% Tukey's test to identify the significant differences.

Results

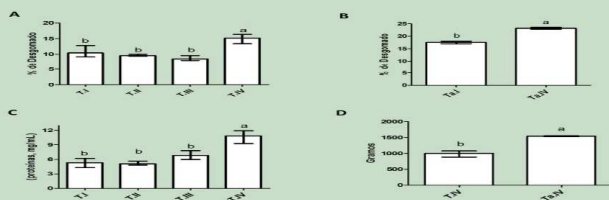


Figure 1. Extraction performance of SH. The percentage of degumming is plotted in the heating (A) and autoclave (B) treatments, calculated from the loss of mass of the shell of silk cocoons. C. The concentrations of soluble proteins are plotted in the degumming processes by heating, quantified through the Lowry method. D. Estimated yield of total mass extraction from 20,000 shells of silk cocoons (1 shell = 0.33 g), using the heating and autoclave treatment, with the degumming solution in alkaline conditions. The comparison between the treatments is made by means of a simple ANOVA, followed by 0.05% Tukey's test.

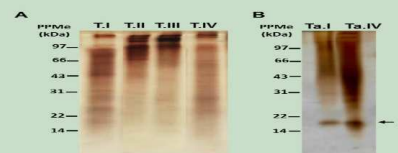


Figure 2. Evaluation of the electrophoretic migration pattern of SH in SDS-PAGE. The samples were mixed with the sample buffer (1:1, v:v) and centrifuged at 5 000 g, then the concentrating gel of 4% acrylamide was applied. A qualitative analysis (10-30 µg of proteins) was performed under non-reducing conditions, 12.5% separating gel and silver nitrate A staining. A replica of the samples obtained in the degumming processes was evaluated by heating. B. A replica of the degumming processes in the autoclave was evaluated. PPMe indicates the estimated location of molecular weight patterns, according to the literature (Wu et al., 2007).

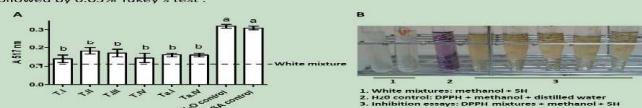


Figure 3. Inhibition of the absorbance of the DPPH free radical by the SH. A. HS = 1 mg/mL was evaluated, according to the total mass extracted from the shell of the silk cocoon. A simple ANOVA was performed, followed by Tukey's test with 0.05% significance for the comparison of the different degumming treatments. Distilled water and BSA (1 mg / mL) were used as controls. The dashed line of the white mixture indicates the average absorbance value shown by the different mixtures of the HS with methanol. B. Image of several reactions that were part of the DPPH free radical inhibition test, dissolved in methanol.



Mixing SH with corn meal



Pigs eating SH with corn meal; in progress during more than 1 month



SH application on lettuce leaves; in progress during more than 10 days.

Conclusions

The application of SH in the agricultural sector could be explored to avoid environmental pollution and increase food and feed quality.

Posibles acciones

- Realizar ensayos para diferentes usos de la pupa.
- diseñar diferente manejo agronómico: distancias entre surcos, plantas y altura del corte.
- Evaluar la diversificación de actividades agrícolas en el ciclo de la Sericultura
- Posibilidades de establecer convenios de trabajo
- Se valoró la posibilidad de establecer colaboraciones con Tailandia en temas relacionados con la producción de huevos de *Bombyx mori*.
- Mantener el intercambio con expertos en la sericultura