

RESEARCH ARTICLE

Effect of the phytochemicals fortification of the mulberry leaf (*Bougainvillea spectabilis*) on the commercial characteristics of the multivoltine silk worm *Bombyx mori* Linn

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ABSTRACT

Silkworm farming is susceptible to diseases during the summer and necessitates careful attention and upkeep throughout the rearing process. In the tropics, summer is defined by high temperatures, a dry, hot, and dusty atmosphere, and little rainfall. These factors make it difficult to cultivate mulberries and raise silkworms. The silkworms get weaker and more vulnerable to infections and the spread of illness in high temperatures and low humidity. One of the most serious threats to silk cocoon production during the summer is the silkworm disease known as Nuclear Polyhedrosis (Grasserie). Up until the beginning of larval life and of spinning, the fifth instar larva of *Bombyx mori* (Pure Mysore) were fed on mulberry leaves phytochemicals fortified with 0.1%, 1.0%, 2.0%, and 5.0% leaf extract of *Bougainvillea spectabilis* (Paper Flower) Labial. Compared to the control, the entire rearing time was shortened with all concentration of *Bougainvillea spectabilis* (Paper Flower). All concentrations of *Bougainvillea spectabilis* (Paper Flower) extract and a 2.5% concentration of the same resulted in a notable increase in filament length and silk ratio percentage. However, when compared to control values, the weights of the shell and cocoon dropped. One of the most deadly illnesses that affect silkworms is the *Bombyx mori* nuclear polyhedrosis virus (BmNPV), which causes grasserie disease and causes massive economic damage to the sericulture industry. Therefore, it is essential to properly treat the illness throughout the summer and minimize the loss of the silk harvest. This study describes the approach, analyzes the findings, and proposes ways to enhance the usefulness of sericulture applications in the future.

Keywords: *Bougainvillea spectabilis*, Silkworm, Fortification, Economic characters and Silkworm disease

INTRODUCTION

One of the traditional medicinal plants with possible anti-fertility effects is *Bougainvillea spectabilis* (**Family: Nyctaginaceae**), sometimes known as Great *Bougainvillea* or Paper Flower. India stands out among the world's silk-producing nations.

In India, agriculture provides farmers with a supporting source of income. The methods of sericulture have evolved in order to increase productivity. Just like any other living thing, silk worms are constantly subjected to illness and death. However, continuous cultivation made mulberry silkworms extremely vulnerable to a variety of illnesses, resulting in a 30–40% loss in cocoon yield. Because it has been domesticated for over 5,000 years, the mulberry silkworm, *Bombyx mori* L., is susceptible to viral, bacterial, fungal, and protozoan infections. One of the essential aspects of successful silkworm culture for producing more and better cocoons is the management of silkworm disease. There are several strategies for managing illnesses. For instance, the disinfectants used in chawki rooms include phytochemicals, which are harmful to silkworms as well as the people who work there. The herbal renaissance has had a significant influence on Western medicine, which is now gaining popularity globally, and plant compounds have already been chemically characterized. India has an ancient herbal history that rivals China's. We have complained despite our abundance of resources. With great interest, several scientists have examined the plant products from various plant tissues (Fraenkel, 1959, Saxena, et al. , 1990 & Subramanyam, 1990). The life and behavior of silk worm insects are impacted by plant extracts. Since there is not much data available on how plant extracts affect silkworms, this research seeks to investigate the impact of Bougainvillea or Paper Flower extracts on silkworms' cocoon characteristics in order to treat the illness management in silkworms' growing larvae. Due to their cost-effectiveness and eco-friendly nature, plant compounds are ideal for managing diseases in the rearing house under the present conditions. Several writers have highlighted the growth-promoting qualities of specific plants in addition to their antimicrobial properties (Subha K 2005, Samson MV et. al. 1998, and Gad AA et al 2010). In several nations, indigenous tribes have utilized the aqueous extract and decoction of this plant as a method of fertility regulation. According to Ram R et al. (2000), the leaf extract of bougainvillea, which had undergone partial purification using ammonium sulfate fractionation, had activity against BmNPV and showed a marked decrease in grasserie mortality. In addition, they discovered that applying Bougainvillea Antiviral Protein (BAP) to antifertility actions from the defoliator pest improved the economic characteristics of the cocoon. Nuclear Polyhedrosis (Grasserie) is one of the most dangerous silkworm illnesses, posing a significant risk to the manufacture of silk cocoons throughout the summer. Botanicals' bio-molecules, such as their chemical structures, include aldehyde, ketones, phenols, oxides, esters, and alcohols. Using environmentally acceptable techniques, these functional groups can be used to treat

viral, fungal, bacterial, and protozoan illnesses in silkworms due to their antibacterial activity.

MATERIAL AND METHODS

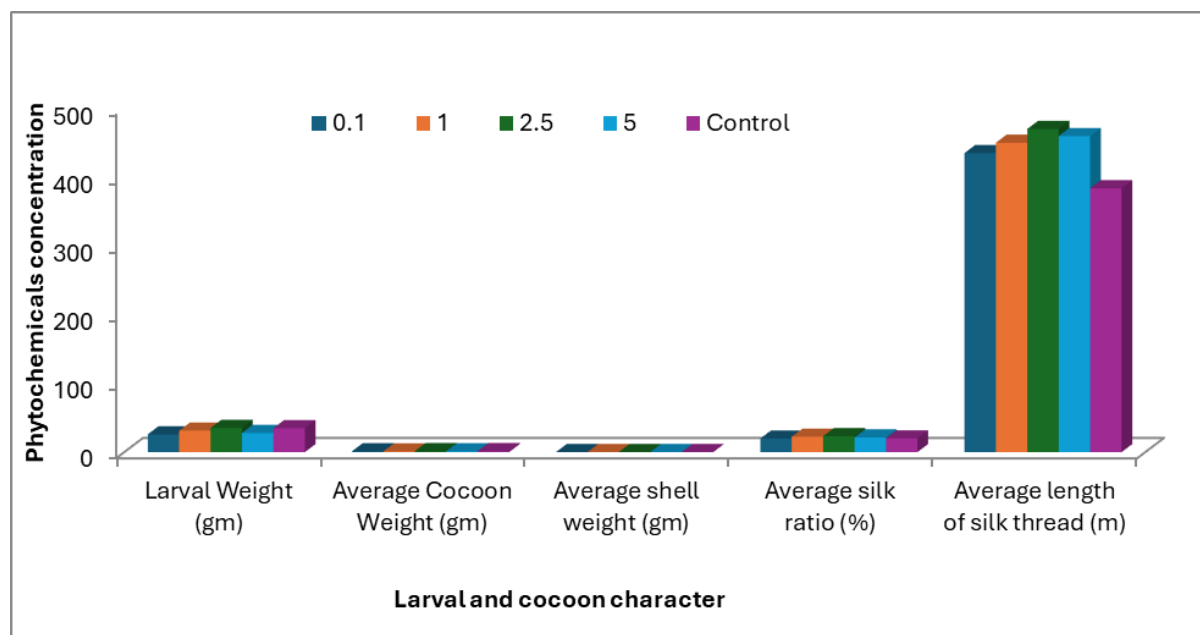
These multivoltine (Pure Mysore x NB4D2) silkworm hybrids have a low productivity rate, but are more adaptable to fluctuating temperatures, subpar hygienic practices, and subsistence farming conditions, which makes them a favorite among farmers with limited resources. The mulberry garden, which was established in 1978, was used to raise it on Kanva leaves until it was spun in the prescribed environmental conditions (Krishnaswami 1978). The newly molted fifth instar larvae were raised in batches with three replications of 100 larvae each, at a controlled temperature of 261°C and a relative humidity of 805%RH. Bougainvillea or Paper Flower's tender leaves were gathered from campus. The leaves and flower were powered after being air dried in the shade for a month. Using petroleum ether as a solvent, varying concentrations of each substance 0.1%, 1.0%, 2.5%, and 5.0% were made in a round bottom flask. The flask's contents were filtered after a week, and the filtrate was used to fortify phytochemicals. The fresh mulberry leaves were weighed and sprayed with a known volume of leaf extract using an atomizer after 24, 48, 72, 90, and 120 hours of fourth molting before feeding. Water-treated worms were maintained as usual; while petroleum-fortified mulberry leaf fed silk worms were kept as a control. The cocoon characteristics of silkworm larvae were examined when they were allowed to develop into their full size and spin a cocoon.

RESULTS AND DISCUSSION

One of the key factors in the success of commercial sericulture is now the management of silkworm illnesses. It is essential to take the required measures to lower the pathogen load and pathogenicity and to improve the larvae' health by boosting their disease resistance in order to produce a consistent and high cocoon output. Plants have unique biochemical mechanisms for producing and storing a wide variety of primary and secondary phytochemicals components, which help the plant defend itself against environmental stressors. For example, these plant compounds have been beneficial to living things as spices and medicines (Akinmoladun et al, 2007, Keita Sekou et. al. 2001). Therefore, botanicals were given to assess the silkworm's ability to fight illness. Phytochemicals have reduced the weight of fifth instar larvae by 26.00 gm, 31.40 gm, and 28.01 gm for 0.1%, 1.0%, and 5.0% concentrations, respectively, but at a 2.5% concentration of phytochemicals, the weight is higher and more effective at 35.40 gm compared to the weight of control batches at 35.00 gm.

Table 1: Effect of the phytochemicals fortification of the mulberry leaf (*Bougainvillea spectabilis*) on the commercial characteristics of the multivoltine silk worm *Bombyx mori* Linn

Concentration of Phyto Chemicals (%)	Larval weight (gm)	Average Cocoon Weight (gm)	Average Shell Weight (gm)	Average silk Ratio (%)	Average Length of silk thread (m)
0.10	26.00	1.29	0.27	19.84	435.3
1.00	31.40	1.17	0.25	22.47	450.40
2.50	35.40	1.50	0.30	23.33	470.40
5.00	28.01	1.30	0.26	21.50	460.10
Control	35.00	1.49	0.27	20.10	384.10

**Figure 1: Effect of the phytochemicals fortification of the mulberry leaf (*Bougainvillea spectabilis*) on the commercial characteristics of the multivoltine silk worm *Bombyx mori* Linn**

The impact of phytochemicals on the cocoon and post cocoon parameters. The cocoon weight after treatment with four different concentrations of paper flower/leaf extract was considerably reduced at 2.5% phytochemicals concentration, but it decreased in comparison to the control at the other three concentrations (0.1%, 1.0%, and 5.0%). The weight of the shell has decreased in the following order at 0.1%, 1.0%, and 5.0% leaf extract phytochemicals concentrations: 0.27gm, 0.25gm, and 0.260gm, with the exception of 2.5%. The shell ratio is 19.84%, 22.47%, 21.50%, and 20.10% at 0.1%, 1.0%, 5.0%, and control parameters, but it increases to 23.33% when the phytochemicals concentration is 2.5%. The extract had a higher phytochemicals concentration of 2.5% at a filament length of 470.40 meters. The silkworms were given mulberry leaves that had been supplemented with 0.1%, 1.0%, 2.0%, and 5.0% *E. globules* leaf extracted. Similar research on the feeding of fortified mulberry by *P. coryleifolia* against silkworm has been documented by (Shivaprakasam, N et al 1996), even if there have been no studies on the impact of this plant extract on

silkworm. On silkworm with extract of *P. coryleifolia* and *T. terrestris*, where the phytochemicals increased the larval weight, silk gland weight, cocoon weight, and silk filament length, (Murugan et al 1998, Shilpashree PS 2013) also described the plant extracts' growth-promoting effect. The improvement in silk output at lower concentration may be attributed, according to (Kanavar GK 1973, Nagashetti SM et al 2013), to the conversion of more leaf ingested during the rearing period and a direct stimulatory effect of the substance on protein production in the silk gland.

Changes in the ratio of circulating hormones could be the cause of these physiological and molecular level shifts. Likewise, silkworms fed mulberry leaves supplemented with extracts of *Terminalia arjuna*, *Tinospora cordifolia*, and *W. somnifera* showed an increase in larval weight when compared to the control group. Chandrasekharan K et al. (2006) and Biabani MR et al. (2005) also demonstrated that the larval weight of *Euphorba prostrata* (3.286g) and *Centella asiatica* (3.284g) was significantly greater than that of water

(3.248g) and normal control (3.255g). In contrast to the control group (30.70g/10larvae), aqueous extract of *T. procumbens*, *T. terrestris*, and *P. hysderophorus* sprayed on silkworm yielded the greatest larval weight (30.25g/10larvae), according to a study by (Nagavelli V et al 2012, Chandrasekharan K et al 2006). Thomas S et al 2013 also recorded a maximum larval weight of 33.8 kg/10 larvae, while (Kona Vs et al 2012) recorded a maximum larval weight of 33.8 kg/10 larvae when additional foliation was performed with 20% *P. hysderophorus* aqueous leaf extract as opposed to the control (24.47/10 larvae). These findings show that, in a manner similar to healthy larvae (Singla S et al 2013, Thomas S et al 2012), leaf extract from Paper Flower or Bougainvillea was able to sustain higher haemolymph protein levels even when NB4D2 infection was present. The damaging impact of multivoltine Pure Mysore on silkworm physiology is highlighted by the noticeable drop in protein concentration in the virus-only group. On the other hand, the fact that leaf extract from medicinal plants like Paper Flower and Bougainvillea can promote protein synthesis and enhance immune function indicates their potential as protective agents in silkworm rearing.

CONCLUSION

The Indian silk business has experienced tremendous expansion throughout the years, and it currently accounts for more than 180% of the world's silk output. In addition to producing all five types of commercially utilized silk in the world, India has become the second-largest producer of raw mulberry silk. Major advancements in Research and Development in tropical sericulture made such a feat possible. Nonetheless, the majority of silk output originates from bivoltine and multivoltine hybrids, which are mostly serrated for the handloom industry. Silk with excellent warp quality that is required for power looms must originate from bivoltine cocoons, which makes its production essential. Furthermore, the Indian silk industry is hampered by two significant limitations: low productivity and high manufacturing costs. The use of botanicals is also growing in significance in sericulture, particularly in the treatment of silkworm diseases. The chemicals in the botanicals have antiviral, antifungal, antiprozoan and antibacterial effects that may be used in a variety of ways in silkworm culture. They have a role in fostering silkworm growth and can indirectly help prevent additional BmNPV epidemics. The antiviral effects of chosen botanicals, including *E. officinalis*, *P. niruri*, and *P. corylifolia*, were examined in this study by testing them on third instar larvae of bivoltine double hybrid DH 1 treated with BmNPV. The chloroform leaf extract of *P. corylifolia* at 1000 ppm was shown to greatly lower the larval mortality of silkworm and also improve economic factors such as larval weight, cocoon weight,

shell weight, shell ratio, filament length, filament weight, and denier. These results indicate that Bougainvillea has potential as a natural component of bed disinfectants and may be successfully integrated into comprehensive methods for managing viral, bacterial, fungal and Protozoan illnesses in silkworm cultivation to the use of these extracts improved the biological features and technological attributes, making it possible to utilized in sericulture to boost the quantity and quality of the cocoon yield.

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REFERENCES

- Akinmoladun C Afolabi Ibukun EO Emmanuel Afor, Efere Martins Obuotor, Farombi EO (2007). Phytochemical constituent and antioxidant activity of extract from the leaves of *Ocimum gratissimum*. Scientific Research and Essays 2(5):163-166.
- Biabani MR Seidavi AR Gholami MR Etebari K Matindoost L (2005) Evaluation of resistance to nuclear polyhedrosis virus in 20 commercial hybrids of silkworm (*Bombyx mori*). Formosan Entomol 25:103-112.
- Chandrasekharan K Nataraju B Balavenkatasubbaiah M Sharma SD Selvakumar T Dandin SB (2006). Effect of BmNPV infection during the later instars on the larval and cocoon characters of silkworm, *Bombyx mori* L. Indian Journal of Sericulture 45(2):104-109.
- Chandrasekharan K Nataraju B, Balavenkata subbaiah M Sharma SD Selvakumar T Dandin SB (2006). Grasserie and post cocoon mortality in silkworm. Indian Silk 45(4):12-13.
- Fraenkel GS (1959) The raison d'etre of secondary plant substances. Science, 129:1466-1470.
- Gad AA Alzahofi NN (2010) Changes in the haemocytes of *Bombyx mori* larvae (Lepidoptera: Bombycidae) in relation to *Escherichia coli* and *Bacillus thuringiensis* infection. Egypt Sci Mag 6(1-2):15-21.
- Karnavar GK and Nayaar KK (1973) Insect fat body J. Anim, Morphol. Physiol 20: 64-69.
- Kéita Sékou Moussa Charles Vincent Jean-Pierre Schmit John Thor Arnason André Bélanger (2001). Efficacy of essential oil of *Ocimum basilicum* L. and *O. gratissimum* L. applied as an insecticidal fumigant and powder to control *Callosobruchus maculatus* (Fab.) Coleoptera: Bruchidae Journal of Stored Products Research 37(4):339-349.
- Kona VS Subramoniam M Binson VA (2012) An Efficient Smart-IoT-Aided Waste Management System with Optimal Shortest Path Routing Using Mud Ring Algorithm. IEEE International Conference on Recent Advances in Systems Science and Engineering RASSE. 1-7.
- Krishnaswami S (1978). New Technology of Silkworm Rearing. CSTI Bulletin, 2:1-28.
- Murugan K Jeyabalan D Senthil Kumar N and Sivaprakasam N (1998) Growth promoting effects of plant products on silkworm A bio-technological approach, J. Sci. Indust. Res 57: 740-745.

- Nagashetti SM Biradar S Dambal SD, Raghavendra CG Parameshachari BD (2013) Detection of disease in Bombyx mori silkworm by using image analysis approach. IEEE Mysore Sub Section International Conference (Mysuru Con) 440-444.
- Nagavelli U Samanta D Chakraborty P (2012). Machine Learning Technology-Based Heart Disease Detection Models. Journal of Healthcare Engineering 1:735-736.
- Ram R (2000) appropriate silkworm rearing technology In: Agrawal HO, Seth MK, editors. Sericulture in India. Bishen Singh Mahendra Pal Singh Press, Dehradun, India 289-302.
- Samson MV Singh RN Sasidharan TO (1998) Resham Jyothi-a wide spectrum bed disinfectant. Indian Silk 37(3):9-10.
- Saxena RN and Tikku (1990). Impact of natural products on the physiology of phytophagous insects. Proc. Indian Acad. Sci. (B) 99: 185-198.
- Shilpashree PS Karegowda AG Suresh KV, Rani L (2013) Classification of Healthy and Diseased Silkworms using Ensemble Learning and CNN. International Conference on Smart Systems for applications in Electrical Sciences (ICSSES) 1-5.
- Shubha K (2005) Efficacy of medicinal plant extracts on stability and spread of BmNPV. [M.Sc. (Seri.) Thesis]. UAS, Bangalore, India 84-87.
- Singla S Garg S, Garg I Jha TK, Singh B Arya H (2013). Diseases are detection in Bombyx Mori Silkworm Using Deep Learning Algorithm CNN. International Conference on Advanced Computing & Communication Technologies (ICACC Tech) 316-320).
- Sivaprakasam N and Rabindra RJ (1996). Integrated disease management methods for grassari in silkworm, Bombyx mori, Indian, J. Seicult 34: 10-104.
- Subramanyam B (1990). Azadirachtin- a naturally occurring insect growth regulator. Proc. Indian Acad. Sci. (B) 99:277-288.
- Thomas S Thomas J (2012) Non-destructive silkworm pupa gender classification with X-ray images using ensemble learning. Artificial Intelligence in Agriculture 6: 100-110.
- Thomas S Thomas JA (2013) Review on existing methods and classification algorithms used for sex determination of silkworm in sericulture. In International Conference on Intelligent Systems Design and Applications 567-579.