

RESEARCH ARTICLE

Influence of *Psoralea corylifolia* on Economic Traits of Silkworm, *Bombyx mori* L.

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ABSTRACT

Sericulture is a vital agro-based industry in which the productivity of the silkworm *Bombyx mori* L. is greatly influenced by nutrition and rearing practices. The present study evaluated the effect of *Psoralea corylifolia* leaf extract on larval growth, cocoon characteristics, and rearing performance. The experiment was conducted using a completely randomized design with seven treatments and two controls, each replicated thrice. Mulberry leaves were treated with different concentrations of the extract and fed during specific stages of larval development. The results revealed that larval weight showed marginal variation among treatments; however, significant improvements were observed in cocoon and reeling traits. Among all treatments, 2 ml/L extract applied on the 2nd and 4th day of the fifth instar exhibited the most consistent and superior performance, recording higher larval weight (18.20 g), lowest disease incidence (4.80%), high survivability (95.20%), and improved cocoon weight (12.20 g), shell weight (2.60 g), and filament length (1205.60 m). This treatment also maintained balanced denier and raw silk percentage, indicating better silk quality. Although higher concentrations (4 ml/L) showed improvements in certain individual parameters, such as survivability and defect reduction, their performance was less consistent across all traits. Overall, *P. corylifolia* extract, particularly at 2 ml/L applied during the early fifth instar, significantly enhanced silkworm productivity and health, suggesting its potential as an eco-friendly biostimulant in sericulture.

Keywords: *Bombyx mori*, *Psoralea corylifolia*, Cocoon traits, Filament length, Silk productivity.

INTRODUCTION

Sericulture is a vital agro-based industry that significantly supports rural employment and the textile economy, especially in Asian countries. The domesticated silkworm *B. mori* is widely used for commercial silk production due to its ability to produce superior-quality silk fibers. The success of sericulture largely depends on larval growth performance and cocoon quality. Since silkworms are reared on mulberry leaves, silk yield is directly influenced by larval development on mulberry (Bhattacharyya et al., 2016). Larval growth is affected

by environmental conditions, feed quality, and rearing practices, with nutrition playing a key role in determining survival, cocoon traits, and silk quality. Being monophagous, silkworms rely solely on mulberry leaves for essential nutrients; however, variations in leaf quality can significantly impact productivity (Pakhale et al., 2014). In recent years, plant-based supplements and herbal extracts have gained attention as natural biostimulants to enhance silkworm performance. The growth and physiology of *B.mori* are highly dependent on diet composition, which directly influences larval

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development, silk gland activity, and cocoon formation (Rahmathulla, 2012). Nutritional and environmental factors also regulate silk gland function and silk protein synthesis (Sehna, 1990). Medicinal plants are rich in bioactive compounds such as flavonoids, alkaloids, phenolics, terpenoids, and essential oils, which possess antioxidant and antimicrobial properties (Cowan, 1999). These compounds can enhance digestion, nutrient absorption, immunity, and overall physiological efficiency, thereby improving silkworm growth and productivity (Rahmathulla, 2012).

Several studies have demonstrated the positive effects of medicinal plant extracts on silkworm biology and cocoon traits. Supplementation of mulberry leaves with extracts of plants such as *Aloe vera*, *Ocimum sanctum*, and *Withania somnifera* has been shown to improve cocoon weight, shell weight, and shell ratio in *B.mori* (Hajam *et al.*, 2024). Similarly, botanical extracts including *Ocimum sanctum*, *Azadirachta indica*, and *Vitex negundo* have enhanced larval growth, cocoon weight, and filament length (Gupta *et al.*, 2022). Other studies also reported improvements in larval weight and economic traits following dietary supplementation with plant extracts (Rafiq *et al.*, 2025; Mohamed *et al.*, 2025). Among medicinal plants, *P.corylifolia* (Babchi) is notable for its rich phytochemical composition and diverse biological activities. It contains compounds such as psoralen, isopsoralen, bakuchiol, flavonoids, and coumarins, which exhibit antimicrobial, antioxidant, and metabolic regulatory properties (Khushboo *et al.*, 2010). These bioactive constituents may enhance nutrient utilization, larval growth, and stress resistance in insects. However, studies on the effect of *P.corylifolia* in silkworm rearing are limited. Therefore, the present study was undertaken to evaluate the effects of *P. corylifolia* applied to mulberry

leaves on silkworm growth performance and cocoon productivity.

MATERIALS AND METHODS

The experiment was conducted in the silkworm rearing house of the Department of Sericulture, Forest College and Research Institute, Mettupalayam, Tamil Nadu, India, under controlled environmental conditions of temperature (25 ± 2 °C) and relative humidity (70–80%), which are optimum for rearing *B.mori*. Seeds of *P.corylifolia* were cultivated under field conditions, and fully matured plants were harvested. The plant materials were washed thoroughly, shade-dried for about one week to preserve bioactive compounds, and ground into coarse powder. A 25 g powder sample was subjected to Soxhlet extraction with hexane at a 1:10 (w/v) ratio. The extract was filtered, concentrated on a rotary evaporator at 40 °C, and stored at 5 °C for further use (Nafiu *et al.*, 2017). The experiment consisted of two controls and six treatments with different concentrations (1, 2, and 4 ml/L) and feeding schedules. Each treatment included 50 larvae with three replications and was arranged in a completely randomized design (CRD) (Nair *et al.*, 2010). Treated mulberry leaves were air-dried before feeding. Silkworm larvae were reared under standard conditions with proper hygiene, spacing, and feeding practices. During the fifth instar, larvae were fed with treated leaves according to the treatment schedule (Soliman, 2025). After completion of larval development, mature larvae were mounted to form cocoons, and cocoons were harvested for further analysis (Sujatha *et al.*, 2015). The collected data were subjected to ANOVA using GRAPES software to determine significant differences among treatments (Konwar *et al.*, 2023). The experimental treatments were arranged as shown in Table 1.

Table 1. Experimental treatments used in the study

Treatment	Description of Treatment
C ₁	Absolute control – Mulberry leaves untreated.
C ₂	Control – Distilled water spray on mulberry leaves
T ₁	1 ml/L extract applied on 2 nd and 4 th day
T ₂	1 ml/L extract applied on 5 th , 6 th and 7 th day
T ₃	2 ml/L extract applied on 2 nd and 4 th day
T ₄	2 ml/L extract applied on 5 th , 6 th and 7 th day
T ₅	4 ml/L extract applied on 2 nd and 4 th day
T ₆	4 ml/L extract applied on 5 th , 6 th and 7 th day

Observations Recorded

To evaluate the influence of *P. corylifolia* extract, both biological and commercial parameters were recorded. For each treatment, 10 larvae, 5 cocoons, 5 pupae, and 5 shells were randomly selected per replication for observation. Larval parameters included larval weight, larval duration, disease incidence (%), and survivability (%). Larval weight was measured during the fifth instar, and duration was recorded based on the time taken for completion of larval development (Soliman, 2025). After the cocoon harvest, cocoon weight, pupal weight, and shell weight were recorded using a digital balance. Shell ratio was calculated using the standard formula: Shell Ratio (%) = (Shell Weight / Cocoon Weight) × 100 (Central Silk Board, 2015). The effective rate of rearing (ERR) was calculated from the number of good cocoons obtained, and defective cocoons were identified by abnormalities such as double, flimsy, or pierced cocoons (FAO, 1990). Disease incidence was recorded as the percentage of infected larvae. Reeling parameters, such as filament length and weight, were measured, and denier was calculated from these measurements. Raw silk percentage was also estimated to assess silk recovery (Central Silk Technological Research Institute, 2017).

RESULTS AND DISCUSSION

The influence of *Psoralea* leaf extract on the growth, cocoon characteristics, and reeling performance of

B.mori is illustrated through bar graphs for larval (Figure 1) and cocoon traits (Figure 2), while reeling parameters are presented in Table 2. The results indicate that both the concentration and the timing of application had significant effects on silkworm growth, cocoon quality, and reeling performance.

Larval Performance

Larval parameters showed a clear improvement under treated conditions compared to controls. Among all treatments, the 2 ml/L extract applied on the 2nd and 4th days recorded the highest larval weight (18.20 g), indicating enhanced nutrient assimilation and improved physiological efficiency. This improvement may be attributed to the presence of bioactive compounds, including flavonoids, coumarins, and phenolics, in *P. corylifolia*, which are known to stimulate digestion and metabolic activity (Cowan, 1999; Rahmathulla, 2012). Similar enhancement in larval growth due to botanical supplementation has been reported by Rafiq *et al.*, (2020). Larval duration remained relatively stable across treatments, with only a slight extension of less than one day. This marginal increase may be associated with prolonged feeding activity and improved nutrient utilization, allowing larvae to accumulate greater biomass before pupation (Nair *et al.*, 2003). Importantly, this extension did not negatively affect cocoon formation, indicating that the treatments supported sustained physiological

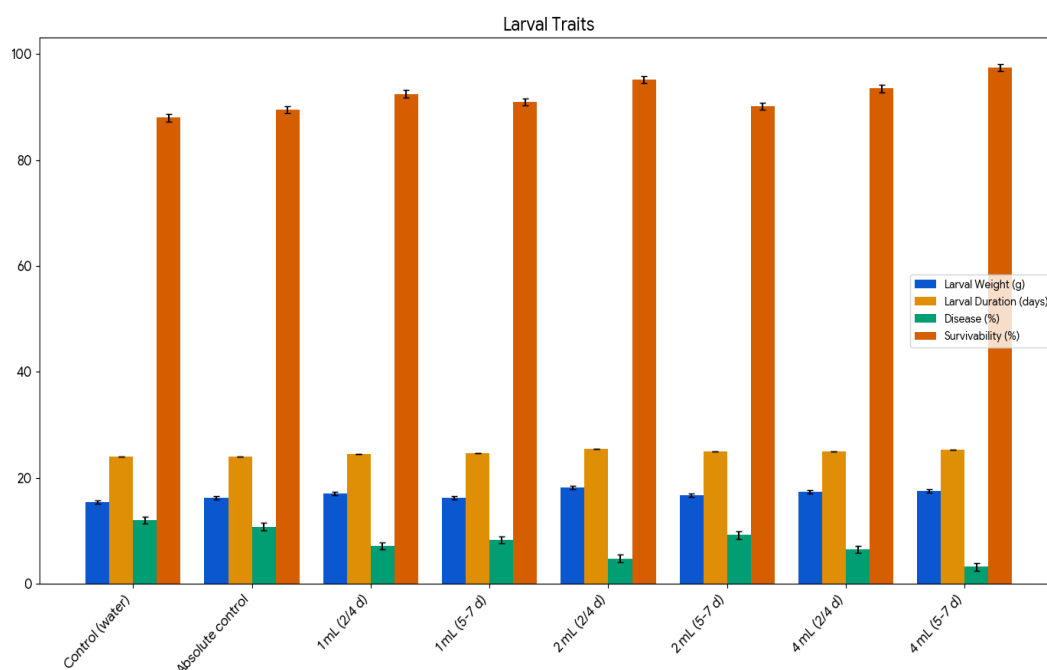


Figure 1. Illustrates the Larval Parameters of Silkworm *B.mori*

development. A significant reduction in disease incidence was observed in treated groups. The lowest disease incidence (3.20%) was recorded at 4 ml/L (5th–7th day), followed by 2 ml/L (2nd & 4th day) at 4.80%, compared with higher levels in the control groups. This clearly demonstrates the antimicrobial properties of *P. corylifolia*, which contains compounds such as psoralen and bakuchiol (Khushboo *et al.*, 2010). Although higher concentrations showed strong disease suppression, their inconsistent performance on other parameters suggests that excessive dosage may impose physiological stress. Survivability was highest in 4 ml/L (5th–7th day) (97.50%), but the 2 ml/L (2nd & 4th day) treatment also maintained high survivability (95.20%) along with superior performance in other traits. This indicates that moderate concentration ensures a balance between immunity enhancement and metabolic stability.

Cocoon Characteristics

Cocoon characteristics showed marked improvement with Psoralea treatments, highlighting the treatments' role in enhancing silk production efficiency. The 2 ml/L (2nd & 4th day) treatment recorded the highest cocoon weight (12.20 g), pupal weight (8.80 g), and shell weight (2.60 g), indicating efficient conversion of ingested nutrients into silk proteins. This suggests enhanced silk gland activity and fibroin synthesis, which are critical determinants

of cocoon quality (Elangovan *et al.*, 2017). Although 4 ml/L (5th–7th day) exhibited the lowest percentage of defective cocoons (1.20%), indicating strong protective effects, its performance in cocoon weight and shell traits was slightly lower than that of the optimal treatment. In contrast, 2 ml/L (on the 2nd & 4th days) maintained balanced performance, with low defective cocoon rates (3.30%) and superior economic traits, making it more suitable for practical application. Shell ratio did not vary significantly among treatments, suggesting that the increase in shell weight was proportional to cocoon weight. This indicates that the treatments enhanced absolute silk yield without altering the structural composition of the cocoon. Similar findings have been reported in studies involving botanical supplementation (Narmadha & Sivaprasad, 2018). The improved cocoon traits can be attributed to improved nutrient assimilation and enhanced physiological processes induced by plant-derived bioactive compounds, thereby supporting silk protein synthesis and energy metabolism.

Reeling Characters

Reeling traits further confirmed the positive impact of *P. corylifolia* extract on silk production. The 2 ml/L (2nd & 4th day) treatment recorded the highest filament length (1205.60 m) and filament weight (0.295 g), indicating enhanced silk secretion and improved silk gland function. This improvement

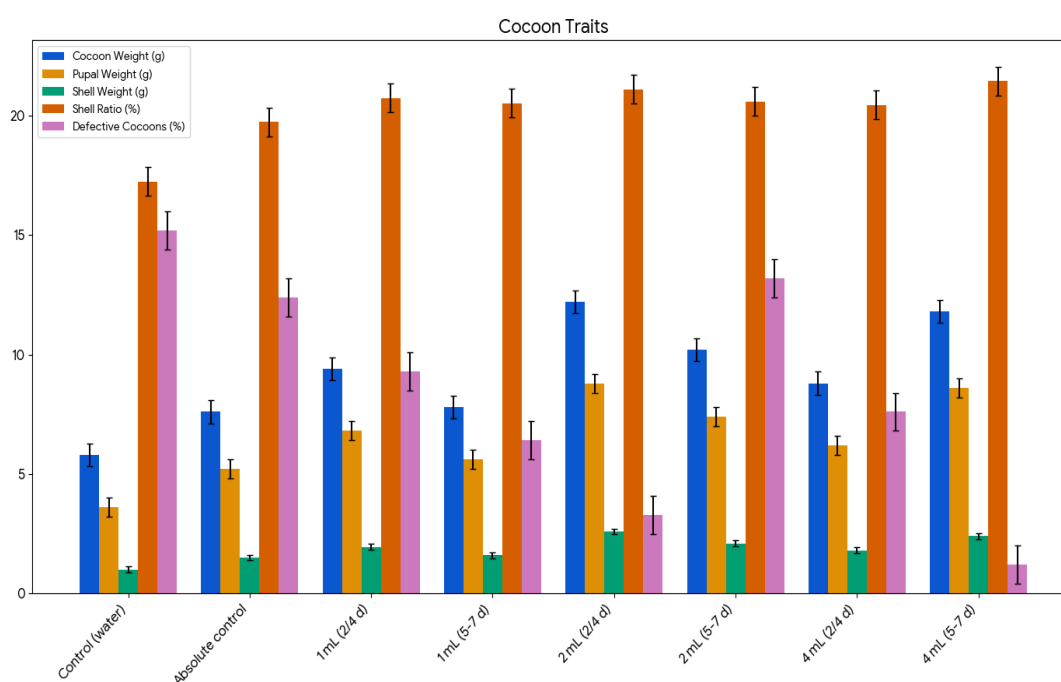


Figure 2. Illustrates the Cocoon Parameters of Silkworm *B.mori*

Table 2. Reeling Traits of *B.mori* under Different Treatments

Treatments	Filament Length (m)	Filament Weight (g)	Denier	Raw Silk (%)
Control (water)	900.00	0.195	1.95	19.50
Absolute control	952.00	0.218	2.06	14.53
1 mL (2nd & 4th day)	1025.50	0.255	2.24	13.08
1 mL (5th–7th day)	978.30	0.228	2.10	14.25
2 mL (2nd & 4th day)	1205.60	0.295	2.20	11.35
2 mL (5th–7th day)	1092.80	0.268	2.21	12.76
4 mL (2nd & 4th day)	1142.60	0.283	2.23	11.79
4 mL (5th–7th day)	1035.40	0.247	2.15	10.74
SE(d)	48.50	0.020	0.12	0.48
CD (0.05)	105.20	0.045	0.26	1.05

is consistent with reports that plant extracts can stimulate fibroin synthesis and silk gland activity (Fouad & Ahmed, 2025). Although 4 ml/L (2nd & 4th day) also showed high filament length (1142.60 m), its variability across other parameters suggests that higher concentrations may not consistently support optimal silk production. Denier values across treatments remained within acceptable limits, indicating uniform filament thickness and good silk quality. The 2 ml/L treatment maintained an optimal denier (2.20), ensuring a desirable balance between fineness and strength of silk filament. The raw silk percentage was also improved in the treated groups, reflecting higher silk recovery efficiency. This indicates that treated cocoons yielded more usable silk during reeling, which is a critical economic parameter in sericulture (Rafiq et al., 2020).

The present study clearly demonstrates that the application of *P. corylifolia* extract has a significant positive influence on the growth, cocoon traits, and reeling performance of *B. mori*. The treatments improved larval health by reducing disease incidence and enhancing survival, while also improving cocoon and silk production parameters. Among all treatments, 2 ml/L extract applied on the 2nd and 4th day of the fifth instar emerged as the most effective and consistent treatment, showing superior performance in larval weight, cocoon weight, shell weight, filament length, and overall rearing efficiency. This treatment maintained an appropriate balance among growth enhancement, silk quality, and disease control. Although higher-concentration (4 ml/L) treatments showed improvements in certain individual traits, such as reduced disease incidence and fewer defective cocoons, their performance was not consistent across all parameters. This indicates that excessive

concentration may lead to variability in physiological response. Overall, the study confirms that moderate concentration with early-stage application is more effective than higher doses, ensuring stable and balanced improvement in all economic traits. The findings suggest that *P. corylifolia* extract can be used as a promising eco-friendly biostimulant in sericulture to enhance productivity and silk quality. Further research focusing on large-scale validation, formulation standardization, and field-level application is recommended to facilitate its practical adoption in commercial sericulture.

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Conflict of Interests

The authors declare no conflicts of interest relevant to this article

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Ethics Statement:

This study involved plant-based experimental material and did not involve human participants or animals. Therefore, ethical approval from an institutional ethics committee was not required.



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Consent for Publication:

All authors have read and approved the final version of the manuscript and consent to its submission and publication in the journal.

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The authors declare that they have no competing financial or non-financial interests that could have influenced the research, analysis, or interpretation of the results presented in this manuscript.

Data Availability:

All data generated or analyzed during this study are included within the manuscript. Additional information related to the study can be obtained from the corresponding author upon reasonable request.

Author Contributions:

All authors contributed significantly to the research and preparation of this manuscript. Conceptualization and study design were carried out by the lead author. Experimental work and data collection were performed by the research team. Data analysis and interpretation were conducted collaboratively. The manuscript was drafted by the lead author and critically reviewed, edited, and approved by all co-authors prior to submission.

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