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Comparative Study of Foliar Biochemical Constituents of Major Host Plants and Their Influence on Growth Performance of *Antheraea mylitta*

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Abstract

The tropical tasar silkworm, *Antheraea mylitta, is an economically important wild silkworm species widely reared in the forests* of India. The growth and productivity of this silkworm largely depend on the nutritional quality of its host plants. The present study investigates the foliar biochemical composition of three major host plants—*Terminalia arjuna*, *Terminalia tomentosa*, and *Shorea robusta*—and evaluates their influence on the growth performance of *Antheraea mylitta* larvae. Important biochemical constituents such as proteins, carbohydrates, lipids, phenols, and moisture content were analyzed. Larval growth parameters, including larval weight, larval duration, and cocoon characteristics, were also assessed. The results indicated that *Terminalia arjuna* had higher protein and carbohydrate content than other host plants, significantly enhancing larval growth and cocoon yield. In contrast, *Shorea robusta* showed higher phenolic compounds that negatively influenced larval development. The study highlights the importance of selecting nutritionally superior host plants to enhance productivity in tasar sericulture.

Keywords: Tasar silkworm, host plants, foliar biochemistry, larval growth, *Antheraea mylitta*

1. Introduction

The productivity of tasar sericulture largely depends on the nutritional quality of host plants consumed by the tropical tasar silkworm *Antheraea mylitta*. Major host plants such as *Terminalia arjuna*, *Terminalia tomentosa*, and *Shorea robusta* differ in their foliar biochemical composition, which directly influences larval physiology and growth performance. Leaves of these host plants contain essential nutrients, including proteins, carbohydrates, lipids, minerals, and vitamins that are necessary for larval metabolism and silk protein synthesis. When larvae feed on nutritionally rich leaves, these nutrients are digested by enzymatic processes in the midgut, thereby improving nutrient assimilation and energy production (Venkataramana et al., 2010). Proteins present in host plant leaves are broken down into amino acids by protease enzymes, which are subsequently used for the synthesis of silk proteins such

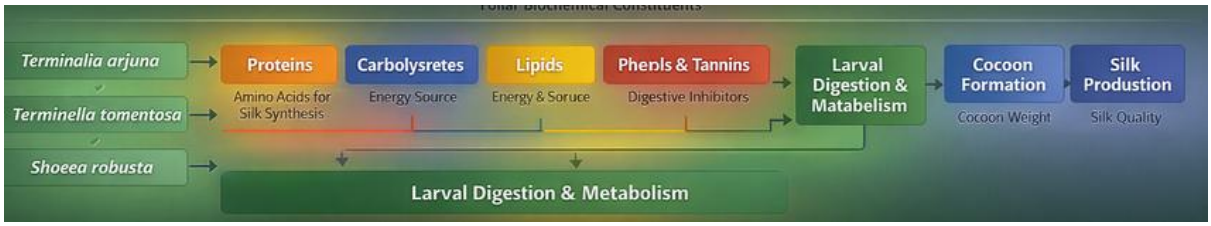
as fibroin and sericin. Carbohydrates are converted into glucose by amylase enzymes, providing the metabolic energy required for larval growth, movement, and cocoon spinning. Lipase enzymes digest lipids and help maintain cellular metabolism and energy balance in developing larvae (Kumari et al., 2017). Consequently, host plants with higher protein and carbohydrate content promote faster larval development, increased larval weight, and better cocoon yield. However, host plants may also contain secondary metabolites such as phenols and tannins, which can inhibit digestive enzyme activity and reduce nutrient absorption. Such biochemical compounds negatively affect larval growth and cocoon quality. Therefore, understanding the relationship between foliar biochemical constituents and larval performance is essential for selecting nutritionally superior host plants and improving tasar silk productivity (Pandey et al., 2016; Rath et al., 2020).

2. Objectives of the Study

1. To analyze the foliar biochemical constituents (protein, carbohydrate, lipid, phenol, and moisture content) of major host plants of *Antheraea mylitta*.
2. To compare the growth performance of *Antheraea mylitta* larvae reared on different host plants.
3. To determine the relationship between leaf biochemical composition and larval growth parameters in tasar silkworm.

2.1 Analysis of Foliar Biochemical Constituents of Major Host Plants of *Antheraea mylitta*

The biochemical composition of host plant leaves plays a crucial role in determining the nutritional quality available to the tasar silkworm *Antheraea mylitta*. Host plants such as *Terminalia arjuna*, *Terminalia tomentosa*, and *Shorea robusta* contain varying concentrations of essential nutrients, including proteins, carbohydrates, lipids, phenolic compounds, and moisture.



These biochemical constituents directly influence larval feeding efficiency, metabolism, and overall development. Proteins serve as an important source of amino acids required for the synthesis of silk proteins. At the same time, carbohydrates act as the primary energy source necessary for larval activity and physiological processes. Lipids contribute to energy storage and cellular metabolism, supporting the overall health and development of the larvae. Moisture content in leaves affects their palatability and digestibility, which, in turn, influences feeding behavior. However, secondary metabolites such as phenols and tannins may act as defensive compounds in plants and can inhibit digestive enzymes in silkworm larvae, thereby reducing nutrient assimilation and growth performance (Rahmathulla, 2012; Bhattacharya & Jolly, 2016). Therefore, analyzing the foliar biochemical constituents of major host plants is essential to understand their nutritional suitability for tasar silkworm rearing.

2.2 Comparison of Growth Performance of *Antheraea mylitta* Larvae on Different Host Plants

The growth performance of *Antheraea mylitta* larvae is strongly influenced by the nutritional quality of the host plants on which they feed. In tasar sericulture, host plants such as *Terminalia arjuna*, *Terminalia tomentosa*, and *Shorea robusta* are commonly used because they provide the essential nutrients required for larval growth and cocoon formation. However, the biochemical composition of these plants differs considerably, which leads to variations in larval development and silk productivity. Host plants that contain higher concentrations of proteins, carbohydrates, and essential minerals tend to support faster larval growth, higher survival rates, and higher cocoon yields. Proteins present in host plant leaves are particularly important because they supply amino acids necessary for the synthesis of silk proteins such as fibroin and sericin. Carbohydrates act as the main energy source required for larval metabolism, feeding activity, and cocoon spinning. When larvae consume leaves rich in these nutrients, their digestive system efficiently converts the nutrients into body tissue and silk proteins, resulting in increased larval weight and improved cocoon characteristics. In contrast, host plants with higher levels of phenolic compounds and tannins may reduce digestive efficiency and nutrient absorption, thereby slowing larval development and reducing cocoon yield (Rahmathulla, 2012).

Table: Growth Performance Parameters of *Antheraea mylitta* Larvae on Different Host Plants

Growth Parameter	Terminalia arjuna	Terminalia tomentosa	Shorea robusta
Larval Weight (g)	High	Moderate	Low
Larval Duration (days)	Short	Moderate	Long
Survival Rate (%)	High	Moderate	Lower
Cocoon Weight (g)	High	Moderate	Low
Shell Weight (g)	High	Moderate	Low

The comparative evaluation of larvae reared on different host plants provides valuable insights into the suitability of each plant species for tasar silkworm cultivation. Studies have shown that larvae reared on *Terminalia arjuna* often exhibit better growth performance due to the higher nutritional value of its leaves. Larvae feeding on *Terminalia tomentosa* generally demonstrate moderate growth performance, while those feeding on *Shorea robusta* may show comparatively slower growth because of the presence of inhibitory secondary metabolites (Singh & Srivastava, 2018). Growth performance of silkworm larvae can be assessed using several biological parameters, including larval weight, larval duration, survival rate, cocoon weight, and shell weight. These parameters provide a comprehensive understanding of how different host plants influence larval physiology and silk production. Evaluating these characteristics helps researchers identify nutritionally superior host plants that can enhance tasar silk productivity and improve the economic viability of sericulture practices.The comparative results clearly indicate that *Terminalia arjuna* is the most suitable host plant for tasar silkworm rearing, as it supports better larval growth, higher survival rate, and superior cocoon quality. Therefore, proper

selection and management of nutritionally rich host plants are critical to enhancing the productivity and sustainability of tasar sericulture systems.

2.3 Relationship Between Leaf Biochemical Composition and Larval Growth Parameters

The correlation between the biochemical content of host plant leaves and the growth rate of Antheraea mylitta larvae is important to understand. It can be used to enhance the productivity of tasar sericulture. Leaves with high nutrients will facilitate the process of good digestion and absorption of nutrients that will translate into weight gain in larval, a higher rate of growth, and high cocoon productivity. Proteins and carbohydrates found in leaves are decomposed into amino acids and metabolic energy, respectively, contributing to the synthesis of silk proteins and larval movement and cocoon spinning. Lipids are pertinent in the regulation of cellular functions and energy balance. Conversely, increases in phenolic compounds and tannin concentrations can suppress digestive enzyme activity and decrease nutrient uptake, which may eventually affect larval growth and cocoon quality. When foliar biochemical constituents are analyzed together with larval growth parameters, one can develop a definite correlation between the host plant nutrition and silkworm productivity. The research can be useful in selecting the most appropriate host plants and enhancing management practices in tasar sericulture systems (Kumar et al., 2019).

3. Materials and Methods

3.1 Study Area

The current study was conducted under laboratory rearing conditions to assess how host plant biochemical composition influences the growth performance of the tropical tasar silkworm, Antheraea mylitta. The fresh leaves of the host plants, which are widely used in forests, were collected from local plantations used in tasar sericulture. The fact is that the rearing experiment was carried out under the same environmental conditions (temperature, humidity, and light) to eliminate external variation, and the observed variations in larval performance were primarily related to the nutritional value of the host plants.

3.2 Host Plants Selected

Three major host plants widely used for rearing *Antheraea mylitta* were selected for the study:

- ***Terminalia arjuna***
- ***Terminalia tomentosa***
- ***Shorea robusta***

These host plants were also used to collect healthy, fully grown leaves during the rearing season. The leaves were washed with distilled water to remove dust and other impurities, then used to conduct biochemical analyses and feeding experiments.

3.3 Biochemical Analysis of Leaves

Analysis of the collected leaf samples was conducted to identify relevant biochemical constituents affecting silkworm nutrition. Protein analysis was done using the Lowry method, and carbohydrate

analysis was done using the Anthrone method. Soxhlet extraction was used to determine the lipid content, and the Folin-Ciocalteu method was used to measure phenolic compounds. The moisture content of the leaves was measured by the oven-drying method.

3.4 Rearing of Silkworm Larvae

Antheraea mylitta were raised under controlled, disease-free conditions. Larvae were categorized into three experimental groups, with each group being fed on leaves of only one of the host plants chosen during the larval period.

3.5 Growth Performance Parameters

Performance on growth was measured as the larval weight, larval duration, cocoon weight, and cocoon shell weight.

3.6 Statistical Analysis

One-way Analysis of Variance (ANOVA) was used to analyze the collected data and determine significant differences among treatments. The statistical significance level was set at $p < 0.05$.

4. Results and Discussion

4.1 Foliar Biochemical Composition of Host Plants

Leaf biochemical composition of the host plants is a decisive factor in the nutritional value of the leaves to the larvae of Antheraea mylitta. In the current paper, the foliar biochemical composition of three prominent host plants, including Terminalia arjuna, Terminalia tomentosa, and Shorea robusta, was examined to understand their effects on silkworm nutrition and growth.

Table 1: Foliar Biochemical Composition of Major Host Plants

Host Plant	Protein (%)	Carbohydrate (%)	Lipid (%)	Phenol (%)	Moisture (%)
Terminalia arjuna	18.5	24.3	6.2	1.2	68.5
Terminalia tomentosa	16.2	21.7	5.4	1.6	66.2
Shorea robusta	14.1	19.8	4.8	2.3	65.1

The findings show that the Terminalia arjuna leaves contain the most protein, carbohydrates, lipids, and moisture among the three host plants. The increased protein content makes the source dependent on the essential amino acids required for silk protein synthesis. In contrast, carbohydrates serve as a significant source of energy to the larval metabolism and growth. Leaf palatability and digestibility are also influenced by moisture content, which stimulates productive feeding on silkworm larvae.

On the contrary, the leaves of Shorea robusta contained relatively less proteins and carbohydrates and had a higher level of phenolic compounds. The phenols and tannins are recognized plant defense compounds that may suppress digestive enzymes and reduce nutritional absorption in silkworm larvae. Thus, the larger leaves, which possess greater phenolic loads, could have a deleterious impact on the larva's growth and development. The biochemical constituents of Terminalia tomentosa were intermediate, meaning that the nutritional appropriateness of tasar silkworm rearing was moderate.

4.2 Growth Performance of *Antheraea mylitta*

The growth performance of *Antheraea mylitta* larvae reared on different host plants was evaluated using parameters such as larval weight, larval duration, cocoon weight, and cocoon shell weight.

Table 2: Growth Performance of *Antheraea mylitta* on Different Host Plants

Host Plant	Larval Weight (g)	Larval Duration (days)	Cocoon Weight (g)	Shell Weight (g)
Terminalia arjuna	32.5	28	12.8	2.6
Terminalia tomentosa	29.3	30	11.4	2.2
Shorea robusta	26.1	32	9.8	1.8

The findings indicated that larvae reared on Terminalia arjuna had the highest larval weight, the shortest larval period, and the best cocoon features compared to larvae reared on other host plants. This could be explained by the fact that the nutritional content of T. arjuna leaves is better, particularly in protein and carbohydrate concentrations.

The growth performance of larvae reared on Terminalia tomentosa was moderate, as the plant had an intermediate leaf biochemical composition. Conversely, the larvae that appeared on Shorea robusta had the lowest larval weight and yield of cocoon. This reduced performance could be linked to the increased phenolic content of S. robusta leaves, which can adversely affect the activity of digestive enzymes and nutrient uptake, underscoring the nutritional superiority of host plants in effective tasar sericulture.

5. Discussion

Results show that the quality of nutritional food web type leaves of host plants has a great impact on the larval development and the cocoon generation in the Antheraea mylitta. Protein- and carbohydrate-rich leaves enhance nutrient digestion and metabolism, thereby improving larval growth. The availability of secondary metabolites (e.g., phenols and tannins) in host plants can inhibit digestive enzyme activity and nutrient uptake. This was the reason for the comparatively low performance of larvae fed on Shorea robusta. These findings affirm that the choice of more nutritionally beneficial host plants is very important for enhancing the productivity of tasar silk.

6. Conclusion

The paper concludes that the growth performance of Antheraea mylitta is strongly influenced by the host plant's foliar biochemical composition. Among the host plants under study, Terminalia arjuna was found to be the best, owing to higher protein and carbohydrate content and lower phenolic compound content. Larvae raised on this host plant exhibited better growth rates, higher larval weights, and greater cocoon yields. Thus, tasar sericulture may be greatly improved and rendered more sustainable by cultivating nutritionally beneficial host plants such as Terminalia arjuna.

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