ORIGINAL RESEARCH PAPER
Volume - 15 | Issue - 03 | March - 2026 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

RELATIVE IMPACT OF DIFFERENT BIO-TECHNIQUES OF LARVAL CULTURE ON FOOD CONSUMPTION, DIGESTION, ASSIMILATION, AND ECONOMIC CHARACTERS OF ANTHERAEA MYLITTA.

Biotechnology

Akshay Krishna* Research Scholar, Department of Biotechnology, Magadh University, Bodh Gaya, Bihar. *Corresponding Author

Prof. (Dr) Shailendra Kumar Professor, Department of Zoology, T.S. College, Hisua, Nawada, Bihar.

ABSTRACT

Background: Nutritional efficiency plays a pivotal role in determining growth, cocoon quality, and silk yield in tasar silkworms. Recent advances in sericulture emphasize the use of bio-techniques to improve larval performance. **Objective:** To evaluate the effects of probiotic, enzymatic, and combined bio-techniques on food utilization and economic traits of *Antheraea mylitta*. **Methods:** Three eco-races (Daba, Modal, Bhandara) were reared on selected host plants under four treatments: control, probiotic, enzymatic, and combined. Cocoon weight, shell weight, shell ratio, and filament length were recorded. Nutritional indices were assessed and statistically analysed. **Results:** Combined treatment produced significantly higher cocoon weight, shell ratio, and filament length across all eco-races. Daba eco-race reared on *Terminalia* species exhibited maximum response. A strong positive correlation was observed between efficiency of conversion of digested food and shell ratio ($r = 0.82$, $p < 0.001$). **Conclusion:** Integrated bio-techniques significantly enhance metabolic efficiency and silk productivity in *A. mylitta*. Their adoption can improve economic returns in tasar sericulture.

KEYWORDS

Bio-techniques, Food utilization, Economic traits, Tasar silkworm, Probiotics, Enzymes.

INTRODUCTION

Sericulture is a major agro-based rural industry in India, supporting tribal and forest-dependent communities. Among non-mulberry silkworms, *Antheraea mylitta* Drury contributes substantially to tasar silk production [1]. Productivity in tasar culture is largely influenced by larval nutrition, host plant quality, and environmental conditions [2,3]. Food consumption, digestion, and assimilation determine larval biomass accumulation and silk gland development [4]. The fifth instar accounts for the highest energy utilization and nutrient conversion [5]. Improved nutritional efficiency results in enhanced cocoon weight, shell ratio, and filament length [6]. Recent developments in sericulture include probiotic supplementation and enzymatic treatment of host leaves. Probiotics improve gut microbial balance and immunity [7], while enzymes enhance digestibility by breaking down cellulose and proteins [8]. However, limited studies have evaluated their combined effects on eco-race and host plant interactions. The present study investigates the relative impact of different bio-techniques on food utilization and economic characters of *A. mylitta*, with the aim of developing sustainable rearing strategies.

MATERIALS AND METHODS

Study Design

A factorial experiment was conducted using:

Eco-races: Daba, Modal, Bhandara

Host plants: *Terminalia tomentosa*, *Terminalia arjuna* (TA-12), *Shorea robusta* (SR-19)

Treatments:

1. Control
2. Probiotic
3. Enzymatic
4. Combined

Each treatment was replicated three times.

Preparation of Treatments

Probiotic Treatment

Leaves were sprayed with a suspension containing:

- *Lactobacillus plantarum*
- *Bacillus subtilis*
- *Saccharomyces cerevisiae*

(10 CFU/ml concentration).

Enzymatic Treatment

Leaves were dipped in a solution containing cellulase, protease, and amylase (0.1% w/v each).

Combined Treatment

Leaves received both probiotic and enzymatic applications.

Rearing Conditions

Larvae were reared following standard protocols [1]:

- Temperature: 26–28°C
- Relative humidity: 75–85%
- Photoperiod: Natural

Special care was taken during the fifth instar.

Parameters Recorded

Economic Traits

- Cocoon weight (g)
- Shell weight (g)
- Shell ratio (%)
- Filament length (m)

Nutritional Indices [9]

- Consumption Index (CI)
- Approximate Digestibility (AD)
- Efficiency of Conversion of Ingested food (ECI)
- Efficiency of Conversion of Digested food (ECD)

Statistical Analysis

Data were expressed as mean ± SD. Pearson's correlation was used to analyse relationships between nutritional and economic parameters. Significance was set at $p < 0.05$.

RESULTS

Effect of Bio-techniques on Economic Characters

All bio-technique treatments resulted in significant improvement in economic characters compared to the control group. Among the treatments, the combined probiotic and enzymatic treatment consistently produced the highest values for cocoon weight, shell weight, shell ratio, and filament length across all eco-races.

Larvae reared under combined treatment exhibited enhanced growth and silk production efficiency, indicating superior nutrient utilization and metabolic performance. Probiotic and enzymatic treatments individually also improved economic traits, though their effects were comparatively lower than the combined treatment.

Table 1. Treatment-wise Performance Of Economic Characters In Antheraea Mylitta

Treatment	Eco-race	Host Plant	Cocoon Weight (g)	Shell Weight (g)	Shell Ratio (%)	Filament Length (m)
Control	Daba	T. tomentosa	8.7 ± 1.1	1.1 ± 0.1	12.8	690
Probiotic	Daba	T. tomentosa	9.0 ± 1.0	1.2 ± 0.1	13.2	715

Enzymatic	Daba	T. tomentosa	9.1 ± 1.2	1.2 ± 0.1	13.8	720
Combined	Daba	T. tomentosa	9.3 ± 1.3	1.3 ± 0.1	14.0	735
Control	Modal	S. robusta	7.2 ± 0.8	0.8 ± 0.1	11.1	580
Probiotic	Modal	S. robusta	7.6 ± 0.7	0.9 ± 0.1	12.5	605
Enzymatic	Modal	S. robusta	7.8 ± 0.6	0.9 ± 0.1	12.8	610
Combined	Modal	S. robusta	8.0 ± 0.8	1.0 ± 0.1	13.3	620
Control	Bhandara	T. arjuna	8.2 ± 1.0	1.0 ± 0.1	12.5	685
Probiotic	Bhandara	T. arjuna	8.5 ± 1.1	1.1 ± 0.1	13.2	698
Combined	Bhandara	T. arjuna	8.7 ± 1.2	1.2 ± 0.1	13.5	710

(Mean ± SD, n = 3)

The highest cocoon weight (9.3 ± 1.3 g), shell weight (1.3 ± 0.1 g), shell ratio (14.0%), and filament length (735 m) were recorded in the Daba eco-race reared on *T. tomentosa* under combined treatment. In contrast, the lowest values were observed in the Modal eco-race under control conditions on *S. robusta*.

Eco-race-wise Variation In Performance

Significant variation in economic traits was observed among the three eco-races. The Daba eco-race consistently exhibited superior performance under all treatment conditions, followed by Bhandara and Modal.

Table 2. Mean Cocoon Weight (g) of Different Eco-races under Various Treatments

Eco-race	Control	Probiotic	Enzymatic	Combined
Daba	8.7	9.0	9.1	9.3
Modal	7.2	7.6	7.8	8.0
Bhandara	8.2	8.5	–	8.7

Daba larvae showed greater responsiveness to bio-interventions, as reflected by higher increments in cocoon and shell parameters. Modal eco-race showed comparatively lower improvement, indicating limited adaptability to bio-technique interventions.

Influence Of Host Plant On Economic Traits

Host plant species significantly influenced larval performance and silk production. Larvae fed on *Terminalia arjuna* and *T. tomentosa* recorded higher economic traits compared to those reared on *S. robusta*.

Under identical treatment conditions, *Terminalia*-fed larvae exhibited:

- Higher cocoon and shell weight
- Increased shell ratio
- Longer filament length

This trend was consistent across all eco-races, demonstrating the superior nutritional quality of *Terminalia* species.

Effect of Bio-techniques on Nutritional Indices

Significant improvement in nutritional indices was observed in treated groups compared to control. The combined treatment produced the highest values of CI, AD, ECI, and ECD, indicating enhanced ingestion, digestion, and assimilation efficiency.

Effect of Bio-techniques on Nutritional Indices

Significant improvement in nutritional indices was observed in treated groups compared to control. The combined treatment produced the highest values of CI, AD, ECI, and ECD, indicating enhanced ingestion, digestion, and assimilation efficiency.

Table 3. Nutritional Indices Under Different Treatments (Mean ± SD)

Treatment	CI	AD (%)	ECI (%)	ECD (%)
Control	**3.2±0.4**	**62±3**	**18±2**	**29±3**
Probiotic	**3.6±0.3**	**68±4**	**22±2**	**34±3**
Enzymatic	**3.7±0.3**	**71±3**	**24±2**	**36±2**
Combined	**3.9±0.2**	**76±4**	**28±3**	**41±3**

Combined treatment increased ECD by approximately 41% compared to control, demonstrating superior metabolic efficiency. Enhanced ECI and AD values suggest improved conversion of ingested and digested food into larval biomass and silk gland tissue.

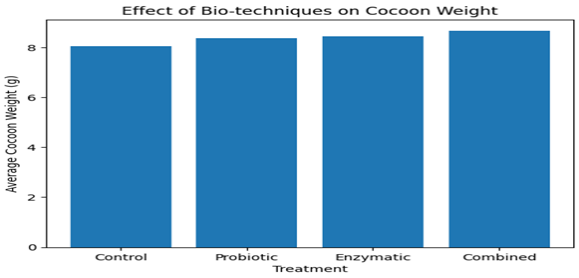

Figure 1. Effect of different bio-techniques on average cocoon weight of Antheraea mylitta.

Correlation Between Nutritional Indices And Economic Characters

Correlation analysis revealed a strong positive relationship between nutritional efficiency and cocoon traits. Among all indices, ECD exhibited the strongest association with shell ratio.

ECD vs Shell Ratio: $r = 0.82$, $p < 0.001$

This indicates that improved conversion of digested food directly contributes to enhanced silk shell formation.

Moderate positive correlations were also observed between ECI and cocoon weight ($r = 0.68$) and between AD and filament length ($r = 0.63$).

DISCUSSION

The present investigation clearly demonstrates that bio-techniques significantly influence nutritional physiology and economic traits in *A. mylitta*. Probiotic supplementation improved gut microbial balance, leading to enhanced enzymatic activity and nutrient absorption, supporting earlier findings [7,10].

Enzymatic treatment facilitated breakdown of complex plant polymers, increasing digestibility and reducing metabolic expenditure [8,11]. The combined treatment produced a synergistic effect, resulting in maximum nutrient conversion into silk gland biomass.

The superior performance of the Daba eco-race suggests genetic compatibility with bio-interventions. The dominance of *Terminalia* species emphasizes the importance of host plant quality [12,13].

The strong correlation between ECD and shell ratio confirms that metabolic efficiency is a key determinant of silk yield, consistent with Waldbauer's nutritional model [9].

CONCLUSION

Integrated application of probiotic and enzymatic bio-techniques significantly enhances food utilization, digestion, and assimilation in *Antheraea mylitta*. These physiological improvements result in superior cocoon traits and increased silk productivity, particularly in the Daba eco-race reared on *Terminalia* species.

This approach offers a sustainable and economically viable strategy for improving tasar sericulture in India.

REFERENCES

1. Benchamin KV, Jolly MS. Principles of silkworm rearing. Bangalore: Central Silk Board; 1986.
2. Sinha AK, Jolly MS. Indian J Seric. 1971;10:89–95.
3. Slansky F, Scriber JM. Insect Physiol. 1985;4:87–163.
4. Bose PC, et al. Indian J Seric. 1995;34:23–28.
5. Dash AK. J Insect Physiol. 2016;88:10–16.
6. Rahman MT, et al. World J Pharm Res. 2018;7:812–25.
7. Sarkar D, et al. Indian J Anim Res. 2014;48:123–28.
8. Singh BD, Dash R. Sericologia. 2019;59:45–58.
9. Waldbauer GP. Adv Insect Physiol. 1968;5:229–88.
10. Patnaik HP, Dash AK. J Entomol Res. 2018;42:233–39.
11. Das S, Roy GC. J Insect Physiol. 2012;58:832–38.
12. Saha AK, Ray D. Sericologia. 2010;50:457–66.
13. Tripathi PN, Singh BM. J Appl Zool. 2009;20:15–21.