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Impact of Host Plants on Growth, Development and Economic Characters of Eri Silkworm (*Samia ricini* Boisd.)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Eri silkworms (*Samia ricini* Boisd.) are phytophagous insect which feeds on a numbers of host plants. In the present study an effort was made to evaluate the economic characters like larval duration (days), larval weight (g), single cocoon weight (g), pupal weight (g), single shell weight (g), shell ratio (%), effective rate of rearing (ERR %) of two promising eco-races of eri silkworm *viz.,* Titabar and Borduar. The main objective of this study was to highlight the critical role of food plants

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and eco-race selection in influencing the growth, development and economic viability of eri silkworm rearing. The findings of the present investigation showed that two eco-races of eri silkworm reared on castor leaves found to be performed better in all the parameters followed by borpat and tapioca leaves. The lowest value for all the economic characters were found in both the eco-race reared on borkesseru leaves.

Keywords: Eri silkworm; eco-race; host plants; economic characters.

1. INTRODUCTION

In the realm of sericulture, where the delicate process of silk production begins, the quality of food plants plays a pivotal role. Silkworms are voracious feeders with specific dietary requirements. Since the phytophagous silkworms solely depend on their host plants, the importance of the food plants cannot be overstated. The host plans are fundamental to entire sericulture process, influencing everything from the growth and development of silkworm to the economic viability of silk production.

Eri silkworm culture is mostly practiced by the tribal peoples of hills and plains of North-Eastern region, India, is specially confined to the Brahmaputra valley of Assam [1]. Eri silkworm being polyphagous in nature can thrive on a variety of host plants. These host plants are categorized as primary, secondary and tertiary host plants depending on their preferability o feed on that particular plant and the yield potential of quality silkby feeding on those host plant leaves [2]. castor (*Ricinus communis*) and kesseru (*Heteropanax fragrans*) are the primary host plant where borpat (*Ailanthus grandis*), borkesseru (*Ailanthus excelsa*), tapioca (*Manihot utilissima*) etc. are the secondary host plants of eri silkworm. The prime objective of the Sericulture industry is to enhance the silk yarn production, which largely depends on the ingested food and their utilization by the silkworms [3]. Though these host plants provide the balanced nutrition profile to support the optimal growth of the silkworms, all are not equally good for eri silkworm rearing and they use to perform differently when reared on different food plants [4]. It has been well documented that yield attributing characters are varied from one race to another due to variation of nutritional quality in different host plant. The twenty six eco-races of eri silkworms are found in the North-Eastern region [5]. It is incumbent to screen out the best performed eco-race of eri silkworm to maximize the yield of silk. Castor is the most suited and preferred primary host plant for eri silkworm, but mostly it is annual in nature. Moreover, it is not found throughout the year to conduct the rearing of multivoltine eri silkworms. Therefore, it is necessary to avail the alternate host plants for continuing the rearing of silkworms all round the year to produce quality and quantity of silk. In the present study, the economic characters of two eco-races of eri silkworm were evaluated to find out the most suited host plant for the rearing of eri silkworm.

2. MATERIALS AND METHODS

The present experiment to find out the economic characters of Borduar and Titabar eco-races of eri silkworm reared on five different host plants was conducted in the well-equipped rearing room of the Department of Sericulture, Assam Agricultural University, Jorhat during the two consecutive years (2023-24). Castor, kesseru, borpat, borkesseru and tapioca were selected for rearing of eri silkworm by following the standard rearing techniques suggested by Chowdhury [6]. The silkworms of both the eco-races were reared on these selected host plants under normal room temperature and humidity condition from first to fifth instar. Three replications consisting 100 larvae for each of the host plants were maintained separately for both the eco-races. The larvae were fed four times with quality leaves daily except during the moulting period. With the advancement of the ages of the larvae the quantity of food was increased as required by the worms. Mature worms were mounted treatment wise separately on separate chandraki for spinning of the cocoons and harvested after completion of the cocoon formation. The experiment was laid out in Completely Randomized Design (CRD) for evaluation of different economic parameters *viz.,* larval duration (days), full grown and mature larval weight (g), single cocoon weight (g), pupal weight (g), single shell weight (g), shell ratio (%), effective rate of rearing (ERR%). The experimental errors of the various effects were determined by calculating their respective F-values as described by Panse and Sukhatme, [7].

3. RESULTS AND DISCUSSION

The findings on morpho-economic traits of the Borduar and Titabar eco-race of eri silkworm fed on five different host plants are presented with the help of the Table 1 and Fig. 1.

3.1 Larval Duration (Days)

Larval duration is a crucial trait since it reduces the amount of food used during its larval life without impacting the yield of cocoons [8]. A shorter larval period accelerates the overall lifecycle of the silkworm which leads to faster silk production. The larval duration was found to be shorter in case of castor fed larvae irrespective of the eco-race. The larval duration of eri silkworm reared on different host plant differed significantly. Lowest larval duration was observed in the Titabar eco-race (26.167 days) reared on castor leaves and the longest duration was observed in case of Borduar eco-race (32.167 days) reared on borkesseru leaves. Among the host plants castor reared larvae shows shortest larval duration for both the Titabar and Borduar eco-race (26.167 days) and (28.333 days) respectively followed by borpat and tapioca reared larvae (Table 1). The interaction between the eco-race and the host plant was found to be significant. The present result got strengthened with the result of Ray et al*.* [9]; Kumar and Elongovan, [10] and Swathiga et al. [8] who reported the shortest larval duration in Titabar eco-race. Kamble and Jadhav [2] reported the shortest larval duration of eri silkworm fed on castor leaves.

3.2 Full Grown Larval Weight (g)

Achieving higher larval weight can be a sign of effective resource or food utilization which contributes to the better silk production efficiency by the silkworms. In case of full grown larval weight it was found to be maximum in Titabar eco-race fed on castor leaves (9.369 g) followed by borpat (8.057 g) and tapioca (6.202 g). The lowest full grown larval weight was found in borkesseru fed Borduar eco-race (5.312 g). Irrespective of the eco-race the maximum full grown larval weight was recorded in castor fed larvae followed by borpat and tapioca fed one. The full grown larval weight was found to be significantly different for the different host plant. The interaction between eco-race and the host plant was found to be significant. The current findings are consistent with those of Kumar and Elongovan [10] and Swathiga et al. [8].

3.3 Mature Larval Weight (g)

The data presented on the Table 1 depicted that mature larval weight also follows the same trend as full grown larval weight. Highest mature larval weight was recorded in case of castor fed Titabor eco-race (7.265g) followed by borpat (5.918 g) and tapioca (5.210 g) fed silkworms. The silkworm fed with borkesseru leaves showed lower mature larval weight for both the eco-races. Between the two eco-races Titabar performed well when reared with all the selected host plant leaves. Significant variation was observed among the host plant and between the two eco-races. Similar results of the castor fed eri silkworms mature larval weight were also reported by Bora et al. [11].

3.4 Effective Rate of Rearing (ERR %)

ERR is an imperative physiological criteria for selecting the superior quality silkworm breeds [12]. Studying this parameter allows for better management of resources such as space, feed that ensuring the optimal condition for better growth and development of the silkworms. In essence, the ERR% is a crucial parameter that impacts the efficiency, cost-effectiveness and profitability of silkworm rearing because it has direct impact on cocoon yield. In the present investigation ERR % was found to be higher in case of castor reared silkworm for Titabar and Borduar eco-race *i.e.* 95.167% and 92% respectively. Among the host plants castor reared silkworms shows highest ERR% irrespective of the eco-races. This result was in accordance with the findings of Kumar and Elangovan [13].

3.5 Cocoon Weight (g)

Good cocoon weight is vital in sericulture because it directly impacts silk yield and economic returns. Heavier cocoons generally produce more silk and longer filament, enhancing both quantity and quality of the final product. In contrast with the findings of Kamble and Jhadav [2], the cocoon weight was found to be more in castor reared eri silkworm irrespective of the eco-races followed by borpat and tapioca reared worms. Variation in cocoon weight was noticed between the eco-races and among the host plants. Between the Titabar and Borduar eco-races of eri silkworm, in case of Titabar highest single cocoon weight was observed when reared on different host plants.The highest cocoon weight was recorded in castor reared Titabar

Table 1. Morpho-economic traits of promising eco-races of eri silkworm reared on different host plant

Eco-race	Host plant	Larval duration (days)	Weight of full-grown larva (g)	Weight of mature larva (g)	ERR (%)	Cocoon weight (g)	Shell weigh (g)	Pupal weight (g)	Shell ratio (%)
Titabar	Castor	26.167	9.369	7.265	95.167	4.105	0.596	3.476	12.168
	Kesseru	29.833	6.498	4.962	90.167	2.751	0.389	2.314	9.447
	Borpat	28.167	8.057	5.918	93.500	3.314	0.515	2.806	11.329
	Borkesseru	30.667	5.812	4.718	88.500	2.264	0.302	1.925	9.380
	Tapioca	29.000	6.202	5.210	91.917	2.995	0.422	2.500	9.804
Mean		28.767	7.187	5.614	91.850	3.086	0.445	2.604	10.426
Borduar	Castor	28.333	7.796	5.512	93.556	3.187	0.432	2.723	10.959
	Kesseru	31.167	5.480	3.900	87.083	2.407	0.317	2.073	9.506
	Borpat	29.000	6.915	5.022	91.167	3.000	0.406	2.603	10.987
	Borkesseru	32.167	5.312	4.582	85.750	2.127	0.299	1.825	8.911
	Tapioca	30.167	6.126	4.980	90.050	2.563	0.364	2.204	9.770
Mean		30.167	6.325	4.799	89.521	2.657	0.363	2.287	10.027
Host plant	SEd(±)	0.175	0.290	0.203	0.178	0.095	0.010	0.026	0.215
	CD (5%)	0.367	0.609	0.427	0.375	0.199	0.021	0.054	0.451
Eco-race	SEd(±)	0.111	0.183	0.128	0.113	0.060	0.006	0.016	0.136
	CD (5%)	0.232	0.385	0.270	0.237	0.126	0.013	0.024	0.285
Host plant x Eco-race	SEd(±)	0.247	0.410	0.287	0.252	0.134	0.014	0.036	0.304
	CD (5%)	0.519	0.862	0.603	0.530	0.282	0.030	0.076	0.638

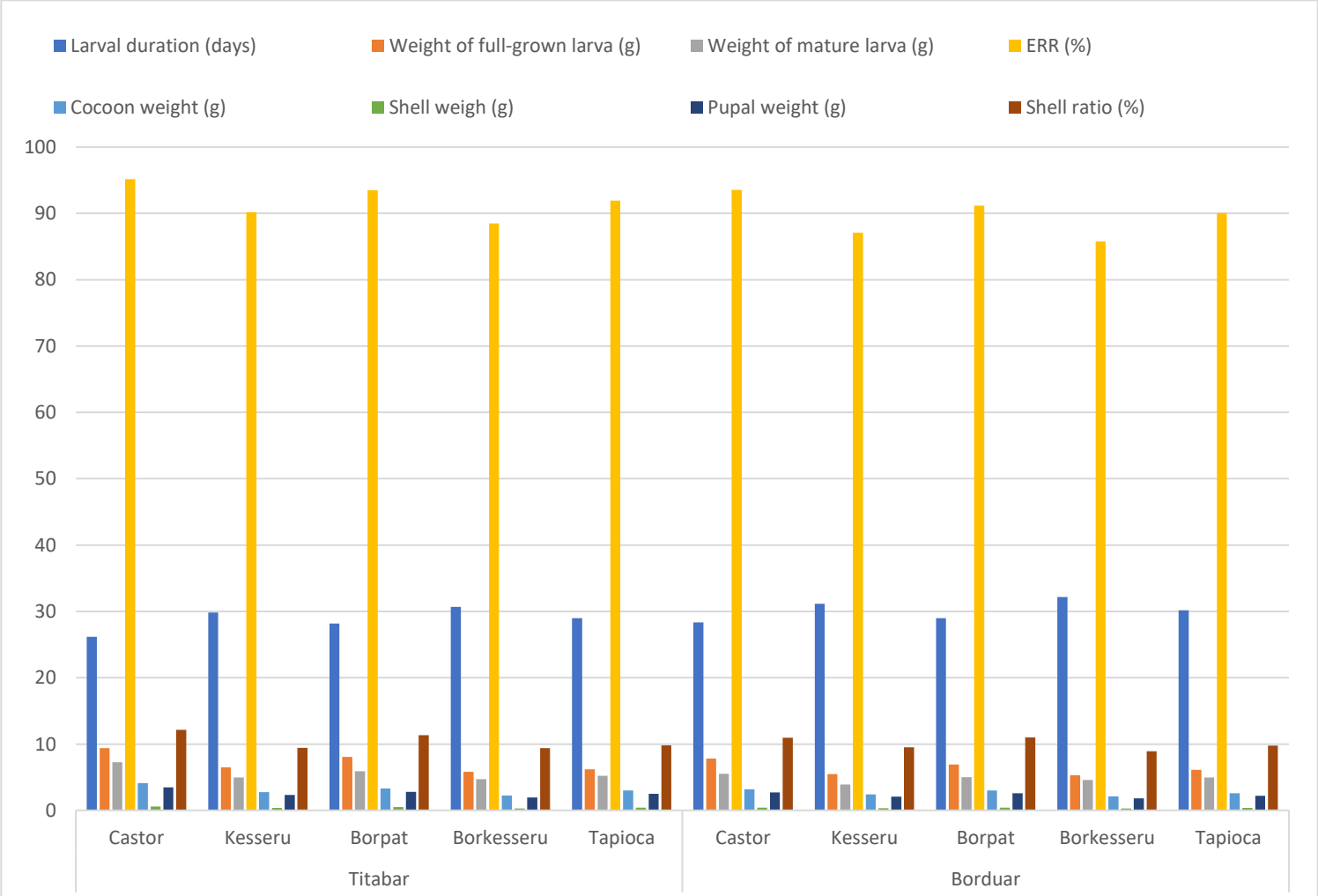

Fig. 1. Economic traits of promising eco-races of eri silkworm reared on different host plants

eco-race (4.105 g) followed by borpat (3.314g) and tapioca (2.995 g). Vasanth et al. [14] also reported that castor reared eri silkworm larvae showed the highest cocoon weight. The study was also supported by the results of Thanga et al. [15].

3.6 Shell Weight (g)

In case of shell weight similar trend was observed as in cocoon weight. Highest shell weight was recorded on castor reared Titabar eco-race (0.596 g) followed by borpat (0.515 g) and tapioca (0.422 g) reared silkworm. Lowest was recorded in case of Borduar eco-race reared on borkesseru leaves (0.299 g). This finding was in accordance with the results of Thanga et al. [15] and Kumar and Elangovan [12].

3.7 Pupal Weight (g)

In consistent with the cocoon weight and shell weight, the highest pupal weight was observed in castor reared Titabar eco-race (3.476 g) followed by borpat (2.806 g) and tapioca (2.500 g). The lowest was recorded in borkesseru fed Borduar eco-race (1.825 g). The pupal weight between the eco-races reared on different host plants were differed significantly.

3.8 Shell Ratio (%)

Significantly higher shell ratios were obtained when eco-races of eri silkworm were reared on the leaves of castor. It was found to be more in Titabar eco-race reared on castor leaves (12.163 %) followed by borpat (11.329 %) and tapioca (9.804%). In interaction between host plant and eco-race shell ratio was significantly higher in casor x Titabar (12.163%) and lower in borkesseru x Borduar (8.911%). Singh et al. [16] and Chakravorty [17] reported average cocoon weight and maximum shell weight in Titabar eco-race and highest shell ratio and maximum ERR %. Overall, the results of present study support the findings of earlier works and the suitability of Titabar eco-race when reared with castor leaves. The variation in the economic parameters of eri silkworm is highly influenced by the nutritional value of the food plants. There is a highly significant variation of the yield characters of both the eco-race of eri silkworm fed by different the food plants as well as also in the interaction between the food plants and eco-races which may be due to the feeding of different host plant having different nutritional value or may be due to the environmental factors.

4. CONCLUSION

The research findings indicate that the yield attributing characters of eri silkworm exhibit significant variation among the different eco-races when reared on various food plants. This variation highlights the critical role of food plants and eco-race selection in influencing the growth, development and economic viability of silkworm rearing. These results underscore the importance of optimizing food plant choices as well as eco-race selection to enhance the overall efficiency and profitability of sericulture. The present study also depicted that eri rearer can go for the rearing of eri silkworm with borpat during the unavailability of castor leaves. Future research should continue to explore the relationship between the food plants and different eco-races of eri silkworm performance to further refine rearing practices and contribute to the advancement of sustainable eri-culure.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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