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ASSESSMENT OF HOST-PLANT SUITABILITY AND REARING PERFORMANCE OF ERI SILKWORM, *Samia ricini* DONOVAN ON PURPLE-COLOURED CASTOR VARIETY LOCALLY AVAILABLE IN MANIPUR, INDIA

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ABSTRACT

Host plant suitability is a critical determinant of larval growth, survival, reproductive potential and cocoon productivity in eri silkworm, *Samia ricini* Donovan. The present investigation was conducted during 2025–2026 to evaluate the rearing performance of the Manipur local ecorace of eri silkworm on a locally available Purple-Coloured Castor (PCC) variety (*Ricinus communis* L.) in comparison with two other castor varieties, Non-Bloomy Red (NBR) and Non-Bloomy Green (NBG) and two alternative perennial host plants, tapioca (*Manihot esculenta* Crantz) and kesseru (*Heteropanax fragrans* Seem). The experiment encompassed spring, summer and autumn rearing seasons and assessed key biological and economic parameters, including fecundity, egg hatching percentage, larval duration, mature larval weight, effective rate of rearing (ERR), pupation percentage, cocoon weight, shell weight and shell ratio. Among the five host plants evaluated, the overall rearing performance followed the order NBR > NBG > PCC > tapioca > kesseru. Eri silkworms reared on PCC completed larval development in 20 days and attained mean mature larval weights of 5.71 g in males and 8.75 g in females. The corresponding male and female cocoon weights were 2.53 and 3.44 g, respectively, while shell weights were 0.32 and 0.40 g, respectively. PCC recorded an ERR of 85.00% and a pupation percentage of 88.12%, with male and female shell ratios of 12.81 and 11.80%, respectively. In comparison, NBR exhibited the highest reported performance, recording a fecundity of 325 eggs, an egg hatching percentage of 88.78%, mature larval weights of 6.38 g in males and 9.25 g in females, a pupation percentage of 95.06% and an ERR of 93.50%. The corresponding male and female cocoon weights were 2.63 and 3.53 g, shell weights were 0.37 and 0.45 g, and shell ratios were 14.17 and 12.04%, respectively. Overall, NBR demonstrated superior rearing performance among the evaluated host plants, whereas PCC exhibited better performance than tapioca and kesseru, which is found suitable for Eri silkworm rearing.

Key words : Eri silkworm, *Samia ricini*, Purple-coloured castor, Host-plant suitability, Larval growth, Effective rate of rearing, Cocoon characteristics, Shell ratio, Manipur.

Introduction

Sericulture, the art and science of silk production, has been an integral part of India's cultural heritage for centuries. Silk is a functional term used to describe natural-protein fibers that secreted by arthropods (Chowdhary, 2006). Silk production has the potential to make a significant contribution to the economy of many countries where is surplus labour, low-costs of production and a willingness to adopt new technologies (Hajare *et al.*, 2007). India is the only country in the world where all the four types of commercially exploited silks i.e. Mulberry, Tasar, Eri and Muga are produced. Among the four commercially exploited silk varieties in India, *Samia ricini* Donovan, commonly called Eri silk holds a distinctive position due to its hardiness, polyphagous feeding habit and the production of the warm and durable eri silk. Ericulture plays significant role in rural livelihood

security especially among marginalized and weaker sections of the society, covering more than 0.18 million families of the country (Ahmed *et al*., 2015) with an annual production of 4236 MT. Eri-silkworm is one of the most exploited, domesticated and commercialized non-mulberry silkworms. It has many generations per year and feeds on several host plant species (Bhattacharya *et al*., 2006; Chakravorty and Neog, 2006; Bindroo *et al*., 2007). The fibers are also used in a range of textiles such as shawls, blankets and industrial materials like paper and filters (Subramanianan *et al*., 2013; Wongsorn *et al*., 2024). It is a domesticated silkworm and can be reared in doors (Joshi, 1992). It feeds on over 29 species of host plants (Reddy *et al*., 2002). Among all host plants, castor is the most preferred host plant for eri silkworm (Naika *et al*., 2003; Sannappa *et al*., 2004; Kumar and Elangovan, 2010). The choice of plant plays a crucial role in determining the growth, development and economic traits of larvae, ultimately affecting cocoon yield and quality. Being a polyphagous insect, Eri silkworm has a diverse diet consisting of leaves from various food plants, such as Castor (*Ricinus communis* L), Tapioca (*Manihot esculenta* Crantz), Wild Castor (*Jatropha curcas* L), Papaya (*Carica papaya* L), Barkesseru (*Ailanthus excelsa* Roxb), Kesseru (*Heteropanax fragrans* Seem) and many others. The Castor plant (*Ricinus communis* L.) serves as the primary food source for Eri silkworm, playing a pivotal role in its successful rearing and silk production. The silkworm's remarkable adaptability allows it to survive on various secondary and tertiary host plants during times of food scarcity, including Tapioca, Papaya, Barkesseru etc. These secondary plants offer varying degrees of nutritional support, although they do not contribute as significantly to the quality of silk as castor (Sarkar and Borpuzari, 2022; Devi *et al*., 2025; Tulu *et al*., 2022). Recent research has focused on improving the sustainability of eri silkworm farming through the exploration of alternative host plants, genetic breeding for enhanced silk yield and disease resistance and techniques to expand the ecological benefits of eri silkworm cultivation.

The diversity of castor cultivars, including NBR (Non-Bloomy Red), NBG (Non-Bloomy Green) and Local Purple coloured castor (PCC) varieties, presents opportunities for optimizing Eri silkworm rearing performance. Different Castor varieties exhibit variations in their agronomic characteristics, leaf nutritional composition, and yield potential, which directly influence silkworm growth, development and economic parameters. This study aims to learn the suitability of Purple-coloured castor in Ericulture and this castor variety is available in Manipur. Understanding the comparative performance of Eri silkworm when reared on these different host plants is crucial for enhancing silk productivity, ensuring year-round availability of quality feed and improving the economic viability of ericulture in a particular agroclimatic condition. In conventional rearing practices, the demand for a consistent supply of fresh leaves, particularly from the primary food plant Castor, poses significant challenges due to leaf quality variations and scarcity. This predicament sometimes renders the rearing process uncertain and time-consuming. The evaluation of alternative host plants and different Castor varieties becomes essential for developing sustainable and efficient sericulture practices that can support the livelihood of silk producers, particularly in rural areas. The present study aims to assess host plant suitability of a castor variety, Purple coloured castor (PCC) in Eri silkworm rearing. Its performance was assessed based on the key economic parameters such as larval duration, larval weight, cocoon weight, shell weight, shell ratio, effective rate of rearing (ERR%) and compared with other four different host plants.

Materials and Methods

The present experiment was conducted at the Regional Sericultural Research Station (RSRS), Imphal following the standard package of practices. The experiment was designed to find out host suitability of locally available Purple coloured castor variety for Eri silkworm rearing. The silkworm rearing parameters were recorded as such silkworm growth, larval duration, matured larval weight, cocoon weight, shell weight, shell ratio, effective rate of rearing (ERR%) and its performance was compared with other four different host plants viz., Non-Bloomy Red (NBR) castor variety, Non-Bloomy Green (NBG) castor, two perennial host plants, tapioca (*Manihot esculenta* Crantz) and kesseru (*Heteropanax fragrans* Seem). Each treatment consisted of 2 diseases free layings in each replicate, there were three replicates of each treatment. Rearing was conducted under identical environmental, room temperature 25°C±2 and Relative humidity 65%±5.

Five host plant were selected for the comparative study as shown below:

Treatment	Host Plant (Variety)	Scientific Name
T_1	Castor (NBR variety)	*Ricinus communis*
T_2	Castor (NBG variety)	*Ricinus communis*
T_3	Castor (PCC variety)	*Ricinus communis*
T_4	Tapioca	*Manihot esculenta*
T_5	Kesseru	*Heteropanax fragrans*

Host Plant maintenance and Leaf collection

The host plants- Castor (NBR, NBG, PCC), Tapioca, and Kesseru were maintained and used in the experiment as food plants. Only fresh, healthy leaves were collected daily in the morning and evening for feeding purpose. Tender leaves were provided to early instar larvae (1st and 2nd instar worms), semi-matured and matured leaves were provided to later instars (3rd to 5th instars). Before feeding, leaves were washed thoroughly, air-dried in room condition and stored in a cool, humid environment to maintain freshness.

Rearing material

Eri silkworm of Manipur ecorace was used in the experiment and its generations are being maintained in Regional Sericultural Research Station, Imphal. Silkworm rearing was conducted in a clean, well-ventilated room with necessary equipment and facilities. The rearing house, trays and other rearing appliances were cleaned and disinfected using bleaching powder, slaked lime and sodium hypochlorite solutions. The room temperature was maintained at 25 ± 2°C and relative humidity at 65%±5, which is suitable for Eri silkworm rearing.

The following rearing equipment and materials were utilized for experiment:

- Rearing trays: Used for rearing larvae at various stages; they provided good aeration and ease of handling.
- Paraffin paper and foam pads: Used to line the trays and maintain leaf freshness, moisture maintenance during rearing.
- Feeding brushes: Used for gently transferring newly hatched larvae without injury.
- Ant wells: Used to prevent attack of ants to the chawki worms.
- Rearing stands: Bamboo or wooden stands were used to support trays at multiple levels for space-efficient rearing and proper ventilation.
- Mountages: Used for matured larvae to spin cocoons.

Disinfection and Sanitation

Prior to the initiation of rearing, all rearing equipment and trays were disinfected with 5% bleaching powder solution and dried completely before use. The disinfection procedure was aimed at preventing contamination from pathogens and ensuring a disease-free environment. Regular cleaning and waste removal (bed cleaning) were carried out during each larval instar to maintain hygienic rearing conditions and prevent accumulation of faecal matter or leftover leaves, which could otherwise lead to microbial growth and disease occurrence.

Silkworm rearing

The Disease-Free Laying's (DFLs) of *Samia ricini* were incubated under controlled environmental conditions of 27°C temperature and 75%±5 relative humidity until hatching. Moist filter paper was placed beneath the egg cards to maintain uniform humidity. The eggs hatched within 5-6 days, and the newly emerged larvae were gently transferred to rearing trays using soft brushes lined with fresh tender host plant leaves of respective treatments.

Rearing was conducted through five larval instars, maintaining hygienic and uniform conditions for all treatments. Tender, semi-mature, and mature leaves were offered according to the larval stage. The feeding schedule was maintained four times daily at 6:00 a.m., 11:00 a.m., 3:00 p.m. and 8:00 p.m. to ensure continuous food availability and avoiding silkworm starvation.

Rearing was performed under the following standard environmental conditions (Table 1).

Table 1 : Standard environmental conditions maintained in the rearing house.

Parameter	Range/condition
Temperature	25 ± 2°C
Relative humidity	60-70%
Light: Dark Period	12 h: 12 h
Feeding Frequency	4 times per day
Ventilation	Adequate natural aeration

Daily bed cleaning was performed to remove leftover leaves and excreta, preventing contamination and disease occurrence. Equal quantities of leaves were supplied to each treatment to ensure uniform feeding conditions and data recorded.

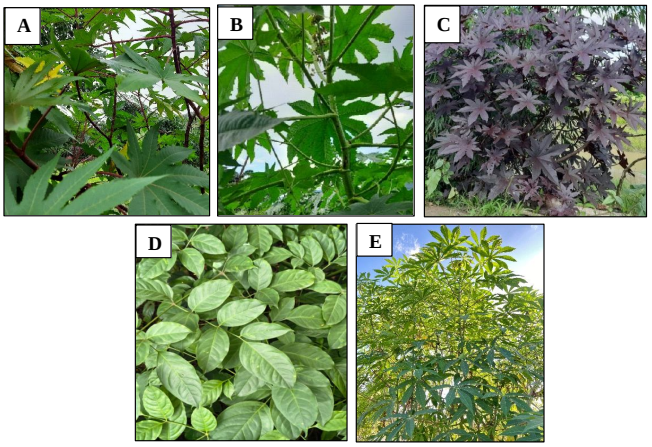


Fig. 1 : A. Castor-Non-Bloomy Red (NBR) **B**. Castor-Non-Bloomy Green (NBG) **C.** Castor-Purple-Coloured Castor (PCC) **D**. Kesseru (*Heteropanax fragrans* **E**. Tapioca (*Manihot esculenta*).

Mounting and spinning

When the larvae reached maturity-identified by a yellowish translucent body and cessation of feeding-they were transferred to mountages for spinning. Each mountage accommodated approximately 30-40 matured larvae. The spinning process lasted 3-4 days, during which larvae produced open-ended cocoons. After completion of spinning, cocoons were carefully harvested, cleaned, and shade-dried for 2-3 days to remove surface moisture and prepare them for post-cocoon analysis.

Parameters recorded

To evaluate the performance of eri silkworms on different host plants, the following biological and economic parameters were recorded.

S. no.	Parameter	Description
1.	Larval duration (days)	Number of days from 1st instar to mature larva
2.	Larval weight (g)	Weight of mature larvae
3.	Single Cocoon weight (g)	Weight of cocoon
4.	Single Pupal weight (g)	Weight of pupa
5.	Single Shell weight (g)	Weight of shell
6.	Shell ratio (%)	(Shell weight / Cocoon weight) × 100
7.	Pupation (%)	Number of live pupae cocoon /Total number of cocoon assessed × 100
8.	Effective rate of rearing (ERR%)	(No. of cocoons harvested / Total larvae brushed) × 100
9.	Fecundity	Number of eggs laying by a female silkworm moth
10.	Hatching (%)	Total number of eggs hatched / Total number of eggs × 100

Results and Discussion

To assess the host plant suitability, Eri silkworm (*Samia ricini* Donovan) was reared on locally available Purple-Coloured Castor (PCC) variety (*Ricinus communis* L) and its rearing performance was compared with other popular castor varieties viz. Non-Bloomy Red (NBR), Non-Bloomy Green (NBG) and other perennial host plants *viz*., Tapioca (*Manihot esculenta* Crantz) and Kesseru (*Heteropanax fragrans* Seem). The purple-coloured castor variety abundantly available in Manipur and its rearing performance was compared with other important host plants considering the key economic parameters of Eri silkworm rearing such as larval duration, larval weight, cocoon weight, effective rate of rearing (ERR%), pupation%, shell weight, shell ratio % etc.

The shortest larval duration was recorded in larvae fed on NBR (18.33±0.33 days), which was found to be statistically at par with larvae fed on NBG (18.67±0.33 days). A marginal, non-significant increase in development time was observed in larvae fed on PCC castor (20.00±0.58 days) as compared to NBR and NBG. However, longer larval period was witnessed in larvae fed on Tapioca (23.33±0.88 days) and Kessaru (25.67±0.88 days), both of which were statistically significant with critical difference value (CD = 2.06). Similar findings were reported by Yumnam Debaraj *et al.* (2023), who observed faster larval development on castor than on alternative hosts.

The performance of Eri silkworm on different host plants exhibited significant variation across different parameters. The fecundity, hatching percentage, larval weight, pupation percentage, and effective rate of rearing (ERR%) of eri silkworm reared on different host plants are presented in Table 4. Significant differences among the treatments were observed for all the parameters studied. The highest fecundity was recorded on NBR with 325 eggs per female, which was statistically at par with NBG (318 eggs), PCC (311 eggs) and Tapioca (310 eggs), but significantly higher than Kesseru, which recorded 289 eggs. Hatching percentage also followed a similar trend, with the maximum value observed in NBR (88.78%), followed by NBG (87.96%), Tapioca (86.63%) and PCC (85.40%), while the minimum hatching percentage was recorded in Kesseru (82.02%). The larval weight of both male and female larvae varied significantly among the host plants. The highest male larval weight was recorded in NBR (6.38 g), followed by NBG (5.77 g) and PCC (5.64 g), whereas the lowest value was observed in Tapioca (4.97 g). Similarly, female larval weight was maximum in NBR (9.25 g), followed by NBG (8.92 g), PCC (7.75g) and minimum in Tapioca (6.93 g).

Table 2 : Larval duration of Eri Silkworm reared on different host plants.

Treatment	T_1	T_2	T_3	T_4	T_5
Host	Non-Bloomy Red	Non-Bloomy Green	Purple Coloured Castor	Tapioca	Kesseru
Larval duration (days)	18.33±0.33	18.67±0.33	20.00±0.58	23.33±0.88	25.67±0.88
CD	2.06				

Table 3 : Fecundity, Hatching %, Larval weight, Pupation% and ERR% of Eri Silkworm reared on different host plants.

Treatment	Host	Fecundity	Hatching%	Larval weight (g)		Pupation%	ERR%
				Male	Female		
T_1	NBR	325	88.78	6.38	9.25	95.06	93.50
T_2	NBG	318	87.96	5.77	8.92	94.68	92.40
T_3	PCC	311	85.40	5.64	7.75	92.37	90.20
T_4	TAP	310	86.63	4.97	6.93	88.12	85.00
T_5	KES	289	82.02	5.04	7.24	85.29	82.50
C.D.		**4.50**	**1.86**	**0.40**	**0.53**	**2.68**	**2.31**
SE(m)		1.36	0.56	0.14	0.19	0.81	0.70
SE(d)		1.92	0.80	0.19	0.26	1.15	0.99

NBR=Non-bloomy Red, NBG=Non-bloomy Green, PCC=Purple coloured castor, TAP=Tapioca, KES=Kesseru

Table 4 : Cocoon weight, Shell weight and Shell ratio (%) of Eri Silkworm reared on different Host Plants.

Treatment	Host plant	Cocoon weight (g)		Shell weight (g)		Shell ratio (%)	
		Male	Female	Male	Female	Male	Female
T_1	NBR	2.63±0.05	3.53±0.09	0.37±0.01	0.45±0.02	14.17±0.32	12.04±0.42
T_2	NBG	2.57±0.04	3.47±0.12	0.35±0.01	0.43±0.02	12.7±0.22	12.31±0.26
T_3	PCC	2.53±0.05	3.44±0.05	0.32±0.01	0.40±0.01	12.81±0.32	11.80±0.20
T_4	TAP	2.15±0.06	2.80±0.08	0.26±0.01	0.32±0.02	12.02±0.21	11.43±0.31
T_5	KES	2.10±0.04	2.52±0.04	0.24±0.01	0.26±0.01	11.42±0.25	10.31±0.16
C.D.		**0.14**	**0.22**	**0.022**	**0.044**	**0.74**	**0.82**
SE(d)		0.07	0.11	0.011	0.022	0.37	0.40

NBR = Non-bloomy Red, NBG=Non-bloomy Green, PCC=Purple coloured castor, TAP=Tapioca, KES = Kesseru.

Pupation percentage was highest in NBR (95.06%), followed by NBG (94.68%) and PCC (92.37%), while the lowest pupation percentage was observed in Kesseru (85.29%). The effective rate of rearing (ERR%) ranged from 82.50 to 93.50%, with the highest value recorded in NBR (93.50), NBG (92.40), PCC 90.20), followed by Tapioca (85.00) and the lowest in Kesseru (82.50). The calculated critical difference (CD) values at the 5% level indicated that the observed differences among treatments were statistically significant. Deka *et al*. (2011) demonstrated that the castor plant yielded the best results for larval growth as well as spinning characters. Vaishali V. Birari et al., (2019) also reported the castor exhibited highest cocoon weight, cocoon shell weight and shell ratio.

Cocoon characteristics of Eri silkworm reared on different host plants were assessed and recorded. The best rearing performance was found in NBR with cocoon weight (♂ 2.63g, ♀ 3.53g), shell weight (♂ 0.37g, ♀ 0.45g), shell ratio% (♂ 14.17, ♀ 12.04) and followed by NBG and PCC castor variety. Eri silkworm reared on PCC found cocoon weight (♂ 2.53g, ♀ 3.44g), shell weight (♂ 0.32g, ♀ 0.40g), shell ratio% (♂ 12.81, ♀ 11.80). The rearing performance of Eri silkworm on five different food plants was found as NBR > NBG > PCC > Tapioca > Kesseru. The performance of purple-coloured castor variety was found better than Tapioca and Kesseru.

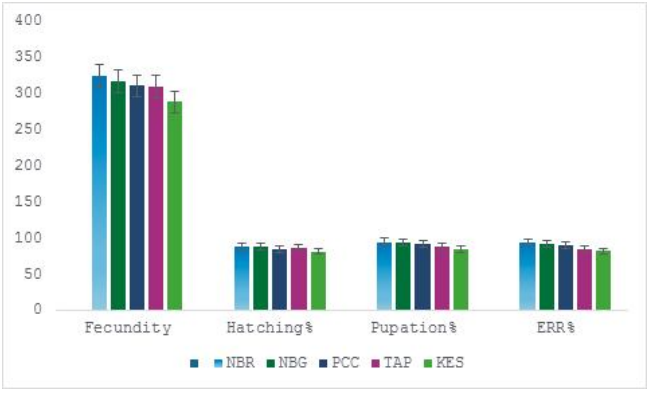


Fig. 2 : Fecundity, Hatching%, Pupation% and ERR% of Eri Silkworm reared on different host plants.

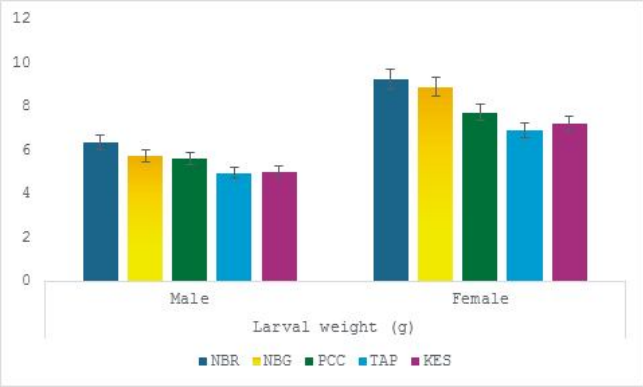


Fig. 3 : Larval weight (g) of Eri silkworm reared on different host plants.

Conclusion

From the study, it has learnt that Purple coloured castor (PCC) variety found in Manipur is suitable for Eri silkworm rearing. Its performance is at par with superior castor variet *viz*., NBR and NBG. These findings indicate that the locally available PCC variety has potential as an additional host-plant resource for eri silkworm cultivation in Manipur, offering scope for host-plant diversification and strengthening regional ericulture. Further investigations incorporating replicated multi-season trials, statistical validation, leaf biomass productivity, nutritional profiling and economic assessment are necessary to establish its agronomic suitability and commercial viability in Ericulture.

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