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Effect of different seasons on the rearing of Eri silkworm, *Samia ricini* on *Gmelina arborea* leaves

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Abstract
In the present study, an attempt was made to rear *Samia ricini* on the leaves of *Gmelina arborea* and *Ricinus communis* (control) during four different seasons. The highest larval weight was recorded during summer (S2) for both *R. communis* (6.899 g) and *G. arborea* (5.310 g). The larval duration was found to be ranged from 26.67±1.789 to 40.78±1.719 days in *G. arborea* fed silkworms and 21.55±0.096 to 35.78±1.534 days in *R. communis* fed silkworm. The pupal duration was significantly longer in *G. arborea* (13.11±0.699 to 16±1 days) than in *R. communis* (11.11±0.699 to 13±0.084 days). No significant differences were recorded concerning the effective rate of rearing (%), emergence rate (%) and survival rate (%), cocoon weight (g), shell weight (g), shell ratio (%), fecundity (nos.) and hatchability (%). The growth period was recorded shorter during summer (S2) and autumn (S3) however the percentage of effective rate of rearing (%), emergence rate (%), and survival rate were higher during spring (S4) and autumn (S3). Therefore, it may be concluded that *G. arborea* can be a potential food plant for Eri silkworm *S. ricini*.

Keywords: Eri-silkworms, gamari, castor, host plants, economic parameters.

Introduction
Sericulture is an agro-based industry that involves the cultivation of food plants to feed the silkworms for the production of cocoons, reeling, and spinning the cocoons for the production of yarn. The North-Eastern part of India is rich in Seri biodiversity being a natural abode for several sericigenous insects and their host plants [1]. *Samia ricini* is one of the most domesticated, exploited, and popular non-mulberry silkworms largely reared by the farmers of the North-eastern part of India, particularly in Assam [2].
The quality of leaves is the most important factor influencing the larval growth and the quality of cocoons produced by silkworms [3]. Being polyphagous in nature, the Eri silkworm feeds on many food plants like Castor (*Ricinus communis* Linn.), Kesseru (*Heteropanax fragrans*), Tapioca (*Manihot esculenta*), Borpat *(Ailanthus grandis)*, Papaya *(Carica papaya)*, Borkesseru *(Ailanthus excelsa)*, Payam (*Evodia flaxinifolia*), Gulancha *(Plumeria acutifolia)* and several others. Among all, *R. communis* is the most preferred host plant for the rearing of Eri silkworm[4-5]but the seasonality, high maintenance rate and unavailability of land to cultivate *R. communis* plants to feed the silkworms is a limiting factor. Therefore, it is a need to evaluate the potential of the other food plants for rearing purposes. The food plants play a great role in the silkworm as it is the only source of nutrition therefore, the present study was designed to evaluate the effect of food plants as well as the influence of season on the growth, development, and cocoon parameters of Eri-silkworm.

Material and Methods
The study was carried out in the Department of Zoology, Bodol and University. Disease-free eggs were collected from the Directorate of Sericulture, Kokrajhar, and rearing was done using standard procedures as described by Sarkar, (1980) [6]. Eggs were grouped randomly into two groups consisting of 300 eggs in each group. The larvae hatch out of the eggs were transferred to rearing trays and fed with tender *R. communis* leaves, three times a day up to the second instar larval stage. In the third instar, the larvae of the first group were reared on *R. communis* leaves as control while the larvae of the second group were fed with *Gmelina arborea* leaves. Matured leaves were used to feed the larvae 3 times a day until it reaches the fifth instar.
The economic parameters like egg fecundity (nos.), larval (g) and pupal duration (days), larval weight (g), survivability (%), hatchability (%), the effective rate of rearing (ERR %), emergence rate (%) were recorded. Cocoon parameters like the weight of cocoon (g) and shell (g), silk ratios (%) were also recorded for silkworms reared.

Season-wise variation of the above parameters was also studied in four different seasons S1- Spring (Feb-Apr), S2-Summer (May-July), S3-Autumn (Aug-Oct), S4 Winter (Nov-Jan). The experiment was carried out in triplicates.

Statistical analysis: The collected data were analyzed statistically using IBM-SPSS statistical server documentation version 20. The data are represented in mean± standard deviation (SD) and variance analysis at the level of p=0.05% significance.

Results and Discussion

The weight of larvae in different seasons showed the maximum weight of fifth instar larva was recorded to be highest during S2 for both in *R. communis* (6.899 g) and *G. arborea* (5.310 g) fed silkworms (Figure 1.). The results obtained from the economic parameters of silkworm reared on *R. communis* and *G. arborea* during four different seasons-S1, S2, S3, and S4 are represented in Tables 1 and 2. The data revealed that the fecundity of the silkworms fed in *R. communis* leaves was recorded to be higher (462.22±4.260, 460.22±5.035, 472.88±8.904, 360.44±4.338 nos.) followed by the silkworms fed in *G. arborea* leaves (400.66±8.258, 397.44±7.963, 405.77±7.413, 323.55±8.355 nos.) in all seasons. The larval duration (days) and pupal duration were recorded to be shorter in silkworms fed with *R. communis* leave followed by *G. arborea*. The percentage of hatching, emergence rate, and effective rate of rearing in silkworms fed in *G. arborea* leaves was found to be almost similar to silkworms fed in *R. communis* leaves. The percentage of survival rate recorded in silkworms fed with castor leaves was higher than the percentage recorded in silkworms fed with *G. arborea* leaves in all seasons (Table 1). The effect of host plants was recorded to be similar to the silkworms fed with *R. communis* leaves (Table 2). Significant differences among all the parameters have not been recorded. Similar observations where the larval duration ranged from 22.67 to 25.83 days is found [7-8].

In the present study, it is found that the larvae reared on *R. communis* leaves showed better rearing performance with regards to its growth and cocoon characters during all seasons. The larvae reared on *G. arborea* leaves showed longer larval and pupal duration as compared to *R. communis* fed silkworms. The influence of season on the rearing performance is also reflected. The larvae fed on *R. communis* showed a longer growth period during winter and autumn while in *G. arborea* fed silkworms longer larval and pupal duration was observed during winter and spring. The percentage of fecundity, hatchability, and survival rate of eri silkworms reared on *R. communis* and *G. arborea* were higher during seasons S1 and S3. The percentage of emergence rate in silkworms fed with *R. communis* leaves was higher during seasons S1 and S3. However, in silkworms fed with *G. arborea* leaves the emergence rate was higher during seasons S1 and S2. The cocoon characters like the weight of cocoon (g), shell weight (g), and percentage of shell ratio were recorded to be higher during season S1 and S3 in the silkworms fed with *R. communis* as well as *G. arborea* leaves. The nutritional content of host plants acts as a major factor in the survival of non-mulberry silkworms [9]. The larvae receiving the castor leaves during the fifth instar had better growth irrespective of the diet used earlier, i.e., whether tapioca/castor [10]. Castor was found best in terms of different parameters *viz,* the nutritive value of larva, larval weight, Effective rate of rearing, cocoon weight, shell weight, pupal weight, fecundity, hatching percentage, and larval duration was found shorter on castor fed leaves [11]. Similar studies were done in which higher larval weight is observed in silkworms fed with castor [12, 13]. The growth, development, and economic parameters of silkworms are influenced by the host plants and their nutritive content [14]. The silk production also depends on the amount and the rate of food provided and the quantity of food intake which also influences the growth rate, period, rate of survival, moth emergence, and silk secretion [14].

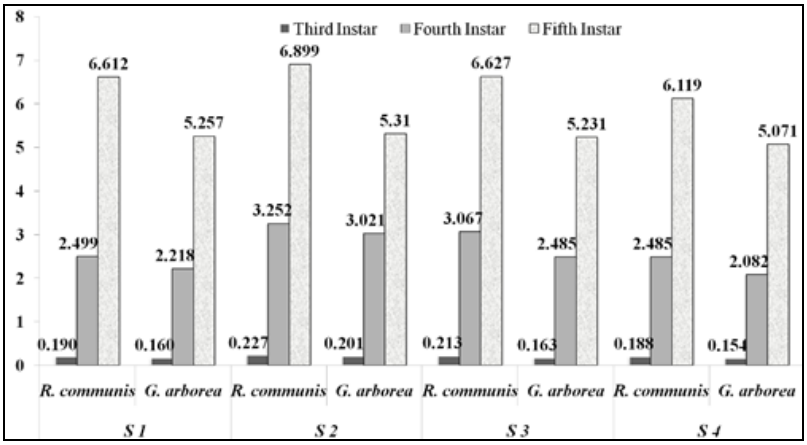

Fig 1: The instar wise larval weight of *Samiaricini* reared on *Ricinus communis* and *Gmelina arborea* leaves during four different seasons

Table 1: The economic parameters of *Samia ricini* reared using *Ricinus communis* and *Gmelina arborea* leaves during four different seasons.

	R. communis				***G. arborea***			
	S 1	**S2**	**S3**	**S 4**	**S 1**	**S 2**	**S 3**	**S 4**
Larval duration (days)	21.89±0.699	21.55±0.906	23.44±0.788	35.78±1.534	28.22±0.977	26.67±1.789	27.22±1.324	40.78±1.719
Pupal duration (days)	11.33±0.774	11.11±0.699	12.55±0.649	13±0.894	14.22±0.596	13.11±0.699	14±0.894	16±1.000
Fecundity (nos)	462.22±4.260	460.22±5.035	472.88±8.904	360.44±4.338	400.66±8.258	397.44±7.963	405.77±7.413	323.55±8.355
Hatchability (%)	97.40±1.987	95.92±2.897	96.29±2.330	87.40±3.583	95.19±2.165	82.13±4.191	87.67±3.528	82.53±4.034
Effective rate of rearing (%)	82.93±4.258	81.22±6.236	84.28±3.265	79.43±6.892	82.13±4.191	80.64±4.240	82.63±3.174	78.26±5.201
Emergence rate (%)	93.12±1.898	92.73±4.551	93.16±5.542	90.349±4.263	91.57±3.484	91.65±1.370	91.6±2.510	90.70±4.948
Survival rate (%)	88.23±3.773	85.44±4.406	89.318±4.308	83.168±4.844	85.29±4.667	83.82±4.179	85.36±3.517	81.72±5.448

Table 2: The cocoon characters of *Samia ricini* reared using *Ricinus communis* and *Gmelina arborea* leaves during four different seasons.

	R. communis				***G. arborea***			
	S 1	**S2**	**S3**	**S 4**	**S 1**	**S 2**	**S 3**	**S 4**
Cocoon weight (gms)	3.22±0.064	3.13±0.018	3.20±0.046	3.04±0.094	3.13±0.073	3.12±0.007	3.19±0.036	3.1±0.138
Shell weight (gms)	0.44±0.024	0.43±0.008	0.43±0.008	0.40±0.010	0.42±0.017	0.41±0.08	0.43±0.010	0.39±0.013
Shell ratio (%)	13.83±0.777	13.75±0.300	13.85±0.565	13.45±0.485	13.34±0.702	13.12±0.002	13.40±0.642	13.17±0.911

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