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EFFECT OF DIFFERENT FOOD PLANTS ON THE REARING PERFORMANCE AND COCOON QUALITY OF *ANTHERAEA PROYLEI* JOLLY (LEPIDOPTERA: SATURNIIDAE) IN MANIPUR

[1*]S. Subharani, [1]L. Somen Singh, [1]Y. Debaraj and [2]K.M. Vijayakumari
[1]Regional Sericultural Research Station, Central Silk Board, Ministry of Textiles (Govt. of India), Imphal-795002, Manipur, INDIA.
[2] Central Muga, Eri Research and Training Institute, Central Silk Board, Ministry of Textiles (Govt. of India), Lahdiogarh-785700, Jorhat, INDIA.
*E-mail: drsubharani@gmail.com

ABSTRACT

Antheraea proylei Jolly (Lepidoptera: Saturniidae) is the only commercially exploited oak tasar silkworm mainly reared outdoor on different food plants.The total larval period of oak tasar silkworm recorded by feeding *Quercus serrata*, *Quercus griffithii* and *Lithocarpus dealbata* during spring season was 33, 34 and 40 days respectively whereas it was extended by four to five days during autumn season. Spring season showed better effective rate of rearing (ERR) in *Q. serrata*, *Q. griffithii* and *L. dealbata* fed worms recorded 42.05, 40.96 and 38.00 respectively whereas it was only 27.27, 25.75 and 14.53 respectively during autumn season. The present study indicated that, among the two seasons rearing performance was better in spring season over autumn season. Whereas among the food plants, performance of cocoon parameters like single cocoon weight, peduncle length, shell weight, pupal weight etc. was observed superior with *Q. serrata* as a food plant than those fed with *Q. griffithii* and *L. dealbata*.

Keywords **:** oak tasar silkworm, food plants, seasons, ERR, cocoon parameters.

Introduction

Oak tasar culture is a boon for the people of North east India since this culture is an income generating agro-enterprise of high returns which can alleviate poverty, through increasing rural women employment. The oak tasar silk is a product of the polyphagous sericigenous insect, *A. proylei*. This semi domesticated, weakly bivoltine silkworm prefers temperate type of climate and hence, the name temperate tasar silkworm, and is distributed in the temperate regions of sub-himalayan belt of India. Manipur, known for the highest oak tasar silk production is situated in the far flung North Eastern corner of India where natural food plants of oak species are grown in abundance. In Manipur there are about, 40,000 hectares of oak flora available, out of which nearly 20,000 hectares could conveniently be utilized for oak tasar culture.

A. proylei thrives on the food plants *viz*., *Q. serrata*, *Q. griffithi* and *Q. dealbata* in two seasons *viz*., spring and autumn. Success of oak tasar industry largely depends on increased productivity of quality foliage per unit area and proper management practices. The greatest success has been observed in Spring (March-April) rearing then it declined during autumn season. The temperature and relative humidity during spring is congenial throughout the rearing and hence, rearing is very easy and cocoon production is good. The oak leaves that became over matured after the spring crop, had low protein and carbohydrate, high fibre, tannin contents were unpalatable to the silkworm larvae. Varietal differences in oak comprise difference in protein, carbohydrate, fibre, tannin, macro and micro nutrients contents as well as chemical phenol, moisture content that makes one variety more palatable to the silkworm than the others. The quality of leaves directly influence the health, growth and survival of silkworm (Sinha *et al*., 1986; Das and Vijayaraghavan, 1990; Chaluvachari and Bongale, 1993). Jolly (1972) reported that healthy growth of silkworm and ultimately the economic traits are largely influenced by the nutritional status of leaves fed to the worms.

In spite of the abundance and suitability of oak flora in the state, the success of oak tasar silkworm rearing depends upon a number of factors such as biotic and abiotic factors, nutritional constituents of plants and silkworm variety. The present study was carried out to study the effect of different food plants on the rearing performance and cocoon quality of *A. proylei* during spring and autumn crop.

Materials and Methods

The study was conducted in experimental field of Regional Sericultural Research Station, Imphal to assess the impact of three different oak tasar food plants *viz*., *Q. serrata, Q. griffithii* and *L. delbata* on larval duration, larval weight, effective rate of rearing (ERR), cocoon yield and

cocoon economic traits during spring and autumn crop. The disease free layings were obtained from Oak Tasar grainage section of RSRS, Imphal. The rearing field was disinfected seven days ahead of brushing with lime and bleaching powder (9:1) and the rearing appliances with 0.2 % sodium hypochlorite solution. The food plants of oak tasar silkworm were pruned 3 months ahead of rearing during spring crop and light clipping of the branches twenty days ahead of rearing during autumn crop. The rearing was conducted by following the recommended rearing technology for oak tasar culture developed by RSRS, Imphal. Rearing of early instars up to 2nd stage was done indoor (mean temperature & relative humidity at 25°C and 80%) and the late age at outdoor (mean temperature & relative humidity at 27°C and 85%) under nylon net cover on the bush plantation for protection of worm from pest and predator. On hatching, the hatched worms along with the cloth bags were kept in bamboo trays containing few twigs of the food plants so as to enable the worms to crawl over the twigs. The worms were fed with the leaves suitable for each instar. When 80% of the leaves are eaten by the worms, the worms were transferred to another plant by cutting the branches with the help of secateurs. Care was taken to protect them from pest and predators by applying nylon nets. For management of diseases, the diseased worms if noticed in the rearing field were removed immediately and disposed in 0.2 % sodium hypochlorite and buried in the soil. The observations on different rearing parameters viz. effective rate of rearing (ERR) viz. total number of mature worms collected out of total number of worms brushed for control, body weight of mature larvae, cocoon weight, shell weight and silk ratio percent (SR%) were recorded in both the season. The experiments were replicated and analyzed on the basis of season and food plants in Microsoft Excel.

Formulae associated with silkworm rearing:

1. $$\text{ERR}\% = \frac{\text{No. of mature worms collected}}{\text{No. of worms brushed}} \times 100$$

2. $$\text{Shell ratio}\% = \frac{\text{Shell weight}}{\text{Cocoon weight}} \times 100$$

Results and Discussion

The comparative rearing performance data of *A. proylei* under the agro-climatic conditions of Manipur with larval and cocoon traits as influenced by different host plant in both the crops are presented in Table 1 & 2.During the study, disease free layings (dfls) were brushed on three different food plants viz. *Q. serrata, L. Dealbata* and *Q. griffithii* in both the seasons and harvested cocoons by following the standard rearing protocol of oak tasar (Table 1). The life cycle of *A. proylei* is shortest in *Q. serrata* fed worms in both the seasons.

Larval weight

Growth and development of the larvae was better on *Q. serrata* compared to *Q. griffithi and L. dealbata* in both the seasons. There was no significant difference of larval weight in young age worms. The matured larva of *A. proylei* fed on *Q. serrata* was 22.39 g and 23.10 g during spring and summer crop respectively followed by *Q. griffithi*. However, the larvae fed on *L. dealbata* were retarded showing only 12.90 g and 16.19 g during spring and autumn crop respectively (Table 1). This showed a significant difference in development of the larvae in these host plants. Dash *et al*., (1992) reported that suitable host plant and the leaf nutrition of food plants enhances the growth of larvae. Rajaram and Samson (2000) also reported that nutritional value of the food plant either alone or in combination plays an important role in the growth and productivity in muga silkworm.

Larval duration

The larval duration of silkworm, *A. proylei* fed on three different host plants was estimated at every instar during the rearing period and is presented in Table 1. The larva spins the cocoons after active feeding through five larval instars. The total larval span recorded was 33 days in *Q. serrata* fed larvae, 34 days in *Q. griffithi* whereas in *L. dealbata* fed larvae it was extended upto 40 days during spring crop. During autumn season the total larval duration recorded was 38, 39 and 43 days in *Q. serrata, Q. griffithi* and *L. dealbata* respectively. The shortest larval duration was observed in *Q. serrata* fed worms whereas the longest duration was observed in *L. dealbata* fed worms in both the seasons. Pandey (1995) reported that nutritive value of leaf is the major contributing factor for survival of non-mulberry silkworms.

Effective rate of rearing

Effective Rate of Rearing (ERR), which reveals the percentage of the number of cocoons harvested to the number of larvae brushed, had shown better performance in spring crop when compared with autumn crop. The effective rate of rearing of worms was highest recording 42.05 cocoons /dfl and 27.27 cocoons per dfl during spring and autumn crop respectively in *Q. serrata* fed worms followed by *Q. griffithii* and *L. dealbata* in both the crops which may be due to better quality leaves (Table 1). Subharani *et al*. (2017) reported that the rearing performances of *A. proylei* fed on *Q. serrata* had shown highest cocoon productivity than *Q. griffithii* and *L. dealbata* during autumn crop. The low ERR % recorded may be due tothe role of leaf quality on cocoon production has been reported by Sinha and Jolly (1971).

Cocoon weight

The cocoon traits like cocoon weight, shell weight and shell ratio is different in different seasons is also related to the host plants fed to the larvae. *A. proylei* produced best quality and quantity of cocoon when their larvae were fed on food plant *Q. serrata* in spring season as compared to other host plant. *Q. griffithi* performance on cocoon formation is comparatively better than *L. dealbata*. The larvae of *A. proylei* fed on *Q. serrata* recorded 8.38 g and 8.25 g cocoon weight whereas it was 7.10 g and 7.01 g during spring and autumn crop respectively when fed on *L. dealbata*. Quality of leaves play an important role in cocoon production was reported by Somasundaram *et al*. (1996).

Shell weight

It is the weight of the cocoon shell which is taken after removing the pupa from the cocoon. *A. proylei* larvae fed on *Q. serrata* recorded 0.83 g shell weight on an average during both the seasons whereas it was only 0.61 g on *L. dealbata* fed worms. Mandal *et al*. (2021) studied the growth and development of silkworm larvae and economic characters of cocoons and opined that it is influenced largely by the nutritional quality of mulberry leaves fed to the larvae.

Silk ratio

Silk ratio of *A. proylei* cocoons reared on different food plants *viz*, *Q. serrata*, *Q. griffithi* and *L. dealbata* showed significant difference. The silk ratio was highest in *Q. serrata* fed worms recording 10.39 g and 9.64 g respectively during both the seasons and at par with *Q. griffithi* fed worms. *L. dealbata* fed worms showed the lowest shell ratio in both the seasons.

The present study indicated that among the two seasons rearing performance was good in spring season over autumn season. Singh *et al*. (1991) reported that rearing of *A. proylei* prevails during March-December but the frequency of success in rearing shows remarkable variation in different months of the year. The study also revealed that feeding with *Q. serrata* leaves to *A. proylei* exhibited higher survivability as compared to feeding with *Q. griffithi* and *L. dealbata* leaves in both the seasons. Jena (2016) reported that insects feeding on nutritionally enriched leaves directly influence the better growth and development of silkworm larva as well as the quality and quantity of silk production, establishment of food plant specificity of the silkworm along with evaluation of the commercial parameters in each food plant which is highly essential for increasing the cocoon yield and production of raw silk. Yokoyama (1963) reported that the nutrition value of host plants and their seasonal variability are closely related to that of the silk worm. The performance of the three batches of silkworm based on survivability and cocoon productivity was graded in the order *Q. serrata* > *Q. griffithii* > *L.* dealbata.

Table 1: Comparative rearing performance of *A. proylei* during Spring and Autumn crop in different food plants

Sl. No.	Food Plant	Season					
		Spring			Autumn		
		Larval weight (gm)	Total larval duration (days)	ERR (%)	Larval wt.(g)	Total larval duration (days)	ERR (%)
1	*Q. serrata*	22.39±0.93	33±0.82	42.05±0.69	23.10±0.16	38±0.65	27.27± 0.89
2	*Q. grifithii*	19.12±0.16	34±0.71	40.96±1.61	18.91±0.80	39±0.24	25.75± 0.73
3	*L. dealbata*	12.90±0.69	40±1.63	38.00±0.81	16.19±0.04	43±0.98	14.53± 0.01
	S.Ed(±)	0.66	0.10	0.73	0.52	0.37	0.81
	CD 0.05	1.88	3.15	2.08	1.50	1.07	2.33

Table 2: Economic parameters of *A. proylei* reared on different food plants during Spring and Autumn crop

Sl. No.	Food plant	Season					
		Spring			Autumn		
		Cocoon wt.(g)	Shell wt.(g)	Shell ratio (%)	Cocoon wt.(g)	Shell wt.(g)	Shell ratio (%)
1	*Q. serrata*	8.38±0.14	0.86±0.03	10.26±0.70	8.25±0.03	0.80±0.06	9.69±0.81
2	*Q. grifithii*	8.16±0.42	0.79±0.05	9.68±0.71	8.19±0.21	0.83±0.03	10.13±0.01
3	*L. dealbata*	7.10±0.14	0.63±0.01	8.87±0.42	7.01±0.01	0.60±0.04	8.55±0.32
	S.Ed (±)	0.86	0.04	0.19	0.12	0.03	0.40
	CD 0.05	0.30	0.13	0.54	0.35	0.09	1.16

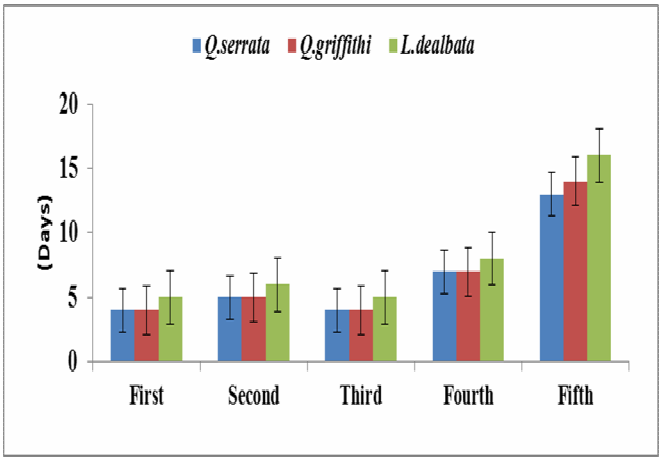

Fig. 1 : Comparison of larval duration of different instars of *Antheraea proylei* reared in different food plants during spring crop

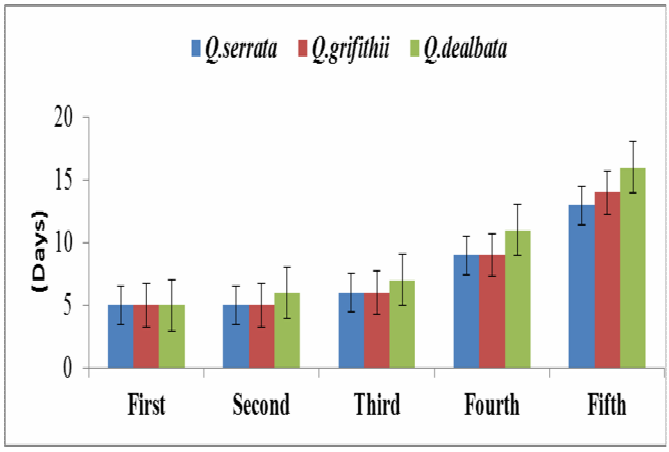

Fig. 2: Comparison of larval duration of different instars of *Antheraea proylei* reared in different food plants during autumn crop

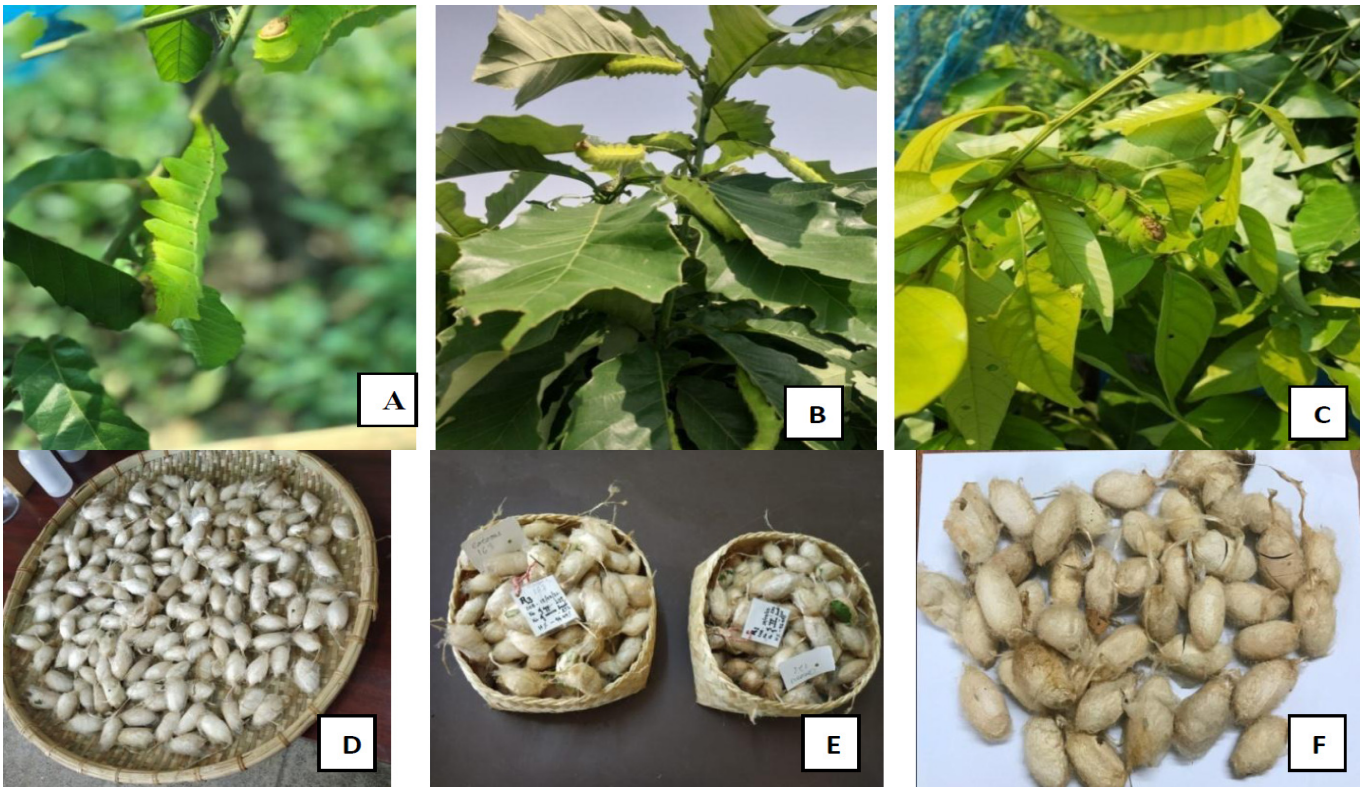

Photo plate: A- Larvae reared on *Q. serrata* B- Larvae reared on *Q. griffithii* C- Larvae reared on *L. dealbata* D- Cocoons from *Q. serrata* fed larvae E- Cocoons from *Q. griffithii* fed larvae F- Cocoons from *L. dealbata* fed larvae.

Conclusion

Feeding of oak tasar silkworm, *A. proylei* on different food plants *viz*., *Q. serrata*, *Q. griffithii* and *L. dealbata* was studied for production, productivity of oak tasar cocoons during spring and autumn crop. Thecocoon productivity and performance of cocoon parameters like single cocoon weight, shell weight and shell ratio was observed better with *Q. serrata* as a food plant.Though the larva of *A. proylei* fed well in all the three food plants *viz*., *Q. serrata*, *Q. griffithii* and *L. dealbata*, the growth rate of the larvae was retarded when fed on *L. dealbata.* As a result larval period was prolonged to five to six days on *L. dealbata* .The study showed that larvae feeding on favourable food plants have direct effect on the increase of growth rate, shorter larval duration and cocoon yield and its contributing factors during both the seasons.

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