



Seasonal variation in larval growth of Eri silkworm (*Samia ricini* Boisduval) reared on two *Ailanthus* species

Borah, R.R.¹, Saikia, M. ✉¹, Saikia, H.², Borgohain, A.², Borah, Dutta, R.²

Received: 09.04.2021

Revised: 05.05.2021

Accepted: 25.05.2021

Abstract

Present study was undertaken to evaluate the impact of different seasons in larval growth of eri silkworm (*Samia ricini* Boisduval) reared on *Ailanthus* species viz., borpat (*Ailanthus grandis*) and borkesseru (*Ailanthus excelsa*). The study revealed that the larval growth parameters of eri silkworm was found better in terms of larval duration, full grown larval weight and matured larval weight on the borpat leaves as compared to the borkesseru leaves. Considering the seasons, the full grown larval weight and matured larval weight were observed significantly higher during the autumn season but the shortest larval duration was observed during the late summer season.

Key words: *Ailanthus*, Autumn, Early summer, Eri silkworm, Late summer, Spring

Introduction

Eri culture is the cultivation of eri silkworm food plants, production of eggs, rearing of eri silkworm, spinning of cocoon for production of yarn and weaving of eri silk fabrics. Eri silkworm under family saturniidae is completely domesticated, polyphagous, multivoltine silkworm and around 5-6 crops can be raised per year depending on the availability of the host plants. Eri culture is widely practiced in Assam, Meghalaya, Arunachal Pradesh, Nagaland and Manipur of North East India. The biggest portion of eri silk production of India is contributed from Assam. In eri sector of Assam about, 2,40,939 numbers of families are engaged and the total area under eri food plants is 42,471.01 hectare (Anon., 2019a) with a production of 4764 MT eri silk during 2018-19 (Anonymous 2019b).

Study of the effects of host plants on the biology of insects is important in understanding the host suitability under different environmental conditions (Xue *et al.*, 2010). Various workers in their earlier works on eri silkworm observed that there was a marked difference in the larval growth and development when they feed on different plants (Ahmed *et al.*, 2015; Devi Borah *et al.*, 2020).

Author's Address

¹Department of Sericulture, Faculty of Agriculture, Assam Agricultural University, Jorhat, Assam

²College of Sericulture, Titabar, Assam Agricultural University, Assam

E-mail: dr.moni1980@gmail.com

Nutrient content of host plant either alone or in combination plays an important role in the larval growth, development and silk productivity of eri silkworm, *Samia ricini* (Das and Das, 2003; Kumar and Elangovan, 2010). Apart from this, temperature and RH exert synergistic impact regarding the silkworm larval period (Morohoshi, 1969). Low temperature is always better than higher temperature concerning the productivity of silkworm and larval duration for different instars (Datta *et al.*, 2001; Pandey and Tripathi, 2008). Castor (*Ricinus communis* Linn.) and kesseru (*Heteropanax fragrans* Seeman) are the major host plants of eri silkworm. Other than these two host plants, eri silkworm benefits from several alternative food plants like borpat (*Ailanthus grandis* Prain), borkesseru (*Ailanthus excelsa* Roxb.), tapioca (*Manihot utilissima* Pohl.), payam (*Evodia flaxinifolia* Hook.) etc. (Chutia *et al.*, 2014). Castor is an annual plant and the leaves become scanty during the winter season. It has to be grown fresh for every six months due to annual nature. Utilization of alternate or secondary host plants at the hour of shortage of leaves is required to meet the requirement. *Ailanthus* species viz., borpat and borkesseru are perennial and leaves are accessible consistently throughout the year. As being the secondary host plants, it is essential to generate data on larval characters in various seasons as healthy and vigorous larva decides the

cocoon and yarn quantity and quality. Marked difference in the larval growth and development of eri silkworm were observed when they feed on different host plants (Devi Borah *et al.*, 2020). Naik *et al.* (2010) also reported that host plants had a significant effect on life cycle, adult longevity, matured larval weight, cocoon weight, pupal weight, shell ratio percentage of eri silkworm. Therefore, the present investigation has been undertaken to know the impact of *Ailanthus* species leaves on larval characters of eri silkworm in various rearing seasons.

Materials and Methods

The eri silkworms were reared during the year 2018-19 following the technique suggested by Chowdhury (1982). The rearing room and the rearing appliances were disinfected with 2 per cent formalin solution three days prior to rearing. Borpat and borkesseru, two secondary host plants were used for rearing eri silkworms under the laboratory condition from 1st instar to 5th instar. The rearing of eri silkworms was conducted during four different seasons *viz.*, spring (March-April), early summer (May-June), late summer (August-September), autumn (October-November). Each treatment was replicated three times consisting of 150 larvae for each host plant. The newly hatched worms were separated with feather from their egg shell and were transferred to the rearing tray (90 cm × 70 cm × 7.5 cm). The newly hatched larvae were provided with small tender succulent leaves from both the host plants. The medium to matured leaves of both the host plants were fed subsequently with the advancement of the larval growth of the silkworms. The larvae were fed four times per day (6 am, 10 am, 2 pm, and 8 pm). At the time of moulting, the leaves were not provided. The spacing and cleaning of the rearing bed were practiced appropriately. Spacing was maintained along with the bed cleaning for good aeration and controlling the overcrowding of worms. The full grown and matured larvae were taken for recording the weight treatment wise.

Results and Discussion

The findings regarding the larval duration of eri silkworm reared on two different *Ailanthus* species are presented in Table-1. The effect of different

seasons on the larval duration of eri silkworm was found to be significantly different. The shortest larval duration was found in the late summer (19.22 days) whereas the longest larval duration was recorded in the spring season (37.78 days). Regardless of season, the eri silkworm reared on borpat leaves recorded a significantly shorter larval duration (25.11 days) compared to borkesseru leaves (26.41 days). The interaction effect due to season and host plant was found to be non-significant. Irrespective of host plant and season, the shorter larval duration was registered on borpat leaves in the late summer (18.50 days) whereas the longest larval duration was recorded on borkesseru leaves during the spring season (38.43 days).

Castor was reported as the most preferred host plant of eri silkworm and better performance was observed in terms of larval characters (Dutta, 2000; Deka *et al.*, 2011). Borpat and borkesseru as an alternative host plant can be utilized for eri silkworm rearing during scarcity of castor leaves as it shows larval parameters *at par* with castor. Reddy *et al.* (1989) recorded the larval duration on castor fed eri silkworm as 22.63 days and on barkesseru fed eri silkworm to be 37.33 days. Shaw (1998) reported significantly the shortest larval duration in castor (17 days) compared to borpat (20 days), barkesseru (21.88 days) and *Ailanthus altissima* (26 days). However, Deori (2006) reported significantly longer larval duration in borpat (29 days) compared to borkesseru (28.50 days) and castor (22.83 days). Ahmed *et al.* (2015) recorded the shortest larval period (18.33 ± 0.58 days) while feeding with castor (1st to 2nd instar) and subsequent feeding with borpat (3rd to 5th instar) during July-August whereas borpat (19.33 ± 0.58 days) and barkesseru (22.67 ± 0.58 days) fed worms took slightly longer period. Larval duration is an important parameter for rearing eri silkworm due to its commercial nature. Shorter larval duration is considered better for commercial exploitation because it minimizes the cost of labour, time and supply of leaves.

The results on seasonal variation of full grown larval weight (Table 2) of eri silkworm reared on two *Ailanthus* species were found to be significantly different. Among the different seasons, significantly the highest full grown larval weight was found during autumn (10.08g) and the lowest was recorded in the early summer season (7.38g). Irrespective of the seasons, the eri silkworm reared on borpat leaves showed a significantly higher



Table 1: Effect of season and *Ailanthus* species on larval duration (days) of eri silkworm

Seasons	Host plants		Mean
	Borpat	Borkesseru	
Spring (Mar-April)	37.13	38.43	37.78
Early summer (May-June)	23.66	24.33	24.00
Late summer (Aug-Sept)	18.50	19.93	19.22
Autumn (Oct-Nov)	21.13	22.93	22.03
Mean	25.11	26.41	
	S.Ed (\pm)	CD (5%)	
Seasons	0.35	0.74	
Host plants	0.25	0.53	
Seasons \times Host plants	0.50	NS	

Data are mean of 3 replications, NS = Non significant

Table 2: Effect of season and *Ailanthus* species on full grown larval weight (g) of eri silkworm

Seasons	Host plants		Mean
	Borpat	Borkesseru	
Spring (Mar-April)	9.06	8.47	8.77
Early summer (May-June)	7.71	7.05	7.38
Late summer (Aug-Sept)	8.65	8.10	8.38
Autumn (Oct-Nov)	10.24	9.92	10.08
Mean	8.91	8.39	
	S.Ed (\pm)	CD (5%)	
Seasons	0.16	0.35	
Host plants	0.12	0.25	
Seasons \times Host plants	0.23	NS	

Data are mean of 3 replications, NS = Non significant

Table 3: Effect of season and *Ailanthus* species on matured larval weight (g) of eri silkworm

Seasons	Host plants		Mean
	Borpat	Borkesseru	
Spring (Mar-April)	7.42	6.68	7.05
Early summer (May-June)	6.31	5.66	5.99
Late summer (Aug-Sept)	7.11	6.58	6.84
Autumn (Oct-Nov)	8.34	7.93	8.14
Mean	7.29	6.71	
	S.Ed (\pm)	CD (5%)	
Seasons	0.11	0.24	
Host plants	0.08	0.17	
Seasons \times Host plants	0.16	NS	

Data are mean of 3 replications, NS = Non significant

larval weight (8.91g) compared to the borkesseru leaves (8.39g). The interaction effect of the seasons and the host plants were found to be non-significant. However, the highest full grown larval weight was recorded in borpat leaves during the autumn season (10.24g) and the lowest (7.05g) was observed in borkesseru leaves during early summer. The results of the effect of various seasons on the matured larval weight (Table 3) of eri silkworm

were found to be significant. The highest matured larval weight was found in the autumn season (8.14g) whereas the lowest matured larval weight was recorded in the early summer (5.99g). However, matured larval weight of spring (7.05g) was found to be *at par* with the weight in the late summer season (6.84g). Setting aside the seasons, significantly the higher matured larval weight was recorded on the borpat leaves (7.29g) compared to

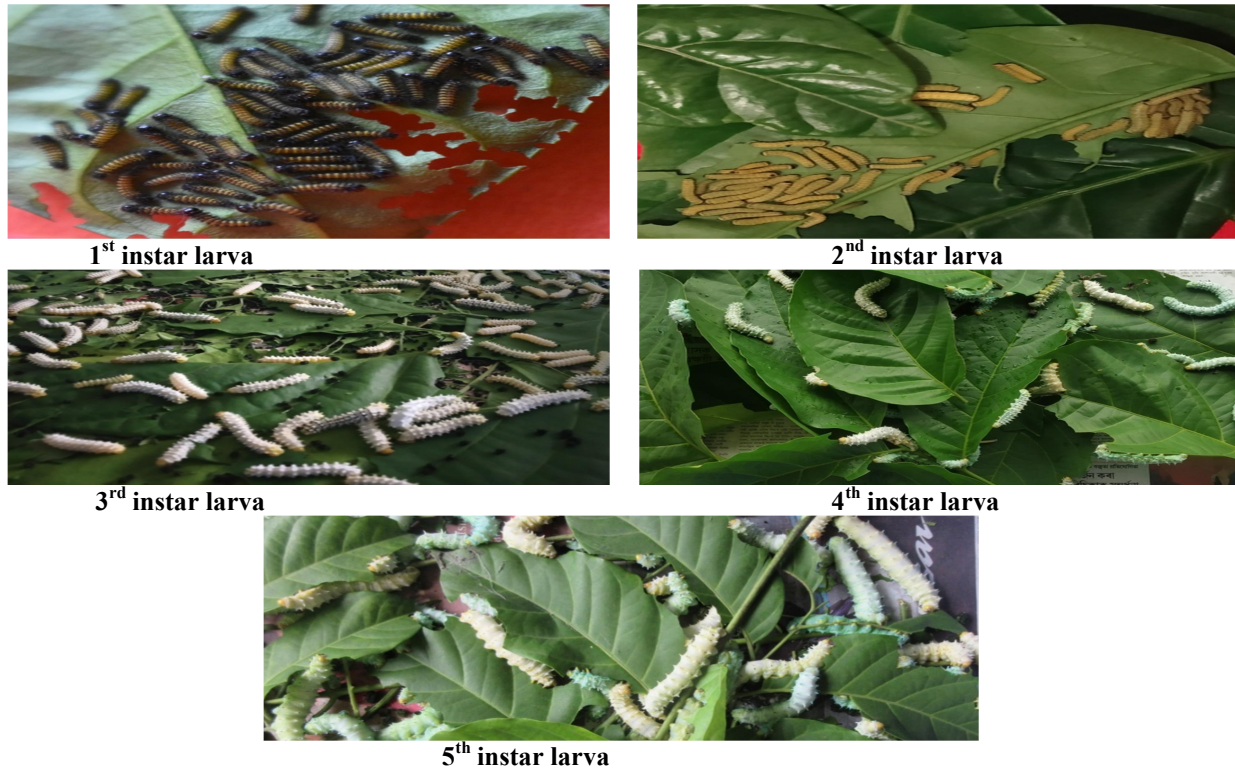


Figure 1 : Different instars of eri silkworm larvae reared on borpat leaves.

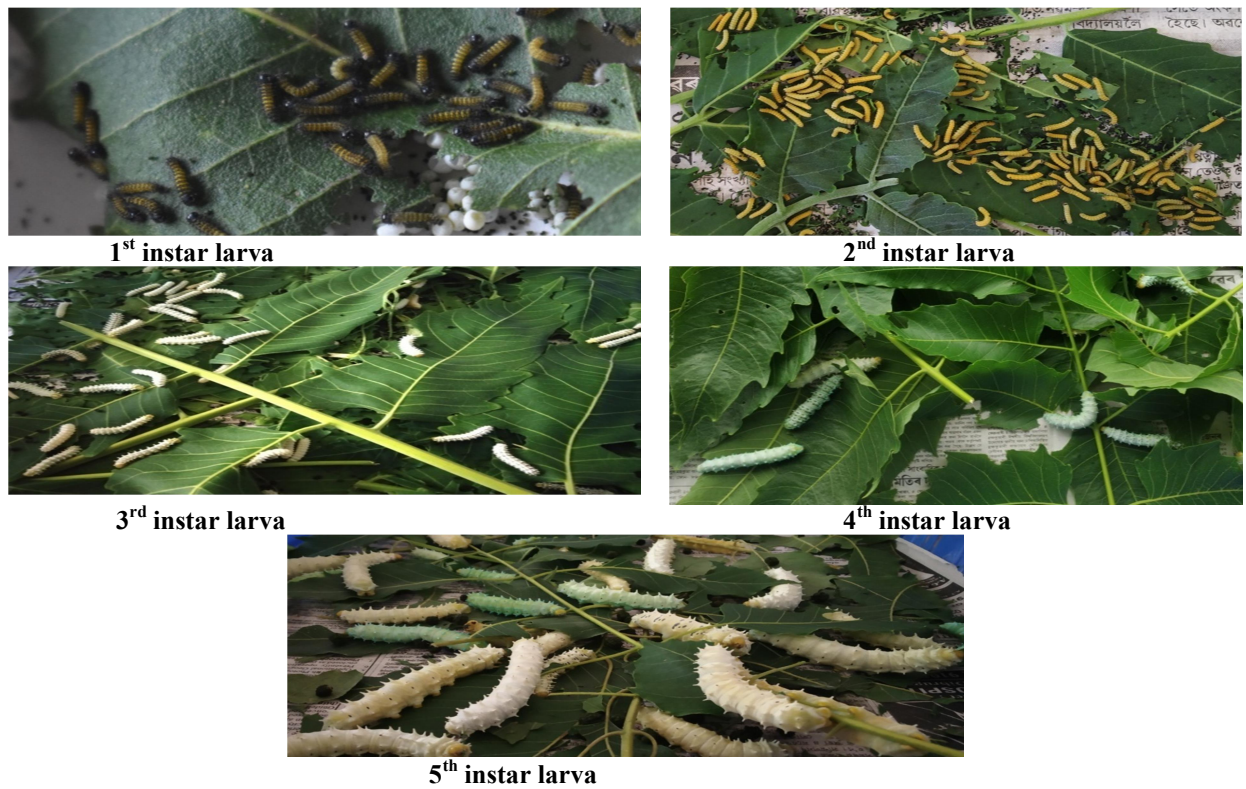


Fig. 2. Different instars of eri silkworm larvae reared on borkesseru leaves

borkesseru leaves (6.71g). The interaction effect due to seasons and host plants was found to be non-significant. It was observed that the highest matured larval weight was registered for the borpat leaves in the autumn season (8.34g) and the lowest matured larval weight was registered for the borkesseru leaves in the early summer (5.66g).

Shaw (1998) reported significantly higher larval weight in castor (7.440g) compared to borpat (6.473g), barkesseru (5.652g) and *Ailanthus altissima* (5.120g). Dutta (2000) found that larval weight of eri silkworm was better on castor (1st to 2nd instar) interchanged with borkesseru (3rd to 5th instar). Sarmah *et al.* (2012) observed that castor fed eri silkworms showed the highest larval weight (7.32g) during October-November followed by May- June (7.02g) and August-September (6.66g). Ahmed *et al.* (2015) recorded significantly higher matured larval weight in castor + borpat (7.61 ± 0.09 g) reared eri silkworm compared to borpat (7.48 ± 0.07 g) and barkesseru (7.08 ± 0.15 g) during September-October. Birari (2019) recorded significantly higher mature larval weight on castor followed by tapioca, barkesseru, Indian almond and on banyan tree. The life cycle routine of the silkworm from identical genetic stock varies significantly based on the nutritional quality of

leaves as reported in mulberry silkworm (Rahmathulla, 2011). The larval duration and the larval weight of the silkworm reared on different host plants show variation which might be due to the difference in energy which the larvae get from the leaves of host plants (House, 1974).

Conclusion

Present research work revealed that the late summer season and borpat leaves performed better in regards to larval duration. But full grown and matured larval weight were found better in the autumn season and borpat leaves. Thus, it can be inferred that both the plants are suitable for rearing eri silkworm in different seasons with slight variation in performance. Considering the cost of cultivation of castor and availability of borpat and borkesseru in the natural habitat of north-eastern states, the establishment of plantation in the farmer's field is an urgent requirement.

Acknowledgement

The authors are thankful to Dr. L.C. Dutta, Professor and Head of the Sericulture Department, Faculty of Agriculture, Assam Agricultural University, Jorhat -785013, Assam for his moral support and continuous encouragement.

References

- Ahmed, S. A., Sarkar, C. R., Sarmah, M. C., Ahmed, M. and Singh, N. I. 2015. Rearing performance and reproductive biology of eri silkworm, *Samia ricini* (Donovan) feeding on *Ailanthus* species and other promising food plants. *Advances in Biological Researches*, 9(1): 07-14.
- Anonymous. 2019a. Statistical Handbook of Assam (2018-19). Chapter-11, Sericulture, Directorate of Economics and Statistics, Govt. of Assam, pp. 133-137.
- Anonymous. 2019b. Annual report (2018-19). Central Silk Board, Ministry of Textiles, Govt. of India, p. 95.
- Birari, V. V., Siddhapara, M. R. and Desai A. V. 2019. Rearing performance of eri silkworm, *Samia ricini* (Dovovan) on different host plants. *Journal of Farm Sciences*, 32(4): 443-446.
- Chowdhury, S. N. 1982. *Eri silk industry*. Directorate of Sericulture and Weaving, Govt. of Assam, Guwahati, pp. 1-177.
- Chutia, P. , Kumar, R. and Khanikar, D. P. 2014. Host Plants Relationship in terms of Cocoon Colour and Compactness of Eri Silkworm (*Samia ricini*). *Biological Forum – An International Journal*, 6(2): 340-343.
- Das, K. and Das, R. 2003. Growth and development of muga silkworm feed on different food plants. *Indian Silk*, 11: 19-21.
- Datta, R. K., Kumar, N. S., Basavaraja, H. K., Kumar, C. M. K. and Reddy, N. M. 2001. CSR18 × CSR19 - a robust bivoltine hybrid suitable for all season rearing in the tropics. *Indian Silk*, 39: 5-7.
- Deka, M., Dutta, S. and Devi, D. 2011. Impact of feeding of *Samia cynthia ricini* Boisduval (red variety) (Lepidopera: Saturniidae) in respect of larval growth and spinning. *International Journal of Pure and Applied Sciences and Technology*, 5(2): 131-140.
- Deori, G. 2006. Biochemical analysis of *Ailanthus* leaves and its impact on proximate composition of eri silkworm pupae. M.Sc. (Agri.) Thesis submitted to Assam Agricultural University, Jorhat, Assam.



- Devi Borah, S., Saikia, M. and Boro, P. 2020. Rearing performance of two selected eco-races of eri silkworm (*Samia ricini* Donovan) fed with castor and borpat leaves during spring and autumn season in Assam. **Journal of Entomology and Zoology Studies**, 8(3): 2024-2028.
- Dutta, P. P. 2000. Rearing performance of eri silkworm *Philosamia ricini* Hutt. by interchanging castor with different host plants in different seasons. M.Sc. (Agri.) Thesis submitted to Assam Agricultural University, Jorhat, Assam.
- House, H. L. 1974. Nutrition. In: Rockstein, M. (Ed.), The Physiology of Insecta, 2nd Edition, New York, Academic. 5: 1-62.
- Kumar, R. and Elangovan, V. 2010. Assessment of the volumetric attributes of eri silkworm (*Philosamia ricini*) reared on different host plants. **International Journal of Science and Nature**, 1(2): 156-160.
- Morohoshi, S. 1969. The control of growth and development in *Bombyx mori* L. Relationship between environmental moulting and voltine characters. In. Proceedings of the Japan Academy, 45: 797-802.
- Naik, C. M., Patil, G. M., Murthy, C., Awaknavar, J. S., Shekharappa and Alagundagi, S. C. 2010. Development and economic cocoon parameters of eri silkworm *Samia ricini* Boisduval (Lepidoptera: Saturniidae) as influenced by new hosts. **Karnataka Journal of Agricultural Sciences**, 23(5): 716-721.
- Pandey, P. and Tripathi, S. P. 2008. Effect of humidity in the survival and weight of *Bombyx mori* L. larvae. **Malaysian Applied Biology Journal**, 37: 37-39.
- Rahmathulla, V. K. 2011. Management of climatic factors for successful silkworm (*Bombyxmori Bombyxmori* L.) crop and higher silk production: a review. **Psyche**, 1-12.
- Sarmah, M. C., Ahmed, S. A., Sarkar, B. N., Debraj, Y. and Singh, L. S. 2012. Seasonal variation in the commercial and economic characters of eri silkworm *Samia ricini* (Donovan). **Munis Entomology & Zoology Journal**, 7(2): 1268-1271.
- Shaw, C. 1998. Evaluation of *Ailanthus* species in relation to nutrition, growth and cocoon characters of eri silkworm, *Philosamia ricini* Hutt. M.Sc. (Agri.) Thesis submitted to Assam Agricultural University, Jorhat, Assam.
- Xue, M., Pang, Y. H., Wang, H. T., Li, Q. L. and Liu, T. X. 2010. Effects of four host plants on biology and food utilization of the cutworm, *Spodoptera litura*. **Journal of Insect Science**, 10: 1-14.

