INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print) 2222-5234 (Online)
http://www.innspub.net
Vol. 22, No. 2, p. 14-17, 2023

RESEARCH PAPER OPEN ACCESS

Rearing performance of Eri silkworm, *Samia ricini* reared on *Carica papaya* leaves during different seasons in Kokrajhar, Assam

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Key words: Eri silkworms, Food plants, Economic parameters, *Carica papaya*, Seasonal variation

http://dx.doi.org/10.12692/ijb/22.2.14-17 Article published on February 04, 2023

Abstract

Samia ricini is one of the most common silkworms reared in Kokrajhar district. *Samia ricini* is known to feed on a variety of host plants however, the rearing performance and silk quality of the silkworm depends primarily on the type of food plants used for rearing. Castor plant is regarded as the primary host plant, but it is not commonly available throughout the year. Therefore, an attempt was made to study the rearing performance of *Samia ricini* which was reared using *Carica papaya* leaves during different seasons. The growth parameters and cocoon characters of the silkworms reared on *Carica papaya* leaves were comparatively normal. The larval duration ranged from 30.11±0.942 to 41.88 ±1.135 days in *Carica papaya* fed silkworms and 21.55±0.906 to 35.78±1.534 days in *R. communis* (castor) fed silkworm. The pupal duration in silkworms fed with *C. papaya* ranged from 14.44±1.011 to 17.89±0.699 days and 11.11±0.699 to 13±0.894 days in *R. communis* fed silkworms. The effective rate of rearing (ERR%) emergence rate (ER%), survival rate (SR%), cocoon weight (g), shell weight (g), shell ratio (%), hatchability (%) and fecundity (nos.) of the silkworms fed with *C. papaya* leaves were also found to be normal as compared to the silkworm fed with *R. communis* leaves. However, the growth duration and overall performance of the silkworm was found to be better during S2 (summer) and S3 (autumn)and lower during S4 (winter). The present study indicates that the economic and growth parameters of Eri silkworms reared using *C. papaya* leaves was comparable with those reared using castor leaves therefore, *C. papaya* may also be considered as a potential host plant for the rearing of *Samia ricini*.

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Introduction

Sericulture refers to the mass scale rearing of silk producing organisms to produce silk. Eri culture plays a significant role in rural livelihood and rural economy. Among all the silkworms, *Samia ricini* is most reared by the farmers of Northeastern part of India inclusing Kokrajhar district of Assam (Sahu *et al*., 2006). Eri silkworm is the only silkworm which is completely domesticated multivoltine and feeds on a variety of host plants (Joshi, K.L., 1992). Castor (*Ricinus communis* L.) and Kesseru (*Heteropanax fragrans* Seem.) is considered as primary food plants whereas the other important host plants include Payam (*Evodia flaxinifolia* Hook.), Tapioca (*Manihot utilissima* Phol.) and Barpat (*Ailanthus grandis* Roxb). Hazarika *et al.* (2003) indicates that castor is best in terms of growth parameters of silkworm like larval weight, Effective rate of rearing, cocoon weight, hatchability, shell weight, shell ratio etc. but the seasonality, high maintenance rate and requirement of huge land to cultivate castor plants makes it a limiting factor to use castor to feed the Eri silkworms.

The growth and economic parameters and silk production depends primarily upon the quality of leaves used to feed the larvae of Eri silkworm and the identification of the factors that contribute to how the silkworm respond to different foods and food components is highly essential (Ravikumar, 1988; Sannappa and Jayaramaiah, 1999). Therefore, the selection of suitable food plant for better growth and silk production is highly required. Hence, the present study was conducted to evaluate the effect of *C. papaya* leaves on the growth, development and cocoon parameters of Eri silkworm during different seasons.

Material and methods

Rearing of silkworms

The present study was conducted at Department of Zoology, Bodoland University during four different seasons, S1- Spring (Feb-Apr), S2- Summer (May-July), S3-Autumn (Aug-Oct), S4 Winter (Nov-Jan). Disease free eggs were collected from Directorate of Sericulture, CSB, Kokrajhar and rearing was done by adopting standard eri silkworm rearing techniques as described by Sarkar, 1980. Rearing of silkworm was performed in two groups consisting of equal number of eggs. One group was reared using *Ricinus communis* leaves throughout the whole life cycle while the silkworms in the other group was reared using *Ricinus communis* for first two instars and *Carica papaya* leaves from third to fifth larvae stage. The initial larvae were fed with tender castor leaves while matured leaves were used to feed the larvae from third to fifth larval stage.

Observation of economic parameters

Growth and economic parameters like fecundity (nos.), larval and pupal duration (days), larval survivability (%), hatchability (%), effective rate of rearing (ERR%), emergence rate (ER%) were observed and recorded during the study. Cocoon parameters like weight of cocoon (g), shell weight (g) and silk ratio (%) were also recorded. All the recordings were done in triplicates.

Result

The observation recorded from the rearing of the *Samia ricini* using *Carica papaya* leaves and *R. communis* leaves is presented and discussed below in table 1 and table 2. The larval duration of the silkworm fed with *R. communis* ranged from 21.55±0.906 to 35.78±1.534 while in silkworms fed with *C. papaya* leaves the duration ranged from 30.11±0.942 to 41.88±1.135 and the pupal duration of the silkworm fed with *R. communis* ranged from 11.11±0.699 to 13±0.894 while in *C. papaya* fed silkworms it ranged from 13.33±0.894 to 17.89±0.699. The larval and pupal duration of the silkworms of both the groups was found to be shorter during S2 (Summer) and longest during S4 (Winter). The larval and pupal duration was greatly influenced by the temperature, it was shorter during the warmer season and longest during winter. The fecundity and hatchability were also found to be lower during winter and higher during the winter period (S4).

The effective rate of rearing (ERR%) and emergence rate (ER%) ranged from 79.43±6.892 to 84.28±3.265 and 90.349±4.263 to 93.16±5.542 respectively in castor fed silkworms while in papaya fed silkworms it ranged from 60.74±6.344 to 81.08±4.590 and

77.06±4.444 to 89.80±5.436 respectively. The effective rate of rearing (%) and emergence rate of the silkworms of both the groups were found to be comparable in all seasons except in S4 (winter) where the silkworms fed with papaya leaves showed lower result as compared to the other group. The survival rate of the silkworms fed with papaya leaves was at par with the survival rate of silkworms fed with castor leaves. However, the survival rate (%) of the silkworms fed with papaya leaves was lower during winter 68.36±5.891 as compared to 83.168±4.848 in silkworms fed with castor leaves. The shell ratio of the silkworm fed with papaya leaves was similar and comparable to that of castor fed silkworms.

Table 1. Table showing the economic parameters of *S.ricini* reared using *R. commnis* and *C. papaya* leaves during four different seasons.

	R. communis				*C. papaya*			
	Season 1	Season 2	Season 3	Season 4	Season 1	Season 2	Season 3	Season 4
Larval duration (days)	21.89± 0.699	21.55± 0.906	23.44± 0.788	35.78± 1.534	31.22± 0.788	30.11± 0.942	36.44± 1.490	41.88± 1.135
Pupal duration (days)	11.33± 0.774	11.11± 0.699	12.55± 0.649	13± 0.894	14.44± 1.011	15.33± 0.894	17.55± 1.011	17.89± 0.699
Fecundity (nos)	462.22± 4.260	460.22± 5.035	472.88± 8.904	360.44± 4.338	350.55± 9.829	370.11± 5.536	364.66± 8.246	319.22± 4.467
Hatchability (%)	97.40± 1.987	95.92± 2.897	96.29± 2.330	87.40± 3.583	88.88± 3.944	89.25± 3.583	85.92± 4.157	82.59± 3.85
Effective rate of rearing (%)	82.93± 4.258	81.22± 6.236	84.28± 3.265	79.43± 6.892	80.09± 4.257	80.58± 3.859	81.08± 4.590	60.74± 6.344
Emergence rate (%)	93.12± 1.898	92.73± 4.551	93.16± 5.542	90.349± 4.263	89.51± 4.161	89.80± 5.436	89.364± 3.364	77.06± 4.444
Survival rate (%)	88.23± 3.773	85.44± 4.406	89.318± 4.308	83.168± 4.844	83.82± 5.597	83.52± 3.569	80.25± 3.019	68.36± 5.891

Table 2. Table showing the cocoon characters of *S.ricini* reared using *R. commnis* and *C. papaya* leaves during four different seasons.

	R. commnis				*C. papaya*			
	Season 1	Season 2	Season 3	Season 4	Season 1	Season 2	Season 3	Season 4
Cocoon weight (gms)	3.22± 0.064	3.13± 0.018	3.20± 0.046	3.04± 0.094	2.138± 0.057	2.3± 0.128	2.899± 0.168	2.75± 0.158
Shell weight (gms)	0.44± 0.024	0.43± 0.008	0.43± 0.008	0.40± 0.010	0.27± 0.016	0.29± 0.09	0.29± 0.009	0.32± 0.027
Shell ratio (%)	13.83± 0.777	13.75± 0.300	13.85± 0.565	13.45± 0.485	12.68± 0.616	12.37± 0.515	12.80± 0.768	11.703± 0.484

Discussion

The present study focuses on the growth and economic parameters of silkworm reared using *C. papaya* leaves as well as the seasonal variation of the economic parameters. Darshi A. *et al.*, 2008 studied that the growth and economic parameters of the silkworm is greatly influenced by genes and climatic factors like temperature, humidity etc. In the present study, it was observed that the silkworms reared on *R. communis* and *C. papaya* showed better rearing performance in terms of larval and pupal duration during S2 when the temperature was warmer and the longest duration was observed during S4 (winter). The economic parameters of the silkworms in terms of fecundity (nos.), hatchability (%), effective rate of rearing (%), emergence rate (%), survival rate (%) reared on *C. papaya* leaves was better during S2 (summers) while the silkworms reared on *R. communis* was found to be better during S3 (autumn). The cocoon parameters and silk ratio of the silkworms fed on *R. communis* as well as *C. papaya* was found to be better during S3 (autumn). The nutritional content of the host plants serves as the major factor responsible for the survival of the silkworms. Hazarika *et al.* (2003) found that castor is best suited for rearing of eri silkworms in terms of growth and economic parameters like larval weight, fecundity, hatching percentage, survival rate, effective rate of rearing and shorter duration of larva and pupa.

The effect of different season on the growth parameters is also reflected in the present study. The larval and pupal duration was comparatively shorter during S2 (summer) and longest during S4 (winter) for *R. communis* as well as *C. papaya* fed silkworms. The fecundity, hatchability, effective rate of rearing, emergence rate of the silkworms fed with *R. communis* was found to be higher during S3 (autumn) while it was higher during S2 (summer) in case of *C. papaya* fed silkworms. The overall performance of the silkworms was found to be better during S2 and S3 for the silkworms of both the groups.

Conclusion

The economic parameters of the silkworms reared using *R. communis* manifested better during all seasons however, the performance of the silkworms reared using *C. papaya* was also comparable and not much difference was observed during all the seasons except during S4 (winter) where the rearing performance was found to be lower. Therefore, it can be concluded that C. papaya leaves can be used as a potential host for rearing of *S. ricini* during all the seasons except S4 (winter).

Acknowledgement

The authors would like to thank National fellowship for tribal affairs for providing financial help to carry out the research. We would also like to acknowledge and thank Directorate of Sericulture, Kokrajhar for providing necessary help during the rearing of silkworms.

Conflict of interest

The authors declare that there is no conflict of interest.

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