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INTERCHANGE EFFECT OF FOOD PLANTS ON YIELD AND QUALITATIVE CHARACTERS OF ERI (*SAMIA RICINI* DONOVAN) COCOON

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ABSTRACT

The study revealed that the food plants and their interchange combinations had significant effect on qualitative characters of cocoon and cocoon yield. Among the sole food plants, castor was found to be better in terms of green cocoon yield with higher effective rate of rearing and cocoon weight while Kesseru appeared to be better in terms of cut cocoon yield with higher shell weight and shell ratio. Though Borpat occupies a lower position in respect of green and cut cocoon yield, the food plant appears to be better than castor and Kesseru in terms of shell ratio and effective rate of rearing respectively. It was observed that among all the interchange combinations of the food plants, castor in combination with Kesseru (Castor + Kesseru) appeared to be significantly better in respect of cocoon weight, shell weight, shell ratio, effective rate of rearing, green cocoon yield and cut cocoon yield followed by castor in combination with Borpat (Castor + Borpat).

***Keywords* :** Eri silkworm, food plants, cocoon yield, effective rate of rearing.

Introduction

Sericulture is an agro-based industry having both agricultural and industrial activities intertwined together. It involves raising of silkworm food plants, rearing of silkworm for production of cocoons, reeling or spinning of cocoon and finally the production of silk. It is remarkable for its low investment and quick and high returns which make it an ideal industry or enterprise and fits well into the socio-economic fabric of India. Sericulture is broadly classified into two distinct sectors *viz*., mulberry and *vanya*. Mulberry sericulture is concerned with rearing of mulberry silkworm for production of mulberry silk and *vanya* sericulture is concerned with production of different varieties *i.e.* Eri (*Samia ricini* Donovan), muga (*Antheraea assamensis* Helfer), tropical tasar (*Antheraea mylitta* Drury) and oak-tasar (*Antheraea proylei* Jolly) silkworm.

The Eri silkworm is multivoltine in nature having five to six generations in a year. It is polyphagous in nature and feeds on leaves of plants mainly belong to the family Euphorbiaceae, Araliaceae, Apocynaceae and Simaroubaceae. Traditionally, Eri culture is carried out from castor (*Ricinus communis*) and kesseru (*Heteropanax fragrans*) plants and other food plants like tapioca borpat, borkesseru (*Manihot utilissima*), payam (*Evodia flaxinifolia*), korha (*Sapium eugenifolium*) etc. during scarcity of the primary host plants. Growth and development of the Eri silkworm depends on the quality of leaves supplied. It has direct influences in the quantity and quality of silk produced by the silkworm. Literature contains few studies on effect of different food plants and their interchange combinations in nutritional ecology and economic aspects in relation to larval growth and cocoon characters of Eri silkworm (Muthukrishnan and Radha, 1978; Joshi and Mishra, 1979; Thangavelu and Borah, 1986; Devaiah *et al.*, 1988; Sharma *et al.*, 1998; Dutta and Khanikor, 2005). However, information on interchange effect food plants on yield and qualitative characters of Eri cocoons is scanty, therefore the investigation was undertaken to find out the effect of interchange of host plant.

Materials and Method

The investigation was carried out in the Department of Sericulture, Faculty of Agriculture, Assam Agricultural University, Jorhat. The Eri silkworms were reared during spring (March-April) season, 2014 on the following dietary regiments (Table 1) of sole and interchanged combinations of food plants, castor (*Ricinus communis*), kesseru (*Heteropanax fragrans*) and borpat (*Ailanthus grandis*) by following the technique suggested by Chowdhury (1982). In all the dietary regiments four replications consisting 0.50 gm of eggs (seed) in each replication were maintained to study the rearing performance of the larvae.

Table 1 : Treatments details

Experimental code	Combination of food plants
T_1	Castor (first to fifth instar)
T_2	Kesseru (first to fifth instar)
T_3	Borpat (first to fifth instar)
T_4	Castor (first to third instar) + Kesseru (fourth to fifth instar)
T_5	Castor (first to third instar) + Borpat (fourth to fifth instar)
T_6	Kesseru (first to third instar) + Castor (fourth to fifth instar)
T_7	Kesseru (first to third instar) + Borpat (fourth to fifth instar)
T_8	Borpat (first to third instar) + Castor (fourth to fifth instar)
T_9	Borpat (first to third instar) + Kesseru (fourth to fifth instar)

The effective rate of rearing was calculated from the numbers of larvae brushed and numbers of cocoons harvested replication wise from each dietary regiments and expressed in percentage using the following formula

$$\text{ERR (\%)} = \frac{\text{No. of Cocoons harvested}}{\text{No. of larvae brushed}} \times 100$$

The green cocoon yield (with pupa) and cut cocoon yield (without pupa) were weighed on Docbel-Braun Weighing Balance and recorded as kg per hundred gram of seed replication wise for each dietary regiment.

The cocoon (with pupa) and cocoon shell (without pupa) were weighed on Electronic Cocoon Weighing Balance and recorded in gram; and cocoon shell ratio was calculated in percentage following Krishnaswami *et al.* (1972). The observations were made from 10 randomly selected cocoons replication wise from each dietary regiment.

$$\text{Shell ratio (\%)} = \frac{\text{Weight of the cocoon shell}}{\text{Weight of the cocoon with pupa}} \times 100$$

Results and Discussion

Data presented in Table 2 revealed that effective rate of rearing of Eri silkworm vary significantly ($p<0.05$) in different food plants and their interchange combinations. Among the sole food plants significantly the highest ERR (89.75%) was observed in castor (T_1); borpat (T_3) and kesseru (T_2) were *at par* with 84.25% and 82.75% ERR, respectively. Among interchange combinations of castor + kesseru (T_4), castor + borpat (T_5) and kesseru + castor (T_6) recording ERR of 80.75%, 82.75% and 80.50% respectively were *at par* with each other and did not vary significantly from that of sole kesseru (T_2) and borpat (T_3). Though the ERR was recorded the lowest (76.50%) in borpat + kesseru (T_9), it did not vary significantly from kesseru + borpat (T_7) and borpat + castor (T_8) which recorded 78.25% and 79.00%, respectively.

Results (Table 2) revealed that there was significant difference ($p<0.05$) in green cocoon yield of Eri silkworm per 100g of seed reared on the food plants and their interchange combinations. Among the sole food plants castor fed larvae (T_1) produced significantly the highest green cocoon yield (91.02 kg) followed by kesseru (T_2) and borpat (T_3) fed larvae with 83.42 kg and 77.71 kg green cocoon, respectively. In all the interchanged combinations of the food plants the green cocoon yield was found to be significantly lower than the sole food plants. The food plant combination castor +kesseru (T_4) and castor + borpat (T_5) which registered green cocoon yield of 68.89 kg and 68.80 kg, respectively were *at par* and differed significantly from the rest of the combinations. Though kesseru + castor (T_6) registered the lowest green cocoon yield (57.22 kg), it was found to be *at par* with kesseru + borpat (T_7), borpat + castor (T_8) and borpat + kesseru (T_9) combination which recorded 60.68 kg, 60.29 kg and 59.64 kg, respectively in respect of this parameter.

Results depicted in Table 2 revealed that the cut cocoon yield per 100g of Eri silkworm seed vary significantly ($p<0.05$) in different food plant and their interchange combinations. Among the sole food plants kesseru (T_2) registered for the highest cut cocoon yield (10.46 kg) and found to be *at par* with castor (T_1) but significantly different from borpat (T_3) which registered 9.16 kg of cut cocoon yield/100g of seed. In all the interchanged combinations of the food plants the cut cocoon yield were found to be significantly lower than the sole food plants, however, the combination of castor + kesseru (T_4) which registered 9.13 kg was found to be *at par* with borpat (T_3). The food plant combination castor + borpat (T_5), kesseru + borpat (T_7) and borpat + kesseru (T_9) which registered cut cocoon yield of 8.16 kg, 7.33 kg and 7.41 kg, respectively were found to be *at par* with each other. Though kesseru + castor (T_6) combination was registered for the lowest cut yield (6.98 kg), it did not vary significantly from kesseru + borpat (T_7), borpat + castor (T_8) and borpat + kesseru (T_9) combinations in respect of this parameter.

Table 2 : Cocoon yield parameters of Eri silkworm reared on different food plants and their interchange combinations

Host plant combination (Treatment)	Effective rate of rearing (ERR) (%)	Green cocoon yield (kg/100g of seed)	Cut cocoon yield (kg/100g of seed)
Castor (T_1)	89.75	91.02	9.98
Kesseru (T_2)	82.75	83.42	10.46
Barpat (T_3)	84.25	77.71	9.16
Castor+Kesseru (T_4)	80.75	68.89	9.13
Castor + Borpat (T_5)	82.75	68.80	8.16
Kesseru+Castor(T_6)	80.50	57.22	6.98
Kesseru+Borpat (T_7)	78.25	60.68	7.33
Borpat+Castor (T_8)	79.00	60.29	7.10
Borpat+Kesseru (T_9)	76.50	59.64	7.41
S.Ed (±)	1.936	2.227	0.415
CD at 5%	3.969	4.566	0.851

Data represent mean of 4 replications

Results (Table 3) revealed that there was significant difference ($p<0.05$) in the cocoon weight of the silkworm reared on the food plants and their interchange combinations. Among the sole food plants castor fed larvae (T_1) produced significantly the highest cocoon weight (3.08g) followed by kesseru (T_2) fed larvae (2.91g). The cocoon weight (2.82g) of borpat (T_3) fed larvae was found *at par* with kesseru fed larvae. In all the interchanged combinations of the food plants the cocoon weight were found to be significantly lower than the sole food plants. The larvae offered with different food plant combination castor + kesseru (T_4), castor+ borpat (T_5) and kesseru + castor (T_6) registered cocoon weight of 2.60g, 2.58g and 2.50g, respectively and T_4 and T_5 found to be *at par* with each other. Though combination of borpat + kesseru (T_9) registered for the lowest cocoon weight (2.38g), it did not vary significantly from borpat + castor (T_8) combination which recorded 2.42g, respectively in respect of this parameter.

Significant difference ($p<0.05$) was observed in the cocoon shell weight of Eri silkworm reared on different sole and their interchanged combinations of the food plants. Among the sole food plant the highest cocoon shell weight (0.36g) was registered for the cocoons obtained from kesseru (T_2) fed larvae followed by castor (T_1) and borpat (T_3) fed larvae with 0.34g and 0.32g, respectively. Among the food plant combination castor+ kesseru (T_4) registered cocoon shell weight of 0.33g and found to be *at par* with sole castor (T_1) and barpat (T_3). The food plant combination castor + borpat (T_5) and kesseru + borpat (T_7) recorded shell weight of 0.31g and 0.30g respectively and found to be *at par* with each other. The lowest shell weight (0.27g) recorded in borpat + castor (T_8) did not differ significantly from borpat + kesseru (T_9) combination which recorded 0.28g.

Result revealed that food plants and their interchange combinations had significant ($p<0.05$) effect on the shell ratio of Eri cocoons. Among the sole food plants kesseru fed larvae (T_2) produced cocoons with significantly higher shell ratio (12.53%) followed by borpat (T_3) fed larvae (11.45%).Though the lowest shell ratio (11.05%) was recorded for the cocoons of castor (T_1) fed larvae, it was found *at par* with the cocoons of borpat (T_3) fed larvae. Among the interchanged combinations castor + kesseru (T_4), castor + borpat (T_5) and kesseru + borpat (T_7) registering 12.71%, 11.94% and 11.90% of cocoon shell ratio, respectively were *at par* and did not vary significantly from that of kesseru (T_2). Though the combination of borpat + castor (T_8) recorded the lowest shell ratio (11.24%), it did not vary significantly from kesseru + castor (T_6), kesseru + borpat (T_7) and castor + borpat (T_9) combinations in respect of this parameter.

Table 3 : Effect of food plants and their interchange combinations on cocoon weight, shell weight and shell ratio of Eri cocoon

Host plants combination (Treatment)	Cocoon weight (g)	Shell weight (g)	Shell ratio (%)
Castor (T_1)	3.08	0.34	11.05
Kesseru (T_2)	2.91	0.36	12.53
Barpat (T_3)	2.82	0.32	11.45
Castor+Kesseru (T_4)	2.60	0.33	12.71
Castor + Borpat (T_5)	2.58	0.31	11.94
Kesseru+Castor(T_6)	2.50	0.29	11.60
Kesseru+Borpat (T_7)	2.48	0.30	11.90
Borpat+Castor (T_8)	2.42	0.27	11.24
Borpat+Kesseru (T_9)	2.38	0.28	11.77
S.Ed(±)	0.05	0.01	0.44
CD at 5%	0.10	0.02	0.86

Data represent mean of 10 observations

The Eri cocoons are the basic raw materials for the production of Eri spun yarn. The growth of the silkworm larvae is directly related to quality of the host plants. It is obvious that highly nutritious and good quality food is very essential for proper growth and development of larvae to spin good quality cocoons to produce good quality Eri spun yarn. The present study reveals that rearing of Eri silkworm on different food plants and interchanging the food plants during rearing period had significant effect on qualitative cocoon characters and yield attributing parameters of cocoon *viz*., cocoon weight, cocoon shell weight, shell ratio percentage ,effective rate of rearing and cocoon yield. Among the sole food plants castor was found to be better in terms of effective rate of rearing, cocoon weight and green cocoon yield while kesseru appeared to be better in terms of shell weight, shell ratio and cut cocoon yield of Eri silkworm. Though borpat occupies a lower position in these parameters, the food plant appears to be better than castor and kesseru in terms of shell ratio and effective rate of rearing, respectively. These variations in cocoon quality of Eri silkworm might be due to the nutritional quality of the food plant leaves and also the required balance of the nutrients within the species owing to many factors including the synthetic ability and metabolic activities of the silkworm involving specific interrelations between certain nutrients (House, 1974). Sharma *et al. (*1998) also worked out the effect of castor, kesseru and borpat on certain life parameters of Eri silkworm and reported that castor feeding increased the fecundity and adult longevity while borpat feeding increased shell weight and shell ratio of Eri cocoons. The superiority of castor in respect of larval growth and cocoon characters of Eri silkworm have been established (Kapil, 1967; Pathak and Dutta, 1990; Rajashekhargouda *et al.,* 2009; Deka *et al.,* 2011). It was reported that though castor and kesseru are the most preferred food plants for commercial Eri silkworm rearing and Eri silk production, borpatleaves can also be best utilized for rearing of the silkworm (Chowdhury, 1982; Khanikor *et al*., 1997; Shaw, 1998). Muthukrishnan and Radha (1978) also reported the effect of feeding tapioca, castor and papaya on rearing performance of Eri silkworm.

Interchange of the food plants during rearing period found to have significant effect on qualitative cocoon characters and cocoon yield of Eri silkworm. It was observed that among all the interchange combinations of the food plants, castor in combination with kesseru (castor + kesseru) appeared to be significantly better in respect of cocoon weight, shell weight, shell ratio, effective rate of rearing, green cocoon yield and cut cocoon yield followed by castor in combination with borpat (castor + borpat). Kesseru in combination of castor (kesseru + castor) and borpat (kesseru + borpat) though behave equally in respect of cocoon weight, shell weight, shell ratio and effective rate of rearing, the combination of kesseru + borpat appeared to be better than kesseru + castor in respect of green cocoon and cut cocoon yield. Borpat in combination with castor (borpat + castor) and kesseru (borpat + kesseru) behave equally and registered for comparatively lower values of cocoon weight, cocoon shell ratio and effective rate of rearing among the food plant combinations, however, green cocoon yield and cut cocoon yield was comparatively better than kesseru with castor (kesseru + castor) combination. The variations in qualitative cocoon characters and cocoon yield of the silkworm in different dietary regiments of food plant combinations might be due to the differential energy that the larvae derived from their food (House, 1974). The interchange effect of different combinations of castor, tapioca and borpat on rearing performance of Eri silkworm had been reported (Joshi and Mishra, 1979; Devaiah *et al.* 1988; Govindan *et al.* 1992; Dutta and Khanikor, 2005; Venu and Munirajappa, 2013). Ahmed *et al. (*2015) reported that substitution of castor with borpat leaves in third instar onwards (late stage rearing) or rearing with borpat alone from brushing till spinning would make Eri culture sustainable and economically vibrant among the primary stack holders.

Conclusion

From the present investigation it can be concluded that though castor is considered best, kesseru and borpat are equally suitable for rearing and cocoon production of Eri silkworm considering the cocoon characters and yield. As castor is an annual plant, utilization of selective perennial plant will reduce the cost of cultivation of the food plant of Eri silkworm.

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. *Adv. Biol. Res.,* **9**(1), 07-14.

Chowdhury, S.N. (1982). *Eri silk Industry*. Directorate of SEriculture and Weaving, Govt. of Assam. pp. 24-25

Deka, M., Dutta, S. and Devi, D. (2011). Impact of feeding of *Samia cynthia ricini* Boisduval (red variety) (Lepidopera: Saturnidae) in respect of larval growth and spinning. *Int. J. Pure Appl. Sci. Technol*., **5**(2),131-140.

Devaiah, M.C., Rajashekargouda, R. and Suhas, Y. (1988). Effect of castor, tapioca and their combination on the growth and development of the larvae and cocoon characters of *Samia cynthia ricini* Boisd. Scientific papers Abst. Central Silk Board, Bangalore. *International Congress in Tropical Sericulture practices*, p. 33.

Dutta, P.P. and Khanikor, D.P. (2005). Rearing performance of Eri silkworm (*Samia ricini*) with interchange of food plants in different seasons. *Bull. Ind. Acad. Seri*., **9**(2): 31-36.

Govindan, R., Devaiah, M.C. and Rangaswamy, H.R. (1978). Effect of different food plants on the growth of fifth instar larva and economic traits of cocoons of *Philosamia ricini* Hutt. *All Indian Symp. on Seric. Sci*, Oct 23-26, Bangalore, Abs, p: 49.

House, H.L. (1974). Insect Nutrition. In: *The Physiology of Insecta*. Vol. V (2nd Ed.), Rockstein (Ed.), Acad. Press, New York, pp. 1-53.

Joshi, K.L. and Mishra, S.D. (1979). Studies on live weight of larvae, cocoons and pupae and silk contents of Eri silkworm, *Philosamia ricini* Hutt. (Lepidoptera: Saturniidae) reared on interchanged two host plants. *Trans. Insdt. & UCDS.***4**(2): 97-100.

Kapil, R.P. (1967). Effects of feeding different host plants on the growth of larvae and weight of cocoon of *Philosamia ricini* Hutt. *Indian J. Ent.* **29**(3): 295-296.

Khanikor, D.P., Dutta, S.K. and Khound, J. (1997). Exploitation of barkesseru, *A. excelsa* leaves as a substitute to castor leaves for rearing Eri silkworm. *New Agric.* **8**(1): 7-12.

Krishnaswami, S., Rao, M.N.R., Suryanarayan, S.K. and Sundarmurthy, T.S. (1972). *Manual on Sericulture.* Silk reeling. FAO Agricultural Services Bulletins, *Rome*. p. 112.

Muthukrishnan, T. S. and Radha, N. V. (1978). Feeding studies on Eri silkworm with tapioca, castor and papaya. *All India Symp. on SEric. Sci., Univ. Agric. Sci., Hebbal, Bangalore*, p. 49

Pathak, A. K. and Dutta, L. (1990). Studies on nutritional growth and cocoon characters of Eri silkworm, *Philosamia ricini* Hutt. fed on different food plants. *J. Assam Sci. Soc.,* **32**(4): 36-39.

Rajashekhargouda, R. P., Kusugal, S. and Ankad, G. (2009). Performance of Eri silkworm, *Samia cynthia ricini* Boisd. on few food plants. *Karnataka J. Agric. Sci.* **22**(1): 220-221.

Sharma, R.K., Dutta, S.K., Khanikor, D.P. and Dutta, L.C. (1998). Effect of larval food plants on certain life parameters of Eri silkworm, *Philosamia ricini* Hutt. *Journal of Agricultural Science Society, NE India*. **11**(1):5-9.

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, AAU, Jorhat.

Thangavelu, K. and Borah, A. (1986). *Eri culture*. Boraiah, G. (Ed), Suramya Publ. Bangalore, pp.135-137.

Venu, N. and Munirajappa (2013). Impact of independent and sequential feeding of different host plants on economic traits of Eri silkworm, *Philosamia ricini* Hutt. *Int. J. Sci. Nat.* **4**(1): 51-56.