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IMPACT OF INDEPENDENT AND SEQUENTIAL FEEDING OF DIFFERENT HOST PLANTS ON ECONOMIC TRAITS OF ERI SILKWORM, *PHILOSAMIA RICINI* HUTT

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ABSTRACT
The study was undertaken to evaluate the morpho-economic triats of eri silkworm, *Philosamia ricini* Hutt by feeding different host plants leaves. Healthy leaves of Castor (*Ricinus communis* L), Tapioca (*Manihot esculenta* Crantz), Wild Castor (*Jatropha curcas* L), Barkesseru (*Ailanthus excelsa* Roxb) were used to conduct rearing. Independent trials as well as interchanging of food plants during rearing were undertaken. It is observed that, despite the fact that the castor leaves serve as chief feed for rearing of eri silkworms, the combination of castor and tapioca leaves could also be beneficially used for commercial rearing of eri silkworm. When the worms were reared by feeding the leaves of castor up to 3rd instar and interchanging with tapioca leaves during 4th and 5th instar resulted in better eri silk recovery. Hence, the present study recommends the sequential treatment namely, castor leaves alternating with tapioca leaves for commercial rearing of eri silk worm larvae.

KEY WORDS: Economic traits, Eri silkworm, Growth & Development, Host plants.

INTRODUCTION

The Eri silkworm, *Philosamia ricini,* Hutt. belonging to family saturnidae, is the one among the commercially exploited silkworm species and can be reared indoors throughout the year to produce silk depending on the availability of suitable host plants (Debraj *et al*., 2003). Eri silkworm is a polyphagus insect and feeds on the leaves of several food plants *viz*., Castor (*Ricinus communis* L), Tapioca (*Manihot esculenta* Crantz), Wild Castor (*Jatropha curcas* L), Papaya (*Carica papaya* L), Barkesseru (*Ailanthus excelsa* Roxb), Kesseru (*Heteropanax fragrans* Seem), etc. Although, eri silkworm is known to feed on the leaves of more than 30 host plant species, castor is considered as the principle host plant (Govindan *et al*., 1978; Arora and Gupta, 1979; Dayashankar, 1982; Devaiah *et al*., 1985; Gogoi, 1998; Chowduary, 2006 and Sannappa *et al*., 2007). Previous workers studied rearing performance of eri silkworm by using the leaves of different food plants and they have recorded varied results such as prolonged larval duration, reduced larval weight, cocoon weight, shell weight, shell ratio and pupal weight. On the other hand, eri host plants are interchangeable at 3rd instar to 5th instar especially during the scarcity of castor leaves (Dutta and Khanikor, 2005; Mukul Deka *et al*., 2011). However, the new practice of utilizing sequential use of food plants for commercial rearing is yet to be worked out. Therefore, in the present investigation an attempt has been made to record the rearing performance of eri silkworm by feeding the leaves of castor, tapioca, ailanthus and jatropha, independently as well as sequentially.

MATERIALS AND METHODS

Present study was conducted at Department of Sericulture, Bangalore University, Bangalore. Disease free layings (DFL's) of eri silkworm were obtained from Central Sericulture Research and Training Institute, Mysore. The eggs were disinfected with 2% formalin solution for 15 minutes and washed in a tap water and kept for incubation for hatching (Chowdhury 1982). Castor (Fig. 1), tapioca (Fig. 2), ailanthus (Fig. 3) and jatropha (Fig. 4) leaves were collected from the plants cultivated in the experimental garden attached to the department of sericulture and used for the rearing. Rearing was undertaken as per the standard rearing techniques (Krishnaswamy *et al*., 1972; Sarkar 1980). Rearing room and appliances were well disinfected thoroughly with 2% formalin solution. The room temperature and humidity were maintained at 25^0C – 28^0C and 70% - 80% respectively. Newly hatched larvae were transferred to the rearing trays with the help of the feather. First and second instar larvae were fed four times a day with tender leaves. Medium aged leaves were given to third instar and matured leaves were fed five times a day to the fourth and fifth instars larvae. Bed cleaning was done regularly and the matured larvae were transferred to the bamboo chandrike for spinning of cocoons. Cocoon harvesting was done on the sixth day of spinning.

The experiment was carried out with seven treatments.

T_1 = Castor (1st to 5th instar)
T_2 = Tapioca (1st to 5th instar)
T_3 = Ailanthus (1st to 5th instar)
T_4 = Jatropha (1st to 5th instar)
T_5 = Castor (1st to 3rd instar) + Tapioca (4th to 5th instar)
T_6 = Castor (1st to 3rd instar) + Ailanthus (4th to 5th instar)
T_7 = Castor (1st to 3rd instar) + Jatropha (4th to 5th instar)

Each treatment consists of four replications. During rearing observations on larval duration, larval weight,

effective rate of rearing (ERR), cocoon weight, pupal weight, shell weight, and shell ratio percentage were recorded. The data was analysed statistically as mean of three independent replications (± SE) and analysed by one way ANOVA with Post hoc Bonferroni test for independent and sequential host plants by using SPSS software. The interpretation of the data was done using critical difference (CD) values calculated at P = <0.05.

Fig.1: Eri silkworm larvae fed on Castor (*Ricinus communis*) leaves.

Fig.2: Eri silkworm larvae fed on Tapioca (*Manihot esculenta*) leaves.

Fig.3: Eri silkworm larvae fed on Barkesseru (*Ailanthus excelsa*) Leaves.

Fig.4: Eri silkworm larvae fed on Wild Castor (*Jatropha curcas*) leaves.

Larval parameters

Larval duration (days): Total larval duration was recorded in days from the time of hatching till spinning for each treatment.

Larval weight (g): Weight of healthy matured larvae was taken during fifth instar (one day prior to spinning), for each replication and the average was calculated.

Effective rate of Rearing (ERR) %: ERR was calculated by using the formula

$$ERR\% = \frac{\text{Number of cocoons harvested}}{\text{Total number of silkworms brushed}} \times 100$$

Cocoon parameters

Cocoon weight (g): Ten cocoons were randomly collected from each treatment and individual cocoon weight was recorded and average was determined.

Pupal weight (g): After obtaining the cocoon weight they were cut open to record pupal weight.

Shell weight (g): After removing the pupae and larval excuvium from the cocoons, shell weight was recorded.

Shell ratio (%): Shell ratio is the amount of silk present in a cocoon shell and expressed in percentage.

$$\text{Shell ratio (\%)} = \frac{\text{shell weight (g)}}{\text{Cocoon weight (g)}} \times 100$$

RESULTS AND DISCUSSION

The potentiality of ericulture as a viable subsidiary occupation has been highlighted by several workers (Prakash *et al*., 2003; Saratchandra, 2003). It is evident that there will be a substantial increase in annual income of the farmers by practicing ericulture which brings socio-economic change at the rural level. Castor is considered as the primary food plant of eri silkworm. However, during the scarcity of castor leaves especially at fourth and fifth instar when the larvae consume more quantity of leaves, secondary food plants like tapioca, ailanthus and jatropha can be used for successfully rearing purpose (Devaiah *et al*., 1978; Reddy *et al*., 1989 and Rajesh Kumar and Gangwar, 2010).

Larval duration (days)

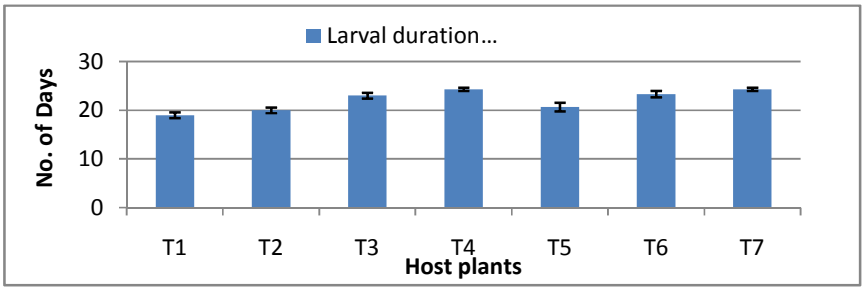
Eri silkworms fed on castor tapioca, ailanthus and jatropha leaves shows the mean larval duration was 19 days, 20 days, 23 days and 24.33days respectively. (Table 1). However, eri larvae which were fed with castor leaves during 1st instar to 3rd instar and feeding with tapioca, ailanthus and jatropha leaves from 4th instar to spinning recorded a mean larval duration of 20.67days, 23.33days and 24.67days respectively (Table 2). Significant differences were not observed when castor and other host plants were used for rearing. ($F_{6, 14}$ = 13.54 at P = <0.05). Devaiah *et al*., (1978) reported that, the eri worms

completed larval duration at 21-28days when reared on castor leaves. Thangavelu and Phukon (1987) have recorded 16 and19days of larval duration when castor and tapioca leaves were used for rearing respectively.

TABLE: 1 Effect of independent treatment of host plants on growth and development of eri silkworm, *Philosamia ricini*

Parameters	Food plants (M ±SE)			
	T1	T2	T3	T4
Larval duration (days)	19.00 ± 0.58	20.00 ±0.58	23.00 ±0.58	24.33 ±0.33
Larval weight (g)	7.53 ±0.15	6.76 ±0.08	6.08 ±0.01	6.06 ±0.01
ERR (%)	88.67 ±0.88	83.00 ±1.53	75.67 ±1.45	73.00 ±1.53
Cocoon Weight (g)	3.58 ±0.04	3.18 ±0.04	3.05 ±0.04	2.81 ±0.09
Pupal weight (g)	3.04 ±0.03	2.68 ±0.03	2.58 ±0.03	2.37 ±0.08
Shell weight (g)	0.54 ±0.02	0.50 ±0.01	0.48 ±0.01	0.44 ±0.01
Shell Ratio (%)	15.08 ±0.32	15.72 ±0.34	15.73 ±0.30	15.65 ±0.31

The mean difference is significant at the 0.05 level.



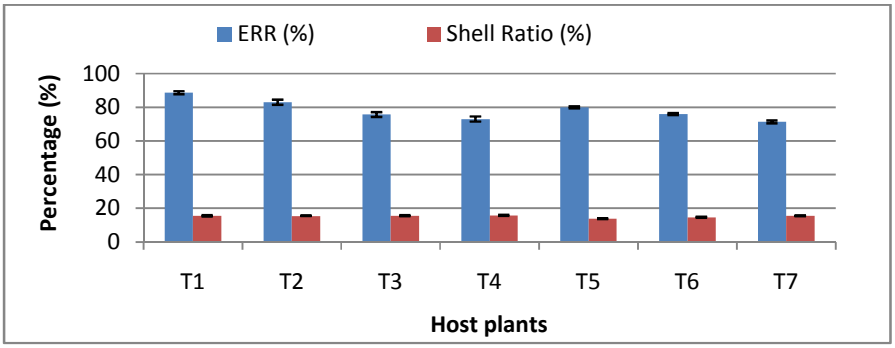
GRAPH 1: Data on larval duration (± SE) when reared on different host plants (independent and sequential treatments)

Larval weight (g)

Eri larvae fed on castor, tapioca, ailanthus and jatropha leaves recorded the mean larval weight of 7.53g, 6.76g, 6.08g and 6.06g respectively (Table 1). While the eri larvae which were given castor leaves from 1st instar to 3rd instar and tapioca, ailanthus and jatropha leaves during 4th instar and 5th instar recorded mean larva weight of 6.48g, 6.00g and 5.78g respectively (Table 2). Significant differences were not recorded between independent and sequential treatments with $F_{6, 14}$ = 28.25 at P = <0.05. However, previous workers have reported variations in larval weight depending upon the food plants (Govindan *et al*., 1978; Reddy *et al*., 1989 and Rajesh Kumar and Gangwar, 2010). Present study, thus, deviates from the earlier reports.

Effective Rate of Rearing (ERR) %

Eri silkworms fed on castor, tapioca, ailanthus and jatropha leaves recorded a mean ERR of 88.67%, 83.00%, 75.67% and 73.00% respectively (Table 1). Eri silkworms given castor leaves during 1st instar to 3rd instar periods and then feeding with leaves of tapioca, ailanthus and jatropha from 4th instar to spinning recorded the mean ERR of 80.00%, 76.00% and 71.33% respectively (Table 2). However, castor was found to be significant when compared to other host plants in independent and sequential rearing with $F_{6, 14}$ = 28.68 at P = <0.05. Similar observations were also recorded by the earlier workers (Kuberappa *et al*., 1986; Rajesh Kumar and Gangwar, 2010; Mukul Deka *et al*., 2011). The experimental results clearly indicates that based on the host plants and other environmental factors ERR differs.



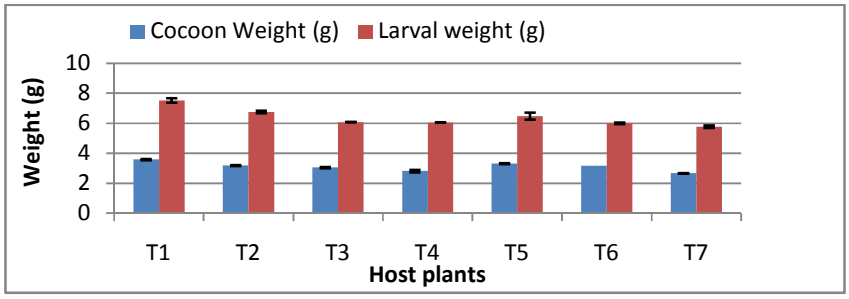
GRAPH 4: Data on ERR % (± SE) and Shell ratio % (± SE) when reared on different host plants (independent and sequential treatments)

Cocoon weight (g)

Eri silkworms fed on castor, tapioca, ailanthus and jatropha leaves recorded the mean cocoon weight of 3.58g, 3.18g, 3.05g, 2.81g respectively (Table 1). Further, eri larvae which were fed with castor leaves from 1st instar to 3rd instar periods and with tapioca, ailanthus and jatropha

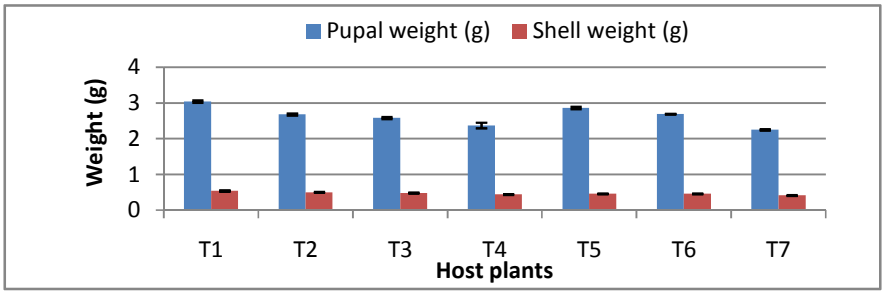
leaves during 4th instar and 5th instar periods recorded the mean cocoon weight of 3.31g, 3.16g and 2.67g respectively (Table 2). Significant difference was not noticed between independent and sequential rearing. ($F_{6, 14}$ = 47.85 at P = <0.05). The data reported by Rajesh Kumar and Gangwar (2010) are in conformity with the present findings. However, Patil *et al*., (1986) reported 2.50g of cocoon weight by feeding the larvae with castor leaves which differs from the present observations. Surayanarayana *et al*., (2003) also observed that the castor showed better performance compared to the other host plants.

GRAPH 2: Data on Cocoon weight (± SE) and Larval weight (± SE) when reared on different host plants (independent and sequential treatments)



Pupal weight (g)

Eri larvae fed on castor, tapioca, ailanthus and jatropha leaves recorded the mean pupal weight of 3.04g, 2.68g, 2.58g and 2.37g respectively (Table 1). Eri larvae fed with castor leaves up to 3rd instar and from 4th instar onwards feeding with tapioca, ailanthus and jatropha leaves till spinning recorded the mean pupal weight of 2.68g, 2.69g and 2.25g respectively (Table 2). Castor plant established its superiority with other food plants in independent treatment. On the other hand, sequential treatment of castor leaves with tapioca is proved to be good for eri rearing with F6, 14 = 47.75 at P = < 0.05. Govindan et al., (1978), Kuberappa et al., (1986) and Sannappa (1997) have recorded the pupal weight of 2.18g, 1.98g and 1.89g respectively when eri worms were reared on castor leaves.



GRAPH 3: Data on Pupal weight (± SE) and Shell weight (± SE) when reared on different host plants (independent and sequential treatments)

Shell weight (g)

Eri larvae fed on castor, tapioca, ailanthus and jatropha leaves recorded the mean shell weight of 0.54g, 0.50g, 0.48g and 0.44g respectively (Table 1). Eri larvae which were fed with castor leaves during 1st to 3rd instar and feeding with tapioca, ailanthus and jatropha leaves from 4th instar to till hatching recorded the mean shell weight of 0.46g, 0.46g and 0.41g respectively (Table 2). The data recorded was found to be significant in all treatment in independent and sequential rearing except tapioca which was found to be non significant in independent rearing with $F_{6, 14}$ = 17.51 at P = <0.05. Jolly *et al*., (1979) and Narayanaswamy (1988) have recorded 0.40g of shell weight when eri worms were reared on castor leaves. Reddy *et al*., (1978), Rajesh Kumar and Gangwar (2010) have recorded similar results when the eri worms reared on tapioca leaves.

Shell ratio %

Eri worms which were fed on castor, tapioca, ailanthus and jatropha leaves recorded the mean shell ratio of 15.08%, 15.72%, 15.73% and 15.65% respectively (Table 1). While the eri worms were reared on castor leaves up to 3rd instar and then feeding with tapioca, ailanthus and jatropha leaves in 4th and 5th instar recorded mean shell ratio of 13.89%, 14.55% and 15.35% respectively (Table 2). Non significant differences was observed in independent and sequential rearing of different host plants with $F_{6, 14}$ = 7.77 at P = < 0.05. Basaiah (1988) and Kumar

et al., (1993) were recorded the shell ratio of 15.26% and 15.43% when eri worms are reared on Aruna variety of castor. Present findings are at variance from this report.

TABLE: 2 Effect of sequential treatment of host plants on growth and development of eri silkworm, *Philosamia ricini*

Parameters	Food plants (M ±SE)		
	T5	T6	T7
Larval duration (days)	20.67 ±0.88	23.33 ±0.67	24.67 ±0.33
Larval weight (g)	6.48 ±0.23	6.00 ±0.06	5.78 ±0.09
ERR (%)	80.00 ± 0.58	76.00 ±0.58	71.33 ±0.88
Cocoon Weight (g)	3.31 ±0.03	3.16 ±0.01	2.67 ±0.02
Pupal weight (g)	2.86 ±0.03	2.69 ±0.01	2.25 ±0.02
Shell weight (g)	0.46 ±0.01	0.46 ±0.01	0.41 ±0.01
Shell Ratio (%)	13.89 ±0.21	14.55 ±0.27	15.35 ±0.24

The mean difference is significant at the 0.05 level.

CONCLUSION

The present study clearly proved that, the rearing of eri larvae by feeding the castor leaves from 1st to 3rd instar and interchanging with tapioca leaves during 4th and 5th instars improved the commercial characteristic features such as larval weight, larval duration, ERR, cocoon weight and shell weight. Similarly, as noted by previous workers the castor plant has established its superiority with other host plants by encouraging the growth and development of eri silkworms. Present study, therefore, recommends the use of castor and tapioca leaves sequentially for successful production of eri silk.

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