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ORIGINAL ARTICLE

Effect of feed additives on economic parameters of eri silkworm, *Philosamia ricini* Donovan (Lepidoptera: Saturniidae)

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ABSTRACT

The observations on different parameters of eri silkworm with respect to feed additives revealed that the larval duration of eri silkworm was recor ded significantly ($F_{3,11}$ = 0.11, $p < 0.01$) minimum on black gram additive (19.50±0.289 days) followed by mung bean additive (21.00±0.289 days), pigeon pea additive (22.00±0.289 days) and castor alone used as control (22.00±0.577 days). The larval and cocoon weight of eri silkworm was recorded significantly ($F_{3,11}$ = 0.94 & 0.95, $p < 0.01$) maximum (7.25±0.046 and 3.35±0.012 gram) on black gram additive. The highest cocoon shell weight and shell ratio was recorded (0.49±0.023 gram and 14.63±0.688 %) further on black gram additive. The pupal period of eri silkworm remarkably showed ($F_{3,11}$ = 5.72, $p < 0.01$) shortest duration (9.75±0.144 days) on black gram additive and longest (11.17±0.220 days) on pigeon pea additive. In addition, pupation rate and leaf silk conversion rate (LSCR) of Philosamia ricini showed significant ($F_{3,11}$ = 0.65 & 1.74, $p < 0.01$) and highest rate (85.00±1.732 and 3.05±0.035 %) on black gram additive and lowest rate (81.33±0.882 and 2.78±0.040 %) on control. Therefore, eri silkworm, Philosamia ricini showed highest preference on Vigna mungo additives followed by Cajanus cajan, Vigna radiate and Ricinus communis.

Key words: *Cajanus cajan, eri silkworm, Ricinus communis, Vigna mungo, Vigna radiate*

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INTRODUCTION

Eri silkworm is only non-mulberry silkworm, which is domesticated completely. The 'Eri' is derived from the Sanskrit term 'Erranda', which refers to castor plant, although it is primary food source of eri silkworm. However, Arora and Gupta (1979) listed about 30 host plant species on which eri silkworm is known to feed and Manjunatha (2008) reported it as polyphagous. Due to availability of castor plants throughout India and Eri silk can easily cultivate on it in both natural as well as domestic conditions. Eri silk is as soft as other kinds of silk and can be blended with other fibres like wool and polyester for durability and decoration (Siddiqui, *et al.,* 1993 & Manjunatha, 2008).

India ranks second in silk production after china, and account about 23060 mt of mulberry and non-mulberry silk. Among them mulberry contributes about 80.73%, eri 13.14%, tasar 5.55% and muga negligible 0.5% of the total raw silk production in the country (Tripathi and Ahmad, 2013). However, the contribution of eri silk from different part of India is about 740 mt from Assam, 374 mt from Manipur, 202 mt from Meghalaya, 115 mt from Nagaland, 5 mt from Arunachal Pradesh, 4.2 mt from Mizoram, 14 mt from Andhra Pradesh, 8 mt from West Bengal, 130 mt from Bihar, 3.10 mt from Chattisgarh, 0.20 mt from Jharkhand, 10 mt from Kerala, 4.10 mt from Orissa, 0.10 mt from Sikkim and 4.0 mt from Uttar Pradesh (Giridhar, *et al.,* 2007 & Manjunatha, 2008).

Culture of Eri silk is believed to have originated from the northeastern India especially Assam where the castor cultivated as major host plant of eri silkworm. But in recent years, culture of eri silkworm has been introduced in Southern states, where, its cultivation affected due to the attack of various insect pest and disease, which may ultimately distress the production of silk. Therefore, in present investigations, different additives of food supplied with the castor leaves to improve the production of eri silkworm.

MATERIALS AND METHODS

The present study was conducted to evaluate different food additives on economic traits of eri silkworm, *Philosamia ricini* Donovan in the Department of Zoology Gandhi Faiz-E-Aam College, Shahjahanpur Uttar Pradesh. The eggs of eri silk worm were collected from Eri Silkworm Seed Production Centre (ESSPC), Haldwani, Uttrakhand. Standard tray rearing method was practiced as recommended per recommendations of Sarkar (1988). To design present experimental control, a sum of 100 worms was maintained on castor (*Ricinus communis*) leaves separately in wooden tray. For treatment of different additives 10 gram flour of pigeon pea (*Cajanus cajan*), black gram (*Vigna mungo*) and mung bean (*Vigna radiate*) were mixed with one kg leaves of castor. Three replications of each treatment along with control were maintained in the laboratory. The tender leaves of castor were provided to the caterpillars up to development of third instar larvae. However, mature leaves were provided to fourth and fifth instars larvae of eri silkworm. The cocoon harvesting was carried out on fifth and six day of spinning.

ANALYSIS OF DATA:

The economic traits *viz.*, larval duration, larval weight, single cocoon weight, shell weight, shell ratio, pupal period, pupation rate and leaf silk conversion rate (LSCR) were observed with respect to each treatment. The larval duration, pupal duration, larval weight, cocoon weight and cocoon shell weight were directly observed with respect to different additives. However, shell ratio, pupation rate and leaf silk conversion rate were calculated by using following formula.

Shell Ratio = [Shell weight/ Cocoon weight] x 100
Pupation Rate = [No. of larvae pupated/ No. of larvae mounted for spinning] x 100
LSCR = [(Single shell weight x 10000)/(5^{th} instar larvae ingesta/400 x 10000)] x 100

The data collected for different economic parameters of eri silkworm *Philosamia ricini* were subjected to one way ANOVA, which calculated by using software MINITAB 11 for window. The data presented in table was pooled analysis of two successive generations. However, the values presented in tables were means with standard error of means, which was compared by using Duncan's Multiple Range Test (DMRT).

RESTULTS AND DISCUSSION

After supplying food additives (pigeon pea, *Cajanus cajan*; black gram, *Vigna mungo* and mung bean, *Vigna radiate*) with castor leaves, different economic parameters *i.e.*, larval duration, larval weight, cocoon weight, shell weight, shell ratio, pupal period, pupation rate and leaf silk conversion rate (LSCR) of eri silkworm *Philosamia ricini* were recorded in the laboratory. The observations on larval duration of eri silkworm was recorded significantly ($F_{3,11} = 0.11$, $p < 0.01$) minimum on black gram additive (19.50±0.289 days) followed by mung bean additive (21.00±0.289 days), pigeon pea additive (22.00±0.289 days) and control which is castor only (22.00±0.577 days), respectively (Table 1). In previous observations of Subramanianan, *et al.,* (2013) and Shifa, *et al.,* (2015), larval duration of eri silkworm ranged from 22.67 to 25.83 days and also showed complete corroboration present result.

The larval weight of eri silkworm was recorded significantly ($F_{3,11}$ = 0.94, p < 0.01) maximum on black gram additive (7.25±0.046 gram) and minimum on control (6.52±0.075 gram). In addition, cocoon weight of *Philosamia ricini* was observed significantly ($F_{3,11}$ = 0.95, p < 0.01) highest (3.35±0.012 gram) on black gram additive and lowest (3.25±0.069 gram) on control (Table 1). On the other hand, Subramanianan *et al.,* (2013) reported maximum larval weight of eri silkworm (*Samia cynthia ricini*) up to 7.904 gram and cocoon weight up to 3.683 gram on castor, this study give strengthen to present research work.

Table 1: Effect of feed additives on economic parameters of eri silkworm, *Philosamia ricini*

Treatments	Larval duration (day)	Larval Weight (gram)	Cocoon Weight (gram)	Shell Weight (gram)	Shell Ratio (%)	Pupal period (days)	Pupation Rate (%)	LSCR (%)
Pigeon pea (*Cajanus cajan*)	22.00±0.289c	6.60±0.092a	3.26±0.012a	0.47±0.040a	14.41±1.219a	11.17±0.220c	82.50±0.289a	2.95±0.144b
Black gram (*Vigna mungo*)	19.50±0.289a	7.25±0.046c	3.35±0.012b	0.49±0.023a	14.63±0.688a	9.75±0.144a	85.00±1.732b	3.05±0.035b
Mung bean (*Vigna radiate*)	21.00±0.289b	6.75±0.023b	3.28±0.040a	0.48±0.040a	14.44±1.160a	11.00±0.577bc	83.00±1.732a	3.01±0.052b
Control (Castor, *Ricinus communis*)	22.00±0.577c	6.52±0.075a	3.25±0.069a	0.46±0.040a	14.11±0.941a	10.75±0.433b	81.33±0.882a	2.78±0.040a
F and p value	F = 0.11 d.f. = 3, 11 p < 0.01	F = 0.94 d.f. = 3, 11 p < 0.01	F = 0.95 d.f. = 3, 11 p < 0.01	F = 1.00 d.f. = 3, 11 p < 0.01	F = 0.66 d.f. = 3, 11 p < 0.01	F = 5.72 d.f. = 3, 11 p < 0.01	F = 0.65 d.f. = 3, 11 p < 0.01	F =1.74 d.f. = 3, 11 p < 0.01
LSD value	0.612	0.093	0.058	0.052	1.509	0.368	1.940	0.106

Means within a column with the same letters are not significantly different (LSD test at 1% level)

As far as shell weight and shell ratio was concerned, maximum cocoon shell weight and shell ratio was observed on black gram additive (0.49±0.023 gram and 14.63±0.688 %) and minimum on control (0.46±0.040 gram and 14.11±0.941 %), respectively (Table 1). In another experiment, Narayanaswamy and Ananthanarayana (2006) made observations with respect to cocoon yield of *Bombyx mori* and Philip, *et al.,* (2009) provide information on the different biological parameters of eri silkworm, are in support of present research findings.

The pupal period of eri silkworm showed a remarkable difference and significantly ($F_{3,11}$ = 5.72, p < 0.01) shortest duration was recorded on black gram additive (9.75±0.144 days) in contrast longest on pigeon pea additive (11.17±0.220 days) (Table 1). Similar observations on nutritional value and utilization indices were also recorded in mulberry silkworm, *Bombyx mori* by Gokulamma and Reddy (2005).

In addition, pupation rate and leaf silk conversion rate (LSCR) of *Philosamia ricini* showed significant ($F_{3,11}$ = 0.65 & 1.74, p < 0.01) and highest values as 85.00±1.732 and 3.05±0.035 % with black gram additive and lowest values as 81.33±0.882 and 2.78±0.040 % with control, respectively (Table 1). Similar observations on host preference of eri silkworm was also made by Nangia *et al.,* (2000) and reported preference of food in the order of castor followed by tapioca, papaya, barkesseru and gulancha, respectively. The other observations with respect to various food additives on different parameters of silkworm was reported on amway protein additive by Rani, *et al.,* (2011), on bovine milk additive by Konala, *et al.,* (2013), on lemon juice additive by Thulasi and Sivaprasad (2014) and on flour of maize additive by Vanmathi (2016), which give strengthen to present findings.

CONCLUSION

The nutritional supplements when added to normal food, not only tend to increase the nutritional value of food but also improves vital parameters of silkworm (Bajpeyi, *et al.,* 1991 & Sujatha, *et al.,* 2014). Therefore, in present findings, among different additive, black gram *Vigna mungo* showed better performance with significantly minimum larval duration and pupal period, in contrast with maximum larval, cocoon and cocoon shell weight, and higher shell ratio and leaf silk conversion ratio (LSCR).

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