IRA-International Journal of Applied Sciences
ISSN 2455-4499; Vol.03, Issue 03 (2016)
Institute of Research Advances
http://research-advances.org/index.php/IRAJAS

Influence of Supplementation of Zea Mays Flour on the Growth and Economic Traits of Silkworm, Bombyx Mori L.(PFD)

Shifa Vanmathi. J
Assistant Professor
Department Of Animal Science
Manonmaniam Sundaranar University
Tirunelveli -627011, Tamilnadu, India.

DOI: http://dx.doi.org/10.21013/jas.v3.n3.p17

How to cite this paper:
J, S. (2016). Influence of Supplementation of Zea Mays Flour on the Growth and Economic Traits of Silkworm, Bombyx Mori L.(PFD). *IRA-International Journal of Applied Sciences* (ISSN 2455-4499), 3(3). doi:http://dx.doi.org/10.21013/jas.v3.n3.p17

ABSTRACT

Studies were carried out on the impact of supplementation of Zea mays flour on silkworm Bombyx mori belonging to double hybrid variety (PFD). The 3rd,4th 5th instars larvae were feed with leaves supplemented with different concentrations of Zea mays flour. Maximum larval weight was observed in 5th instar larvae in 10% Treatment (4.59±0.31g) and 5% Treatment (3.98±0.23g) as compared to the control (3.13± 0.14g).Mulberry leaves treated with Zea mays flour protein (10%)fed larvae recorded a maximum cocoon weight (2.32±0.07g), pupal weight (1.53±0.12g) shell weight (0.42±0.02g) , shell ratio (24.55±0.62%) silk filament length (851.11±6.94m) silk filament weight (0.51±0.04g). Shell ratio in this treatment (10%) showed an increase of 18.38 % over control filament length 21.64% . Larvae fed with mulberry leaves enriched with Zea mays flour protein showed significant enchancement in economic characters of Bombyx mori was traced.

Keywords: Silkworm *Bombyx mori L.*(PFD), *Zea mays* flour, growth and economic traits

INTRODUCTION:

Silkworm *Bombyx mori* L.(Lepidoptera: Bombycidae), the source of fabulous Silk has been under domestication for the past 5000years India has a long tradition of producing and using Silk, "The Queen of fabrics". Sericulture today is practiced in industrially advanced countries such as Japan and Russia as well as in countries like china. India and south Korea are developing industrially (Bhattacharya and Kaliwal, 2003).

The leaves of Morus species are the sole source of the food for Silkworm, *B.mori.L*, and Nutritional quality of leaves plays a vital role in determining the health and growth of the larvae. The feeding of nutritionally enriched leaves showed better growth and development of Silkworm larvae, as well as directly influence on the quality and quantity of Silk production (Krishnaswami, *et.a*l., 1971).

Fortification of mulberry leaves by using supplementary nutrient and feeding to the Silkworms is a useful modern technique to increase economic value of cocoon (Kumararaj *et.al*., 1972). The supplementation of extra nutrients along with mulberry leaves results higher yield because the production of superior quality and quantity of Silk depends mainly on nutritional status and healthiness of the larva.

(Horie and Watanabe 1983) showed that the supplementation of corn flour protein increased the protein and amino acid content in the larval haemolymph of the Silkworm *B.mori* . In recent years attempts have been made in sericulture with nutrients such as proteins, carbohydrades, amino acids, vitamins, hormones antibiotics etc. For better performance and to get high yield and quantity cocoons (Sannapa, *et.al*., 2002; Etebari, *et al*.,2004).

Larvae of *B. mori* were reared on various kinds of dietary protein (soybean, mushroom, corn flour and mixture of them) using semi-artificial diet. Larvae fed on semi-artificial diet containing corn flour all over the 5th instar larvae gave the highest records on the larval duration, weights of larvae, silk gland, pupa, cocoon and cocoon shell, as well as number of deposited eggs. The same diet gave the lowest mortality percentages. (Mona Mahmoud, 2013)

Our present study focused to evaluate the effect of different concentrations of corn flour on the length, weight; economic characteristics of Silk worm namely cocoon

weight, Shell weight, shell ratio, Silk filament length and Silk filament weight of Silk worm *Bombyx mori L.*

MATERIALS AND METHODS

Collection and rearing of *Bombyx mori L*

The Silk worm selected for the experiment was a popular double hybride variety (PFD) *Bombyx mori L.* (Lepidoptera:Bombycidae) and selected feed additive was Corn flour, *Z. mays*. The 3rdinstar batches of larvae stage of double hybride variety (PFD) Silkworms was obtained from the Government sericulture unit of Tamil Nadu Silk Board Rearing Centre, V.M. Chatram, Tirunelveli district. During the entire procedure of rearing, fresh mulberry leaves of MR2 variety were collected in the early morning and evening from the field and stored in wet gunny bags.The larvae were fed four times a day, at 6 a.m,11 a.m, 2 p.m, and 6 p.m. Chopped mulberry leaves were used according to the age of the larvae. Bed cleaning, spacing, feeding time were adopted carefully following the methods of Krishnaswami,1978.

The rearing room and appliances were thoroughly cleaned and the floor was washed with five per cent bleaching powder solution. The whole room was disinfected by spraying with 2.5 percent sanitech in 0.5 per cent slacked lime solution (Dandin *et.al*., 2003). Bed cleaning was done once during first instar and twice during second instar.. An optimum temperature of 25±1ºc and 75±5 % percent relative humidity was maintained through out the experimental period. The bottoms of the rearing trays were lined with paraffin paper and the edges with wet foam rubber strips. (Jolly,1986).

Food supplements for young age Silkworm, *Bombyx mori L*

The commercial *Zea mays* flour were purchased from the market and different concentrations of *Zea mays* flour suspensions were prepared in distilled water. The known quantity of mulberry leaves (1kg) were dipped in corn flour suspension, air-dried and fed to the experimental groups from the first day of the 3rd instar to the end of the 5th instar. In experimental groups 30 larvae of 3rd instar in each treatment fed with leaves sprayed with flour in two doses like 5% (treatment 1) and 10%(treatment 2) respectively. One batch (45 larvae) of silkworm was fed with normal mulberry leaves (control) in three replications.

Studies were carried out on enriching the mulberry leaves with *Zea mays* flour to improve the Silkworm nutrition. In treatment -1 and 2 were the of leaves as first feed and normal control was fed with fresh mulberry leaves sprayed with distilled water only. This experiment was conducted in Completely Randomised Design (CRD) with three replications (Panse and Sukhatme,1957).

Observations of economic characters of Silk worm, *B.mori L.*

a) Larval length and larval weight of Silk worm, *B.mori L.*

To study the effect of feeding mulberry leaves enriched with different concentration of corn flour on the larval growth and larval weight of the Silkworm were observed on 3rd , 4th and 5th instar (10 days) using a digital balance (0.01 g). Fifteen larvae from every replication were randomly selected and their mass recorded from which the average larval length and weight was observed (Radjabi,*et al.*,2009).

b) Cocoon characters of Silk worm, *B.mori L.*

The matured 5th instar larvae were mounted and the cocoons were harvested on fifth day. The commercial parameters such as cocoon weight, pupal weight, shell

weight, shell ratio, Silk filament length, Silk filament weight were determined by the standard procedure (Sonwalker,1992) .

i) Cocoon, Pupa and cocoon shell weight:

One week after pupation, the cocoons were harvested and cocoons in good condition were cut open from each batch. Male and female pupae were separated and cocoon, pupa and shell weight were recorded. The randomly selected cocoons were taken and weighed using an electronic balance and the weight was expressed in grams. After removing the floss, the cocoons were cut open and the pupae were taken out without causing any damage to them. Then the pupae were weighed using an electronic balance. The shell of the cocoon after removing the floss and pupa was weighed using an electronic balance (Balamani, *et al.*, 1995)

ii) Cocoon Shell percentage:

The percentage of cocoon Shell was calculated using the following formula and expressed in percentage.

Cocoon Shell percentage = Shell weight / Cocoon weight ×100 (Waldbauer,1968)

c) Observation of Silk characters of Silk worm, *Bombyx mori L.*

Cocoon from each replication were stifled in boiling water and threads from individual cocoons were reeled using an eporouette and observed for their silk characters as silk filament length and silk filament weight.

$$\text{Silk filament weight} = \frac{\text{Number of rotation in eporouette}}{\text{Cocoon}}$$

Statistical Analysis:

All the values were statistically analyzed and are presented as Mean±SD

RESULTS AND DISCUSSION

In the present study the results indicates that, the impact of different concentrations of *Zea mays* flour on growth and economic characters of Silk worm, *Bombyx mori L.*
(Lepidoptera:Bombycidae)

Larval Length of Silk worm, *Bombyx mori L.*

The effect of mulberry leaves enrichment with *Zea mays* flour treatment of an larval length is shown in (Table-1). In 3rd instar , 4th instar and 5th instar period, the maximum larval length was observed in Treatment 2 (10%) (3.22±0.07cm), (4.2±0.26cm),(8.6±0.06cm) followed by treatment 1 (5%) (3.13±0.15cm) (4.03±0.18cm),(4.03±0.18cm) and minimum length was observed in control. (3.11±0.04cm),(4.01±0.26cm). (6.98±0.38cm) respectively. Highly significant gain in larval length was observed in treatment 2 followed by Treatment 1 similar to the report of Sarkar *et.al.*, 1995.

Larval Weight of Silk worm *Bombyx mori L.*

The results pertaining to larval weight was found to be highly significant (Table-2). On 3rd instar, the maximum larval weight was recorded in Treatment 2 (0.52±0.01g), (1.92±0.62g), (4.59±0.31g) followed by Treatment 1(0.46±0.03g) (1.59±0.17g) (3.98±0.23g) and control (0.44±0.00g) (0.85±0.04g) (3.13± 0.14g) respectively. Highly significant gain in larval weight was observed in Treatment 2 with10% corn flour followed by Treatment 1.The increase of body weight in treatment 2 may be due to the fortification of leaf with the feed corn flour supplement

. Similar results were reported by El-Hattab, 2002 indicated that the 5th instar larval fed on diet contained mulberry leaves with Corn flour gave the highest significant weights of larvae, silk glands and pupae

Cocoon Characters of Silk worm, *Bombyx mori L.*

The data represented in (Table 3) reveals that the economic parameters of *Bombyx mori L.*

a) Cocoon Weight

The cocoon weight was significantly higher in Treatment 2 (10%) (2.32±0.07g) followed by Treatment1 (5%) (2.12±0.20g) and lower in control (1.34±0.13 g). According to (Subbarao *et.al*,1989), mulberry leaves enriched with corn flour powder in two different concentration (5gm to 10gm) helped to improved qualitative and quantitative characters of cocoon and fecundity.

b)Pupal Weight

The maximum pupal weight was noticed in Treatment 2(1.53±0.12g), followed by Treatment 1(1.41±0.36g) and compared to control(1.06±0.10g). Ganga and Gowri 1990 also recorded improvement in larval weight, silk gland weight and commercial cocoon characters compared to the control and the optimum shell ratio in the cereal flours supplemented groups.

c) Shell Weight

The data pertaining to the shell weight are highly significant. Maximum shell weight was recorded in treatment 2 (0.42±0.02g) followed by Treatment 1(0.39±0.02g) and minimum shell weight was observed in control (0.33±0.03g). The main reason of nutritional supplementation for silk worms is to enhance the economic traits such as cocoon weight, cocoon shell weight and cocoon shell percentage. There are numerous reports containing the positive effects of nutritional supplementation on the economic traits of silkworm (Kabila, *et.al*.,1994,). (Etebari,2002) reported that a treatment with 2% ascorbic acid increased the cocoon weight and the shell weight of both male and female silkworm.

d) Shell ratio

Marked and significant increase in shell ratio was observed in control(24.55±0.62%) followed by Treatment-1(18.80±1.92%) and Treatment-2(18.38±0.71%). Shell weight and shell ratio are important criteria to be considered in the marketing of cocoon. Protein supplementation in the form of hydrolysed corn flour protein (Subburathinam and Krishnan,1998) was found to improved larval, cocoon, shell weight, cocoon/shell ratio, fecundity and haemolymph storage proteins.Lots of researchers fed silkworms mulberry leaves treated with different substances in order to obtain an increase in cocoon production.

Silk Characters of Silk worm, *Bombyx mori L.*

a) Silk filament length

The results indicated that the Treatment-2(851.11±6.94m) showed maximum silk filament length compared to Treatment-1 (755.00±5.00m) and Minimum silk filament length was recorded in control (660±12.01m) (Table-4)

b) Silk Filament weight

The data showed that the maximum Silk filament weight was found in Treatment-2 (0.51±0.04g), and Treatment-1(0.42±0.01gm). Minimum Silk filament weight was observed in control (0.32±0.03gm) (Table-4).According to (Subbarao *et.al.*,1989) mulberry leaves enriched with corn flour powder in two different

concentration (5gm to 10gm) helped to improved qualitative and quantitative characters of cocoon and fecundity.

In conclusion, *Zea mays* flour was found to promote significant improvement in larval and cocoon characters of Silk worm *Bombyx mori L* Significant increase in economic characters like larval length, larval weight, cocoon weight and silk filament length of cocoon was observed in treatment with corn flour powder. The study proves the efficacy of corn flour treatment in silkworm rearing. As these materials are cheap and cost effective, they can be recommended for the farmers use

TABLE:1

Effect of *Zea mays* flour on larval length (cm) of silkworm *Bombyx mori L.*

Treatment	No. of days									
	1	2	3	4	5	6	7	8	9	10
	3rd instar			4th instar			5th instar			
Treatment 1	2.03± 0.03	2.11±0.46	3.13±0.15	3.69±0.17	3.87±0.19	4.03±0.18	6.01±0.37	6.18±0.39	6.38±0.26	8.15±0.14
Treatment 2	2.06±0.05	2.13±0.57	3.22±0.07	3.94±0.17	4.05±0.17	4.2±0.26	6.11±0.14	6.32±0.18	6.57±0.09	8.6±0.06
Control	1.92±0.17	2.05±0.11	3.11±0.04	3.57±0.09	3.86±0.18	4.01±0.26	4.97±0.52	5.19±0.44	5.59±0.28	6.98±0.38

TABLE: 2

Effect of *Zea mays* flour on larval weight (gm) of silkworm, *Bombyx mori L.*

Treatment	No. of days									
	1	2	3	4	5	6	7	8	9	10
	3rd instar			4th instar			5th instar			
Treatment 1	0.22±0.00	0.33±0.02	0.46±0.03	0.51±0.06	1.54±0.17	1.59±0.17	1.67±0.63	2.13±0.10	2.36±0.21	3.98±0.23
Treatment 2	0.25±0.01	0.35±0.02	0.52±0.01	0.56±0.02	1.76±0.18	1.82±0.18	1.92±0.62	2.18±0.12	3.37±0.68	4.59±0.31
Control	0.17±0.37	0.27±0.01	0.44±0.00	0.46±0.00	0.69±0.13	0.85±0.04	0.88±0.37	1.69±0.06	2.02±0.14	3.13±0.14

The experiment data was expressed as Mean ± S.D. The mean difference is significant of the p<005 level.

TABLE:3

Effect of corn flour administration on cocoon characters of Silkworm *Bombyx mori L.*

Treatment	Cocoon weight (gm)	Pupal weight (gm)	Shell weight(gm)	Shell ratio (%)
Treatment 1	2.12±0.20	1.41±0.36	0.39±0.02	18.80±1.92
Treatment 2	2.32±0.07	1.53±0.12	0.42±0.02	18.38±0.71
Control	1.34±0.13	1.06±0.10	0.33±0.03	24.55±0.62

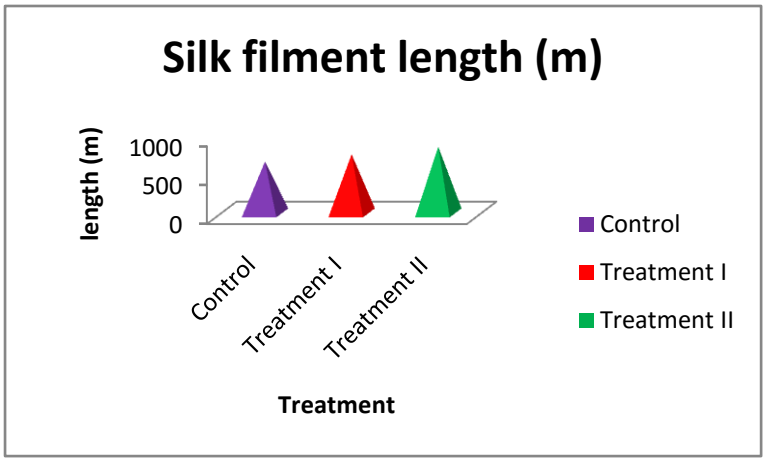
TABLE:4

Effect of corn flour administration on silk characters of Silkworm *Bombyx mori L.*

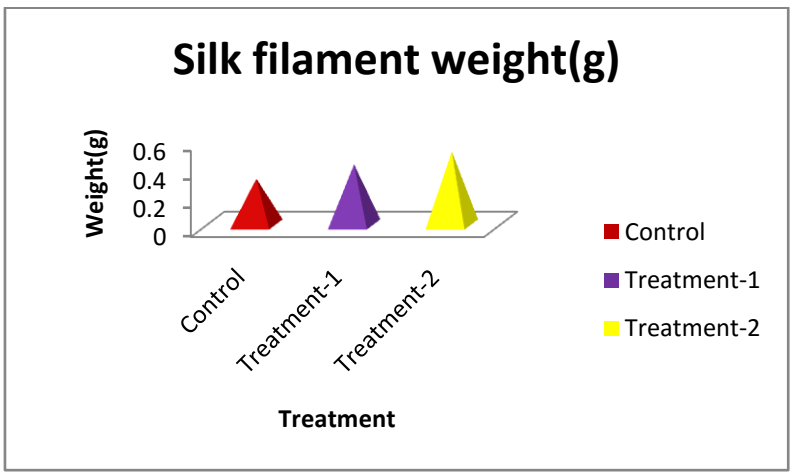
Treatment	Silk filament length (m)	Silk filament weight (g)
Treatment 1	755.00±5.00	0.42±0.01
Treatment 2	851.11±6.94	0.51±0.04
Control	660.00±12.01	0.32±0.03

The experiment data was expressed as Mean ± SD. The mean difference is significant of the p<005 level

Influence of corn flour on Silk Parameters of Silk worm *Bombyx mori L*



Influence of corn flour on Silk Filament weight (g) of Silk worm *Bombyx mori L.*



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