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Improvement in Economic Traits of the Eri Silkworm, *Samia ricini* (Donovan) by supplementation 1 & 2% Protein as a Diet

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ABSTRACT

Nutrition plays a crucial role in sericulture by improving the viable characters of silkworm. Silkworm being a monophagous insect derives almost all the nutrients required for its growth from the Castor leaves *Ricinus communis*) itself. Additional supplement of protein can act for the production of good qualified cocoon and silk. The nutritional supplement of 1% & 2% protein concentration may influence the larval growth of eri silkworm *Samia ricini* D. which eventually reflects in the economic traits. Larvae fed with castor leaves enriched with 1 & 2% protein showed significant enhancement in morphometric growth rate in larval, pupal and cocoons along with feed efficiency as well as tensile properties of the silk fibers although *Ricinicus* leaves treated with protein (2%) fed larvae recorded a maximum effect over control The present investigation was therefore commenced to study the effect of protein on the quantitative traits of *S. ricini*.

Key words: morphometric growth, nutritional supplement, *Ricinus communis*, *Samia ricini,* tensile properties

INTRODUCTION

Nutrition plays a key role in sericulture by improving the viable qualities of silkworm. Eri silkworm *Samia ricini* D. derives almost all the nutrients required for its growth from the castor leaf itself (Ito, 1978). The intake of nutrient by the larvae is also proportional to the availability of feed. The silkworm nourishment is considered as a major area of research in sericulture (Legay, 1958; Sampath *et al.*, 2013). Nutrition study on silkworm is an essential precondition for its proper profitable management. Nutrition can act as a sole factor for improvement of quality and quantity of silkworm (Laskar and Datta, 2000). Sannapa *et al*. (2002) and Etebari *et al*. (2004) has made attempts with nutrients such as proteins, carbohydrates, vitamins hormones antibiotics etc. for better performance and to get high yield and quality cocoons. Jeyapaul *et al*.(2003), Hemmatabadi *et al.* (2014) and Sheeba *et al*. (2006) have tried to give addition feed supplements along with castor leaves to enhance economic characteristics of the silkworm. The present investigation was therefore, undertaken with an aim to study the effect of additional supplement with protein 1% & 2% on the quantitative traits of *S. ricini* D.

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MATERIALS AND METHODS

The present study was carried out in the sericulture room of Pragjyotish College, Guwahati..from the month of February to April 2015. Fresh disease free laying was procured from Eri Silkworm Seed Production Center Azara (Assam) under Central Silk Board (GOI). Protein at different concentrations of 1% & 2% were prepared from the stock solution. Fresh Castor leaves were cleaned. Weighed quantities of leaves (depending on larval stage) were dipped separately with 1% & 2% protein of different concentrations. The treated leaves that were dipped in 1% & 2% protein concentrations were allowed to dry in shade for 15 min prior to feeding. The third instar larvae were fed with treated leaves and control were given untreated leaves. Rearing was done as per the method of Krishnaswami *et al*. (1973). Larval weights were recorded regularly for both control, and treated (1 & 2%) protein groups. Observations on larval weight, cocoon weight, pupal weight, shell weight and shell percentage were recorded both for all the treatment. Consumption and growth parameters were measured on dry weight basis (Waldbauer, 1968; Kumar *et al*., 2009). Fibres were acclimatized in standard conditions of humidity (65%) and temperature (25^0C) for 24 hours. The deniers (linear density) of all the fibres were measured out separately. The fibres of the control and 1% & 2% protein treated eri silkworm were tested for breaking tenacity, percentage elongation at break, All the values were statistically analyzed and are presented as Mean±SD.

Table1. Feed efficacy data of *Samia ricini* fed in different treatments

Experimental Groups / Concentration		Food Consumption Rate (gm)	Food Utilization Rate (gm)	Food Digestibility (%)	Food Consumption Index (%)	Co-efficient of Food Utilization (%)
3rd Instar	Control	27.10±1.15	23.34±0.14	65.11±0.31	17.41±1.04	64.39±0.56
	Protein 1%	27.27±1.05	23.87±0.11	65.23±0.09	17.71±1.12	64.45±0.15
	Protein 2%	27.48±1.08	24.09±0.31	65.44±0.11	17.94±1.11	64.66±0.30
4th Instar	Control	29.61±0.89	27.36±1.69	69.49±1.11	11.52±1.19	69.24±0.83
	Protein 1%	29.76±0.11	28.95±1.01	69.59±0.19	11.99±1.15	69.58±0.09
	Protein 2%	29.96±0.21	29.75±1.11	69.76±0.12	12.19±1.25	69.76±0.19
5th Instar	Control	25.51±0.78	23.12±1.19	64.24±0.25	13.77±1.48	62.73±0.53
	Protein 1%	24.62±0.16	24.19±1.22	64.38±1.15	14.02±1.11	62.94±0.15
	Protein 2%	24.83±0.19	25.36±1.49	64.49±1.10	14.52±1.09	63.04±0.13

Values are Mean ± Standard Deviation of six observations

Table 2. Growth rate of of *Samia ricini* fed in different treatments

Experimental Groups / Concentrations		Larval length (cm)	Larval weight (gm)
3rd Instar	Control	2.12±0.21	2.41±0.07
	Protein 1%	2.39±0.12	2.46±0.10
	Protein 2%	2.55±0.11	2.56±0.09
4th Instar	Control	3.05±0.16	5.45±0.24
	Protein 1%	3.41±0.12	5.66±0.07
	Protein 2%	3.76±0.10	5.76±0.12
5th Instar	Control	4.54±0.35	6.85±0.38
	Protein 1%	4.66±0.10	7.28±0.11
	Protein 2%	4.75±0.12	7.58±0.19

Values are Mean ± Standard Deviation of six observations.

RESULTS AND DISCUSSION

The results of present investigation indicated the impact of protein on growth and economic parameters of *Samia ricini*. Different concentration of protein (1 and 2%) fed to the III Instar larvae of silkworm shows changes in growth and economic parameters of silkworm *Samia ricini* (Prabu *et al.*, 2012). The feed efficiency as observed was found highest with 2% protein treated group but food consumption rate, food utilization rate, food digestibility, food consumption index and co-efficient of food utilization decreased in the fifth instar, probably because of greater expense of energy due to the approach of maturity (Table 1). Larval length and larval were found increasing (Venkatesh Kumar *et al.*, 2014) from 3rd to 5th instar but highest result was observed at 2% protein treated larvae (Table 2). Characteristic of Pupa in terms of length (2.38±0.10 cm), width (1.19±0.09cm) and weight (1.22±0.08gm) was found highest at 2% protein (Table 3). Average length of cocoon was found highest at 2% protein (3.46±0.10), followed by 1% (3.38±0.09) and control (3.31±0.35) (Table 4). Filament length was recorded maximum in 2% protein treated group with 1.99±0.09m in length (Table 5). The highest feed efficacy data was observed in 2% of protein. It was evident from the experiments that, protein treated leaves fed larvae showed a significant enhancement in reeling performance (Devi and Yellamma, 2013, Sundaramahalingam *et al.*,

Table 3. Growth rate of *Samia ricini* larvae produced pupae

	Growth Parameter of Pupa (insert)		
Experimental Groups / Concentration	**Length (cm)**	**Width (cm)**	**Weight (gm)**
Control (C)	2.12±0.31	1.08±0.11	1.01±0.11
Protein 1%	2.25±0.12	1.14±0.07	1.18±0.09
Protein 2%	2.38±0.10	1.19±0.09	1.22±0.08

Values are Mean ± Standard Deviation of six observations.

Table 4. Morphometric data of control and Protein 1 & 2% treated castor leaves fed *Samia ricini* larvae produced cocoon

	Parameter of Cocoon		
Experimental Groups/ Concentration	**Length (cm)**	**Width (cm)**	**Weight (gm)**
Control	3.31±0.35	2.09±0.11	3.67±0.09
Protein 1%	3.38±0.09	2.22±0.11	3.81±0.09
Protein 2%	3.46±0.10	2.31±0.10	3.99±0.07

Values are Mean ± Standard Deviation of six observations

Table 5. Tensile properties of the fibers of *Samia ricini* (D) treated with 1 & 2% Protein with castor leaves.

Experimental Groups / Concentration	**Tenacity (g/den)**	**Denier(g/m)**	**Filament length (m)**	**Elongation (%)**
Control	2.05 ±0.04	450.00 ±5.098	1.08 ±0.02	0.19 ±0.09
Protein 1%	2.45 ±0.10	506.00±2.168	1.56±0.09	0.38 ±0.09
Protein 2%	2.85 ±0.10	516.00±2.168	1.99±0.09	0.65 ±0.09

The values are Mean ± Standard Deviation of 5 replication

1998). Maximum cocoon length (3.46±0.10) was observed in 2% protein fed (Table 4). The cocoon length of 3.31±0.35 was recorded in control. The results were found to be statistically significant.

Filament length is considered to be more important for the reeling parameters. The result indicated that, the treatment with supplementation of 2% protein showed maximum length (1.99±0.09m, Table 5). In the present study, denier was calculated for the filament produced by control and treated worms. Denier was found to be the maximum in worms treated with 2% protein supplement (516.00±2.168g/m). It was followed by larva treated with 1% of supplementary food (506.00±2.168g/m) which clearly indicated that yarn quality was found better in 2% protein treated group as fabrics with a high denier count tend to be thick, sturdy, and durable. The higher denier count may have a relationship with the quality of silk protein (Nath *et al.*, 2013, Iizuka,. 1998 and Rao, 1978). The percentage of change over control is highly significant in all the treatments.

The highest Food Consumption rate, food digestibility rate was observed in 2% concentration of protein for V Instar larvae, followed by 1% and then by control, the same was also observed for IV Instar larvae and III Instar larvae when compared with control. An analysis of food consumption index showed significant difference with highest (17.94±1.11) was noticed in 2% concentration of protein for III Instar larvae when compared with the control (17.41±1.04, Table 1).

Co-efficient of Food Utilization was highly significant in III and IV Instar 2% treated worms. There was a tremendous increase in the weight of the larvae in treated groups in all the Instar stages (Table 2). Highest weight gain was observed in 2% concentration of protein in III Instar treated larvae (2.56±0.09g) against control (2.41±0.07 g) followed by IV Instar treated larvae (5.76±0.12 g) against 5.45±0.24g in control and 6.85±0.38g was recorded in V Instar control larvae against the 2% protein treated larvae (7.58±0.19g). The results of the present study recommend supplementation of protein along with castor leaves for feeding *Samia*. It also indicated that 2% protein (Kedir *et al.,* 2014) is the optimum dose for the better performance of rearing and reeling parameters of silkworm *Samia ricini* (D).

CONCLUSION

The results of the present study recommend supplementation of protein along with Castor leaves for feeding *Samia ricini* (D). It also indicated that different protein concentration can act for the better performance of rearing and reeling parameters of silkworm *S. ricini*. The treated group was found to produce better quality fiber as seen from the results of the tensile parameters. Although the feeding habit, life cycle etc. was similar the additional supplementation may have given rise to the differences found in the tensile properties possessed by the silk fiber produced by them. This finding will be helpful in accessing the quality parameters of the eri fiber as well as to adopt better strategies to improve the properties of the silk produced.

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