INTERNATIONAL JOURNAL OF ADVANCED BIOLOGICAL RESEARCH

www.scienceandnature.org

EFFECT OF SOYA PROTEIN ENRICHED FORTIFIED FEED OF TASAR SILKWORM (*ANTHEREA MYLITTA*, DRURY) ON REARING PERFORMANCE AND ECONOMICAL COCOON CHARACTERS

*Kamaraj, S., Pandiaraj, T., Immaual Gilwax Prabhu, Sanju Kumari and Sinha, A.K.
Scientist, Central Tasar Research and Training Institute, Ranchi, Jharkhand-835 303
*Corresponding author email- skraj1963@gmail.com

ABSTRACT
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. The experiment was carried out with soya aqueous solution spray, soya powder dust formulation application on the leaves of tasar silkworm host plant leaves along with no adding any supplementation on leaves as control treatments. The treatments were carried out during chawki stage (I and II instars larva) followed by fifth instar larva under indoor rearing practice. The results indicated duration of silkworm larva was observed two days earlier with soya solution spray treatment than soya powder dust and control treatments. Among the treatments, soya solution treated batch gave higher larval weight as compared to other treatments. Similarly, maximum cocoon weight, shell weight, pupal weight and shell ratio was obtained in leaves of fortified with soya solution spray treatment followed by soya dust formulation. Hence, the results of present study clearly designate the effectiveness of soya protein feed supplement ingredients improves the rearing performance and cocoon characters of tasar silkworm.

KEYWORDS: Cocoon, Pupa, Rearing, Shell, Soya supplement, Tasar.

INTRODUCTION

Silk constitutes only 0.3% of total fabrics of the world, but still it is called as Queen of Textiles due to its certain inherent qualities. India has the distinction of being the only country in the world producing all the five commercially exploited silk varieties *viz*. Mulberry silk, tropical and temperate/Oak Tasar, Eri Silk and Muga. Tasar silkworm is reared in the jungles of central and north-eastern parts of India. Tasar culture is the main source of income for many tribal communities in India. Mostly tribals are dependent on the industry (Shruti Rai, *et al.,* 2006). Tasar silkworm (*Antheraea mylitta* D.) is a polyphagous insect feeding primarily on Asan (*T. tomentosa*), Arjun (*T. arjuna*), Sal (*S. robusta)* and secondarily on more than two dozens of food plants. The growth and development of tasar silkworm larvae and economic characters of cocoons are directly proportional to the nutritional contents of leaves (Sinha *et al., 2002*). Sahay *et al.* (2001) indicated that leaf quality is one of the important factors contributing to success of tasar crops.

Chawki is considered as one of the important stage from which a successful cocoon crop is ensured. The first three instars are highly sensitive and require at most care for their growth and development. Chawki rearing needs optimum environmental conditions which can sustain the outbreak of silkworm disease avoiding crop failures during late age rearing (Bedford, 1944; Jolly, 1986). Owing to the high cost of artificial food, introduction of these techniques in India is very limited. Hence, an economically cheaper technique is very much essential which could still improve cocoon characters and production is needed (JOCV, 1980). Fortification of leaves with soybean products fulfilled the above need. Quantitative and qualitative supplementation of protein plays a critical role in influencing the growth and development of the insect. Ito (1980) stated that rich sources of dietary proteins like soya protein are known to promote growth and to improve the economic characters of the silkworm. Horie and Watanabe (1983) showed that the supplementation of soybean protein increased the protein and amino acid content in the larval haemolymph of the silkworm *B. mori.* Krishnan *et al.* (1995) showed that the hydrolyzed soya protein (P-soyatase) supplementation decreased the larval duration, increased the accumulation of haemolymph protein (SP-1: female specific protein and SP-2; an arlyphorin), larval weight and cocoon characters. Keeping in view the above facts, an attempt was made to increase the growth of young age silkworm and cocoon yield using food additives.

MATERIALS & METHODS

An experiment was conducted during 1st rearing crop (*Kharif*) season of 2016 at Pilot Project Centre, Kharswan, Jharkhand which is situated between 22^{o} 30’ and 24^{o} 30’ N Latitude and between 83^{o}22$^{'}$ and 85^{o} 06’ E Longitude at an altitude of 302 meters above MSL. The region enjoys a humid to sub-tropical climate and receives a mean annual

rainfall of 1160 mm in 100 rainy days. Of this, nearly about 85 per cent is received during south - west monsoon (2nd week of June – 1st week of October. Average maximum and minimum temperature during the growing season were 30.6 and 23.5°C, respectively.

The experimental trial was arranged as a complete randomized block design with one control and replicated thrice. The treatment consisted of soybean powder aqueous solution spray on leaves during chawki stage (T1); Soybean powder formulation dust on leaves during chawki stage (T2) and one control (T3). Chawki was conducted in indoor with 9 Dfls in cellular rearing in wooden trays. The tender leaves of Arjun plant (*Terminalia arjuna*) were treated with 5.0 per cent soya solution which prepared by 50g soya powder dissolved in 1 litre water and soaked leaves for five minutes in solution then leaves were dried under shade. Soya powder was dusted on the leaf surface for dust formulation treatment. The neonate larvae were allowed the feed over the treated tender leaves twice a day *i.e.* morning and evening hours. Before commencement of rearing, the rearing room and appliances were thoroughly cleaned and the floor was disinfected with 5.0 per cent bleaching powder solution. The litters and excreta are disposed and maintained in hygienic. Commercial grease is applied inside the upper rim of the tray on all the sides as a thin film of 1 cm wide to avoid larva exist from the rearing tray. Tray rearing was continued up to second instars thereafter all the treated and control treatment larva were shifted to outdoor for third and fourth instars reared in outdoor plantation as treatment wise with recommended procedures, whereby no treatments was imposed during these stages. Later, post fourth instar larvae was collected from the outdoor and released into indoor rearing trays for same treatment as followed chawki. The ten larvae were selected from each treatment during fifth instar and measured different larval and cocoon characters.

RESULTS & DISCUSSION

Rearing performance

Data presented on Table 1 show that larval duration varied from second instars and significant variation was observed in fifth instars. In our experiment, the rearing was started with 9 Dfls each on 16-07-2016 in all the treatments under indoor rearing practices as Chawki. However, the date of spinning was differed in various treatments. Treatment with soya solution spray was observed that larvae was started and completed spinning in two days earlier (17-08-2016) and soya powder dust and control treated larvae was started spin on date 19-08-2016. Larval duration of soya spray solution was 32 days whereas soya powder dust and control treatments were 34 days to complete life cycle. This might be due to proteineous food may accelerate the amino acid content in the larval haemolymph of the silkworm led to complete earlier duration of larva. Horie and Watanabe (1983) showed that the supplementation of soya bean protein decrease larval duration of the silkworm. Similar result was also corroborated by Sekar (1995). However, in present study, soya solution spray treatment differed invariably with soya powder dust and control treatments in order to harvestable cocoons which concur with the result of Sundarraj, *et al*. (2000) who harvested cocoon yield of 64.35kg/100dfls when reared on soyabean flour supplemented leaves and control group recorded only 52.16kg/100dfls.

TABLE 1. Effect of soya powder dust, soya solution spray and control on rearing performance

Particular		Soya solution spray	Soya powder dust	Control
Date of rearing details	Chawki (I & II instars in indoor)	16/7/2016	16/7/2016	16/7/2016
	Outdoor (III &IV instars)	27/7/2016	27/7/2016	27/7/2016
	Indoor (V instar)	12/8/2016	12/8/2016	12/8/2016
Date of spinning		17/8/2016	19/8/2016	19/8/2016
Larval duration (day)		32	34	34
No. of cocoon harvest		28	30	30

Larval weight

Data showing in Fig. 2 illustrated that larval weight was observed consistently irrespective of hatching period during I instar stage *i.e.,* 0.08g. However, larval weight differed progressively from II instar onwards and significant variation was observed during fifth instar. It showed that the larvae fed with soya aqueous solution treated leaves recorded higher larval weight (0.67, 4.92, 6.84 and 40.27 g during II, III, IV and V instars, respectively) as compared to soya dust treatment (0.63, 4.74, 6.68 and 38.50 g during II,III, IV and V instars, respectively) and control treatment (0.41, 4.09, 6.10 and 32.0 g during II, III, IV and V instars, respectively). Larvae were fed with leaves supplemented with soya solution aqueous had at the end of the 5th instar a significant increase in body mass compared to the mass of larvae in the control group. The protein supplement feed increase significant in larvae weight (Etebari and Fazilati, 2003). Increases in glycogen in the fat body have been reported after feed supplementation with protein food (Hugar, 1998). The similar finding was also supported by Mahmoud (2013).

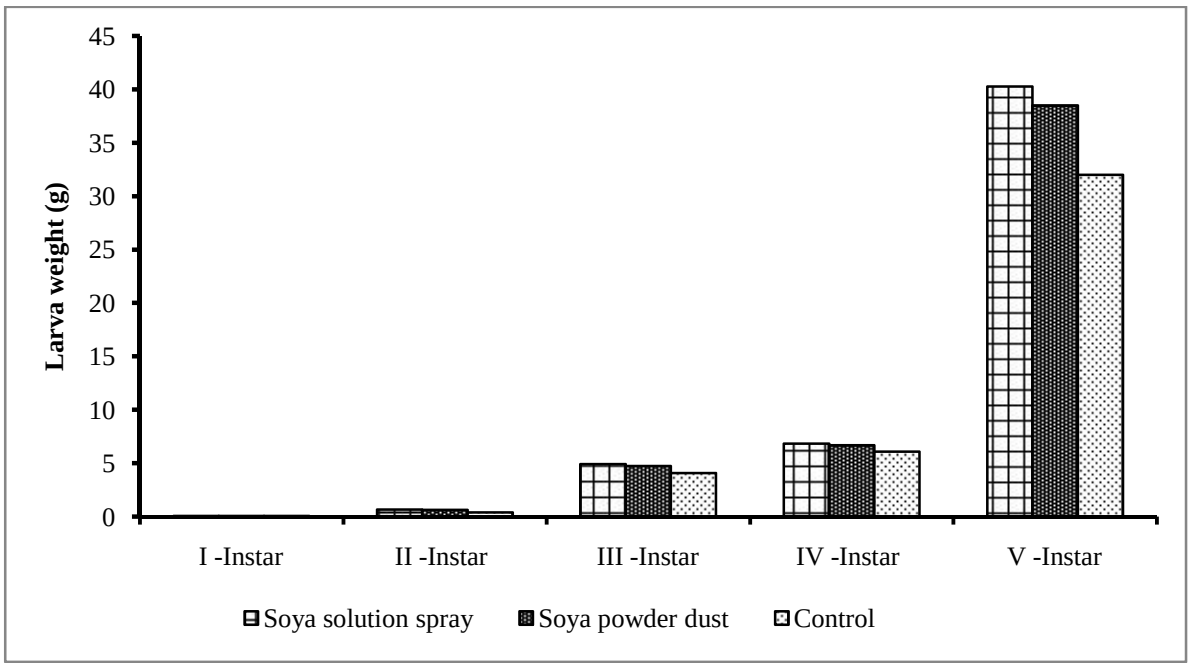

FIGURE 1: Effect of soya solution spray, soya powder dust and control on larval growth and development

Cocoon characters

Soya supplement exerted significant influence on cocoon characters. The average cocoon weight of both male and female silkworm in experiment was 11.9 and 13.0 g, respectively (Fig. 2). The male and female cocoon weight of soya solution spray treatments recorded 10 and 13.5% higher than control treatments. Similarly, soya solution spray treatments was found higher shell and pupa weight (1.93 and 1.71g of male and female, respectively for shell weight and 9.97 and 11.29 g of male and female, respectively for pupae weight) than control treatment. This result showing that all the silkworms fed with soya solution treated leaves observed 11.2 and 13.5% higher as shell weight and 9.6 and 28.6% higher as pupae weight for male and female silkworm, respectively as compared to control treatments. Whereas, shell ratio percentage was found higher (16.2 and 13.5% male and female, respectively) under soya solution spray treated leaves than any other treatments. These values are in concurrence with the work of Subburathinum and Krishna (1992) who have sprayed protein rich source that favorably influenced higher shell percentage. The result demonstrates that shell ratio for male and female were 2.0 and 13.2% higher in soya solution spray, respectively than control treatment. The results ascribed to the proteineous soya feed supplement ingredients involved in the synthesis of silk proteins and nucleic acids such as RNA and DNA in the silk gland cells there by improves the silk content in the cocoon shell (Nirwani and Kaliwal, 1996). The results are in conformity with Rajegowda (2002) who observed higher cocoon and shell weight when silkworm fed with protein rich food like SERIPRO.

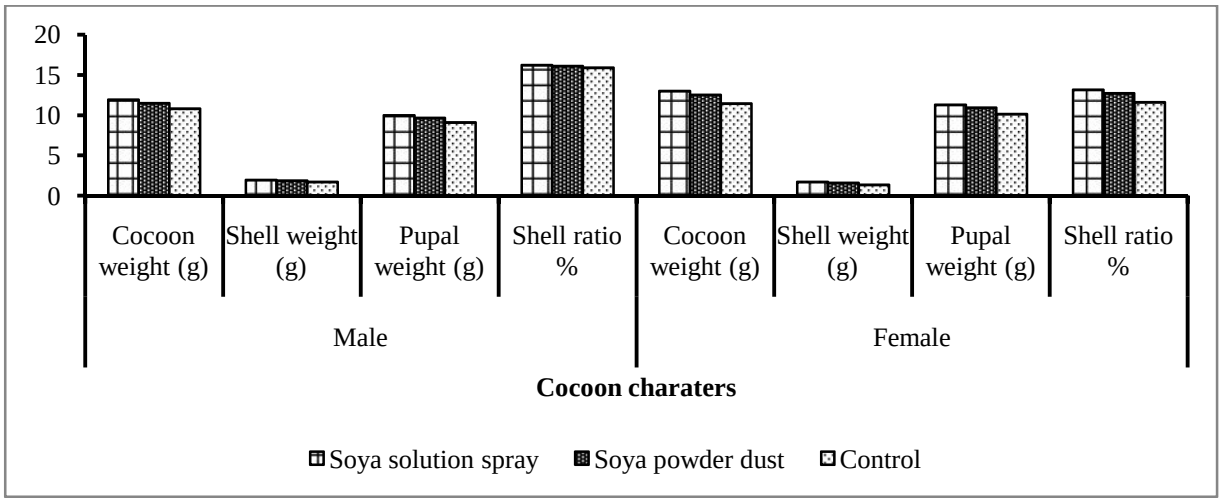

FIGURE 2: Effect of soya solution spray, soya powder dust and control on Cocoon characters

CONCLUSION

Consequently, it is concluded that the supplementation of soya protein fortified leaves to the larval period may have beneficial effects on the growth of the silkworm and also increase the quality and quantity of the silk cocoon production. So, this supplementation could be prescribed to the farmers to get more quantity of silk.

REFERENCES

Bedford, E.C.G. (1944) Continuous rearing of silkworm, *J. Ent. Soc. S. Afr*. 7, 68-72.

Etebari, K. and Fazilati, M. (2003) Effect of feeding on mulberry's supplementary leaves with N, P, and K in some biological and biochemical characteristics of silkworm, *Journal of Science Technology Agriculture and Natural Resources*, 7, 233-244.

Horie, Y. and Watanabe, K. (1983) Effect of various levels of dietary protein and supplementation with limiting amino acids on growth, haemolymph components and uric acid excretion in silkworm, *bombyxmori*, *J. Insect Physiol*. 29, 187-199.

Hugar I., Nirwani, R. and Kaliwal, B. (1998) Effect of zinc chloride on the biochemical parameters of the silkworm, *Bombyx mori* L., *Sericologia*, 38, 299-303.

Ito, T. (1980) Dietary requirements of the silkworm, *bombyx mori* L. and its artificial diets., *XVI Int. Cong. Entomol. Abr.*, Tokyo, Japan, 448.

JOCV (Japan Overseas Co operation Volunteers) (1982) Text Book of Tropical Sericulture, Tokyo. 387.

Jolly, M. S. (1986) Pebrine and its control, *Bulletin No. 5*. CSR&TI, Mysore

Krishnan, M., Subburathinam, K.M. and Janarthan, S. (1995) Effect of hydrolyzed protein (PSoyatose) on haemolymph protein profile, larval and pupal characters of the silkworm, *bombyx mori* L. (lepidoptera: bombycidae), *Sericologia*, 35, 227-235.

Muhammad Ashfaq, Sajjad Ali, Muhammad Asif and Hanif, (2009) Bioaccumulation of cobalt in silkworm (*Bombyx mori* L.) in relation to mulberry, soil and wastewater metal concentrations, *Process Biochemistry*, 44, 1179–1184.

Nirwani, R. B. and Kaliwal, B.B. (1996) Effect of Folic Acid on economic traits and the change of some metabolic substances of Bivoltine Silkworm, *Bombyx mori* L. *Korean J Seri Sci*, 38, 118–123.

Sahay Alok, Sahay D.N. and Thangavelu, K. (2001) Disease management during tasar seed production. Workshop on “Tasar seed production, planning and grainage”. Central Tasar Research and Training Institute, Ranchi. June, 14 – 16, 32- 45.

Sekar, K. (1995) Foliar supplementation of soya flour for improving the silk yield of mulberry silkworm, *bombyx mori* L. *M.Sc. Thesis*, Tamil Nadu Agricultural University, Coimbatore.

Sinha, A.K., Sinha, U.S.P., Banerjee, N.D., Prasad. J. & Brahamchari, B.N. (2002) Effect of foliar spray of micronutrients on leaf yield of *Terminalia arjuna* and quality of cocoons produced on them. *Plant Archives*, 2(2), 151–155.

Shruti Rai, K Kamal, Aggarwal and Cherukuri R. Babu (2006) Influence of host plant (*Terminalia arjuna*) defences on the evolution of feeding behaviour in the tasar silkworm, *Current Science*, 91(1), 10.

Subburathinum, K. M. and Krishna, M. (1998) Role of Soya bean protein in silkworm nutrition, *Indian silk*, 9 – 10.

Sundarraj, S., Chinnaswamy, K.P. and Neelu Nangia (2000) Soybean to boost cocoon production. Indian silk, 39(6), 11.