



Estd. 1989

JOURNAL OF ULTRA SCIENTIST OF PHYSICAL SCIENCES

An International Open Free Access Peer Reviewed Research Journal of Physical Sciences

website:- www.ultrascientist.org**Modulation of Juvenile Hormone Analogue (Jha) Mimic on Larval Instars of Tropical Tasar Silk Insect (Lepidoptera: Saturniidae) to Elucidate the State of Silk Performance Parameters**

SHRUTI YADAV and S.P. ROY

Post-Graduate department of Biotechnology/ Zoology

T.M. Bhagalpur University, Bhagalpur – 812 007 (Bihar) India

Corresponding Author Email:- kbshrutiadav@gmail.com<http://dx.doi.org/10.22147/jusps-B/290503>**Acceptance Date 10th April, 2017, Online Publication Date 2nd May, 2017****Abstract**

The present paper deals with the effect of *Samrudhi*, a Juvenile Hormone Analogue (JHA) mimic on 5th instars larvae of *Antheraea mylitta* D. and was studied at interval of 48, 72 and 96 hours for knowing silk performance parameters viz. larval weight, cocoon weight, shell weight and shell ratio (gm). The larvae were reared on arjun leavers (*Terminalla arjuna*) in the laboratory at temperature range 25+/-2oC and 70+/-5%RH. It was observed that the weight increased by 10-15% and silk weight by above 10%. The increase in cocoon yield was 8-10kg/100 dfls. Thus, the effect of *Samrudhi* on 5th instar larvae of *Antheraea mylitta* D. applied topically may be able to increase tasar silk productivity.

Key words: Juvenile Hormone Analogue, tasar silkworm larvae, silk performance parameters, Arjun leaves.

Introduction

Some techniques and tools are needed to increase in feeding periods of larval instars of tasar silkworm for increasing tasar silk productivity. Recently a number of chemicals have been investigated which have been found with a positive role to prolong the larval life of insects. Shimda *et al.*, (1971) had reported on the Juvenile hormone analogues (JHA) which are known to prolong the larval duration in insects and these have been utilized for the improvement of silk production in the silkworm *Bombyx mori* Linn. As early as, Akai *et al.*,^{1,2} demonstrated

enhanced accumulation of silk protein accompanying the prolongation of larval growth in *Bombyx mori* treated with JHA. In the last two to three decades, a number of newer JHA compound have been investigated and many investigators have tried to study the effect of JHA compounds on various hybrids of silkworms to elucidate the contribution of varied JHA compound responsible for increasing the yield. Murakoshi *et al.*,¹⁴ had reported on increase in silk production of silkworm *Bombyx mori* L. due to oral administration of juvenile hormone analogue. Many of these experiments also attempt to explain the mode of action of individual formulation (Akai *et al.*,

1981). In view of the biological significance of JHA compound on the yield of silk materials this study was undertaken in an attempt to study the effect of selected JHA compound on the growth, silk performances and larval duration of *Antheraea mylitta* D. in the laboratory. The proper industrial application of the natural fiber can enhance the silk protein material and can improve the mechanical performance and the method of forming of the same^{8,12}. The development and rehabilitation of Sericulture industry is a major concern of the developing countries⁴.

Materials and Methods

Daba ecorace of *Antheraea mylitta* Drury was used in the present investigation. The rearing conditions as given in Reddy *et al.*,¹⁵ were followed to nurture the silkworm larvae in captivity.

Chemicals :

Samrudhi, silk enhancing hormone, as a kind of JHA (Imported from: SDS Biotech K.K., Tokyo, Japan), a Seri-Grow product has been used in the present study.

Treatment Procedures :

5 ml. of *Samrudhi* was mixed with 2.5 litres of water and sprayed on 100 dfls and after 30-45 mts the arjun leaves were provided to the 5th instar larvae. Time of treatment was at the interval of 48, 72 and 96 hours. Larval period, larval duration and percentage survival were noted on each treatment. The silk performance parameters viz. larval weight, cocoon weight, shell weight and shell ratio were evaluated to know the percentage increase of treatment over control. No other treatment was done after the spray of *Samrudhi* on the larvae.

Results

The effect of *Samrudhi*, a Juvenile Hormone Analogue (JHA) mimic on 5th instar larvae of *Antheraea mylitta* Drury has been studied at the interval of 48, 72 and 96 hours and various silk performance parameters such as larval weight, cocoon

weight, shell weight and shell ratio (gm) were evaluated. The data have been presented in table 1.0. The data on the state of silk performance parameters under control have been depicted in Table 1.1. The percent increase of silk performance parameters have been summarized in Table 1.2.

It was observed that *Samrudhi* has significant effect on the larval period, larval duration and percent survival of the 5th instar larvae. The data after treatment of chemicals and control revealed significant difference in silk performance parameters. Thus, it was an apparent increase in larval weight (+1.00 gm), cocoon weight (+0.12 gm), shell weight (0.6 gm) and shell ratio (0.11 gm) have been observed in the present study.

The larvae were reared on arjun leaves in the laboratory at temperature range 25+2°C and 70+5% RH. Silkworms of equal size and weight were selected after the 4th mounting. Silkworms were taken in batches consisting of three replicates. Each replicate had 5 silkworms and treated with *Samrudhi*. The effect of *Samrudhi*, a JHA mimic on 5th instar larvae of *Antheraea mylitta* and increase in larval duration, larval weight and cocoon weight have been studied.

It was observed that the treated silkworms consume one or two extra feed and build bigger and heavier cocoons. Cocoons weight increased by 10-15% and silk weight by above 10%. The increase in cocoon yield was 8-10 kg/100 dfls. The *Samrudhi* was applied on 3rd day of 5th instar larvae of *Antheraea mylitta*.

The treatment with *Samrudhi* increased the appetite and feeding capacity of larvae of arjun leaves tremendously and weight of larvae increased on 48, 72 and 96 hours of treatment in ascending order. The weight of larvae, silk yield and cocoon weight of *Antheraea mylitta* has been recorded after 7 days. The effect of *Samrudhi* on the 5th instars larvae of *Antheraea mylitta* Drury when applied topically may be able to increase tasar silk productivity which will be a viable tool for sustainable agriculture.

Discussion

Samrudhi is a Juvenile Hormone (JH). It made

Table 1.0 Effect of *Samrudhi*, a Juvenile Hormone (JH) mimic on larval instars of *Antheraea mylitta* Drury

Larval instar	Time of treatment (hrs)	Larval Period (D:H)	Larval duration (D:H)	Survival (%)	Silk performances parameters Larval wt. (gm)	Cocoon wt. (gm)	Shell wt. (gm)	Shell ratio (gm)
5 th instar	48	33.15	7.00	40+2.50	36.0+1.5	12.25+0.5	1.30+0.6	10.76+0.8
	72	35.15	7.02	58+3.80	36.5+1.6	12.50+0.4	1.50+0.6	10.85+1.0
	96	36.00	7.05	31+0.25	36.8+1.8	12.90+0.8	1.75+0.7	11.85+1.5

Table 1.1 State of Silk Performances under control

Larval instar	Larval Period (D:H)	Larval duration (D:H)	Survival (%)	Silk performances parameters Larval wt.(gm)	Cocoon wt.(gm)	Shell wt. (gm)	Shell ratio(gm)
5 th instar	48	33.15	88.0+5.0	35.0+2.5	12.13+1.2	1.36+1.0	10.76+0.8

Table 1.2. Percent increase of Silk Performance Parameters of Treatment over control

Larval instars	Larval weight (gm)	Cocoon weight (gm)	Shell weight (gm)	Shell ratio (gm)
5 th instar	+1.00	+0.12	+0.6	+0.11

silkworm bigger and heavier with higher silk content so that the farmers get more cocoon yield (8-10kg/100 dfls) and reelers get 10% more silk yarn. However, some pertinent works have been done on the effect of JHA on the 5th instar larvae of *Bombyx mori*. Chang *et al.*,⁵ have reported on the effect of JH on 5th instar larvae of *Bombyx mori* and found highest yield of silk when applied on 2nd and 3rd days of 5th instar larvae. Chaudhary *et al.*,⁶ observed the highest silk increase when applied on the 3rd day of 5th instar larvae. This is in conformity with the present study. They concluded that Juvenile Hormone SJ-42F applied topically on larval instars of *Bombyx mori* L. produced the giant cocoon. Trivedy *et al.*,¹⁷ Mamatha *et al.*,¹³ and others had studied the effect of a juvenile hormone analogue, *Labomin* on the growth and economic

characters of silkworm, *Bombyx mori* L. Such studies are in conformity with the present observation in which *Samrudhi*, a juvenile hormone analogue mimic had resulted on similar output of economic characters of tasar silkworms of *daba ecorace* of *Antheraea mylitta* Drury. Some publications⁹ suggested new technology of silkworm rearing on which the present study was done on the tropical tasar silkworm larvae. Kumar *et al.*, (2008) had reported on the endogenous 20 hydroxyecdysone levels in the haemolymph of non-diapause-destined and diapauses-destined generations of tasar silkworm, *Antheraea mylitta* Drury (Lepidoptera : Saturniidae) and associated developmental changes. Gangwar⁷ found an increase of larval period from 1-10 days with treatment of JH analogues in 5th instar larvae at different concentrations. But this prolongation was beneficial

only at low concentration of JH analogues.

Tzenov *et al.*, has worked on the preservation terms of non diapausing silk worm, *Bombyx mori*. Eggs at lower temperatures in 2001. B. Abbasov in ³ had put emphasis on the Revival of sericulture industries and the upliftment of small silk enterprises for its development in Azerbaijan. J.S. Lim in ² has discussed about the development and challenges of the Sericulture Industry in the developing countries in Bangkok, Thailand. Khan *et al.*, in ⁸ has studied the basic structural characteristics and properties of the of the *Bombyx mori* silk fiber obtained by various artificial silking speeds.

Conclusion

The main consideration for this treatment is to produce more tasar silk and to increase the feeding periods of the larvae so that more weight gain was obtained. Thus, application of such tools in tasar silk culture may produce more silk and get net return which ranges from Rs.800 to Rs. 1200/100dfls for the farmer. It was estimated that the reelers get one kilogram more silk for 100 dfls *i.e.* Rs.1100-1300. Such biotechnological techniques in tasar culture will be highly beneficial for increasing tasar silk productivity.

Acknowledgements

The authors are thankful to Professor and Head, Post-Graduate Department of Biotechnology/ Zoology, **DBT Sponsored**, T.M. Bhagalpur University, Bhagalpur for providing laboratory facilities.

References

1. Akai, H. and Kobayashi, M., Induction of prolonged larval instar by Juvenile hormone in *Bombyx mori* (Lepidoptera: Bombycidae). *Appl. Entomol. Zool.*, 6, 138-139 (1971).
2. Akai, H., Kiguchi, K. and Mori, K., The influence of Juvenile hormone, on the growth and metamorphosis of *Bombyx mori* larvae: *Bull. Servic. Exp. Sta.* 125, 287-305 (1973).
3. Abbasov, B., Revival of sericultural industries and promotion of small silk enterprise development in Azerbaijan. In: Proceedings of "International Workshop on Revival and Promotion of Sericultural Industries and Small Silk Enterprise Development in the Black & Caspian Seas Region", Tashkent, Uzbekistan; 11–15 April (2005).
4. Beshkov, S. and Tzenov P., Project for sericulture rehabilitation, development and silk production growth in Bulgaria for the period of 2005-2010. In: "International Workshop on Revival and Promotion of Sericultural Industries and Small Silk Enterprise Development in the Black & Caspian Seas Region", Tashkent, Uzbekistan; 553-558. 5 (2005).
5. Chang, S.F., Murakoshi, S. and Tamrura, S., Giant cocoon formation in the silkworm *Bombyx mori* L. topically treated with methylenedioxy-phenyl derivatives, *Agric. Biol. Chem.*, 36(4), 692-694 (1972).
6. Choudhary, S.K., Sehnal, F., Raj, S.K., Raju, S. and Mathu, S., Giant cocoon formation in *Bombyx mori* L. topically treated with Juvenile hormone SJ-42F, *Sericologia*, 26(4), 455-459 (1986).
7. Gangwar, S.K., Effect of Juvenile hormone mimics R394 on silkworm (*Bombyx mori* L.) Growth and Development of silk II and ARPN *Journal of Ari and Bio Sci.*, 4(6), 65-67 (2009).
8. Khan Md.M.R., Morikawa H., Gotoh Y., Miura M., Ming Z., Sato, Y and Iwasa M., Structural characteristics and properties of *Bombyx mori* silk fiber obtained by different artificial forcibly silking speeds. *International Journal of Biological Macromolecules* 42, pp. 264–270 (2008).
9. Krishnashwami, S., Narasimhana, M.N., Suryanarayam, S.K., and Kumarraj, S., *Sericulture Mannal II Silkworm rearing, Food and Agriculture Organisation of the United Nations*. P. 131 (1973).
10. Lim, J.S., Developments in the world sericulture industry: Lessons and challenges for developing countries, 19th congress of International Sericultural Commission, Sep. 2002, Bangkok, Thailand, 13 pp (2002).
11. Liu X, Y. and Du, N., Patent Number: WO 2008/033104 A1 Enhanced Silk Protein Material Having Improved Mechanical Performance and Method of Forming the Same (2008).

12. Mussig, J., (Ed.). *Industrial Applications of Natural Fibres*, John Wiley & Sons, Ltd, pp.386, ISBN 978-0-470-69508-1, United Kingdom (2010).
13. Mamatha, D. H., Kanji, V. K., Cohly, H.H.P. and Rao, M.R., Juvenile Hormone Analysis, Methoprene and Fenoxycarb Dose – dependently Enhance certain Enzyme Activities in the silkworm *Bombyx mori* L. *Int.J. Environ Res. Public Health*, 5(2), 120-124 (2008).
14. Murakoshi, S., Chang, C. and Tamura, S., Increase in Silk production by silkworm *Bombyx mori* L. due to oral administration of Juvenile hormone analogue. *Agric. Biol. Chem.*, 36(4), 672-674 (1972).
15. Reddy, R.M., Charan, R., Prasad, R., Reddy, B.C., Maniula, A. and Shivaprasad, V., Rearing and grainage Performance of Indian Tropical tasar silkworm, *Antheraea mylitta*, D. fed on *Terminalia tomentosa* (W & A) and *Lagerstroemia parviflora* (Roxb.) food plants *Aca, J of Ento.* 3(3), 69-74 (2010).
16. Shimada, S., Kamada, A. and Asano, S., Studies on utilization of methoprene synthetic compound with Juvenile hormone activity for the silkworm rearing. II, An aspect of silk formation in the silkworm, *Bombyx mori*, applied with methoprene examined by the vital staining with this mimic. *J. Seric. Sci. Jpn.*, 48, 282-286 (1979).
17. Trivedy, K., Ramadevi, O.K. Magadum, S.B. and Datta, R.K., Effect of a Juvenile hormone analogue, Labomin on the growth and economic characters of silkworm, *Bombyx mori* L. *Indian J. Seric.* 32(2), 162 – 168 (1993).
18. Tzenov P., Nacheva, Y. and Lazarov J., Study on the preservation terms of non diapausing silkworm, *Bombyx mori* L. eggs at low temperature, *Bulgarian Journal of Agricultural Science*, 7, 467-470 (2001).
19. Tzenov, P. and Z.I. De, Guzman., Breeding the new Bulgarian sex-limited for larval markings silkworm *Bombyx mori* L. commercial hybrid Ze/4 and study on its performance in the Philippines and Bulgaria, *Sericologia*, 297-312. (France) (2004).