International Journal of Zoology Studies
ISSN: 2455-7269; Impact Factor: RJIF 5.14
Received: 18-02-2019; Accepted: 23-03-2019
www.zoologyjournals.com
Volume 4; Issue 3; May 2019; Page No. 15-17

Effect of thermal variation on protein content of silk gland in multivoltine mulberry silkworm, *Bombyx mori* Linn.

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Abstract
Variation of temperature plays a pivotal role in sericulture by improving the commercial character. The present investigation inferred that the total protein content in the silk gland has been influenced significantly by varying temperature. The maximum level 9.11 µg/mg of protein was noticed in the silk gland obtained from larvae reared at 26°C while minimum protein content of silk gland 5.56µg/mg was recorded in the silk gland of Vth instar larvae of *Bombyx mori* at 10°C.

Keywords: *Bombyx mori* larvae, BOD incubator, rearing trays

1. Introduction
Generally silkworm *Bombyx mori* L. is monophagous insect which character feed solely on mulberry leaves. Silkworm larva obtains different amino acids from mulberry leaves and uses to synthesize silk protein secreted during spinning [1]. Protein plays an important physiological role in the growth and development of silkworm and silk protein synthesis. The process of spinning is an important biological act in the post- embryonic development of silkworm. The only function of the silk gland is to synthesis the protein needed for silk formation. Therefore the silk gland metabolism necessarily involves protein metabolism to a large extent. Moreover the developing organism represents a dynamic system which changes continuously in its physiological and biochemical properties as the morphogenesis proceeds and is an integrated result of change in silk gland tissues which have specific ontogeny patterns and biochemical properties of their own. The role played by the silk gland as an individual tissue is quite critical in the formation of cocoons. Thus it is hypothesized that variation in the temperature may influence the level of total protein content in the silk gland of *Bombyx mori*. Keeping this view an attempt has been made to study the effect of varying temperature regimes on the total protein level in the silk gland of Nistari race of *Bombyx mori* L.

2. Materials and Methods
The seed cocoon of *Bombyx mori* larvae obtained from the silkworm grainage. The whole grainage operation was performed as per description given by [2]. To observed the effect of temperature on the performance of *Bombyx mori* larvae the experiment was performed at different temperature regimes like 10, 14, 18, 26, 34, and 38°C. At 38°C the larvae did not survive after the fourth instar stage. The experiments were conducted in BOD incubator separately one after another. The optimum condition of the experiments like 26±1°C temperature, 80±5RH and 12 hrs light a day were taken as control for all the experimental designing were similar to [3]. After four hours mating moths were decoupled manually and transferred chronically to BOD incubators maintained 10°C (One of the six experimental temperature regimes), 80±1%RH and 12 hrs light a day. The egg laying moth were covered by open plastic cellules to prevent the intermixing of egg masses deposited by different female moths after 24hrs of egg laying, the female moths were individually examined for their disease freeness.
To observe the effect of temperature of protein content in the silk gland of experimental *Bombyx mori* were dissected on the Vth day of fifth instar larvae and silk gland was taken out. Estimation of total protein in silk gland was made according to the method of [4].

3. Statistical analysis
The value of protein content in silk gland experiment were made the data obtained were analyzed statistically by one way ANOVA.

4. Result
The data presented in (Table-1 and Fig-1) clearly indicate that total protein content in the silk gland was considerably influenced due to the variation in temperature. With the variation in temperature from 10°C to 26°C, the total protein content increased from 5.56µg/mg at 10°C to the maximum level of 9.11µg/mg at 26°C. But further increase in temperature from 26 to 34°C caused gradual decrease in the total protein of silk gland which reached to the level of 7.47µg/mg at 34°C. At 38°C larvae did not survive after IVth instar stage. One way ANOVA indicates that variation in temperature has significant ($P<0.01$) influence on the total protein content in the silk gland of *Bombyx mori*. The present study focused on molecule which was available in the metabolic pool of fifth instar larvae of variation of temperature on protein content on protein content of silk tissues.

Table 1: Effect of thermal acclimation on the total protein content µg/mg in the silk gland of *Bombyx mori.*

Temperature (°C)						F-ratio n_1= 5 425.38*
10°	14°	18°	26°	34°	38°	
5.56±0.060	6.22±0.063	6.83±0.080	9.11±0.113	7.47±0.111	N. Sd.	

N. Sd. = Not Survived *P< 0.01
Each value represent mean ± SD six replicates.

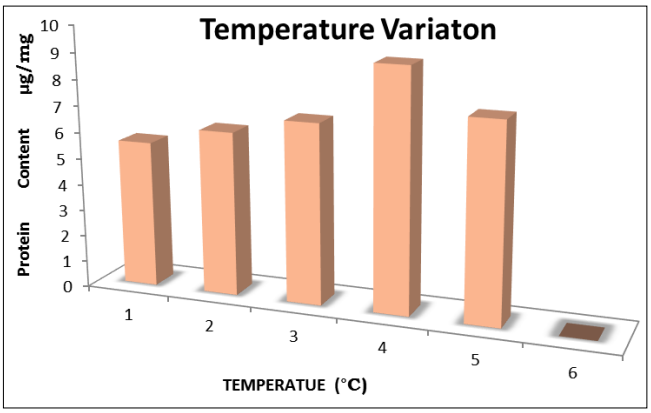

Fig 1: Effect of thermal acclimation on the total protein content µg/mg in the silk gland of *Bombyx mori.*

5. Discussion

It is well known that temperature plays a major role in their physiological behavior of the insect. The insects will get acclimatized to the low temperature by the production of various cryoprotectants like glycerol, trahalose, sorbitol etc. [5, 6]. All amino acids in protein occur in the insect eggs which the concentration of glutamic, alanine and glycine were noticed to be of high level [7]. The most rapid protein metabolism was noticed in the silk gland of silkworm [8]. The protein synthesis was noticed to be stimulated at low temperature of 15°C due to increased neurosecretory activity in Locusta migratoria [9]. The rate of increase in the amount of total blood protein of *Bombyx mori* was rapid in the larval instar than in any other stage [10]. Thirty percent of silk protein mass in Rhynchosciara Americana was derived from the free amino acids and protein of the haemolymph while the rest was synthesized by the salivary gland during spinning process [11, 12]. The protein content present in the silk gland of *Bombyx mori* declined notably with the increasing cold treatment of silkworm eggs [13, 14] but the pre-refrigeration period was no considerable impact on the total protein level in the silk gland of *Bombyx mori*. During the late spinning process the decrease in the free amino acid content of silk gland was influenced by the thermal acclimation of protein content in the fat body [15]. Thus it may indicate that a temperature regime of 26°C is required for a good cocoon crop for industry.

6. Acknowledgement

The authors thanks Prof C.P.M Tripathi and V.B Upadhyay department of Zoology D.D.U Gorakhpur University Gorakhpur for providing laboratory facilities a linguistic improvements of the manuscript respectively.

7. Conclusion

It may be concluded that especially thermal affects the biochemical changes which affects the cocoon morphology as well as its stiffness and strength which we attribute to altered spinning behavior and amino acid protein curing time. Biochemical change affects cocoon colouration perhaps due to tanning agent. Finally the protein content of a cocoon modifies sericine distribution and stiffness without changing toughness. Our results demonstrate environmentally induced quality parameters. The variation of temperature of *Bombyx mori* has considerable influence the protein content in silk gland. The good amount of protein content was noticed in silk gland at 26°C. This is improving the cocoon production to sericulture industry at 26°C temperature for rearers.

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