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Influence of Varying Temperature on Pupation from Larvae of Silkworm *Bombyx Mori*

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Abstract

Present study was carried out to see the influence of varying temperature on development of pupa from larvae of silkworm *Bombyx mori.* It is observed that mortality rate is less at temperature 24ºC. It is also observed that weight of pupa and shell reared at temperature 24ºC are more.

Keywords: *Bombyx Mori,* Temperature, Pupa, Larvae.

Introduction

Silkworm is the larva of the domesticated silk moth, *Bombyx mori.* It is an economically important insect, being a primary producer of silk. A silkworm´s preferred food is mulberry leaves (Krishnaswami *et al,,* 2005). It is mainly dependent on humans for its reproduction.Silkworm larvae are fed by mulberry leaves and after the fourth moult, climb a twig placed near them and spin their silken cocoons. This process is achieved by the worm through a dense fluid secreted from its glands, resulting in the fibre of the cocoon (Rahmathulla 2009). The silk is a continuous-filament fibre consisting of fibroin protein, secreted from two salivary glands in the head and a gum called sericin, which cements the two filaments together. The sericin is removed by placing the cocoons in hot water, which frees the s ilk filaments and make it ready for reeling. This is known as degumming process. The immersion in hot water also kills the silkworm pupae. Jordan (2002) studied effect of varied temperature on various stages of silkworm.The natural silk synthesized by the silkworm and spun in the form of a silk cocoon is originally synthesized in the silk gland. Silk gland of *Bombyx mori* is a typical exocrine gland secreting large amount of silk proteins. It is a paired organ consisting of modified labial/salivary glands located at the two lateral sides under the alimentary canal. Each gland is basically a tube made of glandular epithelium with two rows of cells surrounding the lumen. Kremky and michalska (2004) studied effect of temporary reduced air temperature on some characters during silkworm rearing. Singh et al (2013) studied insect adaptations to changing environment of temperature and humidity.

The silk fiber protein is synthesized by silk gland cells and stored in the lumen of the silk glands. Subsequently, it is converted into silk fibres. Quantity and nature of sericin are fundamental characteristics in conferring distinctive traits to the cocoon. Sericin is insoluble in cold water, however, it is easily hydrolyzed, where by the long protein molecules breaks down to smaller fractions, which are easily dispersed, or soluble in hot water. Life cycle of silk worm is greatly influenced by factors of environment. Temperature is one of the most important physical environmental factors. Kremky and Michalska(2004) reported silk worm larvae spun best cocoon at 25°C and 75 % RH. Some researcher showed that good quality cocoon are produced within 25 - 30° C and level above these marks cocoon quality worse (Jordan 2002). Ahsan (1995) gave variability of some quantitative traits in the hybrids of silkworm *Bombyx mor*i. Genetic variability and co relation analysis in hybrids of mulberry silkworm, *Bombyx mori* for egg characters was studied by Ahsan and Rahman (1996). Mishra and Upadhaya (2006) studied effect of temperature on nutritional efficiency of food in mulberry silkworm larvae. Muniraju et al., (2006) described influence of temperature on the growth of silkworm. Selection of healthy silkworm strain through high temperature rearing of fifth instar larvae was given by Shirota (2013). Ueda and Lizuka (2013) studied effect of rearing temperature on health of silkworm larvae and quality of cocoons.

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Aim of Study

Aim of present study is to see influence of physical environmental factor, temperature on rearing of silkworm *Bombyx mori* larvae. Effect on weight of pupa was also recorded.

Material and Methods

In present investigation study is conducted to determine the effect of sudden change in temperature on larvae of *Bombyx mori* to enhance silk production. Work was carried out at Government Resham Kendra Saber and Mhow. Productive bivoltine silkworm hybrid(CSR2 × CSR4) developed by breeders of Central Sericultural Research and Training Institute (Mysore, India) was used as a study material. This hybrid is suitable to rear during favourable season (August–February). The hybrid is preferred because of high survivability, yield and silk ratio. Young age silkworm rearing was conducted by providing fresh tender leaves of mulberry variety with moisture content of 75-80%. The temperature 20,22,24,26,28 °C and °humidity 75-80% was maintained stable during rearing.

Fifty larvae in replicates were separated and kept in different temperature and constant humidity treatments conditions in a Sericatron. Sericatron is a environmental chamber with precise automatic control facilities for uniform maintenance of temperature and humidity. Known quantity of fresh mulberry leaves were provided three times a day and care was taken to maintain the moisture content of leaf to the maximum possible extent. Mortality rate,weight of pupa and shell were recorded.

Results and Discussion

Fifty larvae in replicates were kept at different temperatures in sericatron and were fed on known quantity of fresh mulberry leaves. Mortality rate of larvae was observed. Table 1 shows the influence of temperature on pupa development from larvae of *Bombyx mori*. Larvae were reared at varied temperature. Better results were obtained at temperature 24°C and 26°C

Table-1 Effect of Temperature on Pupa Mortality

S.No.	Larvae	Temperature	%of Pupa Formed	%of Larvae ortality
1.	50	22°C	74	26
2.	50	24°C	86	14
3.	50	26°C	82	18
4.	50	28°C	76	24

Table 1 shows percentage of pupa formed from larvae at different temperature.

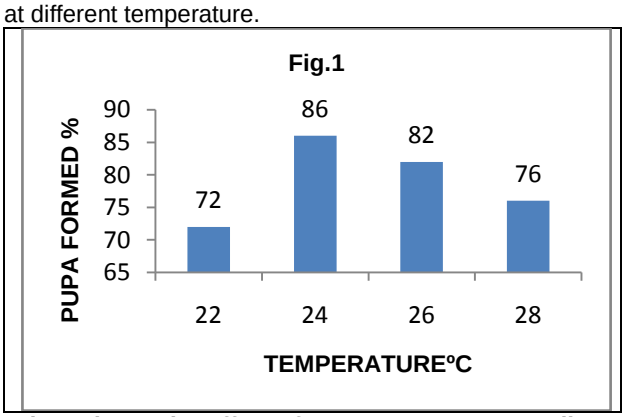

Fig.1 Shows the Effect of Temperature on Mortality of Larvae. Maximum Mortality is at Temperature 22 °C and 28°C .

Table-2 Effect of Temperature on Weight of Pupa

S.NO.	Temperature	Average Weight of Pupa Formed
1.	22°C	2.10 gm
2.	24°C	2.97gm
3.	26°C	2.45 gm
4.	28°C	2.08gm

In table 2 it is seen that weight of pupa is more at temperature 24°C and 26°C. Weight of pupa cocoon formed can be correlated with silk fibres.

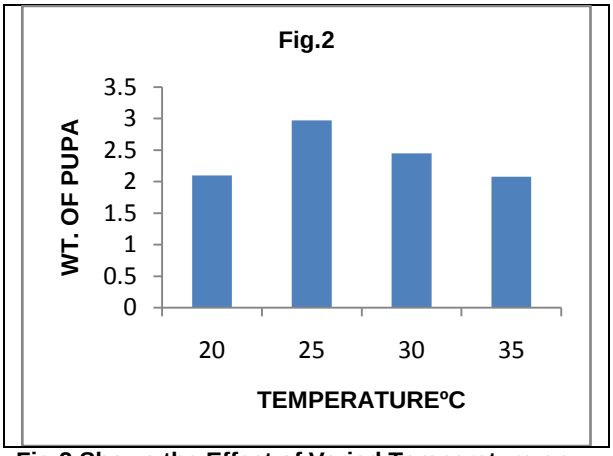

Fig.2 Shows the Effect of Varied Temperature on Weight of Pupa. Maximum Weight is at Temperature 24°C and 26°C .

Table 3 Effect of Temperature on Weight of Shell

S.No.	Temperature	Weight of Shell
1.	22°C	O.218gm
2.	24°C	0.365gm
3.	26°C	0.350gm
4.	28°C	0.200gm

In table 3 it is seen that weight of shell is 0.218 at 22ºC, 0.365 at 24ºC, 0.365 at 26ºC and 0.200 at 28ºC Larvae were reared at different temperature and pupa were formed. Mortality rate and weight of pupa were recorded at different temperature. Weight of pupa was 2.97gms reared at 24ºC and the weight of shell was 0.365gms.

Temperature plays a vital role on the growth of the silkworms. As silkworms are cold-blooded animals, temperature have a direct effect on various physiological activities. The temperature has a direct correlation with the growth of silkworm; wide fluctuation of temperature is harmful to the development of silkworm. Muniraju et al. (2006) described the influence of temperature on the growth of silkworm.

When temperature falls below 20 °C, metabolic functions become inactive. The present study indicated that temperature affected both the growth and development of silkworm. The low values were obtained at 22 °C and 28 °C temperature. Pupa weight was recorded lower at 22 °C and 28 °C temperature. Fluctuations of temperature prevents insects from attaining their potential physiological performance. The growth and development were higher when optimum temperature was maintained. Greater growth and development subsequently affects the cocoon traits.

In the present study, table 1 shows the influence of temperature on pupa development from larvae of *Bombyx mori*. Larvae were treated with varied

temperature ie 22 °C ,24 °C,26 °C and 28 °C with constant humidity 75-80%. Better results are obtained at temperature 24 °C and 26 °C.

Ueda and Suzuki (2013) reported that physiological activities, food intake and economic parameters influenced the body temperature of silkworm. Rahmathulla et al. (2008) reported higher silk gland growth in silkworm when administered with folic acid along with mulberry leaf. Similarly, Malik and Reddy (2006) reported higher silk gland mean weight and somatic index when silkworm treated with linoleic acid. Water is an essential requirement for metabolic activity and optimum growth. At higher temperature, probably evapo-transpiration at body surfaces and respiratory epithelium of tracheal system significantly increases. The problem of water balance in silkworm at ambient temperature is further complicated by poor moisture content of the leaf, which finally affects the growth and productivity of silkworm (Rahmathulla 2003). The present study indicates that greater growth and development of silkworm larva obtained under the optimum environmental conditions of 24 °C and 75-80% RH, thus help to improve the productivity of sericulture.

Conclusion

In present study it is concluded that result of development of larvae were better obtained at 24°C temperature.It is also observed that average weight of pupa and weight of shell was more at temperature 24 °C.

Suggestions

In present research attempt is made to encourage sericulture by maintaining optimum temperature. Study can be further made using different hybrids of silkworm and providing better nutritional conditions and growth hormones

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