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Effects of Temperature and R.H. % on Commercial Characters of Silkworm (*bomby xmori.l*) cocoons in Anantapuramu district of AP, India

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Abstract

Silk is considered to be queen of textiles which is proteinecious in nature. Rearing of silkworm for the production of silk fiber is called sericulture. Investigation was carried out to evaluate the best environmental conditions for commercial cocoon production of Bombyx mori. Temperature and R.H. % plays vary vital role on silkworm growth and development and it leads to cocoon quality. The appropriate temperature for silkworm rearing is 25^{O}C ±1 and appropriate R.H. % is 80%. Rearing is suggested in suitable environmental conditions. Bi-voltain silkworm registered best grads and high quality cocoon production. Rearing is suggested especially in September to January for good quality cocoon production in Anantapuramu district of Andhra Pradesh.

Keywords: Silk worm rearing, environmental conditions, R.H., *Bombyx mori.*

Introduction

Sericulture is one of the agro based industries in India. India occupies second place of Mulberry raw silk production in the world. Mulberry silk comes from the cocoons of *Bombyx mori* (L). The fact that the Silkworm, *Bombyx mori* is domesticated for nearly four thousand years ago is well established.

It is well documented that all insects require proper environmental conditions for normal life. The environment influences the activities of the organism directly or indirectly. This is true for domesticated insects like *Bombyx mori*. Due to continuous domestication for many years, the silkworm has lost many of its natural activities as sense of smell, flight etc. and it is completely under the protection of the silkworm growers. Though the number of generations in a year is controlled genetically in the silkworm, environmental conditions like photoperiod[1] temperature, humidity etc., are known to influence during the entire life cycle of the silkworm[2]. Studies on the effects of environmental factors, especially temperature on the physiology are sporadic[3]. Mulberry silkworm is an economically important domesticated insect for luxuriant silk production extensive studies on growth rates associated with photoperiod[4]. Photoperiodic mechanism has been demonstrated to be mostly influenced by the other environmental factors such as temperature and humidity[5]. Developmental events that occur once in the life cycle of an individual insect have long been known to express at a specific part of the day to manifest a population rhythm[6].

Material and Methods

The silkworm, *Bombyx mori L.* was used for this present investigation. Three silkworm breeds/hybrids, viz. P.M. (Pure Mysore) a pure multivoltine breed, NB4D2,a pure bivoltine breed evolved at the CSR&TI, Mysore and PM X NB4D2, a hybrid or crossbreed (popularly called as CB) between PM and NB4D2 were selected as the experimental material.

Rearing method: The silkworm rearing method followed was that advocated by Krishnaswami (1986)[7]. However, the chawki (young age; 1st and 2nd instar larvae) rearing was not conducted according to Krishnaswami (1986) to maintain uniformity in induced climatic condition all through the experimentation. Hatched out larvae from the DFLs, collected in to pre-disinfect rearing trays, were daily fed four times (06:00, 100:00, 16:00, 22:00h) on fresh mulberry (*Morus* spp. V1 variety) leaves except during moulting. While cleaning the unconsumed leaves, two times during 1st and 2nd instar and once every day after the 2nd moult, the larvae were transferred into separate pre-disinfected rearing trays. The larvae under moult, however, were not disturbed.

Temperature conditions: Three degrees of Temperatures, viz. 25, 30, 35^{O} C were maintained in the laboratory throughout experimentation, using an Environmental chamber (Kolarstat).

Humidity conditions: Three levels of relative humidity (R.H.), viz. 60, 70, 80% were induced for the study on the three experimental silkworm breeds/hybrids, all through the experimentation.

Results and Discussion

Cocoon characters, Cocoon weight: The results on cocoon weight in three silkworm breeds/hybrids. P.M. a pure multivoltine breed, NB4D2,a pure bi-voltine breed evolved at the CSR&TI, Mysore and PM X NB4D2, are furnished in table-

1. A clear cut trend in cocoon weight was observed between the breeds studied. Thus, PM being the multivoltine breed had cocoons of less weight. The cocoons of NB4D2, a bi-voltine had heavier cocoons of around 2 grams. The cocoons of the hybrid, PM X NB4D2 were of intermediate in weight. When the temperature was taken into consideration, all the breeds/hybrids gave greater cocoon weight at 25^{O}C. The cocoon weight decreased according to increase in temperature table-1. Thus expressing an inverse relationship. The response of humidity was not as for as the cocoon weight was concerned. It was generally observed that higher humidities resulted in higher cocoon weights.

Table-1
Cocoon weight (grams) each value is the average of 20 observations

Race	Temperature (^{O}C)	Relative humidity (%)		
		60	70	80
PM	25	1.224	1.36	1.224
	30	1.36	1.423	1.144
	35	1.138	1.037	1.014
NB4D2	25	2.147	2.132	2.276
	30	1.601	1.816	1.917
	35	1.246	1.366	1.414
PM X NB4D2	25	1.813	1.804	1.837
	30	1.633	1.616	1.692
	35	1.433	1.295	1.436

Pupal weight: The results on pupal weight in three breeds/ hybrids of the silkworm (*Bombyx mori*) are furnished in table-2. The trend followed in response to the pupal weight was that of the cocoon. Thus, pupal weight was more in bi-voltine NB4D2 less in multivoltine PM and intermediate in hybrid PM X NB4D2. The relationship between pupal weight and temperature was inverse and that between pupal weight and humidity was direct.

Table-2
Pupal weight (grams) each value is the average of 20 observations

Race	Temperature (^{O}C)	Relative humidity (%)		
		60	70	80
PM	25	1.040	1.164	1.245
	30	0.953	0.973	1.159
	35	0.965	0.870	0.853
NB4D2	25	1.763	1.753	1.867
	30	1.3	1.479	1.592
	35	0.965	1.065	1.144
PM X NB4D2	25	1.512	1.502	1.532
	30	1.373	1.344	1.432
	35	1.201	1.080	1.209

Reelable silk thread length: The results on the reelable silk thread length in three breeds/hybrids of thesilkworm are furnished in the table-3. The trend followed in response to the reelable silk filament length was also the same as observed for cocoon, pupal weight. Thus the silk thread was longer in bi-voltine NB4D2, shorter in multivoltine PM and intermediate in hybrid PM XNB4D2. The relationship between silk thread length and temperature was inverse while that between thread length and humidity was direct.

Table-3
Reelable silk thread length (meters) each value is the average of 20 observations

Race	Temperature (^{O}C)	Relative humidity (%)		
		60	70	80
PM	25	540.8	473.8	543
	30	448.8	409.4	406.4
	35	404.2	391.4	412.6
NB4D2	25	1233.6	1146.8	1327.6
	30	1019.6	997.6	867.6
	35	800.4	833.8	830.6
PM X NB4D2	25	660.8	677.8	750.4
	30	618	597.5	519.3
	35	479.2	463.5	43409

Discussion: Many environmental factors have been reported to show their influence on the growth and development of insects. A clear-cut trend in cocoon weight as observed between the breed/hybrids studied. PM being the multivoltine breed gave cocoons of lower weight. The cocoons of NB4D2 were heavier, weighing around 2grams. The cocoons of the hybrid PM X NB4D2 were intermediate in weight. When the temperature was taken into consideration, all the breeds/hybrids resulted in greater cocoon weight at 25^{O}C. the cocoon weight decreased according to increase in temperature, thus expressing an inverse relationship. The response to humidity was not clear as for as the cocoon weight is concerned. It was generally observed that higher humidities resulted in higher cocoon weights. The trend followed in response to the pupal weight was that of the cocoon. Thus pupal weight was more in NB4D2, less in PM and intermediate in PM X NB4D2. The relationship between pupal weight and temperature was inverse and that between pupal weight and humidity was direct. The trend followed in response of the reelable silk filament length was also as observed for cocoon and pupal weight. Thus, silk filament length was more in NB4D2, less in PM and intermediate in PM X NB4D2. The relationship between silk thread length and temperature (inverse relationship) as well as that between the thread length and humidity (direct relation) was that as observed for cocoon as well as pupal weight.

Conclusion

The results thus suggest that (1) the multivoltine breed PM and the hybrid, PM X NB4D2 can be reared under temperatures of up to 30 ^{O}C and (2) Bi-voltine should be reared only at 25^{O}C for

profitability in silkworm rearing. Humidity has greater effects on the bi-loltine silkworm rather than multivoltine breed or multivoltine X Bivoltine hybrid (CB). Therefore, bi-voltine rearing in Andhra Pradesh is in general and Anantapuramu area in particular should be restricted for good seasons (September to January) only.

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