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STUDIES ON THE OCCURRENCE OF BIPUPATE AND TRIPUPATE COCOONS IN A BIVOLTINE HYBRID, $SK_6 \times SK_7$ OF THE MULBERRY SILKWORM, *BOMBYX MORI* L.

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In mulberry silkworm, occurrence of bipupate cocoon is a common phenomenon but tripupate cocoon formation is rare. It is formed by the joint labour of two or three larvae. The formation of bipupate and tripupate cocoons is a phenomenon determined by ontogenetic circumstances depending upon the amount of space available to the spinning worms. Studies conducted during autumn crop rearing revealed that the occurrence of bipupate and tripupate cocoon was 3.94 % and 1.0 % out of the total cocoon observed. In bipupate cocoons, the highest frequency of association was observed in M: F (66.85 %) and lowest was in F: F (13.92 %). In tripupate cocoons, the highest frequency of association was in 2M: 1F (43.13 %) and lowest was in 3F (23.28 %). The information on the occurrence of tripupate cocoons in other silkworm is scanty.

Key words : *Bombyx mori*, bivoltine hybrid, bipupate, tripupate cocoons

INTRODUCTION

Cocoons having two and three pupae are termed as bipupate or double and tripupate or triple cocoons and considered as deformed or defective cocoons. Occurrence of bipupate or tripupate cocoons is occasional and is formed by the joint labour of two or three larvae. The cocoons are large and variable in shape and usually enclose more than one pupa. The formation of bipupate and tripupate cocoons is a phenomenon determined by ontogenetic circumstances depending upon the amount of space available to the spinning worms. Studies have been made on the occurrence of bipupate cocoons in different silkworms, *i.e.* in mulberry silkworm (Kumararaj, 1968 & 1984; Ravindra Singh, 1994), eri and muga silkworm (Talukdar, 1961; Barah *et al.*, 1988) and tasar silkworm (Nayak *et al.*, 1986 & 1987). In the present study, an attempt was made to study the formation of bipupate and tripupate cocoons in a bivoltine hybrid, $SK_6 \times SK_7$ of the mulberry silkworm, *Bombyx mori* L.

MATERIALS AND METHODS

During seed crop rearing (September-October, 2010) of 100 dfl eggs of $SK_6 \times SK_7$ at Regional Sericultural Research Station, Jorhat, Assam, a total number of 26,771 good cocoons were obtained and sorted bipupate and tripupate cocoons. After cut open the cocoon shells, they were grouped into three different categories depending upon the sex association, *i.e.* i) female and female (F : F) ii) male and male (M : M) and iii) male and female (M : F) in bipupate cocoons. The tripupate cocoons were categorized into three groups according to the availability of pupae in a cocoon, *i.e.* i) three females (3F) ii) two males and one female (2M : F) and iii) two females and one male (2F : M). The mean sex association percentages of each group were calculated and the data were analyzed. The cocoon weight, cocoon shell weight and the cocoon shell percentage of the

individual cocoon of the different categories were weighed and calculated.

RESULTS AND DISCUSSION

Occurrence of bipupate cocoon is a common phenomenon in mulberry silkworm. However, tripupate cocoon formation is rare in silkworm. The results of the present study revealed that occurrence of bipupate cocoon were 3.94 % out of the total cocoons observed, whereas tripupate cocoons were about 1 % and rarely occurred. In bipupate cocoons, the highest frequency of association was observed in M: F (66 .85 %), which was followed by M : M (19.22 %) and F : F (13.92 %), respectively (Table I). The higher frequency of sex association in M: F was inconformity with the findings of Ravindra Singh (1994) in mulberry. It was also assumed that the higher percentage of sex association in M : F might be due to release of sex attractant by male or female. Similar results were also reported in tropical tasar (Nayak *et al.*, 1986), whereas in muga silkworm, contradictory result was observed and higher sex association has been recorded in F : F (Talukdar, 1961; Barah *et al.*, 1988). In muga silkworm, it was reported that overcrowding in the cocoonage leads to increase occurrence of double cocoon (Barah *et al.*, 1988). However, the reason cannot be attributed for higher sex association in F : F.

Table I : Sex association in bipupate and tripupate cocoons in a bivoltine hybrid, $SK_6 \times SK_7$ of the mulberry silkworm, *Bombyx mori* L.

(a) Bipupate cocoons				
Total cocoons harvested	**No. of bipupate cocoons**	**Female : Female (F : F)**	**Male : Male (M : M)**	**Male : Female (M : F)**
2677!	1056	147 (13.92)	203 (19.22)	706 (66.85)
(b) Tripupate cocoons				
Total cocoons harvested	**No. of tripupate cocoons**	**Three Females (3F)**	**Two Males : One Female (2M : F)**	**Two Females : One Male (2F : M)**
26771	263	61 (23.28)	113 (43.13)	87 (33.21)

Figures in parentheses indicate percentage of sex association.

In the present study, the overall occurrence of male was 52.65 %, whereas female occurrence was 47.35 %. The highest cocoon weight was recorded in F : F and that of cocoon shell weight and cocoon shell percentage were higher in M : F (Table II). In tripupate cocoons, the highest frequency of association was in 2M: F (43.13 %) followed by 2F: M (33.21 %) and 3F (23.28 %), respectively. The highest cocoon weight was recorded in 3F and that of cocoon shell weight and cocoon shell percentage were higher in 2M: F (Table II). The information on the occurrence of tripupate cocoons in different silkworm is scanty. In *Antheraea mylitta*, the causes for the formation of bipupate cocoons were due to physiological, physical or environmental stress as assumed by Nayak *et al.* (1986). Dash & Nayak (1990) have reported that the higher percentage of

Table II : Cocoon characters in bipupate and tripupate cocoons in a bivoltine hybrid, $SK_6 \times SK_7$ of the mulberry silkworm, *Bombyx mori* L. (mean ± SD).

(a) Bipupate cocoon			
Cocoon characters	**Female : Female**	**Male : Male**	**Male : Female**
Cocoon wt. (g)	3.14 ± 0.21 (2.74 - 3.42)	2.59 ± 0.21 (2.27 - 2.98)	2.87 ± 0.17 (2.57 - 3.09)
Cocoon Shell wt. (g)	0.48 ± 0.04 (0.42 - 0.56)	0.44 ± 0.05 (0.34 - 0.51)	0.51 ± 0.03 (0.47 - 0.55)
SR%	15.51 ± 1.25 (13.83 - 17.96)	16.91 ± 1.34 (14.48 - 18.38)	17.73 ± 1.26 (16.06 - 19.05)
(b) Tripupate cocoon			
Cocoon characters	**Three Females**	**Two Males : One Female**	**Two Females : One Male**
Cocoon wt. (g)	5.23 ± 0.29 (4.89 - 5.47)	3.85 ± 0.03 (3.82 - 3.87)	4.54 ± 0.60 (4.15 - 5.23)
Cocoon Shell wt. (g)	0.57 ± 0.06 (0.51 - 0.63)	0.68 ± 0.05 (0.63 - 0.74)	0.64 ± 0.07 (0.55 - 0.69)
SR%	11.04 ± 1.29 (9.56 - 11.99)	17.72 ± 1.24 (16.50 - 18.98)	14.07 ± 1.34 (13.25 - 15.62)

Figures in parentheses indicate range values.

bipupate cocoon formation in *A. mylitta* might be due to frequent handling of the silkworm during the semi-domesticated rearing.

The silk produced from bipupate cocoons is known as dupion silk and it has more durability. Since bipupate cocoons are defective cocoons, these are not considered for further use and discarded in considerable number earlier. However, Krishna Rao *et al.* (2003) have opined that these cocoons can be used in seed production in the grainages as normal cocoon so as to improve seed recovery percentage. Occurrence of bipupate cocoons also depends upon the races. Some race produces more number of bipupate cocoons whereas some races produce few bipupate cocoons.

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