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RARE MALE MATING PHENOMENON IN MULBERRY SILKWORM *BOMBYX MORI* L.

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Abstract

Intersexual selection (female choice) is a widely observed phenomenon between mating partners in animal kingdom. Further, minority male mating advantage is a phenomenon, whereby genetic variability can be maintained in a population without genetic load at equilibrium. Such type of matings, though observed in almost all species of *Drosophila* are not reported in lepidopteran insects. So, in order to detect the rare-male effect in silkworm *Bombyx mori* L. the present investigations were carried out to study the mating success of Kalimpong-A and NB18 races of silkworm *B. mori*. In all experiments, female choice was employed. The experiments were conducted at nine different ratios. The results show that though both types of males are eqully successful in mating when present in equal ratio, they are more successful when they are in minority. This advantage disappears when males become common. Thus, the present observations provide evidence for the existence of minority male mating advantage in *B. mori*.

Key Words : Silkworm, *Bombyx mori* L., Kalimpong -A, NB18, Rare-male mating advantage.

Introduction

Frequency dependent selection may be positive in favour of a common or negative in favour of a rare type. Rare-male mating advantage is one of the widely studied frequency dependent sexual selection. When two races of same species are present together, the rare type is more successful in mating than the common one. First report of behavioral pleotropism was demonstrated by Sturtevant in 1915 in *Drosophila* (McFarland, 1985). The reason for sexual selection is said to have attractive sons, provided the attractive characters are inherited. These sons in turn will be successful in attracting females and in reproducing themselves (Fisher, 1930). The first report of the occurrence of rare-male mating advantage in multiple choice was shown by Petit (1951). Later, it was demonstrated that this phenomenon helps to maintain polymorphism and was influenced by genetic background, temperature, age, nutrition, etc. (Petit, 1954, 1958). Subsequent to this, a number of rare-male mating advantage reports have been documented, which suggest that the phenomenon is common in *Drosophila* (Ehrman and Probber, 1978; Ehrman and Parsons, 1981; Spiess, 1982; Singh and Chatterjee, 1985).

The rare-male mating phenomenon is of evolutionary significnce, because it is a way of maintaining high level of genetic variability in a natural population, without genetic load at equilibrium. The phenomenon of rare-mle mating promotes the outbreeding and exchange of genes among different populations (Lewontine, 1974). There are reports of such phenomenon in flour beetles *Tribolium castancum* (Sinnock, 1970), parasite wasp, *Mormoniella vitripennis* (Grant *et al.*, 1974, 1980). Several explanations have been proposed to account for minority male mating advantage (Spiess, 1982; Knoppien, 1985).

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Silkworm *Bombyx mori* L., a popular insect of economic importance is known to have more than 500 races and many of them are evolved through conventional breeding techniques. To study the rare-male mating advantage in these insects, two bivoltine races (Kalimpong - A and NB18), were used.

Material and Methods

To test minority-male mating advantage with Kalmipong-A (KA) and New Bivoltine-18 (NB18) moths, the cocoons were cut open on 5th day of their spinning and male and females were separated and preserved separately. On the day of their emergence, a single female of required race was introduced into a glass trough (45 cm diameter) followed by the male moths of both the races in desired ratio. The pairing was recorded at 5 minutes interval for 30 minutes. One hundred replicates were run with each of the nine ratios with KA and NB18 females separately. All experiments were conducted from 0500 to 0900 Hrs. in a controlled room temperature (24°C) under normal room light conditions.

Observation and Discussions

Table 1 contains data on the number of matings of KA and NB18 males with both types of females at different ratios. It is observed that when both KA and NB18 males are present in equal numbers (ratio), the mating frequency of either KA or NB18 does not vary much from the expected frequency. However, both the races show high frequency of mating when the males are in minority. For example, when KA males are in 3,2 and 1 numbers against 7,8 and 9 numbers of NB18 males KA males will largely succeed in mating, though they are in minority (VALUE 5.76, 6.25 and 5.44 respectively, which is statistically significant at 0.05 level). Similarly, when NB18 males are in 1 and 2 numbers against 9 and 8 KA males, they too succeed in mating to a larger extent and have a statistically significant deviation from expected chi-square value. However, both the races lose this advantage, when they are more in numbers, thus providing evidence for rare-male mating advantage phenomenon.

Darwin maintained that the advantage of behavior evolved through sexual selection lies primarily in the satisfaction of female choice (McFarland, 1985) and the females try to court and mate with males with special features, though many a times such features may be disadvantageous in the face of natural selection. Zahavi (1975) suggested that females prefer such males precisely because they carry a handicap and therefore must be robust individuals. Similarly, rare-male mating is an important phenomenon with evolutionry implication. According to Spiess and Spiess (1969), the nature of cue is different for different male types. The females become conditioned against mating with the males the first court these during their unreceptive period. As these males are of common type, the rare males are successful in mating as they are able to break the habituation, when the females become sexually active. However, such frequency depends on several forces such as age of the female, previous experience, etc. (Pruzan and Ehrman, 1974). There are reports of rare-female mating advantage (Spiess and Spiess, 1969), rare-male mating advantage (Singh and Chatterjee, 1989). However, though the exact cause of minority mating and mechanism of such incidence is not fully understood, it is believed that the process is controlled by a combination of several specific mechanisms and vary widely.

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Table 1
Number of matings of Kalimpong-A and NB18 males with the types of females at different ratios (Data based on 100 replicates)

Female type	Male Ratio		Expected Frequency		Observed X^2 Frequency		Chi square Value
	KA	NB18	KA	NB18	KA	NB18	
KA	8	1	90	10	85	15	2.78
KA	8	2	80	20	75	25	1.53
KA	7	3	70	30	65	35	1.19
KA	6	4	60	40	58	42	1.07
KA	5	5	50	50	55	45	1.00
KA	4	6	40	60	48	52	2.73
KA	3	7	30	70	41	59	5.76*
KA	2	8	20	80	30	70	6.25*
KA	1	9	10	90	17	83	5.44*
NB18	9	1	90	10	82	18	7.11**
NB18	8	2	80	20	71	29	5.06*
NB18	7	3	70	30	61	39	3.86
NB18	6	4	60	40	58	42	1.67
NB18	5	5	50	50	47	53	0.36
NB18	4	6	40	60	45	55	1.04
NB18	3	7	30	70	34	55	1.71
NB18	2	8	20	80	27	73	3.30
NB18	1	9	10	90	12	88	0.44

* Statistically significant (p 0.05 level).

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