Effect of mating duration and the number of females/male moth of *Bombyx mori* L. on eggs fertility

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**Key Words**
Mating duration; Egg fertility; Silkworm; *Bombyx mori* L.

**Abstract** The present work was carried out to investigate eggs fertility of *Bombyx mori* L. as affected by mating duration and male fertility and their ability of mating more than once of silkworm. Monovoltine hybrid imported race of *B. mori* L. was obtained from Sericulture Research Department, Agriculture Research Centre, Ministry of Agriculture in form of eggs and reared under laboratory conditions of 25 ± 3°C, 72 ± 2% R.H. and 15:9 daily L:D and the emergence moths were used for the mating experiment. The obtained results showed that the minimum duration of mating to produce fertility eggs higher than 95% was ½ h and the least fertility rate of eggs was produced when the mating duration was less than ½ h. The average highest number of females for mating with the same male is 20.8 females, the average number of females that laid fertilized eggs at a higher rate of 90% is 13.8 female, the average number of females that laid fertilized eggs at a lower rate of 90% is 2.6 female while the average number of mated (4.4 females) females laid unfertilized eggs.

**Introduction**

The rearing of mulberry silkworm dependant on several factors contributes in the growth and development of silkworm for the production of quality eggs. Quality silkworm seed refers to richness of laying, egg viability, hatching uniformity and more importantly good rearing performance of the progeny (Ullal and Narashimhanna, 1981) and it depends on management practices *i.e.*, rearing temperature, humidity, nutrition, and genotype of the breed. The better rearing conditions, environment and nutrition during larval period may lead to higher fecundity by silkworm moths (Miller, 2005; Malik and Reddy, 2007). Temperature and humidity are key environmental factors that influence the physiology of insects (Hussain et al., 2011). Fecundity and fertility are the two main factors of seed cocoon production. Several factors affect the fecundity and fertility of silkworm races including aberrations in sex organ, faulty handling of moth during mating and egg laying, defective preservation of cocoons and environmental stress during larval rearing and cocoon storage (Biram et al., 2009).

This study aimed to produce high fertility eggs dependant on mating duration and ability of males on mating more than once and know the number of mated females per one male.
Materials and methods

Laboratory experiments were conducted on the monovoltine hybrid imported race of *Bombyx mori* L. obtained from Sericulture Research Department, Agriculture Research Centre, Ministry of Agriculture in form of eggs and reared under laboratory conditions of 25 ± 3 °C; 72 ± 2% R.H. and 15:9 daily L:D. Just before starting experiments, the laboratory and implements were disinfected and precautions were taken against possibilities of certain epidemic diseases which may be attached to the mulberry leaves in the orchards. The rearing place was supplied with sufficient breeding frames (2 × 0.8 m, each). Soon after hatching, larvae were supplied with sufficient amount of mulberry leaves, *Morus alba* two times daily. The leaves were always cleaned from dust, and were given to the first and second larval instars as strips, afterward the diet was distributed in a manner that the larvae did not suffocate. At the end of each instar bed cleaning nets were used to pick up the larvae and replace their bed. The larvae were reared under standard rearing conditions (Krishnaswami, 1983). On 5th day of the 5th instar, ripe larvae were collected manually and transferred to mountages for cocooning. The cocoons were made within 72 h of mounting and seed cocoons were harvested on eighth day of spinning. Cocoons were preserved at 25 ± 1 °C and 75 ± 5% R.H. After accomplishment of emergence, moths were sexed and two sets of experiments were made.

Mating duration

The female moths and the male moths were collected and distributed on separated box one male with one female, and were subjected to different mating durations (¼, ½, 1, 2, 3, 4, 5, 6 and 12 h); after specific mating duration, moths were decoupled and the females moths were kept for oviposition individually and the males were disposed. In each treatment, three replications were made; the oviposited eggs were counted and recorded.

The number of female used for mating from the same male

The female moths and male moths were collected and were prepared. The same male was used for repeat mating. Every time virgin female was used. The Decoupling is done after 2 h of mating. After decoupling females were kept for oviposition. Five replications were made. Then the total oviposited eggs/female were counted and the percentages of eggs fertility were assessed.

Results and discussion

Mating duration

The data given in Table 1, clearly show the mean of percentages of eggs fertility affected by mating duration. The mating duration from ¼ h to 12 h produced fertilized eggs without significant differences in percentage of eggs fertility. While mating duration less than ½ h appears to be insufficient period to provide female with spermatic fluid to produce the highest number of fertilized eggs. As shown in the same table, ¼ h mating duration leads to significantly reduce the fertilized eggs produced/female (89.33%).

The mating duration vary depending on the races. Sarkar et al. (2009) found that fertility was below 50% when mating duration was reduced to below two hours. Due to this fact he used (Multivoltine) and (Bivoltine) races in his experiments.

Potential of male for mating with different number of females

Data in Tables 2 and 3 show the ability of *B. mori* L. male moth for mating with more than one female expressed by the percentage of fertilized eggs produced/female.

As shown in Table 2 the females from 1 to 14 which mated with the same male produced an average between 95.86% and 99.60% fertilized eggs without significant differences. The number of females/male may increase to 15 females in some cases. From 15 to 19 females/male the number of fertilized eggs laid/
female was significantly decreased, and reached its minimum (2.52% fertilized eggs). Some males were able to mate with more than 19 females, but these females produced unfertilized eggs.

Data in Table 3 summarize the relation between numbers of females mated from the same male and percent of fertilized eggs laid/female. Total number of females mated with one male ranged between 20 and 24 with an average of 20.8, total number of females ranged between 12 and 15 with an average of 13.8 females laid eggs at a higher rate of fertility ranged between 90% and 100%, 1–4 females with an average of 2.6 females laid eggs at rate <90% of fertility while 1–6 females with an average of 4.4 laid unfertilized eggs.

The ability of male for mating more than once varies depending on races. Sarkar et al. (2009) found that multiple use of male caused significant reduction in fertility but not fecundity. Till fourth mating no significant reduction in fertility was observed, and thereafter fertility reduced considerably. Due to this fact he used (Multivoltine) and (Bivoltine) races in his experiments.

**Conclusion**

It could be concluded that, in monovoltine race of Silkworm, half an hour of mating duration and maximum number of 14 female per each male are necessary to produce fertilized eggs.

**Table 3** The total number of females mated from the same male.

<table>
<thead>
<tr>
<th>No. male</th>
<th>Total number of females mated with one male</th>
<th>No. females that laid fertilized eggs (100–90%)</th>
<th>No. females that laid fertilized eggs (&lt;90%)</th>
<th>No. females that laid eggs not fertilized (0%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24</td>
<td>14</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
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<td>3</td>
</tr>
<tr>
<td>4</td>
<td>18</td>
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<tr>
<td>5</td>
<td>20</td>
<td>13</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Mean</td>
<td>20.8</td>
<td>13.8</td>
<td>2.6</td>
<td>4.4</td>
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<td>±2.0396</td>
<td>±1.1662</td>
<td>±1.2000</td>
<td>±2.0591</td>
<td></td>
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</tbody>
</table>

**References**


