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Evaluation of oviposition substrates and mating duration on fecundity and egg hatchability of *Samia ricini* Donovan (Lepidoptera: Saturniidae)

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ABSTRACT: Assessment of oviposition substrates and mating duration on the fecundity and egg hatchability of eri silkworm *Samia ricini* Donovan, revealed that maximum disease free layings were recorded in the control (353 eggs with 98 % hatchability) followed by the treatment, mating duration of six hours (332 eggs with 96 % hatchability). Poor egg laying and egg hatchability was noticed in one hour (151 eggs with 41 % hatchability). Correlation coefficients between mating duration, fecundity and egg hatchability showed strong positive correlation. Oviposition substrate's impact on fecundity and egg hatchability revealed that gada cloth gave better results (344 eggs with 96 % hatchability) whereas polythene cover recorded poor fecundity (203 eggs) and jack fruit kharika recorded poor hatchability (90 %). A minimum of six hours of mating duration is needed for the eri moth to attain its full fecundity potential and better egg hatchability.

KEY WORDS: Eri silkworm, substrates, gada cloth, correlation, regression

India is the second largest producer of silk in the world with a total raw silk production of 36,152 MT. Its uniqueness lies in having all the four types of commercial silkworm species. Among them, mulberry silk accounts for about 70.21% (25,384 MT) followed by eri silk 19.80% (7,157 MT), tasar silk 9.3% (3,370 MT) and muga silk 0.66% (240 MT) (CSB, 2020). Eri silkworm *Samia ricini* Donovan, is a polyphagous and multivoltine species, and 95 per cent of its total silk production in the world is contributed by India. Its primary hosts are castor (*Ricinus communis* Linn.) and kesseru (*Heteropanax fragrans* Roxb.). Secondary host plants include cassava (*Manihot esculenta* Crantz.) and many other plants belonging to the family Euphorbiaceae. Eri silk has excellent thermal properties and offers tremendous blending possibilities with other natural silks such as wool, cotton, jute and synthetic fibers (Gautam and Goel, 2006). Eri silkworm has its own advantage of being more disease resistant and requires fewer resources. Hence, it is known as poor man's silk. However, its potential remains unexploited because of poor quality eggs. In silkworm rearing, quality of eggs is the major factor affecting the cocoon yield. Production of good quality eggs (disease free layings - DFLs) and high fecundity rate are influenced by oviposition substrate and mating duration. A study was undertaken to assess different oviposition substrates and mating durations on fecundity and

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egg hatchability, in the Department of Entomology, Faculty of Agriculture, Annamalai University during 2021.

Eggs of eri silkworm were procured from eri silkworm seed production centre, Central Sericulture Germplasm Resource Centre, Hosur, Tamil Nadu. Eggs were surface sterilized with two per cent formalin and thoroughly washed in water and incubated at 26°C and 85 per cent relative humidity. Rearing room was disinfected seven days before rearing using five per cent bleaching powder solution and kept closed for 24 hours. Rearing room was well ventilated and fly proofing was done for avoiding uzi fly attack. Neonates were brushed immediately after hatching on young leaves in a plastic tray and covered with paraffin paper to maintain temperature and humidity. The worms were reared using leaves of castor. First and second instar larvae were fed two times a day and third, fourth and fifth instar larvae were fed thrice. Bed cleaning was done daily. Ripened fifth instar larvae were identified by gently rubbing, on which they produced sound of hollowness. They were transferred to plastic collapsible mountages (Netrikas) for cocoon spinning. Cocoon harvest was done five days after spinning. After harvesting the cocoons were cut opened and healthy pupae were collected for experiments. Collected healthy pupae were placed in cardboard box for adult emergence. After emergence, moths were allowed to mate for various mating durations *viz.,* one, two, three, four, five and six hours on gada cloth. Naturally decoupling pairs were treated as control. Each treatment was replicated thrice and each replication consisted of three pairs of eri moth (Subramanian *et al.,* 2012). After the respective mating duration was over, the male moths were separated gently without damaging their genital organ. Each mated female eri moth from respective replications was kept separately in cardboard boxes for egg laying. Fecundity was measured and the DFLs were maintained till fifteen days in the same cardboard boxes for calculating hatchability.

$$\text{Hatchability (\%)} = \frac{\text{No. of normal eggs} - \text{No. of unhatched eggs}}{\text{No. of normal eggs}} \times 100$$

Seven treatments *viz.,* Kharikas (sticks) of castor, mulberry, jack fruit tied vertically along a rope, plastic tray, cardboard box, polythene bags and gada cloth lined container were evaluated for their suitability as oviposition substrates. All the treatments were replicated thrice, and each replication consisted of three mated females. Naturally decoupled female moths were collected after mating and allowed to lay eggs in respective oviposition substrates. Fecundity and hatchability were calculated.

The experiments revealed that eri moth required a minimum mating duration of six hours to produce fertile DFLs with a fecundity of 300 – 350 eggs/ moth (Table 1). It was also found that when moths allowed for decoupling naturally the fecundity increased. Egg laying and hatchability was poor in one hour (151 eggs, 41 %), two hours (194 eggs, 48 %) and three hours (241 eggs, 66 %). Maximum fecundity was obtained in the control treatment (353 eggs, 98 %). This was followed by six hours mating duration (332 eggs, 96 %). Subramanian *et al.* (2012) who indicated poor egg laying when moths were allowed to mate for only an hour. However, their finding of reduction in fecundity below five hours mating duration was in contradiction to the present finding, wherein it was found that mating duration below 6 hours recorded poor egg laying and hatchability. Similarly, the findings of Behura and Panda (1978) who recorded that four hours of mating duration as minimum was also contradictory with present results.

Correlation between mating duration and fecundity indicated a strong positive correlation ($r = 0.992$),. Regression analysis revealed 98.41 per cent variation ($\beta = 0.9841$) in fecundity as influenced by mating duration. The regression equation indicated that for every one-hour increase in mating duration fecundity increased by 35 numbers of eggs. Correlation between mating duration and egg hatchability ($r = 0.971$) indicated a strong positive correlation. Regression analysis showed 97.1 per cent variation ($\beta = 0.971$) in egg hatchability as influenced by mating duration. The regression equation indicated that for every one-hour increase in mating duration, hatchability increased by 11 per cent.

Table 1. Effect of different mating durations on fecundity and egg hatchability

Mating duration	Fecundity*	Hatchability#
1 hr	151 (12.30)^{g}	41 (38.93)^{g}
2 hrs	194 (13.93)^{f}	48 (42.60)^{f}
3 hrs	241 (15.52)^{e}	66 (53.13)^{e}
4 hrs	253 (15.91)^{d}	71 (58.50)^{d}
5 hrs	292 (17.09)^{c}	92 (71.57)^{c}
6 hrs	332 (18.23)^{b}	96 (76.31)^{b}
Control	353 (18.80)^{a}	98 (80.12)^{a}
CD 0.05	1.920	5.556
SE(d)	0.887	2.545

Mean of three replications
*Values within parenthesis are square root transformed
#Values within parenthesis are arc sine transformed
Values with different alphabets with in a column differ significantly

Table 2. Effect of different substrates on fecundity and egg hatchability

Substrates	Fecundity*	Hatchability#
Castor kharika	325 (18.04)^{a}	96 (76.00)^{ab}
Mulberry kharika	298 (17.27)^{d}	92 (73.78)^{b}
Jack fruit kharika	308 (17.56)^{c}	90 (70.79)^{c}
Cardboard box	319 (17.86)^{b}	96 (78.25)^{a}
Gada cloth	344 (18.55)^{a}	96 (78.74)^{a}
Polythene cover	203 (14.27)^{e}	93 (74.34)^{b}
Plastic tray	317 (17.80)^{bc}	95 (78.30)^{a}
CD 0.05	0.456	2.938
SE(d)	0.223	1.170

Mean of three replications
*Values within parenthesis are square root transformed
#Values within parenthesis are arc sine transformed
Values with different alphabets with in a column differ significantly

The influence of oviposition substrates on fecundity and hatchability, revealed that gada cloth recorded maximum egg laying (344 eggs) and was followed by castor kharika (325 eggs) and both were found on par with each other. Cardboard box treatment recorded a maximum fecundity of 319 eggs and plastic tray treatment recorded 317 eggs. Poor egg laying was noticed in polythene cover treatment (203 eggs). Egg hatchability was maximum in gada cloth (96 %), cardboard box (96 %) and plastic tray (95 %). All the three treatments were on par with each other. Jack fruit kharika recorded poor hatchability (90 %) among the other treatments (Table 2). The present finding was in contradiction to the findings of Subramanian *et al.* (2012) who reported that egg laying pattern of eri moths were not influenced by the substratum. From the results of the present study, it may be concluded that eri moths need six hours minimum mating duration to obtain better fecundity and hatchability. Further as gada cloth performed as the best oviposition substrate, it can be utilized in commercial grainages.

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