

Original Research Article

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## Studies on Egg Laying Behaviour and Fecundity under Different Stress Conditions in Tropical Tasar Silk Moth

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### ABSTRACT

Tasar silkworm (*Antheraea mylitta* Drury) rearing and cocoon production are mainly carried out by Tribal people of Central India and some parts of Odisha and Telangana states. Lack of Tasar silkworm seed production and preservation technology is creating difficulties in timely supply of adequate quantity of seed to the farmers and others stake holders. High temperature above 28°C and less relative humidity than 50% are not suitable for the oviposition and hatching of eggs. In Tasar silk moth, egg retention was also more even after 72 h of oviposition in natural conditions. In the present investigation, while providing optimum temperature (27-28°C) and humidity (75-80%) in the egg laying room, egg laying was carried out in bivoltine and trivoltine broods under different stress conditions. The results indicated that in bivoltines (per 5 moths), in T1 where antenna and wings were amputated, the number of eggs recorded were 1306, in T2 (legs and wings cut) it were 902 and in T3 (antenna, wings & legs cut), the number of laid eggs were 1154 when compared to 907 in Normal conditions (T0) for 5 months. Egg retention results indicated that in T1, it was 200 amounting to 13.28% and fecundity was 261. In T2, it was 145 amounting to 13.85% and fecundity was 180. In T3, with Antenna, legs & wings amputation egg retention was 135 amounting to 10.47% and fecundity of 231. In case of normal moths (T0), egg retention was 124 amounting to 12.03% with a fecundity of 181. In case of Trivoltines (5 moths) also same pattern was observed. The mentioned stress conditions are useful while grainage operations for getting more fecundity.

#### Keywords

Tasar silkworm,  
*Antheraea mylitta*,  
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### Introduction

The scarcity of good quality eggs for commercial rearing is one of the important reasons for the decline in Tasar silk

production. In Tasar culture, pre-seed and seed crops are affected by adverse climatic conditions; diseases and erratic emergence in seed cocoon as a result commercial crops are not getting adequate timely supply of quality

seed. The rearers are unable to utilize their full potential of natural plantation for rearing during the favorable commercial crops.

Hence, there is a wide gap between the demand and supply of disease free layings. Lack of seed preservation technology and seed multiplication at P2 and P1 level is weakly integrated.

The Central Silk Board (CSB) intervening with technological improvements and producing and supplying basic seed annually to State Departments / other agencies to bring good cocoon production through newly established Basic Tasar Silkworm Seed Organization (BTSSO) and its Basic Seed Multiplication Centers (BSMTCs).

The commercial disease free layings are distributed through private rearers and it is necessary to preserve the produced seed and supply for commercial crops (Singh *et al.*, 2014). The role of temperature and relative humidity on oviposition and incubation of eggs were reported earlier by several workers (Pandey *et al.*, 2010). The impact of temperature stress on hatching of eggs in Tasar silkworm showed great deal of variation in hatching percentage. High temperature more than 28°C and Relative humidity less than 50% are not suitable for oviposition and hatching of eggs.

The egg retention was also more in Tasar silk moths even after 72 h of egg laying in natural conditions of egg laying and this is one of the factor for poor fecundity in Tasar silk moth.

Antennae are considered as nostrils in insects to trap odor molecules (Zacharuk, 1985) and contact chemoreception has been studied to induce oviposition in *Pieris* butterflies by glucosinolates compounds (Chapman, 1998). In this context, the present study was carried out to know egg laying behavior and fecundity

under different stress conditions of antennae / wings amputation to realize its full potential.

## Materials and Methods

The required seed cocoons were obtained from CTR&TI, Ranchi (Daba, bivoltine and Trivoltine broods) during 2016 and preserved under optimum conditions of temperature (27-28°C) and humidity (45-50%) recommended for seed cocoon preservation (Singh *et al.*, 2014). The bivoltine and trivoltine broods were exposed to the light regime of L: 16 h. (4PM – 8 AM) and D: 8h. (8AM – 4 PM) one month prior to emergence till the completion of grainage operations and moth emergence was recorded under this photo period. (Vemananda Reddy *et al.*, 2015). In the egg laying room optimum temperature (28°C) and humidity (80%) were maintained for better oviposition. The male and female moths were left for 3-4 h coupling (Jolly *et al.*, 1974) and seed production was carried out under different stress conditions *i.e.*, T1; Antenna & wings amputated, T2; Legs & wings amputated and T3; Antenna, wings & legs amputated and T0 (Normal) and egg laying behavior was observed. The collected eggs were incubated at 25 ± 1°C and relative humidity of 80 ± 5 % in the SERICATRON (an environmental chamber where required temperature and humidity can be maintained) till hatching and hatching percent was recorded.

## Results and Discussion

In the present study the egg laying behavior and fecundity was observed in bivoltine and Trivoltine broods of Daba race for 5 gravid female moths in each treatment under different stress conditions (Table 1&2). The results indicated that for bivoltine (Table.1) with Antenna & wings amputation (T1) recorded 766 eggs on first day and 540 on second day totaling to 1306 amounting to 86.72%. Egg retention for 5 months was 200 amounting to

13.28% and fecundity was 261 eggs per month. In T2 with legs and wings amputated indicated 539 eggs on first day and 363 on second day totaling to 902 and amounting to 86.15 %. Egg retention was 145 amounting to 13.85 % and fecundity was 180. In T3, with Antenna, legs & wings cut indicated 1015 eggs on first day and 139 on second day totaling to 1154 and amounting to 89.53 % and egg retention was 135 amounting to 10.47 % and fecundity of 231. In case of normal moths (T0), it was indicated 682 eggs on first day and 225 on second day totaling to 907, amounting to 87.97 % and eggs retention was 124 amounting to 12.03 % per with a fecundity of 213.

The results indicated for Trivoltine brood (Table.2) with Antenna & wings amputation (T1) recorded 781 eggs on first day and 450 on second day totaling to 1231 amounting to 95.42%. Egg retention was 59 amounting to 4.57% and fecundity was 246 eggs. In T2 with legs and wings amputated indicated 516 eggs on first day and 316 on second day totaling to 832 and amounting to 85.15 %. Egg retention was 245 amounting to 25.07% and fecundity was 166 per month. In T3, with Antenna, legs & wings cut indicated 833 eggs on first day and 293 on second day totaling to 1126 and amounting to 96.98% and egg retention was 35 amounting to 3.01 % and fecundity of 225. In case of normal moths (T0), it was indicated 582 eggs on first day and 328 on second day totaling to 910, amounting to 86.34 % and eggs retention was 144 amounting to 13.66 % with a fecundity of 182. The weight of male, female moths, single egg weight and eggs / g were recorded and depicted in Table 3 indicating 95 eggs / gm and 85 eggs / gm in bivoltine and trivoltine respectively.

The results on hatching in bivoltines were depicted in Table.4 indicating 91.25, 91.40, 88.95 and 90.20% in T1, T2, T3 and T0

respectively. The results on hatching in Trivoltine indicated 91.00, 90.00, 89.00 and 90.00% in T1, T2, T3 and T0 respectively.

Quality of Silkworm seed refers to richness of layings, egg viability and uniform hatching is indication for good performance of the progeny (Ullal and Narasimhanna, 1985). Several research workers have made attempts earlier to study different aspects of Tasar seed preservation for skipping unfavorable seasons (Jolly *et al.*, 1974). Nayak and Dash (2001) have demonstrated the influence of climatological factors on reproduction of Tasar silk moth.

In the present investigation, when provided optimum temperature (27-28°C) and humidity (75-80%) in the egg laying room and egg laying carried out under stress conditions, number of eggs laid were improved in both bivoltine and trivoltine broods. In T1 where antenna and wings were amputated, the number of eggs recorded were 1306, in T2 (legs and wings cut) it were 902 and in T3 (antenna, wings & legs cut), the number of laid eggs were 1154 and when compared to 907 in Normal (T0). Egg retention was also recorded and found to be less in treated batches (Table.1).

In case of Trivoltine also same pattern was observed (Table.2). In T1 where antenna and wings were amputated, the number of eggs recorded were 1231, in T2 (legs and wings cut) it were 832 and in T3 (antenna, wings & legs cut), the number of laid eggs were 1126 and when compared to 910 in Normal (T0).

The Similar results of higher egg recovery was obtained by Kamaraj *et al.*, (2014) where in it was mentioned that antenna amputated Tasar silk moths yielded more eggs during grainage operations and have shown improved hatching. But in the present investigation hatching was observed almost similar in all

treatments irrespective of different stress (Table.3). Ravindra Singh *et al.*, (2004), first time reported 10% increase in fecundity of antennae amputated female moths of mulberry

silkworm and also suggested to carry out similar studies in Non-mulberry silkworms including Tasar silkworm.

**Table.1** Egg laying efficiency in Bivoltine Tasar silk moths (sample 5 moths)

Treatments	1 <sup>st</sup> day	2 <sup>nd</sup> day	Total laid eggs		Egg retention in the abdomen		Total eggs	Fecundity (No)
			No	(%)	No	(%)		
Antenna & wings cut (T1)	766	540	1306	86.72	200	13.28	1506	261
Legs & wings cut (T2)	539	363	902	86.15	145	13.85	1047	180
Antenna, wings & legs cut (T3)	1015	139	1154	89.53	135	10.47	1289	231
Normal (T0)	682	225	907	87.97	124	12.03	1031	181

**Table.2** Egg laying efficiency in Trivoltine Tasar moths (sample 5 moths)

Treatments	1 <sup>st</sup> day	2 <sup>nd</sup> day	Total laid eggs		Egg retention in the abdomen		Total eggs	Fecundity (No)
			No	(%)	No	(%)		
Antenna & wings cut (T1)	781	450	1231	95.42	59	4.57	1290	246
Legs & wings cut (T2)	516	316	832	85.15	245	25.07	977	166
Antenna, wings & legs cut (T3)	833	293	1126	96.98	35	3.01	1161	225
Normal (T0)	582	328	910	86.34	144	13.66	1054	182

**Table.3** Weight of Tasar silkmoth (Average of 5 moths)

Parameters	Bivoltine	Trivoltine	Difference (%)
Weight of male moth (g)	3.986	2.342	<b>41.24</b>
Weight of Female moth (g)	8.286	6.998	<b>15.54</b>
Weight of single egg (mg)	10.52	11.30	<b>7.41</b>
Eggs / gram (No)	<b>95</b>	<b>85</b>	<b>10 (Nos)</b>

**Table.4** Effect of treated eggs on hatching in Tasar silkworm

Treatments	Bivoltine eggs / g.95		Trivoltine eggs /g.85	
	Eggs kept	Hatching %	Eggs kept	Hatching %
<b>Antenna &amp; wings cut (T1)</b>	475	91.25	425	<b>91.00</b>
<b>Legs and wings cut (T2)</b>	475	91.40	425	<b>90.00</b>
<b>Antenna, wings &amp; legs cut (T3)</b>	475	88.95	425	<b>89.00</b>
<b>Normal (T0)</b>	<b>475</b>	<b>90.20</b>	<b>425</b>	<b>90.00</b>

It is clear from the results that in treated batches T1 and T3, where amputation of antennae involved, the eggs laid were more indicating importance of antenna in egg laying when compared to other batches where Antenna amputation was not involved (T2 and T0). Morohoshi (2000) reported that among the four groups of secretary cells laterally located in the hind brain, the IV group consists of 3 Neuro- secretary cells are directly linked to the antennae on the head and their secretion passes through outer axon and reaches the corpus cardiacum where it stimulates the organs and regulates its function.

It is concluded that when stress was given in the form of body parts amputation, the Neurohormones may give signal to the brain and stimulate to lay whatever eggs remained in the abdomen. This type of stress conditions mentioned above may be practiced during

grainage operations of Tasar silk moth for improved egg laying and fecundity.

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