The Pharma Innovation Journal 2022; 11(11): 1588-1591

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(11): 1588-1591
© 2022 TPI
www.thepharmajournal.com
Received: 19-08-2022
Accepted: 23-09-2022

Noureen Naaz Ansari
Student, College of Agriculture, Raipur, Chhattisgarh, India

Yogesh Kumar Meshram
Associate Professor, DKS College of Agriculture and Research Station, Bhatapara, Chhattisgarh, India

Dinesh Kumar
Scientist D, Tasar Research and Extension Centre, Seoni, Janjgir-Champa, Chhattisgarh, India

Bhanu Pratap Katlam
Professor, College of Agriculture, Raipur, Chhattisgarh, India

Manju Tondon
Assistant Professor, College of Agriculture and Research Station, Janjgir-Champa, Chhattisgarh, India

PK Bhagat
Assistant Professor, RMD College of Agriculture and Research Station, Ambikapur, Chhattisgarh, India

Corresponding Author:
Noureen Naaz Ansari
Student, College of Agriculture, Raipur, Chhattisgarh, India

Impact of biometric variations of cocoon of tasar silkworm, *Antheraea mylitta* drury (Lepidoptera: Saturniidae) on its fecundity

Noureen Naaz Ansari, Yogesh Kumar Meshram, Dinesh Kumar, Bhanu Pratap Katlam, Manju Tondon and PK Bhagat

Abstract
During the experiment, different combinations of seed cocoons of *Antheraea mylitta* were grouped in three categories on the basis of weight of cocoons of male and female (higher, middle and lower) and total nine combinations were kept separately for emergence from cocoon. Different parameters like weight, length, girth of pupa, total fecundity, total unlaid eggs, coefficient of egg laying and number of hatched eggs were recorded. In comparison to all the combinations maximum fecundity was recorded in T_5 (middle female group and middle male group) 291. Unlaid eggs were statistically minimum in T_5 (11). Highest number of hatched eggs was found in T_5 (253). Maximum coefficient of egg laying was also observed in the T_5 (combination of middle female group and middle male group) 96.26 per cent. The correlation of cocoon parameters with cocoon weight were analyzed and it showed highly positive correlation with pupa weight (r=0.998); with cocoon length (r=0.834), with cocoon width (r=0.962) whereas negative correlation existed between cocoon weight and fecundity (r=-0.761); pupa weight and fecundity (r=-0.77). Hence, it can be concluded that T_5 (combination of middle female group and middle male group) was best combination for all parameters followed by T_4 (middle female group and higher male group).

Keywords: Cocoon weight, pupal weight, oviposition, fecundity, unlaid eggs, tasar silkworm, *Antheraea mylitta*

Introduction
The word 'Sericulture' has been derived from the Latin word sericum 'silk' and French word culture 'cultivation'. Silkworms are cultivated for the production of silk under sericulture. Major silk producing countries in the world are China, India, Brazil, Japan, Thailand, Iran etc. Today China and India are the two main fabricators in the world with more than 60% of world's annual production. The second largest producer of silk in world is India. In the last one decade the production in India has increased by approximately 18 MT. India is the only country which produces all four types of silk. Tropical tasar silkworm *A. mylitta* Drury (Lepidoptera: Saturniidae) is the most economically utilized non-mulberry silkworm in tropical India *A. mylitta* has been categorized into many ecotypes and dominant ecorace is Daba. The major food plants of tropical tasar silkworm are Arjun and Asan. Seed production is the ultimate goal of grainage. Tasar culture is practiced by approximately 1.40 lakh tribal families in Jharkhand, Odisha, Chhattisgarh, West Bengal, Andhra Pradesh, Uttar Pradesh, Madhya Pradesh and Maharashtra. In Chhattisgarh, Mulberry and Tasar silk are being produced in twenty one districts.

Janjgir-Champa district of Chhattisgarh is famous in the whole world for its production of tasar silk. At present 45 lakh cocoons, are being produced in the district of Janjgir-Champa, whereas the demand is above 5.00 crore. Total 4.0 lakhs DFLs (seed) are required during commercial crop, to fulfill the requirement, 44 private seed production units are established (Singh, 2020) [12]. There exists a requited relationship between the female pupal weight and pattern of egg laying among the ecotypes of *A. mylitta* Drury. *A. mylitta* has the potentiality of producing more than 350 eggs but it produces about 160-220 eggs out of which approximately 80-85% of eggs are laid and the rest are kept by the female. So, efforts are needed to be made for better utilization of the capacity through different tactics. An analysis of unhatched eggs during first crop grainage exposed that nearby 23.65% of eggs do not hatch. Pupal weight and moth sizes had an impact on fecundity, coupling and fertility of males and emergence, coupling, and fecundity of females Reddy *et al*., (2010) [9].

Female pupal weight and number of eggs laid by female moth of *A. mylitta* D are reciprocal factors of each other (Sharma and Mishra, 2020) [11].

From the above estimations, we can see that there is considerable loss of seed cocoons during grainage which leads to low fecundity, fertility and also at the level of incubation and hatching. Hence, it is essential to improve the fecundity, fertility and hatchability of eggs of tasar silkworm for maximum silk production under agro-climatic condition of Janjgir-Champa, Chhattisgarh.

Materials and Method

The present investigation was conducted in Research Extension Centre, Central Tasar Research and Training Institute, Central Silk Board, Seoni-Champa, District Janjgir-Champa, Chhattisgarh, during 2nd grainage DABA BV 2021-2022. The experiment was laid out on randomized block design with nine treatments and ten replications.

The healthy 450 live tasar seed cocoons *A. mylitta* were obtained from the second crop from 5 garland each of 100 (60 male: 40 female) cocoons and were cut open, sex identified and 225 male and female each were separated. Weight of cocoon, shell and pupae were taken and categorized male and female into 3 groups i.e. Male (Higher, Middle and Lower) and female (Higher, Middle and Lower) on weight basis. 3 garlands of each group were prepared and each garland of male was hanged with different categories of garlands of females in 9 rings which were made up of mulberry sticks and covered with net kept for emergence of moths. Usually the moths start emerging during late afternoon and coupling occurs during morning hours.

In morning hours, natural pairing was identified, forewing of coupled female moth was cut and left for fertilization. Ten pairs from each treatment were selected and female moths were depaired in the evening hours and after cutting of the wings slightly press their abdomen for urination. Later each female moth was kept individually in nylon bags in dark condition at 28±2ºC temperature and 70±5% R.H, (Ovi-position/egg laying device) for oviposition. After 72 hours, laid eggs were counted and surgical operation of female moths was done to record the number of fully developed unlaid eggs in the ovarioles. The coefficient of egg laying was calculated for each replication with the help of given formula:

$$\text{Coefficient of egg laying} = \frac{\text{Number of eggs laid}}{\text{Total Number of laid and unlaid egg}} \text{x100}$$

The nylon net bag containing tasar silkworm eggs were dipped in 5% solution of Depuratex for 10 minutes and continuously stirred. The nylon net bags were taken out and rinsed in the running water for 1-2 minutes to remove the meconium layer from eggs to prevent contamination. The sterilized tasar silkworm eggs were dried in shade or by using an egg drying table.

Results and Discussion

The first crop cocoons of tasar silkworm were grouped on basis of cocoon weight i.e. higher (above 14 g), middle (between 13-14g) and lower (below 13 g) of female and in male, higher (above 11 g), middle (between 10-11 g) and lower (below 10g) after sex determination. Total six groups were prepared and weight, length and girth of pupa were measured. Preliminary observations showed that the cocoon weight, pupa weight, length and girth of pupa of female is higher than male and decreases with decrease of categories i.e. higher to lower. Further nine treatment combinations were prepared on the basis of experimental design.

Table 1: Cocoon weight, Pupa weight, Pupa length, Pupa girth, Fecundity, Inlaid eggs. HatChed eggs and Coefficient of egg-laying of tasar silkworm, A. *mylitla cluing* rd grainage 2021- 2022

Treatment	Cocoon weight (g) [Mean±SE]	Pupa weight (g) [Mean±SE]	Pupa length (cm) [Mean±SE]	Pupa Girth (cm) [Mean±SE]	Fecundity [Mean±SE]	Unlaid eggs [Mean±SE]	Hatched eggs [Mean±SE]	Coefficient of egg laying (%)
TI	13.089±0.087.	11.380±0.076	4.859±0.048	7.335±0.043	165.70±5.445	59.00±1.909	105.4±4.269	73.74
T2	12.693±0.086	11.096±0.070	4.721±0.038	7.203±0.031	217.40±3.212	16.30±1.291.	151.1±4.845.	93.03
T3	12.297±0.092	10.593±0.180	4.611±0.040	7.173±0.031	185.30±2.797	39.90±2.057	136.3±3.333	82.28
T4	12.210±0.033	10.631±0.044	4.847±0.041	7.247±0.037	237.50±1.821	14.50±0.764	204.4±2.500	94.25
T5	11.813±0.030	10.348±0.035	4.709±0.036	7.1.15±0.033	291.20±4.351	11.30±0.978	253.4±5.224	96.26
T6	11.417±0.033	10.011±0.037	4.599±0.030	7.085±0.031	251.30±3.824	14.50±1.046	194.7±3 A83	94.54
T7	11.405±0.046	10.089±0.046	4.897±0.062	7.248±0.038	221.70±3.640	18.70±1.334	162.4±4.806	92.22
T8	11.008±0.049	9.805±0.039	4.759±0.041	7.117±0.027	182.40±7.786	18.70±1.044	129.7±3 A59	90.70
T9	10.612±0.051	9.468±0.049	4.649±0.035	7.087±0.024	183.00±9.079	58.90±1.456	122.3±8.857	75.65
CD at 5%	0.149	0.201	0.104	0.081	10.244	3.827	13.445	
S.E(±)	0.053	0.072	0.037	0.029	3.626	1.337	4.759	

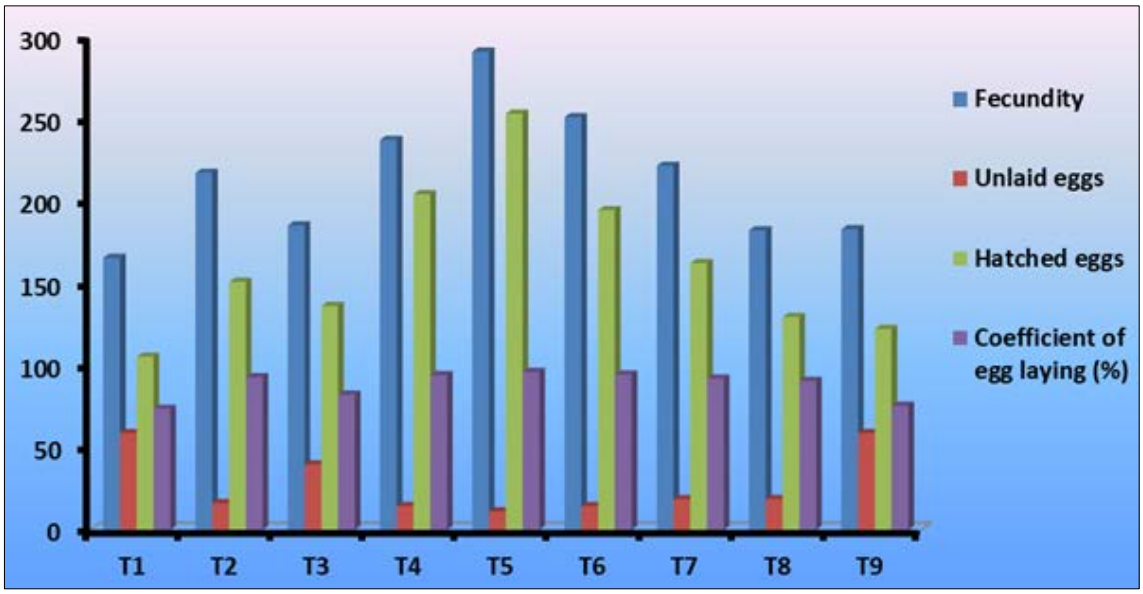


Fig 1: Fecundity, Unlaid eggs, Hatched eggs and Coefficient of egg-laying of tasar silkworm, *A. mylitta*

Fecundity (laid eggs) of tasar silkworm, *A. mylitta* kept for seed production was observed. The results reflected that the maximum fecundity was recorded in T_5 (291.200±4.351) followed by T_6 (251.300±3.824). The T_5 differ significantly from other treatments. Fecundity was observed to be below 200 in T_1, T_3, T_8 and T_9. Hence, it may be inferred that T_5 (Female middle weight cocoons and male middle weight cocoons) and T_6 (Female middle weight cocoons and male lower weight cocoons) gave the best results.

Singh *et al*., (2003) [16]; and Singh *et al*., (1998) [14] also noted in *Bombyx mori* that moderate weight should be encouraged for egg production and high pupal weight should be discouraged. Number of eggs laid and pupal weight is positively correlated Gowda et al., (1988). Ashan and Khanna, (1976) [1] and Miller *et al*. (1982) [4] reported that fecundity could be attributed to the variations in the pupal weight of female.

After three days of oviposition, female moths were anatomize to record number of retained eggs in the ovaries which were known as unlaid eggs. The highly significant differences were noticed in different treatments except T_1 and T_9 which had non-significant variation between the treatments. T_5 (11.300±0.978) showed lowest unlaid eggs and considered as the best combination of treatment whereas highest unlaid eggs recorded in T_1 (59±1.909) followed by T_9 (58.900±1.456). It may be concluded that less unlaid eggs reflected the fitness of female and male for higher fecundity. Present finding is supported by the report of Berger *et al.* (2008) [2] who stated that females with higher weight contain more unlaid eggs in its abdomen and Rosenheim, (2011) [10] that females die with remaining unlaid eggs.

The total numbers of eggs hatched (72 hours) was recorded. The results indicated that maximum number of eggs hatched in T_5 (253.400±5.) followed by T_4 (204.400±2.500) whereas the lowest number of hatched eggs was recorded in T_1 and T_9. It was also found the highly significant differences were there among T_5 and other treatments. This is in accordance with the results obtained by Reddy *et al*. (2010) [9]; Singh *et al*. (1994) [13] and Calvo and Molina (2005) [3] that Mid pupal weight groups of males and females shown enhanced hatching Reddy *et al*. (2009) [8]; in *Samia cynthia Ricini* cocoon weight has significant positive correlation with egg hatchability.

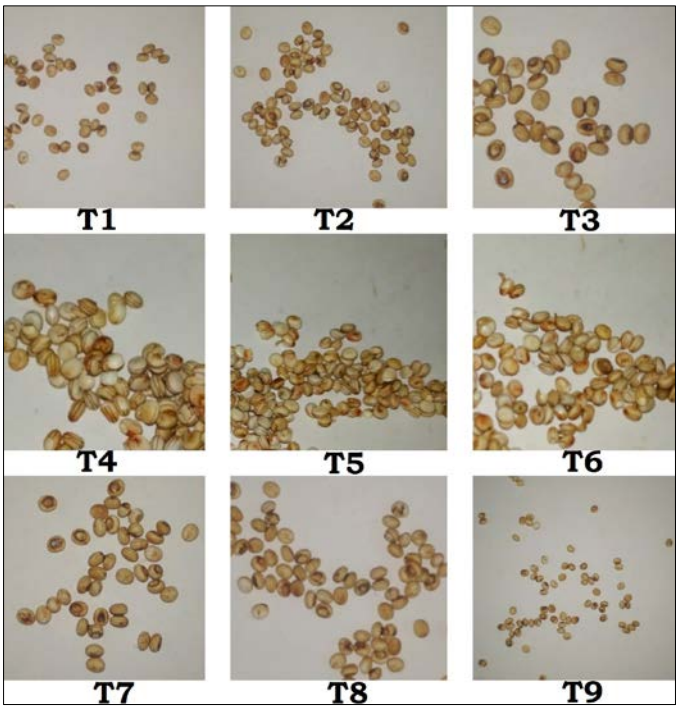
The maximum coefficient of egg laying was observed in T_5 (96.26 per cent) followed by T_6 (94.54 per cent) and T_4 (94.25 per cent) whereas the lowest value was recorded in T_1 (73.74 per cent). There were no significant differences among all the other treatments.

Table 2: Correlation of cocoon parameters and fecundity of tasar silkworm, *A. mylitta*

Parameters	Cocoon weight (g)	Pupa weight (g)	Cocoon length (cm)	Cocoon width (cm)	Fecundity (Nos.)
Cocoon weight (g)	1**				
Pupa weight (g)	0.998**	1**			
Cocoon length (cm)	0.834**	0.836**	1**		
Cocoon width (cm)	0.962	0.973	0.895**	1**	
Fecundity (Nos.)	-0.761*	-0.77	-0.589	-0.817*	1**

(*) Significant at 1% level (0.834)
(**)Significant at 5% level (0.707)

Correlation of cocoon weight, pupal weight, pupal length, width and fecundity of tasar silkworm were found out. It was noticed that there is highly positive correlation among cocoon weight, pupal weight, pupal length and width whereas negative correlation showed in cocoon traits and fecundity. Present findings are supported by the statements given by Singh and Saratchandra (2004) [15]; Rajanna and Reddy (1990) [6] in *Bombyx mori* and Tammaru (1996) [17] in *Epirrita autumnata* that highly significant and positive correlation exist between pupal weight and fecundity.



Conclusion

Among different combinations of female and male, middle female weight cocoon and middle male weight cocoon combination gave best fecundity with minimum number of unlaid eggs and number of hatched eggs was also highest in T_5. So, it can be clearly concluded that, the fecundity and hatching was mainly influenced by female weight. This denotes that lower to higher males and middle females seed cocoons should be selected for high production of seed ultimately high production of silk.

References

1. Asha AM, Khanna. Relation between weight of female pupae and number of eggs laid by an adult of *Antherea mylitta*, D. Ann. Reg., Central Tassar Research Station, Ranchi; c1976. p. 65-69.
2. Berger D, Walters R, Gotthard K. What limits insect fecundity? Body size- and temperature-dependent egg maturation and oviposition in a butterfly. Functional Ecology. 2008;22(3):523-529.
3. Calvo D, Molina JM. Fecundity-body size relationship and other reproductive aspects of *Streblote panda* (Lepidoptera: Lasiocampidae), Annals of the Entomological Society of America. 2005;98(2):191-196.
4. Miller TA, Cooper WJ, Highfill JW. Relationships between Pupal Size and Egg Production in Reared Female *Antheraea polyphemus* Annals of the Entomological Society of America. 1982;75(1):107-108.
5. Nagalakshmamma K, Gowda BLV, Devaiah MC. Relationship between pupal weight and fecundity in *Samia cynthia ricini*. International Congress on Tropical Sericultural Practices, Central Silk Board. Bangalore; c1988. p. 56.
6. Rajanna GS, Reddy GS. Studies on the variability and interrelationship between some quantitative characters in different breeds of silkworm, *Bombyx mori* L. Sericologia. 1990;30(1):67-74.
7. Rath SS, Ojha NG, Negi BBS, Kumar N, Sinha BRR. Pd. Survey on hatching pattern of eggs. Annual Report, CTR & TI, Ranchi; c1995. p. 40-41.
8. Reddy M, Sinha M, Hansda G, Prakash N. Application of Parents by Selection for Basic and Commercial Seed Efficiency in Tropical Tasar Silkworm, *Antheraea mylitta* Drury (Lepidoptera: Saturniidae). Academic Journal of Entomology. 2009;2(2):56-61.
9. Reddy RM, Suryanarayana N, Rai S, Prakash NBV. Reproductive performance in relation to male and female pupal weights and their combinations in tropical tasar silkworm, *Antheraea mylitta* D. Sericologia. 2010;50(3):403-412.
10. Rosenheim J. Stochasticity in reproductive opportunity and the evolution of egg limitation in insects. Evolution; international Journal of Organic Evolution. 2011;65(8):2300-12.
11. Sharma KB, Mishra A. Correlation and Regression Studies In Relation To Female Pupal Weight and Egg Laying in Tasar Silkworm, *Antheraea mylitta* D. Journal of Global Biosciences. 2020;9(6):7614-7617.
12. Singh J, Mittal V, Gadad H, Singh GP, Surendranath B, Sahay A. Tasar silkworm pest management. current status and recent advances in tasar sericulture. 1st Edition, CTR&TI, Ranchi; c2020. p. 132-137.
13. Singh T. Correlation between pupal weight and fecundity in *Bombyx mori* (L). Annals of Entomology. 1994;12:5-7.
14. Singh T. Behavioral aspects of oviposition in silkworm *Bombyx mori*. Indian J Seric. 1998;37:101-108.
15. Singh T, Saratchandra B. Principles and techniques of silkworm seed production. Discovery Publishing House, New Delhi; c2004. p. 126-129.
16. Singh T, Saratchandra B, Phani Raj HS. Physiological and biochemical modulations during oviposition and egg laying in the silkworm, *Bombyx mori* (L.). Int. J Indust. Entomol. 2003;6(2):115-123.
17. Tammaru T, Kaitaniemi P, Ruohomäki K. Realized Fecundity in *Epirrita autumnata* (Lepidoptera: Geometridae): Relation to Body Size and Consequences to Population Dynamics. Oikos. 1996;77(3):407-416.