EVALUATION OF SEASONAL GROWTH VARIATION IN MOTH OF ANTHERAEA MYLITTA DRURY (SATURNIIDAE) GROWN ON DIFFERENT HOST PLANTS

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ABSTRACT

Antheraea mylitta Drury, the Indian tropical tasar silk insect that produces the world famous tasar silk, is usually reared in the forest areas on different tasar host plants by the poor section of the society as a fruitful source of their livelihood. The moth of A. *mylitta* though is non-feeding, is the most vital stage for growth and race continuation as well as for exploiting its genetic potency and dynamics to our best advantages. An experimental rearing of *Antheraea mylitta* Drury was carried out during autumn and winter seasons at Similipal Biosphere Reserve, Mayurbhanj, Odisha, India, to assess the growth performance in terms of length, breadth and weight of male moths grown on eight different host plants at different altitudes. At both the lower and medium altitudes during autumn season as well as at lower altitude during winter season, the moths raised on (*Terminalia alata* W. & A.) food plant displayed the highest growth performances where as the Jamun (*Syzygium cumini* (L.) Skeels) grown moths exhibited the lowest values of growth parameters. In view of comparatively superior performance of all the growth parameters of the male moths, the food plants utilized during autumn season at both the lower and medium altitudes were graded in the order Asan > Sal > Arjun > Ber > Sidha > Dha > Bahada >Jamun. However, considering the overall better performances of all the growth indicators of the moths during winter season at lower altitude, the same food plants were ranked in the order Asan followed by Arjun, Sal, Ber, Sidha, Dha, Bahada and Jamun. The present investigation also revealed that irrespective of the food plants, winter season is more ideal for tasar cocoon crop performance in comparison to autumn, may be due to availability of favourable lower temperature, lesser relative humidity, shorter photoperiod and less number of rainy days than autumn season.

KEYWORDS: *Antheraea mylitta*, moth, altitude, host plants, growth, winter.

INTRODUCTION

Antheraea mylitta Drury is a semi domesticated foliovorous tropical tasar silk insect distributed in the form of about 44 ecoraces over the dense tropical forest belt of India and is exploited commercially for production of tasar silk. It is trivoltine (three generations produced in a year) at lower altitude (50 – 300 m ASL) in India. Being polyphagous in nature, it has a number of food plants of which Asan (*Terminalia alata* W. & A.), Arjun (*Terminalia arjuna* W. & A.) and Sal (*Shorea robusta* Gaertn) are commonly considered as primary food plants, although huge number of secondary food plants like Ber (*Ziziphus jujube* Gaertn), Sidha (*Lagerstroemia parviflora* Roxb.), Dha (*Anogeissus latifolia* Wall.), Bahada (*Terminalia belerica* (Gaertn) Roxb.), Jamun (*Syzygium cumini* (L.) Skeels), etc. are available in the natural forests of India at different altitudes. The vast availability of these unutilized food plants near the rearing field in the hilly districts can be exploited sustainably by the local tribes for cocoon crop performance of *A. mylitta*. Since the host plants profoundly affect the silk production, establishment of food plant specificity of silk insect along with evaluation of the commercial parameters of tasar culture in each food plant is highly essential for increasing the production of raw silk and seed cocoons.

Studies on cocoon crop performance of *A. mylitta* reared on some secondary food plants at lower altitude have already been made (Dash *et al*., 1992). Literatures are also available on larval energetics in different food plants (Dash and Dash, 1989 – 90; Dash *et al*., 1996), evaluation of Novel Tasar Silkworm Feed (Kumar *et al*., 2013), effect of Feeding Trial (Singh *et al*., 2011), comparative Study of the Effect of Different Food Plants (Deka and Kumari, 2013), rearing and cocooning of tropical tasar silk worm (Ojha *et al*., 1994), structural and functional aspects of the genitalia of *A. mylitta* (Sen and Jolly, 1971), fecundity of female moth (Dash and Nayak, 1990a), cytological investigation of different ecoraces of *A. mylitta* (Sinha *et al.* 1993), but lack of information on the growth performance of moths raised on different primary as well as secondary food plants at different altitudes during different seasons prompted to take up the present investigation to evaluate the growth of male moth of *A. mylitta* in different food plants at both the lower and medium altitudes during autumn season as well as at lower altitude during winter season for proper gradation of the food plants and seasons in the tropical tasar belt of India.

MATERIALS AND METHODS

A number of food plants from each of the eight categories, having identical growth were selected at two different altitudes i.e. lower altitude (50 – 300 m ASL) and medium altitude (301 – 600 m ASL) for the rearing of larvae of *A. mylitta*. The larvae were reared on each food plant at lower altitude during autumn and winter seasons and at medium altitude during autumn season only. The mature fifth instar male larvae allotted with different serial numbers were allowed to grow up to cocoon stage. The healthy cocoons were collected from each type of food plant and were preserved in grainage house according to their serial numbers until the moth emergence. The growth of freshly emerged male moths so obtained was measured in terms of length (cm), breadth (cm) and weight (g). The length and breadth (at the thoracic and abdominal joint) of the male moth were measured by using millimeter scale and slide caliper respectively. The weight of the moth was determined gravimetrically by using 0.001 mg sensitive digital balance. The data so obtained was subjected to calculation of Mean and Standard Deviation ($\bar{x} \pm SD$) values for each growth parameter. Further, the data generated was analyzed by use of standard statistical methods like 't' test and ANOVA test (Sokal and Rohlf,1969) for interpretations.

RESULTS

During autumn season at lower altitude the highest growth in terms of length (4.68 ± 0.03), breadth (1.47 ± 0.01) and weight (2.52 ± 0.03) was observed in case of Asan grown male moth of *A. mylitta* **(Table 1)**. The lowest growth of male moth in length (3. 62 ± 0.06), breadth (0.88 ± 0.02) and weight (1.21 ± 0.03) was noted from Jamun food plants (Table 1). The 't' test indicated significant ($p < 0.05$) difference in growth in terms of length, breadth and weight of the moths raised on different food plants. The ANOVA test showed significant ($p < 0.01$) interaction between the food plants and the growth parameters of the male moths. Considering the overall growth performances of male moths of *A. mylitta* during autumn season at lower altitude the gradation of the food plants was in the order Asan > Sal > Arjun > Ber > Sidha > Dha > Bahada >Jamun.

Table 1. Growth ($\bar{x} \pm SD$) of virgin male moth raised during autumn season at lower altitude on different food plants

Food Plants	Length (cm)	Breadth (cm)	Weight (g)
Asan	4.68 ± 0.03	1.47 ± 0.01	2.52 ± 0.03
Arjun	4.34 ± 0.02	1.29 ± 0.03	2.14 ± 0.02
Sal	4.51 ± 0.03	1.38 ± 0.02	2.31 ± 0.04
Ber	4.19 ± 0.04	1.21 ± 0.01	1.97 ± 0.02
Sidha	3.96 ± 0.02	1.12 ± 0.03	1.78 ± 0.03
Dha	3.81 ± 0.03	1.04 ± 0.02	1.62 ± 0.02
Bahada	3.57 ± 0.04	0.96 ± 0.01	1.39 ± 0.04
Jamun	3.26 ± 0.06	0.88 ± 0.02	1.21 ± 0.03

At medium altitude during autumn season the Asan grown moth showed the highest growth in terms of length (4.84 ± 0.03), breadth (1.71 ± 0.02) and weight (2.97 ± 0.04) (Table 2). The lowest growth in length (3.48 ± 0.04), breadth (1.03 ± 0.02) and weight (1.64 ± 0.06) was noted from the moth raised on Jamun food plant **(Table 2)**. Significant ($p < 0.05$) difference in growth in terms of length, breadth and weight of moths grown on different food plants was observed from 't' test. The ANOVA test also indicated significant ($p < 0.01$) interaction between the different food plants and growth parameters of moths. On the basis of comparatively higher growth of male moths during autumn season at medium altitude, the experimental food plants were ranked as Asan followed by Sal, Arjun, Ber, Sidha, Dha, Bahada and Jamun.

Table 2. Growth ($\bar{x}$ ± SD) of virgin male moth raised during autumn season at medium altitude on different food plants

Food Plants	Length (cm)	Breadth (cm)	Weight (g)
Asan	4.84 ± 0.03	1.71 ± 0.02	2.97 ± 0.04
Arjun	4.52 ± 0.02	1.47 ± 0.03	2.68 ± 0.02
Sal	4.69 ± 0.04	1.58 ± 0.02	2.83 ± 0.03
Ber	4.41 ± 0.02	1.39 ± 0.01	2.49 ± 0.04
Sidha	4.23 ± 0.04	1.31 ± 0.02	2.32 ± 0.03
Dha	4.01 ± 0.03	1.23 ± 0.01	2.11 ± 0.04
Bahada	3.76 ± 0.06	1.12 ± 0.03	1.89 ± 0.02
Jamun	3.48 ± 0.04	1.03 ± 0.02	1.64 ± 0.06

Likewise, during winter season at lower altitude the highest growth in terms of length (4.97 ± 0.03), breadth (1.54 ± 0.01) and weight (2.94 ± 0.03) was noted from the moth raised on Asan food plant (Table 3).The Jamun grown moth exhibited the lowest growth in terms of length (3.37 ± 0.06), breadth (0.89 ± 0.01) and weight (1.62 ± 0.04) **(Table 3).** The 't' test indicated significant ($p < 0.05$) difference in all the growth parameters of the moths grown on different food plants. The ANOVA test also showed significant ($p < 0.01$) interaction between the food plants and growth indicators of male moths. In view of comparatively superior growth performance of the moths during winter season at lower altitude, the food plants were graded in the order Asan > Arjun > Sal > Ber > Sidha > Dha > Bahada >Jamun.

Table 3. Growth ($\bar{x}$ ± SD) of virgin male moth raised during winter season at lower altitude on different food plants

Food Plants	Length (cm)	Breadth (cm)	Weight (g)
Asan	4.97 ± 0.03	1.54 ± 0.01	2.94 ± 0.03
Arjun	4.71 ± 0.04	1.43 ± 0.02	2.77 ± 0.02
Sal	4.52 ± 0.02	1.34 ± 0.01	2.56 ± 0.03
Ber	4.34 ± 0.04	1.23 ± 0.03	2.42 ± 0.01
Sidha	4.09 ± 0.03	1.13 ± 0.02	2.21 ± 0.04
Dha	3.93 ± 0.02	1.06 ± 0.01	2.08 ± 0.03
Bahada	3.68 ± 0.04	0.98 ± 0.02	1.83 ± 0.02
Jamun	3.37 ± 0.06	0.89 ± 0.01	1.62 ± 0.04

From the above observations it was found that the growth of male moths of *A. mylitta* in terms of length, breadth and weight at lower altitude during autumn and winter seasons and at medium altitude during autumn season only was the highest in Asan food plant and the lowest in Jamun food plant.

DISCUSSION

Dash *et al*. (1992) recorded superiority of Sal for cocoon crop parameters (weight of cocoon, pupa and shell) at lower altitude in rainy season only; whereas superiority of Asan was observed during autumn and winter season in the same altitude. Jolly *et al*. (1974) reported superior growth parameters of tasar cocoon crop raised on Sal food plants. In the present investigation the growth of male moth in terms of length, breadth and weight during autumn season at both the lower and medium altitudes as well as at lower altitude during winter season was observed to be the highest in Asan food plant. This indicates the superiority of Asan plant among all the food plants for cocoon crop performance. It might be due to better nutritional supplement and phagostimulants obtained from Asan leaf for the growth of moth favoured by optimum climatic conditions which can be ascertained by further biochemical investigation.

Nayak *et al.* (1992) reported that voltinism in wild silk moth *Antheraea paphia* L. is primarily governed by altitudinal gradient as well as the changing environmental factors. Change of attitude also influences the change of body size in many macrolepidopterans and there is a positive size to altitude relation (Sullivan and Miller 2007). The present findings reflected greater growth of male moths in all respect at medium altitude than at lower altitude during autumn season irrespective of the leaf of the food plants consumed by *A. mylitta*. The probable reasons for the superior performance of growth parameters of male moth with increase in altitude might be due to decrease in temperature and photoperiod but increase in RH.

Jolly (1966) reported that Asan, Arjun and Sal food plants are of primary importance for cocoon crop performance. Dash *et al*. (1992) reported appreciable cocoon crop performance on the food plants like Asan, Arjun, Sal, Ber, Sidha and Dha only. But the current study indicates consideration of Ber, Sidha and Dha for rearing activities of *A. mylitta* when there is inadequacy of primary food plants in the rearing field without hampering much the economics of cocoon crop, although they are graded as secondary food plants by Jolly (1966). The present finding further indicates much encouraging growth results on Ber for which it can be also included under primary group of food plants of *A. mylitta,* since the overall performance on it remains very much at par with Arjun and Sal. However in case of acute shortage of food plants during peak period of rearing seasons, the consideration of food plants like Sidha and Dha for rearing purpose is suggested here since the performance of cocoon crop on these food plants is commercially not too much impaired. The growth performance of moths raised on Bahada food plants indicates considerable results for its utilization at the time of severe scarcity of food plants. But very poor growth of moth in Jamun food plant at all the experimental altitudes indicates the commercial non viability of this food plant for rearing activities, may be due to greater phagoinhibitants. Further investigation on the above growth parameters at the other stages of the insect may be carried out in order to draw a concrete conclusion.

REFERENCES

1. Dash, A. K. and Dash, M. C. (1989 – 90). Energetics of the Indian tasar silk worm, *Antheraea mylitta* Drury (Lepidoptera: Saturniidae) raised on Asan (*Terminalia tomentosa*) food plant. Wild Silk moth, 2: 165 – 172.
2. Dash, A. K. and Nayak, B. K. (1990a). Towards preservation of off – season eggs of tasar silk insect *Antheraea mylitta* Drury (Lepidoptera: Saturniidae) through refrigeration. Proc. 77th Ind. Sci. Congr., pp. 50 – 51.
3. Dash, A. K., Nayak, B. K. and Dash, M. C. (1992). The effect of different food plants on cocoon crop performance in Indian tasar silk worm, *Antheraea mylitta* Drury (Lepidoptera: Saturniidae). J. Res. Lepid., 31 (1 - 2): 127 – 131.
4. Dash, A. K., Nayak, B. K. and Dash, M. C. (1996). Energetics of the Indian tasar silk worm, *Antheraea mylitta* Drury (Lepidoptera: Saturniidae) raised on Arjun (*Terminalia arjun*). Int. J. Wild Silk moth and Silk, 2: 37 – 40.
5. Deka, M. and Kumari, M. (2013). Comparative Study of the Effect of Different Food Plant Species on Cocoon Crop Performance of Tropical Tasar Silkworm (*Antheraea mylitta* Drury**).** Int. J. Res. Chem. Environ., Vol.3, Issue 1: 99-104.
6. Jolly, M. S. (1966). Tasar Research Scientific Brochure. Central Silk Board, Bombay, India,40p.
7. Jolly, M. S., Sen, S. K. and Ahsan, M. M. (1974). Tasar culture. Central Silk Board, Ambica publisher, Bombay, pp 152.
8. Kumar, D., Pandey, J. P., Sinha, A. K., Salaj, S., Mishra, P. K. and Prasad, B. C. (2013). Evaluation of Novel Tasar Silkworm Feed for *Antheraea mylitta*: It's Impact on Rearing, Cocoon Trait and Biomolecular Profile. American J. of Biochemistry and Molecular Biology, 3: 167-174.
9. Nayak, B. K., Dash, A. K., Dash, M. C. and Akai, H. (1992). Environmental regulation of voltinism in *A. paphia* Linn. (Lepidoptera: Saturniidae), the Indian tasar silk insect. Wild silk moth, 4: 47 - 56.
10. Ojha, N. G., Sinha, S. S., Singh, M. K. and Sharan, S. K. (1994). Rearing and cocooning of tropical tasar silk worm, *Antheraea mylitta* Drury (Lepidoptera: Saturniidae) in indoor condition. Int. J. Wild silk moths and silk, 1 (2): 257 - 260.
11. Sen, S. K. and Jolly, M. S. (1971). On the genitalia of tasar silkmoth, *Antheraea mylitta* D. (Lepidoptera : Saturniidae). Indian J. Seric., 10: 50 – 52.
12. Singh, G. S., Rath, S. S., Singh, S. S., Singh, M. K. and Vijayaparakash, N. B. (2011). Effect of Feeding Trial on Commercial Characters in Tropical Tasar Silkworm *Antheraea mylitta* Drury. Asian J. Exp. Sci., Vol. 25, No. 1: 63-66.
13. Sinha, R. K., Sharma, K. K., Bansal, A. K., Sinha, B.R.R.P. and Noamani, M. K. R. (1993). Cytological investigation of various ecoraces of *Antheraea mylitta* D. (Lepidoptera : Saturniidae). J. Seric., 1 (2): 59 - 62.
14. Sokal, R. R. and Rohlf, F. J. (1969). In Biometry. The principles and practices of statistics in biological research, W. H. Freeman & Co. San Francisco, pp. 1 – 776.
15. Sullivan, J. Bolling and Miller, E. William. 2007. Intraspecific Body Size Variation in Macrolepidoptera as Related to Altitude of Capture site and Seasonal Generation. Journal of the Lepidopterists' Society, 61(2): 72–77 pp.