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Biology of *Attacus atlas* (Lepidoptera : Saturniidae) A Wild Silk Worm of India

KEYWORDS: Attacus atlas, wild silkworm, biology

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ABSTRACT *Attacus atlas, Linnaeus (Lepidoptera : Saturniidae) is wild silk worm, which produce durable, brownish and wooly like silk. The silk worms feed on Angeer Ficus carica Linnaeus, Castor Recinus comnunis, Mango Mangifera indica Linnaeus and Custard apple Annona squamosa Linnaeus. The biology of A. atlas was studied on E. carica at laboratory conditions (27±1oC, 75-80% R.H. and 12 hr photoperiod). A. atlas completed its life cycle from egg to adult within 62 days. Incubation, larval and pupal periods were 10 days, 26.5 days and 28 days respectively. Morphological features and general appearance of immature stages of A. atacus have been reported. Moth emergence from cocoon took place early in the morning. Mated female laid 134 to 160 eggs. The pupa was brownish colored and 4.4 cm long and 1.5 cm broad.*

INTRODUCTION

India is the only country in the world which produces 4 to 5 kinds of commercial silks namely, mulberry silk from *Bombyx mori* L., Tasar silk from *Antheraea mylitta* Drury, Muga silk from *Antheraea assama* W. and Eri silk from *Samia cynthia ricini* Hutt. Out of which rearing techniques for *B. mori, A. assama* and *S.c. ricini* have been well established and for *A. mylitta* is poorly established. However, rearing techniques for *Attacus atlas* L. is yet to be established. In fact, biology of this worm is also not fully known. Therefore, the present paper deals with biology of *A. atlas* on its natural food plant Angeer *Ficus carica* Linnaeus. Review of literature indicates that very little is known about the biology of silk work *A. atlas* except the work of Kavane & Sathe (2011) and Saikia and Handique (1998). The biology of other wild silk worms are studied by several workers those are listed in references of the text.

MATERIALS & METHODS

The cocoons and larvae of *A. atlas* were collected from the forests of Western Maharashtra on natural food plants such as Angeer *F. carica,* Mango *Mangifera indica,* Linnaeus Castor *Ricinus communis* Linnaeus and Custard apple *Annona squamosa* Linnaeus and reared on *F. carica* leaves for adult emergence. Female moths emerging from the cocoons were tied on along with their own cocoon and kept in the cage with male moth. The eggs were collected from floor walls of the cage at room temperature (27±1°C, 75-80% R.H. and 12 hr photoperiod) containing luxuriant leaves of *F. carica* cut under water and kept in conical flasks filled with water. The newly hatched larvae were released on the branches of host food plant with the help of camel hair brush and feather. Branches were changed from time to time and rearing area was cleaned every day. After maturity, the larvae were transferred to dry leaf branches for spinning cocoons. Cocoons were harvested after 6-8 days of pupation. Later, adult emergence was noted. Observations have been made on eggs, larvae, pupae and adults with respect to their duration and morphological features. Observations were also made on oviposition and mating behaviour.

RESULTS

Eggs (Figure 1)

The oval dorsoventrally compressed eggs were with hard chitinised shell, composed of hexagonal cells. Egg was about 3.04 mm in length and 2.5 mm in breadth, weighing about 0.012 g. The newly laid eggs look creamy white but became light brown later. Eggs were laid scattered and have gummy substances due to which they get attached to each other. Incubation period was 10 days.

Larval Stage (Figure 3)

The first instar larvae were 1.7 cm in length, 0.3 cm in breadth and 0.020 g in weight. Body colour was white with black inter segmental region. There were six tubercles in each body segment of silk worm from 1st to 10th and five on 11th and four tubercles on the remaining 12th and 13th body segments. Each tubercles beared some hair like setae.

The late stage of 1st instar larvae were quite different from the early stage. During late stage. They were 2 cm in length and 0.34 cm in breadth and weight 0.112 g. The early and late stage of this instar lasted for 1.5 days and 3.5 days respectively. During late stage, the head of the tubercle became blunt and knob shaped. This instar lasted for 5 days.

Second instar larvae were whitish dorsally and some what orange-red on the lateral side of the body. Crystalline powdery substance was found on all the tubercles. The dorsal tubercles were bluish in colour. The head became light brown in colour. Second instar larvae measured about 2.61 cm in length, 0.4 cm in breadth and 0.785 g in weight. This stage lasted for 4.5 days.

Third instar larvae were with five additional pairs of ventrolateral tubercles on each side of the first five body segments. The reddish colour was disappeared. The first three rows of dorsal tubercles gradually shortened. The clasper showed triangular shaped red ring. The larvae measured 3.2 cm, 0.8 cm and 2.780 g in body length, width and weight respectively. This instar lasted for 4.0 days.

Fourth instar larvae measured 5.52 cm in length, 1.3 cm in breadth and 5.58 g in weight. The dorsal tubercles of first

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three segments were completely disappeared. All the lateral tubercles became black. Nine pairs of spiracles were seen. This stage lasted for 6.0 days.

Fifth instar larvae (Figure 3) were 11.14 cm, 2.4 cm, and 22.6 g in length, width and body weight respectively. Body colour became dark green and the lateral tubercles turned blue at the base and black at the tips. Dorsal tubercles became blue in color. The thoracic legs were conical shaped with sharp distal claws. The 6th to 9th abdominal segments, each beared a pair of abdominal legs which were fleshy and flat. Terminally, they formed a disc with a series of hooks inwardly curved and arranged in a semicircle manner. However, a pair of white spots appeared on the ventral side of the 11th abdominal segment in the female larvae but a only single spot was visible in male. The dorsal tubercles project backwards and lateral tubercles project forward. The instar fifth lasted for 7 days.

Pupa and cocoons (Figure 4)

The mature larva constructed its cocoon on fresh leaves dry branch of host plant and suspended it from the twig with the help of a long stalk. It spun its silk fibre around its body with the help of spinneret and tubercles. The pupae were brown coloured and 4.4 cm, 1.4 cm and 7.6 g in length, width and body weight respectively. This stage lasted for 28 days. The colour of cocoon was grayish brown. *A. atlas* silkworm undergoes pupation in an open type silk cage.

Moth (Figure 5 & 6)

Moth emergence took place in the early morning and just after emergence it clinged to its own cocoon and remained there for 8-10 hours till its wings were fully stretched. The males were more active than females. The male moth survived for 2-3 days and the female for 4-6 days after copulation and of egg laying respectively. The reddish brown moth has a wing span of 26 cm in male and 28 cm in female. The basal area of the forewings was brown and red brown edged with red, pale and black lines. Medial area was red brown. At the end of cell with a black edge a large hyaline spot was noted. Apical area was with yellow to pink shade. A yellow brown marginal band with a highly waved black line was present on the fore and hind wings.

The males coupled with the females (Fig. 6) at dusk which lasted for 12-24 hours. The female (Figure 5) laid 134 to 150 eggs which were scattered on the sides of cage.

From Western Ghats and Forest Environment *A. atlas* was recorded feeding on the leaves of *F.carica*(Figure 2), *M. indica*, *A. squamosa* and *R. communis*.

DISCUSSION

Saikia and Handique (1998) studied the life cycle of *A. atlas* by providing main food plant *Meyna laxiflora* under which the incubation period of eggs was 10 days, the larval period was 28 days and the pupal duration was 28 days. The adult male survived for 2-3 days and female 4-6 days. Jolly *et. al.* (1997) reported grayish brown colour of the cocoon of *A. atlas* insect. While, Hampson (1892) reported tubercular arrangement in the larva of *A. atlas.*

Peigler (1989) reported over 100 plant species belonging to 90 genera in 48 families as host plants for *Attacus* spp. Villiard (1969) was of the opinion that greater success on the rearing of *Attacus* larvae particularly the later instars could be achieved by feeding them on a mixed diet of above said plants. Murphy (1990) was the first to mention the present of *Attacus* in mangrove habits, stating that *A. atlas* occurred once on *Avicennia alba* Bl. (Avicenniaceae) and simultaneously with many other trees. However, it occurred at low levels on *Bruguiera gymnorhiza* (L.) Lamk (Rhizophoraceae). In the present study biology of *A. atlas* was studied on host plant *F. carica* and the silkworm completed its life cycle from egg to adult within 64.5 days. However, *A. atlas* was found feeding on the leaves of *M. indica*, *A. sqnamosa* and *R. communis* from the environment of forests of Western Ghats.

Rajadurai *et. al.* (1998) studied the life cycle of *Actias selene* and reported that *A. selene* was distributed widely all along the mixed forests plants such *Terminalia arjuna*, *T. tomentosa* and *Zizipus mauritiana*. The incubation period of egg was 9 days, the larval period was 31 days and the pupal duration was 18 days. The adult males survived for 3-4 days and females 4-6 days. The total period for completion of life cycle was 58 days. While, in the present study of life cycle from egg to adult was completed within 64.5 days which is considerably longer than *A. selene*.

Cotes (1891-93), Barlow (1982) studied the host plants of *A. selene*. *A. selene* feed on *Zanthoxylus acanthopedium* D.C., *Z. alatum* Roxb (Rutaceae), *Cedrela paniculata* (Meliaceae). *Coriana nepalensis* Wall. (Coriariaceae), wild cherry Prinus, Wild peer Pyrus (both Rosaceae), walnut (Juglandaceae) and other fruit trees in Northern India.

Nassig and Peigler (1984) stated that some members of Anacardiaceae are good host plants for *A. selene*. Host plants *Heptapleurum octophyllum* B. and H. (Araliaceae) were reported from Hong Kong (Potter, 1941). Chen-Shuren *et. al.* (1997) observed in China that larvae of *A. selene ningopoana* Felder caused considerable damage to the plant, *Cornus officinalis* Sieh at Zuccy feeding on leaves. The moon moth (*A. selene*) pupa undergoes summer diapause. The moth exhibits trivoltine nature which is to synchronize with the meteorological condition of the region. In the present study only three generations have been completed by *A. atlas.*

According to Jolly *et. al.* (1977) a tasar silkworm *A. mylitta* was polyphagous in nature feeding on a number of host plants. *T. arjuna* (Arjun). *T. tomentosa* (Asan) and *S. robusta* (Sal) were best among all the food plants and considered as primary food plants for commercial rearing. They have since been adopted for large scale exploitation for tasar rearing in the country. Thangavellu (1992) and Thangavellu et. al. (1991) discussed the need for conservation of wild sericigenous insects of India and also indoor rearing of tasar silkworm (*A. mylitta*) for domestication. He also highlighted the importance of systematic research on various aspects of non-mulbeery silk.

Kavane and Sathe (2008) reported rearing technique for tasar silkworm *A. mylitta*. Their results indicated that the rearing success of *A. mylitta* on *T. catappa* under laboratory conditions (24±1^{0}C, 65-70 per cent R. H. and 14 hr photoperiod) was 45 per cent. The cocoon quality was satisfactory. The silkworms were adopted in indoor rearing technique by preparing no peduncle which was normally spun by the worms in outdoor rearing was outstanding feature of the success of indoor rearing technique.

In past, attempts have been made by some workers

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(Chaobas Singh 2005; Sathe and Jadhav, 2001; Shamitha, 2007; Kavane and Sathe, 2008, etc.) to develop indoor rearing method for tasar silkworm *A. mylitta*. Institute of sericultural and an entomological science, Japan has developed some artificial diet for tropical tasar silkworm containing Asan leaf powder, the principal food plant, and has achieved success to some extent (Akai *et. al.* 1991). However, no biology of *A. atlas* has been reported on host plant *E. carico*.

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Fig. 1:- A. atlas eggs

Fig. 2:- F. carica twig

Fig. 3:- *A. atlas* **larva (5th instar)**

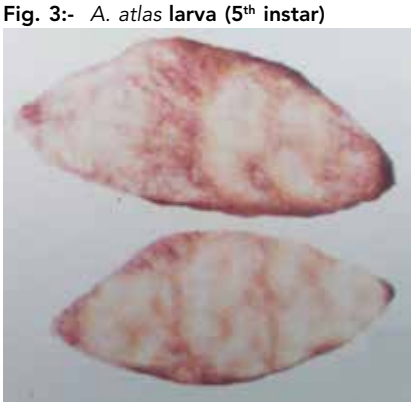

Fig. 4:- *A. atlas* **cocoons**

Fig. 5:- A. atlas female

Fig. 6:- A. atlas mating

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