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Terminalia catappa – A potential new host of Fagara Silkmoth *Attacus atlas* Linn. (Lepidoptera-Saturniidae) from Western Maharashtra

Kavane R.P.**Abstract**

India is second largest producer of wild silk in the world. The wild Indian silks like Tasar *Antheraea mylitta*, Muga *A. assamensis*, Eri *Philosamia ricini* are well known in the world as far as rearing technology is concern. However, rearing technology has not developed for *Attacus atlas* in India and elsewhere although it produces durable and brownish silk. The worms of *A. atlas* are scattered in environment of forest and Western Ghats of Maharashtra. The rearing of the fagara silk moth *A. atlas* was done on *T. catappa* under indoor rearing condition. *A. atlas* completed its life cycle from egg to adult within 62 days. Incubation period, larval (Six instars), and pupa period 10 days, 27.5 days 25 days respectively. The findings of *T. catappa* as a potential new host for fagara silkworm *A. atlas* silkworm has opened new vistas in promoting vanya silk.

Keywords: *Attacus atlas* Fagara silkworm, *Terminalia catappa*, indoor rearing, Western, Maharashtra.

1. Introduction

Attacus atlas moth is the largest species of Lepidoptera in the world. The genus *Attacus* Linnaeus of the family saturniidae is restricted to the Australian region and contains 14 known species, of which 11 are insular endemics [4]. North-eastern region has good potential for sericulture. Eri and Muga silkworms still exist in the wild state in the forests of these regions [9]. The cocoon produced by this silkworm is somewhat similar to eri cocoon in nature and can be spun easily. The colour of this silk yarn resembles tasar spun silk. Review of literature indicates that very little is known about the biology of silk worm [9]. Keeping in this view, an attempt has been made to study the life cycle, rearing procedure & its silk cocoon quality under indoor rearing conditions from western Maharashtra.

2. Materials and Methods

For rearing of wild silkworm *A. atlas* the basic plan of methodology was adopted [11]. Other details of rearing of *A. atlas* silk moths are given in table 1 & 2. Biology of *Attacus atlas* was studied for two generations during August – December (2012-2013). The cocoons of *A. atlas* were collected from a host plant of a Kolhapur forest region during the first week of July and the adults were allowed to emerge under laboratory conditions at 27 ± 2 °C temperature and 75 ± 5 % RH, inside a moth cage made of nylon [11]. Female moths emerging from the cocoons were tied on along with their own cocoon and kept in the cage with male moth. The newly hatched larvae were released on the branches with the help of camlin brush. Branches were changed from time to time and the rearing area was cleaned every day. After maturity, the larvae were transferred to both dry and fresh leaf branches for spinning cocoons.

The hatching percentage of the eggs under aseptic condition was scored and the duration of incubation was recorded. Larval body weight of 1st to 6th instar larva was recorded; the average duration of the entire larval period was recorded basing on the visible morphological characters from the day of hatching to the day of spinning. Cocoon characters like colour, shape, single cocoon weight, and shell weight, length, width, thickness were recorded. The single shell weight, single cocoon weight and shell ratio a percentage was calculated.

$$\text{Shell ratio (\%)} = \frac{\text{Shell weight}}{\text{Cocoon weight}} \times 100$$

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3. Results

The results tabulated in Table 1 and 2 indicate that the cocoon formation took place within 35 to 43 days (average 40 days) cocoon weight, shell weight, length of shell, width of shell and shell thickness were 9.50 g, 1.92 g, 4.4 cm, 1.4 cm and 0.21 mm respectively while, shell ratio was 20.21 per cent. The rearing success of *A. atlas* silkworms on *T. catappa* leaves was 50 per cent. On an average a single mated female laid 110 eggs and produced 62 offsprings with an average sex ratio (m:f) 1:0.75. The longevity of adult moths averaged 4 days in males and 6 days in females.

Eggs: (Fig. 1)

Eggs are oval, dorsoventrally flattened and dull white in colour. Egg is about 2.94 mm in length and 2.1 mm in breadth, weighing about 0.010 g. The newly laid eggs look creamy white but become light brown later. Egg stage lasts for 10 days.

Larval stage: (Figs. 2-13)

Attacus atlas silkworm has distinct body colour and tubercles arrangements.

First instar: (Fig. 2-4)

First larva is 1.6 cm in length, 0.3 cm in breadth and 0.018 g in weight. Body colour white with black inter segmental region. There are six tubercles in each body segment on 1st to 10th and five on 11th and four tubercles on the remaining 12th and 13th body segments. Each tubercle bears some hair like setae.

Late stage of 1st instar larva is quite different from the early stage. During late stage, it attains a length of 2 cm, breadth of 0.34 cm and weight about 0.110 g. The early and late stage of this instar lasts for 1.5 days and 3.5 days respectively. During late stage, the head of the tubercle becomes blunt and knob shaped.

Second instar: (Fig. 5-6)

Second instar larva is dorsally whitish in colour and somewhat orange-red on the lateral side of the body. Crystalline powdery substance was found on all the tubercles, dorsal tubercles are bluish in colour. The head becomes light brown in colour. Second instar larva measures about 2.61 cm in length, 0.4 cm in breadth and 0.785 g in weight.

Third instar: (Fig. 7)

Third instar larva is with five additional pairs of ventro-lateral tubercles on each side of the first five body segments, reddish colour get disappeared. The first three rows of dorsal tubercles gradually shortened and clasper shows triangular shaped red ring and it measures 3.2 cm, 0.8 cm and 2.28 g in body length, width and weight respectively.

Fourth instar: (Fig. 8-9)

Fourth instar larva measures 5.52 cm in length, 1.3 cm in breadth and in weight 5.58 g. The dorsal tubercles of first three segments completely disappeared, lateral tubercles became black and nine pairs of spiracles are seen.

Fifth instar : (Fig. 10-11)

Fifth instar larva is 8.05 cm, 2.1 cm & 20.5 g in length, width, body weight respectively. Body colour becomes dark green and the lateral tubercle colour turns blue at the base and black at the tips. The thoracic legs are conical shaped with sharp distal claws. The 6th to 9th abdominal segment, each bears a

pair of abdominal legs which are fleshy and flat at the end. Terminally, they form a disc with a series of hooks inwardly curved and arranged in a semi-circle. Dorsal tubercles become blue in colour, it project backwards and lateral tubercles project forward.

Sixth instar: (Fig. 12)

Sixth instar larva is 9.05 cm, 2.3 cm & 23.5 g in length, width, body weight respectively. Head Glossy green, vertex smooth, white mealy matter on the frons and little on the sides of epicranial suture. Black patch at the base of labium, mandibles black, clypeus, labrum, maxillary and labial palps pale blue. An anterior bluish white stripe in the black area of the fore legs, pink triangular on anal claspers more oval in shape than in earlier instars, less paler in colour.

Pupa and Cocoon: (Fig. 13)

Mature repining larva constructs its cocoon on fresh leaves and suspends it from the twig with the help of a long stalk. It spins its silk fiber around its body with the help of spinneret and tubercles. The pupa is brown coloured and 4.4 cm, 1.4 cm and 7.6 g in length, width and body weight respectively. This stage lasts for 25 days. The colour of is cocoon grayish brown.

Moth: (Fig. 14-15)

Moth emergence takes place in the early morning and just after emergence, it clings to its own cocoons and remains there for 8-10 hours till its wings are fully stretched. The males are more active and couples with the females at dusk which lasts for 12-24 hours. The female lays 134 numbers of eggs which are scattered on the sides of cage. The male moth survival for 2-3 days and the female for 4-6 days after copulation and of egg laying respectively. The red brown moth has a wing span of 26 cm in male and 28 cm in female. The basal area of the forewings is brown and red brown edged with red, pale and black lines. Medial area is red brown. At the end of cell with a black edge a large hyaline spot is present. Apical area has yellow to pink shade. A yellow brown marginal band with a highly waved black line is present on the fore and hind wings.

4. Discussion

Only one species *Attacus atlas* (L.) known to occur in India, producing wild silk 'fagara' is described [1]. Grayish brown colour of the cocoons and tubercular arrangement in the larva of *A. atlas* studied [2, 3]. Over 100 plant species belonging to 90 genera in 48 families as host plants for *Attacus* spp have been reported [4]. Greater success on the rearing of *Attacus* larvae particularly the later instars could be achieved by feeding them on a mixed diet was described [5]. The presence of *Attacus* in mangrove habitats, stating that *A. atlas* occurred once on *Avicennia alba* Bl. (Avicenniaceae) and simultaneously with many other trees and it occurred at low levels on *Bruguiera gymnorrhiza* (L.) Lamk., (Rhizophoraceae) has been reported [6]. Biology of *A. atlas* was studied on host plant *Ficus carica* silkworm completed its life cycle within 64.5 days has been reported [11].

The Life history of *A. mcmulleni*, field observation from Andaman Islands has been reported [7] and also life cycle of *A. atlas* by providing main food plant *Meyna laxiflora* have been reported [8].

Rearing technique of *A. atlas* silkworm reared on *ficus carica* and results indicated that the rearing success of *A. atlas* on *ficus carica* was 15%. The cocoon quality was satisfactory and silkworms were adopted in indoor rearing technique, which is

normally spun by the worms in naturally growing is outstanding feature of the success of indoor rearing technique [11, 12].

In the present study, the discovery of *T. catappa* as a new and potential host of fagara silkworm *A. atlas* will open new vistas

in wild sericulture. Hence, the life cycle and biological studies of fagara silkworms will be helpful for developing standard rearing technique for silkworms and in understanding the biological peculiarities of the silkworms.



Figs.1to15 : Rearing of *Attacus atlas* on *Terminalia catappa*

(1)Eggs,(2) newly hatched larva (3)1st instar,(4) 1 st moult,(5)2nd &3rd instar, (6)2nd moult (7)3rd moult,(8)4th instar,(9)4 th moult,(10)5th instar,(11)5th moult,(12)6th instar, (13)pupa withcocoon,(14)male moth, (15) female moth.

Table 1: Cocoon characterization of *A. atlas* silkworm

Sr. No.	Cocoon wt. (g)	Shell wt. (g)	Length of Shell (cm)	Width of Shell (cm)	Shell thickness (mm)	Shell ratio (per cent)
1	9.50	1.92	4.4	1.4	0.21	20.21

Table 2: Requirements for rearing one dfls for *A. atlas* silkworm on *T. catappa*

Instar of worms	Duration of days	Feeding time per day	Feeding time total	Feeding dose total (kg)	Leaf proportion (g)	Leaf Number on food plant twig	Leaf size	No of boxes /cage	No of trays	Box / Tray cleaning time	Duration of shedding cuticle (hr)	Humidity	Temp. 0c	Bed size sqft
1 st	3	1	3	0.500	40 -50	2 -3	whole	1	----	2	24	75	28 -30	1sqft
2 nd	2.5	2	6	1- 1.5	50 – 60	3 – 4	whole	1	-----	2	36	75	28 -30	3sqft
3 rd	3	2	6	2 – 3	50 -60	Medium /June	whole	----	1	3	56	80	28-30	6sqft
4 th	5	2	10	3 – 4	65-75	Medium /June	whole	----	1	Once every morning	72	80	28 -30	10sqft
5 th	6	2	12	4 -5	75 - 85	Medium /June	whole	----	1	Once every morning	72	80	28 -30	16sqft
6 th	8	2	16	4-5	75-80	Medium /June	whole	-----	2	Once every morning	-----	80	28 -30	24sqft

One dfls – one female moth layings the eggs.

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