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Biology of Bihar hairy Caterpillar, *Spilosoma obliqua* Walker under laboratory conditions on mulberry

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Abstract

Mulberry being the sole food for silkworm *Bombyx mori* L. it is known to be attacked by many insect pests, of which the defoliating species are more predominant. The *Spilosoma obliqua* Walker commonly known as Bihar hairy caterpillar or Jute hairy caterpillar is a polyphagous pest and is a threat to the mulberry yield. It is also a serious and destructive pest of various crops. To understand the duration of life cycle, longevity and fecundity of the insect, newly hatched larvae were separated from the stock culture. Five pairs of Bihar Hairy caterpillar adult moths were released into the cage for pairing and egg laying under controlled conditions (26 ± 2 °C and 75 to 80% RH). The investigation was carried out during 2020-21 at the Department of Sericulture UAS, GKVK, Bengaluru-65 and revealed the *S. obliqua* eggs incubation period was about 4 to 6 days with an average of 5.0 ± 1.00 . The hatching percentages were found to be of 88.25 to 94.25 with an average of 91.9 ± 3.19 . The duration of first, second, third, fourth, fifth and sixth instar were 3.31 to 4.82 days with an average of 3.85 ± 0.84 days., 2.21 to 2.39 days with an average of 2.27 ± 0.20 days, 2.29 to 5.43 days with an average of 4.30 ± 0.10 days, 3.41 to 3.61 days with an average of 3.50 ± 0.10 days and 5.40 to 5.60 days with an average of 5.50 ± 0.10 days, respectively. The pupal period was 10.61 to 12.62 days with an average of 11.5 ± 1.03 days, The data on longevity of female moths were found in the range of 4.21 to 4.48 days with an average of 4.31 ± 0.1 days, while in case of male moths it was found to be of 3.33 to 3.52 days with an average of 3.42 ± 0.1 days the average fecundity of adult female was 620 to 900 with an average of 740 ± 14.22 .

Keywords: Bihar hairy caterpillar, *Spilosoma obliqua*, life cycle, longevity

Introduction

The superiority of silk as a textile fibre has been recognized from the time immemorial and even today, no other fabric can match its lustre and elegance. Mulberry being the sole food for silkworm *Bombyx mori* L. it is known to be attacked by many insect pests, of which the defoliating species are more predominant. The *Spilosoma obliqua* Walker commonly known as Bihar hairy caterpillar or Jute hairy caterpillar belonging to the family *Erebidae* is a polyphagous pest and is a threat to the yield. It is a serious and destructive pest of various crops. The *S. obliqua* also feeds on mulberry leaves which is a food plant of silkworms. The heavy infestation of Bihar hairy caterpillars on the mulberry plants leads to yield loss. The IPM (integrated Pest Management) requires prior knowledge of the biology and ecology of insect pests. The present study focuses on the biology of *S. obliqua* on mulberry.

Materials and Methods

To understand the duration of life cycle, longevity and fecundity of the insect, newly hatched larvae were separated from the stock culture. Five pairs of Bihar Hairy caterpillar adult moths were released into the cage for pairing and egg laying. Cotton was soaked in 10 per cent of honey solution was provided as food for the Bihar hairy caterpillar adults. The oviposition set containing eggs was transferred to larval rearing containers. adult moths were released into the cage for pairing and egg laying. The oviposition set containing eggs was transferred to larval rearing containers and were fed with fresh mulberry leaves daily. In order to maintain proper hygiene, the left-over debris like faecal matter, dried leaves, dead larvae, etc. were removed regularly from the rearing box. Data pertaining to egg output, egg incubation period, larval duration, adult longevity were recorded during respective stages of development.

Determination of larval instars

The size variation of head capsule is an index of growth and development of the larvae. Therefore, head capsule measurement was considered to determine the immature instars of the insect. Eggs from the culture were allowed to hatch. From the emerging larvae, fifteen larvae were reared individually on host. The head capsules were collected at every successive moult, right from initial stage and were stored separately in a small labelled plastic vial for the individual instars. At the end of the experiment, all the head capsules were separately measured across the greatest width (at the base of mandible) with the help of stereomicroscope having an ocular micrometer. The data thus obtained were computed and subjected to statistical analysis.

Results and Discussion

Incubation period of *S. obliqua* eggs

The observations on incubation period of *S. obliqua* were started immediately after the egg laying and continued up to hatching. The incubation period was varied from 4 to 6 days with an average of 5.0 ± 1.00 (Table 1). Results of the present investigation on incubation period of *S. obliqua* were in close agreement with the results of the earlier workers as they recorded the incubation period of eggs in the range of 3-12 days (Singh and Singh, 1995)^[6]; 5.60 days (Nath and Singh, 1996)^[5] and 6.5 to 10.5 days (Debaraj and Singh, 2010)^[1].

Hatching percentage of *S. obliqua* eggs

Observations on hatching percentage of *S. obliqua* eggs were recorded by putting five sets each of fifty eggs. The hatching percentages (Table 1) were found to be of 88.25 to 94.25 with an average of 91.9 ± 3.19 . The results are in conformity with the report of Singh and Singh (1995)^[6] who observed 83.5 to 99.33 percent hatchability for the eggs of *S. obliqua*.

Egg

The eggs deposited by mated adult female moth were in clusters and initially they are greenish in colour. The eggs turn from greenish to pale yellow and prior to hatching it becomes dark brown. Similarly, Warad and Kalleshwaraswamy (2017)^[3] studied the biology of *S. obliqua* and observed the eggs of *S. obliqua* were creamy white at the time of deposition and turned pale yellow before hatching. The number of eggs per mass was 620 to 900 (Table 1) in batches and covered with hairy scales of the tip of the abdomen of the female moth. When the eggs were about to hatch, turned blackish which was the developing head of the larvae. One day prior to hatching, the dark head of the young larva was observed inside the egg shell. Incubation period ranged from 4 - 6 days with an average of 5.00 days. The present findings are in accordance with Pandit and Veeranna (2020)^[5] who reported the biology of Bihar hairy caterpillar on mulberry and the incubation period was observed as 4- 6days. Biology of *Diacrisia oblique* Walk was studied by Djou (1938)^[2], observed that a female laid 342- 1356 eggs and incubation period was 6-11 days.

Larva

After hatching, the larva comes out from the egg. During its larval developmental period, the caterpillar moulted five

times and had six larval instars. The total larval period ranged from 24.61 - 28.40 days with an average of 26.2 ± 0.71 days (Table 1).

First instar

The newly hatched larva was creamy whitish with shining brown head and having brown spots over entire body from which white hair arises which later turn black. The integument was transparent, abdominal segments were distinct with three pairs of prolegs. Larvae turned pale yellow colour within a few hours after hatching. The data (Table 1) on first instar larvae of *S. obliqua* revealed that the duration of first instar was found to be 3.31 to 4.82 days with an average of 3.85 ± 0.84 days.

Second instar

As the larva advances to second instar, the body grows faster and as a result, the body turns wider than the head. The larva was translucent light yellow in colour with prominent setae and tubercles. The width of the head capsule of the newly moulted larva ranged from 0.05-0.07mm with an average 0.06 ± 0.008 (Table 2). The second instar varied from 2.21 to 2.39 days with an average of 2.27 ± 0.20 days to enter into next instar (Table 1).

Third instar

Third instar larvae were similar to second instar but the coloration of head and body segments were little darker compared to the second instar. The third instar larvae were more active than the first and second instar larvae. The larva was light yellowish in colour with black patches on the anterior and posterior region of the body. The spiracles were black in colour and are nine in number. The width of the second moult head capsule was 0.08-0.16mm with an average of 0.11 ± 0.02 (Table 2). The duration of third instar larvae was 2.29 to 5.43 days with an average of 4.30 ± 0.10 days (Table 1).

Fourth instar

The larva was yellowish in colour with yellow longitudinal stripes. Head and prothoracic shield were dark brown. Black patches were present on the anterior and posterior region. The head capsule width of third moult was 0.14 to 0.19 mm with an average of 0.16 ± 0.15 (Table 2). The duration of fourth instar larvae was 3.41 to 3.61 days with an average of 3.50 ± 0.10 days (Table 1).

Fifth instar

Fifth instar larva was almost similar to fourth instar, except in its size. Black patches were present on the anterior and posterior region. The larvae had dense hairs on its body. The width of fourth moult larva head capsule measured 0.21 to 0.29 mm with an average of 0.24 ± 0.22 (Table 2). The duration of fifth instar larvae was 3.40 to 3.70 days with an average of 3.50 ± 0.15 (Table 1).

Sixth instar

The fully-grown larva was stout and cylindrical, brown in colour, the head of the larva was dark brown and conspicuous dark anterior and posterior patches of the larva. The larvae had dense hairs on its body. The head capsule width of fifth moult larva was 0.39 to 0.55 mm with an average of 0.44 ± 0.04 (Table 2). The duration of sixth instar

larvae was 5.40 to 5.60 days with an average of 5.50 ± 0.10 days (Table 1).

Total larval duration

The total larval period (Table 1) of *S. obliqua* was ranged from 24.61 to 28.40 days with an average of 26.2 ± 0.71 days. Earlier workers also reported larval period of 17.22 days (Singh and Singh, 1995) [5], 24.72 days (Nath and Singh, 1996) [5] and 24 days (Debaraj and Singh, 2010) [1]. Mallikarjun warad and Kaleshwaraswamy C. M 2017 [3] observed the total larval period ranged from 24 - 26 days with an average of 25.75 days.

Pupa

Pupation occurred in the soil as soil was provided as medium. The pupa was elongated and oval in shape. The eyes and the antennal case were prominent. The freshly formed obiect pupa was yellowish and gradually reached to dark brown. They undergone pupation inside the hairy cocoon, hence pupal sexing was not possible. The rate of pupation ranged between 73.56 to 90.12 days with a mean duration of 82.0 ± 8.59 per cent (Table 1).

Pupal period

The duration of pupae was varied from 10.61 to 12.62 days with an average of 11.5 ± 1.03 days, (Table 1). The present

findings are in close conformity with the report of Singh and Singh (1995) [6] and Nath and Singh (1996) [5] in which they reported pupal period of 10.25 and 11.46 days, respectively.

Longevity and fecundity

The data on longevity of female moths were found in the range of 4.21 to 4.48 days with an average of 4.31 ± 0.1 days, while in case of male moths it was found to be of 3.33 to 3.52 days with an average of 3.42 ± 0.1 days (Table 1).

The fecundity was varied from 620 to 900 eggs with an average of 740 ± 14.22 eggs (Table 1) which is in the conformity with the report of Singh and Singh (1995) [6] who reported that the *S. obliqua* laid 1849 eggs /female while Debaraj and Singh (2010) [1] reported that the fecundity was 987 eggs /female.

Total life span

The total life span was found to be of 39.25 to 43.25 days with an average of 41.2 ± 2.0 days in case of male, while it was ranged from 43.44 to 45.65 days with an average of 44.6 ± 1.1 days in case of female. The present findings are in close conformity with the report of Singh and Singh, 1995 [6]; Nath and Singh, 1996 [5] and Debaraj and Singh, 2010 [1] as they reported that the total life span was found to be 37.50; 53.06 and 39.60 days, respectively.

Table 1: Biology of Bihar hairy caterpillar, *S. obliqua* under laboratory conditions

| | Minimum | Maximum | Mean \pm SD | |
|-------------------------------|------------------|---------|-----------------|----------------|
| *Egg Incubation period (days) | 4 | 6 | 5.0 ± 1.00 | |
| 1st instar duration | 3.31 | 4.82 | 3.85 ± 0.84 | |
| 2nd instar duration | 2.21 | 2.39 | $2.27 \pm .20$ | |
| 3rd instar duration | 2.29 | 5.43 | 4.30 ± 0.10 | |
| 4th instar duration | 3.41 | 3.61 | 3.50 ± 0.10 | |
| 5th instar duration | 3.40 | 3.70 | 3.50 ± 0.15 | |
| 6th instar duration | 5.40 | 5.60 | 5.50 ± 0.10 | |
| *Total larval duration | 24.61 | 28.40 | 26.2 ± 0.71 | |
| Larval survivability (%) | 80.36 | 85.32 | 82.7 ± 2.50 | |
| Pupal period (days) | 10.61 | 12.62 | 11.5 ± 1.03 | |
| Pupation rate (%) | 73.56 | 90.12 | 82.0 ± 8.59 | |
| Moth emergence (%) | 0.56 | 93.36 | 88.7 ± 7.09 | |
| **Adult longevity | Male longevity | 3.33 | 3.52 | 3.42 ± 0.1 |
| | Female longevity | 4.21 | 4.48 | 4.31 ± 0.1 |
| Total life-cycle (days) | Male | 39.25 | 43.25 | 41.2 ± 2.0 |
| | Female | 43.44 | 45.65 | 44.6 ± 1.1 |
| Fecundity (No.) | 620 | 900 | 740 ± 14.22 | |
| Hatchability (%) | 88.25 | 94.25 | 91.9 ± 3.19 | |

*N=30 **N=5pairs

Table 2: Measurements of head capsule of Bihar hairy caterpillar, *S. obliqua*

| | Measurements width (mm) | |
|-----------------------|-------------------------|------------------|
| | Range | Mean \pm SD |
| 1 st moult | 0.05-0.07 | 0.06 ± 0.008 |
| 2 nd moult | 0.08-0.16 | 0.11 ± 0.02 |
| 3 rd moult | 0.14-0.19 | 0.16 ± 0.15 |
| 4 th moult | 0.21-0.29 | 0.24 ± 0.22 |
| 5 th moult | 0.39-0.55 | 0.44 ± 0.04 |

N=15

Conclusion

The investigation was carried out during 2020-21 at the Department of Sericulture UAS, GKVK, Bengaluru-65 and revealed the *S. obliqua* eggs incubation period was about 4 to 6 days with an average of 5.0 ± 1.00 . The hatching percentages were found to be of 88.25 to 94.25 with an

average of 91.9 ± 3.19 . The duration of first, second, third, fourth, fifth and sixth instar were 3.31 to 4.82 days with an average of 3.85 ± 0.84 days., 2.21 to 2.39 days with an average of 2.27 ± 0.20 days, 2.29 to 5.43 days with an average of 4.30 ± 0.10 days, 3.41 to 3.61 days with an average of 3.50 ± 0.10 days and 5.40 to 5.60 days with an average of

5.50±0.10days, respectively. The pupal period was 10.61 to 12.62 days with an average of 11.5±1.03 days, The data on longevity of female moths were found in the range of 4.21 to 4.48 days with an average of 4.31±0.1days, while in case of male moths it was found to be of 3.33 to 3.52 days with an average of 3.42±0.1. days the average fecundity of adult female was 620 to 900 with an average of 740±14.22.

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