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Biology and morphometry *Spodoptera litura* Fabricius on tomato

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Abstract

The present investigation was conducted to study biology and morphometry of *Spodoptera litura* on tomato leaves. Larvae were brought from field and reared in glass jars by providing tomato leaves at research laboratory, BCKV during 2016-17 at three different temperatures, 20 °C, 25 °C and 30 °C with RH 75 ± 5 %. At 20 °C, total larval period completed in 41.8±3.56 days while it took 25.8 ± 0.67 days and 16.3 ± 0.83 days in 25 °C and 30 °C respectively. Total developmental period completed in 60.4 ± 3.13, 41.6 ± 1.08 and 30.1 ± 1.29 days in 20 °C, 25 °C and 30 °C respectively. As the temperature increased, number of days required for development decreased. The length of different larval instars increased from 3.48 ± 0.08 mm to 36.26 ± 0.24 mm and breadth from 0.3 ± 0.007 mm to 4.1 ± 0.02 starting from first instar to fifth/sixth instar.

Keywords: *Spodoptera litura*, biology, morphometry, tomato

1. Introduction

Tomato is native to Central and South America [2]. It is a popular and versatile food ranking third in the world's vegetable production, next to potato and sweet potato and placing itself in first place among the processing crops [3]. A wide range of insects attack tomato and forms major limiting factor in its successful cultivation and in improvement of yield.

Among them *Spodoptera litura* is an important polyphagous pest in India, China and Japan. It is a serious pest of various economically important crops such as cotton, tomato, groundnut, chilli, tobacco, castor, okra and pulses etc. [5]. During the vegetative stage of the crop it feeds on leaves and on young parts at reproductive stage it feeds on pods [1]. The increasing infestation of this pest in tomato fields has raised a number of questions regarding the factors responsible for its population build up under natural conditions. The basic information on biology is required for the development of pest forewarning system. Keeping this in view, the present study was undertaken for this pest in West Bengal region.

2. Materials and Methods

2.1 Biology of *Spodoptera litura* Fabricius

The culture of *Spodoptera litura* Fabricius was maintained on tomato leaves at research laboratory, BCKV during 2016-17. A large number of matured larvae were handpicked from the tomato plants at farm during morning hours. The larvae were brought to the laboratory and then reared in a glass jar. The mouth of the jar was covered with a fine muslin cloth tied with rubber band. The matured larvae were fed with fresh tomato leaves without any infestation larvae in pre-pupal stage were transferred to another jar containing soil for pupation. On emergence the female and male were identified and pair were transferred to cage for mating. The cage was provided with 10% honey solution soaked cotton. Female laid eggs not only on lower side of leaves of tomato plant (raised in pot and kept in cage) but also on the surface of polythene bag, in masses covered with anal hairs. The male and the female were distinguished by the females having tuft of hair on tip of abdomen. Ten newly hatched larvae were transferred with the help of a soft camel hair brush to the petri dishes (5 cm x 1 cm) and were provided with fresh tomato leaves. The leaves were changed every day with fresh leaves and faecal matter was removed. The larval development was observed daily.

After completion of the larval development went for pupation within the soil and left to record pupal duration.

The experiment was conducted in culture room with maintaining the three different temperature i.e. 20 °C, 25 °C and 30 °C.

2.2 Morphological studies of *Spodoptera litura* Fabricius

The length and breadth of larvae, pupae and adults (5 of each stage) were measured with the help of ocular-stage micrometer for first instar and with millimetre scale for second to last instar. The breadth of different instars was measured at their broadest part of the body region.

3. Statistical analysis

Mean was calculated of different parameters and standard deviation is done to quantify the amount of variation.

4. Results and Discussion

The eggs were laid in mass covered with hairs on the lower surface of leaves, muslin cloth and polythene. Eggs were very small, round in shape and yellowish white in colour. Freshly laid eggs measured from 4.1±0.3 mm to 4.2±0.3 mm in diameter. On hatching, *S. litura* larvae passed through five larval instars (some larvae in 20 °C passed through six instar) to become adult. The length of different larval instars increased from 3.48±0.08 mm to 36.26±0.24 mm and breadth from 0.3±0.007 mm to 3.56±0.134 mm starting first instar to fifth instar. The length and breadth of pupa varied from 17.34±0.34 to 18.36±0.47 mm and 4.94±0.089 to 5.18±0.130 mm respectively. The length of the adult varied from

16.2±0.10 mm to 16.4±0.41 mm and breadth from 7.76±0.023 mm to 7.82±0.216 mm. The present finding was more or less in conformity with that of Tithi and her co workers [7] reported that the length of 1st, 2nd, 3rd, 4th and 5th instar larvae varied from 8.9±0.9 to 10.2±0.8, 13.5±1.0 to 16.3±1.5, 20.5±1.9 to 24.5±0.6, 28.8±1.5 to 32.3±2.8 and 47.5±1.9 to 50.5±1.9 mm, respectively. The breadth of 1st, 2nd, 3rd, 4th and 5th instar larvae were measured 1.3±0.2 to 1.5±0.2, 2.3±0.5 to 2.5±0.5, 3.3±0.5 to 4.0±0.8, 4.8±0.5 to 6.0±0.8 and 7.8±0.5 to 8.3±0.4 mm, respectively. Incubation period was 4.8±0.44 days at 20 °C, 3.6±0.41 at 25 °C and 2.7±0.27 days at 30 °C. The larval period was 41.8±3.56 days at 20 °C, 25.8±0.67 days at 25 °C and 16.3±0.83 days at 30 °C.

Time requirement to complete different instars had been presented in table 1. Pupation took place within a soil. The pre-pupal and pupal periods were 2.8±0.83; 6.6±1.51 days at 20 °C, 2.6±0.22; 5.2±0.44 days at 25 °C and 1.9±0.22; 5.7±0.27 days at 30 °C respectively. The total developmental period from egg to adult emergence was averaged to 60.4±3.13 days at 20 °C, 41.6±1.08 days at 25 °C and 30.1±1.29 days at 30 °C. The longevity of adult moth was 4.4±1.14, 4.4±0.41 and 3.5±0.35 days at 20, 25 and 30 °C respectively. Similarly, Sanjrani and co workers reported that the shortest duration of the life cycle (26.6 days) was at higher temperature i.e. 34.9 °C and duration increased as the temperature decreases [6]. Bae and his co workers also reported larval duration was 23.6- 30.4 days at 24 °C, 18.6- 22.3 days at 28 °C and 14.5-18.0 days at 32 °C [4]

Table 1: Morphometric parameters of *Spodoptera litura* feeding on tomato leaves at 20, 25 and 30 °C

| | Length (mm) | | | Breadth (mm) | | |
|------------------------|-------------|------------|------------|--------------|-----------|-----------|
| | 20 °C | 25 °C | 30 °C | 20 °C | 25 °C | 30 °C |
| Egg (Diameter mm) | | 3.68±0.08 | | 4.1±0.3 | 4.2±0.3 | 4.1±0.3 |
| 1 st Instar | 3.8±0.05 | | 3.48±0.08 | 0.3±0.007 | 0.38±0.08 | 0.32±0.04 |
| 2 nd Instar | 9.1±0.17 | 8.76±0.11 | 8.62±0.22 | 1.26±0.03 | 1.32±0.04 | 1.32±0.08 |
| 3 rd Instar | 14.42±0.07 | 15.26±0.39 | 15.14±0.29 | 2.06±0.05 | 2.18±0.08 | 2.24±0.11 |
| 4 th Instar | 25.16±0.15 | 24.82±0.34 | 25.94±0.37 | 2.6±0.05 | 2.64±0.11 | 2.72±0.08 |
| 5 th Instar | 31.5±0.15 | 31.64±0.25 | 36.26±0.24 | 3.36±0.05 | 3.2±0.07 | 3.56±0.13 |
| 6 th Instar | 33.8±0.10 | - | - | 4.1±0.02 | - | - |
| Pupa | 17.92±0.15 | 18.36±0.47 | 17.34±0.34 | 5.12±0.06 | 5.18±0.13 | 4.94±0.08 |
| Adult | 16.2±0.10 | 16.4±0.41 | 16.24±0.35 | 7.76±0.02 | 7.82±0.21 | 7.76±0.18 |

Table 2: Developmental period (in days) of *Spodoptera litura* feeding on tomato leaves at 20 °C, 25 °C and 30 °C

| Life stages | | 20 °C (X±SD) | 25 °C (X±SD) | 30 °C (X±SD) |
|---------------------|------------------------|--------------|--------------|--------------|
| | | (Days) | (Days) | (Days) |
| Egg | | 4.8±0.44 | 3.6±0.41 | 2.7±0.27 |
| | 1 st Instar | 9.8±1.09 | 4.6±0.41 | 4.6±0.41 |
| Larva | 2 nd Instar | 7.8±0.83 | 6.2±0.44 | 4.1±0.22 |
| | 3 rd Instar | 8.4±1.14 | 6.5±0.50 | 2.8±0.27 |
| | 4 th Instar | 5.6±1.67 | 4.0±0.70 | 2.6±0.22 |
| | 5 th Instar | 6.8±2.16 | 4.5±0.35 | 2.2±0.27 |
| | 6 th Instar | 3.4±0.89 | - | - |
| Total larval period | | 41.8±3.56 | 25.8±0.67 | 16.3±0.83 |
| Prepupal | | 2.8±0.83 | 2.6±0.22 | 1.9±0.22 |
| Pupal | | 6.6±1.51 | 5.2±0.44 | 5.7±0.27 |
| Adult | | 4.4±1.14 | 4.4±0.41 | 3.5±0.35 |
| Total | | 60.4±3.13 | 41.6±1.08 | 30.1±1.29 |

5. Conclusion

Spodoptera litura larvae reared at 20, 25 and 30 °C with RH 75 ± 5 % on tomato. At 20 °C, total larval period completed in 41.8±3.56 days while it took 25.8 ± 0.67 days and 16.3 ± 0.83 days in 25 °C and 30 °C respectively. Total developmental period completed in 60.4 ± 3.13, 41.6 ± 1.08 and 30.1 ± 1.29

days in 20 °C, 25 °C and 30 °C respectively. As the temperature increased, number of days required for development decreased. The length of different larval instars increased from 3.48 ± 0.08 mm to 36.26 ± 0.24 mm and breadth from 0.3 ± 0.007 mm to 4.1 ± 0.02 starting from first instar to fifth/sixth instar.

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