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Effect of *BT* on third instar larvae against *Spodoptera litura* (Fab.) on different host plants under laboratory condition

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Abstract
The present studies were undertaken at Department of Entomology, College of Agriculture, Dapoli (M.S.) during 2017-18 to study the effect of *Bt* on third instar larvae against *Spodoptera litura* (Fab.) on different host plants under laboratory condition. The results on the study on efficacy of *Bt* against 3rd instar larvae of *S. litura* on different host plants revealed that *Bt* on okra was most effective with cent per cent mortality followed by cowpea with 96.67 per cent mortality. While *Bt* on sweet potato was least effective and significantly inferior to the rest of the treatments.

Keywords: host plant, *Bt*, *Bacillus thuringiensis*, *Spodoptera litura* (Fab.) etc.

Introduction
The *Spodoptera litura* Fab. (Lepidoptera: Noctuidae) is a serious polyphagous insect causing immense damage to field crops like vegetables, oilseeds, pulses, throughout the Country (Gargav and Katiyar, 1971) [7]. This insect has been reported causing extensive damage to a wide range of crops such as oilseeds, pulses, fodders, fiber crops, fruit trees, weeds, medicinal and ornamental plants. (Singh and Singh, 1993) [11]. It was found to cause 26-100 per cent yield loss in groundnut (Dhir *et al*. 1992) [5].

Host plant is a key determinant of the establishment, growth, survival and fecundity of herbivorous insects. Though many host plants were reported for *S. litura*, every host does not support the pest in the same way. There have been a number of studies on the biological parameters of S. *litura* on different host plants under different environmental conditions, particularly, in India (Patel *et al*. 1986) [10], Pakistan (Ahmad *et al*., 2007) [1], China (Zhu *et al*. 2000) [13] Korea (Bae and Park, 1999) [2] and other Asian countries (Etman and Hooper, 1979) [6] where S. *litura* has been an important pest on various crops.

Number of crops have been reported as its host plants such as maize, lentil, green gram, moth bean, castor, sesame, groundnut, tomato, cauliflower, cabbage, colocasia, agathi, indigo, slender pigweed, brinjal, chilli, banana, Lucerne, carpet weed, elephant yam, tobacco and grasses by some researchers and workers. (Lal and Nayak, 1963, Bhalani and Talati, 1984, Patel *et al.*1987 and Bhalani, 1989) [8, 3, 4].

Among various biological control agents tried worldwide against *S. litura*, microbial agents especially *Bacillus thuringiensis* (*Bt*) is a promising bio control agent widely used against *Spodoptera.* However, effect of *Bt* may vary on the target insect feeding on different host plants. The information on the above aspects of *Spodoptera* is scanty under Konkan region of Maharashtra. Keeping in mind the above points, the present investigation was carried out to study the effect of *Bt* on third instar larvae against *Spodoptera litura* (Fab.) on different host plants under laboratory condition.

Materials and methods
1. Mass rearing of *S. litura*
The larvae of *S. litura* were initially collected from the infested plants of Palak (*Spinacea oleracea* L.) leaves growing at the Horticulture farm of College of Agriculture, Dapoli (Maharashtra). Culture was maintained under laboratory conditions on castor *(Ricinus communis* L.) leaves at room temperature (27 ± 3°C) and relative humidity (70 ± 5%). Fresh food was provided daily, during experimental period. Proper hygienic conditions were maintained. Full-grown larvae were allowed to pupate in the glass bottles (18 cm height and

9 cm diameter). Pupae were separated and kept in a separate glass bottle. Emerging moths were used to build up subsequent culture. Adults were fed on 10 per cent honey. A folded black paper sheet was placed in the jar to provide suitable sites for oviposition. Open end of bottle was covered with muslin cloth held tightly with the help of a rubber band. Eggs obtained from these moths were placed in glass bottle by cutting the paper strips along with the eggs. Newly hatched larvae were further used for different aspects of the study.

2. Experimental details

A statistically designed lab experiment using Completely Randomized Design (CRD) having replications and treatments was laid out at Department of Entomology laboratory, College of Agriculture, Dapoli to study comparative biology of *S. litura* on different host plants under laboratory condition. The details of experiment are given below:

Experimental details

Location: Department of Entomology laboratory, College of Agriculture, Dapoli.
Design: CRD
Replication: Three
No. of larvae per replication: Ten
Treatment: Eight (Different host plants as given below)

Treatments	Host plants
T_1	Castor, *Recinus communis* (L.)
T_2	Mulberry, *Morus alba* (L.)
T_3	Okra, *Abelmoschus esculentus* (L.)
T_4	Cowpea *Vigna unguiculata* (L.)
T_5	Taro, *Colocacia esculenta* (L.)
T_6	Tapioca, *Manihot esculenta (*L.)
T_7	Groundnut, *Arachis hypogaea* (L.)
T_8	Sweet potato, *Ipomoea batatas* (L.)

Study the efficacy of *B. thuringiensis* (*Bt*) against third instar larvae of *S. litura* on different host plants

1. Preparation of solution

Bt commercial formulation, Dipel (*Bacillus thuringiensis* var. *kurstaki*) was tested for its efficacy against *S. litura* through different hosts. *Bt* solution (1.5gm/litre of water) was prepared in glass bottle (18 cm height and 9 cm diameter) for further testing.

2. Treatment of *Bt* to S. *litura*

Fresh leaves of each host plant were thoroughly washed, dried in shade and dipped in *Bt* solution. After proper drying in shade, the leaves were placed in different glass bottles (18 cm height and 9 cm diameter). Third instar larvae of the test insect, taken from mass culture maintained on respective host plants in laboratory were starved for 24 hours and then placed individually on different host plants treated with *Bt* solution. Another set of experiment was also conducted by dipping leaves of each host in water on which third instar larvae were released to serve as control. A set of ten larvae each were maintained and replicated thrice.

3. Observation

Observations on larval mortality were recorded at an interval of 24, 48, and 72 hours after release of larvae. Per cent mortality was calculated by counting dead larvae. The data obtained were subjected to statistical analysis.

Results and Discussion

Study the efficacy of *B. thuringiensis* (*Bt*) against third instar larvae of *S. litura* on different host plants

The observations recorded on cumulative mean per cent mortality of third instar larvae on different hosts treated with *Bt* at 1.5 g/l of water are presented in Table 1 and Fig 1. The larval mortality was recorded at 24, 48, and 72 hours post treatment.

Results obtained, 24 hrs after treatment indicated that *Bt* treated cowpea gave maximum mortality (46.67%) followed by tapioca (26.67%) which were at par with each other. Further, okra (16.67%), groundnut (13.33%), taro (10.00%), mulberry and sweet potato (6.67% each) were at par with tapioca. *Bt* treated castor leaves gave least effective results with 3.33 per cent**.**

Data recorded 48 hrs after treatment revealed that *Bt* treated okra (93.33%) gave maximum per cent mortality which was at par with cowpea (90.00%) which further was at par with groundnut (76.67%). Groundnut was also at par with tapioca (66.67%). Further tapioca, mulberry and sweet potato (46.67% each) were also found at par. Lowest larval mortality was observed on castor (26.67%) and taro (23.33%) which were at par with each other.

Data obtained 72 hrs post treatment showed that maximum mortality was on okra (100%) and was at par with *Bt* treated cow pea (96.67%), groundnut (93.33%), castor (86.67%) and tapioca (83.33%). Further tapioca, taro (70.00%), mulberry (70.00%), and sweet potato (63.33%) were found at par with each other and all showed comparatively lower rate of mortality as compared to okra, cowpea, groundnut and castor.

Yanar *et al.* (2017) [12] studied the influence of plants secondary compounds on survival rate of *Lymantria dispar* (L.) which was infected with *Btk* using four different host species. The lowest mortality percentage was seen on the larvae which fed on the *Elaeagnus rhamnoides* L. (33.33%) that had highest protein rate while larvae fed on the *Crataegus monogyna* jack. (93.30%) showed highest mortality that had lowest protein rate followed by *Quercus cerris* L. (86.70%) and hazelnut (73.30%). Muralibaskaran *et al.* (1996) [9] recorded mortality responses of fourth instar larvae of *S. litura* on different host plants treated with *NPV*. They recorded highest mortality of larvae fed on tobacco leaves (91.70%) and sunflower (90.00%) followed by castor (86.70%) and cotton (61.70%). Thus, the present findings are also in accordance with the above one.

Conclusion

During the present studies, on the efficacy of *Bt* against 3rd instar larvae of *Spodoptera litura* on different host plants revealed that *Bt* on okra was most effective with cent per cent mortality followed by cowpea with 96.67 per cent mortality. While *Bt* on sweet potato was least effective and significantly inferior to the rest of the treatments.

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