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Research Article

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Toxicity of *Bacillus thuringiensis* against second instar larvae of *Spodoptera litura* on different host plants

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ABSTRACT

Spodoptera litura is serious pest of many horticultural and agricultural crops. *S. litura* can cause severe economic loss of crops like cotton, cabbage and okra. Different methods are adopted to control this notorious insect pest throughout the globe but biological control is one of them that proved best against it. In 2019, current study was conducted to check the toxicity of *Bacillus thuringiensis* on 2nd larval instars under laboratory conditions by using different hosts. Mortality data was recorded at 24, 48 and 72 hours of post treatment. The results showed that maximum mortality was recorded on okra (41.46%) followed by cotton (34.67%) and cabbage (23.87%) after 24 hours. After 72 hours of post treatment, maximum mortality of larvae was observed on *Bt* treated leaves of cabbage than okra. The results indicated that 100% mortality was recorded on cabbage after 72 hours of treatment. *Bt* treated cabbage leaves were found most effective with 11.21% mortality while cotton gave least effective results with 9.99%. The current study concluded that microbial control is best approach to control insect pest under laboratory as well as field conditions.

Keywords: *Spodoptera litura*, Cabbage, Okra, Horticultural crops, Microbial control

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INTRODUCTION

Spodoptera litura is polyphagous and serious insect pest of cotton growing areas of world including Pakistan [1-3]. Africa, India, China, Pakistan, Australia, the Pacific Region and New Zealand are severely infested countries by this pest [4].

Larvae of *S. litura* feed on leaves, tender shoots and brackets [5] of more than 87 plant species including fruits, crops and vegetables [6] in various regions of the world [2,7-9] especially tropical and subtropical [10]. Larvae of this pest can cause about 31-100 crops losses [11,12].

Due to high fecundity and fertility, pest can cause severe economic losses and becoming pest of many fodder crops [6,13-16]. It is good flyer and migrates quickly from one area to another of the globe especially in Pakistan. The crop production can reduce due to attack of this pest under favorable environmental conditions [4].

The various management strategies like cultural, biological and chemicals are adopted by many researchers to control this notorious pest at national and international level. Chemical control like insecticides is one of them that used frequently alone or in combination with other chemicals to control this pest, *S. litura*. The conventional insecticides (carbamates, pyrethroids and organophosphates) [6] and many other new chemistry insecticides [4,13] are applied to control this pest at small and large scale by many farmers and researchers.

The excessive use of these chemicals against this pest can caused resistant and fail to control this pest under laboratory as well as field conditions. There is need to adopt another approach

to control this notorious insect pest. Microbial insecticides like *Bt.* are eco-friendly, safe for environment and beneficial fauna (predators, pollinators and parasitoids), proved an effective tool against insect pest, *S. litura*.

The current study was conducted to check the toxicity of *Bacillus thuringiensis* against second instar larvae of *S. litura* by using different host plants under laboratory conditions. The purpose of current study was to check either bacteria prove an effective control strategy against tested pest or not.

MATERIAL AND METHODS

Collection and Rearing

The immature stages (eggs and larvae) of *Spodoptera litura* were collected from different farmer field at Rawalpindi during 2018. The collected specimens were transferred into laboratory and reared on different hosts (cotton, okra and cabbage) under controlled conditions *i.e.* 27 ± 3°C and 70 ± 5% temperature and relative humidity (RH), respectively. The rearing of *S. litura* larvae was carried out in Department of Entomology, PMAS Arid Agriculture University, Rawalpindi. The fresh leaves of each host were provided to collected larvae during whole study period. The full grown larvae were selected and kept into plastic jars and allowed to pupate. Pupae were collected and kept separate into rearing cages for adult emergence and 10% honey solution were provided to emerging adults. One pair of moth was kept separately into separate rearing cage to build up successive culture. A folded tissue paper was hanged in the cage for oviposition and egg lying purpose. The mouth of cage was covered with fine mesh cloth or muslin cloth that tightly held with the rubber band. Eggs laid by single female were collected and placed individually into glass bottle along with food for new hatching larvae. The hatched larvae were further used in experiment. The same procedure was repeated up to three generations and proper hygienic conditions were maintained throughout the study period.

Experimental Detail

Completely Randomized Design (CRD) having three treatments with three replications and ten larvae were used per replication to study the toxicological effect of *B. thuringiensis* on 2nd instar larvae by using different hosts.

The description of experiment is given below;

Treatment	Hosts
T_1	Cotton, *Gossypium hirsutum*
T_2	Okra, *Abelmoschus esculentus*
T_3	Cabbage, *Brassica oleracea*
T_4	Control

Preparation of *Bacillus thuringiensis (Bt.)* solution

Bt. commercial formulation, Dipel (*Bacillus thuringiensis* var. kurstaki) was used to test its potential against 2nd instar larvae of *S. litura* by using different host plants. *Bt.* solution (1.5gm/litre of water) was prepared in beaker for further experiment.

Application of Bacteria (Bt.)

Fresh leaves of each host were collected from fields and washed thoroughly on flowing water. After washing, leaves kept in shade for an hour to dry. Dried leaves were dipped in *Bt.* Solution for 15 second and placed in shade for drying. Then dried leaves were transferred into different plastic jars. The counted number of 24 hours started 2nd instar larvae were taken from mass culture with the help of camel hair brush and shifted into plastic jars containing treated leaves. Larvae were dipped only in distilled water and consider a control.

Data Recoding

Mortality data of tested larvae was recorded at an interval of 24, 48 and 72 hours of post treatment.

RESULTS AND DISCUSSION

Microorganisms such as nematode, fungus and bacteria are commonly used for the control of various insect pests including *S. litura* throughout the globe. These microbes play key role in the management of insect pests and also help in soil aeration and also stop the anaerobic mechanism of microbes. These microbes can release toxic materials on the insect pests and kill them [17].

In the current study, the toxicity of *Bt.* against 2nd instar larvae of *S. litura* was studies under laboratory conditions in 2018. *Bacillus thuringiensis* (*Bt*) was used to check its toxicity against *S. litura*. The results indicated that mortality percentage was increased with time. No mortality was recorded in control (T4) treatment. The similar findings have also reported by many other researchers.

The cumulative mean per cent mortality of larvae was recorded after 24, 48, and 72 hours of post treatment. After 12 hours of post treatment, highest and lowest mortality of larvae were recorded on *Bt* treated leaves of okra and cabbage, respectively. The results showed that maximum mortality was recorded on okra (41.46%) followed by cotton (34.67%) and cabbage (23.87%) after 24 hours.

After 72 hours of post treatment, maximum mortality of larvae was observed on *Bt* treated leaves of cabbage than okra. The results indicated that 100% mortality was recorded on cabbage after 72 hours of treatment. *Bt* treated cabbage leaves were found most effective with 11.21% mortality while cotton gave least effective results with 9.99%. The results indicated that mortality percentage of larvae was increased with increase in time. Similar observations had been reported by many early researchers regarding to insect mortality [3,17].

During the whole study period, maximum mortality of larvae was recorded on okra as compared to all other tested host plants

like cotton and cabbage. The difference between mortality rates on tested hosts is due to presence of secondary and primary compounds like proteins, carbohydrates and many others. Primary and secondary metabolites are playing key role in plants to control insect pests. These compounds can act deterrents and minimize the food consumption.

CONCLUSION

The current study concluded that *Bacillus thuringiensis* is very effective and found more toxic against larvae of *S. litura*. It can give better results against many others insect pests under laboratory as well as field conditions.

List of Abbreviation

Bt: Bacillus thuringiensis
S.litura: Spodoptera litura
CRD: Completely Randomized Design

Statement of Conflict of Interest

Authors have no conflict of interest.

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