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MANAGEMENT OF AMERICAN BOLL WORM *HELICOVERPA ARMIGERA* (HUBNER) BY *BEAUVERIA BASSIANA* (BALSAMO) IN COTTON CROP

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ABSTRACT

Helicoverpa armigera (Hubner) is an important pest of many economically important crops in Indian subcontinent. Larvae destroy both foliage and fruits of plants. Rapid development of resistance to insecticides has made this insect to acquire status of a key pest.The present study was attempt to control the pest population of *Helicoverpa armigera* (Hubner) with an ecosafe entomopathogen Fungus (*Beauveria bassiana,* Balsamo). When five different concentrations (0.15%, 0.20%, 0.25% , 0.30% and 0.35%) were sprayed against larvae of *Helicoverpa armigera* (Hubner), a dose dependent mortality was observed that went up to 71.07 per cent with highest dose of 0.35% . Test of *Beauveria bassiana* on *H. armigera* revealed per cent mortality significant at 1 and 5 per cent level with different doses. Mortality starts after two to three days of treatment and larval death was generally through various morphological deformities in body parts. The treated larvae died mainly due to spread of fungal infections into different body parts. Severity of infection was evident by development of abnormal body parts, fragile skin, entire body covered by fungal mycelia and formation of intermediate stages indicating that chitin is the main target of fungal attack.

Key Words: *Helicoverpa armigera, Beauveria bassiana,* cotton and mortality.

INTRODUCTION

Cotton is one of the most important cash crop of India that suffers heavily from the attack of different pest. Among the insect pest most notorious pest is *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae) is a serious pest on several crops and is widely distributed worldwide. It has now assumed the status of national pest in India as it feeds on several economically important crops. It is known to develop resistance to almost all the insecticides used for its control .The main reason for *Helicoverpa armigera* becoming such a chronic pest is the development of resistance to many insecticides. The caterpillars of Cotton boll worm not only defoliate the tender leaves but also make the holes in the boll and feeds upon the developing seeds. While caterpillar feed on developing boll, it's nearly half of anterior body portion remains inside while the rest of the half body remains hanging outside the ball. The extents of damage has been reported to be approximately 90.95 % of total damage to boll by caterpillar. The caterpillars feed gregariously on the lower surface of leaves and skeletonize them i.e. leaving their veins only. After a week, when they are grown up disperse over the field and eat the leaves and top shoot of plants. In case of heavy infestation the crops are completely defoliated. It has been observed that crops grown in rainfed areas having light soil receive more frequent endemic and epidemic of this pest.

The entomopathogenic fungus, *Beauvaria bassiana* is one of several fungi that are of particular research interest because of its potential as commercial bio insecticides. Some studies had focused on identifying nutrient substrates that *B. bassiana* can utilize with application to industrial production, while others focused on the pathogenic processes of *B. bassiana* and interactions with insect cuticle (Bidochia *et al*., 1990). Entomopathogenic fungi are found worldwide associated to insects and phytophagous mite populations, contributing to biological control of these arthropods on several economically important crops (Sabbour and Sahab, 2007). In pest management, increasing failures of chemical pesticides and the problems posed by their indiscriminate use in the field have created a momentum to develop environment friendly methods of pest control. Among the alternatives that are currently available is the use of entomopathogenic fungi remain the most promising, considering the fact that they can be used in a manner similar to the familiar chemical pesticides.

It is now generally agreed that insecticide application should be replaced by pest management strategies integrating biological, chemical and other methods to reduce the pest population below economic threshold levels. In this context, use of biological agents, especially microbial pathogens, is safe and suitable for a ecosystem. The worldwide awareness about the environment and contamination problems associated with the use of chemical pesticides, it is now opportune time to restructure the future pests control measures using the concept of biological control method.

MATERIALS AND METHODS

The present experiment was conducted from June 2011-April 2012. The details of the various material and methods adopted in the present investigation are the below.

Preparation of medium:

For isolation and culturing of fungi PDA (potato dextrose agar) medium was used ,procedure adopted for the preparation was as follows

PDA (potato dextrose agar) composition:

Ingredients	Amount in gm/l
Potatoes	200
Dextrose	20
Agar	15.0-20.0
Distilled water	1000
P^H	5.6-6.5

Preparation :

The constituents were put into distilled water and boiled. The pH was adjusted around 5.6-6.5. The prepared medium was poured into conical flasks and culture tubes and sterilized at 15 lbs pressure for 20 minute in the autoclave.

Isolation of *Beauveria bassiana* (Balsamo):

The fungus was isolated from dead *Inderballa quadrinotata* the guava bark eating caterpillar larvae on guava trees in orchard of Allahabad agricultural institute the culture was then purified on potato dextrose agar (PDA) medium and maintained for use in the various experiments.

Identification of *Beauveria bassiana* (Balsamo):

In culture, *B. bassiana* grows as a white mould. On most common cultural media, it produces many dry, powdery conidia in distinctive white spore balls. Each spore ball is composed of a cluster of conidiogenous cells. The conidiogenous cells of *B. bassiana* are short and ovoid, and terminate in a narrow apical extension called rachis. The rachis elongates after each conidium is produced, resulting in a long zig-zag extension. The conidia are single-celled, haploid and hydrophobic.

RESULTS AND DISCUSSION

In vitro:

The present laboratory investigation was conducted to ascribe the efficacy of *Beauveria bassiana* as a biological control against in management of *Helicoverpa armigera* (Hubner).

Effect of *Beauveria bassiana* and Cypermethrin on Net mortality per cent of *Helicoverpa armigera*

Effect of Treatment: From the bioassay a linear relation between per cent mortality and dose of concentrations were observed. In the bioassay with *B. bassiana* against *H. armigera*, per cent mortality increased from 26.66 to 66.66 per cent respectively as the dose was increased from 0.20 to 0.35 per cent. In the present study among the applied doses higher concentration recorded the highest mortality where as in less concentration various morphological abnormalities such as malformed larvae

Table 1. Detail of Treatments

S.NO.	TREATMENT NUMBER	CHEMICAL NAME	CONCENTRATION DOSE (%) Recommended by Karthikeyan and Selvanarayanan, (2011)
1	T_0	Control	0.0
2	T_1	*Beauveria bassiana*	0.15
3	T_2	*Beauveria bassiana*	0.20
4	T_3	*Beauveria bassiana*	0.25
5	T_4	Beauveria bassiana	0.30
6	T_5	*Beauveria bassiana*	0.35
7	T_6	Cypermethrin 25Ec	0.01

Table 2. Effect of *Beauveria bassiana* and Cypermethrin on Net mortality per cent of *Helicoverpa armigera*

TREATMENT	Mortality % at different hrs of intervals (Mean of the replicates)		
	24 hrs	48 hrs	72 hrs
T_0 (Control)	0 (0.0)	0 (0.0)	0 (0.0)
T_1 *B. bassiana*(0.15%)	33.33 (35.18)	33.33 (35.18)	46.66 (43.05)
T_2 *B. bassiana*(0.20%)	26.66 (31.05)	33.33 (35.18)	53.33 (46.89)
T_3 *B. bassiana*(0.25%)	46.66 (43.05)	53.33 (46.89)	60.00 (50.77)
T_4 *B. bassiana*(0.30%)	33.33 (35.18)	33.33 (35.18)	46.66 (43.05)
T_5 *B. bassiana*(0.35%)	46.66 (43.05)	53.33 (46.89)	66.66 (54.70)
T_6 Cypermethrin(0.01%)	53.33 (46.89)	66.66 (43.05)	93.33 (75.00)
F- test	S	S	S
S. Ed. (±)	0.436	0.448	0.509
C. D. (P = 0.05)	0.925	0.951	1.079

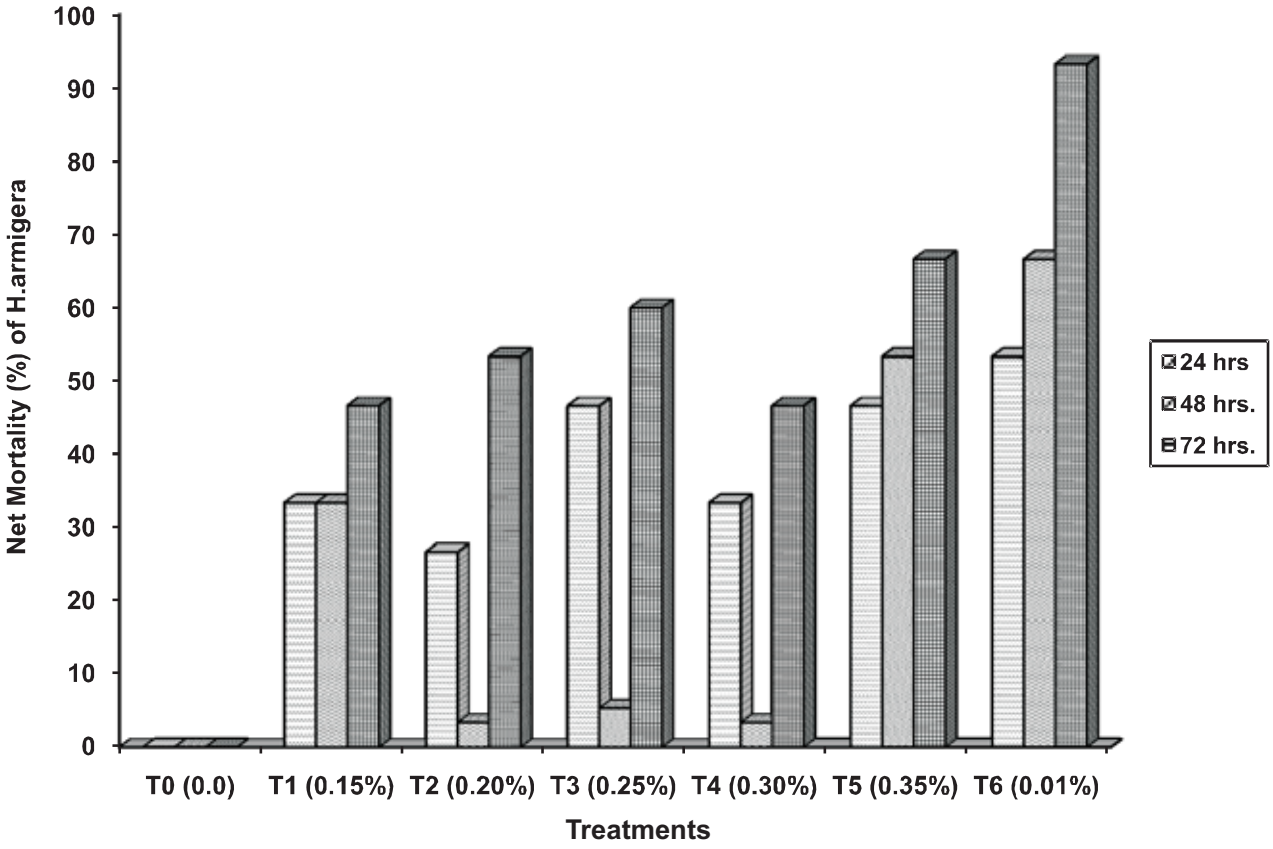

Fig. 1: Percent net mortalityof *Helicoverpa armigera* Treated by *Beauveria bassiana* and Cypermethrin

pupae and adults were noticed larvae became sluggish and stopped feeding after 24hrs. The cuticle of treated larvae blackened which might be due to excessive melanization indicating direct attack of fungus on the defence system of these insects. after 72 hrs.In the present bioassay The per cent mortality increased from 46.66 to 66.66 respectively as the dose level increased from 0.15 to 0.35 per cent (Table 1.2) compared of cypermethrin. From the results obtained, among various concentrations 0.35 per cent recorded the highest per cent mortality and proved its best performance against the *Helicoverpa armigera.* Hence, this concentration of *B. bassiana* and *cypermethrin* could be suggested in managing the *Helicoverpa armigera.*

$$T_0<T_1<T_2<T_3<T_4<T_5<T_6$$

Effect of time period: From the results of present study it was observed that different time periods ($h_1 h_2 \& h_3$) showed significant difference between them. Highest mortality rate was recorded in 72 hours followed by 48hours and 24 hours respectively. 72hours> 48hours>24hours. From the present study it may be concluded that among treatment by spray with Cypermethrin 25 EC @.01% and *beauveria bassiana* 0.35% were found to the best for the superior and maximum insect mortality, larval population reduction and yield of cotton.

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