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Bioefficacy of *Beauveria bassiana* against third instar larvae of *Helicoverpa armigera* at different concentration

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Abstract
Higher dose of *B.bassiana* (10^8 fungal spores/ml) showed higher effectiveness against third instar larvae of *Helicoverpa armigera* with percent mortality of larvae up to 10 DAT. The efficacy inclined gradually with advancement of time but persisted up to 10 days after treatment to induce 90 percent mortality. The *B.bassiana* (10^7 fungal spores/ml) at 10 DAT shows 76.66 percent mortality. From the result it is concluded that the mortality was time dose dependent. As the dose increased the mortality was also increase and vice-versa.

Keywords: *Beauveria bassiana*, *Helicoverpa armigera*, larvae

Introduction

Helicoverpa armigera belongs to family Noctudiae and order Lepidoptera. Moths are stout, light yellowish brown, forewings pale brown with some black dots, hind wings lighter with smoky dark margin. Caterpillar greenish with dark grey line along the sides of the body. The caterpillar feed on tender foliage and young pods. They make holes into the pods and damage the developing seeds by inserting the anterior half Portion of their body.

The failure of chemical pesticide on one hand and health hazards on other hand, have compelled agricultural entomologist to develop economically viable, eco-friendly and sustainable pest management strategies, in this direction, biological control is especially desirable because it is safe to ecosystem, sustainable, economical and advocated as the first line of attack. Microbial control is the biological suppression of insect pests employing microbial world. It has advantage of higher host specificity, virulence, safety to natural enemies and ease in mass production, multiple benefits in Bioefficacy due to accelerating and spreading epizootics in pests, shelf life and compatibility with other methods.

B. bassiana is a cosmopolitan fungus useful for the control of various insect pests of different crops. Narayanan (1988) [6] reported 60-100 per c ent mortality of *H.armigera* by *B. bassiana* .Vimaladevi and Hari (2009) [10] also reported the Pathogenicity of *B. bassiana* to *H.armigera* larvae.

Agrawal and Rajak (1985) [1] reported that *B.bassiana*, an entomopathogenic fungus was considered to be potentially effective for the control of many insect pest-including chickpea borer, *H. armigera* in Jabalpur (M.P.).Narayanan (1988) [6] studied the pathogenicity of *B.bassiana* at the concentrations of 1.0 x 10^7, 1.0 x 10^8, 1.0 x 10^9 and 1.0 x 10^{10} conidia ml^{-1} against *H.armigera* and reported that all the larval instars were highly susceptible to the first two concentration recording 60 to 100 percent mortality of the host.

Gopalkrishnan and Narayanan (1990) [4] reported that *B.bassiana* was pathogenic to all stages of *H.armigera* and caused 60 to 100 percent larval mortality at 10^8 conidia m^{-1} and 60 percent pupal mortality at 10^9 conidia ml^{-1}. The fungus was found pathogenic on eggs of *H. armigera* and all the treated eggs failed to hatch when dipped into a suspension of 1.0 x 10^7 conidia ml^{-1}.

Sandhu and Singh (1993) [8] reported the dorsal and ventral infection of *B.bassiana* causing 100% mortality of *H. armigera* in 4 days. Manjula and Padmavathamma (1999) [5] conducted a laboratory experiment to study the efficacy of nuclear polyhedrosis virus (NPV), *Bacillus thuringiensis* (BT) and *B.bassiana* against five instars of *H. armigera.* The percentage larval mortalities were greater in all five instars of *H. armigera* at higher concentration of NPV, BT and *B.bassiana*. Greater mortality was observed in the early instars as compared with late instars.

Rathod and Rathod (2002) [7] tested *B.bassiana* (1.18 x 10^4, 10^6, 10^8 and 10^{10} conidia ml^{-1}) to control *H. armigera* (eggs and instars I, II, III, IV and V) on groundnut reported that instars II and III were more susceptible to the pathogen than other larval stages. This susceptibility decreased with age. The fungi were pathogenic to all stages of the pest (2-72% mortality) at 1.18 x 10^{10} conidia ml^{-1})

Dhembare and Siddique (2004) [2] evaluated a formulation of myco insectide, *B.bassiana* an entomopathogenic fungus in the laboratory against gram pad borer (*H.armigera*) during winter 2001-2002 and reported that with increase in spore intensities there was increase in mortality of the pest and found that I and II instar larvae were more susceptible to the fungus. They also reported that the maximum reduction was observed from 72h post treatment when larvae and food were treated together. Sridevi *et al* (2004) [9] tested *B.bassiana* (1.6 x 10^5 to 2.5 x 10^5 spore’s ml^{-1}) against third instar larvae of *H. armigera* individual treatment mortality and combination with Btk resulted in 60 to 86.4 percent larval mortality.

Excessive and indiscriminate use of chemical pesticide which is required to be formulated usually give rise to development of resistance to insecticides in the insect pest which become a severe problem due to unawareness of the farming communities to handle insecticide resistance problem. Pesticide active ingredients would not be used in pure form due to difficulty and is in application therefore they are required to be formulated. So the microbial pesticide which is ecofriendly will be more appropriate for farming community and ecosystem leading to the balance of nature. Looking to the eco-friendly properties of *B.bassiana* the studies were undertaken on the Bioefficacy of *B.bassiana* against third instar larvae of *Helicoverpa armigera*

Material and Methods

The laboratory experiment was conducted with 7 preparation and untreated control in CRD with 5 replication with 6 third instar larvae in each replication. Each larva was transferred to separate formalin 2% and UV sterilized plastic vials (6x4cm) to avoid growth of other microorganisms. One ml of each of the preparations was mixed in 999ml of water and sprayed on the overnight soaked gram seeds using hand sprayer and allowed to dry for 15 minutes. Four soaked gram seeds were provided/vial as food. The vials were changed at 2 days interval. The data on larval mortality was recorded at 6,7,8,9 and 10 days after treatment and were converted into per cent mortality.

Result and Discussion

The data shown in Table 7 revealed that higher dose of *B. bassiana* (10^8 fungal spores/ml) showed higher effectiveness against third instar larvae of *Helicoverpa armigera* with percent mortality of larvae upto 10 DAT. The efficacy included gradually with advancement of time but persisted upto 10 days after treatment to induce 90 percent mortality.

The *B. bassiana* (10^7 fungal spores/ml) showed 16.66 percent mortality after 6 DAT and its mortality was increased upto 76.66 percent at 10 DAT. The *B. bassiana* (10^6 fungal spores/ml) showed 13.33 percent mortality after 6 DAT and its mortality was increased upto 66.66 percent at 10 DAT. At (10^5 fungal spore/ml) the 13.33 percent mortality was observed at 6 DAT and mortality was increased upto 56.66 percent 10 DAT. The *Beauveria bassiana* (10^4 fungal spore/ml) showed 10 percent mortality after 6 DAT and its mortality was increased upto 43.33 percent at 10 DAT. The treatment of *B. bassiana* (10^3 fungal spore/ml) showed 6.66 to 40 percent mortality and the treatment of *B. bassiana* (10^{2} fungal spore /ml) showed 0 to 16.66 percent mortality. In control treatment with only water spray showed 00 percent mortality. From the results it is concluded that the mortality was time dose dependent. As dose increased the mortality was also increase and vice-versa.

Table 7: Bioefficacy of *Beauveria bassiana* against third instars larvae of *Helicoverpa armigera* at different concentration.

Sr. No.	Fungal Spore/ml Treatment	6 DAT	7 DAT	8 DAT	9 DAT	10 DAT
1.	10^8	30	40	60	80	90
2.	10^7	16.66	36.66	50	63.33	76.66
3.	10^6	13.33	30	40	50	66.66
4.	10^5	13.33	23.33	30	46.66	56.66
5.	10^4	10	16.66	23.33	36.66	43.33
6.	10^3	6.66	13.33	20	30	40
7.	10^2	00	00	6.66	10	16.66
8.	Control	00	00	00	00	00

Figures mentioned are converted into percent mortality

The present investigation is in confirmation with Narayanan (1988) [6] and Gopalkrishnan and Narayanan (1990) [4] and reported that *B. bassiana* was pathogenic to all the stages of *H. armigera* and caused 60 to 100 percent mortality at 10^8 condia/ml.

Manjula and Padmavathamma (1999) [5] also reported that percent larval mortality were greater of *H. armigera* at higher concentration of *B. bassiana*. Hassani (2000) also studied and reported that mortality in *H. armigera* ranged from 39 to 98 percent.

Dhembare and Siddique (2004) [2] reported in the laboratory experiment against *H. armigera* that with increase in spore intensities there was increase in mortality of the test and found that I and II instar larvae were more susceptible to the fungus. Sridevi *et al* (2004) [9] tested *B. bassiana* (1.6×10^5 to 2.5×10^5 spores ml) against third instar larvae of *H. armigera* individual treatment mortality and combination with Btk resulted in 60 to 86.4 percent larval mortality.

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