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Entomopathogenic efficacy of *Beauvaria bassina* and *Bacillus thurengiensis* against aphid (*Aphis gossypii*) Glover on okra under field conditions

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Abstract

A field trial was undertaken to study the harmful effect of entomopathogenic *Beauvaria bassina* and *Bacillus thureingienis* for the management of *Aphis gossypii* aphid on okra under field condition. Three replications for each treatment were used. The rate of concentrations was (10^{8} - 10^{9} conidiamL^{-1}) of *Beauveria bassiana* and (10^{8}-10^{9}sporesmL^{-1}) *Bacillus thureingiensis* were applied as foliar spray. the significant maximum mean reduction in the population of aphids was recoded for *Beauveria* + *Bacillus* 30.59, 63.55 and 84.85 followed by *Beauveria bassiana* with% reduction of 27.86,57.52 and 79.20, and 26.54, 56.88 and 77.56 after 24, 48 and 72 hrs of post application respectively. The minimum% reduction in population of aphids was recorded from control with 6.55, 8.50±0.36 and 9.75 after 24, 48 and 72 hrs post treatments application. The combination of *Beauvaria bassina* and *Bacillus thureingienis* caused maximum% reduction in population in the field therefore, it recommended to use biopesticdes for the management of *A. gossypii* in okra field.

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Introduction

Okra, (*Abelmoschus esculentus* L. Moench) is one of the most important widely grown consumed vegetables and plays a significant role in world food security. (Bayer *et al.,* 2003). The successful production of okra is affected by different factors from which insect pests are one of the most important problems. About 72 species of insect pests are attacked on this crop. The aphids (*Aphis gossypii*, Glover), whitefly, (*Bemisia tobacii*) and leafhopper (*Amrasca biguttula biguttula*, Ishida) comprises the major sucking complex causing 17.46% yield losses in okra (Sarkar *et al.*, 1996). As aphids are one of the most polyphagus insects damage the plant by sucking phloem sap. Aphids also serves as the largest group of vectors of plant diseases which greatly increase crop losses (Minks and Harrewijn 1988, Messing *et al.*, 2007).

To minimize insect pest population mostly the growers used pesticides for the management of insect pests but their adverse effects created by pesticides prompted us the need to identify alternative methods to manage these insect pests (Zamani *et al.,* 2006). A well planned IPM strategy is useful for the management of insect pests including cultural control, chemical control, mechanical control, biological control and plant-extracts as a biopesticide used worldwide for the management of different insect pests (Wood *et al.,* 1985). Among these applications, entomopathogenic fungi and bacteria are important natural control agents of many insect pests worldwide (Carruther *et al.*, 1990).

Fungi *Beauveria bassiana* is worldwide well known as an entomopathogenic fungus infect the insect cuticle directly by contact (Sung *et al.*, 2007). This fungus successfully develops as biological control agent for many agricultural pests worldwide. *Beauveria bassiana* has the ability to persist for longer time periods by re-establish in the form of inoculum from the dead cadavers (Athanassiou *et al.*, 2008). To improve their insecticidal activity, the fungal conidia may be augmented with several carriers like inert dusts, mineral oils and botanical insecticides. The bacterium relies on insecticidal crystal proteins to kill their insect larval hosts (Wu *et al.*, 2011).

Moreover, soil bacterium entomopathogen *Bacillus thuringiensis* also showed great success as microbial pesticides to control insect pests. *Bacillus thuringiensis* is a gram positive bacterium and produce crystal proteins known as Cry and Cyt toxins to cause toxicity in different insect pests (Feitelson *et al.,* 1993). This bacterium *Bacillus thuringiensis* form crystal like parasporal inclusion during sporulation (Aronson *et al.*, 2002). They contain proteins called d-endotoxins, which are famous for their insecticidal properties (Aronson *et al.,* 1993 and Van Frankenhuyzen *et al.*, 2009).

Keeping in view the importance of entomopathogenic fungi *Beauveria bassiana* and *Bacillus thurengensis,* the present study was intended with the objective to evaluate their potential for the management of *Aphis. gossypii* aphid on okra crop under field conditions.

Material and methods

Study Area

The field experiment was conducted in the Kharif season of 2015 at the Youngwala field, University of Agriculture Faisalabad, to evaluate the efficacy of bio-pesticides *B. bassiana* and *B. thuringienisis* against aphid in okra. The experiment was laid out in Randomized complete blocked design (RCBD), with three replications and three treatments and a control plot. Entomopathogenic, *B. bassiana* and *B. thuringiensis* were used in three different formulations. High pressure of knapsack was used for spraying different formulation with a spray volume of 2000mL at the foliar stage.

The treatment details are as follows:

- Foliar spray of *Beauveria bassiana* (350ml) in (350ml) water.
- *Bacillus thuringiensis* (350ml) in (350ml) water.
- *Beauveria bassiana* + *Bacillus thuringiensis* (175ml+175ml) in (350ml) water were sprayed.

Sprays of each entomopathogens were given at foliage. Data were collected on a mean number of aphids per plant before spray (Control), and after spray with different time intervals i.e. 24, 48 and 72 hrs. Aphids were counted from randomly selected 10 tagged plants covering the top, middle and lower leaves.

Statistical Analysis

The data were subjected to statistical analysis using statistical software statistix 8.1 the LSD test at ≤ 0.05 and were presented in Table 1.

Results

Efficacy of Entomopathogenic Beauveria bassiana, Bacillus thuringiensis, Beauveria+Bacillus on% reduction in population of aphid A. gossypii on okra crop

Results regarding Efficacy of entomopathogenic *Beauveria bassiana, Bacillus thuringiensis. Beauveria* + *Bacillus on* % reduction in population of aphid *A. gossypii* on okra crop (Table 1) revealed that the significant maximum mean reduction in the population of aphids was recoded for Beauveria + *Bacillus* 30.59, 63.55 and 84.85 followed by *Beauveria bassiana* with% reduction of 27.86, 57.52 and 79.20, and 26.54, 56.88 and 77.56 after 24, 48 and 72 hrs of post application respectively.

The minimum% reduction in population of aphids was recorded from control with 6.55, 8.50±0.36 and 9.75 after 24, 48 and 72hrs post treatments application.

Table 1. Efficacy of Entomopathogenic *Beauveria bassiana, Bacillus thuringiensis, Beauveria* + *Bacillus* on% reduction in population of aphid *A. gossypii* on okra crop.

Entomopathogenic Fungi+Bacteria	Pre-Spray Mean population ± SE	Time Intervals ±SE		
		24	48	72
		% Reduction ± SE	% Reduction± SE	%Reduction ± SE
Beauveria bassiana	19.00±1.09	27.86±0.59b	57.52±0.47 b	79.20±0.61 b
Bacillus thuringiensis	18.67±1.08	26.54±0.29 b	56.88±0.47 b	77.56±0.39 b
Beauveria+Bacillus	19.33±1.09	30.59±0.30 a	63.55±0.73 a	84.85±0.93 a
Control	17.55±1.07	6.55±0.43 c	8.50±0.36 c	9.75±0.34 c
LSD		1.52	1.85	2.16

Discussion

The present study was conducted to find the effect of microbial insecticides on against aphid *A. gossypii* Glover on okra. On the basis of experiment, the results showed that the combination of *Beauveria bassiana* and *Bacillus thuringiensis* caused maximum reduction in the population of *A. gossypii* 30.59, 63.55 and 84.85% after 24, 48 and 72hrs of post application.

These results are in line with (Jugno *et al.*, 2018) who studied effect of combination of *Beauveria* and *Bacillus thuringiensis* on *A. gossypii* in brinjal crop and find the same trend in population of aphids. Correspondence results reported by Shafighi *et al.*, 2014 who used same microbial pesticides along with resistant varieties and reported that alone as well as in combination these chemicals caused maximum and reasonable population reduction of tested insect pests. Current research is also similar with the findings of Janaki *et al.*, 2010, Sandhu *et al.*, 2012, Erler and Ates *et al.,* 2015; Chinniah *et al.*, 2016 and Shahzad *et al.*, 2016 where they have used microbial insecticides and reported that these biocontrol agents caused mortality in different life stages of insect pests of brinjal and gives maximum results in population reduction. Ursani *et al.*, (2014) also founded that the population of brinjal pests has been depressed by the use of different bio-pesticides. The findings of this research are in resemblance with present research. Srinivasan, (2012) performed an experiment to carry out the effects of bio-pesticides on pest management with collaboration of other management techniques such as resistant varieties, natural enemies.

Integration of bio-pesticide can increase performance of IPM strategies. Sharma and tayde (2017) founded that *Metarhizium anisopliae*, *Beauveria bassiana*, Neem oil, Spinosad, Emamectin benzoate, *Verticillium lecanii*, Cypermethrin were evaluated against fruit and shoot borer and found that these all chemicals in combination and alone as well caused maximum mortality of invested pests which supports present findings where used *B. thuringiensis* along with some botanicals against lepidopterous insect pests, provided mortality up to 85% and then reported that whenever all elements are combined they are proved to be helpful in controlling insect pests.

Recommendation

The microbial pesticide caused maximum mortality in *A. gossypii* population therefore it is recommended to incorporate the use combination of *Bacillus* and *Beauveria* or alone each of the microbial pesticides for control of aphids in okra field in IPM programs.

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