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EVALUATION OF BIOPESTICIDES FOR THE MANAGEMENT OF OKRA SHOOT AND FRUIT BORER, *Earias vittella* (Fabricious) IN FIELD LEVEL

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ABSTRACT

The present study was conducted to find out suitable bio-pesticides for the control of okra shoot and fruit borer to improve the production and quality of okra in Bangladesh. Three insecticides namely-Spinosad (Success 2.5 SC), Emamectin benzoate (Suspend 5SG) and *Beauveria basssiana* (1×10^8 CFU/100 ml) were evaluated with recommended dose using okra variety 'BARI Dharos-1'. Emamectin benzoate and Spinosad were found the more effective for the reduction of shoot and fruit infestation caused by *Earias vittella* in okra field than fungal insecticide *Beauveria basssiana*. The shoot infestation after 3rd spray was 22.25, 2.33, 0.00, and 12.00% in untreated control, Spinosad, Emamectin benzoate and *Beauveria bassiana* treated plants, respectively. The fruit infestation after 3rd spray was 11.32, 3.17, 2.25, and 6.00% in untreated control, Spinosad, Emamectin benzoate and *Beauveria bassiana* treated plants, respectively. The highest yield was increased in Emamectin benzoate treatment over control (48.25%), followed by Spinosad (40.84%) and *Beauveria bassiana* (13.70%) treatments. Considering the fruit infestation and yield of okra plants, Emamectin benzoate and Spinosad were found effective bio-pesticides against *E. vittella* under field condition and therefore, may be recommended for the management of okra shoot and fruit borer.

Key words: Bio-pesticides, management, okra shoot and fruit borer

Introduction

Okra is cultivated mainly for its immature fruits, which are generally cooked as vegetable. Okra soups and stews are also popular dishes. Tender fruits have high mucilage content and are used in soups and gravies. Besides being a vegetable, it acts as clarifying agent in jaggery preparation (Chauhan, 1972). The fruits also have some medicinal value. A mucilaginous preparation from the pod can be used for plasma replacement or blood volume expansion (Savello *et al.*, 1980). In the year 2017-2018, the okra production was 4.9 t/h (BBS, 2019) whereas in the year 2018-2019, the production increases to 5.1t/ha (BBS, 2020). In Bangladesh, a total area of 12,745.27 ha produced 55,183 metric ton okra in the year 2018-2019 (BBS, 2020). So, it is clearly evident that the demand of okra in the market is on the rise. Okra production in Bangladesh is affected by many factors, among them insect pest attack is the major one. Its production is severely hampered due to the attack of more than three dozen of insect pests from seedling to fruiting stage (Nayar *et al.*, 1976). Several insect pests have so far been recorded to attack okra but okra shoot and fruit borer (OSFB), is the most destructive insect pest responsible for considerable damage to shoots (Butani and Jotwani, 1984). Okra shoot and fruit borer larvae cause damage both in vegetative and reproductive phase of the crop. In reproductive stage, larvae bore into the flower buds and fruits, and feed on inner tissues. As a result, the infested flower buds droop off and infested fruits become deformed in shape with low market value (Dahiya *et al.*, 2008). The use of insecticides have undoubtedly resulted in the maximum production but the proliferation of insecticides and their unilateral utilization have created many problems such as development of resistance in insect pests to insecticides, resurgence of insect pests, outbreak of secondary insect pests, insecticidal residues, destruction of natural enemies, environmental pollution and toxicity to human health. Moreover, residual effect of insecticides causes the imbalance of the agro-ecosystem (Sarker and Nath, 1989). Biopesticides are obviously different from broad spectrum earlier insecticides due to their less side effects on non-target organisms, comparatively quick degradation, less chance to develop insecticide resistance, low residual persistence etc. Keeping the point in view, the present research work emphasis on sustainable and eco-friendly management of *Earias vittella* through different biopesticides in order to protect the target crop as well as the environment.

Materials and Methods

The present experiment was conducted to evaluate the effectiveness of biorational insecticides for the management of okra shoot and fruit borer, *E. vittella* in the field laboratory of the Department of Entomology, Bangladesh Agricultural University, Mymensingh, during the Kharif season (March to July, 2020). Seeds of okra variety 'BARI Dherosh-1' were used in the present study. It is an open pollinated high yielding variety developed by Bangladesh Agricultural Research Institute (BARI), Gazipur. The seeds of the selected variety were collected from local seed market in Mymensingh. Seeds were sown in the experimental plots as 18 seeds per plot (3 seeds per pit and 6 pits per plot). The plant spacing was maintained as 60 × 30 cm, where row to row distance was 60 cm and plant to plant distance was 30 cm. The experiment was conducted using Randomized Complete Block Design (RCBD). The treatments were comprised with insect growth regulator, microbial derivative and microbial pathogen as follows: i) Control , ii) Microbial derivative- Spinosad (Success 2.5SC) @ 1.5 ml/L of water, iii) Microbial derivative- Emamectin benzoate (Suspend 5SG) @ 1.0 ml/L of water and iv) Entomopathogenic fungus (*Beauveria bassiana*) @ 10.0 g/L of water (1×10^8CFU/ml). The selected three treatments comprising three different insecticides- namely, Spinosad (Success 2.5 SC), Microbial derivatives-Emamectin benzoate (Suspend 5SG), Entomopathogenic fungus (*Beauveria bassiana*) were started to apply from the first sign of infestation (*E. vittella*) at 45 days after seed sowing in the fields. A total of three sprays of each treatment were scheduled at 15 days interval. The data obtained from the experiment on various parameters were statistically analyzed using STAR statistical package to find out the variation resulting from the experimental treatments. The significance of difference between the pair of means compared by LSD test at 5% level of probability (Gomez and Gomez, 1984). The mean values for all the parameters were analyzed by Duncan's Multiple Range Test (DMRT).

Results and Discussion

Shoot infestation (%) by okra shoot and fruit borer: The percentage of shoot infestation was not significant after 7 days of first spraying compared to control (Table 1). After the 14 days of first spraying, significant difference was found in shoot infestation among treatments and the percentage of shoot infestation was 15.25%, 8.25%, 11.36%, 14.04% in untreated control, Spinosad, Emamectin benzoate and *B. bassiana* treated plants, respectively. The shoot infestation percentage was significantly decreased after the second spraying (at 7 and 14 DAS), where no shoot infestation was found in Emamectin benzoate treatment after the second spraying. After the 14 days of second spraying, the percentage of shoot infestation was significantly decreased in case of Emamectin benzoate and Spinosad treatments, where shoot infestation in control and *B. bassiana* were not significantly changed. The shoot infestation percentage was significantly decreased also after the third spraying, where no shoot infestation was found in Emamectin benzoate treatment. The shoot infestation after 7 days of third spraying was 21.42%, 2.33%, 0.00% and 12.28% in control, Spinosad, Emamectin benzoate and *B. bassiana* treated plants, respectively. After the 14 days of third spraying, the percentage of shoot infestation was 22.25%, 2.33%, 0.00%, 12.00% in untreated control, Spinosad, Emamectin benzoate and *B. bassiana* treated plants, respectively.

Table 1. Shoot infestation (%) in okra plants treated with selected bio-pesticides at different spraying schedule

Treatments	First spray		Second spray		Third spray	
	7 DAS	14 DAS	7 DAS	14 DAS	7 DAS	14 DAS
Control	14.18a	15.25a	16.05a	18.40a	21.42a	22.25a
Spinosad	13.75a	8.25b	3.33b	3.33b	2.33c	2.33c
Emamectin Benzoate	10.17a	11.36b	3.03b	0.00c	0.00d	0.00d
Beauveria bassiana	14.20a	14.04a	15.70a	13.33a	12.28b	12.00b
F value	8.031	4.114	2.217	5.414	7.621	6.144
P value	0.429	0.039	0.016	0.025	0.003	0.017

In a column, mean value with same letter are not significantly different (Tukey's HSD, $p\leq0.05$). DAS indicates days after spraying.

Fruit infestation (%) by okra shoot and fruit borer: The infested fruits were sorted based on infestation sign (Table 2) and percent fruit infestation was calculated for each treatments. The percentage of fruit infestation was not significantly different after 7 days of first spraying compared to untreated control. After the 14 days of first spraying, the percentage of fruit infestation was 8.86%, 6.36%, 8.93%, 8.47% in untreated control, Spinosad, Emamectin benzoate and *B. bassiana* treated plants, respectively. The fruit infestation percentage was significantly decreased after the second spraying. The fruit infestation after 7 days of second spraying was 12.42%, 3.54%, 3.05% and 8.70% in untreated control, Spinosad, Emamectin benzoate and *B. bassiana* treated plants, respectively. After the 14 days of second spraying, significant difference was found in fruit infestation of okra plants compared to untreated control. The fruit infestation percentage was significantly varied after the third spraying. The fruit infestation after 7 days of third spraying was 14.23%, 3.17%, 2.00% and 7.00% in untreated control, Spinosad, Emamectin benzoate and *B. bassiana* treated plants, respectively. After the 14 days of third spraying, significant difference was found in fruit infestation of okra plants compared to untreated control. Similar research was recorded by Devi *et al.* (2015) for the biorational management of shoot and fruit borer of okra using Emamectin benzoate and *Beauveria bassiana* as well as some other biorational insecticides. For the management of shoot and fruit infestation, Kumar *et al.* (2015) used Neem oil, *B. thuringiensis*, and Entomopathogenic fungus *Beauveria bassiana,* where they found the similar significant result from the *Beauveria bassiana* treated okra plants to manage the infestation by okra shoot and fruit borer. Besides, Devi *et al*. (2015) reported that the extent of fruit infestation caused by okra shoot and fruit borer was reduced using the Emamectin benzoate and *B. bassiana* which was similar to the present study.

Table 2. Okra fruit infestation (%) of *E. vittella* treated with selected biopesticide at different spraying schedule

Treatments	First spray		Second spray		Third spray	
	7 DAS	14 DAS	7 DAS	14 DAS	7 DAS	14 DAS
Control	13.25a	8.86a	12.42a	11.89a	14.23a	11.32a
Spinosad	13.10a	6.36a	3.54c	2.00c	3.17c	3.17c
Emamectin Benzoate	10.74a	8.93a	3.05c	3.03c	2.00c	2.25c
Beauveria bassiana	13.87a	8.47a	8.70b	6.33b	7.00b	6.00b
F value	2.226	4.197	2.271	3.693	6.419	2.142
P value	0.362	0.380	0.027	0.015	0.007	0.017

In a column, mean value with same letter are not significantly different (Tukey's HSD, $p \leq 0.05$)

Effect of different bio-pesticides treatments on the yield of okra: The average yield was comparatively higher in biopesticide treated plants. The highest yield of okra was found in Emamectin benzoate treatment. The yield of okra increased in all three treatments compared to their control counterpart. The highest yield was increased in Emamectin benzoate treatment over control (48.25%). The amount of yield increased over control was 40.84% and 13.70% in Spinosad and *B. bassiana* treatments, respectively. For the management of okra shoot and fruit borer, Devi *et al.* (2015) found that Emamectin benzoate @ 12 g ai/ha provided significantly highest fruit yield (9.62 t/ha) as compared to untreated control (5.210 t/ha).

Table 3. Effect of different biopesticides on the yield of okra

Treatment	Yield (t/ha)
Control	3.82a
Spinosad	5.38c
EmamectinBenzoate	5.66c
Beauveriabassiana	4.34b
F value	3.195
P value	0.037

In a column, mean value with same letter are not significantly different (Tukey's HSD, $p \leq 0.05$)

Conclusion

Based on the above findings of the study, the following conclusions could be drawn: Emamectin benzoate and Spinosad decreased both shoot and fruit infestation of okra shoot and fruit borer. Entomopathogenic fungus *Beauveria bassiana* was found less effective to control okra shoot and fruit borer. Application of Emamectin benzoate and Spinosad produced higher yield of okra. Therefore, Emamectin benzoate and Spinosad can be used to control okra shoot and fruit borer in the fields.

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