

Efficacy of Selected Insecticides Against Okra Shoot and Fruit Borer, *Earias vittella* (Fab.) in Okra *Abelmoschus esculentus* (L.) in Telangana

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Abstract Field experiment was carried out in a randomized block design with eight treatments and replicated thrice during *kharif* 2015 to study the efficacy of seven insecticides against okra shoot and fruit borer, among all insecticidal treatments emamectin benzoate 5 SG at 15 g a. i. ha⁻¹ was adjudged as the best and effective treatment in checking shoot damage on number basis, fruit damage on number and weight basis of 8.22, 10.59 and 9.17%, respectively, followed by spinosad 45 SC at 75 g a. i. ha⁻¹ (8.62, 11.26 and 9.87, respectively), flubendiamide 480 SC at 60 g a. i. ha⁻¹ (9.58, 12.88 and 11.39, respectively), chlorantraniliprole 20 SC at 30 g a.i.ha⁻¹ (12.13, 23.01 and 21.06 respectively), β cyfluthrin + Imidacloprid 300 OD at 30 g a. i. ha⁻¹ (15.16, 25.85 and 22.62 respectively), novaluran 10 EC at 75 g a.

i.ha⁻¹ (14.48, 28.12 and 24.33 respectively) and bifenthrin 10 EC at 80 g a. i. ha⁻¹ (21.92, 31.05 and 26.67, respectively). The treatment emamectin benzoate 5 SG at 15 g a. i. ha⁻¹ exhibited highest yield with 93.04 q ha⁻¹ followed by spinosad 45 SC at 75 g a.i.ha⁻¹ (91.68 q ha⁻¹), flubendiamide 480 SC at 60 g a.i. ha (89.92 q ha⁻¹) chlorantraniliprole 20 SC at 30 g a. i. ha (79.08 q ha⁻¹), β-cyfluthrin + imidacloprid 300 OD at 30 g a. i. ha⁻¹ (77.30 q ha⁻¹), novaluran 10 EC at 75 g a. i.ha⁻¹ (56.06 q ha⁻¹) and bifenthrin 10 EC at 80 g a. i. ha⁻¹ (55.54 q ha⁻¹). The treatments emamectin benzoate 15 g a. i. ha⁻¹, spinosad at 75 g a. i. ha⁻¹ and flubendiamide at 60 g a. i. ha⁻¹ were found to be significantly effective in checking okra shoot and fruit borer damage and recorded higher yield when compared to other insecticidal treatments.

Keywords Okra shoot, Fruit borer, Insecticide, Okra, Efficacy.

Introduction

India is the second largest producer of vegetables next to china with an annual production of 162.897 MT from an area of 9.396 M ha with productivity of 17.3 MT ha⁻¹ during the year 2013-2014 [1]. India is considered as the fruit and vegetable basket of the world. Among all the vegetables okra is an important vegetable crop [2]. It plays an important role in

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human diet and has good nutritional value, particularly high content of vitamin A. Matured fruits and stems containing crude fiber are used in paper industry. The fruits of okra have reawakened beneficial interest in bringing this crop into commercial production [3]. The crop is attacked by more than 37 insect pests which infests the crop from seedling to harvest stage, among which shoot and fruit borer (*Earias vittella* Fab.) are the most important and serious pest causing direct damage to marketable fruits. *Earias vittella* attacks rigorously on okra both at the vegetative and fruiting stages, resulting in a serious decline of quality and quantity of the produce. The maximum fruit and shoot infestation was 41.25% and 8.5%, respectively and the yield loss due to okra shoot and fruit borer was 54.04% in Rajasthan, followed by 22.79-37.52% Punjab and 38.43 in Uttar Pradesh [4]. At present farmers are highly dependent on chemical pesticides to combat the attack of the shoot and fruit borer and at times injudicious application of pesticides at regular intervals with almost double the dose, causes severe ecological consequences like destruction of natural enemy fauna, effect on non-target organisms, development of resistance, environment pollution and leads to undesirable load of pesticide residues in marketable vegetables [5]. Hence, there is a need for review of chemical insecticides which gives efficient and economic management of the shoot and fruit borer.

Materials and Methods

The experiment was laid out in a randomized block design (RBD) with 8 treatments including untreated control and replicated thrice. The individual treatment plot size adopted was 20 m², a popular okra variety Arka Anamika was chosen for study. The first insecticidal application was given when the pest reached Economic Threshold Level. Sprayings were given during morning hours using a hand sprayer and necessary care was taken to prevent the drift of spray fluid reaching the adjacent plots. The second insecticidal applications was given 15 days gap interval after the first one. A total of two insecticidal applications were given during the crop growth. The insecticidal requirement per liter of water was calculated by using the formula, insecticide per liter of water = Conc required/ per cent a.i. × 100. Data on

the shoot and fruit infestation were recorded one day before spraying as pre-treatment count and at 5 days after spraying as post-treatment counts. The observations were recorded on five randomly selected plants which were tagged in each plot leaving the border rows. During the vegetative growth at each observation the number of shoots damaged to the total number of shoots was recorded for the selected 5 plants per plot of the experiment. At fruit bearing, the number and weight of infested fruits to the total number and weight of the fruits in each plot of the experiment was recorded separately at each harvest. The observations recorded from the field were subjected to statistical analysis (RBD) to know the significance of difference among different treatments. The values in percentages were transformed to arc sine values before analysis. The collected data was converted into percentages.

Results and Discussion

The study has been designated to evaluate a suitable insecticide to suppress the okra shoot and fruit borer damage with eight treatments in two sprays during *kharif* 2015. Efficacy of insecticidal treatments were determined in terms of per cent shoot damage on number basis, per cent fruit damage on number and weight basis and per cent reduction of shoot and fruit damage over control.

In case of shoot damage (on number basis), the data revealed that emamectin benzoate at 15 g a. i. ha⁻¹ showed superior results by recording 8.22% (Table 1 and Fig. 1) shoot damage on number basis and was on par with spinosad at 75 g a. i. ha⁻¹ and flubendiamide at 60 g a. i. ha⁻¹ with per cent shoot damage 8.62 and 9.58, respectively. The treatments chlorantraniliprole at 30 g a. i. ha⁻¹ was on par with flubendiamide at 60 g a. i. ha⁻¹ (9.58%) and spinosad at 75 g a. i. ha⁻¹ with per cent shoot damage of 12.13. The treatments chlorantraniliprole at 30 g a. i. ha, novaluran at 75 g a. i. ha⁻¹ and β -cyfluthrin + Imidacloprid at 30 g a. i. ha⁻¹ were on par with each other with per cent shoot damage of 12.13, 14.48 and 15.16, respectively. The treatment bifenthrin at 80 g a. i. ha⁻¹ was significantly different from all other treatments with per cent shoot damage of 21.92. The data on cumulative effect of different treatments at

Table 1. Overall efficacy of different insecticides against okra shoot and fruit borer after two sprays during *kharif*-2015. Figures in the parentheses are arc sine transformed values. DBS : Days before spraying, DAS : Days after spraying.

Sl. No.	Treatments	Dosage g a. i. ha	Shoot damage on number basis		Fruit damage on number basis		Fruit damage on weight basis	
			5 DAS (%)	Reduction over control	5 DAS (%)	Reduction over control	5 DAS (%)	Reduction over control
1	T ₁ -Spinosad 45 SC	75	8.62 (17.05)	69.48	11.26 (19.55)	68.34	9.87 (18.26)	69.34
2	T ₂ -Flubendiamide 480 SC	60	9.58 (18.02)	66.08	12.88 (21.00)	62.78	11.39 (19.69)	64.62
3	T ₃ -Emamectin benzoate 5 SG	15	8.22 (16.63)	70.89	10.59 (18.95)	70.22	9.17 (17.58)	71.51
4	T ₄ -Novaluran 10 EC	75	14.48 (22.35)	48.78	28.12 (32.02)	20.94	24.33 (29.55)	24.42
5	T ₅ -Chlorantraniliprole 20 SC	30	12.13 (20.38)	57.05	23.01 (28.66)	35.31	21.06 (27.31)	34.58
6	T ₆ -(β -cyfluthrin + Imidacloprid) 300 OD	30	15.16 (22.84)	46.32	25.85 (30.55)	27.33	22.62 (28.40)	29.73
7	T ₇ -Bifenthrin 10 EC	80	21.92 (27.92)	22.38	31.05 (33.76)	12.71	26.67 (31.09)	17.15
8	T ₈ -Water spray (Control)	—	28.24 (32.09)	0.00	35.57 (36.61)	0.00	32.19 (34.57)	0.00
	SEm		1.10		0.77		0.84	
	CD (5%)		3.69		2.58		2.80	

five days after each of the two sprays revealed that highest per cent reduction of shoot damage on number basis over control was recorded in the treatment emamectin benzoate at 15 g a. i. ha⁻¹, followed by spinosad at 75 g a. i. ha⁻¹, flubendiamide at 60 g a. i. ha⁻¹, chlorantraniliprole at 30 g a. i. ha⁻¹, novaluran at 75 g a. i. ha⁻¹, β -cyfluthrin + Imidacloprid at 30 g a.

i. ha⁻¹ and bifenthrin at 80 g a. i. ha⁻¹ with 70.89, 69.48, 66.08, 57.05, 48.78, 46.32 and 22.38, respectively.

In case of fruit damage (on number basis), The data indicated that emamectin benzoate at 15 g a. i. ha⁻¹ showed superior results by recording 10.59%

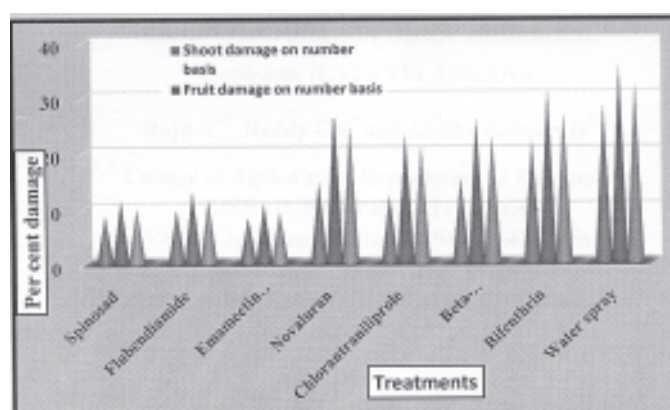


Fig. 1. Overall efficacy of different insecticides against okra shoot and fruit *Borer earias vitella* after two sprays during *kharif*-2015.

(Table 1 and Fig. 1) fruit damage on number basis and was on par with spinosad at 75 g a. i. ha⁻¹ and flubendiamide at 60 g a. i. ha⁻¹ with per cent fruit damage was 11.26 and 12.88, respectively and these treatments were significantly different from all other treatments. The next best treatments were chlorantraniliprole at 30 g a. i. ha⁻¹, β -cyfluthrin + Imidacloprid at 30 g a. i. ha⁻¹, novaluran at 75 g a. i. ha and bifenthrin at 80 g a. i. ha⁻¹ with per cent fruit damage were 23.01, 25.85, 28.12 and 30.05, respectively at five days after two sprays. The treatments chlorantraniliprole at 30 g a. i. ha⁻¹ and β -cyfluthrin + Imidacloprid at 30 g a. i. ha⁻¹ were on par with each other in terms of per cent fruit damage on number basis at five days after each of the two sprays. The treatment novaluran at 75 g a. i. ha⁻¹ was not significantly different from the treatment β -cyfluthrin + Imidacloprid at 30 g a. i. ha⁻¹. The treatment bifenthrin at 80 g a. i. ha⁻¹ was on par with the treatment novaluran at 75 g a. i. ha⁻¹. The data on cumulative effect of different treatments at five days after each of the two sprays revealed that highest per cent reduction of fruit damage on number basis over control was recorded in the treatment emamectin benzoate at 15 g a. i. ha⁻¹, followed by spinosad at 75 g a. i. ha⁻¹, flubendiamide at 60 g a. i. ha⁻¹, chlorantraniliprole at 30 g a. i. ha⁻¹, β -cyfluthrin + Imidacloprid at 30 g a. i. ha⁻¹, novaluran at 75 g a. i. ha⁻¹ and bifenthrin at 80 g a. i. ha⁻¹ with 70.22, 68.34, 62.78, 35.31, 22.13, 27.33 and 12.71, respectively.

In case of fruit damage (on weight basis), the data indicated that emamectin benzoate at 15 g a. i. ha showed superior results by recording 9.17% (Table 1 and Fig. 1) fruit damage on weight basis and was on par with spinosad at 75 g a. i. ha⁻¹ and flubendiamide at 60 g a. i. ha⁻¹ with per cent fruit damage on weight basis 9.87 and 11.39, respectively and these treatments were significantly different from all other treatments. The next best treatments were chlorantraniliprole at 30 g a. i. ha⁻¹, β -cyfluthrin + Imidacloprid at g a. i. ha⁻¹ and novaluran at 75 g a. i. ha⁻¹ were at par with each other with per cent fruit damage of 21.06, 22.62 and 24.33, respectively, at five days after each of the two sprays. The treatment bifenthrin at 80 g a. i. ha⁻¹ was significantly not different from the treatment novaluran at 75 g a. i. ha⁻¹ with per cent fruit damage of 26.67. The data

Table 2. Effect of insecticide on yield of okra.

Sl. No.	Treatments	Dosage (g a. i. ha ⁻¹)	Mean yield (q ha ⁻¹)	Increased mean yield over control (q ha ⁻¹)
1	T ₁ -Spinosad 45 SC	75	91.68	44.69
2	T ₂ -Flubendiamide 480 SC	60	89.92	41.93
3	T ₃ -Emamectin benzoate 5 SG	15	93.04	46.05
4	T ₄ -Novaluran 10 EC	75	56.06	9.07
5	T ₅ -Chlorantraniliprole 20 SC	30	79.08	35.09
6	T ₆ -(β -cyfluthrin +imidacloprid) 300 OD	30	77.30	30.01
7	T ₇ -Bifenthrin 10 EC	80	55.54	8.55
8	T ₈ -Water spray (control)	—	46.99	—
	SE m		0.55	
	CD 5%		1.84	

on cumulative effect of different treatments at five days after each of the two sprays revealed that highest per cent reduction of fruit damage on weight basis over control was recorded in the treatment emamectin benzoate at 15 g a. i. ha⁻¹, followed by spinosad at 75 g a. i. ha⁻¹, flubendiamide at 60 g a. i. ha⁻¹, chlorantraniliprole at 30 g a. i. ha⁻¹, β -cyfluthrin + imidacloprid at 30 g a. i. ha⁻¹, novaluran at g a. i. ha⁻¹ and bifenthrin at 80 g a. i. ha⁻¹ with 71.51, 69.34, 64.62, 34.58, 29.73, 24.42 and 17.15, respectively.

All the insecticidal treatments were found superior over control in terms of the yield (Table 2 and Fig.2). The data revealed that emamectin benzoate at 15 g a. i. ha⁻¹ exhibited highest yield by recording 93.04 q ha⁻¹ and found superior to all other insecticidal treatment. The yield in the treatments of spinosad at 75 g a. i. ha⁻¹ (91.68 q ha⁻¹) and flubendiamide at 60 g a. i. ha⁻¹ (89.92 q ha⁻¹) were on par with each other. The present findings revealed that the treatment emamectin benzoate at 15 g a. i. ha⁻¹ was recorded highest yield (93.04 q ha⁻¹) and followed by spinosad 60 g a. i. ha⁻¹ with 91.68 q ha⁻¹. The present investigation revealed that the treatments emamectin benzoate 15 g a. i. ha⁻¹, spinosad at 75 g a. i. ha⁻¹ and flubendiamide at 60 g a. i. ha⁻¹ were most effective in reducing the per cent shoot damage on number basis, fruit damage on number and weight

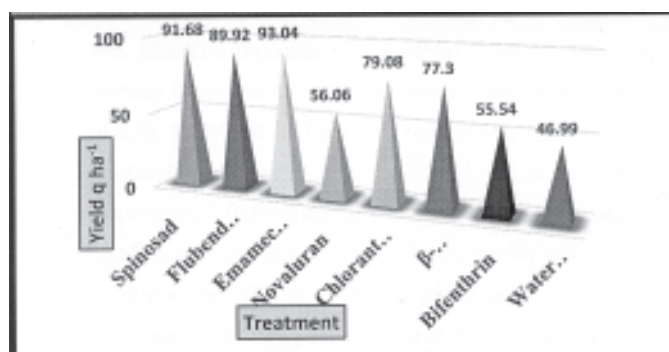


Fig. 2. Effect of insecticides on yield of okra.

basis by okra shoot and fruit borer. The results were in conformity with Dhanalakshmi and Mallapur [6] who reported that among different insecticides the emamectin benzoate 5 SG @ 0.2 g l⁻¹ was the most superior treatment recording the least per cent fruit damage (7.82%) and highest fruit yield (47.02 q ha⁻¹) followed by spinosad 45 SC @ 0.1 ml l⁻¹ (9.19% damage with 45.94 q ha⁻¹ yield). Similar results were reported by Devi et al. [7] and found that the plot treated with emamectin benzoate 12 g.a. i. ha⁻¹ provided the highest fruit yield (96.2 q ha⁻¹) as compared to untreated control (52.10 q ha⁻¹) followed by spinosad 12.5 SC. It was illustrated that emamectin benzoate @ 0.36 g l⁻¹ was most effective followed by spinosad @ 0.5 ml l⁻¹ in controlling fruit damage by okra shoot and fruit borer, *Earias vittella* and recorded maximum yield of okra fruit with emamectin benzoate (89.16 q ha⁻¹) followed by spinosad (85.0 q ha⁻¹) [8]. It was reported that emamectin benzoate @ 8.5 g a. i. ha⁻¹ was the most effective treatment which reduced the okra shoot and fruit borer larval population by 74.18 to 88.01 %, shoot damage by 93.72%, fruit damage by 92.82%, and increased the fruit yield to 72.13% over untreated check [9]. The variations in the results from the present findings may be due to variations in the crop, climatic situations and nature of the insect.

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