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Field Efficacy of Different Insecticides Against Brinjal Shoot and Fruit Borer, *Leucinodes orbonalis* (Guenee)

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

The experiment was carried out at the research plot of the Department of Agricultural Entomology and Central Research Farm, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, during *Kharif* from July to November 2022 in Randomized Block Design (RBD) with three replications. Eight treatments were evaluated against, *Leucinodes orbonalis i.e*., Spinosad 45% SC (0.5ml/L), Chlorantraniliprole 18.5% SC (0.5ml/L), Flubendiamide 480 SC (0.4ml/L), Emamectin benzoate 5 SG (0.4gm/L), Indoxacarb 14.5% SC (0.25ml/L), Neem oil 5% (50ml/L), *Beauveria bassiana* (1X10^8 CFU/gm) 1.15 % WP (2.5gm/L), Control in RBD with three replications. The data on the percent infestation of shoot and fruit borer on brinjal 3rd, 7th, and 14th day after first and second spray reveal that all the chemical treatments were significantly superior over control. The lowest infestation was recorded in Chlorantraniliprole 18.5% SC (12.45) (9.78), Spinosad 45% SC (13.56) (10.43), Emamectin benzoate 5 SG (14.68) (11.39),
Indoxacarb 14.5% Sc (15.34) (12.38), Flubendiamide 480 SC (16.26) (13.30), *Beauveria bassiana* (1X10^8 CFU/gm) 1.15% WP (16.84) (14.56), Neem oil 5% (19.46) (15.52). The best yield and most

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economical treatment was Chlorantraniliprole 18.5% SC (220.5q/ha) (1:8.3) which was par with Spinosad 45% SC (195.30q/ha) (1:7.7) followed by Emamectin benzoate 5 SG (172.50q/ha) (1:6.8), Indoxacarb 14.5 SC (165.35q/ha) (1:6.5), Flubendiamide 480SC (142.33q/ha) (1:5.3), *Beauveria bassiana* (1X108 CFU/gm) 1.15 % WP (130.40q/ha) (1:5.2) and Neem oil 5% (125.50q/ha) (1:5.04) as compared to control (90.00q/ha) (1:3.72). The yields among the treatment were significant.

Keywords: Brinjal; chemical insecticide; chlorantraniliprole; cost benefit ratio; Leucinodes orbonalis; yield.

1. INTRODUCTION

Brinjal (*Solanum melongena* Linnaeus) belongs to the family Solanaceae. Eggplant is referred as the "King of vegetables" originated from India and now grown as a vegetable throughout the tropical, sub-tropical and warm temperate areas of the world. "It is a most important vegetable in the Indian Subcontinent that accounts for almost 50% of the world's area under its cultivation" [1]. "Nutritional value per 100 g of brinjal contains carbohydrates (5.88 g), protein (0.98 g), total fat (0.18 g), dietary fiber (3.0 g), folates (22 mcg), niacin (0.649 mg), riboflavin (0.037 mg),thiamin (0.039 mg), vitamin C (2.2 mg), vitamin A (23 IU), vitamin A,(1µgvRAE),vitamin E (0.30 mg), vitamin K (53 mcg), vitamin sodium (2 mg), potassium (229 mg), calcium (9 mg), iron (0.23 mg), magnesium (14 mg), phosphorus (24 mg), zinc (0.16 mg), and lutein andzeaxanthin (516 mg). It has been reported as Ayurvedic medicine for curing the diabetes. In addition, it is used as a good appetizer, good aphrodisiac, cardio tonic, laxative and reliever of inflammation" [2].

"Total vegetable production in India 191.77million metric tons. China is the largest producer of brinjal and contributes about 68.7% of the word's brinjal production while India occupies second position in production with a share of 23.3%. In India, brinjal occupies fourth position in area among the vegetable crop and contributed 8% of the total production. In Uttar Pradesh brinjal occupies 13 Position in area among the vegetables crop and contributed 2.16% of the total production" [3].

The crop is generally sown twice or thrice in a year, depending upon the irrigation facilities. Many insect pests damage and affect the yield of brinjal crop to a great extent. Destructive and most serious pest causing huge losses in brinjal. The larvae bore into tender shoots in the early stage resulting in drooping shoots, which are readily visible in the infested fields. At the later stage, caterpillars bore into flower buds and fruits, rendering the fruits unfitfor consumption and marketing, resulting in direct yield losses.

"Leucinodes orbonalis Guenee (Pyralidae: Lepidoptera) is the most important insect pestof brinjal and the apparent yield loss varying from 20-90% in various parts of the country" [4]. "The Larvae of this pest cause 12-16% damage to shoots and 20- 60% damage to fruits. The pest is very active during rainy and summer season and often causes more than up to 95% in India. It is also reported that the infestation of fruit borer causes reduction in Vitamin C contentto an extent of 68 % in the infested fruits" [5].

2. MATERIALS AND METHODS

The experiment was conducted during *kharif* season 2022 at Central Research Farm (CRF), SHUATS, Prayagraj, Uttar Pradesh, India in a Randomized Block Design with eight treatments replicated three times using the variety Pusa Purple Round in a plot size of (2m×1m) at a spacing of (60×45cm) with a recommended package of practices excluding plant protection. The soil of the experimental site was well drained. A good tilth area was maintaining with 30 cm borders as a bunds and treatments was assigned randomly. The research field is situated at the right side of Rewa road at 25° 22' 15.888" North Latitude and 81°51' 31.4712" East Longitude and is about 98m above mean sea level. The climate at Prayagraj is typical subtropical which prevails in the eastern part of UP. The extremes of both summer and winter are experienced here. The maximum temperature recorded during summer up to 43°C and the minimum temperature was recorded during winter up to 1.5°C. All necessary facilities for cultivation of crop were available at research farm.

All of the insecticides used in the study were sprayed as foliar application. The eight different treatments were used with dosage consisting of T1 Spinisad 45% SC @ 0.5ml/L, T2 Chlorantraniliprole 18.5% SC @ 0.5ml/L, T3 Flubendiamide 480 SC @ 0.4ml/L, T4 Emamectin benzoate 5 SG @ 0.4gm/L, T5 Indoxacarb 14.5% SC @ 0.25ml/L, T6 Neem oil 5% @ 50ml/L, T7 *Beauveria bassiana* ($1X10^8$

CFU/gm) @ 2.5gm/L and T8 Control. Two sprays were carried out at intervals of 15 days during the experiment to assess the effectiveness of pesticides. On five randomnly chosen and tagged plants in each plot, pre and post-treatment observations on the percent damage of shoot and fruit infestation was made shortly before 24 hours and 3rd, 7th and 14th days, respectively. Descriptive statistics was calculated using MS-EXCEL.

3. RESULTS AND DISCUSSION

"The data on the percent infestation of shoot borer on brinjal 3rd,7th and 14th day after first spray revealed that all the chemical treatments were significantly superior over control". [16] Among all the treatments lowest percent shoot infestation was recorded in Chlorantraniliprole 18.5 %SC (12.45), followed by Spinosad 45% SC (13.56), Emamectin benzoate 5 SG (14.68), Indoxacarb 14.5% SC (15.34), Flubendamide 480 SC (16.26), *Beauveria bassiana* (16.84). The treatment Neem oil 5% (19.46) was least effective among all the treatments and maximum shoot damage was recorded in control plot (29.13).

"The data on the percent infestation of fruit borer on brinjal 3rd,7th and 14th day after second spray revealed that all the chemical treatments were significantly superior over control". [16] Among all the treatments lowest percent fruit infestation was recorded in Chlorantraniliprole 18.5% SC (9.78), followed by Spinosad 45% SC (10.45), Emamectin benzoate 5 SG (11.39), Indoxacarb 14.5% SC (12.38), Flubendamide 480 SC (13.3), *Beauveria bassiana* (14.56). The treatment Neem oil 5% (15.52) was least effective among all the treatments and maximum fruit damage was recorded in control plot (27.15).

Yield among the treatments were significant. Highest Yield was recorded in Chlorantraniliprole 18.5% SC (220.50q/ha) followed by Spinosad 45% SC (195.30 q/ha) Emamectin benzoate 5% SG (172.50q/ha) Indoxacarb 14.5% SC (165.35q/ha), Flubendiamide 480 SC (142.33q/ha), *Beauvaria bassiana* (130.40 q/ha) Neem oil 5% (125.50 q/ha) next and least yield was recorded in Control plot (90.00 q/ha) Among the treatments studied, the best and most economical treatment was Chlorantraniliprole 18.5% SC (1:8.32) followed by Spinosad 45% SC (1:7.78), Emamectin benzoate 5 SG (1:6.88) Indoxacarb 14.5% SC (1:6.54), Flubendiamide 480 SC (1:5.34), *Beauvaria bassiana* (1:5.22) Neem oil 5% (1:5.04) next and least yield was recorded in Control plot (1:3.72).

The results are in support with Tripura et al. [6] and Mainali et al. [7]. reported that the treatment T2 Chlorantraniliprole 18.5% SC was superior in reducing the population of shoot and fruit borer. Next most effective treatment was T1 Spinosad 45% SC which was similar with Singh and Sachan [8] and Devi et al. [9]. Next effective Treatment was recorded in T4 Emamectin benzoate 5 SG which is similar to Sharma and Tayde [10] and Shirdhara et al. [11].

The Highest Yield and cost benefit ratio was recorded in Chlorantraniliprole 18.5% SC (220.50q/ha) and (1:8.32) as respectively. The result is supported by Tripura et al. [6] and Mainali et al. [7]. followed by Spinosad 45% SC (195.30 q/ha) and (1:7.7) in similar findings Singh and Sachan [8] and Devi et al. [9]. Emamectin benzoate 5 SG (172.50q/ha) and (1:6.88) in similar findings Sharma and Tayde [10] and Shirdhara et al. [11], [12,13].

Table 1. Infestation of different insecticides on the percent damage of brinjal shoot and fruit borer, [*Leucinodes orbonalis*]

Sl.No	Treatments	Dosage	Percent Shoot and Fruit Infestation										Yield (q/ha)	C:B Ratio
			First Spray					Second Spray						
			1DBS	3DAS	7DAS	14DAS	Mean	1DBS	3DAS	7DAS	14DAS	Mean		
T1	Spinosad 45% SC	0.5ml/L	21.99	15.42^{ef}	11.63^{fg}	13.64^{f}	13.56	16.22^{ef}	11.18^{ef}	9.68^{ef}	10.45^{fg}	10.43	195.30	1:7.7
T2	Chlorantraniliprole 18.5% SC	0.5ml/L	24.49	14.64^{f}	10.72^{g}	12.01^{g}	12.45	14.82^{f}	10.7^{f}	8.73^{f}	9.91^{g}	9.78	220.50	1:8.3
T3	Flubendiamide 480 SC	0.4ml/L	25.99	18.01^{cd}	14.02^{cd}	16.77^{cd}	16.26	19.39^{cd}	14.11^{c}	12.5^{d}	13.31^{cd}	13.30	142.33	1:5.3
T4	Emamectin benzoate 5 SG	0.4gm/L	25.3	16.98^{de}	12.14^{ef}	14.93^{e}	14.68	16.47^{ef}	12.17^{de}	10.53^{e}	11.49^{ef}	11.39	172.50	1:6.8
T5	Indoxacarb 14.5% SC	0.25ml/L	26.48	17.26^{cd}	13.04^{de}	15.73^{de}	15.34	17.91^{de}	13.04^{d}	11.65^{d}	12.47^{de}	12.38	165.35	1:6.5
T6	Neem oil 5%	50ml/L	25.27	21.63^{b}	17.22^{b}	19.53^{b}	19.46	21.76^{b}	16.82^{b}	14.69^{b}	15.07^{b}	15.52	125.50	1:5.04
T7	*Beauveria bassiana* (1X10^{8} CFU/gm)	2.5gm/L	26.39	18.84^{c}	14.76^{c}	16.93^{c}	16.84	20.59^{bc}	15.86^{b}	13.70^{c}	14.14^{bc}	14.56	130.40	1:5.2
T8	Control	-	23.40	27.70^{a}	29.18^{a}	30.96^{a}	29.13	24.54^{a}	26.16^{a}	27.28^{a}	28.02^{a}	27.15	90.00	1:3.7

Sl.No	Treatments	Dosage	Percent Shoot and Fruit Infestation										Yield (q/ha)	C:B Ratio
			First Spray					Second Spray						
			1DBS	3DAS	7DAS	14DAS	Mean	1DBS	3DAS	7DAS	14DAS	Mean		
F- test		-	NS	S	S	S	S	S	S	S	S	S	-	-
S.Ed. (±)		-	1.6	00.56	00.36	00.38	00.66	00.58	00.35	00.31	00.35	00.37	-	-
C.D.(P=0.05)		-	-	01.69	01.08	01.14	02.15	01.77	01.06	00.94	01.04	01.11	-	-

*DBS****- Day Before Spray*, DAS***- Day After Spray** NS=Non-Significant***, S-Significant*****

4. CONCLUSION

The study concluded that Chlorantraniliprole 18.5% SC is most effective treatment against brinjal shoot and fruit borer producing maximum yield and recorded highest cost benefit ratio compared to other treatments followed by Spinosad 45% SC, Emamectin benzoate 5 SG, Indoxacarb 14.5% SC and Flubendiamide 480 SC has shown better results. *Beauveria bassiana* and Neem oil 5% has shown average in managing *Leucinodes orbonalis*. Botanicals are used as part of integrated pest management to avoid the indiscriminate use of pesticides, which pollute the environment and are not extremely harmful to beneficial insects.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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