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Efficacy of Selected Insecticides Against Tomato Fruit Borer, *Helicoverpa armigera* (Hubner) in Tomato

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present investigation was conducted during *rabi* season of 2023-2024 at Central Research field, SHUATS, Naini, Prayagraj using Randomized Block Design (RBD) method in three replications and 8 treatments. The treatments used were Indoxacarb 14.5 %SC, Chlorantraniliprole 18.5% SC, Emamectin benzoate 5% SG, Spinosad, *Beauveria bassiana* 1.15 WP, NSKE 5% and Fipronil 5% SC, and untreated control. Each Insecticide was sprayed twice at 15 days interval. The pest count per 5 plant was taken 1 day before spray and 3rd, 7th and 14th days after spray. The lowest larval population was recorded in the plot treated with Chlorantraniliprole 18.5% SC 2.67 and 1.86 after 1st and 2nd spray followed by Spinosad 2.90 and 2.21, Indoxacarb 14.5 %SC 2.97 and 2.41, Emamectin benzoate 5% SG 3.20 and 2.66, Fipronil 5% SC 3.60 and 2.90, *Beauveria*

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bassiana 1.15 WP 3.68 and 3.17, NSKE 5% 3.97 and 3.45 was found to be least effective than all other treatments. Among the treatment studied the best and most economical treatment was Chlorantraniliprole 18.5 SC with highest yield and cost benefit ratio of (232 q/h) and (1:8.52) followed by Spinosad 45 % SC %SC (228 q/h), (1:7.83), Indoxacarb 14.5 %SC (205 q/h) and (1:7.71), Emamectin benzoate 5% SG (195 q/h), (1:7.30), Fipronil 5% SC (187 q/h) , (1:7.08), *Beauveria bassiana* 1.15 WP (180 q/h), (1:6.75), NSKE 5% (150 q/h),(1:5.57) as compared to control (100 q/h) and (1:3.97).

Keywords: Benefit cost ratio; Helicoverpa armigera; insecticides; tomato.

1. INTRODUCTION

"Tomato *Lycopersicon esculentum* (Miller) is a perennial shrub that belongs to the family of nightshades or Solanaceae. The tomato is a versatile, popular, and the world's largest vegetable crop. The major component of tomato is lycopene, which act as an antioxidant and reduces the chances of cancer and cardiovascular diseases" [1]. "It is popularly known as Wolf apple, Love of apple or Vilaayati baingan. It can be used fresh in salad, curries or by biproduct like chutney, pickle, soups, ketchup, sauce, powder, purees and as a whole etc" [2].

"Tomato provides vitamin C, mineral manganese, and vitamin E. Moreover, lycopene in tomato is a powerful antioxidant and reduces the risk of prostate cancer" [3].

"Tomato is cultivated in an area of 864 thousand hectares with total production of 189.1 million metric tonnes. India contributes to 11.21% of the world's total tomato production with a production of 21.18 million tonnes" [4]. "India is the second-largest producer of tomatoes in the world. In India, area under tomato reported during 2022-23 was 8.49 lakh ha (20.97 lakh acres)" [5].

"*Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae) is a polyphagous insect-pest which attacks about 181 species of plants belonging to 45 families in India. However, it prefers to feed more on cotton, pulses, vegetables and oilseeds. It is one of the destructive polyphagous pests in the world and widely distributed throughout India on many crops" [6].

It is imperative to assess the efficacy of both chemical and bio-pesticides rigorously to recommend the most efficacious options to farmers. By identifying the optimal chemicals and bio-pesticides capable of controlling pest populations while minimizing crop losses, farmers can deploy the most suitable insecticides for effective Tomato Fruit Borer management.

2. MATERIALS AND METHODS

The experiment was conducted during *Rabi* season 2024 at Central Research Farm (CRF), SHUATS, Prayagraj, Uttar Pradesh, India, in a Randomized Block Design with eight treatments replicated three times using variety Saaho in a plot size of (2 m × 1 m) maintaining 30 cm borders as a bund with total net cultivated area 96 m^2 along with a recommended package of practices excluding plant protection. The treatments used in experiment were viz., Chlorantraniliprole 18.5 % SC (0.3 ml/lit), Spinosad 45% SC (0.4 ml/lit), Indoxacarb 14.5% SC (0.8 ml/lit), *Beauveria bassiana* 1.15 WP (4 g/lit), Fipronil 5% SC (1 ml/ lit), NSKE 5% (5 ml/lit), Emamectin benzoate 5% SG (0.5 ml/lit) and Control. Application of the two rounds of insecticidal treatments were applied at 15 days interval.

The larval population was counted from randomly selected plants in every plot and larval population per 5 plants was noted. After that mean of three replications was calculated for each treatment and the same was done with the untreated plot. The larval population of *Helicoverpa armigera* was recorded before 1 day spraying and on 3rd day, 7th day and 14th day after insecticidal application. Healthy tomato fruit were harvested and their weight from each treatment was expressed as marketable yield in quintal per hectare. Ultimately, the cost benefit ratio was calculated on the basis of prevailing market price of yield, insecticides and spraying cost [7].

$$\text{B: C Ratio} = \frac{\text{Gross return (q/ha)}}{\text{Total cost of cultivation (q/ha)}}$$

3. RESULTS AND DISCUSSION

The results (Table 1) after 1st and 2nd spray revealed that all the treatments were significantly superior over the control. The data on the mean larval population of fruit borer in tomato 3rd, 7th and 14th day after first spray revealed that all the

Table 1. Effect of selected insecticides against tomato fruit borer, *Helicoverpa armigera* (Hubner) in tomato during *rabi* 2023-2024

Treatment		**Before spray**	**Average mean of larva/5 plants.**								**YIELD** (q/ha)	**C:B Ratio**
			First spray				**Second spray**					
			3rd DAS	**7th DAS**	**14th DAS**	**Mean**	**3rd DAS**	**7th DAS**	**14th DAS**	**Mean**		
T1	Indoxacarb 14.5% SC @ 0.8ml/l	5.33	3.33	2.87	2.73	2.97	2.70	2.47	2.07	2.41	205	1:7. 71
T2	Chlorantraniliprole 18.5% SC @ 0.3ml/l	5.47	3.00	2.53	2.47	2.67	2.30	1.87	1.40	1.86	232	1:8. 52
T3	Emamectin benzoate 5% SG @ 0.5ml/l	5.33	3.40	3.13	3.07	3.20	3.10	2.67	2.20	2.66	195	1:7. 30
T4	Spinosad 45% SC @ 0.4ml/l	5.33	3.27	2.73	2.67	2.90	2.50	2.27	1.87	2.21	228	1:7. 83
T5	*Beauveria bassiana* 1.15 WP @4 gm/l	5.13	3.87	3.60	3.53	3.68	3.50	3.20	2.80	3.17	180	1:6. 75
T6	NSKE 5% @ 5ml/l	5.20	4.27	3.87	3.73	3.97	3.80	3.47	3.07	3.45	150	1:5. 57
T7	Fipronil 5% SC @1ml/l	5.20	3.80	3.53	3.47	3.60	3.30	2.93	2.47	2.90	187	1:7. 08
T0	Control	5.00	5.20	5.27	5.33	5.27	5.70	6.27	6.47	6.15	100	1:3. 97
	F-test	**NS**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**		
	C.D. at 5%		**0.381**	**0.249**	**0.211**	**0.228**	**0.200**	**0.258**	**0.360**	**0.486**		
	S. Ed. (+)		**0.18**	**0.12**	**0.10**	**0.5**	**0.9**	**0.12**	**0.17**	**0.23**		

DBS- Day Before Spraying, NS= non-significant, S= Significant DAS- Day After Spraying, treatments were significantly superior over control. Among all the treatments lowest larval population was recorded in Chlorantraniliprole 18.5% SC (2.67) followed by Spinosad 45% SC (2.90), Indoxacarb 14.5% SC (2.97), Emamectin benzoate 5% SG (3.20), Fipronil 5% SC (3.60), *Beauveria bassiana* 1.15 WP (3.68), NSKE 5% (3.97) and Control (5.27).

The data on the mean larval population of fruit borer in tomato 3rd, 7th and 14th day after second spray revealed that all the treatments were significantly superior over control. Among all the treatments lowest larval population was recorded in Chlorantraniliprole 18.5 % SC (1.86) followed by Spinosad 45% SC (2.21), Indoxacarb 14.5% SC (2.41), Emamectin benzoate 5% SG (2.66), Fipronil 5% SC (2.90), *Beauveria bassiana* 1.15 WP (3.17), NSKE 5% (3.45) and Control (6.15).

The highest yield and cost benefit ratio was recorded in Chlorantraniliprole 18.5% SC (232 q/ha), (1:8.52) followed by Spinosad 45% SC (228 q/ha), (1:7.83), Indoxacarb 14.5% SC (205 q/ha), (1:7.71), Emamectin benzoate 5% SG (195 q/ha) (1:7.30), Fipronil 5% SC (187 q/ha), (1:7.08), *Beauveria bassiana* 1.15 WP (180 q/ha), (1:6.75), NSKE 5% (150 q/ha) (1.5.57) and control (100 q/ha), (1:3.97).

The data on the mean larval population after first and second spray in Chlorantraniliprole 18.5% SC was (2.67) and (1.86). which is in support with the Patidar et al., [8]. Spinosad 45% SC was also found to effective (2.90) and (2.21). Similar results were observed by Chandi et al., (2016), Manisha and Kumar [9] and Deepthi and Tayde [10]. Indoxacarb 14.5% SC was next best effective with (2.97) and (2.41). Similar findings were observed by Patil et al., [2], Pal et al., [11] and Singh et al., [12].

The cost benefit ratio ranged between 1:8.52 and 1:3.97. Maximum cost benefit ratio (1:4.40) and yield (295 q/ha) was obtained in Chlorantraniliprole treated plants, which is supported by Sapkal et al., [13], followed by cost benefit ratio (1:4.24) and yield (280 q/ha) of Spinosad treated plants, and the results were similar to the findings of Deepthi and Tayde [10]. Indoxacarb also had a profitable yield of (205 q/ha) and cost benefit ratio (1:7.71) which is similar to Kooner et al., [14], Sowjanya et al. [15], Prashanth et al. [16] and Rahaman et al. [17].

4. CONCLUSION

From the above discussion it was found that, spraying of insecticides significantly reduced the fruit borer population in tomato. The present findings conclude that the new generation insecticides Chlorantraniliprole 18.5% SC, Spinosad 45% SC and Indoxacarb 14.5% SC are suggested for management of tomato fruit borer. Hence, it is suggested that the effective insecticides may be alternated in harmony with the existing Integrated pest management programs in order to avoid the problems associated with insecticidal resistance, pest resurgence etc.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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