

Original Research Article

Efficacy of selected insecticides against tomato fruit borer, *Helicoverpa armigera* (Hubner) in tomato

ABSTRACT

The present investigation was conducted during the rainy 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 plants 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 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 treatments 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 (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.

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 acts as an antioxidant and reduces the chances of cancer and cardiovascular diseases (**Waheed et al., 2020**). It is popularly known as Wolf apple, Love of apple or Vilaayatibaingan. It can be used fresh in salad, curries or by-product like chutney, pickle, soups, ketchup, sauce, powder, purees and a whole etc. (**Patil et al., 2018**).

Tomato provides vitamin C, mineral manganese, and vitamin E. Moreover, lycopene in tomato is a powerful antioxidant and reduces the risk of prostate cancer (**Das and Khatun, 2021**).

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. (**Anonymous 2023**). 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). (**Anonymous 2023**).

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. (**Shinde et al., 2022**).

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.

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 m² 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 (Devi and Tayde, 2017).

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

Result 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 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., (2023)**. Spinosad 45% SC was also found to be effective (2.90) and (2.21). Similar results were observed by **Chandi et al., (2016)**, **Manisha and Kumar (2022)** and **Deepthi and Tayde (2022)**. Indoxacarb 14.5% SC was next best effective with (2.97) and (2.41). Similar findings were observed by **Patil et al., (2018)**, **Pal et al., (2018)** and **Singh et al., (2017)**.

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 **Sapkalet al., (2018)**, 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 (2022)**. Indoxacarb also had a profitable yield of (205 q/ha) and cost benefit ratio (1:7.71) which is similar to **Kooner et al., (2016)**

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					
			3 rd DAS	7 th DA S	14 th DA S	Mean	3 rd DAS	7 th DAS	14 th DAS	Mean		
T₁	Indoxacarb 14.5% SC @ 0.8 ml/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 @ 0.3 ml/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 @ 0.5 ml/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 @ 0.4 ml/l	5.33	3.27	2.73	2.67	2.90	2.50	2.27	1.87	2.21	228	1:7.83
T₅	<i>Beauveria bassiana</i> 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% @ 5 ml/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 @ 1 ml/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,

References

- Anonymous**2023.FoodandAgricultureOrganisation
- Anonymous**2023.MinistryofAgriculture,GovernmentofIndia,NationalHorticultureBoard.
- Das,G.andKhatun,M.R.(2021)**.Evaluationoffieldefficacyofdifferentbacterialfermented insecticides against tomato fruit borer, *Helicoverpaarmigera*(Hubner). *AsianJournal of Research in Biosciences***3**(1): 1-7.
- Deepthi,Y.N.,andYadav,U.(2022)**.Comparisonwithbotanicalsandthebio-agentsonfruit borer,*Helicoverpaarmigera*(Hubner)inTomato.*JournalofEntomologyandZool ogyStudies*, **10**(2), 223-226.
- Devi, H. D. and A. R. Tayde (2017)**. Comparative efficacy of bio-agents and botanicals on themanagementofdiamondbackmoth(*Plutellaxylostella*Linn.)oncabbageunderAllahab ad agroclimatic conditions. *International Journal of Current MicrobiologyandApplied Sciences*,**6**(7): 711-716.
- Kooner, R., Sharma, S., Sandhu, S. S., and Arora, R. (2016)**. Chlorantraniliprole to managetomatofruitborer,*Helicoverpaarmigera*(Hübner)(Lepidoptera:Noctuiidae)inPu njab.*Pesticide Research Journal*, **28**(2): 188-193.
- Manisha, C.,andKumar,A.(2022)**.FieldEfficacyandEconomicsofDifferentInsecticides against Tomato Fruit Borer [*Helicoverpaarmigera*(Hubner)]. *InternationalJournalof Plant and SoilScience*, **34**(22): 455-460
- Pal, S., Singh, D. K., Umrao, R. S., and Sharma, O. (2018)**. Eco-Friendly Management ofTomatoFruitBorer,*Helicoverpaarmigera*underHillCondition,Uttarakhand,India.*Int ernationalJournalofCurrentMicrobiologyandAppliedSciences*,**7**(10):30083013.
- Patidar, R., Raipuriya, N., Singh, S., and Kakade, S. (2023)**. Efficacy of insecticides againstfruit borer, *Helicoverpaarmigera*on *Lycopersicon esculentum* Mill. *The PharmaInnovationJournal*, **12**(10): 1271-1273

Patil, P. V., Pawar, S. A., Kadu, R. V., and Pawar, D. B. (2018). Bio-efficacy of newer insecticides, botanicals and microbial against tomato fruit borer *Helicoverpa armigera* (Hubner) infesting tomato. *Journal of Entomology and Zoology Studies*, **6**(5), 2006-2011.

Sapkal, S.D., Sonkamble, M.M., and Gaikwad, B.B. (2018). Bioefficacy of newer insecticides against tomato fruit borer, *Helicoverpa armigera* (Hubner) on tomato, *Lycopersicon esculentum* (mill) under protected cultivation. *International Journal of Chemical Studies*, **6**(4): 3326-3330.

Shinde, V. M., Dhormare, A. P., Somwanshi, V. L., and Shetgar, S. S. (2022). Biology of *Helicoverpa armigera* (Hubner) on different host plants. *The Pharma Innovation Journal* **11**(9): 2362-236.

Singh, N., Dotasara, S. K., Kherwa, B. and Singh, S. (2017). Management of tomato fruit borer by incorporating newer and biorational insecticides. *Journal of Entomology and Zoology Studies*, **5**(2): 1403-1408.

Waheed, K., Nawaz, H., Hanif, M.A., and Rehman, R. (2020). Tomato. In *Medicinal Plants of South Asia* (pp. 631-644). Elsevier.