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Efficacy of novel insecticides on infestation of tomato fruit borer (*Helicoverpa armigera* Hubner)

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Abstract
An experiment was conducted to evaluate the efficacy of novel insecticides with seven treatments on infestation of tomato fruit borer (*H. armigera)* at JNKVV, Krishi Vigyan Kendra, Chandan Nagar Chhindwara (M.P.) during the Rabi season of 2018-19. Among seven treatments, minimum larval population (0.53 larva/plant) existed in the treatment chlorantraniliprole 18.5 SC. Next effective treatment was spinosad 45 SC (0.69 larva/plant) which was comparable with treatment indoxacarb 14.5 SC (0.68 larva/plant). The rest of treatments *viz*., emamectin benzoate 5 SG, profenofos 50 EC, Azadiractine, were recorded 0.86, 1.05, 1.20 larval population per plant of *H. armigera*, respectively. The minimum fruit damage in the treatment chlorantraniliprole 18.5 SC (8.72%) was found most effective against fruit borer followed by spinosad 45 SC (10.78%), indoxacarb 14.5 SC (11.18%) and emamectin benzoate 5 SG (13.08%). Profenophos (15.98%) and Azadirachtin (17.19%) proved least effect. All the insecticides significantly increased the yield of marketable fruits of tomato over control. The maximum yield (443.15 q/ha) was recorded in Chlorantraniliprole followed by Spinosad (434.65 q /ha), Indoxacarb (427.34 q/ ha) and Emamectin benzoate 5 SG (418.64 q/ha). The minimum yield was observed in profenophos (341.62 q/ ha) followed by Azadirachtin (324.18 q/ha).

Keywords: novel, *Helicoverpa armigera*, *Solanum Lycopersicon*, botanical insecticide

Introduction

Tomato, *Solanum Lycopersicon* Miller is one of the most important herbaceous crop belonging to the family Solanaceae. It is popularly known as *Tamatar*. It ranks third largest vegetable crop after potato and sweet potato, but it top in the list of canned vegetables. It can be used fresh in salad, curries or bi-products like chutney, pickle, soups, ketchup, sauce, powder, purees etc. Tomato is cultivated in an area of 8.08 lakh hectares with production of about 196.96 lakh tonnes and productivity of 24.36 tonnes/ha. In Madhya Pradesh, this crop occupied 84.53 thousand ha area with production of 2419.28 thousand MT (Horticultural Statistics at a Glance, 2018). The tomato cultivated in 8.01 thousand ha area with production of 236.48 thousand MT in the district Chhindwara, Madhya Pradesh (Horticultural Statistics at a Glance, 2017).

The damage caused by insect-pests is one of the main constraints which limit the production of tomato. Among the insect pests, tomato fruit borer is highly destructive pest causing serious damage and responsible for significant yield loss up to 55 per cent (Talekar *et al*., 2006). It also caused 40-50 per cent damage to the tomato crop (Pareek and Bhargava, 2003). Farmers largely follow the chemical method as it gives quick results. High frequency application is the common scenario. However, these chemicals in many cases invited the problems of pesticide resistance, resurgence, secondary pest outbreak, environmental contamination, residual toxicity, phyto-toxicity and toxicity to beneficial organisms like predator and parasitoids as well as disturbance in homeostasis of natural populations. However, the new generations of pesticide molecules with novel mode of action have been studied from the point of view of effectiveness, economics as well as safer for plant and consumers is still lacking. Tomato fruit borer (*H. armigera*) is one of the major key pest of tomato which responsible for economic damage and having high reproductive capacity and capable of migrating over large distances.

Materials and Methods

Experiment for effect of different insecticides against tomato fruit borer (*Helicoverpa armigera* Hubner)" was carried out at JNKVV, Krishi Vigyan Kendra, Chandan Nagar Chhindwara (M.P.) during the Rabi season of 2018-19. The experiments were conducted in a randomized block design with seven treatments including untreated control replicated three times. The tomato crop was transplanted on first week of October, 2018. The row to row distance of 90 cm and plant to plant distance of 30 cm were maintained. Schedule spray was initiated at noticed of 5 per cent fruit infestation in the field. Each spray was given at an interval of 15 days. The total number of healthy fruits and number of infested fruits was recorded. The observations were recorded at 3, 5, and 10 days after spraying for mean larval population of*H. Armigera* and the per cent fruit damage was recorded on the basis of number and weight basis.

$$\text{Per cent fruit damage (Weight basis)} = \frac{\text{Weight of infested fruits}}{\text{Total weight of fruits}} \times 100$$

Table 1: Treatments for management of tomato fruit borer (*H. armigera*)

Tr. No.	Insecticides	Dose (gm or ml/10 lit)
T1	Spinosad 45 SC	4
T2	Emamectin benzoate 5 SG	4
T3	Indoxacarb 14.5 SC	10
T4	Chlorantraniliprole 18.5 SC	3
T5	Profenofos 50 EC	10
T6	Azadiractine	50
T7	Control	-

Results and Discussion

Efficacy of insecticides against larval population of *H. armigera* infesting tomato Mean larval population of *H. armigera* after first, second and third spray during 2018-19. The average data of first, second and third spray during 2018- 19 are presented in Table 2 revealed that minimum larval population (0.53 larva/plant) existed in the treatment chlorantraniliprole 18.5 SC. Next effective treatment was spinosad 45 SC (0.69 larva/plant) hich was comparable with treatment indoxacarb 14.5 SC (0.68 larva/plant). The rest of treatments *viz*., emamectin benzoate 5 SG, profenofos 50 EC, Azadiractine, were recorded 0.86, 1.05, 1.20 larval population per plant of *H. armigera*, respectively.

Table 2: Mean larval population of *H. armigera* at first, second and third spray during 2018-19

S. No.	Treatment	Mean larval population of *H. armigera*			Mean
		First Spray	Second spray	Third spray	
1	Spinosad 45 SC	0.70	0.72	0.65	0.69
2	Emamectin benzoate 5 SG	0.85	0.90	0.84	0.86
3	Indoxacarb 14.5 SC	0.75	0.68	0.60	0.68
4	Chlorantraniliprole 18.5 SC	0.55	0.54	0.50	0.53
5	Profenofos 50 EC	1.03	1.10	1.02	1.05
6	Azadiractine	1.20	1.14	1.25	1.20
7	Untreated Control	1.94	2.25	2.85	2.35
	CD at 5%	-	-	-	0.16

Table 3: Mean per cent fruit damage by *H. armigera* during 2018-19

Sr. No.	Treatment	Pre-treatment damage %	Mean per cent fruit damage of *H. armigera*			Mean (%)
			Ist Spray	IInd spray	IIIrd spray	
1.	Spinosad 45 SC	22.25	12.25	9.45	10.65	10.78
2.	Emamectin benzoate 5 SG	27.50	14.12	12.52	12.60	13.08
3.	Indoxacarb 14.5 SC	26.30	13.15	10.12	10.28	11.18
4.	Chlorantraniliprole 18.5 SC	19.20	9.55	8.35	8.25	8.72
5.	Profenofos 50 EC	33.35	16.15	14.55	14.25	15.98
6.	Azadiractine	37.25	18.06	16.55	16.95	17.19
7.	Untreated Control	61.10	30.55	29.35	29.85	29.92
	CD at 5%	-	-	-	-	2.01

The average data of first, second and third spray during 2018- 19 are presented in Table 3 revealed that minimum fruit damage (8.72%) existed in the treatment chlorantraniliprole 18.5 SC. The next effective treatment was spinosad 45 SC (10.78%) which was at par with treatments indoxacarb 14.5 SC (11.18%) and Treatments Azadiractine (17.19%) found least effective against *H. armigera*. Rest of the treatments *viz*., emamectin benzoate 5 SG (13.08%), profenofos 50EC (15.98%), fruit damage by *H. armigera*.

Effect of Insecticide on fruit infestation and Yield of tomato fruits

Effect of different treatments on fruit infestation and yield of tomato is presented in Table 4. Among the insecticide treatments, Chlorantraniliprole treated plots recorded lowest mean fruit infestation (10.75%) followed by spinosad (12.78%) indoxacarb (13.18%) and Emamectin benzoate (15.15%). The Profenophos (18.95%) and botanical-pesticides, Azadiractine recorded fruit infestations (19.28%) were not so effective treatments but all were superior over untreated control plots (35.85%).

The data presented in Table 4 on yield of tomato fruits revealed that significantly higher (443.15 q/ha) yield obtained when treated with chlorantraniliprole 18.5 SC followed by spinosad 45 SC (434.65 q/ha) and indoxacarb 14.5 SC (427.34 q/ha). The lowest (261.35 q/ha)yield was obtained in untreated control. However, rests of treatments emamectin benzoate 5 SG, profenofos 50 EC and *Azadiractine*, exhibited 418.64,341.62, and 324.18 q/ha yield of tomato, respectively.

Table 4: Effect of insecticide on fruit infestation and Yield performance of tomato during 2018-19

S. No.	Treatments	Cumulative mean % (Fruit infestation)	%Protection over control	Marketable Fruit Yield q/ha	Yield damaged fruit q/ha	Percent damaged fruit	Gross fruit yield q/ha
1	Spinosad 45 SC	12.78	64.35	389.02	45.63	10.50	434.65
2	Emamectin benzoate 5 SG	15.15	57.74	363.38	55.26	13.20	418.64
3	Indoxacarb 14.5 SC	13.18	63.23	379.27	48.07	11.25	427.34
4	Chlorantraniliprole 18.5 SC	10.75	70.01	406.37	36.78	8.30	443.15
5	Profenofos 50 EC	18.95	47.14	284.4	57.22	16.75	341.62
6	Azadiractine	19.25	46.30	268.59	55.59	17.15	324.18
7	Untreated Control	35.85	-	199.81	61.54	23.55	261.35
	S.Em. +-	-	-	-	-	-	-
	C. D. at 5%	2.01	3.44	16.35	8.97	2.01	25.15

Conclusion

The experiment on effect of different insecticidal treatments revealed that chlorantraniliprole was found most effective against tomato fruit borer followed by Spinosad, Indoxacarb and emamectin benzoate resulted higher yield, while profenophos and Azadirachtin proved least effective.

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