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Bio-efficacy of new insecticide against Chilli Fruit Borer

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ABSTRACT

A field experiment was conducted to evaluate the bio-efficacy of Indoxacarb 9% + Emamectin benzoate 1% SC against chilli fruit borer, *Helicoverpa armigera* for two consecutive years. Maximum fruit borer reduction (93.36 % and 90.20%) was recorded in the plants treated with Indoxacarb 9% + Emamectin benzoate 1% SC @50.0 g *a.i.* /ha, followed by Indoxacarb 9% + Emamectin benzoate 1% SC @ 40.0g.a.i./ ha (79.59% and 82.36%) and Emamectin benzoate 5% @10.0 g.a.i./ ha, (77.04% and 80.39%) . Minimum chilli fruit borer population reduction in the plots treated with Indoxacarb 14.5% SC@ 60.0 g a.i./ha (74.49% and 78.04%) followed by Indoxacarb 9% + Emamectin benzoate 1% SC @30.00g.a.i./ha, (61.73% and 66.67%), respectively in Kharif 2018 and 2019 season. The maximum yield (196.50 q/ha) was recorded from the plots treated with Indoxacarb 9% + Emamectin benzoate 1% SC @ 50.0 g *a.i.* /ha followed by Indoxacarb 9% + Emamectin benzoate 1% SC at 100 g a.i/ha (185.85 q/ha). The yield increase was also in high order in these treatments.

Keywords: Bio-efficacy, chilli fruit borer, indoxacarb, emamectin benzoate, yield

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INTRODUCTION

Chilli (*Capsicum annuum* L.) is one of the most important commercial spices of India. It is grown almost throughout the country. There are more than 400 different varieties of chillies found all over the world. Chilli is widely cultivated throughout the world particularly in tropical and subtropical regions. Indian chillies have been dominating the international chilli market. India is the world leader in chilli production followed by China and Pakistan (Balraj and Arockiasamy 2018). In India, chilli is cultivated in an area of 7.67 lakh hectares and the production is estimated at 12.34 lakh tonnes (Priyadarshini *et al.* 2019). India is not only the largest producer but also the largest consumer and exporter of chilli in the world. In India, the major growing states for chilli are Andhra Pradesh, Karnataka, Maharashtra, Madhya Pradesh, Orissa, West Bengal, Rajasthan and Tamil Nadu.

Although, the crop has got great export potential besides huge domestic requirement, a number of limiting factors have been attributed for its low productivity. Fifty-one species of insects and two species of mites belonging to 27 families under 9 orders were recorded on chilli transplanted crop (Reddy and Puttaswamy, 1983). Further, *Melanotus sp*. Eschscholtz (wire worms), *Odontotermes obesus* Rambur (termite), *Holotrichia serrata* Fabricius (white grub), *Helicoverpa armigera* Hubner (fruit borer), thrips (*Scirtothrips dorsalis* Hood and *Thrips flavus* Schrank) and mites (*Petrobia latus* Murray and *Tetranychus neocaledonicus* Andre) were considered as important pests. Among the various insect pests, fruit borer, *Helicoverpa armigera* Hubner (Lepidoptera :Noctuidae) is considered as the most serious and important pest. The damage caused by *H. armigera* during flowering and fruit formation is the most concern. The young larvae of *H. armigera* feed on flower buds and young fruits by making a circular hole. Later, the larvae feed on internal contents usually with its head inside the fruit and rest of the body outside. Reddy *et al*. (2007) reported that the loss caused by the fruit borers is to the extent of 90 per cent in chilli. Though several workers tested different chemicals against fruit borer but still the problem continues. Considering the economic importance of pest, the study was conducted to test the bio-efficacy of newer insecticide molecules against capsicum fruit borer, *Helicoverpa armigera*.

MATERIALS AND METHODS

The field experiment was conducted at JNKVV – Dry land Horticulture Research & Training Centre, Garhakota during Kharif 2018 and 2019 in a randomized block design with seven treatments and three replications following a spacing of 30 x 50 cm in a treatment plot size of 4 x 5 m. Chilli variety, SPH-4482 was used for the experiment. All the management practices except plant protection were adopted as per the recommended package of practices. Different insecticides viz; Indoxacarb 9% + Emamectin benzoate 1% SC at different doses (27+3 g a.i./ha, 36+4 g a.i./ha, 45+5 g a.i./ha, 90+100 g a.i./ha), Indoxacarb 14.5% SC at 60 g a.i./ha and Emamectin Benzoate 5% SG at 10 g a.i./ha were evaluated against fruit borer in chilli. A measured quantity of insecticidal solution was mixed with a little quantity of water and stirred well, after

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which the remaining quantity of water was added to obtain the required concentration of spray fluid. Sprayings were given by using a hand compression knapsack high volume sprayer during morning hours. The plot in each treatment was sprayed with respective insecticides ensuring uniform coverage of insecticide. The observations of fruit borer were recorded from each treatment on randomly selected five plants in each replication. First count was taken one day before first spray (Pre- treatment) and post treatment counts was recorded after 5, 10 and 15 days of each spray. The number of damaged and undamaged fruits and also the number of larvae per plant from each plot was recorded. The data were converted to square root and arc sin transformation beforestatistical analysis. The population data was corrected by the correction factor given by Henderson and Tilton (1955) as under:

Percent reduction in population

$$=100x(1-\frac{T_a x C_b}{T_b x C_a})$$

Where;

T_a = Number of insects after treatment

Tb = Number of insects before treatment

C_a = Number of insects untreated check after treatment

C_b = Number of insects in untreated check before treatment

RESULTS AND DISCUSSION

Chilli fruit borer larval population

Fruit damage on the basis of number of larvae/plant was recorded during the harvesting period of chilli fruits from the experimental crop. The data on number of larvae/plant reflected the level of larval infestation of *Helicoverpa armigera* on chilli crop. Hence, the data obtained on number of larvae/plant was used for comparing the efficacy of spray treatments. The data presented in (Table 1 and 2) revealed that all the insecticides under investigation were observed to be significantly

Table 1: Bio-efficacy of Indoxacarb 9% + Emamectin benzoate 1% SC against chilli fruit borer larvae during Kharif 2018

Sl. No	Treatments	Dose/ha		Pre treat ment	Mean Larval population per plant (No)						
					First Spray			Second spray			% ROC
		g. a.i.	Formulation (ml/gm)		5DAS	10 DAS	15 DAS	5 DAS	10 DAS	15 DAS	
T1	Indoxacarb 9% + Emamectin benzoate1% SC	27+3	300	1.60 (1.44)	1.23 (1.31)	1.05 (1.24)	0.96 (1.21)	0.85 (1.16)	0.79 (1.13)	0.75 (1.18)	61.73
T2	Indoxacarb 9% + Emamectin benzoate1% SC	36+4	400	1.43 (1.39)	1.09 (1.26)	0.92 (1.19)	0.84 (1.15)	0.70 (1.09)	0.56 (1.03)	0.40 (0.95)	79.59
T3	Indoxacarb 9% + Emamectin benzoate1% SC	45+5	500	1.59 (1.44)	1.43 (0.96)	0.75 (0.89)	0.42 (0.79)	0.29 (0.77)	0.17 (0.75)	0.13 (0.72)	93.36
T4	Indoxacarb 9% + Emamectin benzoate1% SC	90+10	1000	1.49 (1.41)	1.42 (1.38)	0.97 (1.21)	0.86 (1.17)	0.74 (1.11)	0.63 (1.06)	0.46 (0.98)	76.53
T5	Indoxacarb 14.5% SC	60	400	1.70 (1.48)	1.52 (1.42)	1.21 (1.30)	1.14 (1.28)	0.83 (1.15)	0.66 (1.08)	0.50 (1.00)	74.49
T6	Emamectin benzoate 5% SG	10	200	1.45 (1.39)	1.23 (1.31)	1.18 (1.29)	1.10 (1.26)	0.83 (1.06)	0.61 (1.05)	0.45 (0.97)	77.04
T7	Control (Untreated)	-		1.53 (1.42)	1.62 (1.45)	1.68 (1.47)	1.73 (1.49)	1.79 (1.51)	1.88 (1.54)	1.96 (1.57)	
	S Em±			0.08	0.10	0.10	0.09	0.08	0.06	0.07	
	C.D at 5%			NS	0.23	0.30	0.27	0.24	0.18	0.20	

The figures in parentheses are mean square root () transformed value.
NS = Non Significant; % ROC = Percent Reduction over control.

reducing the population of fruit borer on chilli at all the days of observations after first and second spray. Maximum fruit borer population reduction was recorded at 15 days after second spray in all the treatments during both the seasons. However, within the treatments maximum fruit borer reduction (93.36 % and 90.20% in 1st and 2nd season), respectively was recorded in the plants treated with Indoxacarb 9% + Emamectin benzoate 1% SC @ 50.0 g *a.i.* /ha, followed by Indoxacarb 9% + Emamectin benzoate 1% SC @ 40.0g.a.i./ ha (79.59% and 82.36% in1st and 2nd season), respectively and Emamectin benzoate 5% @10.0 g.a.i./ ha, (77.04% and 80.39% in 1st and 2nd season), respectively. Minimum chilli fruit borer population reduction in the plots treated with Indoxacarb 14.5% SC@60.0 g a.i./ha (74.49% and 78.04% in 1st and 2nd season) followed by Indoxacarb 9% + Emamectin benzoate 1% SC @30.00g.a.i./ha, (61.73% and 66.67%), respectively in Kharif 2018 and 2019 season.

Chilli fruit damage

The data presented in (Table 3 and 4) revealed that all the insecticides under investigation were observed significantly superior in reducing chilli fruit damage at all the intervals of observations in first and second season trial. Significantly maximum reduction percentage of chilli fruit damage (82.85% and 87.47 %) were recorded from the plants treated with Indoxacarb 9% + Emamectin benzoate 1% SC @ 50.0g *a.i.* /ha followed by Indoxacarb 9% + Emamectin benzoate 1% SC @ 40.0g.a.i./ ha (78.36% and 79.89 %), respectively and Emamectin benzoate 5% SG 10.0 g.a.i./ ha, (73.36% and 78.59%), respectively during both seasons. However, Indoxacarb 14.5% SC@ 60.0 g a.i./ha (64.80% and 74.67%) and Indoxacarb 9% + Emamectin benzoate 1% SC @ 30.0g.a.i./ ha (60.42% and 67.88%) gave least reduction over control during 2018 and 2019 season trials.

Table 2: Bio-efficacy of Indoxacarb 9% + Emamectin benzoate 1% SC against chilli fruit borer larvae during Kharif 2019

Sl.No	Treatments	Dose/ha		Pre- treat ment	Mean Larval Population per plant (No)						% ROC
					First Spray			Second spray			
		g. a.i.	Formulation (ml/gm)		5DAS	10 DAS	15 DAS	5 DAS	10 DAS	15 DAS	
T1	Indoxacarb 9% + Emamectin benzoate 1% SC	27+3	300	1.78 (1.51)	1.43 (1.39)	1.25 (1.32)	1.16 (1.29)	0.95 (1.20)	0.89 (1.18)	0.85 (1.16)	66.67
T2	Indoxacarb 9% + Emamectin benzoate 1% SC	36+4	400	1.83 (1.49)	1.26 (1.33)	1.12 (1.27)	1.04 (1.24)	0.92 (1.19)	0.75 (1.12)	0.45 (0.97)	82.35
T3	Indoxacarb 9% + Emamectin benzoate 1% SC	45+5	500	1.69 (1.48)	1.13 (1.28)	0.80 (1.14)	0.52 (1.01)	0.48 (0.99)	0.35 (0.92)	0.25 (0.87)	90.20
T4	Indoxacarb 9% + Emamectin benzoate 1% SC	90+10	1000	1.84 (1.53)	1.50 (1.41)	1.39 (1.37)	1.10 (1.26)	0.90 (1.18)	0.76 (1.12)	0.58 (1.04)	77.25
T5	Indoxacarb 14.5%	60	400	1.72 (1.49)	1.40 (1.38)	1.15 (1.28)	1.00 (1.22)	0.90 (1.18)	0.74 (1.11)	0.56 (1.03)	78.04
T6	Emamectin benzoate 5% SG	10	200	1.80 (1.52)	1.20 (1.30)	1.05 (1.24)	1.00 (1.22)	0.85 (1.16)	0.64 (1.07)	0.50 (1.00)	80.39
T7	Control (Untreated)	-		1.74 (1.50)	1.92 (1.55)	2.08 (1.61)	2.23 (1.65)	2.38 (1.70)	2.42 (1.71)	2.55 (1.75)	-
	S Em±			0.06	0.08	0.7	0.09	0.07	0.09	0.08	
	C.D at 5%			NS	0.21	0.26	0.22	0.20	0.27	0.25	

The figures in parentheses are mean square root () transformed value.
NS = Non Significant;, % ROC = Percent Reduction over control.

Table 3: Bio-efficacy of Indoxacarb 9% + Emamectin benzoate 1% SC against Chilli fruit borer during Kharif 2018

Sl.No	Treatments	Dose/ha		Pre-Treatment	% fruit damaged after firstspray			% fruit damaged after secondspray			% ROC
		g. a.i.	Formulation (ml/gm)		5 DAA	10 DAA	15 DAA	5 DAA	10 DAA	15 DAA	
T1	Indoxacarb 9% + Emamectin benzoate 1%SC	27+3	300	13.02 (21.15)	12.20 (20.44)	11.00 (19.37)	10.46 (18.87)	9.30 (17.76)	8.67 (17.12)	7.50 (15.89)	60.42
T2	Indoxacarb 9% + Emamectin benzoate 1%SC	36+4	400	12.49 (20.68)	11.40 (19.73)	10.62 (19.02)	9.20 (17.66)	8.43 (16.88)	7.00 (15.34)	4.10 (11.54)	78.36
T3	Indoxacarb 9% + Emamectin benzoate 1%SC	45+5	500	12.75 (20.92)	9.35(18.81)	8.40(16.85)	7.00 (15.34)	6.35 (16.11)	5.60 (13.69)	3.25 (10.39)	82.85
T4	Indoxacarb 9% + Emamectin benzoate 1%SC	90+10	1000	13.25 (21.34)	10.14 (18.57)	8.33 (16.78)	7.36 (15.74)	6.10 (14.30)	5.70(13.81)	4.80 (13.35)	71.87
T5	Indoxacarb 14.5% SC	60	400	13.87 (21.86)	12.26 (20.50)	9.67 (18.12)	8.25 (16.69)	7.40 (15.79)	6.67 (14.96)	5.45 (13.50)	64.80
T6	Emamectin benzoate 5%SG	10	200	12.57 (20.74)	11.43 (19.76)	10.10 (18.53)	9.46 (17.91)	7.33 (15.74)	6.10(14.30)	4.67 (12.48)	75.36
T7	Control (Untreated)	-		13.56 (21.59)	14.40 (22.30)	15.46 (23.15)	16.28 (23.79)	17.10 (24.43)	17.90 (24.86)	18.95 (25.81)	-
	S Em±			0.89	1.12	1.34	1.26	1.08	0.92	1.18	
	C.D at 5%			4.32	4.26	4.85	3.86	3.24	3.34	4.85	

The figures in parentheses are arcsin () transformed value.
% ROC = Percent Reduction over control.

Table 4: Bio-efficacy of Indoxacarb 9% + Emamectin benzoate 1% SC against Chilli fruit borer during Kharif 2019

Sl.No	Treatments	Dose/ha		Pre-Treatment	% fruit damaged after firstspray			% fruit damaged aftersecond spray			% R O C
		g. a.i.	Formulation (ml/gm)		5 DAA	10 DAA	15 DAA	5 DAA	10 DAA	15 DAA	
T1	Indoxacarb 9% + Emamectin benzoate 1%SC	27+3	300	15.35 (21.15)	11.36 (20.44)	10.10 (19.37)	9.64 (18.87)	8.00 (17.76)	7.42 (17.12)	6.15 (15.89)	67.88
T2	Indoxacarb 9% + Emamectin benzoate 1%SC	36+4	400	14.65 (20.68)	9.65(19. 73)	7.50 (10.02)	6.10 (17.66)	5.40 (16.88)	4.85 (15.34)	3.85 (11.32)	79.89
T3	Indoxacarb 9% + Emamectin benzoate 1%SC	45+5	500	14.90 (20.92)	8.65(17. 80)	6.30(16. 85)	4.50 (15.34)	3.15 (16.11)	2.90 (13.69)	2.40 (10.39)	87.47
T4	Indoxacarb 9% + Emamectin benzoate 1%SC	90+10	1000	15.10 (21.34)	9.40 (18.57)	7.40 (16.78)	6.60 (15.73)	5.35 (14.18)	4.25 (13.81)	4.30 (11.97)	77.54
T5	Indoxacarb 14.5% SC	60	400	14.60 (21.86)	10.36 (20.50)	8.70 (18.12)	7.30 (16.69)	6.15 (15.79)	5.27 (14.96)	4.85 (13.50)	74.67
T6	Emamectin benzoate 5%SG	10	200	15.17 (20.74)	9.45 (19.76)	7.10(18. 53)	6.60 (17.90)	5.20 (15.74)	4.80 (14.30)	4.10 (13.76)	78.59
T7	Control (Untreated)	-		14.58 (21.59)	15.30 (22.30)	16.15 (23.15)	16.90 (23.79)	17.38 (24.43)	18.24 (24.86)	19.15 (25.81)	-
	S Em±			0.86	0.92	0.78	0.82	1.18	1.02	1.11	
	C.D at 5%			4.20	4.69	3.96	4.26	3.47	4.14	4.56	

The figures in parentheses are arcsin () transformed value.
% ROC = Percent Reduction Over Control.

Fig. 5: Bio-efficacy of Indoxacarb 9% + Emamectin benzoate 1% SC on yield of chilli

Sl. No.	Treatments	Dose/ha		Yield		Mean Yield q/ha
		g a.i.	Formulation ml	2018 (q/ha)	2019 (q/ha)	
T1	Indoxacarb 9% + Emamectin benzoate 1% SC	27+3	300	160.50	161.80	160.90
T2	Indoxacarb 9% + Emamectin benzoate 1% SC	36+4	400	182.30	184.60	183.45
T3	Indoxacarb 9% + Emamectin benzoate 1% SC	45+5	500	195.40	198.00	196.50
T4	Indoxacarb 9% + Emamectin benzoate 1% SC	90+10	1000	185.70	186.00	185.85
T5	Indoxacarb 14.5% SC	60	400	165.70	164.40	165.04
T6	Emamectin benzoate 5% SG	10	200	178.60	181.30	179.95
T7	Control (Untreated)			143.33	145.67	144.50
SEm				**1.72**	**1.85**	**2.18**
CD at 5%				**7.62**	**7.95**	**8.26**

Chilli yield

Comparing the yield data (Table 5), Indoxacarb 9% + Emamectin benzoate 1% SC at 50 g a.i/ha gave highest yield (196.50 q/ha) followed by Indoxacarb 9% + Emamectin benzoate 1% SC at 100 g a.i/ha (185.85 q/ha), Indoxacarb 9% + Emamectin benzoate 1% SC at 40 g a.i/ha (183.45 q/ha), Emamectin benzoate 5% SG at 10 g a.i/ha (179.95 q/ha), Indoxacarb 14.5% SC at 60 g a.i/ha (165.04 q/ha), Indoxacarb 9% + Emamectin benzoate 1% SC at 30 g a.i/ha (160.90 q/ha), respectively over control.

These results are in agreement with Sahu and Kumar (2018) who reported that Emamectin Benzoate 5% SG was the best treatment for managing chilli borer population. Reddy *et al.* (2007) reported that Emamectin Benzoate 5% SG was the best treatment against pod borers followed by Indoxacarb 14.5% SC @ 1.0 and 0.5ml. Murugaraj *et al.* (2006) found that Emamectin benzoate is highly effective in reducing the larval population of fruit borer (*H. armigera*) of tomato and fruit damage with increased yields. Kana *et al.* (2005) also reported superiority of Emamectin benzoate against fruit borer (*H. armigera*),

CONCLUSION

The results of the field experiment conducted over two consecutive years to evaluate the bio-efficacy of Indoxacarb 9% + Emamectin benzoate 1% SC against the Chilli Fruit Borer, Helicoverpa armigera, are quite promising. Here are the key findings from the study. These results suggest that the combination of Indoxacarb and Emamectin benzoate at the specified rates was highly effective in controlling Helicoverpa armigera infestations in chili pepper crops while also significantly increasing chili pepper yields. Farmers and agricultural practitioners should consider these findings when developing pest management strategies for chili pepper cultivation. However, it's essential to follow local guidelines and regulations for pesticide use and to monitor for potential resistance development over time.

REFERENCES

Balraj S and Arockiasamy P. 2018. Problems of chilli cultivation and marketing in Ramanathapuram district, Tamil Nadu. *International Journal of Research and Analytical Reviews* **5**(4): 2349-5138.

Henderson, C. F., & Tilton, E. W. (1955). Tests with acaricides against the brown wheat mite. *Journal of Economic Entomology* **48**:157–161.

Kana S, Chandra B S, Raghupathy A, Stanly J. 2005. Field efficacy of emamectin benzoate 5% SG against chilli fruit borer *Helicoverpa armigera* (Hubner). *Pestology* **29**:21-24.

Murugaraj P, Nachiappan RM, Selvanarayanan V. 2006. Efficacy of emamectin benzoate (proclaim 05 SG) against tomato fruit borer, *Helicoverpa armigera* (Hubner). *Pestology* **30**(1):11-16.

Priyadarshini S, Nayak A K and Thakoor P. 2019. Bio - efficacy of some insecticides and acaricides against different insect and non -insect pests of chilli and their effect on natural enemies in chilli ecosystem. *Journal of Pharmacognosy and Phytochemistry* **8**(4):462 -467.

Reddy DNR and Puttuswamy.1983. Pest infesting chilli (*Capsicum annuum* L.) – In the transplanted crop. *Mysore Journal of Agricultural Sci*ences **17**: 246-251.

Reddy AV, Sreehari G and Kumar AK. 2007. Efficacy of certain new insecticides against pest complex of chilli (*Capsicum annum* L.). *Asian J Horti*. **2**(2):94-95.

Sahu T and Kumar A. 2018. Field efficacy of some insecticides against chilli thrips (*Scirtothrips dorsalis* (Hood)) in Allahabad (U.P.). *Journal of Entomology and Zoology Studies*. **6**(5):192-195.

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