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BIO-EFFICACY OF NEW INSECTICIDE MOLECULES AGAINST CAPSICUM FRUIT BORER, *HELICOVERPA ARMIGERA* (HUBNER)

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Abstract

Field experiment was conducted at the Gandhi Krishi Vignana Kendra (GKVK), University of Agricultural Sciences, Bengaluru, Karnataka, India during 2012-13 to test the bio-efficacy of new insecticide molecules against capsicum fruit borer, *Helicoverpa armigera* (Hubner). The results indicated that among different chemicals Spinosad 45 SC @ 0.01% emerged as the best treatment which recorded highest per cent reduction of 76.53 with a highest yield of 30050 kg/ ha. However, standard check Quinolphos 25% EC @ 0.05% (16300 kg/ha) was least effective in reducing the incidence of fruit borers.

Key words: Capsicum, Fruit borer, *Helicoverpa armigera*, newer molecules.

1. Introduction

Capsicum is a genus of plants from the nightshade family (*Solanaceae*) native to the Central America, where it was cultivated for thousands of years by the people of the tropical America, and is now cultivated worldwide. Nutritionally, it is rich in vitamins particularly, vitamin A and vitamin C. Often the productivity of capsicum is very low due to several factors. Among them, insect pests cause severe loss. It is attacked by various insect and mite pests from seedling to fruiting stage. It was reported that a total of 293 insects and mite species attacking the Capsicum crop in the field as well as in storage (Anon, 1987). The damage caused by *Helicoverpa armigera* (Hubner) during flowering and fruit formation is the most concern. Reddy and Reddy (1999) 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 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* .

2. Methodology

Field trial was conducted during 2012-13 at Gandhi Krishi Vigyana Kendra (GKVK), University of Agricultural Sciences (UAS), Bengaluru, Karnataka, India. The experiment was laid out in Randomized Complete Block Design (RCBD) with 12 treatments replicated thrice in 2x2m sq plot size with a spacing of 45x45cm. The capsicum variety 'Indra' was raised as per the recommended package of practices except plant protection measures. The treatments were imposed by using Knapsack sprayer @ 400-450 liters of spray solution/ha depending on stage of the crop. The crop received a total of 2 sprays, the first being given when the fruit borer infestation was recorded and the second spray 15 days after the first on need basis. To compare the efficacy of treatments, both recommended insecticides as well as untreated control were maintained. Observations were recorded on the number of larvae per plant on 5 randomly selected plants per plot on one day before, 2, 5 and 10 days after each spray. The data were converted to square root and arc sin transformation before statistical analysis.

3. Results and Discussion

The results of experiment indicated that, before taking up spray there was no significant difference between the different treatments as well as in the control in respect of number of larvae per plant (Table 1). All the treated plots with chemicals were significantly superior in their performance over that of control plots. Two days after the first spray, there was reduction in the number of larvae per plant which ranged from 2.86 to 1.07 per plant. Among the different insecticide molecules, the lowest larval populations were recorded in Spinosad 45 SC @ 0.01% (1.07 larvae/plant) and found to be superior over other treatments. This was followed by Chlorantraniliprole 18.5% SC @ 0.009% (1.17 larvae/plant) was found to be next best treatment and on par with Emamectin benzoate 5 SG @ 0.0012% (1.13 larvae/plant) and Lambda cyhalothrin 5% EC @ 0.005% (1.20 larvae/plant). The treatment Fipronil 5% SL @ 0.01% recorded 1.27 larvae/plant was found to be next succeeding treatment and on par with Novaluron 10% EC @ 0.008% (1.23 larvae/plant) and Indoxacarb 14.5 SC @ 0.008% (1.27 larvae/plant). These were followed by Thiomethoxam 25% WG @ 0.006% (1.33 larvae/plant), Imidacloprid 17.8 SL @ 0.005% (1.47 larvae/plant) and Quinalphos 25% EC @ 0.05% (1.43 larvae/plant) recorded highest larvae/plant. The maximum of 1.53 larvae/plant was recorded in the treatment Dimethoate 30% EC @ 0.05% (Table1).

On five days after spray (DAS), among the different insecticide molecules, the lowest larval population was recorded in Spinosad (0.63 larvae/plant) found to be superior over other treatments. This was followed by Chlorantraniliprole (0.70 larvae/plant) and found to be next best treatment and on par with Emamectin benzoate (0.70 larvae/plant), Novaluron (0.80 larvae/plant), Lambda cyhalothrin (0.73 larvae/plant), Indoxacarb (0.80 larvae/plant) and Fipronil recorded 0.83 larvae/plant. The treatment Thiomethoxam recorded 0.90 larvae/plant was found to be next succeeding treatment. The maximum larvae/plant (1.03) was recorded in the treatments Dimethoate, Imidacloprid and Quinalphos and stood on par with each other (Table1).

Almost similar trend was recorded on 10 DAS, spinosad recorded the least number of larvae/plant (0.57) and; while Dimethoate, Imidacloprid and Quinalphos recorded maximum number of larvae (1.13, 1.10 & 1.10/plant) respectively. However, highest population was observed in case of untreated control (3.00 larvae/plant). The insecticides in the decreasing order of their efficacy were Spinosad 45 SC > Chlorantraniliprole 18.5% SC > Emamectin benzoate 5 SG > Lambda cyhalothrin 5% EC > Fipronil 5% SL > Novaluron 10% EC > Indoxacarb 14.5 SC > Thiomethoxam 25% WG> Dimethoate 30% EC > Imidacloprid 17.8 SL and Quinalphos 25% EC (Table 1).

Among the different insecticide molecules, Spinosad recorded highest per cent reduction of 73.79 and found to be the best treatment followed by Chlorantraniliprole with 72.01 per cent reduction, Emamectin benzoate, Lambda cyhalothrin, Fipronil, and Novaluron with 69.61, 68.43, 66.21 and 65.70 per cent reduction respectively. Indoxacarb with 64.40 per cent reduction was found to be next succeeding treatment followed by Thiomethoxam and Dimethoate. The treatments Imidacloprid and Quinalphos with 59.49 and 58.90 per cent reduction were found to be least effective (Table 2). Similar trend was observed at 2, 5 and 10 days after second spray. However, standard check Quinalphos 25% EC was found to be least effective in reducing the incidence of fruit borer compared to newer molecules. The mean fruit yield was maximum in the treatment Spinosad 45 SC @ 0.01% (30050kg/ha) which was on par with Fipronil 5% SL @ 0.01% (27750 kg/ha), Imidacloprid 17.8 SL @ 0.005% (27150 kg/ha). Benefit cost ratios for the different treatments are presented in Table 2 and ranged from 1:4.6 to 1:1.55. And the highest B: C ratio was recorded in Spinosad 45 SC @ 0.01% (1:4.60).

In conclusion, among different newer insecticide molecules Spinosad 45 SC @ 0.01% was superior in recording less fruit borer population in both sprays with higher fruit yield but was on par with all other newer molecules. These results are in agreement with Ghosh *et al*., (2010) who reported that Spinosad 73 to 84 gm a.i. /ha was effective against *H. armigera* on tomato than Quinalphos, Lambda cyhalothrin and Cypermethrin. Similar results were also obtained by Reddy *et al*. (2007) who reported that Spinosad 45% SC @ 0.3 and 0.2ml was the best treatment against pod borers followed by Indoxacarb 14.5% SC @ 1.0 and 0.5ml. Tatagar *et al*. (2007) indicated that among various dosages Flubendiamide 20 WG @ 60 g a.i. ha^{-1} recorded highest yield of 7.48 q ha^{-1} with lowest fruit damage of 3.45 per cent followed by Flubendiamide 20 WG @ 40 g a.i. ha^{-1} (6.72 q ha^{-1}), Emamectin benzoate 5 SG @ 11 g a.i. ha^{-1} (7.22 q ha^{-1}) and Spinosad 45 SC @ 75 g a.i. ha^{-1} (7.32q ha^{-1}). However, standard check Carbaryl 50 WP @ 1000 g a.i. ha^{-1} (6.46 q ha^{-1}) was least effective in reducing the incidence of fruit borers.

4. Reference

Anonymous, 1987, Literature survey of insect pests of pepper. ARDC Prog. Rep., pp. 77-78.

Ghosh, A., chatterjee, M. and roy, A., 2010, Bio-efficacy of spinosad against tomato fruit borer (*Helicoverpa armigera* Hub.) (Lepidoptera: Noctuidae) and its natural enemies. *J. Horti. Forestry.*, **2**(5): 108-111.

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

Reddy, M.R.S. and Reddy, G.S., 1999, An eco-friendly method to combat *Helicoverpa armigera* (Hub.). *Insect Environ*., **4**: 143-144.

Tatagar, M. H., Mohankumar, H. D., ShivaprasaD, M. and Mesta, R. K., 2007, Bio- efficacy of flubendiamide 20 WG against chilli fruit borers, *Helicoverpa armigera* (Hub.) and *Spodoptera litura* (Fb). *Karnataka J. Agric. Sci*., **22**(3): 579-581.

Annexure

Table 1: Bio-efficacy of new insecticide molecules against *Helicoverpa armigera* on Capsicum

Insecticides	Mean number of larvae per plant								Mean
	First spray				Second spray				
	DBS	2DAS	5DAS	10DAS	DBS	2DAS	5DAS	10DAS	
Emamectin benzoate 5 SG	2.66 (1.78)	1.13 (1.28)[ab]	0.70 (1.09)[ab]	0.73 (1.11)[ab]	2.93 (1.85)	1.00 (1.22)[ab]	0.53 (1.02)[a]	0.40 (0.95)[a]	1.26
Imidacloprid 17.8 SL	2.80 (1.82)	1.47 (1.40)[de]	1.03 (1.24)[d]	1.10 (1.26)[d]	2.86 (1.83)	1.23 (1.32)[de]	0.83 (1.15)[de]	0.70 (1.09)[de]	1.50
Lambda cyhalothrin 5% EC	2.73 (1.80)	1.20 (1.30)[abc]	0.73 (1.11)[abc]	0.80 (1.14)[bc]	2.90 (1.84)	1.00 (1.22)[ab]	0.57 (1.03)[ab]	0.43 (0.96)[ab]	1.29
Thiomethoxam 25% WG	2.66 (1.78)	1.33 (1.35)[cd]	0.90 (1.18)[cd]	0.97 (1.21)[cd]	2.93 (1.85)	1.17 (1.29)[cde]	0.73 (1.11)[cde]	0.60 (1.05)[cde]	1.41
Chlorantraniliprole 18.5% SC	2.93 (1.85)	1.17 (1.29)[ab]	0.70 (1.09)[ab]	0.73 (1.11)[ab]	2.86 (1.83)	0.97 (1.21)[ab]	0.50 (1.00)[a]	0.37 (0.93)[a]	1.27
Novaluron 10% EC	2.66 (1.78)	1.23 (1.32)[bc]	0.80 (1.14)[ab]	0.87 (1.17)[bc]	2.80 (1.82)	1.03 (1.24)[abc]	0.60 (1.05)[abc]	0.47 (0.98)[abc]	1.30
Fipronil 5% SL	2.80 (1.82)	1.27 (1.33)[bc]	0.83 (1.15)[bc]	0.90 (1.18)[bc]	2.86 (1.83)	1.03 (1.24)[abc]	0.60 (1.05)[abc]	0.47 (0.98)[abc]	1.34
Indoxacarb 14.5 SC	2.60 (1.76)	1.27 (1.33)[bc]	0.80 (1.14)[abc]	0.87 (1.17)[bc]	2.93 (1.85)	1.10 (1.26)[bcd]	0.70 (1.09)[bcd]	0.57 (1.03)[bcd]	1.35
Spinosad 45 SC	2.73 (1.79)	1.07 (1.25)[a]	0.63 (1.06)[a]	0.57 (1.03)[a]	2.80 (1.82)	0.93 (1.20)[a]	0.47 (0.98)[a]	0.33 (0.91)[a]	1.19
Dimethoate 30% EC	3.00 (1.87)	1.53 (1.43)[e]	1.03 (1.24)[d]	1.13 (1.28)[d]	3.06 (1.89)	1.23 (1.32)[de]	0.77 (1.13)[de]	0.67 (1.08)[de]	1.55
Quinalphos 25% EC	2.73 (1.80)	1.43 (1.39)[de]	1.03 (1.24)[d]	1.10 (1.26)[d]	2.93 (1.85)	1.30 (1.34)[e]	0.87 (1.17)[e]	0.73 (1.11)[e]	1.51
Untreated control	2.8 (1.81)	2.86 (1.83)[f]	3.06 (1.89)[e]	3.0 (1.87)[e]	3.13 (1.90)	3.06 (1.89)[f]	3.13 (1.90)[f]	3.26 (1.94)[f]	3.03
SE.m ±	-	0.018	0.027	0.021	-	0.021	0.023	0.025	-
CD (p = 0.05)	NS	0.055	0.081	0.063	NS	0.063	0.070	0.076	-

DBS: Day before spray; DAS: Days after spray; Means followed by same letter in the column do not differ significantly (p = 0.05); Figures in the parentheses are $\sqrt{X+0.5}$ transformed value.

Table 2: Effect of new insecticide molecules against capsicum fruit borer and yield

Insecticides	Per cent reduction over control		Mean	Yield (kg/ ha)	Gross return	Net return	B:C ratio
	First spray	Second spray					
Emamectin benzoate 5 SG	69.61	77.96	73.78	27000[abc]	810000	651475	1:4.10
Imidacloprid 17.8 SL	59.49	67.84	63.66	27150[abc]	814500	655543	1:4.12
Lambda cyhalothrin 5% EC	68.43	76.96	72.69	24900[abc]	747000	588191	1:3.70
Thiomethoxam 25% WG	62.17	71.58	66.87	18900[cde]	567000	407789	1:2.56
Chlorantraniliprole 18.5% SC	72.01	78.61	75.31	23750[bcd]	712500	551491	1:3.42
Novaluron 10% EC	65.70	74.95	70.32	24900[abc]	747000	586387	1:3.65
Fipronil 5% SL	66.21	75.54	70.87	27750[ab]	832500	672095	1:4.18
Indoxacarb 14.5 SC	64.40	73.09	68.74	24500[abc]	735000	574461	1:3.57
Spinosad 45 SC	73.79	79.28	76.53	30050[a]	901500	740661	1:4.60
Dimethoate 30% EC	61.12	71.01	66.06	22250[bcd]	667500	508487	1:3.19
Quinalphos 25% EC	58.90	67.06	62.98	16300[de]	489000	329863	1:2.07
Untreated control	-	-	-	13500[e]	405000	246691	1:1.55
SE.m ±	-	-	-	0.17	-	-	-
CD (p = 0.05)	-	-	-	0.36	-	-	-