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EFFICACY OF NOVEL INSECTICIDES AGAINST SHOOT AND FRUIT BORER (*Earias vittella* Fabr.) IN OKRA CROP

Ram Singh Umrao[1]*, Siddarth Singh[1], Jitendra Kumar[2], D.R. Singh[1] and D.K. Singh[3]

[1]Department of Entomology; [2]EBR ; [3]Oil seed section

C.S. Azad University of Agriculture & Technology, Kanpur-208 002

ABSTRACT: Seven novel insecticides (imidacloprid, fipronil, indoxacarb, endosulfan, malathion, Roket and neemarin) with an untreated control were tested for minimizing Earias vittella infestation in okra crop. Three sprayings, first at 30 days after sowing and second and third subsequent sprayings at 15 days interval were done. Data were recorded on 10th day after each spraying. All the treatments were found effective in minimizing fruit infestation over control and indoxacarb was proved to be the best one among all the treatments. After 10th day of first, second and third spraying, infestation was 14.47, 2.68 and 5.68 per cent, respectively. While neemarin was lesser effective having higher fruit infestation of 47.38, 30.53 and 33.52 per cent, respectively over control after 10th day of first, second and third spraying. The yield of okra fruits showed that indoxacarb recorded the highest fresh fruit yield i.e. 7.00 kg per plot (58.33 q/ha) with 42.86 per cent increased yield as compared to control. While neemarin recorded minimum fresh fruit yield i.e. 5.27 kg per plot (43.89 q/ha) with 24.05 per cent increased fruit yield as compared with control.

Keywords : *Earias vittella, indoxacarb, neemarin, okra, new molecules.*

Okra (*Abelmoschus esculentus* L.) is known by various local names in different parts of the world and is often known as 'Lady's Finger'. Worldwide production of okra as fruit vegetable is estimated at six million tonnes per year. India ranks first in the world in its production from 0.35 million ha land (Anon., 2).

Among major insect-pests of okra crop, shoot and fruit borers (*Earias species*) are the most important causing up to 100 per cent damage of okra pods (Radhe and Undirwode, 5). A number of novel insecticides have recently been registered for insect control in agriculture. A major advantage of these new products is that they act on insect biological processes that humans do not experience, such as molting. Many also have greater selectivity to target specific species, so they are less likely to harm natural enemies when compared with the broad spectrum organo-phosphates, carbamate, neonicotinoids and pyrathroids insecticides. Such novel insecticides currently in use are four targeting lepidopteron pests, three targeting sucking insects, one specific to dipterans leaf-miners and one insect growth regulator that control a wide range of insects. One negative aspect of these insecticides is that because of their narrower range of activity controlling only a limited number of pests. Growers may need to apply additional pesticides for secondary pest groups that have poor biological control. Insecticidal resistance in key pests will continue to be a major impetus for adopting novel insecticides (Elizabeth *et al.,* 3).

MATERIALS AND METHODS

Investigation was planned on okra crop in the Horticultural Experimental Field, C.S. Azad University of Agriculture and Technology, Kanpur. The experiment was carried out from February to June 2011 cropping season in RBD with three replications with each plot size of 4m x 3m. The seven insecticides treatments along with one control (Table 1) were tested for their efficacy against shoot and fruit borer of okra.

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Table 1: Novel insecticides tested.

Imidacloprid	17.85 L	0.036%	2 ml/ltr
Indoxacarb	14.5 SC	0.007%	0.5 ml/ltr
Fipronil	5.00 SC	0.01%	2.0 ml/ltr
Neemarin	0.15%	0.0005%	3.0 ml/ltr
Rocket	44%	0.067%	1.5 ml/ltr
Endosulfan	35 EC	0.07%	2 ml/ltr
Malathion	50 EC	0.05%	1 ml/ltr
Control	-	-	-

Spraying of insecticides was done with the help of hand sprayer. Three sprayings were made on the crop, first at 30 days after sowing and two subsequent sprayings after 15 days intervals. Observations were recorded through simple random sampling (SRS) to assess the losses in field of okra due to infestation of shoot and fruit borer. Ten plants were randomly selected from each plot for picking of fruits. Observations on per cent infestation of fruits were recorded on each picking. All the pickings were combined to assess the fresh and infested fruits and average data was analyzed statistically.

RESULTS AND DISCUSSION

The effect of different treatments against shoot and fruit borer (*Earias vittella*) was assessed on the basis of per cent fruit infestation in all respective treatments. It is clear from Table 2 that the data after 10 days of first spraying showed that all the treatments were found significantly superior in controlling *Earias vittella* over control. The least fruit infestation 14.47 and 15.78 per cent were recorded in indoxacarb and imidacloprid with 74.33 and 72.01 per cent reduced fruit damage over control, respectively. Fipronil was found the next best with 21.11 per cent fruit damage and 62.56 per cent decreased damage over control. The spraying of endosulfan and malathion also gave 31.56 and 36.64 per cent infested fruit damage with 44.02 and 35.01 per cent reduction in fruit infestation as compared to control. Neemarin and Roket were least effective and recorded at par fruit infestation i.e. 47.38 and 47.79 per cent with 15.96 and 15.24 per cent reduced fruit damage over control (56.38 per cent).

The data after 10^{th} day of second spraying revealed that indoxacarb was found most effective over all other treatments as it recorded 2.68 per cent fruit damage and reduced 94.09 per cent damage in fruits as compared to control. Imidacloprid and fipronil were found the next best after indoxacarb with 10.76 and 15.34 per cent fruit damage with 76.29 and 66.20 per cent minimized damage over control. The spray of endosulfan, malathion and Roket were also found effective with 21.67, 24.69 and 26.60 per cent fruit damage and 25.27, 45.60 and 41.41 per cent reduced damage over control. Neemarin was found least effective with higher per cent of fruit damage (30.53%) and lowest decrease in infestation as compare to control 45.40 per cent.

The perusal of data (Table 3) showed that the observation after 10^{th} day of third and final spraying, indoxacarb was found most effective insecticide than all other treatments in minimizing the fruit infestation up to 5.68 per cent and showed 85.20 per cent decreased damage as compared to control. Imidacloprid and Fipronil were also found better with 10.33 and 11.65 per cent fruit damage and 73.08 and 69.65 per cent reduced infestation over control. The treatment with endosulfan, malathion and Roket were also effective which recorded 23.47, 25.34 and 32.36 per cent fruit infestation and 38.14, 33.98 and 15.68 per cent decreased fruit damage over control. Neemarin was found least effective and recorded 33.52 per cent fruit infestation and only 12.65 per cent reduction in infestation than control (38.38%).

These findings are in agreement with the reports of Patra *et al.* (4) who evaluated the efficacy of some new insecticides against okra shoot and fruit borer (Earias vittella) and found that application of indoxacarb showed 6.38 per cent damage and 92.8 quintal per hectare yield as compared to 25.1 per cent damage and 49.3 quintal yield per hectare in control. Ahmad *et al.* (1) had also found indoxacarb as a most effective insecticide over other insecticides.

Table 2: Per cent fruit infestation by *Earias vittella* after 10 days of first, second and third spraying on okra crop.

Treatment	First Spraying		Second Spraying		Third Spraying	
	Per cent fruit damage after 10 days	Reduction over control	Per cent fruit damage after 10 days	Reduction over control	Per cent fruit damage after 10 days	Reduction over control
Imidacloprid	15.78(23.405)	72.01	10.76 (19.14)	76.29	10.33 (18.74)	73.08
Fipronil	21.11(27.343)	62.56	15.34 (23.04)	66.20	11.65 (19.94)	69.65
Indoxacarb	14.47 (22.343)	74.33	2.68 (9.30)	94.09	5.68 (13.76)	85.20
Roket	47.79 (43.732)	15.24	26.60 (31.04)	41.41	32.36 (34.67)	15.68
Endosulfan	31.56 (34.178)	44.02	21.67 (27.74)	25.27	23.47 (29.15)	38.14
Malathion	36.64 (37.251)	35.01	24.69 (29.79)	45.60	25.34 (30.22)	33.98
Neemarin	47.38 (43.497)	15.96	30.53 (33.54)	32.75	33.52 (35.38)	12.65
Control	56.38 (51.257)	-	45.40 (42.36)	-	38.38 (38.28)	-
C.D. (P = 0.05)	1.4530		2.0452		1.286	

*The values given in parenthesis are transformed values.

Table 3: Fresh and damage fruit yield of okra from different treatments.

Treatment	Yield of Okra Fruits						Per cent fresh fruit increase in yield over control
	Damaged fruits		Fresh Fruits		Total fruit yield		
	Kg/plot	Q/ha	Kg/plot	Q/ha	Kg/plot	Q/ha	
Imidacloprid	0.73	6.11	6.47	53.89	7.20	59.976	38.14
Fipronil	0.90	7.49	6.10	50.83	7.00	58.31	34.43
Indoxacarb	0.67	5.55	7.00	58.33	7.67	63.86	42.86
Roket	1.07	8.89	5.77	48.05	6.83	56.92	30.64
Endosulfan	1.00	8.33	6.07	50.55	7.70	58.87	34.06
Malathion	1.07	8.89	6.03	50.28	7.10	59.14	33.70
Neemarin	1.50	12.49	5.27	43.89	6.77	56.37	24.05
Control	2.47	20.55	4.00	33.33	6.47	53.87	
CD (P=0.05)	0.29		0.92				

Yield of okra fruits (Table 3) showed that indoxacarb had recorded the highest fresh fruit yield i.e. 7.00 kg per plot with 42.86 per cent increased yield as compared with control. The treatments of imidacloprid and fipronil were also found effective and gave 6.47 kg and 6.10 kg per plot fresh fruit yield with 38.14 and 34.43 per cent increased yield over control. The spray of endosulfan, malathion and roket proved at par and produced 6.07, 6.03 and 5.77 kg per plot of fresh fruit yield and produced 34.06, 33.70 and 30.64 per cent increased yield over control. These findings are also coincides with the reports of Sinha and Nath (6) who worked on efficacy of insecticides against insect-pests of okra and found that indoxacarb and endosulfan were most effective in controlling fruit borer population and gave the maximum yield.

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