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Bio efficacy of newer insecticides against *S. litura* infesting soybean

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ABSTRACT

To test the bio-efficacy of different insecticides against *S. litura*, different seven insecticides were evaluated at Main Oilseed Research Station, Junagadh Agricultural University, Junagadh during *Kharif* 2021. The results of seven tested insecticides on *S. litura* after two sprays revealed that it can be effectively managed by spray application of chlorantraniliprole 10 + lambda cyhalothrin 5 (15 ZC 0.006%) with the lowest number of *S. litura* (0.87 larvae/plant), maximum yield (3002 kg/ha) and 43.77 per cent increase yield over control and a high net realization (59410 Rs./ha). While the treatments of chlorpyriphos 50 + cypermethrin 5 (55 EC 0.11%) and novaluron 5.25 + emamectin benzoate 0.9 (6.15 SC 0.009%) were next effective treatments over control.

Key words: Bio efficacy, *S. litura*, insecticidal treatment, soybean

1. INTRODUCTION

Soybean [*Glycine max* (L.) Merrill.] belonging to family Leguminosae, sub-family Papilionaceae, is one of the important oilseed cash crops of India. It is a unique crop with high nutritional value, thus it is also known as the “Miracle bean, Golden bean and Crop of the planet”. It provides 40% protein, well balanced in essential amino acids, 20% oil, rich in poly unsaturated fats especially Omega 6 and Omega 5 fatty acids, 6-7% total minerals, 5-6% crude fiber and 17-19% carbohydrates [3]. From the nutritional point of view, soybean contains 43.2% protein and 20.00% of edible oil and is also a good source of phosphorus and lecithin. It also contains a good amount of potassium, sulphur and vitamin E. Soybean protein is mainly rich in amino acids like leucine, methionine and threonine that the human body requires. For vegetarians, it is known as "Poor Man's Meat".

Soybean crop having luxuriant growth with succulent leaves attracts several insect pests for feeding, oviposition and shelter. About 65 species of insects have been reported to attack soybean from cotyledon to the harvesting stage in Karnataka [7]. Among the various insect pests reported in India the leaf eating caterpillar, *S. litura* is found to be the major one [2].

Spodoptera litura, otherwise known as the tobacco cutworm or cotton leafworm, is a nocturnal moth in the family Noctuidae. *S. litura* is a serious polyphagous pest in Asia, Oceania and the Indian subcontinent. *S. litura* is an economically important polyphagous pest in India and is considered one of the major threats to the present-day intensive agriculture and changing cropping patterns worldwide, next only to *Helicoverpa armigera* (Hubner). The pest occurs in India, Pakistan, Bangladesh, Sri Lanka, South East Asia, China, Korea, Japan, Philippines, Indonesia, Australia, Pacific Islands, Hawaii and Fiji [5].

The larvae of *S. litura* start eating leaves along the midrib and proceed gradually to the margins [4]. The grownup larvae feed for a short time on a lower surface of the leaf and migrate to the ground where they feed on young seedlings of many plant varieties [8].

2. MATERIALS AND METHODS

A field experiment to evaluate the efficacy of newer insecticides against soybean leaf eating caterpillar (*S. litura*) was conducted at Main Oilseeds Research Station, Junagadh Agricultural University, Junagadh during *kharif* season of 2021. Experiment was laid out in a Randomized Block Design (RBD) with seven treatments and three replications. The row to row distance was kept to be 45 cm and plant to plant distance is 10 cm.

2.1 Method of application of insecticides

All the insecticides were applied in the form of foliar spray with the help of a knapsack sprayer. Spray fluid was prepared by mixing a measured quantity of water and insecticides. All necessary care was taken to prevent the drift of insecticides to reach the adjacent plots. The first application was given at 45 days after sowing. Second spray was given at fifteen days interval.

2.2 Method of recording observations

2.2.1 Larval population

To evaluate the efficacy of different insecticides, observations on the larval population of *S. litura* were recorded from five randomly selected plants from each treatment before spraying and three, seven and ten days after each spray. Further, obtained data were converted into per cent reduction of *S. litura* population over control through the following formula [1].

$$\text{Per cent reduction over control} = 100 \times \frac{C - T}{C}$$

Where,
T = Population of *S. litura* (per plant) from treated plot
C = Population of *S. litura* (per plant) from control plot

2.2.2 Seed yield

With a view to ascertaining the effect of different treatments on yield, harvested soybean was weighted separately from each net plot area. Thus, the seed yield obtained from each net plot was converted on a hectare basis and subjected to statistical analysis. The per cent increase in yield over control can be calculated using the following formula [6].

$$\text{Yield increased over control} = \frac{T-C}{C} \times 100$$

Where,
T= Yield of respective treatment (kg/ha)

C= Yield of control (kg/ha)

3. RESULTS AND DISCUSSION

3.1 First spray

The results based on the mean *S. litura* population are presented in Table 1. It indicated that all the experimental plots showed non-significant variation with respect to the mean *S. litura* population before spraying and *S. litura* population ranged from 2.03 to 2.67.

The *S. litura* population after 3 days of application revealed that in all the treatments *S. litura* population reduced significantly over control. Treatment of chlorantraniliprole 10 + lambda cyhalothrin 5 (15 ZC 0.006%) and chlorpyriphos 50 + cypermethrin 5 (55 EC 0.11%) recorded the significantly lowest larval population of 2.03 larva per plant which was at par with novaluron 5.25 + emamectin benzoate 0.9 (6.15 SC 0.009%) and thiamethoxam 12.6 + lambda cyhalothrin 9.5 (22.10 ZC 0.011%) which registered a larval population of 2.30 and 2.53 larva per plant, respectively. The treatment with novaluron 5.25 + indoxacarb 4.5 (9.75 SC 0.015%), beta-cyfluthrin 8.49 + imidacloprid 19.81 (27.98 OD 0.028%) and profenofos 40 + cypermethrin 4 (44 EC 0.088%) were found comparatively less effective against the pest as they recorded the mean larval population of 2.73, 2.77 and 2.90 larva per plant, respectively. Highest larval population was recorded from untreated plot with 3.37 larva per plant. More or less same trends of efficacy were observed after 7 and 10 days of application as well as pooled over first spray.

The data on the per cent reduction over control revealed that highest reduction (60.16%) of *S. litura* was observed in the treatment of chlorantraniliprole 10 + lambda cyhalothrin 5 (15 ZC 0.006%) followed by chlorpyriphos 50 + cypermethrin 5 (55 EC 0.11%) and novaluron 5.25 + emamectin benzoate 0.9 (6.15 SC 0.009%) with 53.20 and 49.02 per cent reduction over control. However, lowest per reduction (24.51 and 16.43%) of *S. litura* was recorded in novaluron 5.25 + indoxacarb 4.5 (9.75 SC 0.015%) and profenofos 40 + cypermethrin 4 (44 EC 0.088%).

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Table 1: Bio efficacy of newer insecticides against *S. litura* infesting soybean (first spray)

Sr. No.	Treatment	Concentration (%)	Mean number of larva per plant					Per cent reduction over control
			Before spray	Days after spraying			Pooled over period	
				3	7	10		
1	Chlorantraniliprole 10 + Lambda cyhalothrin 15 ZC	0.006	1.59 (2.03)	1.58 (2.03)	1.22 (1.00)	1.25 (1.07)	1.35 (1.36)	62.11
2	Novaluron 5.25 + Emamectin benzoate 6.15 SC	0.009	1.75 (2.37)	1.67 (2.30)	1.40 (1.47)	1.42 (1.53)	1.49 (1.76)	50.97
3	Chlorpyriphos 50 + Cypermethrin 55 EC	0.110	1.53 (1.87)	1.59 (2.03)	1.37 (1.37)	1.39 (1.45)	1.45 (1.61)	55.15
4	Novaluron 5.25 + Indoxacarb 9.75 SC	0.015	1.61 (2.17)	1.80 (2.73)	1.76 (2.60)	1.77 (2.63)	1.77 (2.65)	26.18
5	Thiamethoxam 12.6 + Lambda cyhalothrin 22.10 ZC	0.011	1.66 (2.27)	1.74 (2.53)	1.55 (1.90)	1.56 (1.93)	1.61 (2.12)	40.94
6	Profenofos 40 + Cypermethrin 44 EC	0.088	1.68 (2.33)	1.83 (2.90)	1.78 (2.70)	1.79 (2.73)	1.80 (2.77)	22.84
7	Beta-cyfluthrin 8.49 + Imidacloprid 27.98 OD	0.028	1.64 (2.20)	1.80 (2.77)	1.57 (2.00)	1.59 (2.03)	1.65 (2.26)	37.04
8	Control	-	1.78 (2.67)	1.97 (3.37)	2.00 (3.57)	2.06 (3.83)	2.01 (3.59)	-
	S. Em. ±	T	**0.09**	**0.07**	**0.07**	**0.08**	**0.02**	-
		P	-	-	-	-	**0.04**	-
		T x P	-	-	-	-	**0.07**	-
	C.D. at 5%	T	**NS**	**0.218**	**0.210**	**0.231**	**0.07**	-
		P	-	-	-	-	**0.12**	-
		T x P	-	-	-	-	**NS**	-
	C.V. (%)	-	**11.37**	**8.42**	**10.02**	**10.49**	**8.37**	-

Figures in parenthesis are original values, while outsides are square root transformed values.

NS: Non-significant

3.2 Second spray

The results based on the mean *S. litura* population are presented in Table 2. It indicated that all the experimental plots showed non-significant variation with respect to the mean *S. litura* population before spraying and *S. litura* population ranged from 1.43 to 3.97.

Table 2: Bio efficacy of newer insecticides against *S. litura* infesting soybean (second spray)

Sr. no.	Treatment	Concentration (%)	Mean number of larva per plant					Per cent reduction over control
			Before spray	Days after spraying			Pooled over period	
				3	7	10		
1	Chlorantraniliprole 10 + Lambda cyhalothrin 15 ZC	0.006	1.32 (1.43)	1.21 (1.10)	1.12 (0.83)	1.07 (0.70)	1.13 (0.87)	78.67
2	Novaluron 5.25 + Emamectin benzoate 6.15 SC	0.009	1.50 (1.77)	1.41 (1.50)	1.32 (1.23)	1.24 (1.03)	1.32 (1.25)	69.36
3	Chlorpyriphos 50 + Cypermethrin 55 EC	0.110	1.49 (1.73)	1.40 (1.47)	1.31 (1.23)	1.22 (1.00)	1.25 (1.23)	69.85
4	Novaluron 5.25 + Indoxacarb 9.75 SC	0.015	1.82 (2.83)	1.79 (2.70)	1.78 (2.67)	1.65 (2.23)	1.74 (2.54)	37.74
5	Thiamethoxam 12.6 + Lambda cyhalothrin 22.10 ZC	0.011	1.75 (2.57)	1.73 (2.50)	1.70 (2.40)	1.50 (1.76)	1.64 (2.22)	45.58
6	Profenofos 40 + Cypermethrin 44 EC	0.088	1.88 (3.07)	1.80 (2.77)	1.79 (2.70)	1.77 (2.67)	1.78 (2.71)	33.57
7	Beta-cyfluthrin 8.49 + Imidacloprid 27.98 OD	0.028	1.76 (2.60)	1.74 (2.53)	1.72 (2.47)	1.62 (2.13)	1.69 (2.37)	41.91
8	Control	-	2.11 (3.97)	2.13 (4.07)	2.13 (4.08)	2.14 (4.10)	2.13 (4.08)	-
	S. Em. +	T	**0.09**	**0.09**	**0.08**	**0.07**	**0.03**	-
		P	-	-	-	-	**0.04**	-
		T x P	-	-	-	-	**0.07**	-
	C.D. at 5%	T	**0.275**	**0.262**	**0.240**	**0.207**	**0.09**	-
		P	-	-	-	-	**0.12**	-
		T x P	-	-	-	-	**NS**	-
	C.V. (%)		**11.73**	**11.55**	**10.89**	**9.90**	**8.71**	-

Figures in parenthesis are original values, while outsides are square root transformed values.

NS: Non-significant

The *S. litura* population after 3 days of application revealed that in all the treatments *S. litura* population reduced significantly over control. Treatment of chlorantraniliprole 10 + lambda cyhalothrin 5 (15 ZC 0.006%) recorded significantly lowest larval population of *S. litura* (1.10 larva per plant) at three days after spraying which was at par with chlorpyriphos 50 + cypermethrin 5 (55 EC 0.11%) and novaluron 5.25 + emamectin benzoate 0.9 (6.15 SC 0.009%) as they were recorded larval population of 1.47 and 1.50 larva per

plant, respectively. Thiamethoxam 12.6 + lambda cyhalothrin 9.5 (22.10 ZC 0.011%) and beta-cyfluthrin 8.49 + imidacloprid 19.81 (27.98 OD 0.028%) were next in order with 2.50 and 2.53 larva per plant, respectively. Treatments of novaluron 5.25 + indoxacarb 4.5 (9.75 SC 0.015%) and profenofos 40 + cypermethrin 4 (44 EC 0.088%) remained least effective among all other insecticides evaluated with larval population of 2.70 and 2.77 larva per plant, respectively. However, untreated plot recorded the highest larval population of 4.07 larva per plant. More or less same trends of efficacy were observed after 7 and 10 days of application as well as pooled over second spray.

The data on the per cent reduction over control showed that highest reduction (78.67%) of *S. litura* was observed in the treatment of chlorantraniliprole 10 + lambda cyhalothrin 5 (15 ZC 0.006%) followed by chlorpyriphos 50 + cypermethrin 5 (55 EC 0.11%) and novaluron 5.25 + emamectin benzoate 0.9 (6.15 SC 0.009%) with 58.06 and 70.34 per cent reduction over control. However, lowest per reduction (37.74 and 33.57%) of *S. litura* was recorded in novaluron 5.25 + indoxacarb 4.5 (9.75 SC 0.015%) and profenofos 40 + cypermethrin 4 (44 EC 0.088%).

During present study it was found that the chronological order of effectiveness of different insecticidal treatments based on larval population was chlorantraniliprole 10 + lambda cyhalothrin 5 (15 ZC 0.006%) > chlorpyriphos 50 + cypermethrin 5 (55 EC 0.11%) > novaluron 5.25 + emamectin benzoate 0.9 (6.15 SC 0.009%) > thiamethoxam 12.6 + lambda cyhalothrin 9.5 (22.10 ZC 0.011%) > beta-cyfluthrin 8.49 + imidacloprid 19.81 (27.98 OD 0.028%) > novaluron 5.25 + indoxacarb 4.5 (9.75 SC 0.015%) > profenofos 40 + cypermethrin 4 (44 EC 0.088%).

4. CONCLUSIONS

It can be concluded that among the seven different insecticidal treatments, chlorantraniliprole 10 + lambda cyhalothrin 5 (15 ZC 0.006%) was somewhat costly but found the most effective treatment against *S. litura* with lowest number of *S. litura* (0.80 larva/plant), maximum yield (3002 kg/ha) and 43.77 per cent increase yield over control and a high net realization (59410 Rs./ha). While the treatments chlorpyriphos 50 + cypermethrin 5 (55 EC 0.11%) and novaluron 5.25 + emamectin benzoate 0.9 (6.15 SC 0.009%) were next effective treatments over control.

5. ACKNOLEDMENT

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