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Bio-efficacy of Chemical Insecticides Against *Spodoptera litura* Infesting Soybean

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Abstract: The bio-efficacy of chlorantraniliprole, quinolphos, lamda cyhalothrin, diflubenzuron, endosulfan, triazophos and indoxacarb were evaluated against tobacco leaf eating caterpillar *Spodoptera litura* infesting soybean. The soybean was sprayed twice with respective insecticides at 10 days interval starting from 35 days after germination. The experimental studies revealed that, the larval population of leaf eating caterpillar was significantly reduced by the treatment of quinolphos 25 EC @ 1000 $ml.ha^{-1}$ followed by endosulfan 35 EC @ 1000 $ml.ha^{-1}$ and lambda cyhalothrin 5 EC @ 300 $ml.ha^{-1}$, which were at par with each other. Highest yield was recorded with the treatment of lambda cyhalothrin 5 EC @ 300 ml ha^{-1} (2500 $kg.ha^{-1}$) followed by triazophos 40 EC @ 800 $ml.ha^{-1}$ (2451 $kg.ha^{-1}$), diflubenzuron 25 WP @ 400 $g.ha^{-1}$ (2400 $kg.ha^{-1}$).

Keywords: *Spodoptera litura*, Soybean, Insecticides

1. Introduction

Soybean is a unique crop with high nutritional value, providing 40% protein and 20% edible oil, besides minerals and vitamins. It is playing an important role in augmenting both the production of edible oil and protein simultaneously under the circumstances in which the shortage of these commodities are being by experienced by people. It also supports many industries; soybean oil is used as raw material in manufacturing of antibiotics, paints, varnishes, adhesive, lubricants, etc. Soybean meal is used as protein supplement in human diet, cattle and poultry feed [1]. Soybean is reported to be attacked by 273 species of insects [2] and in India 20 insect pest species have been recorded infesting soybean crop [3]. Some common insect pest complex infecting soybean crops are green semilooper, tobacco leaf eating caterpillar, white fly, girdle beetle etc. [4]. Taking in consideration the seriousness of the pest infestation and damage to soybean crop, the present study was undertaken to manage the pest with the help of chemical insecticides and to know the suitable control measure for the management of the pest.

2. Material and Methods

Field experiment was conducted during *kharif* season of 2011 at the farm of All India Co-ordinated Research Project on Soybean, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani (Maharashtra), India. All the recommended cultural and agronomical practices were carried out to raise a good crop. The experiment was laid out in Randomised Block Design (RBD) replicated triple with gross plot size 4.00 m × 3.60 m. and net plot size 3.00 m × 3.00 m. The soybean variety MAUS-158 was sown at a spacing 45 cm × 5 cm. The crop was sprayed with respective insecticide at an interval of 10 days starting from 35 days after germination.

2.1. Treatment Details

T_1- Chlorantraniliprole 20 SC 40 g $a.i.ha^{-1}$
T_2- Quinalphos 25EC 250 g $a.i.ha^{-1}$
T_3- Lambda cyhalothrin 5 EC 15 g $a.i.ha^{-1}$
T_4- Diflubenzuron 25 WP100 g $a.i.ha^{-1}$
T_5- Endosulfan 35 EC 350 g $a.i.ha^{-1}$
T_6- Triazophos 40 EC 320 g $a.i.ha^{-1}$

T_7- Indoxacarb 14.5 SL 72.5 g a.i.ha^{-1}
T_8 - Untreated control.

2.2. Statistical Analysis

The per cent infestation of *Spodoptera litura* was calculated and subjected to angular transformation. The average number of *Spodoptera* larvae per plant was worked out and transferred by using Poisson formula $\sqrt{x + 0.5}$ before analysis. The data pertaining to infestation, larval count, after their transformation were statistically analysed by standard analysis of variance method [5].

3. Result and Discussion

3.1. Efficacy of Chemical Insecticides on Larval Population of S. litura After First Spraying

The data from the Table 1 revealed that per cent infestation of *Spodoptera* larvae were observed in the range of 7.54 to 9.90 before first spraying and no significant differences were found in all the treatments. After 3 days of first spraying the insecticidal treatments were significantly superior in reducing larval population over untreated control. The treatment (T_2) quinalphos 25 EC @ 1000 ml.ha^{-1} recorded lowest infestation (6.26%) followed by (T_5) endosulfan 35 EC @ 1000 ml ha^{-1} (6.54%), (T_3) lambda cyhalothrin 5 EC @ 300 ml ha^{-1} (6.73%), (T_4) diflubenzuron 25 WP @ 400 ml.ha^{-1} (6.75%), (T_1) chlorantraniliprole 20 SC @ 200 ml.ha^{-1} (6.89%), (T_6) triazophos 40 EC @ 800 ml.ha^{-1} (6.96%) and (T_7) indoxacarb 14.5 SL @ 500 ml.ha^{-1} (7.09%) which were at par with each other. The highest infestation was observed with the treatment T8 untreated control (8.71%). Similar trend of results were observed after 7th and 10th day of first spraying as observed in after 3 days of first spraying and all the insecticidal treatments were found significantly superior over untreated control.

Table 1. *Efficacy of chemical insecticides against Spodoptera litura and its effect on seed yield of soybean crop.*

Treatments		Infestation of *Spodoptera* larvae (%) (days after second spraying)				Infestation of *Spodoptera* larvae (%) (days after second spraying)				Seed Yield kg.ha^{-1}
		1 Day before	3 DAS	7 DAS	10 DAS	1 Day before	3 DAS	7 DAS	10 DAS	
T_1	Chlorantraniliprole 20 SC	8.74 (17.18)	6.89 (15.21)	6.55 (14.82)	6.42 (14.67)	7.47 (15.85)	4.77 (12.61)	4.55 (12.31)	4.22 (11.85)	1670
T_2	Quinalphos 25 EC	7.54 (15.93)	6.26 (14.48)	6.01 (14.16)	5.87 (14.00)	6.57 (14.80)	4.45 (12.17)	4.01 (11.55)	3.92 (11.41)	1570
T_3	Lambda cyhalothrin 5 EC	8.89 (17.34)	6.73 (15.03)	6.77 (15.07)	6.41 (14.65)	7.98 (16.40)	4.62 (12.40)	4.77 (12.61)	4.14 (11.73)	2500
T_4	Diflubenzuron 25 WP	8.96 (17.37)	6.75 (15.04)	6.11 (14.30)	6.92 (15.24)	7.69 (16.09)	4.88 (12.75)	4.11 (11.69)	4.29 (11.95)	2400
T_5	Endosulfan 35 EC	7.79 (16.13)	6.54 (14.81)	6.05 (14.23)	6.07 (14.26)	6.70 (14.99)	4.57 (12.34)	4.05 (11.60)	4.00 (11.53)	1730
T_6	Triazophos 40 EC	9.27 (17.72)	6.96 (15.28)	6.61 (14.89)	6.74 (15.04)	8.22 (16.59)	4.69 (12.50)	4.61 (12.38)	4.47 (12.19)	2451
T_7	Indoxacarb 14.5 SL	7.93 (16.31)	7.09 (15.43)	6.60 (14.88)	6.33 (14.56)	6.89 (15.21)	4.90 (12.77)	4.60 (12.30)	4.30 (11.96)	1930
T_8	Untreated	9.90 (18.33)	8.71 (17.15)	8.56 (17.00)	8.34 (16.78)	8.90 (17.31)	5.75 (13.87)	5.66 (13.74)	5.49 (13.54)	802
	S. E.(m) ±	0.67	0.32	0.20	0.23	0.66	0.23	0.41	0.23	110.24
	C. D. at 0.05%	N. S.	0.97	0.62	0.72	N. S.	0.70	1.26	0.69	313.37

* Figures in parentheses are angular transformed values

3.2. Efficacy of Chemical Insecticides on Larval Population of S. litura After Second Spraying

There were no significant differences were found amongst all the treatments including control before 1 day of second spraying. The results obtained in 3rd, 7th and 10th days after second spraying that all the treatments were found significantly superior over control in reducing the per cent infestation of *Spodoptera* larvae (Table 1). Data regarding observations on 3 days after second spraying treatment (T_2) quinalphos 25 EC @ 1000 ml.ha^{-1} recorded lowest per cent infestation (4.45) followed by (T_5) endosulfan 35 EC @ 1000 ml.ha^{-1} (4.57%), T_3, T_6, T_1, T_4 and T_7 which were at par with each other. All the insecticidal treatments were significantly superior over untreated control (5.75%). The results obtained from 7 days after second spraying recorded that, (T_2) quinalphos 25 EC @ 1000 ml.ha^{-1} was most effective and was significantly superior over all the rest treatments followed by (T_5) endosulfan 35 EC 1000 ml ha^{-1}, T_5, T_4, T_7, T_1, T_6 and T_3 which were at par with each other. All the insecticidal treatments were significantly superior over untreated control (5.66%). Ten days after second spraying treatment (T_2) quinalphos 25 EC 1000 ml.ha^{-1}was significantly superior over all the treatments followed by (T_5) endosulfan 35 EC @ 1000 ml.ha^{-1}, T_3, T_1, T_4 and T_7 which were at par with each other. Also, all the treatments were found significantly superior over untreated control (5.49%).

Maximum protection and reduction in leaf damage was found with the insecticidal treatment of profenophos 0.1% [6] while flubendiamide 480 SC 0.2 ml lit^{-1}, most effective in managing leaf eating caterpillar [7]. [8] Evaluated the various insecticides against *S. litura* and found chlorantraniliprole 30 g a.i. ha^{-1}, methomyl300 g a.i. ha^{-1} and spinosad 75 g a.i. ha^{-1} were most effective insecticides in protecting the soybean crop from infestation of *S. Litura.* Flubendiamide 480 SC @ 200 $ml.ha^{-1}$ was the superior treatment and recorded minimum population of *S. litura* (0.30 larva $plant^{-1}$) and also relatively safe to natural enemies [9] [10] while [11] evaluated all IPM techniques *viz.,* trap cropping, inter cropping, bird perches and IPM modules were superior over control. [12] Evaluated insecticides like quinolphos, chlorpyriphos, carbonyl, methomyl and found effective in reduction of larval population of leaf eating caterpillar. [13] Evaluated seven insecticides and recorded emamectin benzoate 5 SG significantly highest per cent larval reduction over rest of the treatment.

3.3. Yield

Highest yield was obtained from the experimental plots treated with T_3 lambda cyhalothrin 5 EC @ 300 ml ha^{-1} (2500 $kg.ha^{-1}$) followed by T_6 triazophos 40 EC @ 800 ml ha^{-1} (2451 $kg.ha^{-1}$), diflubenzuron 25 WP @ 400 g $ml.ha^{-1}$ (2400 $kg.ha^{-1}$), Indoxacarb 14.5 SL @ 500 $ml.ha^{-1}$ (1930 $kg.ha^{-1}$), endosulfan 35 EC @ 1000 $ml.ha^{-1}$ (1730 $kg.ha^{-1}$), chlorantraniliprole (E2Y45) @ 200 $ml.ha^{-1}$ (1670 $kg.ha^{-1}$). The lowest yield (807 $kg.ha^{-1}$) was reported in untreated control.

[14] Reported that, the highest yield was obtained from experimental plots treated with chlorpyrifos 20 EC and triazophos 40 EC. [15] Reported maximum yield in the experimental plots treated with lambda cyhalothrin 5 EC and triazophos 40 EC @ 0.8 $lit.ha^{-1}$. [6] Recorded highest grain yield with the treatment of profenophos 0.1% while [7] and [9] recorded highest seed yield with the treatment of flubendiamide 480 SC followed by indoxacarb and lamda cyhalothrin.

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