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Evaluation of different insecticides against defoliator pests of soybean

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Abstract
In present studies efficacy of different insecticides against defoliators of soybean are evaluated, six insecticides are applied in plots of size 20m^2 under Randomized Block Design having 7 treatments and 3 replications. After 1st spray the lowest population of tobacco caterpillar was found in Alphacypermethrin (0.09) followed by Teflubenzuron (0.10), Chlorantraniliprole (0.10), Profenophos (0.36) and Indoxacarb (0.97). Lowest population was found in the control plot (0.05) however, in the 2nd spray the lowest population of tobacco caterpillar seen in Chlorantraniliprole (0.08) followed by Teflubenzuron (0.11), Alphacypermethrin (0.14), Profenophos (1.25) and Indoxacarb (1.41). Highest population of tobacco caterpillar was found in untreated plot (0.20). The effect of different insecticides are evaluated to check the mean population of defoliators in which Alphacypermethrin @ 300 ml/ha was most effective for tobacco caterpillar, whereas Teflubenzuron @ 200 ml/ha was moderately effective for green semilooper and whitefly, and Chlorantraniliprole @ 150 ml/ha was effective against thrips and jassids. The insecticides Indoxacarb @ 333 ml/ha and Profenophos @ 1000 ml/ha was moderately effective on these insect pest of soybean whereas Triazophos @ 1000 ml/ha was least effective.

Keywords: Soybean, indoxacarb, tobacco caterpillar, cypermethrin, profenophos

Introduction
Soybean is recognized as one of the premier crops around the world. It's a major source of vegetable oil, protein and animal feed. Due to high protein content (>40%) and high oil content (>20%), as it contains 26.5% carbohydrate, 5.5% minerals and 2% Phospholipids. Soybean is considered to be an important food commodity. Soybean is the major *kharif* crop of Madhya Pradesh, which contributes 59.3 and 60.2 percent in total area and production of the country, respectively and is called "Soya state" (Anonymous, 2009) [1]. Among the various factors responsible for low yield, the insect pests have been considered to be of prime importance. To overcome such problems newer insecticides are needed to be included to try their efficacy and economy against the insect pests *viz*; Green Semilooper (*Chrysodeixis acuta* Walker), Tobacco Caterpillar (*Spodoptera litura* Fabricius) Raghuwanshi, 2008) [10].

Material and Methods
Experimental details
Design: Randomized Block Design
Treatment: 7
Replication: 3
Spacing: 30 cm row length
Plot size: 4mx5m.
Variety: JS97-52

Details of different insecticides for insect pests of soybean

Sl. No.	Insecticides	Formulations	Dose (ml//ha)
1.	Teflubenzuron	150SC	200
2.	Alfacypermethrin	10SC	300
3.	Trizophos	40EC	1000
4.	Indoxacarb	15.8EC	333
5.	Chlorantraniliprole	18.5EC	150
6.	Profenophos	50EC	1000
7.	Control	-	-

Before 24 hrs of spray pre-treatment observation of insect population was recorded, After 1, 3, 7 and 10 days of spray post treatment observation was taken in which larval population was counted in one meter row length was observed.

Result and Discussion

It was observed that soybean crop was heavily attacked by soybean defoliators. After pre and post treatment of the present investigation, the bioefficacy of different insecticides against soybean defoliators are elucidated. There were significant differences among the treatments.

Efficacy of different insecticides were tested in randomized block design with seven treatments including untreated control. Two sprays of insecticide were scheduled at incidence and 30 days after the first spray. Observation was recorded one day before of the treatments application, and thereafter 1, 3, 7, 5 and 10 days after application. The experiment was carried out in soybean crop of variety JS-97-52 during *Kharif*, 2018.

(1) Effect of insecticides against Tobacco caterpillar

Before first application of insecticides the mean population of tobacco caterpillar before insecticide spray was 0.27 to 0.57 and there was no significant difference among the treatments. However, after the application of insecticides, a significance variation in the mean population was recorded after 1,3,5,7 and 10 DAS.

In the 1st spray the lowest population of tobacco caterpillar was found in Alphacypermethrin (0.09) which is more effective than Teflubenzuron (0.10) followed by Chlorantraniliprole (0.10), Profenophos (0.36), Indoxacarb (0.97) and by Trizophos (1.49). Lowest population was found in the control plot (0.05) as well as in the 2nd spray the lowest population of tobacco caterpillar seen in Chlorantraniliprole (0.08) that was more effective than Teflubenzuron (0.11) and followed by Alphacypermethrin (0.14), Profenophos (1.25), Indoxacarb (1.41), Trizophos (2.19). Highest population of tobacco caterpillar was found in untreated plot (0.20).

Lakshmi Narayanamma *et al*., (2013) [5] reported that among different newer insecticide molecules tested against *S. litura*, Chlorantraniliprole 18.5 SC were found more effective in reducing the larval populations. (Hanumantharaya *et al.*, 2013) [3] reported that mean fruit borer population in tomato was significantly lower in chlorantraniliprole 20 EC @ 0.2 ml/lit with 0.14 larva/plant followed by profenophos 50 EC @ 2 ml/lit with 0.20 larvae/plant.

Kumar *et al.*, (2013) [11] tested indoxacarb@ 0.0029% against *S. litura* in soybean field experiment at Instructional Farm, College of Agriculture, Junagadh during *Kharif* 2009 were found to be most effective. (Natikar *et al.*, 2016) [7] reported that indoxacarb 15.8 EC @ 0.3 ml/lit recorded grain yield of (2217.33 kg/ha) and cyantraniliprole 10 OD @ 0.2 ml/lit recorded grain yield of (2053.33 kg/ha) was found reducing the larval population in soybean crop.

Joshi and Patel, (2011) [4] conducted trail with eco-friendly approach for the management of *S. litura* on soybean and the results revealed that, the data on mortality of leaf eating caterpillar indicated that triazophos @ 0.06% gave highest mortality (93.44 %).

Pinto *et al.*, (2011) [12] tested in there research presented high efficacy of insecticides on the control of *Pseudoplusia includens* in the soybean culture. The mixture of alphacypermethrin and teflubenzuron at dosages from 9.0 to 11.25 g a.i. ha-1, teflubenzuron at dosage from 6 to 12 g a.i. ha-1, and the mixture of profenophos and lufenuron @75.0 and 7.5 g a.i/ha were tested. All these insecticides after 15 days of application promote 100% dead caterpillars. None of these insecticides decrease soybean yield.

Table 1: Effect of different insecticides on *S. litura* after 1st spray.

Treatments	Mean population of *S. litura* larvae /plant						Overall mean larval population /mrl
		Days after sowing					
	Pretreatment	1	3	5	7	10	
Teflubenzuron 150SC	0.30 (1.14)	0.07 (1.03)	0.10 (1.04)	0.03 (1.01)	0.17 (1.08)	0.13 (1.06)	0.10
Alphacypermethrin 10SC	0.33 (1.15)	0.07 (1.03)	0.10 (1.58)	0.03 (1.01)	0.17 (1.08)	0.10 (1.04)	0.09
Triazophos 40EC	0.33 (1.15)	1.57 (1.6)	1.50 (1.58)	1.40 (1.54)	1.50 (1.58)	1.50 (1.58)	1.49
Indoxacarb 15.8EC	0.30 (1.14)	1.03 (1.4)	0.73 (1.30)	1.03 (1.40)	1.03 (1.40)	1.03 (1.40)	0.97
Chlorantraniliprole 18.5EC	0.57 (1.25)	0.07 (1.03)	0.07 (1.03)	0.07 (1.03)	0.17 (1.08)	0.13 (1.06)	0.10
Profenophos 50EC	0.27 (1.12)	0.23 (1.10)	0.20 (1.09)	0.90 (1.37)	0.27 (1.12)	0.20 (1.09)	0.36
Control	2.00 (1.17)	0.00 (1)	0.00 (1)	0.00 (1)	0.27 (1.12)	0.00 (1)	0.05
SEm±	0.06	0.06	0.04	0.07	0.06	0.07	0.06
CD at 5%	0.20	0.21	0.14	0.23	0.21	0.21	-

Table 2: Effect of different insecticides on *S. litura* after 2nd spray.

Treatments	Mean population of *S. litura* larvae /plant						Overall mean larval population /mrl
		Days after sowing					
	Pretreatment	1	3	5	7	10	
Teflubenzuron 150SC	0.67 (1.28)	0.07 (1.03)	0.07 (1.03)	0.07 (1.03)	0.27 (1.12)	0.07 (1.03)	0.11
Alphacypermethrin 10SC	1.20 (1.42)	0.33 (1.15)	0.03 (1.04)	0.07 (1.75)	0.20 (1.09)	0.07 (1.03)	0.14
Triazophos 40EC	2.67 (1.81)	2.20 (1.77)	2.17 (1.77)	2.10 (1.75)	2.20 (1.78)	2.30 (1.81)	2.19
Indoxacarb 15.8EC	3.07 (1.96)	1.20 (1.45)	1.50 (1.58)	1.70 (1.64)	1.37 (1.51)	1.27 (1.48)	1.41
Chlorantraniliprole 18.5EC	3.93 (2.01)	0.10 (1.07)	0.07 (1.03)	0.07 (1.03)	0.07 (1.03)	0.10 (1.04)	0.08
Profenophos 50EC	2.40 (1.78)	1.37 (1.53)	1.23 (1.04)	1.30 (1.51)	1.20 (1.48)	1.13 (1.44)	1.25
Control	2.27 (1.77)	0.33 (1.15)	0.00 (1)	0.13 (1.06)	0.27 (1.12)	0.27 (1.12)	0.20
SEm±	0.36	0.10	0.06	0.03	0.09	0.10	0.076
CD at 5%	N/A	0.33	0.19	0.10	0.28	0.32	-

(2) Effect of insecticides against Green semilooper:

Before first application of insecticides the mean population of green semilooper before insecticide spray was 0.27 to 0.47 and there was no significant difference among the treatments. However, after the application of insecticides, a significance variation in the mean population was recorded after 1,3,5,7 and 10 DAS.

In the 1st spray the lowest population of Green semilooper was found in Teflubenzuron (0.06) which is more effective than Alphacypermethrin (0.066) as followed by Chlorantraniliprole (0.1) as followed by Profenophos (0.14) as followed by Trizophos (0.35) as followed by Indoxacarb (0.68). Highest population was found in the control plot (0.77). As well as in the 2nd spray the lowest population of Green semilooper seen in Teflubenzuron (0.06) that is more effective than Chlorantraniliprole (0.06) as followed by Alphacypermethrin (0.07) as followed by Profenophos (0.2) as followed by Indoxacarb (0.2) as followed by Trizophos (0.44). Highest population of Green semilooper was found in untreated plot (0.19).

Bhardwaj *et al.* (2018) [8] The result revealed that the maximum reduction in population was noticed in alphamethrin 10 EC (79.41%), trizophos 40EC (78.37%), and profenphos 50 EC (77.18%). (Kalyan and Ameta, 2016) studied two sprays given in the soybean, of which first spray was given against semilooper and girdle beetle at 35 days after germination (DAG) and second spray was given at 55 DAG against gram pod borer and tobacco caterpillar. The highest reduction in the larval population of semilooper and girdle beetle was recorded in case of Profenophos 50 EC at 3 and 5 (DAS). It was followed by triazophos 40 EC against semilooper and girdle beetle.

Watti and Deotale, (2015) [6] was found statistically significant result. However, The minimum cumulative average number of semilooper larvae (0.12/mrl) was recorded in Indoxacarb 15.8 EC @ 0.60 ml/l (T5).

Pinto *et al.*, (2011) [12] tested in there research presented high efficacy of insecticides on the control of *Pseudoplusia includens* in the soybean culture. Teflubenzuron at dosage from 6 to 12 g a.i.ha-1, and the mixture profenophos and lufenuron at dosage 75.0 and 7.5 g a.i.ha-1, respectively. All these insecticides after 15 days of application promote 100% dead caterpillars. None these insecticides decrease soybean yield.

Table 3: Effect on different insecticides against green semilooper after 1st spray.

Treatments	Mean population of *C. acuta* larvae /plant						Overall mean larval population /mrl
		Days after sowing					
	Pretreatment	1	3	5	7	10	
Teflubenzuron 150SC	0.43 (1.19)	0.07 (1.03)	0.03 (1.01)	0.1 (1.03)	0.07 (1.03)	0.03 (1.01)	0.06
Alphacypermethrin 10SC	0.33 (1.15)	0.03 (1.0)	0.03 (1.01)	0.1 (1.03)	0.1 (1.04)	0.07 (1.03)	0.066
Triazophos 40EC	0.27 (1.12)	0.33 (1.15)	0.33 (1.15)	0.45 (1.03)	0.3 (1.13)	0.37 (1.16)	0.35
Indoxacarb 15.8EC	0.27 (1.12)	0.1 (1.04)	0.13 (1.06)	0.15 (1.04)	0.17 (1.08)	0.13 (1.06)	0.68
Chlorantraniliprole 18.5EC	0.53 (1.23)	0.03 (1.01)	0.07 (1.03)	0.1 (1.03)	0.07 (1.03)	0.03 (1.01)	0.1
Profenophos 50EC	0.47 (1.20)	0.1 (1.08)	0.1 (1.04)	0.2 (1.06)	0.13 (1.06)	0.17 (1.08)	0.14
Control	0.3 (1.14)	0.2 (1.09)	0.07 (1.03)	0.1 (1.03)	0.33 (1.15)	0.07 (1.03)	0.77
SEm±	0.05	0.01	0.02	0.03	0.03	0.02	0.032
CD at 5%	0.07	0.05	0.03	0.06	0.06	0.085	-

Table 4: Effect on different insecticides against green semilooper after 2nd spray.

Treatments	Mean population of *C. acuta* larvae /plant						Overall mean larval population /mrl
	Days after sowing						
	Pretreatment	1	3	5	7	10	
Teflubenzuron150SC	0.47 (1.20)	0.07 (1.03)	0.07 (1.03)	0.03 (1.01)	0.07 (1.03)	0.07 (1.03)	0.06
Alphacypermethrin10SC	0.87 (1.36)	0.1 (1.04)	0.07 (1.03)	0.07 (1.03)	0.07 (1.03)	0.07 (1.03)	0.07
Triazophos 40EC	1 (1.41)	0.5 (1.22)	0.47 (1.21)	0.43 (1.19)	0.4 (1.18)	0.4 (1.18)	0.44
Indoxacarb 15.8EC	0.67 (1.28)	0.2 (1.09)	0.17 (1.07)	0.2 (1.09)	0.2 (1.09)	0.23 (1.11)	0.2
Chlorantraniliprole 18.5EC	0.8 (1.33)	0.07 (1.03)	0.07 (1.03)	0.07 (1.03)	0.03 (1.01)	0.07 (1.03)	0.06
Profenophos 50EC	0.4 (1.18)	0.2 (1.09)	0.17 (1.09)	0.23 (1.11)	0.2 (1.09)	0.2 (1.09)	0.2
Control	0.67 (1.29)	0.33 (1.15)	0 (1)	0.33 (1.15)	0.2 (1.09)	0.13 (1.06)	0.19
SEm±	0.06	0.03	0.03	0.03	0.02	0.02	0.02
CD at 5%	0.18	0.108	0.093	0.115	0.064	0.071	-

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