Int.J.Curr.Microbiol.App.Sci (2017) *6*(3): 2196-2204

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 6 Number 3 (2017) pp. 2196-2204**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2017.603.250

Bio Efficacy of Botanical Insecticides against Defoliators Pests on Soybean

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Keywords

Botanical insecticides, Defoliator, Soybean.

Article Info

Accepted:
20 February 2017
Available Online:
10 March 2017

A B S T R A C T

The present study was conducted during *kharif*, 2015 at Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). The experiment was laid out in Randomized Block Design (RBD) with nine treatments and three replications. Defoliators are the most damaging insect pest of soybean. In the evaluation of plant products against defoliators of soybean garlic+green chilli @ 8.75 kg/ha was most effective against defoliators *S. litura* and *C. acuta* after first spray having 0.43, 0.52 and in second spray having 0.43 and 0.37 larva/mrl with benefit cost ratio of 8.02.

Introduction

Soybean, *Glycine max* (L.) Merill ranks first in the world for production of edible oil. India ranks third in world in respect of area and fifth in terms of production. It is an annual crop, fairly easy to grow, that produces more protein and oil per unit of land than almost any other crop. It is a versatile food plant that, used in its various forms, is capable of supplying most nutrients. It can substitute for meat and to some extent for milk. It is a crop capable of reducing protein malnutrition. In addition, soybeans are a source of high value animal feed.

The defoliators, *S. litura* and *C. acuta* are serious pest on soybean. The full grown caterpillars are most voracious feeders and cause extensive damage by defoliation. Because of excessive and indiscriminate use of pesticide several problems like development of resistance in targeted species, resurgence of secondary pest, elimination of natural enemies and wild life, contamination of soil, water and food chain and wholesome pollution of environment (Asoken *et al*., 2000).

Botanical pesticides are the important alternatives to minimize or replace the use of synthetic pesticides as they possess an array of properties including toxicity to the pest, repellency, antifeedance, insect growth

regulatory activities against pests of agricultural importance (Prakash and Rao, 1989, 2003).

The current trends of modern society towards'green consumerism' desiring fewer synthetic ingredients in food may favour plant-based products which are generally recognized as safe in ecofriendly management of plant pests as botanical pesticides (Isman *et al.,* 2006).

Materials and Methods

A field experiment was laid out in randomized block design with nine treatments, Neem oil (2%), Karanj oi (2%), NSKE (5%), Karanj seed extract (2.5%), Garlic+green chilli (8.75kg), green chilli (9kg), Red chilli (9kg), Triazophos 40 EC(750ml) and including untreated control replicated three times. The crop was sown on 15th July, 2015 in plot size of 5 m × 4m at Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.).

In this experiment, observations on the efficacy of treatments were recorded one day before the spray and after 3, 7, and 15 days of first and second spraying of plant products.

Defoliator pests

Tobacco caterpillar and green semilooper were observed as the major defoliator pests. The observations of these pests were recorded by counting the no. of larvae per meter row length.

Results and Discussion

Over all mean population of *S.litura* after first spray

Mean larval population during first spray indicated that chemical insecticide *i.e* triazophos @ 750 ml/ha recorded the minimum population of 0.37 larva per meter row length and among the different plant products, garlic+green chilli @ 8.75 kg/ha recorded minimum larval population with 0.43 larva/mrl, followed by NSKE @ 5% (0.50), Karanj seed extract @ 2.5% (0.57), Karanj oil @ 2% (0.63), Neem oil @ 2% (0.70), green chilli @ 9kg/ha (0.77) and it was maximum in red chilli 9kg/ha (0.82) larva/mrl.

Percent reduction of *S.litura* population over control after first spray

Percent reduction of *S.litura* population was higher in triazophos @ 750 ml/ha (68.64%) treated crop and among the plant products, it was maximum in garlic+green chilli @ 8.75 kg/ha (63.56%) treated crop which was followed by NSKE @ 5% (57.63%), Karanj seed extract @ 2.5% (51.69%), Karanj oil @ 2% (46.61%), Neem oil @ 2% (40.67%), green chilli @ 9kg/ha (34.75%) and lowest in red chilli @ 9kg/ha treated plots and was recorded only 30.51 percent reduction in insect population.

Over all mean population of *S.litura* after second spray

Over all mean population of *S.litura* Mean larval population during second spray indicated that chemical insecticide *i.e.* triazophos @ 750 ml/ha recorded the minimum population of 0.37 larva per meter row length and among the different plant products, garlic+green chilli @ 8.75 kg/ha recorded minimum larval population with 0.43 larva/mrl, followed by NSKE @ 5% (0.48), Karanj seed extract @ 2.5% (0.57), green chilli @ 9kg/ha (0.60), Neem oil @ 2% (0.58), Karanj oil @ 2% (0.58) and maximum population in red chilli @ 9kg/ha (0.72larva/mrl).

Table.1 Efficacy of plant products against Tobacco caterpillar (*S. litura*) in soybean during Kharif, 2015 after first spray

Mean population of tobacco caterpillar/mrl										
		Post treatment observation								Percent reduction of insect population over control
	Treatments	**Dose**	**Quantity /ha**	**Pre treat. Obs.**	**1 DAS**	**3 DAS**	**7 DAS**	**15 DAS**	**Mean**	
T1	Neem oil	2%	10lt	0.80 (1.14) *	0.73 (1.10)	0.60 (1.05)	0.67 (1.08)	0.80 (1.14)	0.70 (1.09)	40.67
T 2	Karanj oil	2%	10lt	0.73 (1.11)	0.67 (1.08)	0.53 (1.01)	0.60 (1.05)	0.73 (1.11)	0.63 (1.06)	46.61
T 3	NSKE	5%	25lt	0.67 (1.08)	0.53 (1.02)	0.40 (0.95)	0.47 (0.98)	0.60 (1.05)	0.50 (1.00)	57.63
T 4	Karanj seed extract	2.5%	12.5lt	0.73 (1.11)	0.60 (1.05)	0.47 (0.98)	0.53 (1.01)	0.67 (1.08)	0.57 (1.03)	51.69
T 5	Garlic+green chilli	8.75kg	8.75kg	0.60 (1.05)	0.47 (0.98)	0.33 (0.91)	0.40 (0.94)	0.53 (1.01)	0.43 (0.96)	63.56
T 6	Green chilli	9kg	9kg	0.73 (1.11)	0.80 (1.14)	0.67 (1.08)	0.73 (1.11)	0.87 (1.17)	0.77 (1.12)	34.75
T 7	Red chilli	9kg	9kg	0.80 (1.14)	0.80 (1.14)	0.73 (1.11)	0.80 (1.13)	0.93 (1.19)	0.82 (1.14)	30.51
T 8	Triazophos 40 EC	750ml	750ml	0.53 (1.02)	0.40 (0.95)	0.27 (0.87)	0.33 (0.91)	0.47 (0.98)	0.37 (0.93)	68.64
T 9	Control	–	–	0.87 (1.17)	1.07 (1.25)	1.13 (1.28)	1.20 (1.30)	1.33 (1.35)	1.18 (1.30)	–
	C.D. at 5%			NS	0.12	0.10	0.17	0.11	–	–

Table.2 Efficacy of plant products against Tobacco caterpillar (*S. litura*) in soybean during Kharif, 2015 after second spray

Mean population of tobacco caterpillar/mrl										
		Post treatment observation								Percent reduction of insect population over control
	Treatments	**Dose**	**Quantity /ha**	**Pre treat. Obs.**	**1 DAS**	**3 DAS**	**7 DAS**	**15 DAS**	**Mean**	
T1	Neem oil	2%	10lt	0.60 (1.05)*	0.53 (1.02)	0.47 (0.98)	0.60 (1.05)	0.73 (1.11)	0.58 (1.04)	47.27
T 2	Karanj oil	2%	10lt	0.53 (1.01)	0.47 (0.98)	0.40 (0.95)	0.67 (1.08)	0.80 (1.14)	0.58 (1.04)	47.27
T 3	NSKE	5%	25lt	0.47 (0.98)	0.47 (0.98)	0.33 (0.91)	0.53 (1.02)	0.60 (1.05)	0.48 0.99	56.36
T 4	Karanj seed extract	2.5%	12.5lt	0.53 (1.01)	0.53 (1.01)	0.47 (0.98)	0.60 (1.05)	0.67 (1.08)	0.57 (1.03)	48.18
T 5	Garlic+green chilli	8.75kg	8.75kg	0.53 (1.01)	0.40 (0.95)	0.33 (0.91)	0.47 (0.98)	0.53 (1.02)	0.43 (0.96)	60.90
T 6	Green chilli	9kg	9kg	0.47 (0.98)	0.53 (1.02)	0.53 (1.02)	0.60 (1.05)	0.73 (1.11)	0.60 (1.05)	45.45
T 7	Red chilli	9kg	9kg	0.60 (1.05)	0.60 (1.05)	0.60 (1.05)	0.80 (1.14)	0.87 (1.17)	0.72 (1.10)	34.54
T 8	Triazophos 40 EC	750ml	750ml	0.40 (0.95)	0.33 (0.91)	0.27 (0.87)	0.40 (0.95)	0.47 (0.98)	0.37 (0.93)	66.36
T 9	Control	–	–	0.73 (1.11)	1.00 (1.22)	1.07 (1.25)	1.13 (1.28)	1.20 (1.30)	1.10 (1.26)	–
	C.D. at 5%			NS	0.11	0.10	0.06	0.08	_	_

Table.3 Efficacy of plant products against semilopper (*C. acuta*) in soybean during Kharif, 2015 after first spray

Mean population of semilopper per/mrl										
		Post treatment observation								Percent reduction of insect population over control
	Treatments	**Dose**	**Quantity /ha**	**Pre treat. Obs.**	**1 DAS**	**3 DAS**	**7 DAS**	**15 DAS**	**Mean**	
T1	Neem oil	2%	10lt	1 (1.05)*	0.73 (1.11)	0.67 (1.08)	0.87 (1.17)	0.67 (1.08)	0.73 (1.11)	38.13
T 2	Karanj oil	2%	10lt	1.07 (1.08)	0.67 (1.08)	0.73 (1.11)	0.80 (1.14)	0.53 (1.02)	0.68 (1.09)	42.37
T 3	NSKE	5%	25lt	0.93 (1.05)	0.53 (1.02)	0.60 (1.05)	0.67 (1.08)	0.33 (0.91)	0.53 (1.01)	55.08
T 4	Karanj seed extract	2.5%	12.5lt	1 (1.10)	0.60 (1.05)	0.67 (1.08)	0.73 (1.11)	0.60 (1.05)	0.65 (1.07)	44.91
T 5	Garlic+green chilli	8.75kg	8.75kg	0.87 (105)	0.47 (0.98)	0.53 (1.02)	0.60 (1.05)	0.47 (0.98)	0.52 (1.01)	55.93
T 6	Green chilli	9kg	9kg	1.13 (1.10)	0.67 (1.08)	0.80 (1.14)	0.87 (1.17)	0.73 (1.11)	0.77 (1.12)	34.75
T 7	Red chilli	9kg	9kg	1.13 (1.10)	0.87 (1.17)	0.87 (1.17)	0.93 (1.19)	0.80 (1.14)	0.87 (1.17)	26.27
T 8	Triazophos 40 EC	750ml	750ml	0.80 (1.17)	0.40 (0.94)	0.40 (0.95)	0.47 (0.98)	0.33 (0.90)	0.40 (0.94)	66.10
T 9	Control	–	–	1.20 (1.30)	0.93 (1.20)	1.20 (1.30)	1.27 (1.33)	1.33 (1.35)	1.18 (1.30)	–
	C.D. at 5%			NS	0.10	0.08	0.09	0.15	–	–

Table.4 Efficacy of plant products against semilopper (*C. acuta*) in soybean during Kharif, 2015 after second spray

Mean population of semilopper per mrl										
		Post treatment observation								percent reduction of insect population over control
	Treatments	**Dose**	**Quantity /ha**	**Pre treat. Obser.**	**1 DAS**	**3 DAS**	**7 DAS**	**15 DAS**	**Mean**	
T1	Neem oil	2%	10lt	0.73 (1.11)*	0.67 (1.08)	0.60 (1.05)	0.53 (1.02)	0.73 (1.11)	0.63 (1.06)	42.72
T 2	Karanj oil	2%	10lt	0.80 (1.14)	0.60 (1.05)	0.53 (1.02)	0.47 (0.98)	0.67 (1.05)	0.57 (1.03)	48.18
T 3	NSKE	5%	25lt	0.67 (1.05)	0.47 (0.98)	0.40 (0.94)	0.33 (0.91)	0.53 (1.02)	0.43 (0.96)	60.90
T 4	Karanj seed extract	2.5%	12.5lt	0.73 (1.11)	0.53 (1.02)	0.47 (0.98)	0.40 (0.94)	0.60 (1.05)	0.50 (1.00)	54.54
T 5	Garlic+green chilli	8.75kg	8.75kg	0.60 (1.05)	0.40 (0.94)	0.33 (0.91)	0.27 (0.87)	0.47 (0.98)	0.37 (0.93)	66.36
T 6	Green chilli	9kg	9kg	0.87 (1.17)	0.60 (1.05)	0.53 (1.02)	0.60 (1.05)	0.73 (1.11)	0.62 (1.06)	43.64
T 7	Red chilli	9kg	9kg	0.93 (1.20)	0.80 (1.14)	0.73 (1.11)	0.67 (1.05)	0.87 (1.17)	0.77 (1.12)	30.00
T 8	Triazophos 40 EC	750ml	750ml	0.53 (1.02)	0.33 (0.91)	0.27 (0.87)	0.20 (0.83)	0.33 (0.91)	0.28 (0.88)	74.54
T 9	Control	–	–	1.13 (1.28)	1.07 (1.25)	1.13 (1.28)	1.07 (1.25)	1.13 (1.28)	1.10 (1.26)	–
	C.D. at 5%			NS	0.10	0.13	0.22	0.18	–	–

Table.5 Assessment of benefit cost ratio in soybean Kharif, 2015

S.no.	Treatment	Qty. of spray/ha	No. of spray	Cost of treatment		Total cost (A)	Yield q/ ha	Inc. yield over control (q/ ha)	Value of increased yield (Rs/ ha) (B)	B.C. Ratio
				Cost of insecticides	Labour for spraying charge					
1	Neem oil	10lt.	2	2800	460	3260	9.06	2.87	6858	2.10
2	Karanj oil	10 lt.	2	3000	460	3460	9.57	3.35	8040	2.32
3	NSKE	25 lt.	2	5000	460	5460	10.81	4.62	11088	2.03
4	Karanj seed extract	12.5 lt.	2	2500	460	2960	10.49	4.3	10320	3.48
5	Garlic + green chilli	8.75 kg	2	2610	460	3070	16.45	10.26	24624	8.02
6	green chilli	9 kg	2	900	460	1360	7.98	1.79	4296	3.15
7	Red chilli	9 kg	2	1800	460	2260	9.02	2.83	6792	3.00
8	Triazophos	750 ml	2	600	460	1060	13.83	7.63	18312	17.27
9	Control	-	-	-	-	-	6.13	-	-	-

Percent reduction of *S. litura* population over control after second spray

Percent reduction was higher in triazophos @ 750 ml/ha (66.36%) treated crop. Among the plant products, garlic+green chilli 8.75 kg/ha (60.40%) followed by NSKE @ 5% (56.36%), Karanj seed extract @ 2.5% (48.18%), Karanj oil @ 2% (47.27%), Neem oil @ 2% (47.27%), green chilli @ 9kg/ha (45.45%).It was lowest in red chilli @ 9kg/ha treated plots and recorded only 34.54 percent reduction in insect population.

Overall mean population of *C. acuta* after first spray

Mean larval population during first spray indicated that chemical insecticide *i.e.* triazophos 40 EC @ 750 ml/ha recorded the minimum population of 0.40 larva/mrl and among the different plant products, garlic+green chilli @ 8.75 kg/ha recorded minimum larval population with 0.52 larva/mrl, followed by NSKE @ 5% (0.53), Karanj seed extract @ 2.5% (0.65), Karanj oil @ 2% (0.68), Neem oil @ 2% (0.73), green chilli @ 9kg/ha (0.77 larva/mrl) and it was maximum in red chilli @ 9kg/ha having 0.87 larva/mrl.

Percent reduction of *C. acuta* population over control after first spray

Percent reduction was higher in triazophos @ 750 ml/ha (66.10%) treated crop and among the plant products, it was maximum in garlic+green chilli @ 8.75 kg/ha (55.93%) treated crop followed by NSKE @ 5% (55.08%), Karanj seed extract @ 2.5% (44.91%), Karanj oil @ 2% (42.37%), Neem oil @ 2% (38.13%), green chilli @ 9kg/ha (34.75%) and minimum of 26.27 percent recorded in red chilli @ 9kg/ha treated plots.

Over all mean population of *C. acuta* after second spray: Mean larval population during second spray indicated that chemical insecticide *i.e.* triazophos @ 750 ml/ha recorded the minimum population of 0.28 larva/mrl and among the different plant products, garlic+green chilli @ 8.75 kg/ha recorded minimum larval population with 0.37larva/mrl followed by NSKE @ 5% (0.47), Karanj seed extract @ 2.5% (0.57), Karanj oil @ 2% (0.58), Neem oil @ 2% (0.58), green chilli @ 9kg/ha (0.60) and it was maximum in red chilli @ 9kg/ha having 0.72 larva/mrl.

Percent reduction of *C. acuta* population over control after second spray

Percent reduction higher in triazophos 40 EC @ 750 ml/ha (74.54%) treated crop, and among the plant products, it was maximum in garlic+green chilli @ 8.75 kg/ha (66.36%) treated crop followed by NSKE @ 5% (60.90%), Karanj seed extract @ 2.5% (54.54%), Karanj oil @ 2% (48.18%), green chilli @ 9kg/ha (43.64%), Neem oil @ 2% (42.72%) and lowest in red chilli @ 9kg/ha treated plots was recorded only 43.64 percent reduction in insect population.

The results are in conformity with the findings of Vijayalakshmi *et al*., (1997) who reported that ginger extract as natural pesticide, alone and in combination with other plant products like chilli, garlic and cow urine as effective plant products against *H. armigera*.

Lakshmanan (2001) also reported that the garlic bulb extract alone or in combination with other plant extracts were effective in managing the several lepidopteran pests *viz.*, Earias vitella, Chilo partellus (Swinhoe), Corcyra cephalonica Staint., Helicoverpa armigera and Spodoptera litura. Choudhary and Shrivastava (2007) reported that application of neem seed kernel extract (NSKE) at 5% + neem leaf extract (NLE) at 10% reduced the maximum larval population.

Assessment of benefit cost ratio

Among the plant products, the maximum benefit cost ratio was found in the treatment garlic+green chilli @ 8.75 kg/ha having 8.02. In rest of the plant products, more or less similar benefit cost ratio was obtained like 3.48 in Karanj seed extract @ 2.5% which was followed by green chilli @ 9kg/ha (3.15), red chilli @ 9kg/ha (3.00), Karanj oil @ 2% (2.32), Neem oil @ 2% (2.10) and the minimum benefit cost ratio was recorded in the treatment NSKE @ 5% having only 2.03 and among the chemical treatment triazophos @ 750ml/ha which was used for management of insect pests of soybean the benefit cost ratio was maximum with 17.27.

Present findings are in agreement with those of Raghuvanshi *et al.,* (2014) as they reported that triazophos gave the maximum better return on soybean crop. In contradictory Panchabhavi *et al.,* (1994) reported that lower pod damage and higher seed yield were recorded on pigeon pea when fenvalerate was applied twice at 15 days interval. However, highest cost benefit ratio was obtained in NSKE sprayed at 15 days interval with a seed yield of 12.0 q/ha.

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How to cite this article:

Toshima Kushram, Y.K. Yadu, M.K. Sahu, A.K. Kulmitra and Kumar, R. 2017. Bio Efficacy of Botanical Insecticides against Defoliators Pests on Soybean. *Int.J.Curr.Microbiol.App.Sci.* 6(3): 2196-2204. doi: https://doi.org/10.20546/ijcmas.2017.603.250