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Safety of selected insecticides against lady bird beetle in soybean

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ABSTRACT

Field trial was conducted during *Kharif* 2014 to determine the effects of different treatments against lady bird beetle *Coccinella septumpunctata* in soybean ecosystem in the College of Agriculture Nagpur. Least average number of grubs recorded in treatment of Fenvalerate 20 EC @ 0.50 ml found to be superior as compared to other treatments. The next effective treatments were emamectin benzoate 5 S G @ 0.3 g per lit. and also in Spinosad 45 SC @ 0.25 ml per lit., Indoxacarb 15.8 EC @ 0.60 ml per lit., which were at par with T_6 and T_3. However, the treatment *Neem* oil 2 per cent recorded grubs per 5 plants. Whereas, NSE @ 5 per cent and *Beauveria bassiana* $1x10^8$ CFU @ 4 g per lit. were found to be least effective in reducing grubs population.

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INTRODUCTION

The luxuriant crop growth, soft and succulent foliage of soybean attracts many insects-pests and provides unlimited source of food, space and shelter. About 380 species of insects have been reported on soybean crop from many parts of the world. About 65 insect species have been reported to attack soybean from cotyledon stage to harvesting stage from Karnataka (Rai *et al*., 1973 and Thippaiah, 1997).

Edible soy protein one of the world's least expensive and high quality protein source. Soybean is recognised as valuable food material. The values as per 100 g of edible soybean are protein (43.2 g), fat (19.5 g), calcium (240 mg), iron (11.5 mg), carbonate (426 mg), thiamine (0.73 mg), riboflavin (0.39 mg), niacin (3.20 mg) and energy (432 cal). Commercial methods of use of soy proteins are soy flour (less than 65 % protein), soy protein concentrate (65 to 89% protein) and soy protein isolate (90 % or more protein) (Pandya, 1988).

Soybean agro-ecosystem is being adopted rapidly by farmers of Vidarbha and it becomes second major *Kharif* crop. As a result, many oil industries are established to provide employment in the region. During 2013, soybean cultivation was 12.98 mt with an yield of 1,079 kg per ha. In Maharashtra, area sown under soybean was 3.87 mha with production of 4.86 mt per ha and productivity of 1,255 kg per ha. In Vidarbha, the area sown under the crop was 2.09 mha with total production of 2.66 mt and productivity of 1,155 kg per ha (Anonymous, 2013).

Indiscriminate use of chemical insecticides disturbs the natural balance of pest, leading to resurgence,

outbreak of secondary pests, and pollution in crop ecosystem. From this angle, botanicals have become more attractive and are considered to provide an eco-friendly alternative (Dodia and Patel, 2008).

MATERIAL AND METHODS

A field study was conducted during *Kharif* 2014 to determine the in effects of different treatments against natural enemies in soybean crop in the insectory premises of Agricultural Entomology Section, College of Agriculture Nagpur. Soybean variety JS 335 grown at a spacing of 30 x 5 cm with following treatments *Neem* seed extract (NSE) 5 per cent, *Neem* oil 2 per cent, *Beauveria bassiana* 1 x 10^8 CFU @ 4 g per lit., Spinosad 45 SC @ 0.25 ml per lit., Indoxacarb 15.8 EC @ 0.60 ml per lit., emamectin benzoate 5 SG @ 0.3 g per lit. and Fenvalerate 20 EC @ 0.50 ml per lit.

The spraying of treatments was done with the help of knapsack sprayer and obtained uniform coverage of insecticide spray was given at 30 days after emergence (DAE), second spray at 45 DAE and third spray at 60 DAE. All the recommended practices were adopted for raising the crop.

The field data collected during the course of experimentation was subjected to statistical analysis (Gomez and Gomez, 1984) after appropriate transformation for interpretation of results.

Treatment details		
Treatment No.	Treatments	Dose concentration
T_1	*Neem* seed extract	5%
T_2	*Neem* oil	2%
T_3	Spinosad 45 SC	0.25 ml/lit
T_4	*Beauveria bassiana* 1 x 10^8 CFU	4 g/lit
T_5	Indoxacarb 15.8 EC	0.60 ml/lit
T_6	Emamectin benzoate 5 SG	0.3 g/lit
T_7	Fenvalerate 20 EC	0.50 ml/lit
T_8	Control (Water spray)	-

RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under the following heads:

30 DAE, 7 DAT:

Fenvalerate 20 EC @ 0.50 ml per lit. (0.33 grubs/5 plants) was found maximum reduction of natural enemy than other treatments. This was followed by Spinosad 45 SC @ 0.25 ml per lit. (0.41 grubs/5 plants), Indoxacarb 15.8 EC @ 0.60 ml per lit (0.42 grubs/5 plants) and emamectin benzoate 5 SG @ 0.3 g per lit. (0.47 grubs/5 plants), which were at par with Fenvalerate in reducing the number of larvae. Whereas, NSE @ 5 per cent (0.60 grubs/5plants), *Neem* oil @ 2 per cent (0.68 grubs/5plants) and *Beauveria bassiana* 1×10^8 CFU @ 4 g per lit (0.55 grubs/5plants) were least in reducing the number of grubs. The more average number of grubs were recorded in control (water spray; 0.85 grubs/5plants) (Table 1).

The above results are in conformity with studies conducted by Sechser *et al*. (2003) reported that emamectin benzoate relatively safe to eggs of two lady bird beetles, *Scymnus* spp. and *Coccinella undecimpunctata.*

30 DAE, 14 DAT:

Fenvalerate 20 EC @ 0.50 ml per lit. (0.27 grubs/5 plants) was found very low population of natural enemies. The next treatments namely, Indoxacarb 15.8 EC @ 0.60 ml per lit. (0.28 grubs/5plants), Spinosad 45 SC @ 0.25 ml per lit. (0.37 grubs/5plants) and Emamectin benzoate 5 SG @ 0.3 g per lit. (0.38 grubs/ 5 plants) were found at par with the Fenvalerate treatment in reducing the number of grubs. Whereas, *Neem* seed extract @ 5 per cent (0.67/mrl),*Neem* oil @ 2 per cent (0.60/mrl) and *B. bassiana* 1×10^8 CFU @ 4 g per lit. (0.68 grubs/5plants) were least effective in reducing the number of grubs. The more average number of grubs recorded in control (water spray;0.98 grubs/5plants) (Table 1).

The above results are in comparable with studies conducted by Ghosh *et al.* (2010) who revealed Spinosad safe for the larvae of *M. sexmaculatus*. Guddewar *et al*. (1994) reported the ether extract of *Neem* kernel extract was safer than synthetic insecticide to *C. septumpuctata*. The order of safety was *Neem* kernel extract, endosulphan, quinalphos, malathion and monocrotophos.

45 DAE, 7 DAT:

Fenvalerate 20 EC @ 0.50 ml per lit. (0.21 grubs/5 plants) was found less population of natural enemies over other treatments. The next effective treatments namely, Indoxacarb 15.8 EC @ 0.60 ml per lit. (0.22

grubs/5plants), Spinosad 45 SC @ 0.25 ml per lit. (0.29 grubs/5plants), and Emamectin benzoate 5 SG @ 0.3 g per lit (0.30 grubs/5plants) were found at par with Spinosad in reducing the number of grubs. Whereas, *Neem* seed extract @ 5 per cent (0.74 grubs/5plants), *Neem* oil @ 2 per cent (0.82 grubs/5plants) and *B. bassiana* 1×10^8 CFU @ 4 g per l (0.79 grubs/5plants) were least effective in reducing the number of grubs. The maximum average number of grubs was recorded in control (water spray; 1.08 grubs/5plants) (Table 1). Above results are in line with those obtained by Jalai *et al*. (2009) observed that spinosad showed no effect on larvae of two-spot ladybird, *Adalia bipunctata*.

45 DAE; 14 DAT:

The least number of grubs were found in Fenvalerate 20 EC @ 0.50 ml per lit. (0.17 grubs/ 5plants). The next effective treatments were, Indoxacarb 15.8 EC @ 0.60 ml per lit. (0.20 grubs/5plants), Emamectin benzoate 5 SG @ 0.3 g per lit. (0.25 grubs/ 5plants) and Spinosad 45 SC @ 0.25 ml per lit. (0.26 grubs/5 plants) were found at par with Fenvalerate 20 EC @ 0.50 ml per lit. However, *Neem* seed extract @ 5 per cent (0.49 grubs/5plants), *Neem* oil @ 2 per cent (0.79 grubs/5plants) and *B. bassiana* 1×10^8 CFU @ 4 g per lit. (0.86 grubs/5 plants) were least effective in reducing the number of grubs. The maximum average number of grubs recorded in control (water spray;1.17 grrubs/ 5plants) (Table 1).

Above results are in line with those obtained by Galvan *et al*. (2005) examined the effect of Indoxacarb and Spinosad on development, survival and reproduction of multicolored Asian lady beetle, Harmonia axyridis (Pallas) by spraying first instar and found that Spinosad lessened the survival of treated larvae.

60 DAE; 7 DAT:

Fenvalerate 20 EC @ 0.50 ml per lit. (0.13 grubs/5 plants), was found maximum reduction of natural enemies than other treatments. The next effective treatments namely, emamectin benzoate 5 SG @ 0.3 g per lit. (0.18 gubs/5 plants) and Indoxacarb 15.8 EC @ 0.60 ml per lit. (0.21 grubs/5 plants) and Spinosad 45 SC @ 0.25 ml per lit. (0.29 grubs/5 plants) were found at par with the treatment of Spinosad in reducing the number of larvae. Whereas, *Neem* seed extract @ 5 per cent (0.57 grubs/ 5 plants), *Neem* oil @ 2 per cent (0.87 grubs/5 plants) and *B. bassiana* 1×10^8 CFU @ 4 g per lit. (0.62 grubs/ 5 plants) were least effective in reducing the number of grubs. The more average number of grubs were recorded in control (water spray; 1.22 grubs/5 plants) (Table 1).

Above results are in line with those obtained by Rosaiah (2001) reported regarding predatory populations in okra ecosystem, spiders, chrysopids, *Apanteles* sp. and coccinellids were most predominant and there were no significant differences between the populations of these predators in plant sprayed with different plant products. Kaethner (1991) reported *Neem* extract and *Neem* oil were harmless to the eggs, larvae, adults of *C. carnea* and *Coccinella septumpunctata* (L.). If larvae were sprayed directly in the labarotary, mortality increased and morphogenic defects also developed.

60 DAE; 14 DAT:

Indoxacarb 15.8 EC @ 0.60 ml per lit. (0.16 grubs/ 5 plants), Spinosad 45 SC @ 0.25 ml per lit. (0.23 grubs/ 5 plants) and emamectin benzoate 5 SG @ 0.3 g per lit. (0.13 grubs/mrl) were found superior over other treatments. The next effective treatment Fenvalerate 20 EC @ 0.50 ml per lit. (0.08 grubs/5 plants) was found at par with above treatments. Whereas, *Neem* seed extract @ 5 per cent (0.64 grubs/5plants), *Neem* oil @ 2 per cent (0.92/mrl) and *B. bassiana* 1×10^8 CFU @ 4 g per lit (0.68 grubs/5plants) were least effective in reducing the number of grubs. The more average number of larvae recorded in control (Water spray; 1.25 grubs/5plants) (Table 1).

The results of present studies are comparible with the results reported by Ghelani *et al.* (2014) reported the toxicity of insecticides on predators (Coccinellids and *Chrysoperla*) of sucking pests, all the bio-pesticides found safer to predators, while chemical pesticides were found moderate to higher toxic to predators on *Bt* cotton.

Soybean seed yield:

All the insecticidal treatments led to significant increase (192 to 1069 kg/ha) in seed yield over control. Maximum seed yield was recorded in case of Fenvalerate 20 EC @ 0.50 ml per lit. (2,105 kg/ha) with an increase of 1,069 kg per ha over control (1,036 kg/ha). The other two treatments which were at par were Indoxacarb 15.8 EC @ 0.60 ml per lit. (increase of 974 kg/ha over control) and Spinosad (increase of 866 kg/ha over control). The

Table 1 : Treatments of different treatments on lady bird beetle in soybean

Treatments	30 DAE		45 DAE		60 DAE	
	7 DAT	14 DAT	7 DAT	14 DAT	7 DAT	14 DAT
Neem seed extract @ 5 %	0.60	0.67	0.74	0.49	0.57	0.64
	(4.44)	(4.69)	(1.11)	(0.99)	(1.03)	(1.07)
Neem oil @ 2 %	0.68	0.75	0.82	0.79	0.87	0.92
	(4.73)	(4.97)	(1.15)	(1.14)	(1.17)	(1.19)
Spinosad 45 SC @ 0.25 ml/lit	0.41	0.37	0.29	0.26	0.28	0.23
	(3.67)	(3.49)	(0.89)	(0.87)	(0.88)	(0.85)
Beauveria bassiana $1x10^8$ CFU @ 4 g/lit	0.55	0.68	0.79	0.86	0.62	0.68
	(4.25)	(4.73)	(1.11)	(0.99)	(1.06)	(1.09)
Indoxacarb 15.8 EC @ 0.60 ml/lit	0.42	0.28	0.22	0.2	0.21	0.16
	(3.71)	(3.03)	(0.85)	(0.84)	(0.84)	(0.81)
Emamectin benzoate 5 SG @ 0.3 g/lit	0.47	0.38	0.3	0.25	0.18	0.13
	(3.93)	(3.53)	(0.89)	(0.87)	(0.82)	(0.79)
Fenvalerate 20 EC @ 0.50 ml/lit	0.33	0.27	0.21	0.17	0.13	0.08
	(3.29)	(2.98)	(0.84)	(0.82)	(0.79)	(0.76)
Control (water spray)	0.85	0.98	1.08	1.17	1.22	1.25
	(5.29)	(5.68)	(1.26)	(1.29)	(1.31)	(1.32)
F test	Sig	Sig	Sig	Sig	Sig	Sig
S.E.±	0.33	0.30	0.06	0.08	0.08	0.08
C.D. (P=0.05)	0.99	0.92	0.20	0.24	0.25	0.23
CV	13.40	12.82	11.12	13.77	14.05	13.42

Figures in parenthesis indicates square root transformation

Table 2 : Soybean grain yield

Treatments	Yield kg/plot				
	R_1	R_2	R_3	Mean	Yield q/ha
T_1-*Neem* seed extract (NSE) @ 5%	1.1	1.46	0.89	1.15	12.28
	(1.26)	(1.40)	(1.18)	(1.28)	
T_2-*Neem* oil @ 2%	1.4	1.35	1.32	1.36	14.52
	(1.38)	(1.36)	(1.35)	(1.36)	
T_3-Spinosad 45 SC @ 0.25 ml/lit	1.72	1.77	1.84	1.78	19.02
	(1.49)	(1.51)	(1.53)	(1.51)	
T_4- *Beauveria bassiana* $1x10^8$ CFU @ 4 g/lit	1.05	1.27	1.33	1.22	13.03
	(1.24)	(1.33)	(1.35)	(1.31)	
T_5-Indoxacarb15.8 EC @ 0.60 ml/lit	1.94	1.81	1.89	1.88	20.10
	(1.56)	(1.52)	(1.55)	(1.54)	
T_6- Emamectin benzoate 5 SG @ 0.3 g/lit	1.7	1.69	1.75	1.71	18.30
	(1.48)	(1.48)	(1.50)	(1.49)	
T_7-Fenvalrate 20 EC @ 0.50 ml/lit	1.72	2.05	2.1	1.97	21.05
	(1.49)	(1.60)	(1.61)	(1.57)	
T_8-Control (Water spary)	0.8	1.02	1.09	0.97	10.36
	(1.14)	(1.23)	(1.26)	(1.21)	
F Test	-	-	-	Sig	Sig
S.E.±	-	-	-	0.12	0.8
C.D. (P=0.05)	-	-	-	0.37	2.14
CV	-	-	-	14.82	10.31

lowest yield among insecticidal treatments was recorded was 1,228 kg per ha in case of NSE. Similar yield increase in pigeon pea was recorded by application of different insecticides, among which Indoxacarb 0.0075 per cent followed by Spinosad 0.009 per cent (Giraddi *et al.*, 2002) were found superior. Murugaraj *et al.* (2006), who reported that emamectin benzoate 5 SG @ 11 g a.i. per ha as well

was highly effective in reducing the larval population and fruit damage and in increasing the yield of tomato. Kumar and Devappa (2006) also noted that emamectin benzoate 5 SG @ 200 g per ha as effective in reducing dead hearts, fruit damage, and increasing the total yield of brinjal; and emamectin benzoate 5 SG @ 150 and 200 g per ha to be effective in suppressing the larval population of the pest, increase in yield of cabbage per hectare compared to other insecticides. In Pakistan, Wakil *et al*. (2009) while studying the management of the pod borer, *Helicoverpa armigera* showed the integration of weeding, hand picking of larvae and Indoxacarb sprays as the the most effective in reducing the larval population, pod infestation and maximum grain yield in chickpea crop as represented in Table 2.

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