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Management of sunflower head borers with biopesticides and newer insecticides

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Abstract : Biopesticides alone and incombination with newer insecticides were evaluated for the management of two key lepidopteran pests *viz., Spodoptera litura* Fab. and *Helicoverpa armigera* (Hub) on sunflower (cv. CO 4). Indoxacarb was the most effective chemical in reducing the larval population. Combination of half the recommended dose of two viruses along with half the recommended dose of spinosad and endosulfan were as effective as single application of the insecticide.

Keywords: Sunflower, biopesticides, Helicoverpa armigera and Spodoptera litura

Introduction

Sunflower, *Helianthus annuus* L. is one of the most important oilseed crops being cultivated in about 2.01 million hectares with an average productivity of 539 kg ha^{-1} (DES, 2004). *Helicoverpa armigera* (Hub) and *Spodoptera litura* Fab. (Noctuidae : Lepidoptera) are the serious pests causing damage by boring the head of sunflower and feed on the developing seeds and cause heavy yield loss. The damage caused by the borers also invites the secondary saprophytic fungi which results in the development of head rot. The effectiveness of biopesticides against field populations of *S. litura* (Rabindra *et al.*, 1989) and *H. armigera* (Rabindra *et al.*, 1991) has been studied. In the present investigation, the effect of simultaneous application of baculoviruses alone and in combination with insecticides were evaluated against both the noctuid larvae and compared with chemical insecticides on sunflower under field conditions.

Materials and Methods

Field experiment was conducted from October 2002 to January 2003 at TNAU farm, Coimbatore with sunflower cv. CO 4. Sunflower was sown in plot size of 25 m^2 with a spacing of 30x30 cm. The experiment was conducted in RCBD with fourteen treatments (Table 1) and three replications. The nucleopolyhedro-viruses were applied along with 0.5 per cent tinopal and 0.5 per cent jaggery. The spraying was given with high volume knapsack sprayer in the evening hours so as to avoid the toxicity to the honeybees. The first spraying was given at first flower emergence and subsequently the second spraying was given at ten days after first treatment. Observations on number of larvae per head and honey bee visiting were taken at regular intervals from five randomly selected plants from each plot. Data were subjected to ($\sqrt{x+0.5}$) transformation and means were separated using Duncan's Multiple Range Test (DMRT).

Results and Discussion

Observations showed that indoxacarb 14.5 SC @ 75 g a.i. ha^{-1} was the most effective chemical in checking the larval population of *H. armigera* and *S. litura* and was at par with spinosad 45 SC @ 75 g a.i. ha^{-1}. Combined application of half the recommended dose of

Table 1. Efficacy of biopesticides alone and in combination with newer insecticides against sunflower headborers.

S. No.	Treatments	Mean population of headborers (larvae / head)						Yield
		H. armigera			*S. litura*			
		Precount	I spray	II spray	Precount	I spray	II spray	(kg ha^{-1})
1.	NSKE 5%	0.87 (1.17)	0.33 (0.91)^{c}	0.30 (0.89)^{a}	0.63 (1.06)	0.17 (0.82)	0.17 (0.82)^{ab}	1280^{ef}
2.	Econeem (3000 ppm) @ 1000 ml/ha	0.83 (1.15)	0.23 (0.86)^{b}	0.30 (0.89)^{a}	0.60 (1.05)	0.20 (0.84)^{ab}	0.13 (0.80)^{a}	1250^{ef}
3.	Neem oil 3%	0.77 (1.13)	0.33 (0.91)^{c}	0.33 (0.91)^{a}	0.60 (1.05)	0.20 (0.84)^{bc}	0.13 (0.80)^{a}	1230^{f}
4.	Delfin 25 WG @ 1 kg/ha	0.90 (1.18)	0.20 (0.84)^{b}	0.30 (0.89)^{a}	0.53 (1.01)	0.17 (0.82)^{bc}	0.07 (0.75)^{a}	1290^{ef}
5.	Dipel 8L@ 1000 ml/ha	0.93 (1.20)	0.20 (0.84)^{b}	0.30 (0.89)^{a}	0.57 (1.03)	0.10 (0.77)^{a}	0.13 (0.80)^{aa}	1300de
6.	HaNPV+SINPV Each @1.5 x 10^{12} POB/ha	0.80 (1.14)	0.37(0.93)^{c}	0.33(0.91)^{a}	0.57 (1.03)	0.20 (0.84)^{bc}	0.13 (0.80)^{a}	1260^{ef}
7.	HaNPV+SINPV Each@ 1.5x1012 POB/ha Endosulfan 35 EC@1000 ml/ha	0.83(1.15)	0.33 (0.91)^{c}	0.33(0.91)^{a}	0.50(1.00)	0.17(0.82)^{ab}	0.17(0.82)^{ab}	1350^{cd}
8.	HaNPV+SINPV Each @1.5 x 10^{12} POB/ha Spinosad@150 ml/ha	0.87 (1.17)	0.37 (0.93)^{a}	0.27 (0.87)^{a}	0.53 (1.01)	0.13 (0.80)^{ab}	0.10 (0.77)^{a}	1420^{b}
9.	HaNPV+SINPV Each @7.5 x 10^{11} POB/ha Spinosad@75 ml/ha	0.90 (1.18)	0.23 (0.86)^{b}	0.33 (0.91)^{a}	0.63 (1.06)	0.17 (0.82)^{ab}	0.10 (0.77)^{a}	1370^{bc}
10.	HaNPV+SINPV Each @7.5 x 10^{11} POB/ha Endosulfan 35EC@500 ml/ha	0.83 (1.15)	0.20 (0.84)^{b}	0.33 (0.91)^{a}	0.63 (1.06)	0.17 (0.82)^{ab}	0.07 (0.75)^{a}	1310de
11.	Spinosad@150 ml/ha	0.80 (1.14)	0.20 (0.84)^{b}	0.33 (0.91)^{a}	0.57 (1.03)	0.13 (0.80)^{ab}	0.10 (0.77)^{a}	1480^{a}
12.	Endosulfan 35 EC@1000 ml/ha	0.83 (1.15)	0.20 (0.84)^{b}	0.33 (0.91)a	0.53 (1.01)	0.27 (0.88)^{cd}	0.20 (0.83)^{ab}	1380^{bc}
13.	Indoxacarb 14.5 SC @500 ml/ha	0.97(1.21)	0.07 (0.75)^{a}	0.27 (0.87)^{a}	0.53 (1.01)	0.10 (0.77)^{a}	0.07 (0.75)^{a}	1520^{a}
14.	Untreated check	0.83 (1.15)	1.13 (1.28)^{d}	0.67 (1.08)^{b}	0.63 (1.06)	0.37 (0.93)^{d}	0.37 (0.93)^{b}	1090^{g}

Values in parentheses are transformed by $\sqrt{x + 0.5}$

In column means followed by a common letter are significantly different by DMRT (P=0.05)

Table 2. Safety of biopesticides and newer insecticides to Indian bee, *Apis cerna indica.*

S. No.	Treatments	Number of bees/plot/5 min.				
		Precount	I spray		II spray	
			1 DAT	3 DAT	1 DAT	3 DAT
1.	NSKE 5%	10.33 (3.28)	9.33 (3.12)^{b}	9.00 (3.08)^{bc}	9.67 (3.18)^{b}	11.33 (3.44)^{ab}
2.	Econeem (3000 ppm) @ 1000 ml/ha	9.33 (3.12)	9.67 (3.18)^{b}	10.33 (3.29)^{ab}	9.67 (3.18)^{b}	12.33 (3.58)^{a}
3.	Neem oil 3%	9.33 (3.12)	9.33 (3.12)^{b}	10.00 (3.24)^{ab}	7.33 (2.80)^{d}	10.67 (3.34)^{ab}
4.	Delfin 25 WG @ 1 kg/ha	9.00 (3.07)	9.33 (3.12)^{b}	10.33 (3.29)^{ab}	7.67 (2.86)^{cd}	11.67 (3.49)^{a}
5.	Dipel 8L@ 1000 ml/ha	9.00 (3.07)	10.00 (3.24)^{ab}	9.67 (3.18)^{b}	6.67 (2.67)^{d}	11.00 (3.39)^{ab}
6.	HaNPV+SINPV Each @1.5 x 10^{12} POB/ha	10.00 (3.23)	10.00 (3.24)^{ab}	10.00 (3.24)^{ab}	9.00 (3.08)^{te}	9.67 (3.19)^{b}
7.	HaNPV+SINPV Each@ 1.5x1012 POB/ha- Endosulfan 35 EC@1000 ml/ha	10.00 (3.23)	10.00 (3.24)^{ab}	9.67 (3.18)^{b}	6.67 (2.67)^{d}	10.67 (3.34)^{ab}
8.	HaNPV+SINPV Each @1.5 x 10^{12} POB/ha Spinosad@150 ml/ha	10.33 (3.29)	9.67 (3.18)^{b}	9.67 (3.18)^{b}	6.67 (2.67)^{d}	11.00 (3.39)^{ab}
9.	HaNPV+SINPV Each @7.5 x 10^{11} POB/ha Spinosad@75 ml/ha	9.67 (3.18)	7.33 (2.76)^{c}	7.33 (2.76)^{c}	11.67 (1.06)	11.00 (3.39)^{ab}
10.	HaNPV+SINPV Each @7.5 x 10^{11} POB/ha Endosulfan 35EC@500 ml/ha	10.00 (3.23)	5.67 (2.47)^{cd}	7.67 (2.86)^{cd}	10.33 (3.49)^{a}	11.00 (3.39)^{ab}
11.	Spinosad@150 ml/ha	10.33 (3.29)	4.33 (2.19)^{d}	6.67 (2.67)^{d}	10.00 (3.23)^{ab}	11.00 (3.39)^{ab}
12.	Endosulfan 35 EC@1000 ml/ha	10.33 (3.29)	4.33 (2.19)^{d}	6.67 (2.67)^{d}	10.33 (3.29)^{ab}	11.33 (3.44)^{ab}
13.	Indoxacarb 14.5 SC @500 ml/ha	9.33 (3.12)	0.67 (1.05)^{e}	6.67 (2.67)^{d}	9.67 (3.18)^{b}	10.67 (3.34)^{ab}
14.	Untreated check	9.67 (3.18)	12.33 (3.58)^{e}	11.67 (1.08)^{a}	10.00 (3.23)^{ab}	11.67 (3.49)^{a}

DAT - Days after treatment
Values in parentheses are transformed by $\sqrt{x + 0.05}$
In column means followed by a common letter are significantly different by DMRT (P=0.5)

NPVs and spinosad and endosulfan and application of spinosad and endosulfan as second spray after NPV treatment at recommended dose were also effective in reducing the larval population (Table 1). The *Btk* formulations and NPVs were the next best treatments with increased yield over the untreated check. Muthuswamy *et al.* (1993) reported that combinations of unformulated HaNPV and S1NPV could control mixed populations of *H. armigera* and *S. litura.* Mixture of HaNPV and S1NPV was successfully used to manage the mixed populations in ground nut (Dhandapani *et al.*, 1993) and tomato (Devaraj *et al.,* 2001). The highest seed yield (1520 kg ha^{-1}) was recorded in indoxacarb treated plots ; however it was at par with spinosad treated plots (1480 kg ha^{-1}) (Table 1).

The observations indicated that the bee visit was lower in indoxacarb treated plots followed by endosulfan, spinosad and this was seen upto three day after spraying. But the bee visit was normal in microbial and botanical treated plots (Table 2).

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