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EFFICACY OF INSECTICIDES AND BIOPESTICIDES AGAINST *HELICOVERPA ARMIGERA* (HÜBNER) IN CHICKPEA

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ABSTRACT

Experiment on the efficacy of insecticides/bio-pesticides against *H. armigera* (Hubner) conducted at Agronomy farm College of Agriculture, Bikaner during Rabi 2005-06 revaled that out of ten treatments evaluated for the management of *H. armigera*, two sprays of indoxacarb (0.007%) and spinosad (0.01%) were found most effective followed by thiodicarb (0.07%), endosulfan (0.07%) and triazophos (0.06%) as moderately effective and HaNPV and Bt. as less effective in reducing pod borer population. Nimbecidine (0.5%) and Azacel (0.5%) were found least effective against pod borer. The maximum yield was obtained in plots treated with indoxacarb (1422 kg ha^{-1}) while minimum yield was obtained in the plots treated with Azacel (959 kg ha^{-1}).

Key Words: *Helicoverpa armigera,* insecticides/bio-pesticides, neem based formulation

The pod borer, *Helicoverpa armigera* (Hübner) as a pest due to its cosmopolitan distribution, unpredictable migration, puzzling regional variations in the host range, host preference and host cross over has gained importance at national and international levels. Out of three species of gram pod borer, *viz. Helicoverpa armigera* (Hübner), *H. assulta* (Guenec) and *H. peltigera* (Denis and Schiffermullar) prevailing in India, *H. armigera* (Lepidoptera: Noctuidae) is the most noxious polyphagous pest commonly called as gram pod borer, tomato fruit borer or American boll worm (Prabhakara Rao et al., 2001). The pest is a major constraint in the production of chickpea and has been reported to cause losses ranging from 20 to 80 per cent in different parts of the country (Sithanathan *et al.,* 1989). Keeping in view the economic importance of the pest, the present investigation was undertaken to evaluate the bioefficacy of insecticide/bio-pesticide against *H. armigera* in gram.

MATERIALS AND METHODS

The experiment was conducted at Research Farm, College of Agriculture, Bikaner during *rabi* season 2005-06. Experiment was laid out in Randomized Block Design (RBD) with ten treatments including control and three replications. Chickpea variety C-235 was sown in the month of October, 2005 in plot size of 3.0 m X 1.5 m with row to row and plant to plant distance of 30 x 10 cm respectively. The first spray was given on appearance of the pod borer, whereas, the second spray was given after fortnight of the first spray. The pre- treatment observations on larval population were recorded 24 hrs before and post treatment after 1,3,7 and 15 days of treatment spray on five randomly tagged plants in each plot. The pod damage was recorded at harvest on five randomly tagged plants in each plot.

RESULTS AND DISCUSSION

The data presented in Tables 1 to 3 reveal than in all the treatments maximum reduction in population was observed on third day after each spray. In case of first spray, 3 days after application indoxacarb (84.71 %) and spinosad (83.30%) were found most effective over rest of the treatments. The treatment with thiodicarb, endosulfan and triazophos provided 80.16, 76.80 and 76.80 per cent larval reduction, respectively. Azadirachtin (Azacel) was found least effective with 1793 per cent reduction in while larval population. While HaNPV and Bt. were found significantly better than the treatment of azacel and nimbecidine by reducing larval population by 37.70 and 29.01 per cent respectively.

Similarly, in case of second spray three days after spray, indoxacarb proved most effective and significantly superior over rest of the treatment showing 92.79 per cent reduction in larval population followed by 86.36, 81.49, 80.71 and 80.41 per cent for spinosad, thiodicarb, endosulfan and triazophos. The reduction in larval population was 48.61 and 45.07 per cent in HaNPV and Bt. which was significantly better than the Azacel and Nimbecidine. The treatment of azacel proved least effective followed by Nimbecidine and both of these treatments were comparable to each other.

Table 1: Efficacy of insecticides/ bio- pesticides against *H. armigera* during *Rabi* season 2005-06 (First spray)

S. No.	Treatments	Conc (%) / Dose	Pre-treatment Population	Per cent reduction in larval population* days after treatment			
				1	3	7	15
1.	Indoxacarb	0.007	1.80	74.13 (59.45)	84.71 (66.99)	76.48 (60.96)	70.71 (57.24)
2.	Spinosad	0.01	1.93	72.50 (58.38)	83.30 (65.85)	74.02 (59.33)	68.80 (56.04)
3.	Triazophos	0.06	1.66	68.00 (55.50)	76.80 (61.21)	61.69 (51.73)	50.70 (45.40)
4.	Thiodicarb	0.07	1.66	71.80 (57.92)	80.16 (63.55)	67.51 (55.22)	58.91 (50.11)
5.	Endosulfan	0.07	1.60	68.63 (55.94)	78.8 (62.60)	64.6 (53.49)	56.68 (48.68)
6.	*Bacillus thuringiensis* var. *kurstaki*	1000 ml/ha	1.20	14.82 (22.60)	29.01 (32.59)	45.23 (42.40)	32.23 (34.58)
7.	HaNPV	400LE/ha	1.13	15.90 (23.49)	31.70 (34.27)	46.60 (43.05)	33.29 (35.19)
8.	Azadirachtin (Nimbecidine)	0.50	1.26	10.00 (18.41)	23.68 (29.09)	33.23 (35.17)	26.38 (30.87)
9.	Azadirachtin (Azacel)	0.50	1.40	9.00 (17.48)	17.93 (25.04)	30.10 (33.27)	23.26 (28.75)
10.	Control	–	1.73	0.00	0.00	0.00	0.00
	SEM ±			0.89	0.89	1.05	0.89
	CD at 5 %		NS	2.66	2.65	3.14	2.66

* Mean of three replication
NS= Non- significant
Figures in parentheses are angular transformed values

The over all efficacy of the tested insecticides in both the sprays against *H. armigera* indicated that the treatment of indoxacarb was most effective followed by spinosad. The treatment with thiodicarb, endosulfan, triazophos was in the middle order of efficacy in reducing the larval population of *H. armigera*. The treatment of azacel was least effective followed by nimbecidine, Bt. and HaNPV.

The data presented in Table-3 pertaining to pod damage revealed that all the treatments proved significantly superior in reducing the pod infestation in comparison to control. The minimum pod damage (4.49 per cent) was recorded in the treatment of indoxacarb followed by spinosad (5.45 per cent), which was significantly superior over rest of the treatment. The treatment with thiodicarb, endosulfan and triazophos registered 7.03, 7.16 and 8.18 per cent pod damage and ranked the next best group of insecticides. The treatment with HaNPV, Bt. and nimbecidine were at par having 10.36, 11.04 and 11.93 per cent pod damage, respectively. The treatment of azacel was found least effective with pod damage 12.49 per cent.

The data presented in Table-3 revealed that all the insecticides significantly increased the yield of gram in comparison to control. The maximum yield of 1422 kg ha^{-1} was obtained when crop was treated with indoxacarb which had 72.36 per cent higher yield than that recorded in control. The treatments with thiodicarb, endosulfan and triazophos provided 1211, 1155 and 1103 kg ha^{-1} yield, respectively and formed next best group of insecticides in increasing the yield of gram *i.e.* 46.78, 40.00 and 33.69 per cent, respectively. The yield in case of HaNPV and Bt. was at par. Azacel provided 959 kg ha^{-1} yield and was least effective comparable to Nimbecidine (981 kg ha^{-1}).

The overall efficacy of insecticidal treatments at different time intervals against *H. armigera* revealed that indoxacarb (0.007 per cent) proved most effective in reducing the larval population followed by spinosad (0.01 per cent). The present results corroborate with the results of Bharpoda *et al*. (2005) who also reported indoxacarb as highly effective insecticide against *H. armigera* at different concentrations on different host plants. The treatment of spinosad at 0.01 per cent concentration ranked second in

Table 2: Efficacy of insecticides/ bio- pesticides against *H.armigera* during *Rabi* season 2005-06 (Second spray)

S. No.	Treatments	Conc (%) / Dose	Pre-treatment Population	Per cent reduction in larval population* days after treatment			
				1	3	7	15
1.	Indoxacarb	0.007	1.73	85.00 (67.22)	92.79 (74.39)	77.37 (61.50)	71.51 (57.71)
2.	Spinosad	0.01	1.86	82.61 (65.61)	86.63 (68.51)	76.19 (60.74)	70.91 (57.33)
3.	Triazophos	0.06	1.33	69.48 (56.44)	80.41 (63.75)	59.60 (50.53)	58.31 (49.79)
4.	Thiodicarb	0.07	1.53	73.92 (59.24)	81.49 (64.47)	73.73 (59.11)	65.45 (53.98)
5.	Endosulfan	0.07	1.46	71.90 (57.99)	80.71 (63.84)	66.52 (54.62)	61.08 (51.36)
6.	*Bacillus thuringiensis* var. *kurstaki*	1000 ml/ha	1.06	21.45 (27.51)	45.07 (42.91)	49.91 (44.94)	40.38 (39.44)
7.	HaNPV	400LE/ha	1.00	22.49 (28.29)	48.61 (44.21)	52.43 (46.37)	41.37 (39.95)
8.	Azadirachtin (Nimbecidine)	0.50	1.06	19.43 (26.12)	29.91 (33.10)	40.09 (39.21)	37.81 (37.97)
9.	Azadirachtin (Azacel)	0.50	1.20	17.86 (24.94)	29.40 (32.83)	37.08 (37.49)	32.08 (34.46)
10.	Control	–	2.00	0.00	0.00	0.00	0.00
	SEM +			1.11	1.10	1.18	0.76
	CD at 5 %		NS	3.31	3.27	3.50	2.26

* Mean of three replication
NS= Non- significant
Figures in parentheses are angular transformed values

Table 3: Effect of insecticides/bio-pesticides on the pod damage and yield of chickpea during *Rabi* season 2005-06

S. No.	Treatments	Conc (%) / Dose	Pod damage* (%)	Yield (kg ha^{-1})	Per cent increase in the yield over control
1.	Indoxacarb	0.007	4.49 (12.15)	1422	72.36
2.	Spinosad	0.01	5.45 (13.45)	1318	59.75
3.	Triazophos	0.06	8.18 (16.57)	1103	33.69
4.	Thiodicarb	0.07	7.03 (15.34)	1211	46.78
5.	Endosulfan	0.07	7.16 (15.48)	1155	40.00
6.	*Bacillus thuringiensis* var. *kurstaki*	1000ml/ha	11.04 (19.36)	1044	26.54
7.	HaNPV	400LE/ha	10.36 (18.75)	1074	30.18
8.	Azadirachtin(Nimbecidine)	0.50	11.93 (20.14)	981	18.90
9.	Azadirachtin(Azacel)	0.50	12.49 (20.64)	959	16.24
10.	Control	–	21.46 (27.40)	825	–
	SEM +		0.48	55.74	–
	CD at 5 %		1.43	165.61	–

* Mean of three replication
Figures in parentheses are angular transformed values.

order of efficacy in present investigation. Pan *et al*. (2000) also have reported spinosad as the most effective insecticide against *H. armigera* at different concentrations on cotton.

All the insecticidal treatments increased the yield of gram significantly in comparison to control. The maximum yield was obtained in the treatment of indoxacarb (1422 kg ha^{-1}) followed by spinosad (1318 kg ha^{-1}). The present

finding gets support from the findings of Giraddi *et al.* (2002) who reported 1.46 t. ha^{-1} seed yield in the plots treated with indoxacarb. The treatment of thiodicarb, endosulfan and triazophos provided 1211, 1155 and 1103 kg ha^{-1} yield, respectively. Dahiya *et al.,* (1983), Bhalani and Kotadia (1986) obtained 11.85 and 12.18 q ha^{-1} seed yield in the treatment of endosulfan in comparison to 8.59 and 10.15 q ha^{-1} in control which support the present findings. The HaNPV (1074 kg ha^{-1}) and Bt. (1044 kg ha^{-1}) though found least effective provided good grain yield of gram. The present findings corroborate with the results of Shukla *et al*. (1996) and Jadhav *et al*. (2004) who found NPV effective in comparison to control in increasing the yield. The treatment of Nimbecidine (0.5%) and Azacel (0.5%) provided 981 and 959 kg ha^{-1} seed yield of chickpea in present experiment. Similarly, Sharma *et al.* (1998) reported neem oil as least effective insecticide in increasing the yield of chickpea.

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