Progressive Research 9 (Special) : 458-461 (2014) *Society for Sci. Dev. in Agric. and Tech.*

EVALUATION OF NEWER GROUPS OF INSECTICIDE AGAINST SHOOT AND FRUIT BORER, *Earias vittella* (Fab.) IN OKRA

Sanjay Kumar and R.C. Sharma
Department of Entomology, N.D. Univ. of Agric. and Tech., Kumarganj, Faizabad (U.P.)

ABSTRACT

A field experiment was conducted during Kharif, 2012 and 2013 on okra, *Abelmoschus esculentus* (L.) with eight treatments including control were taken for experimentation. The experiment was lay out in RBD with three replication comprising Indoxacarb @ 75g a.i/ha, Coragen@30g a.i/ha, Spinosad@100g a.i/ha, Profenophos@750g a.i/ha, Thiodicarb@ 750g a.i/ha, Bacillus thuringiensis @ 75g a.i/ha, Azadirachtin @ 2.5lit /ha for minimizing the incidence of shoot and fruit borer in okra. The treatment T_2 Coragen recorded lowest mean number of shoot (5.72 and 6.21%) and fruit damage (6.29 and 6.83%) followed by T_3 spinosad (6.41 and 6.78%) and (7.17 and 7.47%) shoot and fruit damage, respectively during Kharif, 2012 and 2013. The maximum yield recorded in treatment T_2 (118.02 and 117.10 q/ha) and T_2 (115.65 and 114.85 q/ha) as compare to control (68.80 and 68.10 q/ha).

Key words : *Okra, coragen, spinosad, Earias vittella, shoot and fruit borer.*

Okra (*Abelmoschus esculentus* L. Moench.) is a malvaceaeous vegetable crop cultivated in tropical and subtropical part of the world. It is called lady's finger in England, gumbo in the United States of America, and Bhindi in India. About 13 insect pests have been recorded that are known to cause damage to okra (1). The major one is the shoot and fruit borers, Earias vittella Fabricious (2). It is one of the major limiting factors in the production of quality fruits of okra (2). The infestation to okra accounted for nearly 22.5% in Uttar Pradesh (3), 25.9% to 40.9% in Madhya Pradesh by the shoot and fruit borer (4). Earias vittella causes considerable damage at vegetative and reproductive stages and acts as major constraints in the production of marketable fruits of okra.

MATERIALS AND METHODS

The experiment was conducted during the Kharif seasons 2012 and 2013 at Students Instructional Farm, NDUA&T, Kumarganj, Faizabad (UP).The seed of okra (variety- Arka Anamika) was sown in the month of last week of June in both season and all the agronomic and cultural practices recommended for its cultivation were followed as per the requirement. The crop was sown in the plots of 4.5 m x 3 m with row to row and plant to plant spacing 60 cm x 45 cm respectively. Eight treatments including untreated control were taken for experimentation. The experiment was lay out in RBD and replicated thrice comprising Indoxacarb @75g a.i/ha, Coragen@30g a.i/ha, Spinosad@100g a.i/ha, Profenophos@750g a.i/ha, Thiodicarb@750g a.i/ha, Bacillus thuringiensis@75g a.i/ha, Azadirachtin @ 2.5lit /ha. All the treatments were applied three times at fortnightly interval using knapsack sprayer.

Observation on shoot damaged plants caused by Earias species were recorded on ten randomly selected plants from three inner rows in each plot at pre and after treatment at 7 and 15 days after spray. Total numbers of plant as well as shoot damaged plant were exhaustively counted and the treatments were compared in term of percentage shoot damaged. Damage and healthy fruits were recorded separately at each picking to find out the per cent fruit damage. After the last picking, total of all pickings of individual plots produce were calculated to work out the yield of the treatment. Yield of green healthy fruits of each plot was converted into quintal per hectare. The economics of treatment was calculated in term of cost: benefit ratio on the basis of pooled data of fruit yield. All the data were subjected to standard statistical analysis after arc sine transformation to draw the conclusion. The per cent shoot and fruit damaged were calculated by using the following formulae.

$$\text{Shoot / Fruit damaged (\%)} = \frac{\text{Number of damaged Shoot / Fruit}}{\text{Total number of Shoot / Fruit}} \times 100$$

RESULTS AND DISCUSSION

Data obtained during both study years revealed that all the treatments were significantly effective in reducing

Table-1: Effects of insecticide against *Earias vittella* based on per cent shoot damage on okra (Kharif, 2012)

S. No	Treatments	a.i/ha	Pre Treatment	Per cent Shoot Damage DAS (Days After Spraying)						
				I^{st} Spray		II^{nd} Spray		III^{rd} Spray		Mean
				7 DAS	15 DAS	7 DAS	15 DAS	7 DAS	15 DAS	
T_1	Indoxacarb 14.5 EC	75g	22.33 (28.16)	6.04 (14.23)	7.15 (15.5)	6.28 (14.51)	7.25 (15.60)	6.38 (14.63)	7.11 (15.46)	6.70 (14.86)
T_2	Coragen 18.5 SC	30g	22.53 (28.31)	5.10 (13.05)	6.19 (14.41)	5.65 (13.75)	6.40 (14.65)	5.25 (13.24)	5.70 (13.80)	5.72 (14.02)
T_3	Spinosad 45 SC	100g	21.02 (27.28)	5.86 (14.01)	6.85 (15.17)	6.05 (14.24)	6.75 (15.05)	6.10 (14.30)	6.87 (15.19)	6.41 (14.47)
T_4	Profenophos 50 EC	750g	22.52 (28.31)	9.30 (17.75)	10.25 (18.67)	10.30 (18.72)	12.72 (20.88)	8.27 (16.71)	9.13 (17.59)	10.04 (19.05)
T_5	Thidiocarb 75 WP	750g	20.89 (27.09)	9.75 (18.18)	10.50 (18.91)	11.72 (20.02)	13.69 (21.71)	8.53 (16.98)	9.50 (17.95)	10.57 (20.15)
T_6	Bt 5%	75g	19.80 (26.42)	11.85 (20.14)	14.50 (22.37)	12.12 (20.37)	15.05 (22.83)	8.75 (17.20)	11.72 (20.02)	12.33 (21.31)
T_7	Azadirachtin 0.03%	2.5lit	26.03 (30.67)	13.68 (21.71)	15.00 (22.79)	13.50 (21.56)	15.50 (23.18)	11.06 (19.42)	12.55 (20.75)	13.55 (23.08)
T_8	Untreated Control	-	27.43 (31.58)	28.56 (32.3)	26.50 (30.98)	30.58 (33.57)	32.16 (34.53)	27.88 (31.87)	29.68 (33.01)	29.23 (30.09)
	SEm ±	1.10	0.27	0.25	0.32	0.46	0.14	0.26	0.28	
	CD at 5%	3.34	0.82	0.77	0.98	1.38	0.43	0.80	0.86	

*The data in parenthesis is arc sine transformation value.

Table-2 : Effects of insecticide against *Earias vittella* based on per cent fruit damage on okra (Kharif, 2012)

S.No	Treatments	a.i/ha	Pre Treatment	Per cent Shoot Damage DAS (Days After Spraying)						Mean
				I^{st} Spray		II^{nd} Spray		III^{rd} Spray		
				7 DAS	15 DAS	7 DAS	15 DAS	7 DAS	15 DAS	
T_1	Indoxacarb 14.5 EC	75g	21.77 (27.76)	7.15 (15.51)	7.80 (16.21)	7.60 (16.00)	8.50 (16.94)	7.12 (15.47)	8.00 (16.43)	7.70 (16.87)
T_2	Coragen 18.5 SC	30g	19.75 (26.34)	5.50 (13.56	6.38 (14.63)	6.78 (15.09)	7.35 (15.73)	5.60 (13.69)	6.12 (14.32)	6.29 (15.89)
T_3	Spinosad 45 SC	100g	25.94 (30.61)	6.27 (14.50)	7.12 (15.47)	7.15 (15.51)	7.95 (16.38)	6.80 (15.11)	7.70 (16.11)	7.17 (16.46)
T_4	Profenophos 50 EC	750g	21.54 (27.60)	12.33 (20.56)	13.85 (21.85)	12.50 (20.70)	15.50 (23.18)	11.75 (20.05)	12.15 (20.39)	13.01 (19.84)
T_5	Thidiocarb 75 WP	750g	22.70 (28.44)	12.68 (20.86)	14.00 (21.97)	12.66 (20.84)	16.20 (23.73)	12.05 (20.40)	13.50 (21.56)	13.52 (20.09)
T_6	Bt 5%	75g	23.95 (29.27)	13.75 (21.76)	15.78 (23.40)	15.25 (22.98)	17.25 (24.54)	13.16 (21.27)	15.55 (23.22)	15.12 (21.34)
T_7	Azadirachtin 0.03%	2.5lit	26.36 (30.89)	15.75 (23.38)	16.14 (23.69)	15.80 (23.42)	17.50 (24.73)	14.00 (21.97)	17.75 (24.92)	16.16 (22.87)
T_8	Untreated Control	-	28.06 (31.90)	30.32 (33.40)	28.70 (32.39)	30.15 (30.30)	34.50 (35.97)	31.60 (34.20	30.50 (33.52)	30.96 (32.55)
	SEm ±		1.40	0.26	0.18	0.39	0.31	0.27	0.23	0.27
	CD at 5%		4.25	0.80	0.54	1.17	0.95	0.82	0.70	0.83

*The data in parenthesis is arc sine transformation value

the shoot and fruit infestation in okra as compare to the control during both seasons.

The pooled mean per cent shoot infestation was lowest in T2 treated plot (5.72 and 6.21) per cent which was significantly superior to other treatments followed by T_3 (6.41 and 6.78%), T_1 (6.70 and 7.10%), T_4 (10.04 and 11.05%), T_5 (10.57 and 12.07%), T_6 (12.33 and 13.40%), T_7 (13.55 and 14.54%) in compared to Control 29.23 and 31.49% respectively during Kharif, 2012 and 2013 (Table-1 and 3). The present findings are in concurrence with (5) who had reported that foliar spray of spinosad minimized the shoot and fruit borer incidence and gave more okra yield.

Pooled per cent damage fruit on number basis showed significant differences among all the treatments (Table-2 and 4). The lowest fruit damage by *Earias* spp on okra was recorded in treatment T_2 was most effective (6.29%) which was at par with treatment

Table-3 : Effects of insecticide against *Earias vittella* based on per cent shoot damage on okra (Kharif, 2013)

S. No.	Treatments	a.i/ha	Pre Treatment	Per cent Shoot Damage DAS (Days After Spraying)						
				I^{st} Spray		II^{nd} Spray		III^{rd} Spray		Mean
				7 DAS	15 DAS	7 DAS	15 DAS	7 DAS	15 DAS	
T_1	Indoxacarb 14.5 EC	75g	28.17 (32.05)	7.20 (15.56)	7.60 (16.00)	6.55 (14.83)	7.40 (15.78)	6.47 (14.73)	7.35 (15.73)	7.10 (15.44)
T_2	Coragen 18.5 SC	s30g	22.54 (28.34)	6.27 (14.50)	6.60 (14.89)	5.81 (13.94)	6.65 (14.94)	5.60 (13.69)	6.30 (14.54)	6.21 (14.42)
T_3	Spinosad 45 SC	100g	20.42 (26.86)	6.95 (15.28)	7.05 (15.40)	6.30 (14.54)	7.05 (15.40)	6.22 (14.44)	7.10 (15.45)	6.78 (15.09)
T_4	Profenophos 50 EC	750g	25.08 (30.05)	10.70 (19.09)	12.90 (21.05)	11.35 (19.67)	12.95 (21.09)	8.72 (17.17)	9.70 (18.14)	11.05 (19.37)
T_5	Thidiocarb 75 WP	750g	24.38 (29.55)	11.80 (20.09)	13.50 (21.56)	12.85 (20.99)	13.89 (21.88)	9.50 (17.94)	10.85 (19.21)	12.07 (20.28)
T_6	Bt 5%	75g	22.83 (28.46)	12.60 (20.78)	15.15 (22.91)	14.52 (22.40)	15.75 (23.38)	10.50 (18.90)	11.87 (20.15)	13.40 (21.42)
T_7	Azadirachtin 0.03%	2.5lit	21.10 (27.34)	14.80 (22.62)	16.75 (24.16)	14.78 (22.61)	16.25 (23.77)	11.77 (20.02)	12.88 (21.03)	14.54 (22.37)
T_8	Untreated Control	-	22.82 (28.52)	30.17 (33.31)	27.50 (31.63)	32.15 (34.53)	35.25 (36.41)	33.70 (35.48)	30.15 (33.30)	31.49 (34.11)
	SEm ±	1.01	0.31	0.20	0.52	0.36	0.37	0.33	0.35	
	CD at 5%	3.08	0.93	0.60	1.57	1.16	1.12	1.01	1.07	

*The data in parenthesis is arc sine transformation value

Table-4 : Effects of insecticide against *Earias vittella* based on per cent fruit damage on okra (Kharif, 2013)

S. No.	Treatments	a.i/ha	Pre Treatment	Per cent Shoot Damage DAS (Days After Spraying)						
				I^{st} Spray		II^{nd} Spray		III^{rd} Spray		Mean
				7 DAS	15 DAS	7 DAS	15 DAS	7 DAS	15 DAS	
T_1	Indoxacarb 14.5 EC	75g	21.77 (27.81)	7.65 (16.05)	8.50 (16.94)	8.05 (16.48)	9.30 (17.75)	7.50 (15.89)	8.30 (16.74)	8.22 (16.64)
T_2	Coragen 18.5 SC	30g	18.68 (25.56)	6.80 (15.11)	7.25 (15.62)	7.10 (15.45)	7.65 (16.05)	5.80 (13.93)	6.40 (14.65)	6.83 (15.14)
T_3	Spinosad 45 SC	100g	23.61 (29.06)	7.10 (15.45)	7.30 (15.67)	7.25 (15.62)	8.15 (16.59)	7.12 (15.48)	7.90 (16.32)	7.47 (15.86)
T_4	Profenophos 50 EC	750g	22.87 (28.55)	12.60 (20.79)	14.00 (21.97)	12.85 (21.01)	16.12 (23.67)	11.09 (19.43)	13.77 (21.78)	13.41 (21.44)
T_5	Thidiocarb 75 WP	750g	20.23 (26.72)	14.50 (22.38)	15.24 (22.98)	13.50 (21.55)	17.15 (24.46)	12.15 (20.39)	14.20 (22.14)	14.46 (22.32)
T_6	Bt 5%	75g	19.28 (25.95)	15.80 (23.42)	16.85 (24.23)	15.75 (23.38)	17.50 (24.73)	13.25 (21.35)	16.25 (23.77)	15.90 (23.48)
T_7	Azadirachtin 0.03%	2.5lit	24.21 (29.47)	16.00 (23.58)	17.25 (24.54)	16.30 (23.81)	18.50 (25.47)	15.60 (23.26)	18.50 (25.47)	17.03 (24.36)
T_8	Untreated Control	-	23.39 (28.92)	30.50 (33.51)	28.50 (32.26)	34.50 (35.96)	38.10 (38.11)	36.10 (36.92)	31.12 (33.90)	33.14 (35.11)
	SEm ±		1.03	0.36	0.35	0.24	0.31	0.35	0.36	0.33
	CD at 5%		3.15	1.10	1.06	0.74	0.94	1.08	1.08	1.00

*The data in parenthesis is arc sine transformation value

T_3 (7.17%) and T_1 (7.70%) followed by T_4 (13.01%), T_5 (13.52%), T_6 Bt (15.12%) and T_7 (16.16%) as compare to control 30.96% during Kharif 2012. In Kharif 2013, the minimum fruit damage of (6.83%) was recorded in T_2 coragen, while T_3 spinosad (7.47%) was second effective treatment followed by T_1 indoxacarb (8.22%), T_4 profenophos (13.41%), T_5 thiodicarb (14.46%), T_6 Bt (15.90%) and T7 azidirachtin (17.03%) as compare to control 33.14 per cent fruit infestation. The coragen was most effective treatment followed by spinosad and indoxasarb and azadirachtin was least effective treatment. These finding collaborated with the result of (6) who had reported that the Coragen (rynaxypyr) 20 SC @ 30 g a.i. /ha and Coragen 20 SC @ 20 g a.i. /ha were superior to check the fruit damage and higher okra yield followed by spinosad @ 56 g a.i/ha. (7) reported that the Indoxacarb 14.5% SC proved to be the most effective treatment against shoot and fruit

Table-5 : Economics of treatments for management of shoot and fruit borer in okra during Kharif, 2012 and 2013.

Treatment	Quantity required/ ha	Total treatment quantity	Cost of insecticide	Cost of treatment	Yield (q/ha)	Yield saved over control (q/ha)	Value of saved yield (q/ha)	Gross income	Net income	C:B Ratio
Indoxacarb 14.5 EC	500ml	1.50 lit	3400	6750	104.80	36.35	54525	157200	47775	1:8.08
Coragen 18.5% SC	150ml	0.45 lit	14000	7950	117.56	49.11	73665	176340	65715	1:9.27
Spinosad 45% SC	166ml	0.50 lit	14500	8900	115.25	46.80	70200	172875	61300	1:7.89
Profenophos 50%EC	1.50 lit	4.50 lit	520	3990	83.50	15.05	22575	125250	18585	1:5.66
Thidiocarb 75% WP	1.00 Kg	3.00 Kg	1000	4650	81.22	12.77	19155	121830	14505	1:4.12
Bt 5%	1.50 Kg	4.50 Kg	300	3000	76.67	8.22	12330	115005	9330	1:4.11
Azadirachtin 0.03%	2.50 lit	7.50 lit	280	3750	73.32	4.87	7305	109980	3555	1:1.95
Untreated Control	-	-	-	-	68.45	-	-	102675	-	-

borer, *Earias vittella* F. in and it was at par with spinosad.

All the treatment gave higher fruit yield over unprotected control during both the Kharif, season. The coragen @ 30 g a.i./ha treated plot gave maximum fruit yield (118.02 and 117.10 q/ ha) respectively during Kharif 2012 and 2013 followed by T_3 > T_1> T_4>T_5> T_6> and T_7 with respective fruit yields of (115.65 and114.85), (105.35 and 104.25), (84.20 and 82.80), (81.60 and 80.84), (77.24 and 76.10) and (73.74 and 72.90) q/ha respectively were significantly superior over unprotected check (68.80 and 68.10 q/ha) during Kharif 2012 and 2013. Similar finding was also reported by (8) who have reported that the indoxacarb was most effective among all the treatments evaluated against shoot and fruit borer on okra.

Net monitory return in different treatment varied from Rs. 3555 to 65715 per hectare(Table-5). The maximum profit of Rs. 65715/ ha was obtained from the plot treated with T_2 coragen followed by T_3 spinosad Rs. 61300, T_1 indoxacarb Rs 47775, T_4 profenophos Rs. 18585, T_5 thiodicarb Rs. 14505, T_6 Bt Rs. 9930 and least in T_7 Azadirachtin Rs. 3555, respectively.

The cost benefit ratio (CBR) in different treatment ranged 1:1.95 to 1:9.27, however the highest cost benefit ratio of 1:9.27 per rupee was obtained in T_2 treatment followed by T_1 (1:8.08) > T_3 (1:7.89) > T_4 (1:5.66) > T_6 (1:4.12) > T_5 (1:4.11) and T_7 (1:1.95), respectively. The T_2 coragen treatment was more effective to reduce the shoot and fruit infestation as well as to provide highest okra yield. The present observations are conformity with Kumar et al. (2013) who has reported that indoxacarb 14.5 SC @ 0.5 lit/ha minimized the shoot and fruit damage of 1.6% and 3.3%, respectively against the pest as well as gave maximum marketable yield 93.26 q/ha with highest cost benefit ratio of 1 : 9.9. These findings are in accordance with present study.

REFERANCES

1. Mandal, S.K; Sah, S.B; Gupta, S.C. (2006). Screening of okra cultivars against Earias vitella. *Ann. Pl. Protec. Sci., 14(2) :* 471-472.
2. Kharbade, S.B; Chandel, A.G. and Dethe, M.D. (1998). Bioeffecacy of *Bacillus thuringiensis* (Berliner) varietal products against E. vittella (Fab.) on okra. *Pestology, 22(11) :* 8-10.
3. Verma, G. S. (1985). Response of chemicals to control spotted bollworm in okra. *Ind. Jour. Entomology, 47(3):* 357-358.
4. Dhamdhere, S.V; Bahadur, J and Mishra, V.S. (1985). Studies on occurance and succession of pest of okra at Gwalior. *Indian J. Pl. Protection, 12(1):* 9-12.
5. Birah, A; Kumar, K; Bhagat, S; Singh, P.K; Srivastava, R.C. (2010). Evaluation of pest management modules against *Earias vittella* (Febricius) on okra. *Annals Plant Protection Sciences.18 (2) :* 53-55.
6. Chowdary, L.R.; Bheemanna, M.; Kumar, L.R. (2010). Field efficacy of rynaxypyr (coragen) 20 SC against fruit and shoot borer, Earias vittella (Fab.) in okra. *International J. Plant Protection, 3(20) :* 316-318.
7. Singh, S.S.; Rai, M.K. and Singh, V.B. (2010). Bio-efficacy of bio-rational insecticides and B.t. based bio-insecticides against shoot and fruit borer, *Earias vittella* in okra. *Veg. Sci., 37(2) :* 171-174.
8. Umrao, R.S.; Singh, S.; Kumar, J.; Singh D.R. and Singh, D.K. (2012). Efficacy of novel insecticides against shoot and fruit borer (*Earias vittella* Fabr.) in okra crop. *Hort. Flora Research Spectrum, 2(3) :* 251-254.