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Bio-efficacy of BAS 450 01 I 300 SC against major insect pests of okra during *Kharif* season 2015-16 to 2016-17

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Abstract
An experiment was conducted to observe the "Bio-efficacy of BAS 450 01 I 300 SC against major insect pests of okra during *Kharif* Season2015-16 and 2016-17" at Horticulture farm, Department of Horticulture, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya (IGKV), Raipur, Chhattisgarh. In okra crop, novel approaches of insect management by using new molecules of insecticides may play important role to manage shoot and fruit borer and safer to non target pest and natural enemies. Two year computed data of mean per cent of fruit damage indicated that, the plot Field experiment was conducted to evaluate the efficacy of some new insecticides against sucking insect pest's *viz.*, leafhopper, aphid, thrips and whitefly in okra. Two sprays of different insecticides viz., BAS 450 01 I 300 SC, Chlorantraniliprole 18.5% SC, Cypermethrin 10% EC, at three different concentrations of BAS 450 01 I 300 SC@ 18.5, 12.5 and 6.5 g.a.i./ha were made at 1,3,5,7 and 10 days interval. All the treatments registered significantly lower population of sucking pests as compared to untreated control. BAS 450 01 I 300 SC@18.5 g.a.i./ha proved the best treatment for the control of the sucking pest, however, treatments viz., BAS 450 01 I 300 SC@ 12.5 g.a.i./h and Chlorantraniliprole 18.5% SC @ 25 g.a.i./ha were also observed to be effective treatments in most of the observations.

Keywords: Aphid, leafhopper, whitefly and okra

Introduction
Amongst the various vegetable grown Okra *Abelmoschus esculentus* L. (Moench) belongs to family Malvaceae, is an economically important vegetable crop grown in tropical and sub-tropical parts of the world. This crop is suitable for cultivation as a kitchen garden crop as well as on large high-tech commercial farms. It is grown commercially in India, Turkey, Iran, Western Africa, Yugoslavia, Bangladesh, Afghanistan, Pakistan, Burma, Japan, Malaysia, Brazil, Ghana, Ethiopia and the Southern United States. Vegetables constitute an important food item, supplying vitamins, carbohydrates and minerals needed for a balanced diet. (Randhawa, 1974; Masood Khan *et al.*, 2001) [8].

There are several constraints in the cultivation of okra. Many of the pests occurring on cotton are also found on okra crop. As high as, 72 species of insects have been recorded on okra (Srinivas Rao and Rajendran, 2003), of which, the sucking pests comprising of leafhopper, *Amrasca biguttula biguttula* (Ishida), whitefly, *Bemisia tabaci* (Gennadius) and mite, *Tetranychus urticae* (Boisduval) cause significant damage to the crop. Leafhopper, a polyphagous, pest has been a serious pest on okra causing heavy loss during these years. High population of leafhopper significantly sucks cell sap usually from ventral surface of the leaves and inject toxic saliva into plant tissues, turning the leaves to yellowish and curl upward (Singh *et al.*, 2008) [11]. Whitefly (*B. tabaci*) nymphs and adults remove significant amount of cell sap from the leaves to reduce the plant vigour. They are responsible for transmitting yellow vein mosaic virus also. Red spider mites scratch the leaf tissues and lap the oozing out sap. Heavy webbing caused by the mite make it difficult to control.

Among the vegetable crops grown in India, okra is an important crop grown throughout the year. Fruit and shoot borer, *Earias vittella* is the key pest of okra and requires regular control measures to produce a profitable crop. The avoidable losses in yield & fruit damage due to this pest have been estimated from 36-90% (Misra *et al.*, 2002) [5].

Materials and Methods

The experimental site was conducted at Horticulture farm, Department of Horticulture, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya (IGKV) Raipur, Chhattisgarh. During *Kharif* season, 2015-16 and 2016-17. The tested insecticides were first diluted to the desired concentration by using distilled water. Each insecticidal concentration was sprayed through knapsack sprayer after proper dilution of required water quantity. Daily observations of insect pest appearance were observed with respected to the date of sowing of the okra crop. In this experiment, number of infested shoots and number of infested fruits was recorded on randomly selected ten plants/plot at 10 day's interval in each picking. Pretreatment population was recorded at 24 hours before and post treatment after 1, 3, 5,7,10 days of spray for sucking pests and natural enemies on randomly selected 5 plant/plot.

Treatments

S. No.	Treatments	Dose
1.	BAS 450 01 I 300 SC	6.5 g a.i./ha
2.	BAS 450 01 I 300 SC	12.5 g a.i./ha
3.	BAS 450 01 I 300 SC	18.5 g a.i./ha
4.	Chlorantraniliprole 18.5% SC	25 g a.i./ha
5.	Cypermethrin 10% EC	70 g a.i./ha
6.	Untreated control	---

Table 1: Bio-efficacy of BAS 450 01 I 300 SC against Jassid on okra pooled data during *Kharif* 2016-17 and 2017-18.

Treatment No.	Treatment	Dose	Pre treatment	Average no. of jassids/ 3 leaves/ 5 plant										Over all mean
				I Spray					II Spray					
				1 Day	3 Days	5 Days	7 Days	10 Days	1 Days	3 Days	5 Days	7 Days	10 Days	
T_1	BAS 450 01 I 300 SC	6.5 g a.i./ha	6.84 (2.77)	2.16 (1.76)	1.94 (1.69)	1.53 (1.57)	2.14 (1.75)	3.28 (2.05)	2.99 (1.97)	2.56 (1.88)	2.42 (1.83)	2.49 (1.83)	2.83 (1.90)	2.63
T_2	BAS 450 01 I 300 SC	12.5 g a.i./ha	5.87 (2.61)	2.20 (1.77)	1.63 (1.61)	1.48 (1.57)	1.64 (1.61)	2.16 (1.77)	2.52 (2.34)	1.78 (1.66)	1.59 (1.60)	1.48 (1.56)	2.30 (1.79)	2.03
T_3	BAS 450 01 I 300 SC	18.5 g a.i./ha	6.71 (2.74)	2.00 (1.71)	1.52 (1.57)	1.37 (1.53)	1.68 (1.63)	2.04 (1.74)	1.98 (1.72)	1.86 (1.67)	1.69 (1.63)	1.04 (1.42)	1.70 (1.63)	1.90
T_4	Chlorantraniliprole 18.5% SC	25 g a.i./ha	6.82 (2.78)	2.54 (1.84)	2.24 (1.75)	1.97 (1.70)	2.21 (1.78)	2.73 (1.92)	2.98 (1.96)	2.39 (1.82)	2.15 (1.75)	1.81 (1.66)	2.83 (1.92)	2.00
T_5	Cypermethrin 10% EC	70 g a.i./ha	6.53 (2.72)	3.59 (2.10)	3.47 (2.04)	3.19 (1.99)	3.62 (2.09)	4.34 (2.26)	4.19 (2.21)	3.47 (2.07)	3.03 (1.96)	2.68 (1.87)	3.17 (1.99)	3.61
T_6	Untreated control		5.70 (2.56)	6.69 (2.73)	7.11 (2.80)	7.36 (2.85)	7.33 (2.84)	8.11 (2.97)	7.19 (2.83)	7.34 (2.35)	7.65 (2.90)	8.00 (2.95)	7.37 (2.86)	7.38
SEm±			0.16	0.09	0.08	0.09	0.08	0.07	0.12	0.08	0.09	0.10	0.12	
CD at 5%			NS	0.28	0.25	0.27	0.24	0.22	0.37	0.27	0.27	0.30	0.36	

( ) Figures in parentheses are arc sin transformed values.

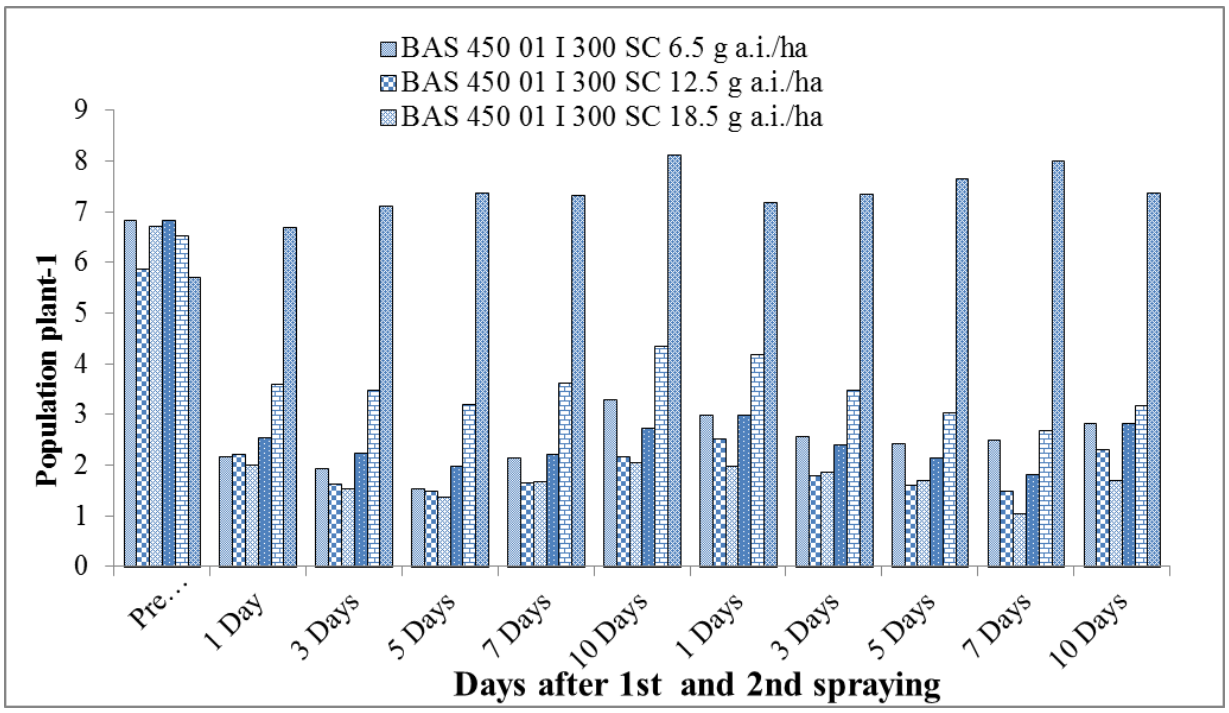

Fig 1: Bio - efficacy of BAS 450 01 I 300 SC against jassid on okra after first and second spray.

Table 2: Bio-efficacy of BAS 450 01 I 300 SC against thrips on okra pooled data during *Kharif* 2016-17 and 2017-18

Treatment No.	Treatment	Dose	Pretreatment	Average no. of thrips 3 leaves/ 5 plant										Over all mean
				I Spray					II Spray					
				1 Day	3 Days	5 Days	7 Days	10 Days	1 Days	3 Days	5 Days	7 Days	10 Days	
T_1	BAS 450 01 I 300 SC	6.5 g.a.i./ha	4.37 (2.21)	1.29 (1.5)	0.91 (1.3)	1.43 (1.5)	2.67 (1.8)	3.21 (1.9)	2.26 (1.7)	1.84 (1.6)	1.44 (1.5)	2.78 (1.8)	3.32 (2.0)	2.26
T_2	BAS 450 01 I 300 SC	12.5 g a.i./ha	3.74 (2.11)	0.95 (1.3)	0.54 (1.2)	1.25 (1.4)	1.81 (1.6)	2.73 (1.8)	1.91 (1.6)	1.10 (1.4)	1.27 (1.4)	1.85 (1.6)	2.83 (1.8)	1.76
T_3	BAS 450 01 I 300 SC	18.5 g a.i./ha	4.16 (2.20)	0.82 (1.3)	0.54 (1.2)	1.20 (1.4)	1.92 (1.6)	2.11 (1.7)	1.68 (1.5)	1.25 (1.4)	0.87 (1.3)	1.99 (1.6)	2.27 (1.7)	1.64
T_4	Chlorantraniliprole 18.5% SC	25 g a.i./ha	4.16 (2.23)	1.88 (1.6)	1.47 (1.5)	2.04 (1.6)	2.74 (1.8)	3.14 (1.9)	2.11 (1.7)	1.71 (1.5)	1.63 (1.5)	2.69 (1.8)	3.18 (1.9)	2.00
T_5	Cypermethrin 10% EC	70 g a.i./ha	5.30 (2.48)	3.18 (1.9)	2.65 (1.8)	2.44 (1.78)	3.12 (1.93)	3.62 (2.05)	2.83 (1.88)	3.01 (1.90)	2.62 (1.80)	3.35 (2.01)	3.93 (2.15)	3.19
T_6	Untreated control	-	5.60 (2.50)	6.09 (2.61)	6.79 (2.73)	7.08 (2.79)	6.58 (2.72)	7.29 (2.83)	8.18 (2.97)	7.17 (2.82)	7.37 (2.85)	6.63 (2.73)	7.08 (2.79)	6.98
Sem ±			0.21	0.10	0.09	0.08	0.07	0.07	0.12	0.09	0.09	0.09	0.09	
CD at 5%			NS	0.29	0.28	0.25	0.23	0.22	0.36	0.27	0.27	0.28	0.27	

( ) Figures in parentheses are arc sin transformed values.

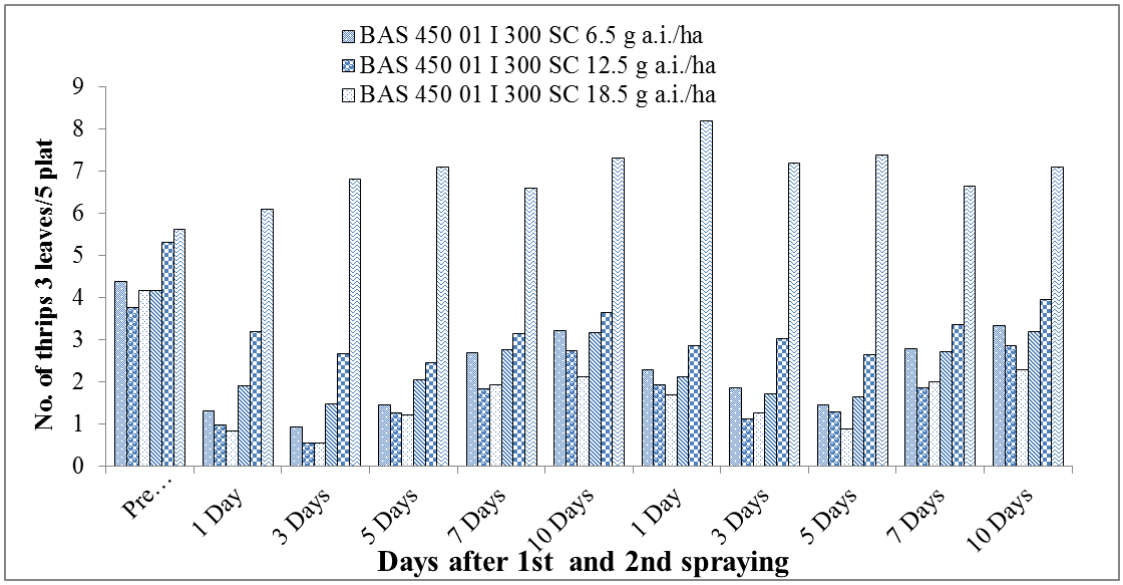

Fig 2: Bio - efficacy of BAS 450 01 I 300 SC against thrips on okra after first and second spray.

Table 3: Bio-efficacy of BAS 450 01 I 300 SC against whitefly on okra pooled data during *Kharif* 2016-17 and 2017-18

Treatment No.	Treatment	Dose	Pre treatment	Average no. of whitefly 3 leaves/ 5 plant										Overall mean
				I Spray					II Spray					
				1 Day	3 Days	5 Days	7 Days	10 Days	1 Days	3 Days	5 Days	7 Days	10 Days	
T_1	BAS 450 01 I 300 SC	6.5 g a.i./ha	3.67 (2.07)	0.92 (1.38)	0.80 (1.34)	0.86 (1.35)	0.97 (1.40)	1.39 (1.54)	1.03 (1.41)	0.85 (1.35)	0.75 (1.32)	0.97 (1.39)	1.25 (1.49)	1.11
T_2	BAS 450 01 I 300 SC	12.5 g a.i./ha	3.78 (2.09)	0.81 (1.33)	0.71 (1.30)	0.79 (1.33)	0.78 (1.33)	1.11 (1.44)	0.97 (1.38)	0.78 (1.32)	0.59 (1.25)	0.68 (1.29)	0.88 (1.35)	0.94
T_3	BAS 450 01 I 300 SC	18.5 g a.i./ha	4.18 (2.21)	0.78 (1.33)	0.67 (1.28)	0.57 (1.24)	0.81 (1.34)	0.95 (1.39)	0.82 (1.33)	0.59 (1.24)	0.41 (1.18)	0.58 (1.25)	0.75 (1.32)	0.85
T_4	Chlorantraniliprole 18.5% SC	25 g a.i./ha	3.88 (2.15)	0.95 (1.39)	0.79 (1.33)	1.01 (1.40)	1.11 (1.44)	1.46 (1.56)	1.48 (1.54)	1.14 (1.43)	1.24 (1.47)	1.19 (1.45)	1.44 (1.54)	2.00
T_5	Cypermethrin 10% EC	70 g a.i./ha	4.39 (2.26)	1.40 (1.53)	1.22 (1.47)	1.12 (1.44)	1.33 (1.51)	1.54 (1.59)	1.59 (1.58)	1.31 (1.49)	1.39 (1.53)	1.35 (1.53)	1.53 (1.58)	1.51
T_6	Untreated control	-	3.57 (2.54)	4.25 (2.28)	4.36 (2.30)	4.54 (2.34)	4.71 (2.37)	4.95 (2.43)	4.27 (2.25)	4.42 (2.28)	4.40 (2.28)	4.14 (2.24)	4.21 (2.26)	4.41
Sem±			0.20	0.08	0.08	0.07	0.06	0.06	0.12	0.10	0.10	0.09	0.09	
CD at 5%				0.24	0.23	0.24	0.21	0.18	0.37	0.32	0.30	0.28	0.27	

( ) Figures in parentheses are arc sin transformed values.

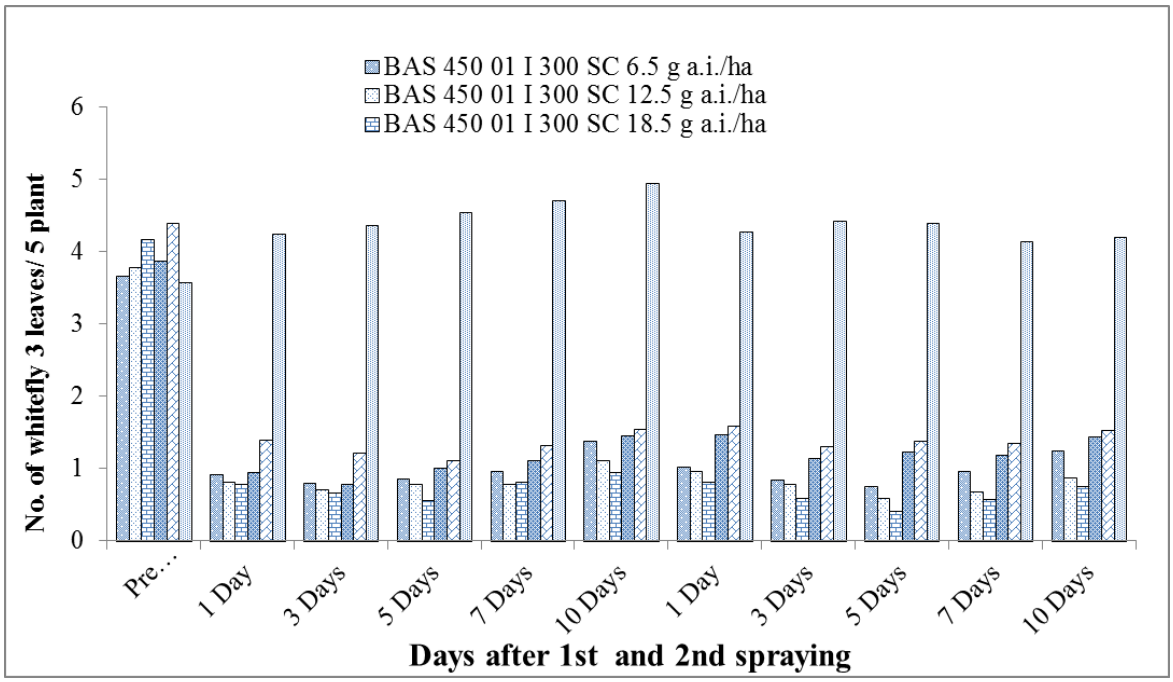

Fig 3: Bio – efficacy of BAS 450 01 I 300 SC against whitefly on okra after first and second spray.

Table 4: Bio-efficacy of BAS 450 01 I 300 SC against shoot and fruit borer, *Earias vittella* Fab. on okra pooled data during *Kharif* 2016-17 and 2017-18

Treatment No.	Treatment	Dose	Percent fruit borer infestation in different fruit pickings										Overall mean
			1st Peaking	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	
T_1	BAS 450 01 I 300 SC	6.5 g a.i./ha	6.22 (13.49)	8.32 (16.29)	12.00 (20.04)	13.62 (21.49)	17.50 (24.68)	20.50 (26.85)	23.62 (29.06)	22.37 (28.21)	24.62 (29.72)	26.57 (31.00)	17.54
T_2	BAS 450 01 I 300 SC	12.5 g a.i./ha	4.45 (12.10)	6.62 (14.87)	9.75 (18.16)	11.86 (20.01)	15.86 (23.44)	19.11 (25.82)	22.11 (28.02)	20.86 (27.14)	23.61 (29.04)	25.85 (30.54)	16.01
T_3	BAS 450 01 I 300 SC	18.5 g a.i./ha	3.76 (10.64)	6.13 (14.07)	8.13 (16.28)	10.59 (18.92)	13.09 (21.15)	16.84 (24.14)	19.59 (26.25)	19.09 (25.89)	21.84 (27.83)	23.84 (29.20)	14.29
T_4	Chlorantraniliprole 18.5% SC	25 g a.i./ha	6.75 (14.72)	9.39 (17.71)	11.79 (19.96)	14.56 (22.21)	18.18 (25.15)	21.43 (27.47)	24.18 (29.38)	22.93 (28.53)	26.06 (30.63)	28.86 (32.45)	20.00
T_5	Cypermethrin 10% EC	70 g a.i./ha	8.52 (16.11)	11.09 (19.14)	14.05 (21.84)	16.32 (23.69)	19.82 (26.39)	22.82 (28.50)	25.70 (30.42)	24.45 (29.60)	27.07 (31.31)	29.57 (32.91)	19.94
T_6	Untreated control		14.14 (22.07)	14.73 (22.56)	17.12 (24.42)	20.02 (26.56)	24.77 (29.83)	27.02 (31.30)	31.02 (33.81)	33.77 (35.51)	36.27 (37.01)	39.52 (38.93)	25.84
SEm±			1.73	1.29	1.14	1.12	0.64	0.79	0.61	0.57	0.60	0.49	
CD at 5%			5.27	3.94	3.47	3.42	1.94	2.42	1.85	1.75	1.83	1.49	

( ) Figures in parentheses are root square transformed values

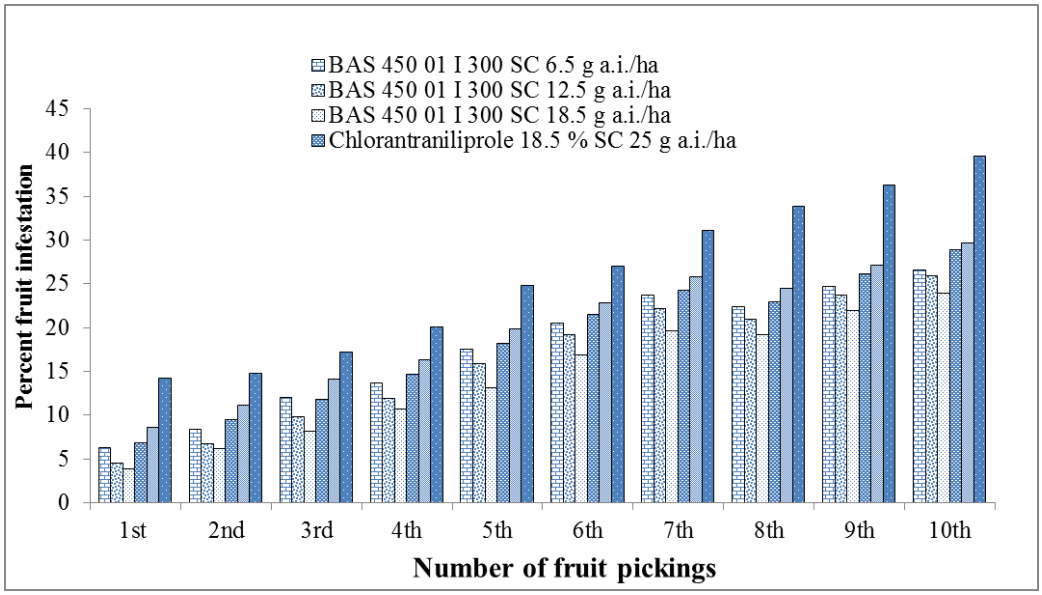

Fig 4: Bio – efficacy of BAS 450 01 I 300 SC against shoot and fruit borer, *Earias vittella* Fab on okra after first and second spray.

Table 5: Effect of BAS 450 01 I 300 SC against Coccinellids on okra pooled data during *Kharif* 2016-17 and 2017-18

Treatment No.	Treatment	Dose	Pre treatment	I Spray					II Spray					Overall mean
			1 DBS	1 Day	3 Days	5 Days	7 Days	10 Days	1 Days	3 Days	5 Days	7 Days	10 Days	
T_1	BAS 450 01 I 300 SC	6.5 g a.i./ha	0.34 (1.16)	0.17 (1.08)	0.20 (1.10)	0.24 (1.11)	0.26 (1.13)	0.27 (1.12)	0.16 (1.08)	0.19 (1.09)	0.21 (1.10)	0.27 (1.12)	0.26 (1.11)	0.24
T_2	BAS 450 01 I 300 SC	12.5 g a.i./ha	0.26 (1.12)	0.19 (1.09)	0.16 (1.07)	0.30 (1.14)	0.26 (1.12)	0.32 (1.15)	0.22 (1.11)	0.17 (1.08)	0.25 (1.11)	0.24 (1.11)	0.25 (1.11)	0.24
T_3	BAS 450 01 I 300 SC	18.5g a.i./ha	0.24 (1.11)	0.11 (1.05)	0.15 (1.07)	0.25 (1.11)	0.27 (1.12)	0.33 (1.15)	0.22 (1.10)	0.16 (1.07)	0.26 (1.12)	0.27 (1.12)	0.32 (1.14)	0.25
T_4	Chlorantraniliprole 18.5% SC	25 g a.i./ha	0.26 (1.12)	0.15 (1.07)	0.13 (1.06)	0.22 (1.11)	0.25 (1.11)	0.22 (1.10)	0.14 (1.07)	0.13 (1.06)	0.16 (1.06)	0.22 (1.11)	0.32 (1.14)	0.22
T_5	Cypermethrin 10% EC	70 g a.i./ha	0.15 (1.07)	0.12 (1.06)	0.16 (1.07)	0.17 (1.08)	0.22 (1.10)	0.26 (1.12)	0.15 (1.07)	0.12 (1.06)	0.24 (1.11)	0.25 (1.12)	0.28 (1.12)	0.21
T_6	Untreated control		0.34 (1.16)	0.30 (1.11)	0.26 (1.08)	0.29 (1.11)	0.34 (1.15)	0.36 (1.16)	0.41 (1.18)	0.41 (1.19)	0.43 (1.20)	0.45 (1.20)	0.44 (1.19)	0.36
SEm±			0.02	0.03	0.03	0.03	0.02	0.03	0.03	0.04	0.05	0.04	0.04	
CD at 5%			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	

( ) Figures in parentheses are arc sin transformed values

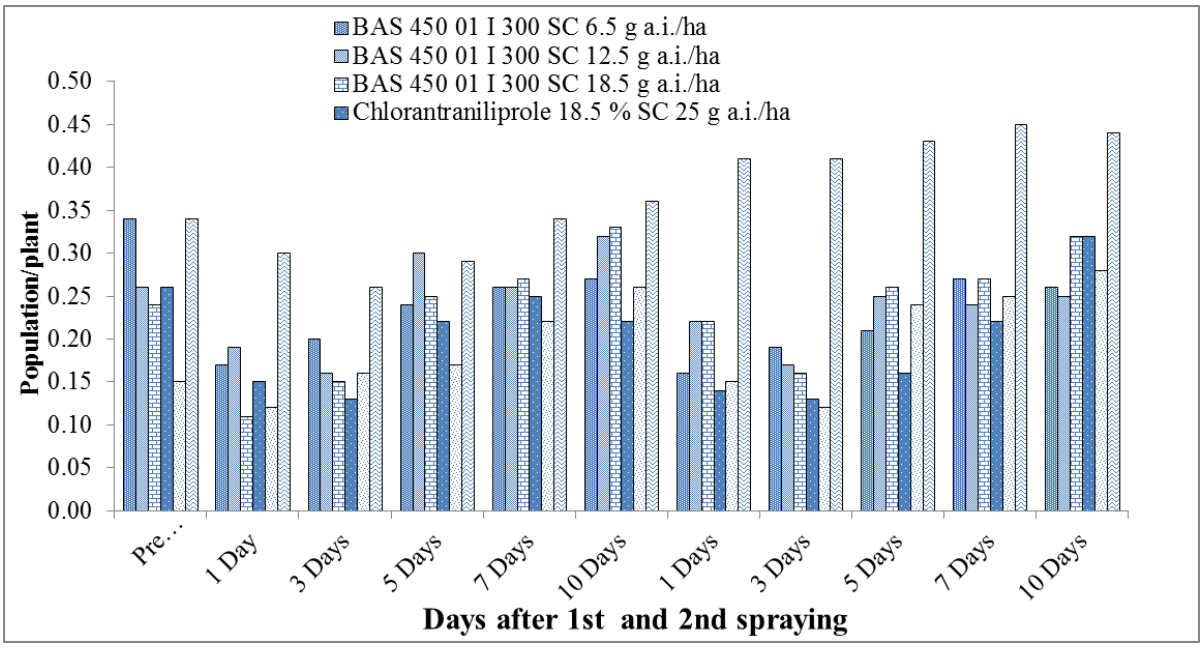

Fig 5: Influence of BAS 450 01 I 300 SC on the occurrence of Coccinellids on okra.

Table 6: Effect of BAS 450 01 I 300 SC against Spider on okra pooled data during *Kharif* 2016-17 and 2017-18

Treatment No.	Treatment	Dose	Pre treatment	I Spray					II Spray					Overall mean
				1 Day	3 Days	5 Days	7 Days	10 Days	1 Days	3 Days	5 Days	7 Days	10 Days	
T_1	BAS 450 01 I 300 SC	6.5 g a.i./ha	0.35 (1.20)	0.32 (1.15)	0.27 (1.12)	0.38 (1.17)	0.41 (1.19)	0.38 (1.17)	0.18 (1.08)	0.15 (1.07)	0.25 (1.11)	0.20 (1.09)	0.28 (1.12)	0.29
T_2	BAS 450 01 I 300 SC	12.5 g a.i./ha	0.38 (1.17)	0.25 (1.11)	0.17 (1.08)	0.31 (1.14)	0.26 (1.12)	0.26 (1.12)	0.27 (1.12)	0.25 (1.11)	0.23 (1.09)	0.27 (1.12)	0.30 (1.14)	0.27
T_3	BAS 450 01 I 300 SC	18.5 g a.i./ha	0.32 (1.15)	0.22 (1.10)	0.25 (1.11)	0.35 (1.15)	0.26 (1.11)	0.22 (1.11)	0.20 (1.09)	0.23 (1.08)	0.25 (1.11)	0.28 (1.12)	0.30 (1.13)	0.28
T_4	Chlorantraniliprole 18.5% SC	25 g a.i./ha	0.36 (1.17)	0.22 (1.11)	0.27 (1.12)	0.37 (1.16)	0.33 (1.14)	0.27 (1.12)	0.18 (1.08)	0.15 (1.07)	0.15 (1.06)	0.25 (1.11)	0.30 (1.13)	2.00
T_5	Cypermethrin 10% EC	70 g a.i./ha	0.21 (1.11)	0.16 (1.07)	0.22 (1.11)	0.30 (1.14)	0.34 (1.15)	0.28 (1.13)	0.18 (1.08)	0.24 (1.11)	0.26 (1.12)	0.28 (1.13)	0.30 (1.14)	0.26
T_6	Untreated control		0.37 (1.17)	0.37 (1.17)	0.35 (1.16)	0.42 (1.19)	0.38 (1.17)	0.37 (1.17)	0.38 (1.16)	0.48 (1.20)	0.50 (1.21)	0.45 (1.20)	0.43 (1.19)	0.41
SEm±			0.03	0.03	0.04	0.05	0.04	0.04	0.03	0.05	0.04	0.04	0.04	
CD at 5%			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	

( ) Figures in parentheses are arc sin transformed values.

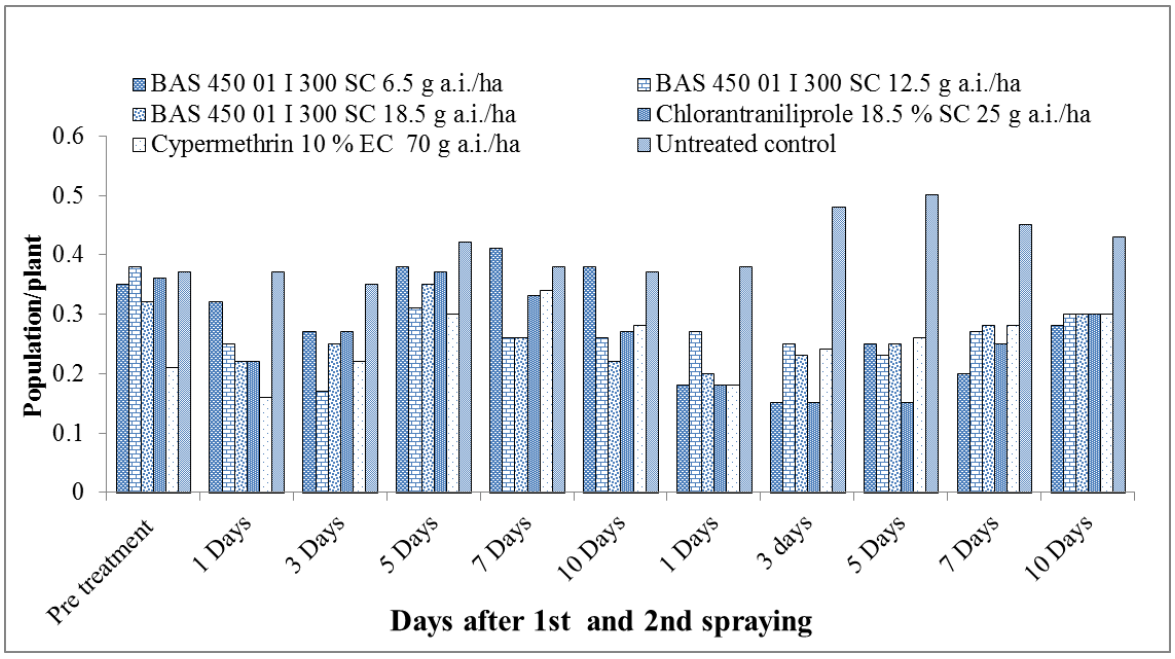

Fig 6: Influence of BAS 450 01 I 300 SC on the occurrence of Spider on okra.

Table 7: Pooled data of Per cent reduction in yield of okra due to infestation of *E. vittella* in different treatments during *Kharif* 2016-17 & 2017-18

Treatments	Insecticide	Dose	Total fruit yield		Healthy fruit yield		Damage fruit yield		Reduction Yield (%)
			2016-17	2017-18.	2016-17	2017-18.	2016-17	2017-18.	
T1	BAS 450 01 I 300 SC	6.5 g a.i./ha	156.50	154.30	154.11	152.10	2.39	2.20	5.13
T2	BAS 450 01 I 300 SC	12.5 g a.i./ha	158.11	154.21	155.99	151.99	2.12	2.22	3.00
T3	BAS 450 01 I 300 SC	18.5 g a.i./ha	158.64	156.64	154.99	153.99	3.65	2.65	2.82
T4	Chlorantraniliprole 18.5% SC	25 g a.i./ha	157.89	157.90	155.10	155.20	2.79	2.70	3.54
T5	Cypermethrin 10% EC	70 g a.i./ha	157.63	155.63	153.21	152.21	4.42	3.42	4.07
T6	Untreated control	-	142.00	138.05	123.00	118.00	10.05	11.05	13.75

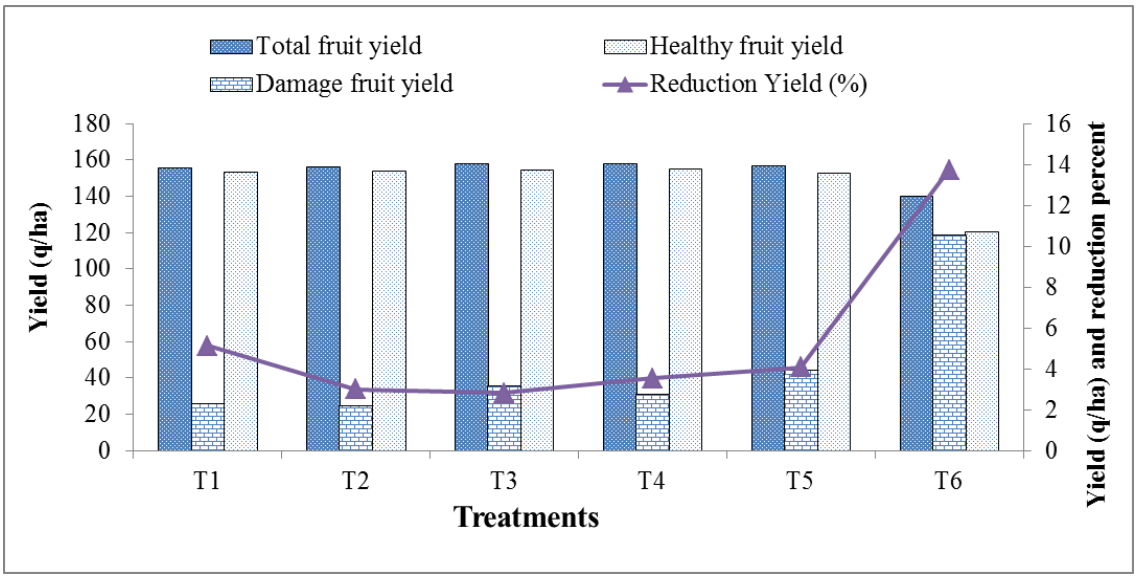

Fig 7: Per cent reduction in yield of okra due to infestation of *E. vittella* in different treatments during *Kharif* 2016-17 & 2017-18.

Results and Discussion

The insecticide molecules BAS 450 01 I 300 SC @ 6.5g.a.i/ha, BAS 450 01 I 300 SC @ 12.5g.a.i/ha, BAS 450 01 I 300 SC@ 18.5g.a.i/ha, Chlorantraniliprole 18.5% SC@ 25g.a.i/h, Cypermethrin 10% EC@70g.a.i./h and untreated control were evaluated for their efficacy manage the pest complex of okra.

Bio Efficacy of BAS 450 01 I 300 SC against shoot and fruit borer, *Earias vittella* (Fab.) on okra. The observations on green fruit infestation of shoot and fruit borer, *Earias vittella* (Fab.) were recorded at each picking with an overall ten pickings. At each pickings, infested and healthy fruits were separated to record pest infestation and reduction in yield for the statistical analysis of data.

Insecticide BAS 450 01 I 300 SC @18.5g.a.i./ha was most effective and statistically significant over rest of the

treatments with the lowest fruit borer infestation Chlorantraniliprole 18.5% SC @ 25g.a.i./ha, (2.00%), followed by BAS 450 01 I 300 SC @18.5g.a.i./ha, (14.29%), and BAS 450 01 I 300 SC @12.5g.a.i./ha, (16.01%), BAS 450 01 I 300 SC @ 6.5g.a.i./ha, (17.54 %) respectively. There was maximum (17.54%) shoot and fruit borer infestation noticed in untreated control.

Patra *et al.* (2009) [6] reported that, Emamectin benzoate 5SG@15g.a.i/ha recorded lowest (4.7%) shoot infestation which was at par with Spinosad 2.5 SC@50g.a.i./ha (4.9%). This was followed by Indoxacarb 14.5 SC@50g.a.i./ha (5.2%) and Methoxyfenzide 24%SC 200g.a.i./ha (7.1%).The highest shoot infestation was recorded in untreated check (21.2%). Sharma and Kaushik (2010) [9] evaluated Spinosad 45 SC along with six chemical insecticides and reported that, Spinosad 45 SC (162.5 ml/ha) was most effective against shoot and fruit borer compare to other six chemical insecticides.

Status of different sucking insect pest of the spraying on okra crops.

Jassid

The non significant difference was observed in different plots during the pretreatment observation. A day after foliar application of insecticides, the minimum jassid population per plant was observed in BAS 450 01 I 300 SC @18.5g.a.i./ha (1.90 jassid/ plant) followed by Chlorantraniliprole 18.5% SC @ 25g.a.i./ha, (2.00%) BAS 450 01 I 300 SC @12.5g.a.i./ha (2.03 jassid/ plant), BAS 450 01 I 300 SC @6.5g.a.i./ha (2.63 jassid/ plant) and in Cypermethrin 10% EC @70g.a.i./ha (3.61 jassid/ plant). However, the maximum jassid population (7.38 jassid/ plant) was noticed in untreated control. Dahatonde *et al.* (2014) [3] revealed that the minimum jassid population (2.11 and 3.77 jassids/three leaves) was recorded in plots treated with imidacloprid 17.8 SL and chlorantraniliprole 18.5 SC, respectively in brinjal. Bagade and Ambekar (2010) superior efficacy of imidacloprid (0.004%) and cypermethrin (0.01%) and found promising in checking the population of aphid and jassids infesting okra.

Aphids

The application of BAS 450 01 I 300 SC @18.5g.a.i./ha, (6.14 aphid/ plant) recorded the least aphid population per plant, followed by BAS 450 01 I 300 SC @12.5g.a.i./ha, (6.74 aphid/ plant) and Chlorantraniliprole 18.5% SC @ 25 g a.i./ ha, (7.82 aphid/ plant) were found statistically on par with each other. There was maximum aphid population (14.81 aphid/ plant) noticed in untreated control (T_6). All the insecticidal treatments had shown highly significant difference among themselves.

Thrips

Thrips population was recorded before and after one, three, five, seven and tenth days after spraying of insecticides. Pre treatment thrips population was observed to be statistically non-significant. The observation recorded on one day after spraying of insecticides displayed that, all the insecticidal treatments were significantly superior over control in reducing the infestation of thrips population. Among all the five insecticidal treatments, the foliar application of BAS 450 01 I 300 SC @18.5g.a.i./ha had the lowest 1.64 thrips population per plant. (T_2) and (T_1) i.e. BAS 450 01 I 300 SC @12.5g.a.i./ha, BAS 450 01 I 300 SC @6.5g.a.i./ha was found statistically on par with each other.

Whitefly

The non significant difference observed in different plots during the pretreatment observation. After foliar application of insecticides, the minimum whitefly population per plant was observed in BAS 450 01 I 300 SC @18.5g.a.i./ha (0.94 whitefly/ plant), followed by BAS 450 01 I 300 SC@12.5g.a.i./ha (1.07whitefly/ plant), BAS 450 01 I 300 SC@6.5g.a.i./ha (1.12 whitefly/ plant) and Cypermethrin 10% EC @70ga.i./ha (1.27 whitefly/ plant), respectively. However, maximum whitefly population (3.94 white fly/plant) noticed in untreated control (T_6). Begum and Patil (2016) [2] recorded that, the mean population of whiteflies of two sprays was calculated and results indicated that, Imidacoprid 17.8 SL @ 40g.a.i./ha proved to be effective and significantly superior over rest of the treatments and recorded minimum population of whiteflies (1.69 whiteflies/3 leaves). Wagh *et al.* (2017) [14] assessed that cypermethrin 25 EC @ 62.50 g a.i. ha-1 (1.60-2.36) and chlorantraniliprole 18.5 SC @ 30 g a.i. ha-1 (1.80-2.60) were effective treatments to reduce the whitefly population in tomato. The present findings are in partial association with the findings of previous researchers.

Effect of insecticides on the natural enemies of insect pest on okra.

Coccinellids

The observations on coccinellids were recorded after first spray revealed that, a non-significant difference among various treatments indicating that the predator was spared in all the treatments. The overall mean population of coccinellids after first spray each spray indicated that untreated control (0.36 cocccinellids/plant) and BAS 450 01 I 300 SC @12.5g.a.i./ha and BAS 450 01 I 300 SC @18.5g.a.i./ha and BAS 450 01 I 300 SC @6.5g.a.i./ha (0.24, 0.25 and 0.24 cocccinellids/plant) recorded relatively higher population of coccinellids. Chlorantraniliprole 18.5% SC@ 25g.a.i./ ha and Cypermethrin 10%EC@70g.a.i./has pared lower predator Population compared to other treatments. The data pertaining to the impact of BAS 450 01 I 300 SC on the occurrence of natural enemies are presented in Table.

Shinde *et al*. (2007) [10] reported that Spinosad 45 SC @ 75g.a.i./ha was most safer insecticide to the predators on okra. The maximum population of lady bird beetle (1.78), chrysopa (0.55) and spider (1.36/plant), respectively were recorded in the treatment of Spinosad 45 SC @75g.a.i./ha over different treatments. Udikeri *et al*. (2004) [13] who reported the activity of predators as good as untreated control indicating the safety of these molecules to predominant natural enemies in cotton ecosystem.

Spiders

Although BAS 450 01 I 300 SC @6.5g.a.i./ha (0.29 spider/ plant) and Chlorantraniliprole 18.5% SC@ 25g.a.i./ ha, (2.00 spider/plant) recorded lower population compared to other treatments in second sprays. In general, untreated control T_6 (0.41 spiders/plant), T_3 (0.28 spiders/plant) and T^2 (0.27 spiders/plant) treatments registered higher population as compared to other treatments.

Shinde *et al*. (2007) [10] reported that Spinosad 45 SC @ 75 g.a.i./ha was most safer insecticide to the predators on okra. The maximum population of lady bird beetle (1.78), chrysopa (0.55) and spider (1.36/plant),respectively were recorded in the treatment of Spinosad 45 SC @75 g.a.i./ha over different treatments.

Fruit yield and economic assessment

The data of two years mean total healthy okra green fruit yield of all the treatment was significant higher over untreated control. Yield of healthy fruits of okra ranged between 152.71 to 155.15 q/ha. Maximum yield was recorded from treatment by Chlorantraniliprole 18.5 % SC @ 25g.a.i/ha,(155.15q/ha.) followed by BAS 450 01 I 300 SC @ 18.5.a.i/ha (i.e.153.99 q/ha). The lowest total yield recorded from untreated control (T6) (153.5 q/ha). The percent reduction in yield due to shoot and fruit borer *Earias vittella* (fab) of okra varied ranged between 1.41 to 6.88 percent. The least percent reduction was recorded in treatment BAS 450 01 I 300 SC @ 18.5.a.i/ha (1.41%), followed by Chlorantraniliprole 18.5% SC @25g a.i./ha, (1.77%), and maximum reduction yield was noticed in BAS 450 01 I 300 SC @6.5g a.i./ha, (2.57%) as compared to untreated control was 6.88% regarding yield, BAS 450 01 I300 @ 18.5.a.i/ha provided the best fruit yield by significantly reducing the fruit damage. This is because of lesser number of larvae in BAS 450 01 I 300 SC treated plot. Thus the study suggest that BAS 450 01 I 300 SC @ 18.5.a.i/ha could be a part in the control programmes of okra fruit borer complex. Patra *et al.* (2016) [7] observed that the chlorantraniliprole was the best treatment in reducing the shoot infestation and gave highest marketable brinjal fruit yield (155.01 q ha-1). Wagh *et al.* (2017) [14] revealed that the chlorantraniliprole 18.5 SC @ 30 g.a.i. ha-1 gave highest marketable yield of tomato (46.03 t ha-1) and found effective against jassid and whiteflies. In relation to the performance of clorhantraniliprole the findings of previous researchers are in close association with the present study.

Conclusion

The new chemical insecticide BAS 450 01 I 300 SC was evaluated for its bio efficacy against major insect pests of okra in the department of Entomology, IGKV, Raipur during *Kharif* 2016-17 and 2017-18.. During the bio efficacy trial, the effect of all tested doses of BAS 450 01 I 300 SC effectively control thsssse population of major insect pests of Okra. It was also observed that BAS 450 01 I 300 SC at all dosages levels tested for bio efficacy has non - significant lower population of natural enemies under field condition.

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