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Field bio efficacy of flubendiamide 480 SC against okra fruit and shoot borer, *Earias vitella* (Fab.) during *Rabi* season, 2012-13

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ABSTRACT

A field experiment was conducted to evaluate the efficacy of flubendiamide 480 SC against okra fruit and shoot borer, *Earias vitella* (Fab.) during *Rabi* season, 2012-2013 at Main Agricultural Research Station, University of Agricultural Sciences, Raichur, Karnataka. The experiment was laid out in RBD with four replications. Among the newer insecticide molecules evaluated, flubendiamide 480 SC @ 60 g a.i/ha and flubendiamide 480 SC @ 48 g a.i/ha were superior in recording less shoot damage (8.7 % and 10.00 %), lower fruit damage (5.70 % and 9.00 %) and higher fruit yield (113.00 q/ha and 104.00 q/ha), followed by cypermethrin @ 10 EC g.a.i/ha.

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INTRODUCTION

Okra, *Abelmoschus esculentus* (L.) Moench is one of the major economically important vegetable crops grown in India which accounts for 21 per cent of total exchange earnings from export of vegetables from India grown mostly in Assam, Uttar Pradesh, Bihar, Orissa, West Bengal, Maharashtra, Andhra Pradesh and Karnataka. Okra is attacked by plethora of insect and mite pests starting from seedling stage to senescence. The spotted bollworm of okra fruit and shoot borer, *E. vitella* is a widely distributed insect pest. It is estimated to cause about 69 per cent losses in marketable yield of okra due to attack of fruit borer (Rawat and Sahu, 1973). Besides various other factors for lower productivity, heavy damage is inflicted by major insect pests *viz.*, leafhopper, *Amrasca biguttula biguttula* (Ishida), whitefly, *Bemisia tabaci* (Gennadius) and shoot and fruit borer, *Erias vittella* (Fabricius). The shoot and fruit borer, *Earias vittella* (Fabricius) is found throught the year with overlapping generations causing considerable damage to the crop. Pareek and Bhargava (2003) recorded 5.33 to 75.75 per cent losses in okra fruits due to the infestation of *E. Vittella*, whereas, Brar *et al*. (1994) reported 50 per cent reduction in fruit yield. Indiscriminate use of pesticides leads to undesirable load of pesticide residues in marketable vegetables (Kumari *et al.*, 2005) and cause severe ecological consequences like destruction of natural enemy fauna, effect on non-target organisms. Repeated use of same chemical may lead to development of resistance in insects. To overcome these problems, studies were conducted to evaluate the efficacy of flubendiamide insecticides and also to establish the dissipation pattern of effective insecticides to fit in pest management strategy.

MATERIAL AND METHODS

Field experiment was conducted at Main Agricultural Research Station, University of Agricultural Sciences, Raichur, Karnataka, with an okra variety, Arka Anamica during 2011-2012 cropping season. The field trial was laid out in a Randomized Block Design with four replications and six treatments with a plot size of 5.0 x5.0 mtr and a spacing of 60 x 30 cms. The seeds were sown after seed treatment with imidacloprid 70 WS @ 10 g per kg seeds against early sucking insect pests. Except for plant protection schedule, all the agronomic practices followed were similar as recommended in package of practices. There were six treatments, *viz.*, three different dosages of flubendiamide 480 SC (36, 48 and 60 g a.i/ha) and compared with cypermethrin 10 EC, pyridayl 10 EC, and untreated control. The first insecticidal application was initiated at 45 days after sowing when the larval population of fruit borer reached at below economic injury level (EIL) and repeated second spray at 15 days after first spray. In both the insecticidal sprays pre-spray count of fruit borer larvae per plant was also taken. Five plants were selected at random and tagged to record number of infested shoots out of total number of shoots on one day before, three, five and seven days after each spray and expressed in percentage.

In each plot five plants were randomly selected and tagged to recorded the number of infested fruits out of total number of fruits one day before, three, five and seven days after each spray and expressed in per cent.

Yield in each treatment was recorded and converted to hectare basis and subjecated to statistical analysis. Predatory population *viz.*, coccinellids and spiders were recorede on five tagged plants on one day before and seven days after each spray and expressed as per plant. Five plants were selected at random from each plot and total number of leaves showing phytotoxicity, they were observed before application and three, seven and fifteen days after spray were recoreded on leaf injury on tips and leaf surface, wilting, necrosis, vein clearing, epinasty and hyponasty. The data recorded are converted into percentage

The extent of phytotoxicity are recorded based on following score.

Score	Phytotoxicity (%)
0	No damage
1	1 – 10 % damage
2	11 – 20 % damage
3	21 – 30 % damage
4	31 – 40 % damage
5	41 – 50 % damage
6	51 – 60 % damage
7	61 – 70 % damage
8	71 – 80 % damage
9	81 – 90 % damage
10	91 – 100 % damage

RESULTS AND DISCUSSION

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

Shoot damage:

One day before spray, the incidence of shoot bore with respect to shoot damage was non significant. Three days after first spray, the shoot damage ranged between 8.70 to 28.70 the lowest shoot damage was recorded in flubendiamide 480 SC @ 60 g a.i/ha 8.70 per cent followed by flubendiamide 480 SC @ 48 g a.i/ha (10.00 %). After seven days the lowest shoot damage noticed in flubendiamide 480 SC @ 60 g a.i/ha (6.20 %) followed by flubendiamide 480 SC @ 48 g a.i/ha (10.00 %), in comparison with cypermethrin 10 EC recorded 12.70 per cent and 14.20 per cent shoot damage after seven days of first and second days of spray, respectively. Similar trend was noticed in all other periodical observations (Table 1).

Shimoge and Vemuri (2014) recoded the results which were in agreements with our results as Flubendiamide at 60 g a.i. ha^{-1} recorded lowest per cent fruit borer infestation of 11.07 as against 39.15 per cent fruit borer infestation in control.

Fruit damage:

During the *Rabi* season the fruit damage varied between 36.20 to 46.20 per cent in various treatments. The lowest fruit damage was recorded in flubendiamide 480 SC @ 60 g a.i/ha recorded 5.7 per cent fruit damage followed by flubendiamide 480 SC @ 48 g a.i/ha (9 %) and this was found at par in comparison with cypermethrin 10 EC recoreded 8.5 per cent these was recorded third day after first spray treatments were significantly superior over rest of the treatments and after seven days of first spray flubendiamide 480 SC @ 60 g a.i/ha recorded (5.00 %) fruit damage followed by 14.7 per cent in flubendiamide 480 SC @ 48 g a.i/ha similar trend was observed after second spray also (Table 2).

Shimoge and Vemuri (2014) the present findings are similar with our results as they showed that Flubendiamide at 60 g a.i. ha-recorded the lowest per cent fruit borer infestation (14.40 %) and superior over all other treatments and control. The results were also conformity with the findings of Nauen *et al*. (2007) who asserted that flubendiamide is a new chemical option for control of multi-resistant noctuid pests and an excellent choice in resistant management strategies for lepidopteran pests in general. These results were also in

Table 1 : Bio-efficacy of Flubendiamide 480 SC against shoot and borer in okra during (2012-2013)

Sr. No.	Treatments	Dosage (g a.i/ha)	Per cent shoot damage						
			I SPRAY				II SPRAY		
			1 DAS	3 DAS	5 DAS	7 DAS	3 DAS	5 DAS	5 DAS
1.	Untreated control	-	31.20 (33.90)	28.70 (32.40)	36.20 (37.00)	33.70 (35.50)	35.00 (36.20)	32.50 (34.70)	37.50 (37.50)
2.	Flubendiamide 480 SC	36	32.00 (34.40)	13.00 (21.00)	17.50 (24.60)	12.00 (20.40)	12.00 (20.10)	12.20 (20.40)	20.00 (26.40)
3.	Flubendiamide 480 SC	48	26.20 (30.80)	10.00 (18.40)	15.00 (22.70)	10.00 (18.40)	14.00 (21.90)	9.00 (17.40)	11.50 (19.50)
4.	Flubendiamide 480 SC	60	32.50 (34.70)	8.60 (16.70)	11.20 (19.50)	6.20 (14.20)	5.00 (12.90)	6.20 (14.20)	6.20 (14.20)
5.	Cypermethrin 10 EC	50	28.50 (31.90)	11.00 (19.30)	15.50 (23.00)	12.70 (20.80)	13.00 (21.00)	10.00 (18.10)	14.20 (22.10)
6.	Pyridalyl 10 EC	50	31.20 (33.90)	12.50 (20.60)	15.00 (22.70)	9.50 (17.90)	13.00 (21.00)	12.20 (20.40)	17.50 (24.60)
	S.E.±		NS	1.10	0.87	1.19	1.13	1.28	1.16
	C.D. (P=0.05)		0.047	3.30	2.62	3.60	3.43	3.86	3.50

NS=Non-significant

Table 2 : Bio-efficacy of Flubendiamide 480 SC against shoot and borer in okra during (2012-2013)

Sr. No.	Treatments	Dosage (g a.i/ha)	Per cent fruit damage							Yield (q/ha)
			I SPRAY				II SPRAY			
			1 DAS	3 DAS	5 DAS	7 DAS	3 DAS	5 DAS	5 DAS	
1.	Untreated control	-	41.20 (39.90)	41.20 (39.90)	40.00 (39.20)	43.70 (41.40)	42.50 (40.60)	43.70 (41.40)	42.00 (40.60)	85.00
2.	Flubendiamide 480 SC	36	41.20 (39.20)	14.70 (22.10)	13.00 (21.00)	18.70 (25.30)	13.00 (21.00)	13.00 (21.00)	21.20 (27.40)	98.00
3.	Flubendiamide 480 SC	48	42.50 (40.60)	9.00 (17.40)	11.70 (19.90)	14.70 (21.90)	11.70 (19.40)	11.20 (19.50)	13.70 (21.00)	104.00
4.	Flubendiamide 480 SC	60	36.20 (36.90)	5.70 (13.60)	6.20 (14.20)	5.00 (12.90)	7.00 (15.10)	7.20 (15.24)	7.50 (15.60)	113.00
5.	Cypermethrin 10 EC	50	46.20 (42.80)	8.50 (16.80)	11.70 (19.90)	11.70 (19.90)	12.70 (20.40)	10.00 (18.10)	16.00 (24.00)	88.00
6.	Pyridalyl 10 EC	50	41.20 (39.90)	9.00 (17.10)	12.50 (20.60)	13.70 (21.70)	13.70 (21.00)	13.50 (21.50)	15.00 (22.60)	87.00
	S.E. ±		NS	1.29	1.13	1.22	0.97	1.36	1.23	4.49
	C.D. (P=0.05)			3.90	3.43	3.69	2.94	4.09	3.71	13.50

NS= Non-significant

agreement with the findings of Hirooka *et al*. (2007), Tohnishi *et al*. (2005), Jagginavar *et al*. (2009).

Yield:

Yield during *Rabi* season varied 113.00 qha^{-1} to 85.0 qha^{-1} in different treatments. The maximum marketable yield recorded in flubendiamide 480 SC @ 60 g a.i ha^{-1} (113.0 q/ha) followed by flubendiamide 480 SC @ 48 g a.i ha^{-1} (104.0 /ha) in comparison with cypermethrin 10 EC recorded 88.00 q/ha. And all other treatments were significantly inferior in yield production, whereas, untreated control recorded lower fruit yield (85.0 q/ha) (Table 2).

Predatory population:

Spiders :

One day before spray, the spray population ranged from 1.62 to 1.75 per plant. there was no adverse effect on spider population on seven days after spray due to application of varying doses of flubendiamide 480 SC when compared to untreated check which recorded maximum spider population of 1.58 per plant (Table 3).

Coccinellids:

The coccinellids population ranged from 1.32 to 1.44 per plant on one day before treatment imposition. The coccinellids population was uniform in almost the chemicals treatment along with untreated check even seven days of spray (Table 3).

Phytotoxicity:

There were no phytotoxicity symptoms like leaf injury tips, wilting, vein clearing, necrosis, epinasty, hyponasty on okra plants treated with various dosages of flubendiamide 480 SC including double the four times of recommended dose (Table 4).

The present findings are in contradictory with observations of Sahoo *et al*. (2009), who reported an initial deposit of 1.06 and 2.00 mg kg following application of flubendiamide 480 SC at 60 and 120 g a.i. ha and which were dissipated to below detectable level of 0.01 mg kg in 7 and 10 days at single and double dosages, respectively. Das *et al*. (2011) reported that in okra the initial deposits of 0.28 and 0.53 μg g reached below determination level (BDL) of 0.01 μg g on the 7th and 10th day with half-life 4.7-5.1 days when flubendiamide

Table 3 : Bio-efficacy of Flubendiamide 480 SC on natural enemies of okra during (2012-2013)

Sr. No.	Treatments	Dose (g a.i/ha)	One day before spray		Three days after spray	
			Spiders/plant	Coccinellids/plant	Spiders/plant	Coccinellids/plants
1.	Untreated control	--	1.70	1.32	1.58	1.28
2.	Flubendiamide 480 SC	36	1.67	1.41	1.55	1.26
3.	Flubendiamide 480 SC	48	1.64	1.35	1.52	1.25
4.	Flubendiamide 480 SC	60	1.69	1.44	1.48	1.22
5.	Cypermethrin 10 EC	50	1.62	1.32	1.50	1.24
6.	Pyridalyl 10 EC	50	1.75	1.36	1.45	1.23

Table 4 : Sympotoms of leaf injury, wilting, vein clearing, necrosis, epinasty and hyponasty before and after spraying of Flubendiamide 480 SC on natural enemies of okra during (2012-2013)

Sr. No.	Treatments	Dosage (g a.i/ha)	Leaf injury on tips/ surface				Wilting				Vein clearing				Necrosis				Epinasty				Hyponasty			
			BS	3 DAS	7 DAS	15 DAS	BS	3 DAS	7 DAS	15 DAS	BS	3 DAS	7 DAS	15 DAS	BS	3 DAS	7 DAS	15 DAS	BS	3 DAS	7 DAS	15 DAS	BS	3 DAS	7 DAS	15 DAS
1.	Untreated control	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.	Flubendiamide 480 SC	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.	Flubendiamide 480 SC	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.	Flubendiamide 480 SC	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

BS= before spraying, 3DAS= 3 days after spraying, 7DAS= 7 days after spraying, 15DAS= 15 days after spraying.
All the treatments were safe and caused no phytotoxicity symptoms on the variety grown.

39.35 SC sprayed at 24 and 48 g a.i. ha, respectively. The variation of initial deposits in the present findings with Das *et al*. (2011) may be due to variation in the dosages applied on the crop. The initial deposit and subsequent residues of flubendiamide (60 g a.i. ha-) in okra fruits at an interval of 0, 1, 3, 5, 7, 10 and 15 days after last spray are presented in table and in figure and chromatograms presented in figure. An initial deposit of 1.49 mg kg- gradually dissipated to 0.84, 0.47, 0.10 and 0.01 mg kg- at 1, 3, 5 and 7 days, respectively. The per cent dissipation was 43.30, 68.08, 93.14 and 98.88, respectively. The residues fell below maximum residue limit (MRL) of 0.2 mg kg- in 4.19 days after the treatment. The half-life (RL) of flubendiamide was worked to be 1.83 days (Shimoge and Vemuri, 2014).

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