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EVALUATION OF SOME INSECTICIDES AGAINST FRUIT AND SHOOT BORER, *EARIAS VITTELLA* (FAB.) IN SEED PRODUCTION OF OKRA (*ABELMOSCHUS ESCULENTUS*)

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ABSTRACT
This study was carried out to determine the efficacy of seven insecticides viz., lamb-dacyhalothrin,imidacloprid, B-Cyfluthrin, cypermethrin, profenofos, dimethoate and indoxacarb against the shoot and fruit borer, *Earias vittella* (Fabricius) on okra cultivar Arka Anamika during *kharif* season of 2011 and 2012. The treatment with lambda-cyhalothrin recorded significantly minimum (18.44% and 10.03%) per cent fruit damage per plant and per cent seed damage per fruit which was at par with the indoxacarb (19.12% and 9.86%) and dimethoate 30% EC 2ml/litre (22.70% and 12.34%) in pooled data. Significantly maximum (57.58% and 31.31%) per cent fruit damage per plant and per cent seed damage per fruit were recorded with imidacloprid 40g a.i/ha in pooled data. The highest seed yield per hectare was observed with application of lamb-dacyhalothrin (1548kg), indaxocarb (1474kg) and dimethoate (1435kg) and the lowest was with imidacloprid (618kg) in pooled data. Except imidacloprid, all insecticides proved significantly effective in controlling *E. vittella* infestation. The highest seed yield with high quality was recorded in the foliar sprays of Lamda-cyhalothrin 30g a.i/ha, for the control of fruit borer incidence in seed production of okra, therefore one among these three chemicals viz., Lamda-cyhalothrin 30g a.i/ha, Indoxacarb 14.5% 0.25ml/litre and Dimethoate 30% EC 2ml/litre can be made use.

INTRODUCTION

Okra (*Abelmoschus esculentus*) is attacked by several insect pests among which shoot and fruit borer, *Earias vittella* (Fabricius) is most serious as it take upper hand by causing direct damage to tender fruits. The larvae feed on and damage growing vegetative parts developing seed in the cotton bolls, shoots of the main axes, succulent internodes, tops of side branches, young leaves and flower buds. *E. vittella* is a major insect pest, which causes 8.4-73.2% infestation on fruit of okra depending on the season (Kumar and Urs, 1988). The avoidable losses in yield and fruit damage due to this pest have been estimated from 36-90% (Misra, *et al.*, 2002). Sinha, *et al.*, 1978 reported that the normal seeds per fruit was reduced by 16.47 % with increase in stained seeds by 200 % and damaged seeds by 18.70 % infested okra fruits when compared with healthy fruits. Chemical control has played a significant role in managing agricultural insect pests. Chakraborty *et al*. (2015) reported that a need based application of agrochemicals protect the ecosystem and exhibit a higher yield in Okra. Hence management of this pest is important. Chemical control of fruit borers of okra for vegetable production is well documented (Hasan, 2010). But, investigations on spray of chemicals for control of fruit borer especially on seed yield and quality are very meager or lacking. Hence this study was carried out to determine the efficacy of insecticides for management of *E. vittella* in seed production of Okra.

MATERIALS AND METHODS

The experiments were carried out in main agriculture research station, UAS Dharwad during *kharif* season, 2011 and 2012 to evaluate the efficacy of insecticides viz., lamda-cyhalothrin 30g a.i/ha, imidacloprid 40g a.i/ha, B-Cyfluthrin 25g a.i/ha, cypermethrin 40g a.i/ha, profenophos 30g a.i/ha, dimethoate 30% EC @ 2ml/litre and indoxacarb 14.5% @ 0.25ml/litre.The crop was sown on *kharif* during both the years in a randomized block design with three replications and each plot measured 3.0mX2.4m. Seeds were sown with spacing of 60X30 cm.The fruits harvested from five tagged plants were counted and were further examined for insect damage. The fruit with even one hole bored by the insect was considered as damaged. The numbers of such damaged fruits were counted and the percentages of damaged fruits per plant were calculated.The seeds from five fruits were collected separately and the bored and stained seeds were considered as damaged and were counted. The average number of damaged seeds of five fruits was calculated and expressed as per cent seed damage per fruit (Bebitha, 2009).

$$\text{Per cent seed damage} = \frac{\text{Number of damaged seeds per fruit}}{\text{Total number of seeds per fruit}} \times 100$$

The mean data was statistically analysed by adopting the appropriate methods outlined by Panse and Sukhatme (1978) and Sundarajan *et al*. (1972). The critical differences were calculated at one and five per cent level of probability, wherever 'F' test was significant. The percentage data were transformed

into arcsine root transformation, wherever it was applicable.

RESULTS AND DISCUSSION

The observations recorded on per cent fruit damage per plant are presented in Table 01. The percent fruit damage per plant was recorded significant differences in both the years of experimentation and as well as in pooled data. The application of lamda-cyhalothrin 30g a.i/ha recorded significantly minimum (16.98, 19.90 and 18.44%) fruit damage per plant in 2011, 2012 and pooled data respectively. This treatment was at par with indoxacarb 14.5% @ 0.25ml/litre (17.61, 20.62 and 19.12%) and Dimethoate 30% EC @ 2ml/litre during 2011, 2012 and in pooled data (21.34, 24.06 and 22.70%) respectively (Fig.01). Significantly maximum (54.63, 60.52 and 57.58%) fruit damage per plant were recorded in imidacloprid 40g a.i/ha in 2011, 2012 and pooled data respectively (Plate 1).

The results obtained on per cent seed damage per fruit scratch plant during 2011, 2012 year wise and pooled are presented in Table 02. Effect of foliar spray with insecticides on per cent seed damage per fruit in okra exhibited significant differences during both the years of experimentation and as well as in pooled data. The application of lamda-cyhalothrin 30g a.i/ha recorded significantly minimum (9.23, 10.82 and 10.03%) seed damage per fruit in 2011, 2012 and pooled data respectively. This treatment was at par with indoxacarb 14.5% @ 0.25ml/litre (8.71, 10.01 and 9.86%) and dimethoate 30% EC @ 2ml/litre during 2011, 2012 and in pooled (11.60, 13.08 and 12.34%). Significantly maximum (29.71, 32.91 and 31.31%) seed damage per fruit were recorded with imidacloprid 40g a.i/ha in 2011, 2012 and pooled data

Table 1: Effect of foliar spray with insecticides on per cent fruit damage per plant in okra

Treatments	Percent fruit damage per plant		
	2011	2012	Pooled
T_1: Lamda-cyhalothrin 30g a.i/ha	16.98(24.33)	19.90(26.48)	18.44(25.42)
T_2 : Imidacloprid 40g a.i/ha	54.63(47.64)	60.52(51.05)	57.58(49.34)
T_3 : B-Cyfluthrin 25 g a.i/ha	36.75(37.30)	40.37(39.43)	38.56(38.37)
T_4 : Cypermethrin 40g a.i/ha	39.70(39.04)	43.02(40.97)	41.36(40.01)
T_5 : Profenophos 30 g a.i/ha	31.66(34.23)	37.15(37.54)	34.41(35.90)
T_6 : Dimethoate 30% EC 2ml/litre	21.34(27.50)	24.06(29.36)	22.70(28.44)
T_7 : Indoxacarb 14.5% 0.25ml/litre	17.61(24.80)	20.62(27.00)	19.12(25.92)
Mean	31.24(33.97)	35.09(36.31)	33.17(35.15)
S.Em+	2.14	1.92	2.05
CD (5%)	6.59	5.92	6.31

* Figures in the parenthesis are arcsine transformed values

Table 2: Effect of foliar spray with insecticides on per cent seed damage per fruit in okra

Treatments	Percent seed damage per fruit		
	2011	2012	Pooled
T_1: Lamda-cyhalothrin 30g a.i/ha	9.23(17.98)*	10.82(19.20)	10.03(18.45)
T_2 : Imidacloprid 40g a.i/ha	29.71(33.02)	32.91(34.99)	31.31(34.01)
T_3 : B-Cyfluthrin 25 g a.i/ha	19.98(26.54)	21.79(27.82)	20.89(27.18)
T_4 : Cypermethrin 40g a.i/ha	21.59(27.68)	22.96(28.62)	22.28(28.15)
T_5 : Profenophos 30 g a.i/ha	17.22(24.51)	19.91(26.49)	18.57(25.51)
T_6 : Dimethoate 30% EC 2ml/litre	11.60(19.90)	13.08(21.19)	12.34(20.56)
T_7 : Indoxacarb 14.5% 0.25ml/litre	8.71(17.16)	11.01(19.37)	9.86(18.29)
Mean	16.86(24.24)	18.93(25.78)	17.89(25.02)
S.Em+	1.49	1.30	1.38
CD (5%)	4.59	4.13	4.27

* Figures in the parenthesis are arcsine transformed values

Table 3: Effect of foliar spray with insecticides on seed yield plot (g) in okra

Treatments	Seed yield per plot (g)		
	2011	2012	Pooled
T_1: Lamda-cyhalothrin 30g a.i/ha	1209	1020	1115
T_2 : Imidacloprid 40g a.i/ha	477	412	445
T_3 : B-Cyfluthrin 25 g a.i/ha	792	659	725
T_4 : Cypermethrin 40g a.i/ha	728	596	662
T_5 : Profenophos 30 g a.i/ha	936	746	841
T_6 : Dimethoate 30% EC 2ml/litre	1109	957	1033
T_7 : Indoxacarb 14.5% 0.25ml/litre	1123	998	1061
Mean	911	770	840
S.Em+	35	33	34
CD (5%)	106	100	102

Table 4: Effect of foliar spray with insecticides on seed yield per ha (kg) in okra

Treatments	Seed yield per ha (kg)		
	2011	2012	Pooled
T_1: Lamda-cyhalothrin 30g a.i/ha	1679	1417	1548
T_2 : Imidacloprid 40g a.i/ha	662	573	618
T_3 : B-Cyfluthrin 25 g a.i/ha	1099	915	1007
T_4 : Cypermethrin 40g a.i/ha	1011	828	919
T_5 : Profenophos 30 g a.i/ha	1300	1037	1169
T_6 : Dimethoate 30% EC 2ml/litre	1541	1330	1435
T_7 : Indoxacarb 14.5% 0.25ml/litre	1560	1389	1474
Mean	1265	1070	1167
S.Em+	22	19	20
CD (5%)	68	59	62

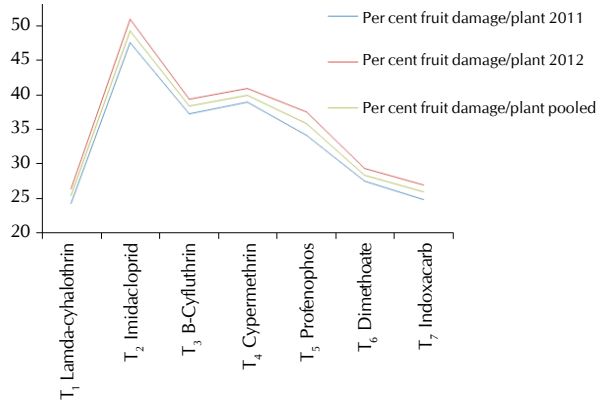

Figure 1: Effect of foliar spray with insecticides on per cent fruit damage per plant in okra

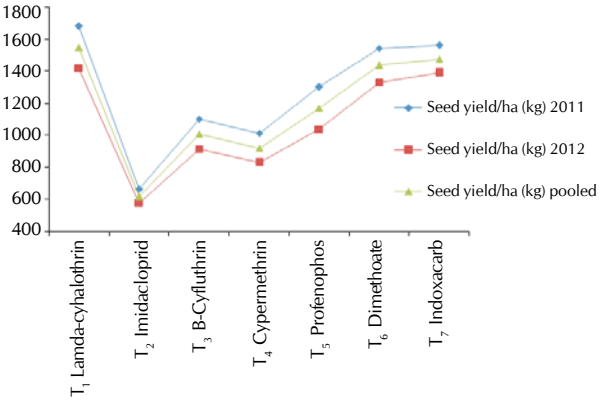

Figure 2: Effect of foliar spray with insecticides on seed yield per ha (kg) in okra

Plate 1: Damaged caused by shoot and fruit borer (*Earias vittella*)

respectively (Plate 2). Das *et al*. (2000) studied the efficacy of four insecticides viz. imidacloprid, acetamopride, acephete and profenofphos against fruit borer *E. vitlella* on okra cv. Satsira and the result showed the reduction in borer infestation to the extent of 15.36, 12.42, 14.25 and 15.70 per cent after three weeks of third and final spray with respective insecticides in okra. Bindu *et al*. (2003) obtained highest control of *E. vitella* on okra by two application of 0.35 per cent endosulfan followed by two application of 0.15 per cent achook. However, endosulfan is highly effective against E. vitella (Singh *et al*., 2009; Prasad and Prasad, 2004; Kadam *et al*. 2000 and Sinha and Sharma, 2007).

The observations recorded on seed yield per plot are presented in Table 03. The seed yield per plot recorded due to the effect of foliar spray with insecticides in okra showed significant differences during both the years of experimentation and as well as in pooled data. The application of lamda-cyhalothrin 30g a.i/ha, indoxacarb 14.5% @ 0.25ml/litre and dimethoate 30% EC @ 2ml/litre recorded significantly higher seed yield per plot during 2011 (1209, 1123 and 1109g), during 2012 (1020, 998 and 957g) and with the pooled (1115, 1061 and 1033g) values respectively which were on par with

Plate 2: Damaged caused by shoot and fruit borer (*Earias vittella*)

each other. The lowest seed yield per plot of 477, 412 and 445g was recorded with application of imidacloprid 40g a.i/ ha during 2011, 2012 and pooled values respectively.

The pooled, 2011 and 2012 seed yield per ha recorded are presented in Table 04. The foliar sprays with insecticides were able to produce significant differences on seed yield per ha. The application of lamda-cyhalothrin 30g a.i/ha recorded significantly maximum (1679, 1417 and 1548 kg) seed yield per ha during 2011, 2012 and pooled data respectively (Fig.02). This was on par with application of indoxacarb 14.5% @ 0.25ml/litre (1560, 1389 and 1474 kg/ha) and dimethoate 30% EC @ 2ml/litre (1541, 1330 and 1435 kg/ha). Significantly minimum (662, 573 and 618kg) seed yield per ha was recorded with application of imidacloprid 40g a.i/ha.

The higher seed yield could be attributed to reduced per cent fruit damage and seed damage. In okra, Hasan (2010) reported that highest seed yield was recorded from dimethoate treatment and lowest in multi neem. Rathod *et al*. (2003), Sinha *et al*. (2007), Lal *et al*. (2008) and Bhushan *et al*., (2011)reported similar results as these are highly effective against shoot and fruit borer on cotton and okra respectively.

Practical utility of the study

The highest seed yield with high quality was recorded in the foliar sprays of Lamda-cyhalothrin 30g a.i/ha, for the control of fruit borer incidence in seed production of okra, one among these three chemicals viz., Lamda-cyhalothrin 30g a.i/ha, Indoxacarb 14.5% 0.25ml/litre and Dimethoate 30% EC 2ml/ litre can be made use.

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