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Field efficacy of selected insecticides against okra shoot and fruit borer [*Earias vittella* (Fabricius)]

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Abstract
An experiment entitled " Field efficacy of selected insecticides against okra shoot and fruit borer [*Earias vittella (*Fabricius)]" was conducted at Central Research Field, Department of Entomology, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during year 2021 Seven treatments were evaluated against, *Earias vittella* i.e., (T1) Imidacloprid 17.8% SL (T2) Spinosad 45% SC (T3) Indoxcarb 14.5% SC (T4) Chlorantraniliprole 18.5% SC (T5) Cypermethrin 25%EC (T6) Profenofos50 EC (T7) Neem oil 0.03% EC (T0) control. Were tested to compare the efficacy against *Earias vittella* and their influences on yield of Okra. The best and most economical treatment was Chlorantraniliprole 18.5% SC (1:7.3), which was par with Spinosad (1:6.4), followed by Indoxacarb 14.5 SC (1:4.9), followed by Cypermethrin 25%EC (1:4.9), followed by Imidacloprid 17.8% SL (1:4.8), followed by Profenofos50 EC (1:4.6) and Neem oil (1:3.8) control (1:3.3).

Keywords: Benefit Cost Ratio**,** *Earias vittella*, Insecticide, okra shoot and fruit borer

Introduction
Okra [*Abelmoschus esculentus* (L.) Moench] is an annual vegetable belonging to Malvaceae family; it is also known by different names *viz*., ladies finger, bhindi, bamia, okro or gumbo in different parts of the world. Okra is known as 'Queen of vegetables. Okra is valued for its tender green fruits. It is cooked in variety of ways and used as an ingredient in a wide variety of dishes. (Reddy *et al*., 2018). Its medicinal value has also been reported in curing ulcer and relief from haemorrhoids. Okra is a very useful plant. It is mainly cultivated for edible fruits but its other parts like leaves, flower petals, stems and roots are also being used as a food, bio-fuel and as a medicine in different parts of the world. It is rich in vitamins, calcium, potassium and other minerals matter.

The total area and production under okra in the world is reported to be 1.26 million ha and 22.29 million tonnes, respectively. It is mainly grown in India, Nigeria, Sudan, Pakistan, Ghana, Egypt, Saudi Arabia, Mexico and Cameroon. India ranks first in okra production 5784.0 thousand tonnes (72% of total world production) having area of 1148.0 thousand hectares with an annual production of 6346 million tonnes and productivity of 11.9 million tonnes/ha. The crop is grown throughout India, Andhra Pradesh is the leading okra producing state which has production of around 1184.2 thousand tons from an area of 78.90 thousand ha, with a productivity of 15 tons / ha. It is followed by west Bengal (862.1 thousand tonnes from 74.00 thousand with 11.70 tonnes/ ha productivity. In Uttar Pradesh area, production and productivity of okra is 12.19 ha, 148.64 tonnes, 12.2 metric tons per hectare (National Horticulture Board 2018-19).

Abelmoschus esculentus (L.) Moench (Okra) is a warm season vegetable, also known as Bhendi or lady's finger. It is an excellent source of minerals, vitamins and fibre. Okra seed oil is reported to contain Linoleic acid which is one of the essential fatty acid (China and Nushirwan, 1990)

Okra is an important vegetable crop grown all over India and tropical and sub-tropical parts of the world. Globally India ranks first in okra production (72% of the total world production) having area of 533 hectares with an annual production of 6346 million tons and productivity of 11.9 million tons/ha. Okra is susceptible to a large number of insect pests and fruit borer (*Earias vittella*) is reported to cause direct damage to the fruits (52.33 to 70.75%) (Pareek and Bhargava, 2009).

Materials and Methods

The present study on, "Field efficacy of selected insecticides against okra shoot and fruit borer *E.vittella (Fabricius*)" will be conducted under the field condition during Kharif 2021.

Experimental site

The experiment will be conducted during kharif season 2021 at Central Research Field, Department of Entomology, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj Uttar Pradesh, India, in a randomized block design with eight treatments replicated three times using variety Super green seeds in a plot size of 2m×2m at a spacing of 45cm × 30cm with a recommended package of practices excluding plant protection. The soil of the experimental site was well drained and medium high.

Method of Recording Observation

Efficacy of treatments

The population of okra shoot and fruit borer was recorded before 1- day spraying and on 3rd day, 7th day and 14th day after insecticidal application. The populations of okra shoot and fruit borer was recorded on 5 randomly selected and tagged plants from each plot and then it was converted into per cent of infestation by following formula.

On Shoot

At each picking the total number of shoots and number of shoots infested of five selected plants from each treatment replication wise was recorded.

$$\% \text{ Shoot infestation} = \frac{\text{No. of shoot infested}}{\text{Total no. of shoot}} \times 100$$

On Fruit

At each picking the total number of fruits and number of fruits infested of five selected plants from each treatment replication wise was recorded.

$$\text{Fruit infestation} = \frac{\text{No. of fruit infested}}{\text{Total no. of fruit}} \times 100$$

Treatments No.	Treatments	Dosages Gm/ml/lit
T_1	Imidacloprid 17.8% SL	0.4ml/lit
T_2	Spinosad 45% SC	0.3-0.4ml/lit
T_3	Indoxacarb 14.5 SC	1.3ml/lit
T_4	Chlorantraniliprole 18.5% SC	1.5ml/lit
T_5	Cypermethrin 25%EC	1.5/lit
T_6	Profenofos50 EC	2ml/lit
T_7	Neem oil 0.03% EC	2ml/lit
T_0	Control	-

Results and Discussion

The present study entitled, "Field efficacy of selected insecticides against okra shoot and fruit borer *E.vittella* (Fabricius)" The data so obtained through observation on various aspects were subjected to statistical analysis wherever necessary and the data was compiled. Results, thus obtained are presented aspect wise here under.

Shoot infestation

Among all the treatments lowest per cent shoot, infestation was recorded in T_4 Chlorantraniliprole 18.5% SC (9.91), T_2 Spinosad (11.68), T_3 Indoxacarb 14.5 SC (13.39), T_5 Cypermethrin 25%EC (16.33), T_1 Imidacloprid 17.8% SL (17.01), T_6 Profenofos50 EC (19.90) and T_7 Neem oil (20.67) was least effective among all the treatments. Control plot T_0 (24.12) infestation.

Fruit infestation

Among all the treatments lowest per cent fruit, infestation was recorded in Chlorantraniliprole 18.5% SC (9.13), T_2 Spinosad (12.37), T_3 Indoxacarb 14.5 SC (14.84), T_5 Cypermethrin 25%EC (15.55), T_1 Imidacloprid 17.8% SL (15.90), T_6 Profenofos50 EC (16.95) and T_7 Neem oil (18.4) was least effective among all the treatments. Control plot T_0 (24.69) infestation.

Table 1: Field efficacy of selected insecticides against okra shoot and fruit borer *E. vittella (Fabricius*) (First Spray): (Percent shoot infestation)

Treatments		Percent shoots infestation of *E. vittella*				
		One day before spray	After spray			
			3 DAS	7 DAS	14 DAS	Mean
T_1	Imidacloprid 17.8% SL	17.51	16.87	16.47	17.71	17.01
T_2	Spinosad 45% SC	15.86	11.45	11.73	11.87	11.68
T_3	Indoxacarb 14.5 SC	15.72	12.92	12.08	15.19	13.39
T_4	Chlorantraniliprole 18.5% SC	17.02	10.51	8.78	10.44	9.91
T_5	Cypermethrin 25%EC	20.76	16.47	15.45	17.08	16.33
T_6	Profenofos50 EC	20.02	20.08	19.4	20.24	19.90
T_7	Neem oil 0.03% EC	20.67	21.04	20.53	20.45	20.67
T_0	Control	20.69	23.11	24.15	29.58	25.61
Overall Mean		18.53	16.55	16.07	17.82	16.81
F- test		NS	S	S	S	S
S. Ed. (±)		1.83	0.86	0.83	0.73	0.74
C. D. (P = 0.05)		-	2.456	2.473	2.236	2.14

Table 2: Field efficacy of selected insecticides against okra shoot and fruit borer *E. vittella (Fabricius*) (Second Spray): (Percent Fruit infestation)

Treatments		Percent shoots infestation of *E. vittella*				
		One day before spray	After spray			
			3 DAS	7 DAS	14 DAS	Mean
T_1	Imidacloprid 17.8% SL	19.39	16.11	14.05	17.55	15.90
T_2	Spinosad 45% SC	20.25	11.47	10.81	14.85	12.37
T_3	Indoxacarb 14.5 SC	16.9	15.1	13.43	16	14.84
T_4	Chlorantraniliprole 18.5% SC	18.94	10.51	7.97	8.93	9.13
T_5	Cypermethrin 25%EC	17.41	15.94	13.7	17.01	15.55
T_6	Profenofos50 EC	19.76	17.09	15.44	18.32	16.95
T_7	Neem oil 0.03% EC	20.24	18.18	17.03	19.99	18.4
T_0	Control	21.52	24.26	26.62	28.44	26.44
Overall Mean		19.59	16.08	14.88	17.63	16.19
F- test		NS	S	S	S	S
S. Ed. (±)		1.89	1.04	1.09	1.13	0.75
C. D. (P = 0.05)		-	3.04	3.32	3.42	1.80

Table 3: Field efficacy of selected insecticides against okra shoot and fruit borer *E. vittella (Fabricius*) on Economics and cost of benefit ratio of okra

Treatment Symbols	Yield (q/ha)	Cost of yield (RS/q)	Gross return (RS)	Total cost of cultivation (RS)	Net return (RS)	B:C Ratio
T_1	136.3	1800	245340	50651	194689	1:4.8
T_2	195.5	1800	351900	54911	296989	1:6.4
T_3	155.47	1800	279846	57111	222735	1:4.9
T_4	224.11	1800	439398	59651	379747	1:7.3
T_5	140.2	1800	252360	50651	201709	1:4.9
T_6	130.18	1800	234324	50751	183573	1:4.6
T_7	107.63	1800	193734	50883	142851	1:3.8
T_0	92.4	1800	166320	50151	116169	1:3.3

Conclusion

From the above discussion it was found that, spraying of insecticides significantly reduced the shoot and fruit borer percent infestation in okra. The present findings conclude that the new generation insecticides like T_4 Chlorantraniliprole 18.5% SC (1.5ml/lit), > T_2 Spinosad (0.3-0.4ml/lit), > T_3 Indoxacarb 14.5 SC (1.3ml/lit), > T_5 Cypermethrin 25%EC (1.5/lit), > T_1 Imidacloprid 17.8% SL (0.4ml/lit), > T_6 Profenofos50 EC (2ml/lit) > T_7 Neem oil 0.03% EC (2ml/lit) and untreated control plant T_0 were found effective against shoot and fruit borer of okra *Earias vittella.* Further, it was observed that the cost benefit ratio was also high with T_4 Chlorantraniliprole 18.5% SC and T_2 Spinosad 45% SC. Hence, it is suggested that the effective insecticides may be alternated in harmony with the existing Intergrated pest management programes in order to avoid the problems associated with insecticidal resistance, pest resurgence etc.

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