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Bio-efficacy of newer and bio-rational insecticides against shoot and fruit borer (*Earias vittella* Fabricius) of okra

Shivani Patta, Amit Kumar Sharma, Rajesh Pachori and Yogendra Kumar Mishra

Abstract
An experiment was conducted on bio-efficacy of newer and bio-rational insecticides against shoot and fruit borer in okra. Efficacy of insecticides tested against *Earias vittell*a in okra indicated that the minimum per cent infestation of shoot and fruit borer was found in the treatment of emamectin benzoate 3.8%+thiamethoxam 20% WDG (16.75%) followed by emamectin benzoate 5% SG (18.93%), spinosad 45% SC (21.20%), profenofos 50% EC. Thiamethoxam 25%WG (27.60%) and *Beauvaria bassiana* both were found at par with each other. Treatment NSKE 5% (31.25%) was found least effective but it was significantly superior to control.

Keywords: Newer and bio-rational insecticides against shoot and fruit borer, *Earias vittella* Fabricius

Introduction
Okra (*Abelmoschus esculentus* L.), commonly known as "Bhindi" is very popular commercially grown crop among vegetables and plays a significant role in the world food security. It is native of tropical or sub-tropical Africa. It has been grown in Mediterranean region as well as in the tropical and subtropical regions. In India okra is being cultivated around the year in *kharif* and summer seasons (Anonymous 2018) [2]. Okra is an export-oriented crop in India as its fruits are exported to the neighboring countries. It has good export potential accounting for 60 percent of fresh vegetable. Its medicinal value has also been reported in curing ulcer and relief from hemorrhoids.

India ranks second in terms of vegetable production in the world but is the world's largest producer of okra and India share 66.3%. World production of okra is estimated at 7896.3 million tons annually at a yield of 6.90 tons per ha in an area of 1148 million ha). It is mainly grown in India, Nigeria, Sudan. Production in India stands at 6146 tons per year with a yield of 11.64 tons per ha in an area of 528 thousand ha. In Madhya Pradesh area is 40.12 thousand ha, production is 536.73 MT and productivity is 13.38 per ha. The major okra growing districts are Chhindwara, Jabalpur, Sagar (Anonymous, 2017) [1]. One of the most important constraints in production of okra is insect pests. Many of the pests occurring on cotton are found to ravage okra crop. As high as 72 species of insects have been recorded on crop (Pal *et al.* 2013), among which the shoot and fruit borers like *Earias vitella* cause significant damage to crop to the tune of 91.60 per cent. The borer has been reported to cause 24.6 to 26.0 percent damage to okra shoots and 40 to 100 per cent loss to fruits (Yadav *et.al.* 2017) [12]. The shoot and fruit borer causes damage to shoots in early vegetative stage and fruits in the reproductive stage. Shoot and fruit borer is also known as tissue borer, as they infest the crop in its early stage of growth. Larvae bore into the young growing shoots and as a result shoots droop down and wither away. Later on, they bore the developing fruit which become unfit for human consumption. In general, the overall damage due to insect pests accounts to 48.97 per cent loss in fruit yields (Subbireddy *et al.*, 2018) [11]. The idea of controlling pests by using various agro-techniques in combination with selective use of insecticides making compatible with other components of the management of okra pests are gaining importance as the most effective measure. Hence, the present study was attempted to evaluate the, field trials on management with newer and bio-rationales insecticides against shoot and fruit borer (*Earias vittella* Fabricius) in okra was conducted and the results are presented.

Materials and Methods

Investigation entitled, "Bio-efficacy of newer and bio-rational insecticides against shoot and fruit borer (*E. vittella* Fab.) in okra" was carried out in the experimental field of Department of Entomology, Adhartal, JNKVV, Jabalpur, Madhya Pradesh during *rabi* season 2018. The experiment was laid out in simple randomized block design (RBD) with eight treatments including untreated control, each replicated thrice. The plot size was kept 4.0 x 5.0 m^2 keeping row to row and plant to plant distance of 60 and 30 cm, respectively. The okra variety, Ankur 40 was used in experiment and was sown on 21st September, 2018. The incidence of shoot and fruit borer (*E. vittella* Fab.) was recorded by the intensity of fruit infestation at each picking were recorded on healthy and damaged fruit weight basis. Fruit infestation by *E. vittella* was judged by total weight of healthy fruits and weight of fruits damaged by ula, *E. vittella*, and the per cent fruit borer infestation was computed as follows:

$$\text{Percentage fruit borer infestation} = \frac{\text{Weight of infested fruits}}{\text{Weight of the total number of fruits}} \times 100$$

Total yield (Kg/ha)

The weight of okra fruits at each picking was recorded individually for each treatment and the total yield was calculated by adding the yield from all pickings in each treatment. The yield was then converted in to per hectare basis. According to the following formula,

$$\text{Yield (Kg/ha)} = \frac{\text{Yield / plot}}{\text{Plot size}} \times 10000$$

Table 1: Treatment details

	Treatment details	Dose (ml\gm/ha)	Dose/litre of water
T_1	Emamectin benzoate 3.8% +Thiamethoxam 20% WDG	100	0.2ml/l
T_2	Emamectin benzoate 5% SG	170	0.34ml/l
T_3	Thiamethoxam 25% WG	100	0.2ml/l
T_4	*Beauvaria bassiana*	1000	2ml/l
T_5	Spinosad 45% SC	100	0.2ml/l
T_6	Profenofos 50% EC	1000	2ml/l
T_7	NSKE 5%	25000	50ml/l
T_8	Control	--	--

Result and discussion

Fruit damage by *Earias vittella*

The treatment of emamectin benzoate 3.8% +thiamethoxam 20% WDG @ 100 g/ha was found to be most effective as it recorded minimum fruit damage (16.75%) followed by emamectin benzoate 5% SG @ 170 g/ha (18.93%), spinosad 45% SC @ 1000 ml/ha (21.20%), profenofos 50% EC @ 1000 ml/ha. Thiamethoxam 25%WG @ 100 g/ha (27.60%) and Beauvaria bassiana both were found to at par with each other. Treatment NSKE 5% @ 25 l/ha (31.25%) was found least effective but it was significantly superior to control.

The present findings are more or less similar with Laichattiwar and Meena (2014) [6] reported that emamectin benzoate was most effective against shoot and fruit borer followed by spinosad. Rakshith and Kumar reported NSKE (9.95%) is the least effective among all the treatments.

Harinkhere (2014) [4] revealed that emamectin benzoate 5% SG found significantly more effective and showed minimum fruit damage. Whereas, Kumar *et al.* (2016) [5], Sarkar *et al.* (2015) [10] and Dhar and Bhattacharya (2015) [3] reported that spinosad 45% SC gave lowest mean fruit damage and vary effective treatment against *Earias vittella*.

Lakkundi and Channaveerswami (2015) [7] reported that Profenophos proved significantly effective in controlling *E. vittella*.

Whereas, Yadav *et al.*, (2017) [12] reported that treatment of indoxacarb (3.86 and 4.10%), was found to be the most effective followed by spinosad (4.30 and 4.76%), emamectin benzoate (4.64 and 5.08%) damage both on number and weight basis, respectively.

Fruit yield

Among the treatments emamectin benzoate 3.8% + thiamethoxam 20% WDG @ 100 g/ha recorded significantly highest fruit yield (58.36q/ha). The next effective treatment was emamectin benzoate 5% SG @ 170 g/ha (55.55 q/ha) followed by spinosad 45% SC @ 1000 ml/ha (52.60 q/ha), profenofos 50EC @ 1000 ml/ha (49.46). Treatment *Beauvaria bassiana* @ 1000 ml/ha (38.58) and NSKE 5% @ 25 l/ha (36.44) were the next better treatments as both were at par to each other.

Table 2: Efficacy of new insecticide and bio-rationales against shoot and fruit borer percent damage and fruit yield per hectare.

	Treatment details	Dose g/ml/ha	Mean percentage Fruit damage by shoot and fruit borer	Fruit Yield* (q/ha)
T_1	Emamectin benzoate 3.8% + Thiamethoxam 20% WDG	100	16.75 (24.14) L	58.36H
	Emamectin Benzoate 5% SG	170	18.93 (25.78)	55.55
T_3	Thiamethoxam 25% WGS	100	27.60 (31.67)	43.02
T4	*Beauvaria bassiana*	1000	28.30 (32.09)	38.58
T_5	Spinosad 45% SC	100	21.20 (27.40)	52.60
T_6	Profenofos 50% EC	1000	24.03 (29.33)	49.46
T_7	NSKE 5%	25000	31.25	36.44

			(33.96)	
T_8	Control	-	37.83 (37.94) H	22.43L
SEm±			0.50	0.78
CD at 5%			1.53	2.36

( ) Figures in parentheses are arcsin transformed value, L= Lowest H= Highest, *Total mean of 9 picking

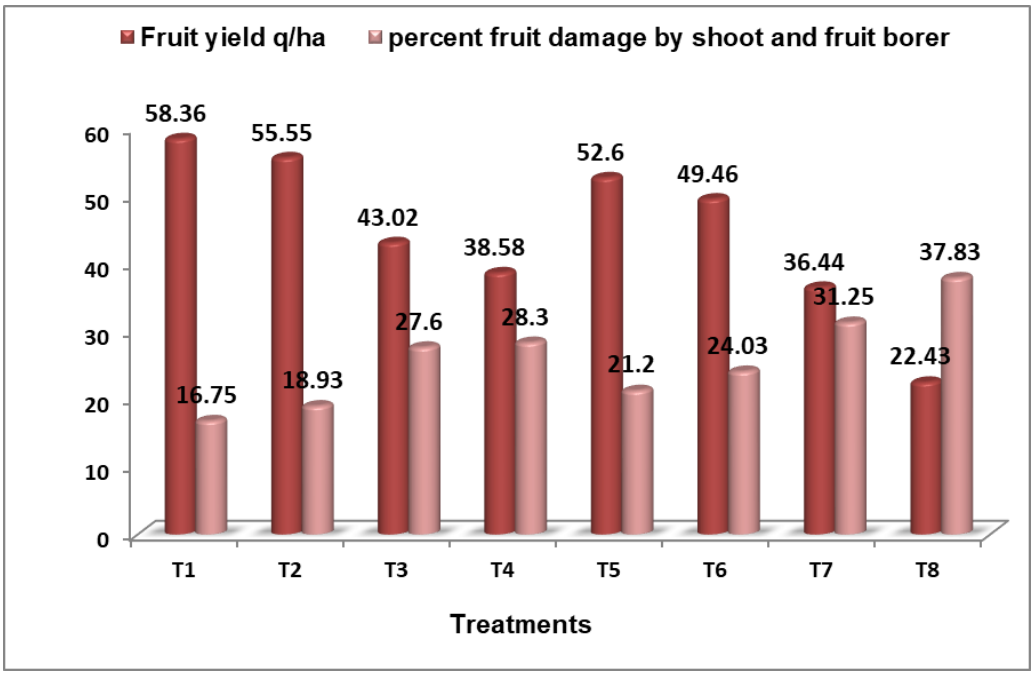

Fig 1: Efficacy of insecticide on okra fruit damage by shoot and fruit borer and fruit yield

Conclusion

The bio efficacy of insecticide i.e., emamectin benzoate 3.8% + Thiamethoxam 20% WDG @ 100 g/ha proved to be most effective against *Earias vittella*. Remaining treatments emamectin benzoate 5% SG @ 170 g/ha, spinosad 45% SC @ 1000 ml/ha, profenofos 50% EC @ 1000 ml/ha. Thiamethoxam 25%WG @ 100 g/ha, *Beauvaria bassiana* and NSKE 5% @ (25 l/ha) were found significantly superior over control for shoot and fruit borer of okra.

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