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Efficacy and Economics of Some Selected Insecticides Against Shoot and Fruit Borer (*Earias Vittella*) of Okra [*Abelmoschus Esculentus* (L.) Moench]

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Abstract

The current study was carried out at Central Research Farm, SHUATS, Naini, Prayagraj, U.P during *kharif* season of 2021. Two applications of seven insecticides were used against Eariasvittellaand the resultsrevealed that Chlorantraniliprole 18.5% SC had the lowest percent of shoot and fruit infestation with 11.71% and 11.96% followed by Emamectin benzoate 5% SG (12.96% and 14.11%), Spinetoram 11.7% SC (13.28% and 14.70%), Imidacloprid 17.8% SL (14.71% and 16.35%), Flonicamid 50 WG (14.90% and 17.31%), Acephate 75 SP (15.74% and 17.65%) and Diafenthiuron 50 WP (16.39% and 19.61%) respectively as compared to control (water spray) with 20.75% and 24.75%. Benefit cost ratio was found highest in Chlorantraniliprole (1: 4.4) followed by Imidacloprid (1: 4.2), Emamectin benzoate (1: 4.2), Spinetoram (1: 3.4), Diafenthiuron (1: 3.3), Flonicamid (1: 3.3), Acephate (1: 3.1) and Control (1: 1.6).

Key words : Benefit cost ratio, Chlorantraniliprole, *Eariasvittella*, Emamectin benzoate, Insecticides, *Kharif*, Shoot and fruit infestation, spinetoram.

Okra [*Abelmoschus esculentus* (L.) Moench] commonly known as *Bhindi* or lady's finger (family Malvaceace) is a popular fruit vegetable crop due to its high nutritional and medicinal values. Due to their sensitive and supplemental character, as well as their growth in high moisture, okra is planted throughout the summer and *kharif* seasons. Carbohydrate (6.4%), Protein (1.9%), Fat (0.2%), Fibre (1.2%), Minerals (0.7%) and Moisture (89.6%) are all present in okra fruits. Anonymous (2013-14). Gujarat is the largest okra producing state in India, with output of roughly 921.72 thousand tones from an area of 75.27 thousand hectares and a productivity of 12.25 tonnes ha^{-1}, followed by West Bengal (914.86 thousand tones from 77.5 thousand hectares and 11.5 tonnes ha^{-1} productivity). Uttar Pradesh has production of 307.29 tonnes from an area of 22.93 thousand ha with a productivity of 13.40 MT ha^{-1} of okra. NHB(2018-19).

One of the limiting factors is the cultivation of okra is infestation of insect pests. As many as 72 species of insects have been recorded on okra Pandey *et al*. (2019). The major insect pests are shoot and fruit borer, *Earias insulana* (Boisd.), *Earias vittella* (Boisd.); leaf hopper, *Amrasca biguttula biguttula* (Ishida.); leaf roller, *Sylepta derogate* (Fab); whitefly, *Bemisia tabaci* (Genn.); Aphid, *Aphis gossypii* (Glov.) and mite, *Tetranychus cinnabarinus* (Boisd.). Nagar *et al*. (2017).

The shoot and fruit borer (E. *insulana* and E. *vittella*) is one of the most serious pests of okra. The larvae bore into the terminal growing shoots, floral buds, flowers and fruits of okra, resulting in cessation, withering and drying of infested shoots, tender leaves and heavy shedding of floral buds and flowers. The infested fruits become malformed and are rendered unfit for human consumption as well as for procurement of the seeds. The borer has been reported to cause 24.6 to 26.0 percent damage

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to okra shoots and 40 to 100 percent loss to fruits. Yadav *et al*. (2017).

Pesticides constitute the key control tactics for management of pests and diseases and the productivity of crops depends on their effective control. Together with high yielding crop varieties and fertilizers, pesticides have helped the Indian farmers in achieving a substantial increase in agricultural productivity. Birthal *et al*. (2000). The area under plant protection has been continuously increasing in India which is why this study has been carried out to find out the efficacy of some selected insecticides in order to control Eariasvittella of okra.

Materials and Methods

During the *kharif* season of 2021, a field research was carried out at Central Research Farm, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj, U.P. The okra seeds of variety 'Abhay' were planted at 45 cm x 30 cm spacing.

The experiment was laid down in randomized block design (RBD) with eight treatments replicated thrice with each plot size of 2m x 2m and proper irrigation was provided. The treatments comprising of Spinetoram 11.7% SC, Emamectin benzoate 5% SG, Chlorantraniliprole 18.5% SC, Flonicamid 50% WG, Acephate 75% SP, Imidacloprid 17.8% SL and Diafenthiuron 50% WP were applied two times using knapsack sprayer. The shoot damage (due to Earias vittella) was recorded at weekly interval while fruit damage at each picking from randomly selected five plants. The observations recorded one day before spray followed by 3, 7 and 14 days after spraying. After the last picking, total of all pickings of individual plots produce were calculated to work out the yield of the treatments. Yield of healthy fruits was converted into quintal per hectare. The extent of damage was computed by using the formula:

Percent shoot infestation

$$\text{Percent shoot damage} = \frac{\text{Number of infested shoots}}{\text{Total number of shoots}} \times 100$$

Percent fruit infestation

$$\text{Percent fruit damage} = \frac{\text{Number of damaged fruit}}{\text{Total number of fruits}} \times 100$$

$$\text{Benefit Cost Ratio} = \frac{\text{Gross returns}}{\text{Total cost}}$$

Results and Discussion

Efficacy of treatments : The data so obtained through observation were subjected to statistical analysis wherever necessary. From the data on mean of shoot infestation of first spray revealed that the treatment Chlorantraniliprole 18.5 percent SC (11.71 percent) caused the least shoot damage, followed by Emamectin benzoate 5 percent SG (12.96 percent), Spinetoram 11.7 percent SC (13.28 percent), Imidacloprid 17.8 percent SL (14.17 percent), Flonicamid 50 percent WG (14.90 percent), Acephate 75 percent SP (15.74 percent), and Diafenthiuron 50 percent WP (16.39 percent) was the least effective treatment. (See Table 1) (Fig. 1).

These results are in support with Shirale *et al*. (2012) Naidu and Kumar (2019) who reported that Chlorantraniliprole proved superior over other insecticides in reducing infestation of L. *orbonalis*. Reshma and Behera (2018) reported Emamectin benzoate as effective treatment.Muthukrishnan *et al*. (2013) reported Spinetoram as effective treatment.

The data on mean of fruit infestation of second spray revealed that the treatment Chlorantraniliprole 18.5 percent SC (11.96

Table 1. Efficacy of some insecticides against shoot and fruit borer of okra [*Abelmoschus esculentus* (L.) Moench] (First spray)

Treatments	% Shoot infestation				
	Before spraying	**3 DAS**	**7 DAS**	**14 DAS**	**Mean**
T_1 - Spinetoram 11.7% SC	18.968 (25.768)*	12.768 (20.936)*	11.771 (20.064)*	15.312 (23.022)*	13.283 (21.346)*
T_2 - Emamectin benzoate 5% SG	20.021 (26.577)*	12.277 (20.505)*	11.553 (19.868)*	15.078 (22.836)*	12.969 (21.077)*
T_3 - Chlorantraniliprole 18.5% SC	20.158 (26.672)*	11.349 (19.653)*	10.007 (18.440)*	13.776 (21.785)*	11.710 (19.972)*
T_4 - Flonicamid 50% WG	18.968 (25.768)*	14.107 (22.057)*	12.824 (20.969)*	17.788 (24.940)*	14.906 (22.664)*
T_5 - Acephate 75% SP	20.021 (26.577)*	14.713 (22.554)*	14.611 (22.393)*	17.919 (25.033)*	15.747 (23.357)*
T_6 - Imidacloprid 17.8 SL	20.158 (26.672)*	13.082 (21.179)*	12.920 (21.028)*	16.532 (23.988)*	14.178 (22.087)*
T_7 - Diafenthiuron 50% WP	20.021 (26.577)*	15.020 (22.799)*	14.888 (22.690)*	19.288 (26.049)*	16.398 (23.850)*
T_0 - Control	18.801 (25.683)*	19.182 (25.974)*	20.258 (26.732)*	22.811 (28.516)*	20.750 (27.084)*
F - test	NS	S	S	S	S
S. Ed. (±)	1.109	0.714	1.431	1.004	0.412
C. D (P = 0.05)	-	1.539	3.073	2.157	0.892

*Figures in parenthesis are arc sin transformed values. DAS : Days After Spray

percent) caused the least fruit damage of the seven insecticides tested against the shoot and fruit borer, followed by Emamectin benzoate 5 percent SG (14.11 percent), Spinetoram 11.7 percent SC (14.70 percent), Imidacloprid 17.8 percent SL (16.35 percent), Flonicamid 50 percent WG (17.31 percent), Acepahte 75 percent SP (17.65 percent) and Diafenthiuron (19.61 percent) was the least effective treatment. (See Table 2) (Fig. 2).

These results are in support with Tripura*et al*. (2017)[10] and Kumar *et al*. (2017) [11] reported that Chlorantraniliprole recorded lowest fruit damage. Parthiban *et al*. (2014) recorded that Emamectin benzoate on fruit yield was the most effective. Bade *et al*. (2017) found Spinetoramas the most effective in reducing the incidence of shoot and fruit borer of brinjal.

Cost benefit ratio : There was a considerable difference in yield between the treatments. In comparison to control (1: 1.6), Chlorantraniliprole (1: 4.4) produced the best yield, followed by Imidacloprid (1: 4.2), Emamectin benzoate (1: 4.2), Spinetoram (1: 3.4), Diafenthiuron (1: 3.3), Flonicamid (1: 3.3), and Acephate (1: 3.1). (See Table 3).

The present results are similar with Kumar *et*

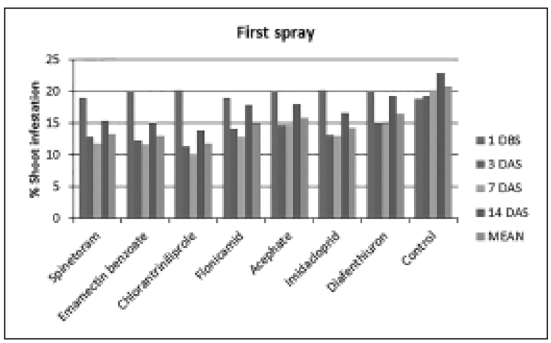

Fig 1. Efficacy of some selected insecticides against shoot and fruit borer of okra. (first spray)

Table 2. Efficacy of some selected insecticides against shoot and fruit borer of okra [*Abelmoschus esculentus* (L.) Moench] (Second spray)

Treatments	% Fruit infestation				
	Before spraying	**3 DAS**	**7 DAS**	**14 DAS**	**Mean**
T_1 - Spinetoram 11.7% SC	24.309 (29.536)*	14.011 (21.980)*	12.515 (20.715)*	17.584 (24.791)*	14.703 (22.497)*
T_2 - Emamectin benzoate 5% SG	24.309 (29.536)*	13.776 (21.785)*	11.847 (20.117)*	16.709 (24.121)*	14.110 (22.016)*
T_3 - Chlorantraniliprole 18.5% SC	23.596 (29.057)*	11.275 (19.616)*	10.307 (18.716)*	14.312 (22.217)*	11.964 (20.192)*
T_4 - Flonicamid 50% WG	24.033 (29.349)*	16.944 (24.296)*	15.661 (23.311)*	19.337 (26.075)*	17.314 (24.569)*
T_5 - Acephate 75% SP	24.309 (29.536)*	18.653 (25.575)*	15.961 (23.536)*	18.340 (23.345)*	17.651 (24.831)*
T_6 - Imidacloprid 17.8 SL	23.596 (29.057)*	15.195 (22.931)*	15.473 (23.142)*	18.389 (25.386)*	16.352 (23.833)*
T_7 - Diafenthiuron 50% WP	23.809 (29.197)*	20.490 (26.900)*	17.725 (24.895)*	20.623 (27.005)*	19.612 (26.274)*
T_0 - Control	23.596 (29.057)*	24.084 (29.381)*	23.358 (29.566)*	25.833 (30.543)*	24.758 (29.837)*
F - test	NS	S	S	S	S
S. Ed. (±)	0.836	1.048	1.723	1.029	0.741
C. D (P = 0.05)	-	2.256	3.701	2.214	1.599

*Figures in parenthesis are arc sin transformed values. DAS : Days After Spray

al. (2017) and Kushwaha and Painkra (2016) recorded highest B:C ratio in Chlorantraniliprole. Nemade *et al*. (2015) [16]concluded that in terms of higher incremental cost benefit ratio, Imidacloprid was found superior. Devi *et al*. (2014) and Singh *et al*. (2018) observed higher B:C ratio in Emamectin benzoate. Ghosal *et al*. (2013) observed highest yield and B:C ratio in Spinetoram.

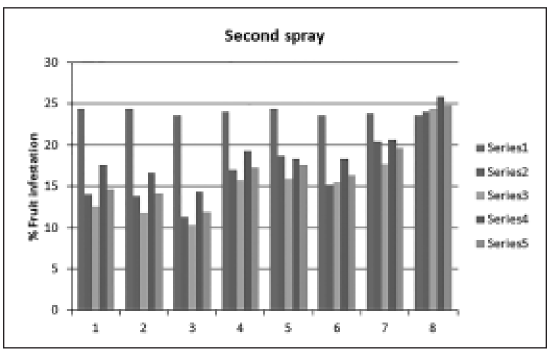

Fig 2. Efficacy of some selected insecticides against shoot and fruit borer of okra. (second spray)

Conclusion

From the experiment discussed above, the results revealed that the most efficient pesticide against shoot and fruit borer was found to be Chlorantraniliprole, followed by Emamectin benzoate and Spinetoram with Diafenthiuron being the least effective. Chlorantraniliprole had the best cost-benefit ratio followed by Imidacloprid, Emamectin benzoate and Spinetoram.

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Table 3. Economics of treatments for management of shoot and fruit borer

Treatments	Yield (q ha^{-1})	Cost of yield	Total cost of yield (Rs.)	Common cost (Rs.)	Treatment cost (Rs.)	Total cost (Rs.)	Cost: Benefit ratio
Spinetoram 11.7% SC	137.9	1500	206850	47278	12050	59328	1: 3.4
Emamectin benzoate 5% SG	140.5	1500	210750	47278	2480	49758	1: 4.2
Chlorantraniliprole 18.5% SC	162.4	1500	243600	47278	8000	55278	1: 4.4
Flonicamid 50% WG	107.2	1500	160800	47278	1280	48558	1: 3.3
Acephate 75% SP	103.3	1500	154950	47278	1454	48732	1: 3.1
Imidacloprid 17.8 % SL	151.8	1500	227700	47278	5800	53078	1: 4.2
Diafenthiuron 50% WP	110.6	1500	165900	47278	2480	49758	1: 3.3
Control	52	1500	78000	47278	-	47278	1: 1.6

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Author contribution statement

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KS is a M.Sc (entomology) student who has conducted the whole trial right from layout to sowing of seeds, observation of pests, spraying of insecticides and harvesting of okra fruits which was done under the guidance of KA, Associate professor. The present article is taken from the M.Sc thesis submitted by KS to SHUATS (Sam Higginbottom University of Agriculture, Technology and Sciences) Prayagraj, U.P.

Conflicts of interest/Competing interests

The author (s) declare (s) no known conflict of interests that could have appeared to influence the work reported in this paper.

References

Anonymous. 2013-14. Final area and production of horticultural crops. Indian Horticulture database, 2014. National Horticulture Board, 279 and 283.

Anonymous. 2018-19. National Horticulture Board, Ministry of Agriculture, Government of India.

Bade, B. A., Kharbade, S. B., Kadam, M. B and Patil, A. S. 2017. Bio-efficacy of novel pesticides against shoot and fruit borer, *Leucinodesorbonalis* (Guen.) on brinjal. Trends in Biosciences, 10(4): 1179-1182

Birthal, P. S., Sharma, O. P., Kumar, S. and Dhandapani, A. 2000. Pesticide use in rainfed cotton: frequency, intensity and determinants. Agricultural Economic Research Review, 13(2): 107-122.

Devi, L. L., Ghule, T. M., Chatterjee, M. L., and Senapati, A.K. 2014. Biorational management of shoot and fruit borer of okra (*Eariasvittella Fabricius*) and their effect on insect predators. Environment & Ecology, 33(3): 1052-1054.

Ghosal, A., Chatterjee, M. L and Bhattacharya, A. 2013. Evaluation of some Biorational pesticides for the management of shoot and fruit borer of brinjal and okra. Pesticide Research Journal, 25(2): 146-151.

Kumar, S., Singh, V. K., Kumar, A and Chandra, N. 2017. Bioefficacy of coragen against shoot and fruit borer, *Earias vittella* (Fab.) in okra. Int. J. Curr. Microbial. App. Sci, 6(10): 1021-1027.

Kumar, S., Singh, V. K., Kumar, A. and Chandra, N. 2017. Bioefficacy of coragen against shoot and fruit borer, *Earias vittella* (Fab.) in okra. Int. J. Curr. Microbiol. App. Sci., 6(10): 1021-1027.

Kushwaha, T. K and Painkra, G. Pd. 2016. Efficacy of certain insecticides against shoot and fruit borer (*Leucinodesorbonalis* Guen.) on kharif season Brinjal (*Solanummelongena* L.) under field condition. International Journal of Agricultural Science and Research (IJASR), 6(2): 383-388.

Muthukrishnan, N., Visnupriya, M., Babyrani, W. and Muthiah, C. 2013. Persistence toxicity and field evaluation of Spinetoram 12 SC against shoot and fruit borer, LeucinodesorbonalisGuenee in Brinjal. Madras Agric.J., 100(4-6): 605-608

Nagar, J., Khinchi, S. K., Kumawat, K. C and Sharma, A. 2017. Screening different varieties of okra [*Abelmoschus esculentus* (L.) moench] against sucking insect pests. Journal of Pharmacognosy and Phytochemistry, 6(3): 30-34.

Naidu, G. and Kumar, A. 2019. Field efficacy of certain insecticides against shoot and fruit borer (*Earias vittella*) on rainy season okra in Prayagraj (U.P). Journal of Entomology and Zoology studies, 7(6): 1211-1213.

Nemade, P. W., Deshmukh, S. B and Ughade, J. D. 2015. Evaluation of newer insecticides against leaf hopper on bt cotton. International journal of plant protection, 8(2): 313-318.

Parthiban, P., Bhaskaran, R. K and Thangavel, M. K. 2014. Field efficacy of Emamectin benzoate 5 WG against lepidopteran pests of okra. Annals of Plant Protection Sciences, 22(1): 98-102.

Reshma, M. and Behera, P. K. 2018. Efficacy of some new insecticides against shoot and fruit borer,Leucinodes orbonalis Guenee. Int. J. Curr. Microbiol. App. Sci, 7(5): 1170-1176.

Shirale, D., Patil, M., Zehr, U and Parimi, S. 2012. Evaluation of newer insecticides for the management of brinjal fruit and shoot borer *Leucinodes orbonalis* (Guenee). Indian Journal of Plant Protection, 40(4): 273-275.

Singh, N., Dotasara, S. K., Kherwa, B. and Singh, S. 2017. Management of tomato fruit borer by incorporating newer and biorational insecticides. Journal of Entomology and Zoology Studies, 5(2): 1403-1408

Tripura, A., Chatterjee, M. L., Pande, R. and Patra, S. 2017. Biorational management of brinjal shoot and fruit borer (*Leucinodesorbonalisguenee*) in mid hills of meghalaya. Journal of Entomology and Zoology Studies, 5(4): 41-45

Yadav, S. K., Kumawat, K. C., Deshwal, H. L., Kumar, S and Manohar, S. V. S. 2017. Bioefficacy of newer and biorational insecticides against shoot and fruit borer, Earias spp. on okra. Int. J. Curr. Microbiol. App. Sci, 6(7): 1035-1044.