Original Research Article

Field efficacy of different insecticides against brinjal shoot and fruit borer, *Leucinodes orbonalis* (Guenee).

ABSTRACT

The experiment was conducted at the research plot of the Department of Agricultural Entomology and Central Research Farm, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, during *Kharif* from July to November 2022 in Randomized Block Design (RBD) with three replications. Eight treatments were evaluated against, *Leucinodes orbonalis i.e*., Spinosad 45% SC (0.5ml/L), Chlorantraniliprole 18.5% SC (0.5ml/L), Flubendiamide 480 SC (0.4ml/L), Emamectin benzoate 5 SG (0.4gm/L), Indoxacarb 14.5% SC (0.25ml/L), Neem oil 5% (50ml/L), *Beauveria bassiana* ($1X10^8$ CFU/gm) 1.15 % WP (2.5gm/L), Control in RBD with three replications. The data on the percent infestation of shoot and fruit borer on brinjal 3rd, 7th, and 14th day after first and second spray reveal that all the chemical treatments were significantly superior over control. The lowest infestation was recorded in Chlorantraniliprole 18.5% SC (12.45) (9.78), Spinosad 45% SC (13.56) (10.43), Emamectin benzoate 5 SG (14.68) (11.39), Indoxacarb 14.5% Sc (15.34) (12.38), Flubendiamide 480 SC (16.26) (13.30), *Beauveria bassiana* ($1X10^8$ CFU/gm) 1.15 % WP (16.84) (14.56), Neem oil 5% (19.46) (15.52). The best yield and most economical treatment was Chlorantraniliprole 18.5% SC (220.5q/ha) (1:8.3) which was par with Spinosad 45% SC (195.30q/ha) (1:7.7) followed by Emamectin benzoate 5 SG (172.50q/ha) (1:6.8), Indoxacarb 14.5 SC (165.35q/ha) (1:6.5), Flubendiamide 480SC (142.33q/ha) (1:5.3), *Beauveria bassiana* (1X108 CFU/gm) 1.15 % WP (130.40q/ha) (1:5.2) and Neem oil 5% (125.50q/ha) (1:5.04) as compared to control (90.00q/ha) (1:3.72). The yields among the treatment were significant.

Key words: Brinjal, Chemical Insecticide, Chlorantraniliprole**,** Cost Benefit Ratio, *Leucinodes orbonalis,* Yield.

INTRODUCTION

Vegetable cultivation is one of the most profitable and dynamic branches of agriculture. It has become an important source of income for both farmers and field labours, serving as a vehicle for reducing poverty in rural areas. Brinjal (*Solanum melongena* Linnaeus) belongs to thefamily Solanaceae. Eggplant is referred as the "King of vegetables" originated from India and now grown as a vegetable throughout the tropical, sub-tropical and warm temperate areas of the world. It is a most important vegetable in the Indian Subcontinent that accounts for almost 50% of the world's area under its cultivation. However, in India, the area is estimated as 7.5% of the total area of vegetables with 8% of the total production of vegetables **(Roy *et al.*, 2016).**

Nutritional value per 100 g of brinjal contains carbohydrates (5.88 g), protein (0.98 g), total fat (0.18 g), dietary fiber (3.0 g), folates (22 mcg), niacin (0.649 mg), riboflavin (0.037 mg),thiamin (0.039 mg), vitamin C (2.2 mg), vitamin A (23 IU), vitamin A,(1µgvRAE),vitamin E (0.30 mg), vitamin K (53 mcg), vitamin sodium (2 mg), potassium (229 mg), calcium (9 mg), iron (0.23 mg), magnesium (14 mg), phosphorus (24 mg), zinc (0.16 mg), and lutein andzeaxanthin (516 mg) **(source: USDA National Nutrient data base, 2018).** It has been reported as Ayurvedic medicine for curing the diabetes. In addition, it is used as a good appetizer, good aphrodisiac, cardio tonic, laxative and reliever of inflammation**. (Kalawate and Dethe, 2012).**

In the world area, production and productivity of brinjal in year 2016 was 1.79 million ha, 51.29 million tons and 28.59 tons per ha, respectively **(Food and Agriculture Organization, 2016)**. China is leading having first rank in production with 32.03 million tons, area with 0.78 million ha and productivity with 40.96 tons per ha.India has second rank in both area and production and 8th in productivity in all brinjal growing countries. In India, Production share of Brinjal with 8.3 % stands at fourth position among vegetable crops after potato, tomato and onion with 25.5, 11.9 and 11.5 per cent respectively. **(Bhadauria *et al.*, 1999).** Asia has the largest brinjal production which comprises about 90% of the total production area and 87% of the world production. **(Mannan *et al.*, 2015).**

The crop is generally sown twice or thrice in a year, depending upon the irrigation facilities. Many insect pests damage and affect the yield of brinjal crop to a great extent. (Singh 1984) have listed about 25 insect pests of brinjal, of which some major insect pests viz; BSFB (*Leucinodes orbonalis* Gu.), Epilachna beetle *(Epilachna vigintioctopunctata* F.), Aphids (*Aphis gossypi* Glower),stem

borer (*Euzophera perticella* Rag.) and Jassid (*Amrasca biguttula biguttula* **(Vevai *et al.*, 1970)**
In India, this pest has a countrywide distribution and has been categorized as the most destructive and most serious pest causing huge losses in brinjal. The larvae bore into tender shoots in the early stage resulting in drooping shoots, which are readily visible in the infested fields. At the later stage, caterpillars bore into flower buds and fruits, rendering the fruits unfitfor consumption and marketing, resulting in direct yield losses. The pest has been reported to inflict losses to the tune of 20.7-60.0 per cent in Tamil Nadu **(Raja *et al*., 1999)**, 70 per cent in Andhra Pradesh **(Sasikala *et al*., 1999),** 80 per cent in Gujarat and 41 per cent in Himachal Pradesh **(Lal and Singh, 1976).**

Leucinodes orbonalis Guenee (Pyralidae: Lepidoptera) is the most important insect pestof brinjal and the apparent yield loss varying from 20-90% in various parts of the country **(Raju *et al*., 2007)**. The Larvae of this pest cause 12-16% damage to shoots and 20- 60% damage to fruits. The pest is very active during rainy and summer season and often causes more than up to 95% in India. It is also reported that the infestation of fruit borer causes reduction in Vitamin C contentto an extent of 68 % in the infested fruits **(Anwar *et al*., 2015)**

MATERIALS AND METHODS

The experiment was conducted during *kharif* season 2022 at Central Research Farm (CRF), SHUATS, Prayagraj, Uttar Pradesh, India in a Randomized Block Design with eight treatments replicated three times using the variety Pusa Purple Round in a plot size of (2m×1m) at a spacing of (60×45cm) with a recommended package of practices excluding plant protection. The soil of the experimental site was well drained and medium high.

All of the insecticides used in the study were sprayed as foliar application. The eight different treatments were used with dosage consisting of T_1 Spinisad 45% SC @ 0.5ml/L, T_2 Chlorantraniliprole 18.5% SC @ 0.5ml/L, T_3 Flubendiamide 480 SC @ 0.4ml/L, T_4 Emamectin benzoate 5 SG @ 0.4gm/L, T_5 Indoxacarb 14.5% SC @ 0.25ml/L, T_6 Neem oil 5% @ 50ml/L, T_7 *Beauveria bassiana* ($1X10^8$ CFU/gm) @ 2.5gm/L and T_8 Control. Two sprays were carried out at intervals of 15 days during the experiment to assess the effectiveness of pesticides. On five randomnly chosen and tagged plants in each plot, pre and post- treatment observations on the percent damage of shoot and fruit infestation was made shortly before 24 hours and 3^{rd} ,7^{th} and 14^{th} days, respectively.Descriptive statistics was calculated using MS-EXCEL. All the statistical software package were carried out using "ICAR WASP".

RESULTS AND DISCUSSION

The data on the percent infestation of shoot borer on brinjal 3rd,7th and 14th day after first spray revealed that all the chemical treatments were significantly superior over control. Among all the treatments lowest percent shoot infestation was recorded in Chlorantraniliprole 18.5 %SC (12.45), followed by Spinosad 45% SC (13.56), Emamectin benzoate 5 SG (14.68), Indoxacarb 14.5% SC (15.34), Flubendamide 480 SC (16.26), *Beauveria bassiana* (16.84). The treatment Neem oil 5% (19.46) was least effective among all the treatments and maximum shoot damage was recorded in control plot (29.13).

The data on the percent infestation of fruit borer on brinjal 3rd,7th and 14th day after second spray revealed that all the chemical treatments were significantly superior over control. Among all the treatments lowest percent fruit infestation was recorded in Chlorantraniliprole 18.5 % SC (9.78), followed by Spinosad 45% SC (10.45), Emamectin benzoate 5 SG (11.39), Indoxacarb 14.5% SC (12.38), Flubendamide 480 SC (13.3), *Beauveria bassiana* (14.56). The treatment Neem oil 5% (15.52) was least effective among all the treatments and maximum fruit damage was recorded in control plot (27.15).

Yield among the treatments were significant. Highest Yield was recorded in Chlorantraniliprole 18.5% SC (220.50q/ha) followed by Spinosad 45% SC (195.30 q/ha) Emamectin benzoate 5% SG (172.50q/ha) Indoxacarb 14.5% SC (165.35q/ha), Flubendiamide 480 SC (142.33q/ha), *Beauvaria bassiana* (130.40 q/ha) Neem oil 5% (125.50 q/ha) next and least yield was recorded in Control plot (90.00 q/ha)

When cost benefit ratio worked out, interesting result was achieved, among the treatment studied, the best and most economical treatment was Chlorantraniliprole 18.5% SC (1:8.32) followed by Spinosad 45% SC (1:7.78), Emamectin benzoate 5 SG (1:6.88) Indoxacarb 14.5% SC (1:6.54), Flubendiamide 480 SC (1:5.34), *Beauvaria bassiana* (1:5.22) Neem oil 5% (1:5.04) next and least yield was recorded in Control plot (1:3.72).

The results are in support with **Tripura *et al*., (2017) and Mainali *et al.*, (2015).** reported that the treatment T_2 Chlorantraniliprole 18.5% SC was superior in reducing the population of shoot and fruit borer. Next most effective treatment was T_1 Spinosad 45% SC which was similar with **Singh and Sachan (2015) and Devi *et al.*, (2015).** Next effective Treatment was recorded in T_4 Emamectin benzoate 5 SG which is similar to **Sharma and Tayde (2017) and Shirdhara *et al.*, (2019).**

The Highest Yield and cost benefit ratio was recorded in Chlorantraniliprole 18.5% SC (220.50q/ha) and (1:8.32) as respectively. The result is supported by **Tripura *et al*., (2017) and Mainali *et al.*, (2015).** followed by Spinosad 45% SC (195.30 q/ha) and (1:7.7) in similar findings **Singh and Sachan (2015). and Devi *et al.*, (2015).** Emamectin benzoate 5 SG (172.50q/ha) and (1:6.88) in similar findings **Sharma and Tayde (2017) and Shirdhara *et al.*, (2019).**

Table:1 Infestation of different insecticides on the percent damage of brinjal shoot and fruit borer, [*Leucinodes orbonalis,*]

Sl.No	Treatments	Percent Shoot and Fruit Infestation										Yield (q/ha)	C:B Ratio
		Dosage	FIRST SPRAY					SECOND SPRAY					
			1DBS	3DAS	7DAS	14DAS	MEAN	1DBS	3DAS	7DAS	14DAS	MEAN	
T1	Spinosad 45% SC	0.5ml/L	21.99	15.42^{ef}	11.63^{fg}	13.64^{f}	13.56	16.22^{ef}	11.18^{ef}	9.68^{ef}	10.45^{fg}	10.43	195.30	1:7.7
T2	Chlorantraniliprole 18.5% SC	0.5ml/L	24.49	14.64^{f}	10.72^{g}	12.01^{g}	12.45	14.82^{f}	10.7^{f}	8.73^{f}	9.91^{g}	9.78	220.50	1:8.3
T3	Flubendiamide 480 SC	0.4ml/L	25.99	18.01^{cd}	14.02^{cd}	16.77^{cd}	16.26	19.39^{cd}	14.11^{c}	12.5^{d}	13.31^{cd}	13.30	142.33	1:5.3
T4	Emamectin benzoate 5 SG	0.4gm/ L	25.3	16.98^{de}	12.14^{ef}	14.93^{e}	14.68	16.47^{ef}	12.17^{de}	10.53^{e}	11.49^{ef}	11.39	172.50	1:6.8
T5	Indoxacarb 14.5% SC	0.25ml/ L	26.48	17.26^{cd}	13.04^{de}	15.73^{de}	15.34	17.91^{de}	13.04^{d}	11.65^{d}	12.47^{de}	12.38	165.35	1:6.5
T6	Neem oil 5%	50ml/L	25.27	21.63^{b}	17.22^{b}	19.53^{b}	19.46	21.76^{b}	16.82^{b}	14.69^{b}	15.07^{b}	15.52	125.50	1:5.04
T7	*Beauveria bassiana* (1X10^{8} CFU/gm)	2.5gm/ L	26.39	18.84^{c}	14.76^{c}	16.93^{c}	16.84	20.59^{bc}	15.86^{b}	13.70^{c}	14.14^{bc}	14.56	130.40	1:5.2
T8	Control	-	23.40	27.70^{a}	29.18^{a}	30.96^{a}	29.13	24.54^{a}	26.16^{a}	27.28^{a}	28.02^{a}	27.15	90.00	1:3.7
F- test		-	NS	S	S	S	S	S	S	S	S	S	-	-
S.Ed. (±)		-	1.6	00.56	00.36	00.38	00.66	00.58	00.35	00.31	00.35	00.37	-	-
C.D.(P=0.05)		-	-	01.69	01.08	01.14	02.15	01.77	01.06	00.94	01.04	01.11	-	-

DBS****-** Day Before Spray*, DAS***- Day After Spray** NS=Non-Significant***, S-Significant****

CONCLUSION

From the present study, the results showed that Chlorantraniliprole 18.5% SC is most effective treatment against brinjal shoot and fruit borer producing maximum yield and recorded highest cost benefit ratio compared to other treatments followed by Spinosad 45% SC, Emamectin benzoate 5 SG, Indoxacarb 14.5% SC and Flubendiamide 480 SC has shown better results. *Beauveria bassiana* and Neem oil 5% has shown average in managing *Leucinodes orbonalis*. Botanicals are the part of integrated pest management in order to avoid indiscriminate use of pesticides causing pollution in the environment and not much harmful to beneficial insects.

References

Anwar, S., Mari, J. M., Khanzada, M. A. and Farman, Ulla. (2015). Efficacy of insecticides against infestation of brinjal fruit borer, *Leucinodes orbonalis* (Guen.) (Pyralidae: Lepidoptera) under field conditions. *Journal of Entomology and Zoology Studies*, *3*(3): 292-295

Bhadauria, N. K. S., Bhadauria, N. S. and Jakhmola, S. S. (1999). Insect pest complex of eggplant, *S. melongena* L. in North West M P. *Advances in Plant Sciences,* 12: 607-08.

Devi, L. L., Ghule, T. M., Chatterjee, M. L. and Senapati, A. K. (2015). Effectiveness of biorational insecticides for the management of brinjal shoot and fruit borer, *Leucinodes orbonalis* Guenee and on yield. *Ecology, Environment and Conservation*, *21*(2)**:** 783-788.

Kalawate, A. and Dethe, M. D. (2012). Bio efficacy study of biorational insecticide on brinjal. *Journal of Biopesticides, 5*(1):75-80.

Lal, S. and Singh, D. N. (1976). Response of Hybrid Brinjal To Nitrogen Fertilization. *Indian Journal of Horticulture, 33*(3and4): 258-261.

Mainali, R. P., **Thapa, R. B., Pokhrel, P., Dangi, N. and Aryal, S. (2015).** Bio- rational management of eggplant fruit and shoot borer, *Leucinodes orbonalis* Guenee, (Lepidoptera: Pyralidae), *Journal of Plant Protection Society,* 4: 235-247.

Mannan, M. A., Islam, K. S. And Jahan, M. (2015). Brinjal shoot and fruit borer infestation inrelation to plant age and season, *Bangladesh Journal of Agricultural Research, 40*(3):

399-407.

Raja, J., Rajendran, B. and Pappiah, C.M. (1999). Management of brinjal shoot and fruit borer, *Leucinodes orbonalis* Guen. *Vegetable Science, 26*(2) : 167-169.

Raju, S.V. S., Bar, U. K., Shanker, U. and Kumar, S. (2007). Scenario of infestation and management of egg plant shoot and fruit borer, *Leucinodes orbonalis* Guenee In India. *Resitance in Pest Management Newsletter,16*(2): 14- 16.

Roy, G., Gazmer, R., Sarkar, S., Laskar, N., Das, G. and Samanta, A. (2016). Comparative

bio efficacy of different insecticides against fruit and shoot borer (*Leucinodes orbonalis* Guenee) of Brinjal and their effect on natural enemies. *International Journal of Green Pharmacy*, *10*(4): S257-S260.

Sasikala, K., ArjunaRao, P. and Krishnayya, P. V. (1999). Comparative efficacy of ecofriendly methods involving egg parasitoid, *Trichogram majaponicum*, mechanical control and safe insecticides against *Leucinodes orbonalis* Guenee infesting brinjal. *Journal of Entomological Research*, *23*(4): 369-372.

Sharma, J. H. and Tayde, A. R. (2017). Evaluation of bio-rational pesticides, against brinjal fruit and shoot borer, *Leucinodes orbonalis* Guen. on brinjal at Allahabad agroclimatic region. *International Journal of Current Microbiology and Applied Sciences*, *6*(6): 2049-2054.

Shridhara, M., Hanchinal, S. G., Sreenivas, A. G., Hosamani, A. C. and Nidagundi, J. M. (**2019).** Evaluation of newer insecticides for the Management of brinjal shoot and fruit borer *Leucinodes orbonalis* (Guenee) (Lepidoptera: Crambidae). *International Journal of Current Microbiology and Applied Sciences*, *8*(3): 2582-2592.

Singh, M. and Sachan, S. K. (2015). Comparative efficacy of some biopesticides against shoot and fruit borer *Leucinodes orbonalis* Guenee in brinjal.*Plant Archives*, 15(2):805-808.

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

Vevai, G. H., Khokhar, K. M. and Ashraf, M. (1970). Management of insect pests of brinjal. Pakisthan *Journal of Agricultural Research*, 23: 33-39.