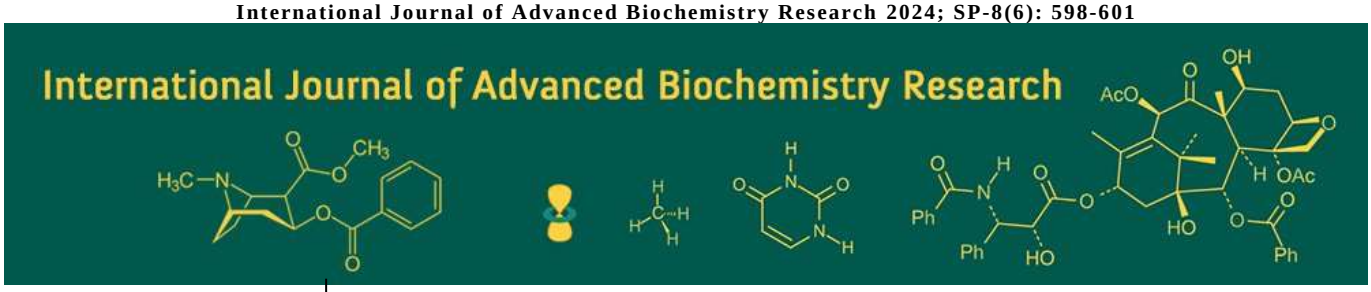

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Comparative study of selected botanicals and chemicals against shoot and fruit borer [*Leucinodes orbonalis* (Guenee)] on brinjal (*Solanum melongena* L.) at Prayagraj

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Abstract
The Investigation on "Comparative study of Selected botanicals and chemicals against shoot and fruit borer [(*Leucinodes orbonalis* (Guenee)] on brinjal (*Solanum melongena* L.) at Prayagraj". on brinjal during *Rabi*,2023-24 at the experimental research plot of Department of Entomology, Central Research Farm (CRF), Sam Higginbottom University of Agriculture, Technology And Science, Prayagraj, Uttar Pradesh. The result showed that the treatments lowest percent shoot and fruits, infestation was recorded in T_3 Neem Oil 2% + Spinosad 45%SC (12.09, 7.09), followed by T6 Neem Oil 2% +Flubendiamide 20 WG (13.93, 9.50), T_2 Spinosad 45% SC (15.23, 10.98), T_4 Flubendiamide 20 WG (16.26, 12.39), T_7 Indoxacarb 14.5%SC (16.96, 13.46), T_1 Neem oil 2% (17.86, 14.45), and T_5 NSKE 3% (20.38, 17.23). The control (28.37, 32.60) was least effective among all the treatments against *Leucinodes orbonalis*.

Keywords: Efficacy, flubendiamide, *Leucinodes orbonalis*, spinosad, botanicals

Introduction
Brinjal (*Solanum melongena* L.) also known as eggplant, belong to family *Solanaceae*, is an important vegetable crop grown throughout the world, especially in South Asia and it is the native of India. Brinjal is known for ayurvedic medicinal properties, especially white brinjal is said to be good for diabetic patients (Kumari *et al.*, 2023) [5].

Brinjal is a major source of supplements, minerals, vitamins, proteins cancer prevention agents, dietary fiber and weight training variables and ranked among the top 10 vegetables in term of oxygen radical absorbance capacity. Nutritionally, 100 grams of cooked fruit contains; very low caloric value (25.0), moisture 92.7%, carbohydrates 8.29 g (of which 3.04 are sugar), fat 0.2 gram, protein 1 gram, β carotene 21.1 µg and Fiber content of 3.4 grams. Other element like 0.7 mg iron, 13.0 mg sodium, 10.6mg magnesium, 213.0 mg potassium 12.0 mg calcium, 26.0 mg phosphorus, 8.93 mg choline, 13.4 g folate, 5.0 mg ascorbic corrosive and 27 International Units of vitamin A, 0.89 mg vitamin B, 2.2mg vitamin C, 0.30 mg vitamin E and 3.5 µg vitamin K are also found in the 100 g ripened fruit. (Lalita *et al.*, 2020) [6].

Annual production of eggplants in China is first ranked the country accounts for 64.41% of total world eggplant production, cultivated over 781,695 hectares, producing 454,852 hg/ha. Followed by India which accounts for 22.97% of total world eggplant production cultivated over 727,000 hectares with a yield of 174,415 hg/ha and Egypt which accounts for 2.14% of total world eggplant production, cultivated over 43,818 hectares with a yield of 269,350 hg/ha.

Brinjal shoot and fruit borer, BFSB, (*Leucinodes orbonalis* Guenee), (Lepidoptera Pyralidae) is the most serious chewing pest of brinjal crop and it damages the fruits up to 50- 70%. It damages shoot and fruit of brinjal plant in almost all stages of growth. Serious damage is caused by the larval stage of this pest. It is an internal borer which damages the tender shoots and fruits. Adult moth having dirty whitish wings and speckled markings lays eggs on young leaves/ flowers/ calyx of the fruits. After hatching the larvae starts boring into the petiole/ midrib of the leaves/ growing shoots/ flower buds/ fruits and closes the bore hole with frays.

growth, yield and fruit quality of crop and thus make it unfit for feeding purpose. (Rehman *et al.*, 2017) [1].

Materials and Methods

The experiment was conducted during *Rabi* season 2023-24 at a Central Research Farm of Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, India in a Randomized Block Design (RBD) with seven treatment and three replication three times using variety Arka Keshaw seeds in plot size of 2m X 1m at a spacing of 60 cm x 45 cm with a recommended package of practices excluding plant protection. The soil of the experimental site was well drained and medium high. The treatments were Neem Oil 2%, Spinosad 45% SC, Neem Oil 2% + Spinosad 45% SC, Flubendiamide 20WG, NSKE 3%, Neem Oil 2% + Flubendiamide 20WG and Indoxacarb 14.5% SC and one control plot (water spray) were used in this study. The insecticides were sprayed twice, first just after the appearance of pest on shoot and the second spray was given after 20 days of first spray. For evaluating the effectiveness of insecticides against shoot and fruit borer, damaged shoots were counted in each plot after 3rd, 7th and 14 days after each spray and the percent shoot infestation was computed on the basis of number of infested shoots out of total number of shoots per plot in each observation. Percent fruit infestation was worked out on the basis of number of infested fruits out of total number of fruits. Gross returns were calculated by multiplying total yield with the market price of the produce. Cost of cultivation and cost of treatments were deducted from the gross returns, to find out returns and cost benefit of ratio.

On Shoot-Number Basis: The total number of shoots and number of shoots infested of five selected plants from each treatment, replication was recorded.

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

(Yadav *et al.*, 2015) [12]

On Fruit: Number Basis: At each picking the total number of fruits and number of fruits infested of five selected plants from each treatment replication-wise was recorded.

The percentage infestation was calculated by the following formula.

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

(Yadav *et al.*, 2015) [12]

Cost benefit ratio of treatments

Gross returns were calculated by multiplying total yield with market price of the produce. Cost of cultivation and cost of treatments were deducted from the gross returns, to find out returns and cost benefit of ratio by following formula,

$$\text{BCR} = \frac{\text{Net returns}}{\text{Total cost}}$$

Results and Discussion

Percent mean infestation (3rd, 7th, 14th) day after first spray: The data on the mean (3rd, 7th, 14th DAS) Per cent infestation of shoot borer on first spray revealed that all the chemical treatments are superior over the control. Among all the treatments lowest percent of shoot infestation was recorded in Neem Oil 2% + Spinosad 45% SC (12.09%), Followed by Neem Oil 2% + Flubendiamide 20 WG (13.93%) and Spinosad 45% SC (15.23%). Treatment Flubendiamide 20 WG (16.26%) and Indoxacarb 14.5%SC (16.96%) was found to be average. The Neem oil 2% (17.86%) and NSKE 3% (20.38%) found to be less effective in controlling the infestation of *Leucinodes orbonalis* Guenee.

Per cent infestation 3rd, 7th, 14th day after second spray

The data on the mean (3rd, 7th, 14th DAS) Per cent infestation of fruit borer on second spray revealed that all the chemical treatments are superior over the control. Among all the treatments lowest percent of fruit infestation was recorded in Neem Oil 2% + Spinosad 45% SC (7.09%), Followed by Neem Oil 2% + Flubendiamide 20 WG (9.50%) and Spinosad 45% SC (10.97%). Treatment Flubendiamide 20 WG (12.39%) and Indoxacarb 14.5%SC (13.45%) was found to be average. The Neem oil 2% (14.44%) and NSKE 3% (17.23%) found to be less effective in controlling the infestation of *Leucinodes orbonalis* Guenee.

Table 1: Bio-efficacy of different botanicals and chemicals insecticides against *Leucinodes orbonalis* on shoots of brinjal (first spray)

S. No.	Treatment	1 day before spray	Percent shoot infestation (first spray)			Mean shoot infestation (%)
			3rd	7th	14th	
T_1	Neem Oil 2%	21.26	21.05	16.23	16.32	17.87
T_2	Spinosad 45% Sc	20.42	17.32	13.31	15.08	15.24
T_3	Neem Oil 2% + Spinosad 45%Sc	20.01	12.06	10.46	13.76	12.09
T_4	Flubendiamide 20WG	20.23	18.56	14.36	15.87	16.26
T_5	NSKE 3%	23.10	22.45	18.47	20.22	20.38
T_6	Neem Oil 2% + Flubendiamide 20WG	22.11	15.69	12.26	13.84	13.93
T_7	Indoxacarb 14.5% SC	21.51	19.60	15.04	16.25	16.96
T_0	Control (untreated)	21.96	25.51	26.57	33.04	28.37
	F - test	NS	S	S	S	S
	SE(d)	----	0.79	0.72	0.72	1.11
	CD at 5%	-----	1.20	1.40	2.57	3.41

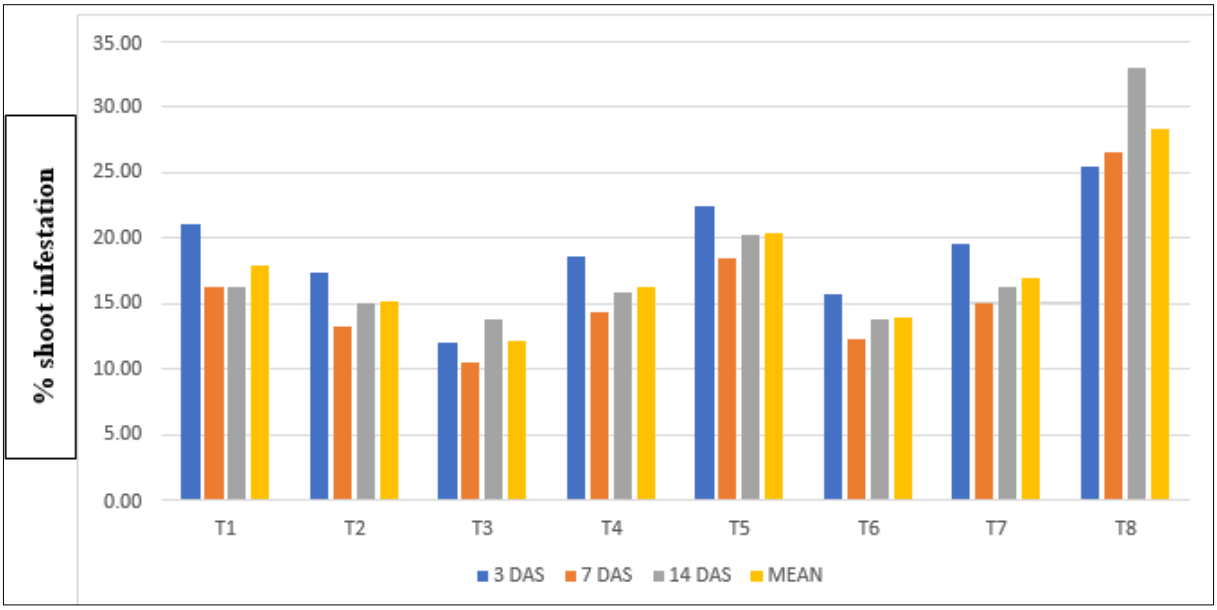

Fig 1: Graphical representation bio-efficacy of different botanicals and chemicals insecticides against *Leucinodes orbonalis* on shoots of brinjal (first spray)

Table 2: Bio-efficacy of different botanicals and chemicals insecticides against *Leucinodes orbonalis* on fruits of brinjal (Second spray)

S. No.	Treatment	1 day before spray	Percent fruit infestation (second spray)			Mean fruit infestation (%)
			3rd	7th	14th	
T_1	Neem Oil 2%	16.46	14.15	13.26	16.15	14.45
T_2	Spinosad 45% SC	17.96	11.02	10.56	11.35	10.98
T_3	Neem Oil 2% + Spinosad 45%SC	15.95	7.46	6.89	6.94	7.09
T_4	Flubendiamide 20WG	15.35	13.32	11.84	12.01	12.39
T_5	NSKE 3%	21.72	18.69	16.63	16.38	17.23
T_6	Neem Oil 2% + Flubendiamide 20 WG	16.43	9.77	9.35	9.39	9.50
T_7	Indoxacarb 14.5% SC	19.60	13.93	12.39	13.83	13.46
T_0	Control	27.59	32.65	32.60	32.56	32.60
	F- test	NS	S	S	S	S
	SE(d)	---	0.96	0.82	0.75	0.40
	CD at5%	---	2.44	1.81	5.06	1.31

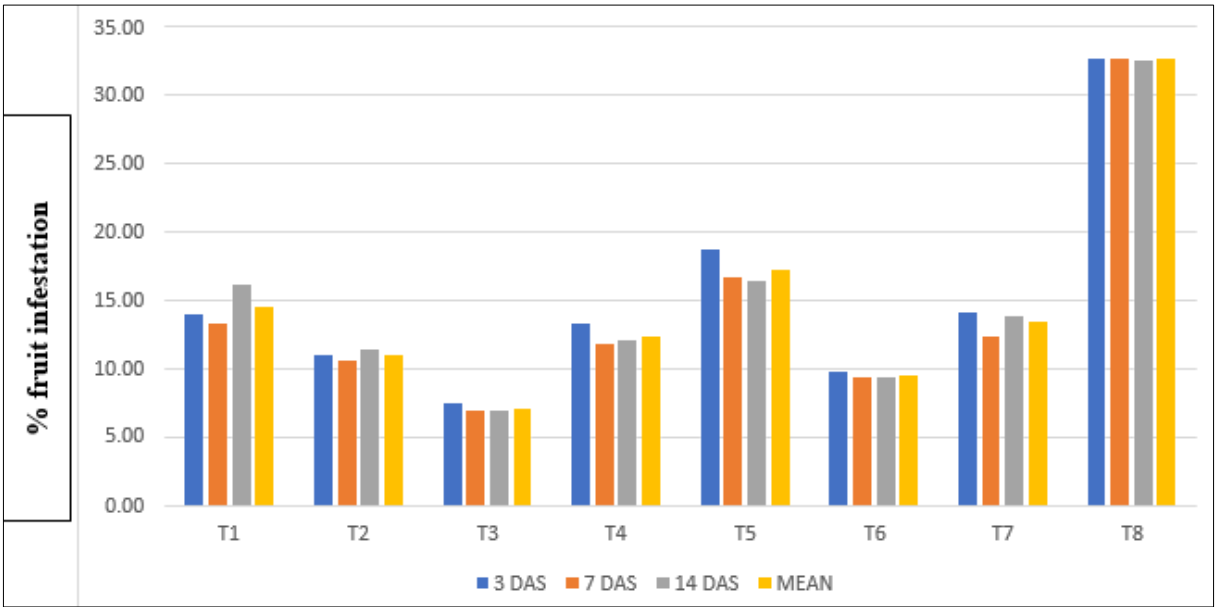

Fig 2: Graphical representation bio-efficacy of different botanicals and chemicals insecticides against *Leucinodes orbonalis* on fruits of brinjal (Second spray)

Conclusion

From the analysis of present similar findings on efficacy of selected botanicals and chemicals insecticides on brinjal shoot and fruit borer, the treatments Neem Oil 2% + Spinosad 45%SC was found most effective against brinjal shoot and fruit borer followed by Neem Oil 2% + Flubendiamide 20 WG, Spinosad 45% SC and resulted higher yield. While Flubendiamide 20 WG and Indoxacarb 14.5%SC ranked middle in order of their efficacy, then Neem oil 2% and NSKE 3% found to be least effective in managing *Leucinodes orbonalis.*

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