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

Gandla Sai Pooja and Ashwani Kumar

Abstract
The field trial was conducted at the Central Research Farm (CRF), SHUATS, Naini, Prayagraj during *kharif* 2021. Seven treatments were evaluated against**,** *Leucinodes orbonalis* i.e., Profenofos 50 EC @ 2ml/l (17.84), lmidacloprid 17.8 SL @ 0.4 ml/l (19.15), Emamectim Benzoate 5 SG @ 0.5 gm/l (15.31), Cypermethrin 25 EC @ 2ml/l (18.64), Flubendamide 20 WG @ 0.75ml/l (16.24), Chlorantraniliprole 18.5 EC @ 0.4ml/l (12.88). The yields among the treatments were significant. The highest yield was recorded in Chlorantraniliprole 18.5 EC (165.8 q/ha) followed by Emamectim Benzoate 5 SG (148.5q/ha), Flubendamide 20 WG (136.5 q/ha), Profenofos 50 EC (127.3 q/ha), Cypermethrin 25 EC (115.9 q/ha) and lmidacloprid 17.8 SL (104.2 q/ha) and The treatment Neem oil (100.1 q/ha) was least effective among all the treatments. Control plot (68 q/ha) infestation. When cost benefit ratio worked out, interesting result was achieved, among the treatment studied, the best and most economical treatment Chlorantraniliprole 18.5 EC (1:6.49), Emamectim Benzoate 5 SG (1:6.06), Flubendamide 20 WG (1:5.43), Profenofos 50 EC (1: 5.12), Cypermethrin 25 EC (1:4.58), lmidacloprid 17.8 SL (1: 4.27), and The treatments Neem oil (1:1.40). was least effective among all the treatments. Control plot (1: 2.84) infestation.

Keywords: Brinjal shoot and fruit borer, evaluation, insecticides, *Leucinodes orbonalis*

Introduction
The eggplant or aubergine or brinjal (*Solanum melongena*) is one of the most important solanaceous vegetable in south-east Asian countries including India, Bangladesh, Srilanka, China and Japan etc. It is native to Indo-Burma region and was known to be grown in Indian since ancient times Warghat *et al.* (2020) [12].

The major brinjal growing states in India are, Andhra Pradesh, Karnataka, West Bengal, Tamil Nadu, Maharashtra, Orissa, Uttar Pradesh, Bihar and Rajasthan. India ranks second and Chinaranks first in the production of brinjal (57.9% of world output). In India, this crop occupies71.13 lakh hectare area along with annual production of 135.57 (lakh tone) and productivity MT per hectare. In Uttar Pradesh, the area under cultivation of brinjal is 3430 hectare producing 111.70 MT and the productivity is 8 MT/ha Bhagwan and Kumar (2017) [2]

It is importance due to its nutritional, medicinal, as well as commercial value, 100gm edible portion of brinjal supplies 40 gm carbohydrates, 1.40gm of protiens, 0.30gm of mineral and vitamins A, B and C (68, 69). The fruits of brinjal are the reasonable sources of vitamins and minerals and it is rich in total water soluble sugars, free reducing sugars, amide proteins among other nutrients. (Abhishek and Dwivedi 2021) [1].

A general view of the pest problem in brinjal in India reveals that this crop is attacked severely by number of pests, shoot and fruit borer (*Leucinodes orbonalis*), epilachna beetle (*Epilachna vigintioctopunctata* Fab.), jassid (*Amrasca biguttula biguttula* Ishida), aphid, thrips and white flies (*Bemicia tabaci* Gennadius). Out of these pests, shoot and fruit borer, *Leucinodes orbonalis* G. is considered to be the most destructive. The infestation on brinjal can be as high as 75 to 92% Brinjal crop is attacked regularly or sporadically by at least 50 insect pests and Aphid, Jassids, Whitefly and shoot and fruit borer are categorized as major pests of regular occurrence, which are in agreement with the present investation.

Materials and Methods
The experiment was conducted during *kharif* season 2021 at the Central Research Farm (CRF) of Sam Higgin bottom University of Agriculture, Technology and Sciences, Naini, Prayagraj,

Uttar Pradesh, India, in a randomized block design with eight treatments replicated three times using Banaras purple round (local variety) in a plot size of 2m×2m at a spacing of 60×60cm with a recommended package of practices excluding plant protection. Seven treatments were evaluated against**,** *Leucinodes orbonalis* i.e., Profenofos 50 EC @ 2ml/l(T1), lmidacloprid 17.8 SL @ 0.4 ml/l(T2), Emamectim Benzoate 5SG@ 0.5 gm/l(T3), Cypermethrin25 EC @ 2ml/l(T4), Flubendamide 20 WG @ 0.75ml/l(T5), Chlorantraniliprole 18.5 EC @ 0.4ml/l(T6),neem oil 3 ml/l (T7)and control plot(T0) The population of brinjal 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 brinjal 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.

$$\text{No. of Shoots effected Percent} = \frac{\text{Shoot damage}}{\text{Total no. of shoots}} \times 100$$

$$\text{Per cent fruit damage} = \frac{\text{No. of fruits affected}}{\text{Total no. of fruits}} \times 100$$

Cost benefit ratio

Based on the yield data, the gross returns and net returns were calculated for each treatment. The benefit cost ratio (BCR) was determined by dividing the additional returns with the additional cost of imposing the respective treatment on hectare basis.

$$\text{B.C.R} = \frac{\text{Gross Returns}}{\text{Total Cost of cultivation}}$$

Results and Discussion

The results of the experiment Evaluation of different insecticides against brinjal shoot and fruit borer (*Leucinodes orbonalis* Guenee) to study cost benefit ratio during *kharif* season of 2021. The data so obtained through observation on various aspects were subjected to statistical analysis wherever necessary and the compiled mean data are tabulated in the following pages. Results obtained are presented aspect wise here under.

The data on the per cent 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 per cent shoot, infestation was recorded in T6 Chlorantraniliprole 18.5 EC (12.88), T3 Emamectim Benzoate 5 SG (15.31), T5 Flubendamid 20 WG (16.24), T1 Profenofos 50 EC (17.84), T4 Cypermethrin 25 EC (18.64), T2 lmidacloprid 17.8 SL (19.15), and the treatments T7 Neem oil (19.56). was least effective among all the treatments. Control plot T0 (24.65) infestation.

Table 1: Efficacy of selected insecticides against *L. orbonalis* on brinjal during *Kharif* season of 2021 (First spray)

Treatments		Per cent shoots infestation of *L. orbonalis*				
		One day before spray	First spray			
			3 DAS	7 DAS	14 DAS	Mean
T1	Profenofos 50 EC	20.80	17.87	13.06	26.97	17.84
T2	lmidacloprid 17.8 SL	20.24	17.88	15.83	23.74	19.15
T3	Emamectin benzoate 5SG	20.81	14.13	10.60	21.20	15.31
T4	Cypermethrin25 EC	20.97	18.64	14.29	22.99	18.64
T5	Flubendamide 20 WG	20.24	15.66	11.36	21.46	16.24
T6	Chlorantraniliprole 18.5 EC	19.77	13.28	8.06	17.31	12.88
T7	Neemoil	20.71	20.23	17.75	25.20	19.56
T0	control	20.42	24.12	22.88	26.97	24.65
Overall Mean		20.49	17.73	14.22	22.68	18.08
F- test		NS	S	S	S	S
S. Ed. (±)		0.81	2.19	1.44	1.40	2.99
C. D. (P = 0.05)		-	4.71	3.10	3.01	1.39

The data on the per cent infestation of fruit borer on brinjal 3rd, 7th and 14th day after second sprayrevealed that all the chemical treatments were significantly superior over control. Among all the treatments lowest per cent fruit, infestation was recorded recorded T6 Chlorantraniliprole 18.5 EC (5.34), T3 Emamectim Benzoate 5 S G (10.73), T5 Flubendamide 20 WG (12.26), T1 Profenofos 50 EC (14.39), T4 Cypermethrin 25 EC (15.41), T2 lmidacloprid 17.8 SL (16.63), and The treatments T7 Neem oil (17.41), was least effective among all the treatments. Control plot T0 (31.92) infestation.

Table 2: Efficacy of selected insecticides against *L. orbonalis* on brinjal during *Kharif* season of 2021 (second spray)

Treatments		Per cent fruit infestation of *Leucinodes orbonalis*				
		One day before spray	After spray			
			3 DAS	7 DAS	14 DAS	Mean
T1	Profenofos 50 EC	22.60	19.10	12.63	11.14	14.39
T2	lmidacloprid 17.8 SL	23.74	20.68	15.72	13.50	16.63
T3	Emamectin benzoate 5SG	21.20	15.48	9.38	7.33	10.73
T4	Cypermethrin25 EC	22.99	20.21	13.54	12.49	15.41
T5	Flubendamide 20 WG	21.46	16.19	11.21	9.38	12.26
T6	Chlorantraniliprole 18.5 EC	17.33	11.20	8.97	7.06	5.34
T7	Neem oil	25.20	20.71	7.03	14.69	17.41
T0	control	26.97	34.00	32.66	31.33	31.92
Overall Mean		20.66	19.78	14.02	13.40	15.63

F- test	NS	S	S	S	S
S. Ed. (±)	1.40	1.91	1.43	1.44	1.18
C. D. (P = 0.05)	3.01	4.10	3.09	3.10	2.53

Table 3: Economics of cultivation

S. No.	Treatments	Yield of q/ha	Cost of yield / in (₹`)/qtl	Total cost of yield in (₹`)	Common cost in (₹`)	Treatment cost in (₹`)	Net return	Total cost in (₹`)	B:C ratio
1	Profenofos	127.3	20000	254600	47848	1820	204932	49668	1:5.12
2	Imidachlopri d	104.2	20000	208400	47848	944	159608	48792	1:4.27
3	Emamectin Benzoate	148.5	20000	297000	47848	1132	248020	48980	1:6.06
4	cypermethrin	115.9	20000	231800	47848	2700	181252	50548	1:4.58
5	Flubendamide	136.5	20000	273000	47848	2424	222728	50272	1:5.43
6	Chlorantranil iprole	165.8	20000	331600	47848	3188	280564	51036	1:6.49
7	Neem oil	100.1	20000	200200	47848	2150	150202	49998	1:4.00
8	Control	68	20000	136000	47848	0	88152	47848	1:2.84

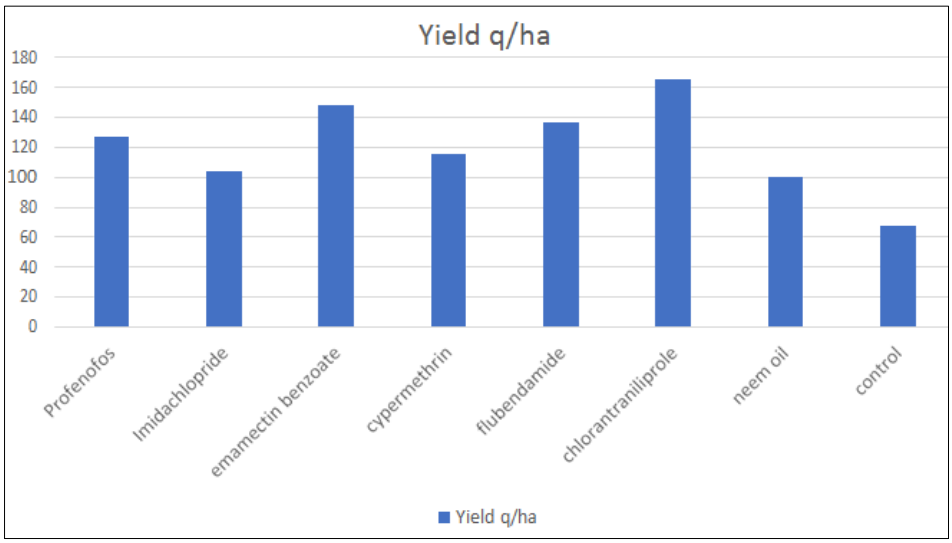

Fig 1: Graphical representation of economics of different treatments

Discussion

All the treatments are found to be superiorly over control on first and second spray and revealed that Chlorantraniliprole 18.5 EC was more effective in per cent infestation of fruit and shoot borer with (5.34 &12.88%) infestation over control respectively. Similar findings made by Mainali *et al.* (2015) [6] (6.31%), Sridhara *et al.*, 2019 [8] (7.38%). After that, Emamectim Benzoate5 SG is found to be more effective treatment in reducing per cent infestation of shoot and fruit borer with (15.31 & 10.73%) which is in line with the findings of Devi *et al.* (2015) [3] shoot infestation of first spray (11.07) and fruit infestation(16.21), Sharma and Tayde (2017) [9] (14.03) reported that Flubendamide 20 WG was found most effective in reducing first spray (11.06) and fruit infestation (16.21) per cent infestation of *Leucinodes orbonalis* as well as increasing the yield in similar findings with Patra *et al*. (2016) [7] (7.96). Profenofos 50 EC (17.84 and 14.39%) is found to be the next effective treatment followed by Cypermethrin 25 EC (18.64 and 15.41%) is found to be more effective treatment in reducing per cent infestation of shoot and fruit borer with which is in line with the findings of Kumar and Thakur (2017) [4] (7.41). The result of is in lmidacloprid 17.8 SL and 16.63%) followed by Neem oil 0.2% (19.56% & 17.41%) is found to be least effective among all the treatments these findings are supported by Bhagawan and Kumar (2017) [2] (9.83).

Cost benefit ratio and Brinjal yield

The yields among the treatments were significant the highest yield was recorded in Chlorantraniliprole 18.5 EC (165.8q/ha) findings with Shridhara *et al.* (2019) [8] (230q/ha), Emamectim Benzoate 5 SG (148.5q/ha) in similar findings with Devi *et al.* (2015) [3] (145.75q/ha), Yadav *et al.* (2015) [13] Flubendamide 20 WG (136.5 q/ha) in similar findings of Patra *et al*. (2009) [7]. Profenofos 50EC (127.3 q/ha), Cypermethrin 25 EC (115.9 q/ha), lmidacloprid 17.8 SL (104.2 q/ha) with findings in Salwe *et al.* (2019) (108q/ha) [11], and The treatments Neem oil (100.1 q/ha). was least effective among all the treatments find similar with with Sharma and Tayde (2017) [9] (90.4q/ha) Control plot (68 q/ha) infestation.

When cost benefit ratio worked out, interesting result was achieved, among the treatment studied the best and most economical treatment Chlorantraniliprole 18.5 EC (1:6.49), Emamectin Benzoate 5 SG (1:6.06) in similar findings with Shidhara *et al.* (2019) [8] (6.06), Flubendamide 20 WG (1:5.43) in similar findings with Shridhara *et al*. (2019) [8] (5.43), Profenofos 50 EC (1:5.12), Cypermethrin 25 EC (1:4.58) find similar with Bhagwan and
Kumar (2017) [2] (8.45) Imiadacloprid 17.8 SL (1:4.27), and the treatments Neem oil (1: 1.40) was least effective among all the treatments similar findings with Sharma and Tayde (2017) [9] (3.73) Control plot (1:2.84) Infestation.

Conclusion

From the present study, the results it showed that chlorantraniliprole 18.5 EC is most effective treatment against brinjal fruit and shoot borer producing maximum yield and

recorded highest Cost Benefit ratio compared to other treatments. While Emamectim Benzoate 5 SG, Flubendamide 20 WG, Profenofos 50 EC has shown average results Cypermethrin 25 EC, lmidacloprid 17.8 SL, has least effectiveness and in botanicals Neem oil found to be least effective 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.

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