International Journal of Advanced Research in Biological Sciences
ISSN: 2348-8069
www.ijarbs.com
(A Peer Reviewed, Referred, Indexed and Open Access Journal)
DOI: 10.22192/ijarbs Coden: IJARQG (USA) Volume 9, Issue 11 -2022

Research Article

DOI: http://dx.doi.org/10.22192/ijarbs.2022.09.11.009

Effectivity of periodic and insecticides on *Leucinodes orbonalis* in eggplant

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Abstract

Six pesticides were tested against brinjal shoot, fruit borer, and seed production in 2021 and 2022: Cypermethrin, Dimethoate, Carbaryl, Diflubenzuron, Neem, and *Bacillus thuringiensis* (dipel). Cypermethrin and dimethoate were discovered to be the two that were most successful in lowering the damage to shoot, fruits, and seed yield and consequently raising the yield of brinjal fruits.

Keywords: Effectivity, *Leucinodes orbonalis, Solanum melongena*

ARTICLE INFO

Article History:

Received 5th November, 2022
Received in revised form 17th November, 2022
Accepted 22nd November, 2022
Published online 30th November 2022

Introduction

The human diet should include plenty of vegetables. A significant crop for dietary vegetables is brinjal. Solanum melongena (Linnaeus), also known as brinjal or eggplant, is one of the most widely cultivated vegetable crops in South-East Asian nations and is thought to be an Indian native (Purseglove, 1968). It is frequently referred to as a poor man's vegetable since it is well-liked by small-scale farmers and people with limited incomes. Although it may be considered a poor man's crop, others refer to brinjal as the "King of Vegetables." Almost every household in India uses it in their recipes, regardless of their cuisine preferences, financial situation, or social standing.

The principal producing nations are Japan, the Philippines, Turkey, China, India, and China. With a 26% global output share, India is the second-largest producer of brinjal behind China thanks to its almost 550,000 hectares of cultivation. For more than 1.4 million small, marginal, and resource-constrained farmers, it represents a significant cash crop. Since brinjal is a sturdy crop that produces well even in dry conditions, it is grown in practically all regions of the nation. West Bengal produces 30% of the world's brinjal, Orissa produces 20%, and Gujarat and Bihar each produce about 10%. The average national productivity of brinjal in 2005–2006 was estimated to be 15.6 tonnes per hectare.The area under brinjal cultivation is estimated at 0.51 million ha with a total production of 8,200,000 Mt. (FAO, 2005).

Leucinodes orbonalis Guenee is, by far, the most dangerous pest in the places where brinjal is grown. The extent of the damage is frequently between 30% and 50%. (Ahmad, 1977). Seasonally and geographically, this may change, and occasionally the entire crop may be destroyed (Alam et al., 2003). The crop is damaged shortly after transplanting and continues during fruit harvest. Eggs are laid by the adult female on the ventral side of leaves, flower buds, and juvenile fruits. The terminal shoots of the pest are initially penetrated by short, pinkish-purple larvae, which causes the shoot to wither and dry. In a later stage, it creates holes in the young fruits and bores inside to feed, rendering the fruits unfit for food. In extreme circumstances, these fruits rot.

In addition to fruits, brinjal also produces seeds, which are profitable. Additionally, the *Leucinodes orbitalis Guenee* infestation lowers the production and viability of brinjal seeds (Lal and Sharma, 1977). According to Gangawar and Sachen (1981) and Patel *et al.*, brinjal pest losses fluctuate from season to season dependent on environmental conditions (1988). Their biology heavily depends on meteorological factors.

Materials and Methods

At the Agriculture Research farm Bichpuri, which is located 14 km from Agra, the field experiments were conducted during the Kharif of 2021-2022 by adhering to standard agronomic procedures recommended in (package of practices for high-yielding verities). *Leucinodes orbonalis Guence*, the brinjal shoot and fruit borer, was first observed after twenty days of the crop being transplanted at intervals of seven days (Singh *et al.* 1997).The observations on the *Leucinodes orbonalis Guenee* population were made in terms of damage to leaves, shoots, and fruits, which were counted along with the damage on 10 randomly chosen plants for each replication. Weekly weather parameter data were compiled and a straightforward correlation analysis was performed on them. Evaluation of the control plan for the brinjal *Leucinodes orbonalis Guenee.*

As it is evident from earlier reports, under agro-climatic conditions of Agra, the shoot and fruit borer, *Leucinodes orbonalis* Guenee. So, a study has been designed to evolve a suitable control schedule with 16 treatments consisting of four insecticides, one neem formulation, one bacterial pesticide (Dipel) and one Insect Growth Regulator (IGR) compound (diflubenzuron 25 WP)

For their effectiveness against one *Leucinodes orbonalis* Guenee in two seasons i.e. Kharif, 2021 and 2022. There were 16 treatments including one control (water spray) and laid out in a simple RBD with 3 replications. Preparation of desired concentration of pesticides Carbaryl and diflubenzuron used in the experiments were available as wet table powders. All the other pesticides used in the experiment were available in liquid form. Water was directly added to all foliar spray pesticides to get desired concentrations. The number of pesticides required per litre of water was calculated by the formula given below:

Pesticide per litre of water =Conc. Required/ Percent ai. ×1000

The fruits were harvested at 2 weeks intervals and in total there were six pickings. The yields of healthy and infested fruits were recorded on a weight and number basis. The yield data were subjected to statistical analysis to know the significance of differences among treatments. The yield per was converted to yield per hectare on the basis of the area covered in each plot.

While comparing the yield from the different treatments, the percent increase in yield over control was calculated with the formula given below (Pradhan, 1983).

Percent increase in yield over control = T- C / C X 100

Where, T-Yield from the treatment plot

C=Yield from the control plot

Seed Yield

In order to estimate the seed yield, one fruit from five randomly selected plants in each replication was tagged. These 15 well-ripened fruits were taken from each treatment and seeds were extracted. Seed yield was calculated on the basis of seed weight/ kg fruit weight. Seed yield was also calculated for the fruit borer-damaged fruits with different numbers of exit holes. After recording the seed yield data for all the treatments, it was subjected to statistical analysis.

Results and Discussion

Shoot infestation

Cypermethrin is best to reduce the shoot infestation in both the years followed by dimethoate (Table 1), The shoot infestation due to cypermethrin in 2020-21 and 2021 -22was 6.12 and 7.75 percent respectively, while in control it was 12.07 and 13.96 percent respectively. This is supported by John Sudheer and Subramanyam (2001), Arjuna Rao (1996).The bio-efficacy of cypermethrin in reducing the shoot infestation to 6.12 and 7.75 percent during 2020-21 and 2021 - 22 respectively is in conformity with the findings of Srinivas and Peter (1993) who reported that the cypermethrin reduced the shoot infestation to 2.21 percent while in control it was 13.5 percent. Neem alone or in combination with pesticides had not given much difference in reducing the shoot infestation when compared to control (Table 1). Similarly, diflubenzuron and B.t alone not provide much effect to reduce the shoot infestation.

Table: 1 Effect of different treatments on the shot infestation by *Leucinodes orbonalis*

Treatment	2020-21 Percent shoot infestation								2021-22 Percent shoot infestation							
	R1		R2		R3		Mean		R1		R2		R3		Mean	
Cypermethrin	4.65	12.45	7.46	15.85	6.25	14.48	6.12	14.26	6.84	15.16	6.79	15.10	9.61	18.06	7.75	16.11
Dimethoate	7.95	16.38	5.85	14.00	7.80	16.22	7.20	15.53	11.42	19.75	9.02	17.48	10.92	19.30	10.45	18.84
Carbaryl	6.66	14.96	9.39	17.84	9.57	18.02	8.54	16.94	8.7	17.15	11.45	19.78	8.27	16.71	9.47	17.88
Diflubenzuron	13.52	21.57	9.18	17.64	9.52	17.97	10.74	19.06	12.52	20.72	12.46	20.57	8.87	17.33	11.28	19.57
Neem	11.48	19.81	7.72	16.13	11.41	19.74	10.20	18.56	12.69	20.87	10.25	18.67	13.20	21.30	12.05	20.28
Bt.(dipel)	8.31	16.75	10.37	18.79	7.23	15.60	8.64	17.05	8.36	16.81	10.91	19.29	12.28	20.51	10.52	18.87
Cypermethrin+Neem	8.33	16.78	8.22	16.66	11.03	19.40	9.19	17.61	11.76	20.06	10.65	19.05	11.26	19.61	11.22	19.57
Dimethoate+Neem	12.62	20.81	8.50	16.95	7.72	16.13	9.61	17.96	7.83	16.25	10.23	18.65	11.54	19.86	9.87	18.25
Carbaryl+Neem	8.59	17.04	7.71	16.12	8.75	17.21	8.35	16.79	11.24	19.59	11.52	19.84	8.84	17.30	10.53	18.91
Diflubenzuron+Neem	8.19	16.63	7.13	15.49	10.66	19.06	8.66	17.06	11.84	20.13	11.21	19.56	12.73	20.90	11.93	20.20
B.t.+ Neem	7.93	16.36	8.54	16.99	8.85	17.31	8.44	16.88	9.89	18.33	12.22	20.46	8.52	16.97	10.21	18.59
B.t.+ Cypermethrin	6.83	15.15	7.94	16.37	8.09	16.52	7.62	16.01	9.74	18.19	10.23	18.65	8.84	17.30	9.60	18.05
B.t.+ Dimethoate	11.68	19.98	7.62	16.02	9.71	18.16	9.67	18.05	8.5	16.95	11.28	19.62	11.54	19.86	10.44	18.81
B.t.+ Carbaryl	7.03	15.38	5.70	13.81	7.80	16.22	6.84	15.14	9.13	17.59	9.67	18.12	9.56	18.01	9.45	17.91
B.t.+ Diflubenzuron	7.45	15.84	10.51	18.92	7.59	15.99	8.52	16.92	10.89	19.27	7.8	16.22	11.09	19.45	9.93	18.31
Control	11.88	20.16	12.06	20.32	12.27	20.50	12.07	20.33	13.8	21.81	11.54	19.86	16.54	24.00	13.96	21.89
S.Em$_{\pm}$							0.932								0.885	
Cd. At 1%							3.624								3.443	
Cd. At 5%							2.691								2.557	

Fruit infestation

During 2020-21, minimum fruit infestation on weight basis was 9.64 percent recorded with the treatment of B.t. at transplanting followed by the application of B.t. + carbaryl (Table 2.). During 2021 -22a minimum fruit infestation of 8.00 and 8.77 percent on weight basis was recorded with the application of B.t. at transplanting followed by combined spray of B.t. + carbaryl and B.t. + diflubenzuron, respectively (Table 2), while a minimum of 8.00 percent infestation on number basis was recorded with the combined spraying of B.t. + carbary! preceded by the B.t. application at transplanting. Spraying of B.t. alone proved to be ineffective against the shoot and fruit borer *Leucinodes orbonalis* Guenee. The efficacy of these treatments, against fruit borer, *Leucinodes orbonalis* Guenee under the present investigation is it conformity with the findings Sekar and Baskaran (1976). However, under present investigation, the shoot damage due to B.t.+ diflubenzuron and B.t. + carbaryl was 8.52 and 9.45 percent respectively, while the shoot infestation in control was 12.07 and 13.96 percent respectively during 2020-21 and 2021 -22.

The results obtained with B.t. + dimethoate and B.t.+ cypermethrin preceded by the application of B.t. were at par with the spraying of cypermethrin and dimethoate. During 2020-21 and the spraying of cypermethrin and dimethoate alone recorded 11.10 and 16.12 percent fruit infestation, respectively on weight basis (Table-2) while on weight basis it recorded 25,85 and 30.75 percent infestation respectively (Table 2) which was at par with the control. This is in conformity with the findings of Peter and Govindarajulu (1994)

Table: 2 Effect of different pesticidal treatments on percent fruits infestation per hectare during 2020-21 and 2021 to 2022

Treatment	2020-21					2021-22				
	Total (q/ha)	Healthy wt.basis (q/ha)	Infested wt. basis (q/ha)	Percent infestation		Total (q/ha)	Healthy wt.basis (q/ha)	Infested wt. basis (q/ha)	Percent infestation	
Cypermethrin	218.51	194.77	23.74	19.41	11.10	217.07	192.34	24.73	19.71	11.47
Dimethoate	193.33	162.47	30.86	23.63	16.12	195.68	165.09	30.59	23.31	15.67
Carbaryl	211.39	185.89	25.50	20.46	12.27	212.68	190.54	22.14	18.87	10.47
Diflubenzuron	174.51	123.57	50.94	32.98	29.65	176.31	123.50	52.81	33.40	30.32
Neem	177.45	132.37	45.08	30.56	25.85	177.00	123.47	53.53	33.67	30.75
Bt.(dipel)	174.84	134.30	40.54	28.93	23.45	161.62	123.73	37.89	29.06	23.64
Cypermethrin+Neem	192.18	165.28	26.90	22.05	14.16	193.63	164.27	29.36	22.97	15.26
Dimethoate+Neem	176.87	153.20	23.67	21.67	13.64	171.68	147.74	23.94	21.90	14.04
Carbaryl+Neem	189.44	162.85	26.59	22.16	14.23	186.79	162.85	23.90	21.02	12.95
Diflubenzuron+Neem	195.70	170.07	25.63	21.36	13.28	183.98	159.56	24.42	21.34	13.39
B.t.+ Neem	183.23	143.70	39.53	27.98	22.01	164.73	131.22	33.51	27.07	20.71
B.t.+ Cypermethrin	208.71	181.56	27.15	21.33	13.28	193.27	168.43	24.84	21.12	13.04
B.t.+ Dimethoate	210.57	186.00	24.57	20.13	11.91	204.22	179.27	24.95	20.55	12.40
B.t.+ Carbaryl	220.82	199.88	20.94	18.08	9.64	219.67	202.27	17.39	16.39	8.00
B.t.+ Diflubenzuron	228.81	201.73	27.08	20.25	12.00	215.48	196.78	18.70	17.13	8.77
Control	160.60	102.14	58.46	37.28	36.72	177.38	114.54	62.84	36.78	35.85
S.Em±		10.291	2.203	0.918			8.604	2.407	1.081	
CD. 1%		40.021	8.567	3.570			33.463	9.361	4.203	
CD 5%		29.722	6.362	2.651			24.851	6.952	3.121	

* Figure the parentheses are arc sine square root percent transformation.

Who reported that spraying of neem 2EC recorded the fruit infestation of 28.3 percent respectively, while it was 31.0 percent infestation in the control. This was also supported by Kuppuswamy and Balasubramanian (1980), who found that spraying of neem oil at 2 percent and neem kernel extract at 5 percent recorded 40.02 and 38.65 percent infestation on number basis while on weight basis it was 39.74 and 39.13 percent infestation respectively, in control it was 42.86 and 41.59 percent on number basis, and weight basis respectively.

During 2020-21, alternate spraying of neem with carbaryl, cypermethrin, and dimethoate reduced the fruit infestation on weight basis by 14.23, 14.16, and 13.64 percent. respectively (Table 5) and were at par with each other, while during 2021-22the alternate spraying of neem with carbaryl, dimethoate and cypermethrin reduced the fruit infestation to the extent of 12.95, 14.04 and 15.26 percent, respectively. These results are supported by the findings of Temurde et al. (1992), who found that the sprays consisting mixing neemark (extract of *Azadirachta indica*) with cypermethrin or fenvalerate gave better control of *Leucinodes orbonalis* Guenee than neemark alone.

Yield of marketable brinjal fruits

During 2020-21, on a weight basis during 2020-21 a maximum yield of 201.73 Q/ha was obtained from the B.t. applied at transplanting followed by the combined spray of B.t. + diflubenzuron, while during 2021 -22the highest fruit yield of 202.28 Q/ha was obtained with B.t. application at transplanting followed by a combined spray of B.t. in combination with carbaryl (Table-2). The present finding is supported by Sekar and Baskaran (1976). Mahesh and Men (2008) reported that Data on marketable brinjal fruits indicated significant differences between treatments and the yield over control. The highest yield was obtained from the standard check, carbaryl 0.2% (132.06.q/ha).

The maximum yield recorded with the treatment of B.t. + diflubenzuron and B.t. + carbaryl was at par with the spraying of cypermethrin which recorded a yield of 194.77 and 192.34 Q / ha on a weight basis during 2020-21 and 2021 -22, respectively. The present finding is supported by Kuppuswamy Balasubramanian (1980), who reported that spraying of 0.005 percentcypermethrin recorded the highest yield of 189.52 Q/ha whereas in control it was 52.71 Q/ha. Peter and Govindarajulu (1994) also reported a maximum yield of 142 Q / ha due to cypermethrin compared to the control (76 Q/ha), which is in conformity with the present finding.

In the present investigation, the shoot damage due to B.t. + diflubenzuron, B.t.carbaryl was 8.52 and 6.84 percent in 2020-21 and 9.93 and 9.45 in 2021-22 respectively, while the shoot infestation in control was 12.07 and 13.96 per cent respectively, during 2020-21 and 2021 -22 (Table 1), while B.t.alone proved to be very less against the shoot borer. This work is supported by Sekar and Baskaran (1976).Fruit infestation on both weight and number basis was minimum due to the treatment of B.t. application at transplanting followed by a combined application of B.t. + cypermethrin and B.t.+ dimethoate (Table 2). It might be due to that chemical pesticidal act as stressors and are frequently synergistic when combined with microorganisms such as Bacillus Thuringian' (Chen et al. 1974).

Seed yield

The seed yield obtained during 2020-21 and 2021-22 from the healthy fruits of different treatments, revealed that there was no significant difference in seed yield among different treatments for healthy fruits. This indicates that the pesticidal treatments do not have either adverse or favourable effects on the seed yield. This work is supported by Krishnasamy (1990)according to him the treatment with pyrethroids (deltamethrin, cypermethrin and fenvalerate) at 0.005 percent concentration increased seed yield and the treatment had little effect on the number of borer holes in the fruit. However, during 2020-21 the highest seed yield of 28.98g per kg fruit weight was recorded in the treatment of B.t. + diflubenzuron followed by B.t.

+ dimethoate having the seed yield of 28.71g per kg fruit weight. While during 2021 -22 a maximum seed yield of 28.67g was obtained from the treatments of B.t.+ diflubenzuron followed by B.t. + carbaryl, B.t. + cypermethrin and diflubenzuron in alternation with neem giving 28.05, 27.97 and 27.52g seed per kg fruit weight, respectively (Table-3,).

Table: 3 Fect of different treatments on seed yield of Brinjal during 2020-21 and 2021 -22

Treatments	Seed yield (g) /Kg fruit wt.					Seed yield (g) /Kg fruit wt.				
	R1	R2	R3	MEAN	Increase(+) / Reduction (-) over control (%)	R1	R2	R3	MEAN	Increase(+) / Reduction (-) over control (%)
Cypermethrin	28.31	26.92	29.92	28.38	3.46	29.03	23.94	27.82	26.93	8.81
Dimethoate	27.04	31.38	27.53	28.65	4.45	24.97	26.53	27.47	26.32	6.34
Carbaryl	28.26	26.07	28.11	27.48	0.18	24.28	24.80	27.18	25.42	2.71
Diflubenzuron	23.68	26.74	24.72	25.05	-8.68	27.44	26.15	26.92	26.84	8.44
Neem	25.87	28.40	24.93	26.40	-3.76	23.71	26.80	23.75	24.75	0.00
Bt.(dipel)	25.76	27.85	27.11	26.91	-1.90	23.44	21.45	26.52	23.80	-3.84
Cypermethrin+Neem	29.67	27.59	26.09	27.78	1.28	22.93	25.25	25.77	24.65	-0.40
Dimethoate+Neem	23.68	26.41	25.43	25.17	-8.24	26.04	21.44	24.63	24.04	-2.87
Carbaryl+Neem	26.26	24.81	25.22	25.43	-7.29	25.25	26.92	27.48	26.55	7.27
Diflubenzuron+Neem	29.69	26.10	29.05	28.28	3.10	26.48	29.03	27.06	27.52	11.19
B.t.+ Neem	26.52	25.60	28.12	26.75	-2.48	29.06	23.87	26.79	26.57	7.35
B.t.+ Cypermethrin	27.24	27.67	27.45	27.45	0.07	26.46	30.07	27.37	27.97	13.01
B.t.+ Dimethoate	28.96	27.16	30.00	28.71	4.67	26.76	27.21	25.53	26.50	7.07
B.t.+ Carbaryl	29.17	29.52	26.04	28.24	2.95	27.23	30.09	26.83	28.05	13.33
B.t.+ Diflubenzuron	27.89	30.08	28.97	28.98	5.65	27.23	29.30	29.49	28.67	15.84
Control	25.86	28.79	27.65	27.43	0.00	23.79	24.02	26.43	24.75	0.00
Infested (2 borer holes)	22.87	23.64	23.00	23.17	-15.53	21.01	21.95	22.40	21.79	-11.96
Infested (4 borer holes)	20.83	20.46	21.05	20.78	-24.24	19.11	19.02	18.32	18.82	-23.96
Infested (6 borer holes)	19.31	18.87	18.51	18.90	-31.10	17.31	17.09	17.38	17.26	-30.26
S.Em$\pm$				0.888					1.023	
CD. 1%				3.453					3.980	
CD 5%				2.565					2.956	

During 2020-21, seeds yield from infested fruits having two, four and six exit holes was 23.17, 20.78, and 18.90g per kg fruit weight, respectively showing a reduction of 15.53, 24.24 and 31.10 percent in comparison to the healthy fruits of control plots. During 2020-21, seeds yield from infested fruits having two, four and six exit holes was 21.79, 18.82, and 17.26g per kg fruit weight showing a reduction of 11.96, 23.96 and 30.26 per cent respectively in comparison to the healthy fruits of control plots. Some results are in conformity with Lal and Sharma (1977), who reported that the infestation by *Leucinodes orbonalis* Guenee reduced the seed yield of brinjal i.e., 1.5, 1.25, 0.80, 0.75, 0.79 and 0.75 per fruit having 1, 2, 3, 4, 5 and 6 borer holes per fruit, respectively and the seed yield from borer fruits ranged from 1.9 to 3.5g per fruit.

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	Website: www.ijarbs.com
Quick Response Code	Subject: Entomology
DOI:10.22192/ijarbs.2022.09.11.009	

How to cite this article:
Kamalesh Kumar. (2022). Effectivity of periodic and insecticides on *Leucinodes orbonalis* in eggplant. Int. J. Adv. Res. Biol. Sci. 9(11): 81-87.
DOI: http://dx.doi.org/10.22192/ijarbs.2022.09.11.009