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Impressive of Periodic and Insecticides on *Leucinodes orbonalis* Infestation on *Solanum melongena*

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ABSTRACT

Six insecticides, namely Cypermethrin, Dimethoate, Carbaryl, Diflubenzuron, Neem and Bacillus thuringiensis (dipel) were tried against brinjal shoot, fruit borer and seed yield. Among them Cypermethrin, and Dimethoate were found to be the most effective in reducing the damage of shoot, fruits, and seed yield and thereby increasing the yield of brinjal fruits. In the present investigation, the shoot damage due to B.t. + diflubenzuron, B.t. + carbaryl was 8.52 and 6.84 percent in 2021- 22 and 9.93 and 9.45 in 2022-23 respectively, while the shoot infestation in control was 12.07 and 13.96 percent respectively, while B.t.alone proved to be very less against the shoot borer. 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. It might be due to that chemical pesticidal act as stressors and are frequently synergistic when combined with microorganisms such as *Bacillus thuringienses*.

Keywords- Effectivity *Leucinodes orbonalis Solanum melongena*.

I. INTRODUCTION

Vegetables are an important constituent of human diet. Brinjal is an important dietary vegetable crop. Brinjal or eggplant, *Solanum melongena* (Linnaeus), is considered to be native of India (Purse glove 1968) and is one of the most commonly grown vegetable crops of Solanaceae family in South-East Asian countries. It is often described as a poor man's vegetable because it is popular amongst small-scale farmers and low-income consumers. A poor man's crop it might be but brinjal is also called by some as the 'King of Vegetables'. It is featured in the dishes of virtually every household in India, regardless of food preferences, income levels and social status.

India, China, Turkey, Japan and Philippines are the major production countries. In India, brinjal is grown on nearly 550,000 hectares, making the country the second largest producer after China with a 26% world production share. It is an important cash crop for more than 1.4 million small, marginal and resource-poor farmers. Brinjal, being a hardy crop that yields well even under drought conditions, is grown in almost all parts of the country. Major brinjal producing states include: West Bengal (30% production share), Orissa (20%), and Gujarat and Bihar (around 10% each). In 2005-2006, the national average productivity of brinjal was recorded around 15.6 tons per hectare. The area under brinjal cultivation is estimated at 0.51million ha. with total production of 8,200,000 Mt. (FAO data, 2005).

Among all the pest, shoot and fruit borer *Leucinodes orbonalis* Guenee is, by and large, the most serious pest throughout the brinjal growing areas extent of damage is often >30 to 50 percent (Ahmad, 1977). This may vary from season to season and location to location, sometimes whole crop can be destroyed (Alam et al., 2003). The damage to the crop starts soon after transplanting and continues till harvest of the fruits. The adult female lays eggs on the ventral surface of the leaves, flower buds and on young fruits. Short pinkish larva of the pest initially bore in to the terminal shoots resulting in withering and drying of the shoot. In the later stage, it bores in to the young fruits by making holes and

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feeds inside which makes the fruits unfit for consumption. Such fruits rot in severe cases.

Apart from fruits, seed are also an economic part of brinjal. The infestation by *Leucinodes orbonalis* Guenee also reduces the seed viability and seed yield of brinjal (Lal and Sharma, 1977). The losses caused by brinjal pests vary from season to season depending upon environmental factors as reported by Gangawar and Sachen (1981) and Patel et al. (1988). Meteorological parameters play a pivotal role in the biology of in the pests.

II. MATERIALS AND METHODS

The field experiments were carried out during kharif 2022- 2023 at the Agriculture Research farm Bichpuri, which is located 14 km. for from Agra, by following common agronomic practices prescribed in (package of practices for high yielding verities). The occurrence of brinjal shoot and fruit borer, *Leucinodes orbonalis* Guence was recorded starting first after twenty days of transplanting the crop at seven days intervals (Singh et al. 1997).

The observations on the population of *Leucinodes orbonalis* Guenee was recorded in terms of damage to leaves shoots and fruits were recorded by counting the total number of shoot and fruits with the damage on ten plants selected randomly in each replication. Weekly data on weather parameters were recorded and subjected to a simple correlation study.

III. RESULT AND DISCUSSION

Table 1: effect of different treatments on the shoot infestation by Leucinodes Orbonalis Guenee During 2021-22 and 2022-23

Treatment	2021-22								2022-23							
	Percent shoot infestation								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±							0.932								0.885	
Cd. At 1%							3.624								3.443	
Cd. At 5%							2.691								2.557	

Table 2: Effect of different pesticidal treatments on percent fruit infestation per hectare During 2021-22 and 2022-23

Treatment	2021-22					2022-23				
	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

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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.

DAS = Days After Spraying

Table 3: Effect of different treatments on seed yield of brinjal During 2021-22 and 2022-23

Treatments	2021-22					2022-23				
	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±				0.888					1.023	
CD. 1%				3.453					3.980	
CD 5%				2.565					2.956	

IV. 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 2021-22 and 2022-23 was 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

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and Subramanyam (2001), Arjuna Rao (1996). The bio-efficacy of cypermethrin in reducing the shoot infestation to 6.12 and 7.75 percent during 2021-22 and 2022-23 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.

V. FRUIT INFESTATION

During 2021-22, 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 2022-23 a 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. + carbaryl preceded by the B.t. application at transplanting. Spraying of B.t. alone proved to be in effective against the shoot and fruit borer *Leucinodes orbonalis* Guenee.The efficacy of these treatments, against fruit borer, *Leucinodes orbonalis* Guenee under 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 2021-22 and 2022-23.

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 2021-22 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).

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 2021-22, alternate spraying of neem with carbaryl, cypermethrin, and dimethoate reduced the fruit infestation on weight basis by 14.23, 14.16, 13.64 percent. respectively (Table 2) and were at par with each other, while during 2022-23 the 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.

VI. YIELD OF MARKETABLE BRINJAL FRUITS

During 2021-22, on weight basis during 2021-22 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 2022-23 the 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 of marketable brinjal fruits indicated the significant differences between treatments, and the yield over control. 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 weight basis during 2021-22 and 2022-23, respectively. The present finding supported by Kuppuswamy Balasubramanian (1980), who reported that spraying of 0.005 percent cypermethrin recorded the highest yield of 189.52 Q/ha whereas in control it was 52.71 Q/ha. Peter and Govindarajulu (1994) also reported the maximum yiekd of 142 Q / ha due to cypermethrin compared to 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 2021- 22 and 9.93 and 9.45 in 2022-23 respectively, while the shoot infestation in control was 12.07 and 13.96 percent respectively, during 2022-23 and 2022-23 (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 5). It might be due to that chemical pesticidal act as stressors and are frequently synergistic when combined with microorganisms such as Bacillus thuringienses (Chen et al. 1974

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VII. SEED YIELD

The seed yield obtained during 2021-22 and 2022-23 from the healthy fruits of different treatments, revealed that there was no significant difference in seed yield among different treatment for healthy fruits. This indicates that the pesticidal treatments not have either adverse or favourable effect 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 fruit. However, during 2021-22 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 2022-23 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).

During 2021-22, 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 2022-23, seeds yield from infested fruits having two, four and six exit holes was 21.79, 18.82, 17.26g per kg fruit weight showing a reduction of 11.96, 23.96 and 30.26 percent 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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