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Efficacy of selected chemicals and biopesticides, against shoot and fruit borer [*Leucinodes orbonalis* (Guenee)] on Brinjal

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Abstract
The present investigation was conducted at the home town Maharashtra during *Kharif* season 2020. At. Tamaswadi, tal. Newasa, dist. Ahmednagar (Maharashtra). Efficacy of some selected chemicals and biopesticides, against shoot and fruit borer [*Leucinodes orbonalis* (Guenee)] on brinjal. The result showed that the spinosad 45% EC was found most effective and showed (8.81) percent shoot infestation, (9.29) percent fruit infestation and (1:7.20) B:C ratio were recorded followed by Imidacloprid 17.8 SL (10.95), (11.14) and (1:5.84), Emamectin benzoate 5 SG (12.27), (12.67) and (1:5.38), Karanj oil 2% (14.81), (16.83) and (1:3.35), Neem oil 2% (13.91), (15.62) and (1:3.87), NSKE 5% (16.76), (20.80) and (1:2.20), *Beauveria bassiana* (16.20), (18.25) and (1:2.53), and Untreated control (24.39), (30.32) and (1:1.69) respectively.

Keywords: Bio-pesticides, brinjal, shoot and fruit borer, *Leucinodes orbonalis*

Introduction
Brinjal (*Solanum melongena*) also known as eggplant is referred as the "King of vegetables" originated from India belonging to the family "Solanaceae" 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 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. It is an important vegetable grown in all the seasons. (Singh and Sachan 2015) [11]. Due to its nutritive value, consisting of minerals like iron, phosphorous, calcium and vitamins like A, B and C, unripe fruits are used primarily as vegetable in the country. It is also used as a raw material in pickle making and as an excellent remedy for those suffering from liver complaints. It has been reported as Ayurveda medicine for curing the diabetes. In addition, it is used as a good appetizer, good aphrodisiac, cardio tonic, laxative and reliever of inflammation. Area with a production and productivity of 2.81 million tons and 12.0 t/h. (Marmat, C. S. and Tayde, A. R. (2017) [14]

A survey carried out by the Asian Vegetable Research and Development Centre (AVRDC, 1995) [4] indicated that the shoot and fruit borer, *Leucinodes orbonalis* Guenee, cotton leaf hopper, *Amrasca biguttula*, *biuttula lshida* and *epilacha beetle*, *Henosepilachna*, *Epilachna vigintiocto punctata* Fabricius are the destructive pests on brinjal in Asia. Independently, in the entire South Asian region the shoot and fruit borer was identified as the primary limiting factor in brinjal production, Occasionally, brinjal is severely infested by mites, *Tetranychus sp*., aphids, *Aphis gossypii* Glover and whiteflies including *Bemisia tabaci* Guenee and *Trialeurodes sp.* In Himachal Pradesh, among 27 different insect species and one mite species reported to be associated with brinjal crop**.**

Shoot and fruit borer, *L. orbonalis* (Lepidopetera L Pyralidae) is the key pest throughout Asia. 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 unfit for consumption and marketing, resulting in direct yield losses. The pest has been reported to inflict losses to the tune of 20.7-60.0 percent in Tamil Nadu. 70 percent and Andhra Pradesh. 80 percent in Gujarat and 41 percent in Himachal Pradesh. **(**Ghosal *et al*., 2013) [6]

Materials and Methods

The present investigation was undertaken to evaluate efficacy of Selected chemicals and biopesticides against shoot and fruit borer on brinjal during *Kharif* season 2020 at village -Tamaswadi, tal.-Newasa, dist-Ahmednagar, (Maharashtra). Field trial was laid out in randomized block design (RBD) with 3 replications and 8 treatments including untreated control during *kharif* 2020- 21 to evaluate the efficacy of three chemicals i.e., Spinosad 45% EC, Imidacloprid 17.8% SL, Emamectin benzoate 5 SG and three botanicals i.e., Karanj oil 2%, Neem oil 2%, NSKE 5% and one biopesticides i.e., *Beauveria bassiana* against shoot and fruit borer on brinjal. Crop was raised in plots measuring 2 x 2 m with a spacing 60 x 60 cm between rows and plant, respectively. Transplanting was done on Sep.1th in 2020. Crop was raised according to all agronomic packages of practices under irrigated condition except the plant protection measure. Two rounds of insecticidal spray of different treatment were imposed on need basis during the crop season. All the treatments were imposed by using hand compression sprayer. First spray was given 45 days after transplanting (15th Oct 2020) and the remaining spray was given at fortnightly intervals. The spraying was done during evening hours and care was taken to avoid drift of insecticides. No sprays were given in untreated control.

Data collection

Five plants were randomly selected from each plot and tagged. The total number of infested shoots and total number of shoots were recorded one day before application and 3rd, 7th and 14th days after application in each treatment. The results thus, obtained were converted into percent shoot infestation with the following formula.

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

Similar observation was taken for fruit infestation with the following formula

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

(Yadav *et al.*, 2015) [15] [16]

Statistical analysis

Data were analyzed by using MSTAT software for analysis of variance. Percentage of shoot and fruit damaged by ESFB was transformed before analysis. ANOVA was made by F variance test and the pair comparisons were performed by Duncan's Multiple Range Test.

(Gomez and Gomez 1984) [7]

Result and Discussion

Table no. 1 Show that The data on the percent infestation of shoot borer on third, seventh and fourteenth day after spray revealed that all the chemical treatments were significantly superior over control. Among all the treatments lowest percent shoot, infestation was recorded in T1 Spinosad (8.81), followed by T2 Imidacloprid (10.95), T3 Emamectin benzoate (12.27), T5 Neem oil (13.91), T4 Karanj oil (14.87), T7 *Beauveria bassiana* (16.20) and T6 NSKE (16.76). The treatments T6 NSKE (16.76) was least effective among all the treatments. Control plot T0 (24.39) infestation.

Table 1: Efficacy of chemicals and biopesticides against brinjal shoot and fruit borer [*Leucinodes orbonalis* (Guenee)] during *Kharif* season 2020. (First Spray): (%shoot infestation).

Treatments		Percent shoots infestation of *Leucinodes orbonalis*				
		One day before spray	After spray			
			3rd Day	7th Day	14th Day	Mean
T1	Spinosad 45 EC	20.76	9.38	6.90	10.15	8.81
		(27.10) *	(17.81) *	(15.21) *	(18.56) *	(17.21) *
T2	Imidacloprid 17.8 SL	20.70 (27.04) *	11.50 (19.80) *	9.00 (17.45) *	12.37 (20.58) *	10.95 (19.29) *
T3	Emamectin benzoate 5 SG	21.76 (27.78) *	12.97 (21.10) *	10.39 (18.80) *	13.47 (21.53) *	12.27 (20.48) *
T4		19.73	14.44	14.53	15.66	14.81
	Karanj oil 2%	(26.34) *	(22.27) *	(22.37) *	(23.27) *	(22.68)*
T5	*Neem oil 2%*	20.24 (26.73)*	13.47 (21.52) *	13.62 (21.65) *	14.65 (22.50) *	13.91 (21.89) *
T6	NSKE (5%)	20.32	16.23	16.90	17.17	16.76
		(26.78) *	(23.75) *	(24.27) *	(24.47) *	(24.17) *
T7	*Beauveria bassiana*	22.51	15.60	16.75	16.84	16.20
		(28.32) *	(23.26) *	(23.70) *	(24.22) *	(23.73) *
T0	Control	21.38	23.33	24.19	25.66	24.39
		(27.52) *	(28.87) *	(29.44) *	(30.42) *	(29.59) *
Overall Mean		20.92	14.61	14.03	15.74	14.76
F- test		NS	S	S	S	S
S. Ed. (±)		3.83	1.98	1.78	1.83	0.72
C. D. (P = 0.05)		-	2.46	2.34	2.37	1.48

*Figures in parenthesis are arc sin transformed values.

Table no. 2 Show that The data on the percent infestation of fruit borer on third, seventh, and fourteenth days after sp ray revealed that all the chemical treatments were significantly superior over control. Among all the treatments lowest percent infestation of shoot and fruit borer was recorded in T1 Spinosa d (9.29), followed by T2 Imadacloprid (11.14), T3 Emamectin benzoate (12.67), T5 Neem oil (1 5.62),T 4 Karanj oil (16.83), T7 *Beauveria bassiana* (18.25) and T6 NSKE (20.80). The treatments T6 NSKE (20.80) was least effective among all the treatments. Control plot T0 (30.32) infestation.

Table 2: Efficacy of chemicals and bio-pesticides against brinjal shoot and fruit borer [*Leucinodes orbonalis (*Guenee)] during *Kharif* season, 2020. (Second Spray): (% fruit infestation).

Treatments		Percent fruit infestation of *Leucinodes orbonalis*				
		One day before spray	After spray			
			3 DAS	7 DAS	14 DAS	Mean
T1		21.61	9.46	7.82	10.59	9.29
	Spinosad 45 EC	(27.66) *	(17.89) *	(16.20) *	(18.79) *	(17.71) *
T2	Imidacloprid 17.8 SL	21.63 (27.66) *	11.42 (19.74) *	9.92 (18.33) *	12.10 (20.35) *	11.14 (19.48) *
T3	Emamectin benzoate 5 SG	21.09 (27.28) *	12.98 (21.09) *	11.39 (19.71) *	13.64 (21.65) *	12.67 (20.83) *
T4	*Karanj oil 2%*	21.73	15.84	17.29	17.38	16.83
		(27.78) *	(23.43) *	(24.56) *	(24.02) *	(24.22) *
T5		20.97	14.84	15.54	16.48	15.62
	Neem oil 2%	(27.25) *	(22.64) *	(23.20) *	(23.93) *	(23.27) *
T6	NSKE (5%)	22.28	20.09	20.69	21.63	20.80
		(28.14) *	(26.61) *	(27.02) *	(27.68) *	(27.13) *
T7	*Beauveria Bassiana*	23.39	17.50	18.17	19.09	18.25
		(28.90) *	(24.72) *	(25.22) *	(25.90) *	(25.28) *
T0	Control	27.21	25.58	30.57	31.81	30.32
		(31.44) *	(32.32) *	(33.57) *	(34.33) *	(33.40) *
Overall Mean		22.48	16.33	16.42	17.84	16.86
F- test		N.S.	S	S	S	S
S. Ed. (±)		4.82	1.82	2.06	2.10	0.59
C. D. (P = 0.05)		-	2.36	2.51	2.54	1.34

*Figures in parenthesis are arc sin transformed values.

Conclusion

From the findings present investigated holds a good promise in the brinjal shoot and fruit borer (*Leucinodes orbonalis*) management and it showed that Spinosad 45% SC is most effective out of seven treatments. It also gave the highest cost benefit ratio and marketable yield. Imidacloprid, Emamectin benzoate, neem oil, karanj oil and *Beauveria bassiana* also effective control on brinjal. NSKE is least effective among the treatments. These plant products also helps in reducing pollution in the environments. Hence it can be suitably incorporated as treatments in IPM programme.

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