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Management of brinjal shoot and fruit borer *Leucinodes orbonalis* (Guenee) by chemical insecticides on brinjal

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Abstract
The investigation was conducted in kharif season 2023 at Rainfed agriculture research farm, Bundelkhand university Jhansi, to find efficacy of selected chemical treatments to management of brinjal fruit and shoot borer[*Leucinodes orbonalis* (Guenee)], the experiment was designed under randomized block design with 9 treatments and 9 replications. Total three sprayings of treatments were done and data were collected before and 3DAS, 7DAS and 14 days after spraying. The investigation was resulted Fluebendiaminde (11.08% infestaion) was found superior effective to shoot infestation followed by Emamectin benzoate(11.88%) and Spinosad(13.30%) while for fruit infestation after third application, Emamectin benzoate(6.10%) was best effective followed by Fluebendiaminde(7.35%) and Spinosad (8.47%), where Emamectin benzoate treated plot also give highest fruit yield and obtained maximum C:B ratio respectively 220.31 Qt/h and 1:3.00.

Keywords: Brinjal fruit and shoot borer Fluebendiaminde, Emamectin benzoate, Spinosad

1. Introduction
The brinjal (*Solanum melongena* L), also known as egg plant or aubergine belonging to the family solanaceae, is one of the most important and popular vegetables grown throughout the world including India. In India, brinjal being a major vegetable crop.
Among the various causes of low productivity of the brinjal, one of the most important factors is the damage inflicted by the insect pests. It is subjected to attack by number of insect pests right from nursery stage till harvesting (Regupathy *et al*., 1997) [10]. Among the insect pests infesting brinjal the major ones are shoot and fruit borer, *Leucinodes orbonalis*, whitefly, *B. tabaci*, leafhopper *A. biguttula biguttula*, and non insect like red spider mite, *T. macfurlanei*. The shoot and fruit borer has a specific nature of feeding. After hatching, the lavae bore in the growing tips of young shoots during vegetative stage of crop. Yellowing and wilting of affected shoot is the common symptoms iof attack (Hedge *et al*., 2009) [3].
It has been reported as Ayurvedic medicine for curing the diabetes. In addition it is used as a good appetizer, good aphrodisiac, cardiotonic, laxative and reliever of inflammation (Aparna *et al* 2012) [1].

2. Methods and Materials
The experiment conducted to find the suitable chemical management of brinjal fruit and shoot borer was carried out at agriculture research field under the department of entomology, Institute of Agricultural Sciences, Bundelkhand university Jhansi. The experiment was conducted in kharif season of 2023, where the nursery of brinjal variety Dev-kiran (614) was grown firstly and seedlings of brinjal were transplanted at well prepared field with spacing of 60*45cm(R*P) under randomized block design where total 27 plots were prepared in three replications. to keep the crop healthy and weed free and to provide good soil condition, inter culture operations were conducted when required and subsequent irrigation were provided as requirement of crop.

3. Observation
To take observation, every plot randomly 5 plants were tagged that was used to take observations. Where the observation of the shoot infestation was taken on the basis of how much

plant shoots were damage in total plant in field and to take fruit infestation, where infested fruit and healthy (non-infested) fruit were counted and calculate the percentage of infestation. With following formula:

Percent shoot/fruit Infestation (%) = [{Number of infested fruit or shoot}/total number of fruit and shoot] * 100

The observations of fruit and shoot infestation were taken before and after application of the treatment and data collected after application were compared with data collected before application, to find out which treatment was best among all to reduction of infestation of insect on brinjal.

4. Results and Discussion

First spray (shoot infestation): The data collected before the spray showed 15.45-18.80 per cent mean shoot infested by borer and after the application of treatment, data 3DAS, 7DAS and 14DAS resulted that treatment Fluebendiaminde (11.08%)was best treatment followed by Emamectin benzoate(11.88%) and Spinosad (13.30%). where the Idoxacarb (14.36%) and Imidacloprid (15.07%) treatment showed average result to reduction of infestation while Azadiractin (17.35%) and Acephate (16.96%) was less effective to control brijal fruit and shoot borer.

Second spray (fruit infestation): The data collected before and 3DAS, 7DAS and 14 days after the second spray resulted minimum fruit infestation was found in Emamectin benzoate (9.51%) followed by Fluebendiaminde (10.68%) and Spinosad (11.76%) while the Azadiractin (15.81%) and Acephate (14.77%) was least effective treatment for management of brijal fruit and shoot borer.

Third spray (fruit infestation): The data was collected after the third spray at 3 DAS,7DAS and 14 days after spraying where minimum fruit infestation percentage was found in Emamectin benzoate treated plot showed 6.10 per cent mean infestation followed by Fluebendiaminde (7.35%) and Spinosad (8.47%). where Acephate and Azadiractin treated plots were found maximum fruit infestation among all treatments while untreated plot showed 21.96 per cent infestion.

Table 1: Effect of treatment on infestation of brinjal fruit and shoot borer on brinjal crop after first spray.

T.no	Treatments	Doses	Mean shoot infestation (percentage)				Mean
			Before	3DAS	7DAS	14DAS	
T_1	Fluebendiaminde 39.35%EC	125 ml/hac	17.21	12.76	9.87	10.62	11.08
T_2	Acephate 75% SP	750gm/hac	18.10	17.57	16.26	17.06	16.96
T_3	Spinosad 45%SC	220 ml/hac	17.69	14.77	11.87	13.25	13.30
T_4	Lambda cyhalothrin2.5%EC	625ml/hac	17.31	17.07	15.09	16.06	16.07
T_5	Idoxacarb14.5%SC	500ml/hac	18.31	15.46	13.23	14.40	14.36
T_6	Emamectin benzoate5%SG	200gm/hac	15.79	13.47	10.32	11.86	11.88
T_7	Azadiractin0.15%EC	5 per cent	18.59	18.01	16.82	17.23	17.35
T_8	Imidacloprid17.8% SL	150ml/hac	18.88	16.47	14.03	14.70	15.07
T_9	Water spray control	------	15.45	16.15	16.70	18.32	17.06
C.D.			2.068	0.707	0.565	0.638	0.716
SE(m)			0.684	0.234	0.187	0.211	0.234

Table 2: Effect of treatment on infestation of brinjal fruit and shoot borer on brinjal crop after second spray.

T.no	Treatments	Doses	Mean fruit infestation (percentage)				Mean
			Before	3DAS	7DAS	14DAS	
T_1	Fluebendiaminde 39.35%EC	125 ml/hac	14.09	11.41	10.16	10.46	10.68
T_2	Acephate 75% SP	750gm/hac	17.03	15.01	14.50	14.81	14.77
T_3	Spinosad 45%SC	220 ml/hac	14.74	12.63	11.13	11.52	11.76
T_4	Lambda cyhalothrin2.5%EC	625ml/hac	17.05	14.81	13.55	14.07	14.14
T_5	Idoxacarb14.5%SC	500ml/hac	16.20	13.54	12.88	13.12	13.18
T_6	Emamectin benzoate5%SG	200gm/hac	14.17	10.28	8.93	9.33	9.51
T_7	Azadiractin0.15%EC	5 per cent	17.60	16.16	15.52	15.75	15.81
T_8	Imidacloprid17.8% SL	150ml/hac	16.08	14.01	13.12	13.47	13.53
T_9	Water spray control	------	18.39	19.74	20.43	21.18	20.45
C.D.			1.045	0.697	0.792	0.896	0.789
SE(m)			0.345	0.231	0.262	0.296	0.261

Table 3: Effect of treatment on infestation of brinjal fruit and shoot borer on brinjal crop after third spray

T.no	Treatments	Doses	Mean fruit infestation (percentage)				Mean
			Before	3DAS	7DAS	14DAS	
T_1	Fluebendiaminde 39.35%EC	125 ml/hac	10.68	8.28	6.35	7.41	7.35
T_2	Acephate 75% SP	750gm/hac	14.77	13.00	12.17	12.65	12.61
T_3	Spinosad 45%SC	220 ml/hac	11.76	9.31	7.53	8.56	8.47
T_4	Lambda cyhalothrin2.5%EC	625ml/hac	14.14	12.33	11.03	11.30	11.55
T_5	Idoxacarb14.5%SC	500ml/hac	13.18	10.77	9.32	9.96	10.02
T_6	Emamectin benzoate5%SG	200gm/hac	9.51	7.22	4.95	6.12	6.10
T_7	Azadiractin0.15%EC	5 per cent	15.81	14.00	12.84	13.64	13.49
T_8	Imidacloprid17.8% SL	150ml/hac	13.53	11.00	9.58	10.38	10.32
T_9	Water spray control	------	20.45	21.27	22.06	22.55	21.96
C.D.			0.364	0.667	0.814	1.093	0.913
SE(m)			0.119	0.220	0.269	0.361	0.302

Fruit yield and cost benefit ratio- the whole data recorded after harvesting resulted maximum fruit yield was obtained from Emamectin benzoate treated plots showed 220.31 Qt/h followed by Fluebendiaminde (214.33 Qt/h) and Spinosad (209.64 Qt/h). the maximum C:B ration and economic return was obtained from Emamectin benzoate(1:3.00) followed by Spinosad(1:2.84) and Fluebendiaminde(1:2.67).

Table 4: Economics of cultivation and yields.

T. no.	Treatments	Yield Qt/h	Gross income (Rs)	Common cost (Rs)	Treatment cost (Rs)	Total cost (Rs)	Net Income (Rs)	C:B ratio
T_1	Fluebendiaminde 39.35%EC	214.33	342928	84800	8550	93350	249578	1:2.67
T_2	Acephate 75% SP	180.68	289088	84800	2925	87725	201363	1:2.30
T_3	Spinosad 45%SC	209.64	335424	84800	2625	87425	247999	1:2.84
T_4	Lambda cyhalothrin2.5%EC	186.54	298464	84800	2925	87725	210739	1:2.40
T_5	Idoxacarb14.5%SC	201.65	322640	84800	4155	88955	233685	1:2.63
T_6	Emamectin benzoate5%SG	220.31	352496	84800	3240	88040	264456	1:3.00
T_7	Azadiractin0.15%EC	172.36	275776	84800	3800	88600	187176	1:2.11
T_8	Imidacloprid17.8% SL	198.40	317440	84800	2520	87320	230120	1:2.64
T_9	Water spray control	131.11	209776	84800	8550	93350	116426	1:1.25

5. Conclusion

from analysis of present investigation resulted Fluebendiaminde was found effective at shoot infestation but Emamectin benzoate was superior effective to reduction of fruit infestation and also produced maximum yield and higher C:B ratio, followed by Fluebendiaminde and Spinosad while Azadiractin and Acephate least effective to manage borer insect remain all treatments were average effective to management of brinjal fruit and shoot borer.

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