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Periodical occurrence and effectiveness of selected insecticides in regulating brinjal shoot and fruit borer (*Leucinodes orbonalis* Guenee)

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Abstract
In the present investigation the seasonal occurrence and effectiveness of seven insecticides on Brinjal shoot and fruit borer were evaluated during *Kharif* 2015 in Central Research Farm, SHUATS, Allahabad. The occurrence of shoot and fruit borer commenced from 34rd standard week (August fourth week) on shoot with an average population of 0.64% infestation. Infestation on fruit starts in 37th standard week (September second week) with an average population of 3.31% infestation. The shoot and fruit borer population increased and gradually reached its peak level of infestation 5.71% at 41st standard week (October second week). The population of shoot and fruit borer decreased with infestation of 2.26 % at 45th standard week (November 1st week) there after declined trend was observed as temperature decreased. The shoot and fruit borer population increased with increasing temperature and positively correlated with maximum temperature. Minimum percent of shoot infestation, percent fruit infestation and B: C ratio were observed in spinosad 45 SC with (7.49%, 10.12% and 1:6.08) respectively.

Keywords: Brinjal, incidence, efficacy and shoot and fruit borer

Introduction
Brinjal (*Solanum melongena* L.) is one of the most important solanaceous vegetables in south-east Asian countries including India. It is an economically important vegetable among small scale farmers and it is a source of cash income for resource poor farmers (Bhushan *et al.*, 2011) [1].

The most extensive pest of Brinjal is shoot and fruit borer (*Leucinodes orbonalis* Guenee) which reduces the yield and inflicts colossal loss in production. The losses caused by pest vary from season to season because moderate temperature and high humidity favour the population build-up of brinjal shoot and fruit borer (Shukla and Khatri, 2010) [8]. Crop losses have been reported to the tune of 70-92% per cent in various parts of the country by this pest (Chakraborti and Sarkar, 2011) [3]. With this background the present investigation was carried out to know the Seasonal incidence and efficacy of selected insecticides against Brinjal shoot and fruit borer.

Materials and Methods
The present investigation was carried out by conducting the *In situ* experiment during *Kharif* (June to October) 2015 at the Central research farm of Department of Entomology, SHUATS, Allahabad, Uttar Pradesh. The experimental material for this study consisted of Banarsi round-II variety of Brinjal and planted in two separate contiguous blocks in Randomized Block Design with seven treatments *viz*., spinosad 45 SC (0.2 ml / lit), abamectin 1.8 EC (1.8 ml / lit), chloropyriphos 20 EC (0.25 ml / lit), carbosulfan 20 EC (1.5 ml / lit), thiodicarb 75 WP (1 gm / lit), deltamethrin 25 EC (0.1 ml / lit) and azadiractin 0.3 EC (5 ml / lit) including an untreated control with three replications by following all the recommended package of practices to raise the healthy crop. The plot size of 2m x 1m and spacing of 60 x 45 cm between rows and plants was maintained. Spraying was done with the help of a knapsack sprayer. Chemicals were sprayed just after initiation of insect and repeated thrice at 15 days interval. The spay solution of a desired concentration was prepare by adopting the following

$$\text{formula} - \quad V = \frac{C \times A}{\%\ a.i.}$$

Where V = Volume / Weight of Commercial insecticide ml.
C = Concentration required.

A = Volume of Solution to be prepared
% a.i. = Percentage of active ingredient in commercial product.

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

Observation to be recorded

Seasonal incidence

The pest population observation was recorded at 7 days interval from the occurrence or initiation of the pest infestation and was continued up to harvest. The incidence and population dynamics of Brinjal shoot and fruit borer was recorded from the five randomly selected and tagged plants by correlating with weather parameter.

Efficacy of treatments

The population of shoots and fruit borer was recorded before 1 day spraying and on 3rd, 7th and 14th day after insecticidal application. The populations of 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 formulas.

Results and Discussion

Seasonal incidence

The results showed that the occurrence of shoot and fruit borer in *Kharif* season was commenced from 34rd standard week (August fourth week) on shoot with an average 0.64% infestation. The borer population increased and gradually reached peak level of 5.71% of larval population at 41st standard week (October third week). The population increased and gradually reached peak level 5.71% larval population and decline in the trend was noticed this may be due to fall in congenial weather parameters. The pest build up was correlating with max temperature and declined as it falls (Table1). The similar findings were reported by Kaur *et al.* (2014) [5].

Table 1: Seasonal incidence of Brinjal shoot and fruit borer during *Kharif* 2015

Standard week	No. of larvae per plant	Temperature		Humidity		Rainfall (mm)	Wind velocity (Km/hr.)	Sunshine (Hours/day)
		Max.	Min.	Max. %	Min. %			
29	0	32.70	27.67	92.14	65.85	6.28	1.59	4.42
30	0	33.68	24.22	90.42	63.71	1.11	2.00	3.82
31	0	35.34	28.02	90.71	58.71	0.42	2.77	5.45
32	0	34.08	27.74	90.57	55.42	2.20	1.33	5.82
33	0	35.97	27.51	92.42	53.42	5.00	1.28	5.34
34	0.64	33.22	27.00	92.85	58.28	12.48	2.22	4.80
35	1.72	35.45	27.42	90.71	54.85	11.85	2.55	5.74
36	2.48	36.42	27.20	89.71	45.42	0.00	1.68	7.97
37	3.31	37.48	27.37	86.71	47.14	0.00	2.17	8.70
38	3.92	35.65	28.05	86.28	55.71	0.60	1.71	7.11
39	4.24	36.42	27.80	90.71	47.14	0.20	1.84	7.17
40	5.12	36.11	27.85	89.00	50.14	0.00	1.56	8.45
41	5.71	35.77	27.82	90.85	51.57	0.00	1.35	8.68
42	4.88	35.85	23.88	78.28	51.40	0.00	0.96	8.57
43	4.31	36.00	20.57	93.00	50.71	0.00	0.71	8.65
44	3.64	35.25	19.71	91.57	29.71	0.64	0.51	6.65
45	2.26	33.57	20.08	90.71	57.00	0.00	0.48	8.30
r		0.829	0.375	-0.622	-0.256	-0.630	-0.444	-0.681
t		5.739	1.566	-3.077	-1.026	-3.140	-1.917	-3.600
Results		S	NS	NS	NS	S	NS	S

Table 2: Efficacy of selected chemical insecticides against Brinjal shoot and fruit borer

Treatments		% Fruit infestation					
		1st spray	2nd spray	3rd spray	Pooled mean	Yield (q/ha)	B:C ratio
T_0	Control	25.53 (30.33)	31.01 (33.84)	34.86 (36.19)	32.93	88.52	1:2.03
T_1	Abamectin	10.79 (19.16)	12.13 (20.38)	10.78 (19.17)	11.45	231.12	1:4.76
T_2	Spinosad	7.49 (15.87)	9.78 (18.22)	10.47 (15.49)	10.12	278.17	1:6.08
T_3	Chlorpyriphos	13.99 (21.95)	14.89 (22.70)	15.97 (23.55)	15.45	206.50	1:4.64
T_4	Carbosulfan	17.48 (24.70)	20.16 (26.68)	21.66 (27.74)	20.91	192.10	1:4.26
T_5	Thiodicarb	14.82 (22.63)	16.38 (23.87)	16.68 (24.11)	16.53	184.30	1:4.05
T_6	Deltamethrin	18.72 (25.62)	20.96 (27.25)	22.36 (28.22)	21.66	178.30	1:4.02
T_7	Azadiractin	21.28 (27.46)	23.47 (28.98)	24.91 (29.94)	24.19	132.40	1:2.93
F- test		S	S	S	S		
S. Ed. (±)		0.35	0.423	1.794	1.397		
C. D. (P = 0.05)		0.75	0.896	3.803	2.962		

*Figures in parenthesis are arc sin transformed values

Efficacy of treatments

Mean of 1st spray: Among all the treatments, lowest percent infestation of shoot and fruit borer was recorded in spinosad (7.49%) followed by Abamectin (10.79%), Chloropyriphos (13.99%), Thiodicarb (14.82%), carbosulfan (17.48%) and Deltamethrin (18.75%). Azadiractin (21.28%) is found be least effective but comparatively superior over the control (Table 2). This finding is in support with Latif *et al.* (2010) [6], Manali *et al*. (2013) Budhvat and Magar (2014), Singh and Sachan (2015) [9].

Mean of 2nd and 3rd spray

The data on the percent fruit infestation of shoot and fruit borer on mean of second and third spray revealed that all the treatments were significantly superior over control. The lowest percent infestation of fruit was recorded in spinosad (10.12%) followed by Abamectin (11.45%), Chloropyriphos (15.45%) and thiodicarb (16.53%), Carbosulfan (20.91%), Deltamethrin (21.66%) and azadirectin (24.19%) is found to be least effective among all the treatments. Similar results were reported by Sahu *et al.* (2004) [7], Singh and Nath (2007) [10], Kalawate and Dethe (2012) [4].

Cost benefit ratio

All the treatments recorded significantly higher yield compared to control. The highest yield was recorded in spinosad 45 SC (278.17 q / ha) followed by abamectin (231.12 q / ha). Among the treatment studied, the best and most economical treatment was spinosad 45 SC with cost: benefit ratio of 1:6.08 followed by abamectin (1:4.76) this is in agreement with the results of Budhvat and Magar (2014).

Conclusion

From the critical analysis of the present findings it can be concluded that the shoot and fruit borer population on Brinjal increased with maximum temperature and decreased with decline in maximum temperature. Spinosad 45SC @ 0.2 ml/lit. Was found to be the superior treatment in managing shoot and fruit borer and producing more fruit yield. It also gave the highest cost benefit ratio and marketable yield under the Allahabad Agroclimatic conditions.

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