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## Assessment of integrated shoot and fruit borer (*Leucinodes orbonalis*) management practices in brinjal field

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### Abstract

To formulate a realistic sustainable management module for brinjal shoot and fruit borer (*Leucinodes orbonalis*) a field experiment was carried out during *kharif* seasons of 2016-17 and 2017-18 in the farmers' fields at Imalia and Kakraua villages of Datia district in Bundel Khand zone. The combination of three components i.e. pheromone trap, timely mechanical control and application of Carbosulfan 25 EC @ 1000ml/ha at 20 days interval after 20 days of planting (M5) was found most effective in reduction of shoot damage (76.59%) and fruit damage (81.44%) followed by M6 (6 times pesticide sprays), M4 (Trap + Two spray of insecticide), M3 (Sex pheromone Trap + M1), M1 (Sanitation + Mechanical removal of shoot and fruits), M2 (Only installation of trap). Highest mean yield of Brinjal per field was recorded in M5 (227.00 q/ha) which is 30.63 per cent more than untreated field followed by M6, M4, M3, M1 and M2. IPM combination M5 provided the highest gross returns (Rs. 181840/ha) and highest net return Rs. 135790/ha. The highest benefit cost ratio of 4.19 was obtained from M4 followed by M5, M2, M6, M3 and M1. However, benefit cost ratio was found in M5 is statistically on par with M2 and M6 similarly, another combination M6 statistically at par with M2.

**Keywords:** Shoot and fruit borer, sex pheromones, sanitation, mechanical removal

### Introduction

Eggplant, *Solanum melongena* Linnaeus is one of the most important vegetables in South and South-East Asia (Thapa, 2010) [14] having hot-wet climate (Hanson *et al.*, 2006) [5]. However, eggplant production is in threat in recent years due to increased cost of production on management of insect pest complex. Fruit and shoot borer, *Leucinodes orbonalis* Guenee is the key pest of eggplant (Latif *et al.*, 2010; Chakraborti and Sarkar, 2011; Saimandir and Gopal, 2012) [9, 3, 11] inflicting sizeable damage in almost all the Brinjal growing areas (Dutta *et al.*, 2011) [4] especially in Bundelkhan region. Shoot and fruit borer is the most destructive pest and is considered to be the limiting factor in quantitative as well as qualitative harvest of Brinjal fruits (Dutta *et al.*, 2011 and Saimandir and Gopal, 2012) [4, 11]. The pest is very active during the rainy and summer season and may cause 85 to 90 % damage (Jagginavar *et al.*, 2009; Thapa, 2010) [6, 14]. The larvae bore into tender shoots at the vegetative stage causing withering and drooping of young shoots (CABI, 2007) [2]. But once fruit setting has been initiated, shoot infestations become very negligible (Kumar and Dharmendra, 2013) [8]. A single larva can infest 4 to 7 fruits during its life span (Jayaraj and Manisegaran, 2010) [7]. Though, many options are available for the management of Eggplant fruit and shoot borer infestation. Farmers are mostly using numbers of synthetic chemicals because of their quick knock-down effect with or without knowing the ill effects of these chemicals. To minimize the use of hazardous chemicals, IPM strategies are suggested to avoid toxicity to human health, environment and beneficial insects. The objective of present study was to evaluate and demonstrate the performance of integrated pest management modules against Eggplant fruit and shoot borer insect under field condition.

### Material and methods

The field experiments were conducted during *kharif seasons* of 2016-17 and 2017-18 in the farmers' fields at Imalia and Kakraua villages of Datia district in Bundel Khand zone. The

The components included **a)** Sanitation and mechanical clipping of drooped shoots and removal of infested fruits from the field at weekly interval, **b)** Sex pheromones are important component of IPM programs and they are mainly used to monitor as well as mass-trap the male insects. Installation of pheromone traps @ 13 per hectare, starting from flower bud initiation (40 days old crop) till final harvest and changing the lures at monthly intervals. Each lure was baited in a sleeve trap and the traps were erected 10 m apart making sure the lure is just above the crop canopy and **c)** Application of Carbosulfan 25 EC @ 1000 ml/ha at 20 days interval after 20 days of planting. The farmers were allowed to grow local Brinjal variety with adopting all the local agronomic practices except plant protection. Plots were arranged in randomized block design with three replications. Five different combinations *viz.*,

M 1 - Sanitation + Mechanical removal of shoot and fruits.

M 2 - Only installation of pheromones traps.

M 3 - Trap + Mechanical removal of shoots and fruits.

M 4 - Trap + Insecticide (Two spray).

M 5 - Trap + Mechanical removal + Insecticide (Two spray).

Along with a farmer's usual practices as M6 - Farmer's practice (6 times pesticide sprays) and a check as M7 - Without any protection were assessed.

The number of total and infested shoot and fruit were counted on 10 randomly selected plants in the middle two rows of each field and the percentage of infested shoot and fruit was calculated using the following formula:

$$\text{Infested shoot or fruit (\%)} = (\text{Po/Pr}) \times 100$$

Where,

Pr = Total number of shoot or fruit per plot

Po = Number of infested shoot or fruit per plot

Finally, mean percentage of shoot and fruit infestation was calculated for each of the treatments from the three replicated plots. The percentage data for the damaged shoots and fruits were converted into its angular transformation. Data were subjected to analysis of variance (ANOVA).

## Result and discussion

It was observed that each of the treatments was significantly effective against Brinjal shoot and fruit borer compared to control. The highest percentage of shoot infestation was observed in case of untreated control which was 16.73 per cent (Table 1). Results indicate that among the five IPM modules along with a farmer's usual practices, M5 having all the three components was found most effective in reduction of shoot damage (79.68%) which was closely followed by the M6 (76.89%). The next in order of efficacy were M4 (67.72%), M3 (63.34%), M1 (51.38%) and the least of 45.01 per cent shoot damage could be avoided by only setting of pheromone traps (M2). All the treated fields had a significantly lower borer infestation than that in control plots.

With regard to fruit infestation, similar results are found in reduction of fruit damage. The highest protection was obtained from M5 (81.44%) followed by M6 (76.29%), M4 (59.58%) and M1 (36.08%). Only installation of traps (M2) provided 30.51 per cent protection in fruit damage. All the treated fields had a significantly lower borer infestation than that in control plots. However, reduction in fruit damage found in M 6 is significantly at par with M 5 and M 1 with M 2.

Highest mean yield of Brinjal per field was recorded in M5 (227.00 q/ha) which is 30.63 per cent more than untreated field followed by M6 (217.93 q/ha), M 4 (213.67 q/ha), M3 (208.17q/ha), M1 (199.83 q/ha) and M2 (196.33q/ha). The other five modules M6, M4, M3, M1 and M2 gave 25.25, 22.80, 19.64, 14.85 and 12.84 per cent more production, respectively (Table 1). However, lowest yield was observed with control (174.00 q/ha). Out of different modules tested by Dutta *et al.* (2011) [4], the module with three different component, *viz.* pheromone trap, mechanical control and application of insecticide was found best in reduction of shoot damage, fruit damage and yield increment. Chakraborty and Sarkar (2011) [3] found that integration of phytosanitation and mechanical control gave satisfactory impact on the incidence and damage of *L. orbonalis*. Alam *et al.* in 2003 [1] proved that sanitation and destruction of alternate host reduces the pest damage to fruit if such practice is coupled with other community wide means to reduce immigration of pest adults into the area. Regular removal of *L. orbonalis* damaged shoots and fruits from the brinjal field reduced the damage and increased the yield (Srinivasan, 2008 and Tamoghna *et al.*, 2014) [12, 13].

The results obtained from economical analysis of different IPM combination M 5 (M1 + M 2 + Two spray of Carbosulfan 25 EC @ 1000ml/ha) provided the highest gross returns (Rs. 181840/ha). The lowest gross returns (Rs. 139200/ha) was computed from untreated field. The highest net return Rs. 139000/ha was also obtained from M5 which is 37.35 per cent more than untreated field followed by M 6 (Rs.29.39%), M 4 (Rs.28.55%), M 3 (Rs.22.03%), M 2 (Rs.16.62%) and M 1 (Rs.16.47%). The highest benefit cost ratio of 4.24 was obtained from M5 followed by M 4, M 2, M 6, M 3 and M 1. However, benefit cost ratio was found in M6 is statistically on par with M 2 similarly, another combination M 3 statistically at par with M1 (Table 2). The combination of compatible tactics was always superior. Any single option, such as sole mechanical control, schedule spray of Carbosulfan 25 EC or sole sex pheromone trap was inferior to any of other combined options and the combinations of options resulted lowest damage shoot/fruit compare to control. Thus, combination of three options produced with the highest yield of healthy fruits as well as maximum BCR (Rahman *et al.*, 2009) [10].

**Table 1:** Performances of different modules in the management of Brinjal shoot and fruit borer. (Pooled data of 2016-17 and 2017-18)

Module	Shoot damage		Fruit damage		Yield	
	Shoot damage (%)	Protection over control (%)	Fruit damage (%)	Protection over control (%)	Yield (q/ha)	Yield gain over control (%)
M1 – Sanitation + Mechanical removal of shoot and fruits	8.13 (16.57)	51.38	20.67 (27.04)	36.08	199.83	14.85
M2 - Only installation of trap	9.20 (17.66)	45.01	22.47 (28.29)	30.51	196.33	12.84
M3 - Trap + mechanical removal of shoots and fruits	6.13 (14.33)	63.34	16.00 (23.58)	50.51	208.17	19.64
M4 - Trap + Insecticide (Two spray)	5.40 (13.44)	67.72	13.07 (21.19)	59.58	213.67	22.80
M5 - Trap + mechanical removal + Insecticide (Two spray)	3.40 (10.63)	79.68	6.00 (14.18)	81.44	227.30	30.63
M6 - Farmer's practice ( 5 times	3.87 (11.34)	76.89	7.67 (16.08)	76.29	217.93	25.25

pesticide sprays)						
M7 - Without any protection	16.73 (24.14)	0.00	32.33 (34.65)	0.00	174.00	0.00
C.D at 5%	0.7709		1.864		3.599	
SE ( $\pm$ )	0.250		0.605		1.168	

**Table 2:** Detail of Economics of treatments (Pooled data of 2016-17 and 2017-18)

Treatment	Cost of treatment (Rs.)	Gross return (Rs)	Net Return (Rs)	Gain over control (%)	Benefit Cost ratio
Module 1	4000	159864	117864	16.47	3.81
Module 2	1040	157064	118024	16.62	4.03
Module 3	5040	166536	123496	22.03	3.87
Module 4	2840	170936	130096	28.55	4.19
Module 5	4840	181840	139000	37.35	4.24
Module 6	5400	174344	130944	29.39	4.02
Module 7	-	139200	101200	-	3.66
CD 5%					0.0695
SE					0.0258

## Conclusion

From the present study, it was clearly evident that the management of Brinjal shoot and fruit borer should be done through integrated approach, rather than relying upon chemical insecticides alone.

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