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Indigenous pest control practices for the management of Brinjal shoot and fruit borer (*Leucinodes orbonalis* Guen.)

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Abstract
An experiment was conducted at the research field of Department of Entomology, Sam Higginbottom University of Agriculture Technology and Sciences, Allahabad during the period of July to November 2016 to determine the effect of some indigenous botanicals for the management of brinjal shoot fruit and borer (*Leucinodes orbonalis* Guen.). Experiment comprised 8 treatments including control *viz.*, T_1 Papaya leaf extract @ 92 g lit^{-1} water, T_2 Jatropha leaf extract @ 50 g lit^{-1} water, T_3 Tamarind fruit extract @ 50 g lit^{-1} water, T_4 Tulsi leaf extract @ 50 g lit^{-1} water, T_5 Neem oil 20 ml lit^{-1} water, T_6 Onion bulb extract @ 30 g lit^{-1} water, T_7 Garlic bulb extract @ 30 g lit^{-1} water, T_0 Control. The experiment was laid out in Randomized Block Design (RBD) with three replications. The treatments were applied at the interval of 15 days. All the treatments against *Leucinodes orbonalis* Guen. revealed significant performance over untreated check. Observations on shoots and fruits were recorded on number basis. The infestation of *Leucinodes orbonalis* on shoots were found to be lowest in Neem oil @ 2%, (13.44%), Jatropha leaf extract @ 50 g lit^{-1} (14.19%) and Papaya leaf extract @ 92 g lit^{-1} (15.03%). Thereby, the minimum number of fruits infestation was found from T_5 (15.88%) followed by T_2 (16.28%) and T_1 (16.66%). The maximum cost benefit ratio was registered in the treatment of Neem oil 2% (1:3.11) which proved as economically valuable treatment.

Keywords: Brinjal, *Leucinodes orbonalis*, indigenous botanicals, cost benefit ratio

Introduction
Brinjal (*Solanum melongena* L.) also known as eggplant and aubergine (French word) in Europe referred as "King of vegetables", is a plant which belongs to the family of Solanaceae. India ranks second contributing 28800 MT to the world production. More than 2 million acres 7.11 lakhs ha are devoted to the cultivation of brinjal in the world. In India this crop occupies 7 lakhs ha area along with annual production of 13557 MT and productivity of 19.1 MT/ha. In Uttar Pradesh, the area under cultivation of brinjal is 3400 ha producing 111,000 MT and productivity is 8.43 MT/ha (NHB database, 2013-14). A major constraint in vegetable production is poor and inadequate control of pests and diseases, which cause high yield losses and increase a risk of severe damage. Among the insect pests infesting brinjal, eggplant fruit and shoot borer, *Leucinodes orbonalis* Guenee is the key pest of eggplant (Latif *et al.*, 2010; Chakraborti and Sarkar, 2011) [2] and is the most destructive, especially in south Asia (Thapa, 2010). The yield loss by this pest varied from 0.08-1.11 q ha^{-1} on the basis of inconsumable pest of damaged fruits and 0.46-3.80 q ha^{-1} when whole of the damaged fruits were taken into consideration. The borer infestation was 78.66% on top shoots in vegetative phase and shifted to flowers and fruits with infestation reaching 66.6% in fruiting phase (Singh *et al*., 2000) [11]. Insecticidal control is one of the common means against the fruit borer. But solely reliance on chemical fertilizers leads to toxicity in the soil and the insect is becoming tolerant to the chemicals. The chemical also makes the vegetables poisonous, ecologically unsafe and economically unviable. Hence, the use of organic amendments in the pest management is considered an ecologically viable proposition which avoids environmental pollution and is economically feasible (Rajendran, 1993). Locally available plant materials have been widely used in the past to protect the plants from damage caused by insects (Golob and Webly 1980) [5] as they are known to leave no toxic residues. Therefore, in the present study**,** an effort was made to manage the brinjal shoot and fruit borer (BSFB) by using indigenous plant extracts and to reduce the cost production.

The brinjal variety SBR 208 was transplanted to the field with a net plot size of 2 m × 1.0m (2 sq. m), spacing- 60× 45 cm

In the present study, effect of seven botanical extracts was tested in experimental brinjal field out of them lowest per cent of shoot infestation was found in the plots treated with neem oil

(13.44%) which showed the best performance against the pest attack. Jatropha leaf extract was also found to be effective (14.19%) followed by papaya leaf extract (15.03%).

Table 1: Effect of indigenous botanicals on brinjal shoot and fruit borer (*Leucinodes orbonalis* Guen.)

Treatments	Dose	% shoot infestation (1st Spray)	% fruit infestation (2nd & 3rd Spray Mean)
T_1 Papaya leaf extract	92g/lit	15.03 (22.81)*	16.66 (24.08)*
T_2 Jatropha leaf extract	50g/lit	14.19 (22.12)*	16.28 (23.79)*
T_3 Tamarind fruit extract	50g/lit	18.54 (25.51)*	19.25 (26.23)*
T_4 Tulsi leaf extrsct	50g/lit	15.44 (23.13)*	17.84 (24.98)*
T_5 Neem oil	2%	13.44 (23.13)*	15.88 (23.48)*
T_6 Onion bulb extract	30g/lit	17.71 (24.88)*	19.20 (25.98)*
T_7 Garlic bulb extract	30g/it	16.78 (24.18)*	18.71 (25.62)*
T_0 Control	Water spray	22.03 (27.95)*	24.10 (29.49)*
S.Ed. (±)		0.86	1.37
C.D (P=0.05)		1.84	2.93

*Figure in parenthesis are arc sin transformed values

All the treatments are significantly superior over control. Murugesam and Murugesh, (2009) [8] reported that the oil product of botanicals was found to be efficient for *L. Orbonalis* management. Neem oil @ 2 percent was the best treatment both in *Kharif* (60.20%) and *Rabi* (59.91%)**.** Among all the treatments the higher reduction of brinjal fruit and shoot borer infestation was found in the plots treated by neem oil and was most effective and these were supported by Mathur *et al.,* (2012) [7]. Tamarind fruit extract results maximum shoot and fruit infestation, less effective and these results are supported by Ashadul *et al.,* (2014) [1].

Cost benefit ratio

The computation indicated that the maximum fruit yield was obtained from the plots treated with neem oil 1.25lit/ha (213.33q/ha) and the report was supported by Raja *et al.*, (1999). (Table-2).The effect of pest control in crop by the pest control agents are known to ensure higher crop yields (Table-2). The cost benefit analysis of different insecticidal application revealed that the highest amount of gross return was obtained by T_5: Neem oil 2% (Rs.213330) with maximum cost benefit ratio of 1:3.11. Deshmukh and Bhamare (2006) [3] reported that among botanical insecticides, neem oil gave the highest cost benefit ratio. The results were supported by Eswara *et al.,* (2004) [4].

Table 2: Cost benefit ratio of the different indigenous botanicals in *L. orbonalis* control on brinjal.

Treatments	Dosage	Yield q/ha	Cost of yield Rs q^{-1}	Gross Return Rs. Ha^{-1}	Common cost (Rs)	Treatment cost (Rs)	Total cost of insecticide	C:B ratio
T_1	9.2 kg/ha	180.33	1000	180330	66718	1614	68368	1:2.63
T_2	5kg/ha	185.67	1000	185670	66718	1350	68068	1:2.72
T_3	5kg/ha	124	1000	124000	66718	1950	68668	1:1.80
T_4	5kg/ha	164.33	1000	164330	66718	1650	68332	1:2.40
T_5	1.25lit/ha	213.33	1000	213330	66718	1875	68593	1:3.11
T_6	10kg/ha	136	1000	136000	66718	3600	70318	1:1.93
T_7	10kg/ha	147.67	1000	147670	66718	4200	68918	1:2.14
T_0	....	93.33	1000	93330	66718	...	66718	1:1.39

Labour charge Rs.200/day *

We can conclude from the present study that the neem oil can be the effective insecticidal agent which when used will give a highest cost benefit ratio taking into consideration of the serious health hazards caused by the chemical insecticides to consumers.

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