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Effect and eco-friendly management of brinjal shoot and fruit borer (*Leucinodes orbonalis* Guenee) on brinjal

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ABSTRACT

Brinjal shoot and fruit borer, *Leucinodes orbonalis* Guenee is a very serious insect of brinjal. During the present investigation, six insecticides were evaluated under field conditions. Regarding the efficacy of insecticides, Imidacloprid 17.8 SL @ 250 g a.i./ha proved most effective which was closely followed by Indoxacarb 14.5 SC @ 50 g a.i./ha and Dimethoate 30 EC @ 1 lit/ha. Maximum fruit yield (220.61 q/ha) was obtained by the treatment of Imidacloprid followed by Indoxacarb (217.88 q/ha) and Dimethoate (216.22 q/ha).

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INTRODUCTION

Brinjal (*Solanum melongena* L.) is one of the most popular and economically important vegetables among small-scale farmers and low-income consumers of South Asia and this region accounts for nearly 60 and 53 per cent of world's area and production, respectively. It is grown in almost all states of India with an area of 5.10 lakh hectares under cultivation and production of 88.0 lakh tonnes (Singhal, 2003). In Himachal Pradesh, the crop is grown in an area of 903 hectares with a production of 17,564 metric tonnes (Anonymous, 2008).

The brinjal crop is attacked by about 140 species of insect pests. Out of numerous insects, brinjal shoot and fruit borer (*L. orbonalis*), leaf hopper (*Amarasca bigutella bigutella*) aphid (*Aphis gossypi*), Hadda beetle (*Epilachna* spp.) and brinjal stem borer (*Euzophera pertialla*) have been reported as important insect pests of the brinjal (Bhadauria *et al.*, 1999; Alpuerto, 1994; Bharadiya and Patel, 2005 and Bustamante *et al*., 1994). A survey carried out by the Asian Vegetable Research and Development Centre (AVRDC, 1995) indicated that the shoot and fruit borer, *Leucinodes orbonalis* Guenee, cotton leaf hopper, *Amrasca biguttula biuttula* lshida and epilacha beetle, *Henosepilachna* (*Epilachna*) *vigintioctopunctata* Fabricius are the destructive pests on brinjal in Asia. Independently, in the entire South Asian region the shoot and fruit borer was indentified as the primary limiting factyor 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 (Patial and Mehta, 2008), shoot and fruit borer, *L. orbonalis* (LepidopetraL Pyralidae) is the key pest throughout Asia (Purohit and Khatri, 1973; Kuppuswamy and Balasubramanian, 1980; Allam *et al.*, 1982). 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 (Patil, 1990). The larvae

bore into tendor 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 per cent in Tamil Nadu (Raja *et al.*, 1999), 70 per cent and Andhra Pradesh (Sasikala *et al.*,1999) 80 per cent in Gujarat (Jhala *et al.*, 2003) and 41 per cent in Himachal Pradesh (Lal *et al.*, 1976). Among these, *L. orbonalis* is the most destructive and the major limiting factor in quantitative as well as qualitative harvest of brinjal (Atwal and Dhaliwal, 2002; Chakraborthy and Sarkar, 2011). Brinjal crop losses by this insect-pest has been reported to an extent of 20.70 per cent to 88.70 per cent (Raju *et al.*, 2007; Chatterjee and Roy, 2004; Dutta *et al.*, 2011; Kaur *et al.*, 1998 and Latif *et al.*, 2010). The use of insecticides has been found very effective in suppressing the insect attack on brinjal. The insecticides have been used extensively for the control of these insect-pests for want of natural enemy complex. At present, repeated applications of synthetic pyrethroids are made for the control of *L. orbonalis* and their indiscriminate use has led to the resurgence of whitefly, aphid and mite. For the control of shoot and fruit borer, endosulfan (0.05%) and fenvalerate (0.01%) have been recommended in the state of Himachal Pradesh (Anonymous, 2003). However, frequent and enormous use of synthetic insecticides have posed the problem of resistance and resurgence against many insect-pests. The present investigation was, threfore, planned to evaluate the efficacy of different novel insecticides against shoot and fruit borer (*L. orbonalis*).

MATERIAL AND METHODS

The field experiment was carried out at Student Research Farm, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh during *Kharif* 2012-13. The experiment was conducted in Randomized Block Design with three replications and seven treatments. The seedlings of brinjal variety Type 3 was obtained from Vegetable Research Farm of the University to carry out the experiment. The plot size was 3×2m^2 and 60×60 cm. The recommended intercultural practices were undertaken as and when required.

Out of the seven treatments, one was biopesticide *i.e.* Azadirachtin, another was biopesticide *i.e. Bacillus thuringiensis* var. kurstaki. There were three novel insecticides *i.e.* Spinosad, Imidacloprid and Indoxacarb and Dimethoate as synthetic insecticide. The first spray of each treatment was applied after 30 days of transplanting (DAT) and repeated four times having 15 days intervals. Observations were recorded on healthy and infested plants by ten randomly selected plants in each plot on 15 days after each spray. However, the response of each treatment against brinjal fruit and shoot borer was assessed by recording the number of infested and healthy shoot/fruit from 10 randomly selected plants at each picking.

The fruit yield was recorded separately from all plots during each picking and converted into kg/plot and q/ha for analyzing and comparison. The data for finding out infestation percentage of insect-pests were transformed by using angular value. The per cent increase yield over control was also calculated by following formula :

$$\text{Per cent increase yield over control} = \frac{T - C}{T} \times 100$$

where,

C= Per cent fruit infestation in control plot

T= Per cent fruit infestation in treated plots by different insecticides.

The mean original data of percentage was calculated as and percentage damage was calculated as percentage reduction over control with the following formula :

$$\text{Damage per cent} = \frac{C - T}{C} \times 100$$

where,

C= Per cent damage of control

T= Per cent damage of treated plot.

RESULTS AND DISCUSSION

Efficacy of different insecticides on the incidence of *L. orbonalis* is presented in Table 1. The results showed that all the treatments were significantly superior in reducing the infestation of shoot and fruit borer resulting in increasing the yield, significantly as compared to control. The first spray was given after 30 days of transplanting. The minimum shoot damage (9.38%) was recorded in the plot treated with Imidacloprid 17.8 SL @ 250 g a.i./ha followed by Indoxacarb 14.5 SC @ 50.0 g a.i./ha, where 11.06 per cent shoot damage was recorded. Dimethoate 30 EC @ 1.0 lit/ha was also effective which gave 12.83 per cent shoot damage. The next treatments in order of effectiveness were Spinosad 45 EC @ 70 g a.i./ha, Azadirachtin 1500 ppm @ 0.15 per cent and *B. thuringiensis* @ 0.1per cent in which 15.47, 15.50 and 16.12 per cent shoot damage was recorded, separately. The maximum shoot damage (27.75%) was recorded in control plot.

The second spray was applied after 15 days of first spraying (45 DAT). The result showed that all the treatments were found significantly superior over control. The minimum shoot damage (7.36%) was recorded with Imidacloprid. Here, the treatment Dimethoate proved better among all the other treatments which gave 9.18 per cent shoot damage followed by Indoxacarb (11.09%). The third, fourth and fifth sprayings were applied after 60 DAT, 75 DAT and 90 DAT, respectively. Table 1 also showed that minimum shoot damage, 9.38, 7.11

and 4.60 per cent was observed in third, fourth and fifth sprayings, respectively in Imidacloprid treated plots. The efficacy of different insecticides *viz.*, Azadirachtin, Dimethoate, Spinosad, Imidacloprid, *B. thuringensis* for the incidence of *L. orbonalis* in brinjal revealed that all the treatments were found significantly effective in reducing the infestation of brinjal shoot and fruit borer. The most effective treatment in reducing the infestation of *L. orbonalis* was Imidacloprid followed by Indoxacarb and Dimethoate which were equally effective and proved significantly superior over control. These results are supported by Patil *et al.* (2009) and Patra *et al.* (2009) who reported that Imidacloprid (15-20 g a.i./ha) applied at 60, 75 and 90 days after transplanting against *L. orbonalis* reduced the pest population.

Evaluation of yield :

The data presented in Table 2 indicated that the higher yield was recorded in all the treated plots ranging between 12.14 to 13.24 kg/plot as compared to control *i.e.* 8.67 kg/ plot. The maximum fruit yield was obtained from Imidacloprid treated plot which gave 13.24 kg fruits/plot and it was statistically superior over all the treatments. The Indoxacarb was the second most effective treatment which gave 13.07 kg/plot yield followed by Dimethoate, Spinosad, Azadirachtin and *B. thuringensis* which provided fruit yield 12.97, 12.60, 12.39 and 12.14 kg/plot, respectively. The results are more or less similar to Sharma and Chibber (1996). The result clearly showed that per cent increase in yield over control varied from 28.51 to 34.51 per cent in different treatments. Maximum per cent increase yield over control was recorded in Imidacloprid treated plot *i.e.* 34.51 per cent followed by Indoxacarb and Dimethoate in which per cent increase in yield were 33.66 and 33.15, respectively. Lowest increase per cent in yield *i.e.* 28.51 was recorded in *B. thuringensis* treated plot. On the basis of per cent increase yield over control, Imidacloprid was found most effective insecticide followed by Indoxacarb and Dimethoate in reducing the infestation of *L. orbonalis*. These findings are more or less similar to those reported by Patra *et al.* (2009). The highest yield (220.61q/ ha) was obtained from the treatment Imidacloprid. The

Table 1 : Effect of various treatments on shoot and fruit damage by *L. orbonalis*

Sr. No.	Common name	Dose	Mean (%) shoot damage				
			I spraying (30DAT)	II spraying (45DAT)	III spraying (60DAT)	IV spraying (75DAT)	V spraying (90DAT)
1.	Azadirachtin	0.15 (%)	15.50 (23.151)	15.56 (22.563)	14.73 (22.559)	12.96 (21.072)	11.46 (19.774)
2.	Dimethoate	1.0 lit./ha	12.83 (20.960)	9.18 (19.430)	12.03 (20.227)	9.97 (18.337)	8.23 (16.653)
3.	Spinosad	70 g a.i./ha	15.47 (23.180)	14.18 (22.240)	14.39 (22.284)	12.59 (20.771)	11.07 (19.435)
4.	Imidacloprid	250 g a.i./ha	9.38(17.812)	7.36 (15.730)	9.38 (17.822)	7.11 (15.449)	4.60 (12.372)
5.	*B.thuringiensis*	0.1 (%)	16.12 (23.665)	14.34 (22.102)	17.21 (24.508)	14.37 (22.270)	12.61 (20.781)
6.	Indoxacarb	50 g a.i./ha	11.06 (19.409)	11.09 (17.616)	10.30 (18.716)	8.65 (17.072)	6.62 (18.896)
7.	Control		27.75 (31.789)	25.87 (30.561)	25.08 (30.041)	26.03 (30.841)	28.48 (32.253)
	S.E. ±		0.740	0.780	0.700	0.920	0.760
	C.D. (P = 0.05)		1.616	1.703	1.536	2.019	1.651

Table 2 : Yield of brinjal fruits from different treatments

Sr. No.	Common name	Dose	Mean fruit yield (kg/plot)	(%) increase yield over control	Total yield (q/ha)
1.	Azadirachtin	0.15 (%)	12.39	30.02	206.44
2.	Dimethoate	1.0 lit./ha	12.97	33.15	216.22
3.	Spinosad	70 g a.i./ha	12.60	31.19	209.94
4.	Imidacloprid	250 g a.i./ha	13.24	34.51	220.61
5.	*B.thuringiensis*	0.1 (%)	12.14	28.51	202.27
6.	Indoxacarb	50 g a.i./ha	13.07	33.66	217.88
7.	Control		8.67		144.44
	S.E. ±		0.220		
	C.D. (P = 0.05)		0.491		

Indoxacarb was second most effective treatment which gave the yield 217.88 q/ha.

All the insecticidal treatments were significantly superior over untreated check. The present observations on the effectiveness of emamectin benzoate are in conformity with those of Kumar and Devappa (2006) in brinjal against *L. orbonalis*, Kanna *et al.* (2005) in tomato against *H. armigera* and Bheemanna *et al*. (2005) in cotton against cotton bollworm complex. Singh *et al.* (1996), Sharma and Chhibber (1999) and Reddy and Srinivasa (2005) reported that endosulfan was found effective in reducing shoot infestation by *L. orbonalis*, which also corroborate the present results. The effectiveness of novaluron is also similar to those of Chatterjee and Roy (2004) and Sawant *et al.* (2004). However, Rajavel *et al.* (1989) reported that spray of lambda-cyhalothrin (31.5 to 50.0 ppm) and deltamethrin (20.0 ppm) provided complete control of *L. orbonalis*, which is contrary to the present findings. This could be due to different climatic conditions and timing and number of insecticidal applications.

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