The Journal of Rural and Agricultural Research Vol. 17 No. 2, 36-39 (2017)
Received April 2017; Acceptance Sepember 2017

Management of brinjal shoot and fruit borer, *leucinodes orbonalis* guenee with selected insecticides

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Abstract

In an experiment conducted at College of Horticulture, Bidar, Karanataka, India during Kharif *2014 and 2015, among the different insecticides evaluated Emamectin benzoate 5 WSG was the best with lowest shoot damage (0.31 ± 0.1 and 1.70 ± 0.2 percent 7 and 14 DAA, respectively). Flubendiamide 480 SC was next best with 0.48±0.1 and 1.41±0.2 percent shoot damage 7 and 14 DAA, respectively. Control plot registered highest shoot damage 4.20±0.1 and 5.70±0.3 per cent 7 and 14 DAA, respectively. Observations made on the fruit infestation revealed that Emamectin benzoate was the best with 4.32±0.21 and 11.09±0.9 per cent fruit infestation 7 and 14 DAA, respectively (after first spray) and 3.40±1.1 and 10.96±7.6 per cent fruit infestation 7 and 14 DAA, respectively (after second spray). Control plot recorded the highest fruit damage (27.89±8.5 and 29.74±4.2 per cent; 28.40±12.3 and 27.28 ± 7.9 seven and fourteen DAA after first and second spray, respectively. The impact of pest control could be clearly seen as the Emamectin benzoate 5 WSG recorded highest yield (38.50 t/ha) followedby Flubendiamide 480 SC (37.80 t/ha). The study conducted during* Kharif *2015 again showed the similar trend with Emamectin benzoate 5 WSG being the most promising followed by Flubendiamide 480 SCto curb the BSFB in both vegetative and reproductive phases of crop growth.*

Keywords: Brinjal, chemical control, shoot borer infestation, fruit borer infestation.

Introduction

Brinjal, *Solanum melongena* Linnaeus is one of the most important vegetables in South and South-East Asia (Thapa, 2010) where hot and wet climates prevail (Hanson *et al*., 2006). It belongs to the plant family Solanacae and is the most commonly grown vegetable of this family (Kantharajha and olegaonkar, 2004). The Indo- Pak Subcontinent is reported to be the native land of brinjal (Dunlop, 2006). In India it is cultivated in 0.71 mha with the production of 13.56 mMt (Anonymous, 2015).

Different insect pests attack brinjal from time of planting till its harvesting. Some important insect pests are brinjal shoot and fruit borer (BSFB) (*Leucinodes orbonalis*), coccinelide beetle (*Epilachna vigintioctopunctata*), jassid *(Amrasca bigutulla bigutulla*), aphid (*Aphis gossyppii*) and white fly (*Bemisia tabaci*) (Latif *et al*., 2009). BSFB is the major pest of brinjal (Saimandir and Gopal, 2012) and is found in all brinjal producing countries (Dutta *et al*., 2011). It is the most important insect pest of brinjal in Asia, especially in India, Pakistan, Sri Lanka, Nepal, Bangladesh, Thailand, Philippines, Cambodia, Laos, Vietnam (AVRDC, 1994), Africa, Sahara and South-East Asia (CABI, 2007). Areas having a hot and humid climate are conducive for its distribution and incidence (Srinivasan, 2009). It causes severe damage in South Asia (Thapa, 2010), where yield losses may reach up to 85 to 90 percent (Jagginavar *et al*., 2009).

The larvae bore into tender shoots at the vegetative stage, flower and fruit (CABI, 2007). Flower infestation is very rare, but infested flowers cannot produce fruit. It is also reported to infest the petiole and midrib of leaves (AVRDC, 1998) causing withering and drooping of young leaves and shoots. But once fruit setting has been initiated, shoot infestations become negligible (Kumar and Dharmendra, 2013) or completely disappear (Naqvi *et al*., 2009). The larvae, after hatching, bore inside fruit and the minute entrance hole is closed by the excreta of feeding larvae. Larvae feed on the mesocarp of fruit and the feeding and excretion result in fruit rottening (Neupane, 2001), making it unfit for human consumption (Baral *et al*., 2006). On average a larva can infest 4 to 7 fruits during its life span (Jayaraj and Manisegaran, 2010). Infestation by this pest results in lowering the vitamin C content up to 80 percent in infested brinjal fruit (Sharma, 2002).

BSFB has become a noxious insect pest in brinjal growing areas of India. Insecticides applications twice a week to control BSFB is a common farmers' practice. Extensive use of these conventional insecticides reduces their efficacy against BSFB and increases the cost of production. Since insecticide have several health hazardous effects, there is a need to use environmentally safe insecticides or less number of sprays and doses of insecticides. The present study was carried out to evaluate the efficacy of different insecticides which can afford the appropriate control.

Materials and Methods

The study was conducted at College of Horticulture, Bidar, Karnataka, India. During *Kharif,* 2014 and 2015. Brinjal cv. Arka sirish was raised in 30cm earthen pots. Transplanting of seedlings was done in the experimental plot on June 18 and June 22 of *Kharif* 2014 and 2015, respectively with spacing of 120 cm X 60 cm (row to row X plant to plant). Plots and replications were separated by 1.0 m of non-cropped area. The experiments were laid out in a Randomized Complete Block Design with four replications having seven treatments including a control (Table 1). Each treatment plot had four rows of 5.0 m length. The crop raised by following by following Recommended Package Practices (Anon. 2013) except plant protection measures. Totally 3 sprays were taken up one in the vegetative stage and two in reproductive stage when the pest crossed the ETL.

For recording shoot infestation, healthy and infested shoots were counted on 10 randomly selected plants in each plot. Data were recorded a day before spray and 7 and 14 days after treatment. Per cent shoot infestation was calculated by using the following formula:

$$\text{Per cent shoot infestation} = \frac{\text{No. of infested shoot}}{\text{Total no. of shoot}} \times 100$$

Similarly, for fruit infestation, healthy and infested fruits were counted a day before and 7 and 14 days after each spray. Per cent fruit infestation was calculated using the following formula:

$$\text{Per cent fruit infestation} = \frac{\text{No. of infested fruit}}{\text{Total no. of fruits}} \times 100$$

The data was subjected to statistical analysis (ANOVA) to determine the significance of treatments. The means were compared by Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1984) at P=0.05.

Results and Discussion

Shoot infestation during Kharif, 2014

The results clearly indicated that the shoot infestations were significantly lower in treated plots as compared to control plots. Among the different insecticides Emamectin benzoate 5 WSGwas on top registering lowest shoot damage (0.31 ± 0.1 and 1.70 ± 0.2 percent 7 and 14 DAA, respectively) (Table 2). Flubendiamide 480 SCwas next best in the row with 0.48±0.1 and 1.41±0.2 percent shoot damage 7 and 14 DAA, respectively. Control plot registered highest shoot damage 4.20±0.1 and 5.70±0.3 per cent 7 and 14 DAA, respectively.

Fruit infestation during Kharif, 2014

Observations made on the fruit infestation revealed that Emamectin benzoate was the best with 4.32±0.21 and 11.09±0.9 per cent fruit infestation 7 and 14 DAA, respectively (after first spray) and 3.40±1.1 and 10.96±7.6 per cent fruit infestation 7 and 14 DAA, respectively (after second spray) (Table 3). Control plot recorded the highest fruit damage (27.89±8.5 and 29.74±4.2 per cent; 28.40±12.3 and 27.28 ± 7.9 per cent 7 and 14 DAA after first and second spray, respectively.

These results are in accordance with the study conducted by Shah *et al*. (2012), who found that

Table 1: Treatment details for the management of brinjal shoot and fruit borer (*L. orbonalis*)

Treatment	Common name	Trade name	Manufacturer	Dose
T1	Spinosad 45 SC	Tracer 45 SC	Dow Agrosciences	0.25 ml/l
T2	Flubendiamide 480 SC	Fame 480 SC	Bayer Cropscience	0.10 ml/l
T3	Emamectin benzoate 5 WSG	Bioclaim 5 WSG	Biostadt India Limited	0.2g/l
T4	Bifenthrin 10 EC	Talstar 10 EC	FMC Corporation	1.3 ml/l
T5	Deltamethrin 2.8 EC	Decis 2.8 EC	Bayer Cropscience	0.5ml/l
T6	Chlorantraniliprole 18.5 SC	Coragen 18.5 SC	DuPont India Pvt. Ltd.,	0.2 ml/l
T7	Control	-	-	-

Table 2: Shoot infestation caused by brinjal shoot and fruit borer (*L. orbonalis*) during *kharif* 2014

Treat-ments	Dose	BSFB shoot infestation (%) (Mean ± SD) 7 DAA	14 DAA
T1	0.25 ml/l	1.19±0.1[b]	2.24±0.3[bc]
T2	0.1 ml/l	0.48±0.1[bc]	1.41±0.2[c]
T3	0.2g/l	0.31±0.1[bc]	1.70±0.2[bc]
T4	1.3 ml/l	0.71±0.1[bc]	2.00±0.4[bc]
T5	0.5 ml/l	1.08±0.4[bc]	2.72±0.3[b]
T6	0.2 ml/l	0.42±0.1[bc]	2.30±0.1[bc]
T7	-	4.20±0.1[a]	5.70±0.3[a]

Note: 1. In vertical columns means followed by same letters are not different statistically (P=0.05) by DMRT.
2. DAA= Days after application

Emamectin benzoate 5 WSG and Flubendamide 480 SC were promising insecticides to lower BSFB infestation and produce high fruit yield. Latif *et al.* (2009) also suggested the application of Flubendamide 480 SC, in combination with mechanical control, potash and field sanitation, for reducing fruit and shoot infestation. The impact of pest control could be clearly seen as the Emamectin benzoate recorded highest yield (38.50 t/ha) followedby Flubendiamide (37.80 t/ha) (Table 3).

Table 4: Shoot infestation caused by brinjal shoot and fruit borer (*L. orbonalis*) during *kharif* 2015.

Treat-ments	Dose	BSFB shoot infestation (%) (Mean ± SD) 7 DAA	14 DAA
T1	0.25 ml/l	1.44±0.15[b]	2.49±0.31[bc]
T2	0.1 ml/l	0.73±0.13[bc]	1.66±0.22[c]
T3	0.2g/l	0.46±0.12[bc]	1.95±0.21[bc]
T4	1.3 ml/l	0.96±0.10[bc]	2.26±0.44[bc]
T5	0.5 ml/l	1.33±0.43[bc]	2.97±0.36[b]
T6	0.2 ml/l	0.67±0.13[bc]	2.55±0.15[bc]
T7	-	4.45±0.11[a]	5.95±0.35[a]

Note: 1. In vertical columns means followed by same letters are not different statistically (P=0.05) by DMRT.
2. DAA= Days after application.

Table 3: Fruit infestation caused by brinjal shoot and fruit borer (*L. orbonalis*) during *kharif* 2014

Treat-ments	Dose	BSFB fruit infestation (%) (Mean ± SD) First spray 7 DAA	First spray 14 DAA	Second spray 7 DAA	Second spray 14 DAA	Fruit yield (tons/ha)
T1	0.25 ml/l	5.09±1.7[bc]	10.20±3.3[c]	5.50±3.3[bc]	10.29±2.5[bc]	37.65[a]
T2	0.1 ml/l	5.95±2.7[bc]	13.95±2.6[b]	6.12±0.85[bc]	12.86±6.9[b]	37.80[a]
T3	0.2g/l	4.32±0.21[bc]	11.09±0.9[bc]	3.40±1.1[c]	10.96±7.6[bc]	38.50[a]
T4	1.3 ml/l	6.71±2.4[b]	13.44±6.9[b]	5.27±2.7[bc]	11.88±6.0[bc]	36.85[a]
T5	0.5 ml/l	6.76 ±1.2[b]	11.56±0.3[bc]	6.96±3.0[b]	9.37±5.6[c]	29.25[b]
T6	0.2 ml/l	3.82±0.8[c]	12.72±8.5[bc]	4.60±0.5[bc]	12.11±2.8[bc]	38.15[a]
T7	-	27.89±8.5[a]	29.74±4.2[a]	28.40±12.3[a]	27.28±7.9[a]	20.30[c]

Note: 1. In vertical columns means followed by same letters are not different statistically (P=0.05) by DMRT.
2. DAA= Days after application.

Table 5: Fruit infestation caused by brinjal shoot and fruit borer (*L. orbonalis*) during *kharif* 2015.

Treat-ments	Dose	BSFB fruit infestation (%) (Mean ± SD) First spray 7 DAA	First spray 14 DAA	Second spray 7 DAA	Second spray 14 DAA	Fruit yield (tons/ha)
T1	0.25 ml/l	5.34±1.72[bc]	10.45±3.34[c]	5.75±3.31[bc]	10.54±2.53[bc]	37.15[a]
T2	0.1 ml/l	6.20±2.75[bc]	14.20±2.66[b]	6.37±0.87[bc]	13.11±6.95[b]	37.30[a]
T3	0.2g/l	4.57±0.26[bc]	11.34±0.92[bc]	3.65±1.12[c]	11.21±7.62[bc]	38.00[a]
T4	1.3 ml/l	6.96±2.42[b]	13.69±6.93[b]	5.52±2.76[bc]	11.38±6.07[bc]	36.35[a]
T5	0.5 ml/l	7.01 ±1.23[b]	11.81±0.35[bc]	7.21±3.02[b]	9.62±5.65[c]	28.75[b]
T6	0.2 ml/l	4.07±0.81[c]	12.97±8.53[bc]	4.85±0.53[bc]	12.36±2.81[bc]	37.65[a]
T7	-	28.14±8.56[a]	29.98±4.23[a]	28.65±12.34[a]	27.53±7.99[a]	19.70[c]

Note: 1. In vertical columns means followed by same letters are not different statistically (P=0.05) by DMRT.
2. DAA= Days after application.

The study conducted during *Kharif* 2015 again showed the similar trend with Emamectin benzoate 5 WSG being the most promising followed by Flubendiamide 480 SCto curb the BSFB in both vegetative and reproductive phases of crop growth (Table 4 & 5).

It can be concluded that insecticides reduced shoot and fruit infestation in treated plots compared to untreated plots. For control of shoot infestation, Emamectin benzoate 5 WSG and Flubendiamide 480 SC were better in both seasons.

Acknowledgements

We thank College of Horticulture, Bidar and University of Horticultural Sciences, Bagalkot, India for their provisions to this study.

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