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Effect of selective insecticides for management of brinjal shoot and fruit borer (*Leucinods orbonalis* Guenee)

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Abstract
Brinjal (*Solanum melongena* L.) is a versatile vegetable. Among the solanaceous vegetables, brinjal is one of the most popular and economically important vegetables among small farmers and it is a source of income for resource-poor farmers. Shoot and fruit borer (BSFB*)* (*Leucinodes orbonalis* Guenee) is a serious insect pest in all brinjal growing states of India. Different insecticides were evaluated for management of shoot and fruit borer. An investigation was carried out using So*ham* variety of brinjal during 2018-19 at JNKVV, Krishi Vigyan Kendra, Chhindwara, Madhya Pradesh. Three different new molecules of Insecticides with different formulations were used *viz*. Spinosad 45 SC with (0.3 ml./l.) concentration, Flubendiamide 480SC with (0.25 ml/l) concentration and Emamectin benzoate 1.9 EC with concentration of (1.0 ml/l) sprayed at three different intervals. All infested fruits were picked from plots one day before insecticide application. Infected shoots were marked by tying a ribbon to all drooping shoots one day before spray. Fruit and shoot infestations were recorded seven days after insecticide application from plants. All treatments reduced shoot and fruit infestation significantly as compared to the control. However, the loss of brinjal was significantly reduced when the plots were treated with Spinosad (0.3 ml/l) proved to be the most effective insecticide followed by Emamectin benzoate (1.0 ml/l) Flubendiamide (0.25 ml/l) and Neem oil (5ml/l) treated plots had the least shoot infestation.

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) [24] 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 Golegaonkar, 2004). The Indo-Pak Subcontinent is reported to be the native land of brinjal (Dunlop, 2006). Its worldwide cultivation is more than 1,600,000 ha and production is 50 million MT (FAO, 2012). In India 2015-16 it was cultivated in 663 thousand ha and production is 12515 thousand MT per annum**.** In Madhya Pradesh 2015-16 it is cultivated in 45.11 thousand ha and production 1160.60 thousand MT .In District Chhindwara 2015-16 it was cultivated in 3.14 thousand ha with production 69.72 thousand MT per annum (Horticultural Statistics at a Glance 2017, Horticulture Statistics Division Department of Agriculture, Cooperation & Farmers Welfare Ministry of Agriculture & Farmers Welfare Government of India).

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 (*Amrascabigutulla bigutulla*), aphid (*Aphis gossyppii*) and white fly (*Bemisia tabaci*) (Latif *et al*., 2009) [16-17]. BSFB is the major pest of brinjal (Latif *et al*., 2010; Chakraborti and Sarkar, 2011; Saimandir and Gopal, 2012) [21] and is found in all brinjal producing countries (Dutta *et al*., 2011) [9]. 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) [5], 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) [24], where yield losses may reach up to 85 to 90 percent (Misra, 2008; Jagginavar *et al*., 2009) [18, 12].

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 (Alam *et al*., 2006) [2]. It is also reported to infest the petiole and midrib of leaves (Alpureto, 1994; 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) [14] or completely disappear (Naqvi *et al*., 2009) [9]. The larvae, after hatching, bore inside fruit and the minute entrance hole is closed by the excreta of feeding larvae (Alam *et al*., 2006) [2]. 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) [6]. On average a larva can infest 4 to 7 fruits during its life span (Jayaraj and Manisegaran, 2010) [13]. Infestation by this pest results in lowering the vitamin C content up to 80 percent in infested brinjal fruit (Sharma, 2002) [23].

Brinjal shoot and fruit borer has become a noxious insect pest in brinjal growing areas of India. In the Madhya Prades, district Chhindwara region twice a week applications of insecticides for BSFB control are a common practice of farmers. 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 effect of selective insecticides to find the best practice if insecticides have to be applied for management of the shoot and fruit borer.

Materials and Methods

An investigation was carried out on brinjal during 2018-19 at JNKVV, Krishi Vigyan Kendra, Chhindwara, Madhya Pradesh. The experiments were laid out in randomized block design (RBD) with five treatments and four replications. Seedlings in the three to four true leaf stage were transplanted in the field by dibbling. Light irrigation was given right after transplanting. Subsequent irrigations were given at two to three days intervals. Three different new molecules of Insecticides and one botanical pesticide with different formulations were used *viz*. Spinosad 45 SC with 0.3 ml./l. concentration, Flubendiamide 48 SC with 0.25 ml/l concentration Emamectin benzoate 1.9EC with concentration of 1.0 ml/l and Neem oil 5 ml/l sprayed at two different (7 and 14 days) intervals.

All infested fruits were picked from plots one day before insecticide application. Infected shoots were marked by tying a ribbon to all drooping shoots one day before spray. Fruit and shoot infestations were recorded seven days after insecticide application from plants. All treatments reduced shoot and fruit infestation significantly as compared to the control.

First spray was applied on vegetative growth stage. Subsequently two sprays were applied in the fruiting stage. Water was applied to control plots when insecticides were sprayed. One day before each application of insecticides all infested fruits were harvested. After sprays, all marketable fruits were harvested from the plants in the middle two rows to note the number of healthy and infested fruits. Percent fruit infestation was calculated using the following formula

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

For recording shoot infestation, healthy and infested shoots were counted on 10 randomly selected plants. Data were recorded one day before spray and seven and fourteen days after treatment. All the infested fruits were picked one day before spray. The infested shoots from selected plants were marked using a ribbon tied around the shoot to avoid recounting during the next data recording. Percent shoot infestation was calculated by using the following formula

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

Table 1: Treatments for brinjal shoot and fruit borer (L. orbonalis) control at Chhindwara on brinjal (*S. melongena)* shoot and fruit borer

Treatment	Common Name	Dose (ml/ ha)
T1	Spinosad 40 SC	150
T2	Flubendiamide 480 SC	125
T3	Emamectin benzoate 1.9EC	500
T4	Neem Oil	2500
T5	Control	-

Results and Discussion

Effect of Insecticide on shoot infestation of brinjal during 2018

During 2018, pretreatment shoot infestation ranged from 10.85 to 14.75% (Table 2) and it was non-significant among treatments. Results revealed that all treatments were effective against BSFB in reducing shoot infestation and superior over untreated control plots. Though, Spinosad recorded lowest mean shoot infestation (6.63%) followed by Emamactin benzoate (7.94%) Flubendamide (8.33%), botanical-pesticides, neem oil were found to be relatively effective treatments against BSFB with 13.44% mean shoot infestation, whereas in control plots mean shoot infestation was 20.85%.

Table 2: Effect of two spray of Insecticide on BFSB (*L. orbonalis*) infestation on shoots of Brinjal during 2018

Treatment (Insecticide)	Dose	Pre treatment damage %	BSFB Shoot Infestation Percent				
			First spray		Second spray		
			7days	14days	7days	14days	Mean (%)
Spinosad	0.3 ml/L	10.85	7.75	7	6.5	5.25	6.63
Flubendiamide	0.25 ml/L	11.2	8.8	8.25	7.5	8.75	8.33
Emamactin benzoate	1.0ml/L	11.5	7.5	7.5	8.25	8.5	7.94
Neem oil	5 ml./L	13.75	10.5	10.5	16.75	16	13.44
Control	-	14.75	17.5	18.5	22.75	24.65	20.85
SE m	-	NS	1.2	1.36	1.44	1.67	-
CD at 5%	-	-	3.6	4.1	4.3	5.0	-

Effect of Insecticide on fruit infestation of brinjal during 2018

Pretreatment shoot infestation ranged from 15.7 to 19.5% (Table 3) and it was non-significant among treatments. Results revealed that all treatments were effective against BSFB in reducing fruit infestation and superior over untreated control. Though, Spinosad recorded lowest mean shoot infestation (7.74%) followed by Emamectin benzoate (8.8%) Flubendamide (10.16%), and botanical-pesticides, neem oil were found to be relatively effective treatments against BSFB with 13.41% mean fruit infestation, whereas in control mean fruit infestation was 29.75%.

Table 3: Effect of two spray of different Insecticide on BSFB (*L. orbonalis*) infestation on fruits of Brinjal during 2018

Treatment (Insecticide)	Dose	Pre treatment damage %	BSFB fruit infestation (%)				Mean (%)
			First spray		Second spray		
			7days	14days	7days	14days	
Spinosad	0.3 ml/L	15.7	5.25	12.39	4.10	10.25	7.74
Flubendiamide	0.25 ml/L	19.5	6.65	14.30	6.25	13.45	10.16
Emamectin benzoate	1.0ml/L	17.0	6.25	11.65	5.90	11.40	8.8
Neem oil	5 ml./L	12.75	10.5	10.25	16.5	16.40	13.41
Control	-	13.75	29.49	31.35	30.90	27.28	29.75
SE m	-	NS	3.85	4.05	4.13	2.93	-
CD at 5%	-	-	11.55	12.15	12.40	8.80	-

Effect of Insecticide on fruit infestation and yield of brinjal during 2018

Effect of different treatments on fruit infestation and yield of brinjal during 2018 is presented in Table 4. Among the insecticide treatments, spinosad treated plots recorded lowest mean fruit infestation (8.25%) followed by emamectin benzoate (11.65%) and flubendamide (14.25%). The botanical-pesticides, neem oil recorded fruit infestations (18.15%) were not so effective treatments but all were superior over untreated control plots (35.48%).

The highest marketable yield was observed in the spinosad (266.5 q/ha) followed by emamectin benzoate (240.5 q/ha), flubendamide (238.5 q/ha) the botanical pesticides, neem oil recorded yield (190.5 q./ha.) whereas in untreated control plot marketable yield was (158.25 q/ha) (Table 4)

Table 4: Effect of Insecticide on fruit infestation and yield of brinjal during 2018

Treatment (Insecticide)	Cumulative Mean % (fruit infestation)	% Protection over control	Yield marketable fruits (q/ha)	Yield damaged fruits (q/ha)	Percent damaged fruits (wt basis)	Gross fruit yield (q/ha)
Spinosad	8.25	73.98	242.5	24.0	9.0	266.5
Flubendiamide	14.25	65.84	210.5	28.0	11.74	238.5
Emamactin benzoate	11.65	70.42	214.25	26.25	10.91	240.5
Neem oil	18.15	54.92	160.0	30.5	16.01	190.5
Control	35.48	-	121	37.25	23.53	158.25
SE m	-	-	27.5	-	-	25.47
CD at 5%	-	-	82.5	-	-	76.43

Conclusion

In the present investigation, Spinosad was most effective insecticide against brinjal shoot and fruit borer. Results of efficacy of spinosad are in conformity with the findings of earlier workers who reported that among the treatments, spinosad was found to be most effective in reducing shoot and fruit infestation was found to be the most effective treatment against brinjal shoot and fruit borer and gave maximum fruit yield. In the present investigation botanical pesticides were also effective treatments as compared to untreated control. Neem oil may be incorporated for integrated management practices of brinjal shoot and fruit borer.

References

1. Adiroubane D, Raghuraman K. Plant products and microbial formulation in the management of brinjal shoot and fruit borer, *Leucinodes orbonalis* (Guenee.). J Biopestic. 2008; 1:124-129.
2. Alam SN, Hossain MI, Rouf FMA, Jhala RC, Patel MG, Rath LK *et al*. Implementation and promotion of an IPM strategy for control of eggplant fruit and shoot borer in South Asia. Tech. Bull. 36. AVRDC publication number, 2006, 06-672.
3. Anil Sharma PC, Bioefficacy of insecticides against *Leucinodes orbonalis* on brinjal. J environ. Biol. 2010; 31:399-402.
4. Aprana K, Dethe MD. Bioefficacy study of biorational insecticide on brinjal. J Biopestic. 2012; 5:75-80.
5. AVRDC. Eggplant entomology. Control of eggplant fruit and shoot borer. Progress Report. Asian Vegetable Brinjal shoot and fruit borer management with insecticides 1419 Research and Development Center, (AVRDC), Shanhua. Taiwan, 1994, 88.
6. Baral K, Roy BC, Rahim KMB, Chatterjee H, Mondal P, Mondal D *et al.* Socio-economic parameters of pesticide use and assessment of impact of an IPM strategy for the control of eggplant fruit and shoot borer in West Bengal, India. Tech. Bull., 37. AVRDC publication number, 2006, 06-673.
7. Chakraborti S, Sarkar PK. Management of *Leucinodes orbonalis* Guenee on eggplant during the rainy season in India. J Protect. Res. 2011; 51:325- 328.
8. Deshmukh RM, Bhamare VK. Field evaluation of some insecticides against brinjal shoot and fruit borer *Leucinodes orbonalis* Guen. Int. J agric. Sci. 2006; 2:247-249.
9. Dutta P, Singha AK, Das P, Kalita S. Management of brinjal fruit and shoot borer, *Leucinodes orbonalis* in agro-ecological conditions of West Tripura. Scholarly J agric. Sci. 2011; 1:16-19.
10. FAO. Faostat. (Available at: http://www.fao.org.) FAO, 2014.

11. Horticultural Statistics at a Glance. Government of India Ministry of Agriculture & Farmers' Welfare Department of Agriculture, Cooperation & Farmers' Welfare Horticulture Statistics Division New Delhi, 2017.
12. Jagginavar SB, Sunitha ND, Biradar AP, Bioefficacy of Flubendiamide 480C against brinjal fruit and shoot borer, *Leucinodes orbonalis* Guen. Kamtaka J agric. Sci. 2009; 22:712-713.
13. Jayaraj J, Manisegaran S. Management of fruit and shoot borer in brinjal. The Hindu Sci-Tech. Agri. College and Res. Inst, 2010.
14. Kumar S, Dharmendra S. Seasonal incidence and economic losses of brinjal shoot and fruit borer, *Leucinodes orbonalis* Guenee. Agric. Sci. Digest. 2013; 33:98-103.
15. Latif MA, Rahman MM, Alama MZ. Efficacy of nine insecticides against shoot and fruit borer, *Leucinodes orbonalis* Guenee (Lepidoptera: Pyralidae) in eggplant. J Pestic. Sci. 2010; 83:391-397.
16. Latif MA, Rahman MM, Alama MZ, Hossain MM, Evaluation of Flubenbendiamide as an IPM component for the management of brinjal shoot and fruit borer, *Leucinodes orbonalis* Guenee. Mun. Ent. Zool. 2009a; 4:257-267.
17. Latif MA, Rahman MM, Islam MR, Nurruddin MM. Survey of arthropod biodiversity in the brinjal field. J. Ent. 2009b; 6:28-34.
18. Misra HP. New promising insecticides for the management of brinjal shoot and fruit borer, *Lecinodes orbonalis* Guenee. *Pest Manage. Hort. Ecosys*. 2008; 14:140-147.
19. Naqvi AR, Pareek BL, Mitharwal BS. Seasonal incidence of shoot and fruit borer, *Leucinodes orbonalis* Guenee infesting in hyper arid regions of Rajhistan. J Insect Sci. 2009; 22: 195-198.
20. Pareet, JD. Biorational approach for the management of brinjal shoot and fruit borer. M.Sc. thesis, Univ. Agricultural Sciences, Dharwad, 2006, 59.
21. Saimandir J, Gopal M. Evaluation of synthetic and natural insecticides for the management of insect pest control of eggplant (*Solanum melongena* L.) and pesticide residue dissipation pattern. Am J Pl. Sci. 2012; 3:214-227.
22. Shah KD, Bharpoda TM, Jhala RC. Bio-efficacy of newer molecules of insecticides against brinjal shoot and fruit borer, *Leucinodes orbonalis* Guenee (Lepidoptera: Pyralidae). AGRES, An International e-Journal. 2012; 1:186-200.
23. Sharma DR. Bioefficacy of certain insecticide and biopesticides against major pest of brinjal under field condition. M.Sc. thesis. Indian Agric. Res. Inst. New Delhi, India, 2002, 160.
24. Thapa RB. Integrated management of brinjal fruit and shoot borer, *Leucinodes orbonalis* Guen: An overview. J Inst. Agric. Anim. Sci. 2010; 30&32:1- 16.
25. Wankhede SM, Kale VD. Effect of insecticides on brinjal shoot and fruit borer, *Leucinodes orbonalis* Guenee. Ann. Pl. Prot. Sci. 2010; 18:336-339.