International Journal of Plant & Soil Science

Volume 34, Issue 24, Page 996-1004, 2022; Article no.IJPSS.94261
ISSN: 2320-7035

Management of the Brinjal Shoot and Fruit Borer *Leucinodes orbonalis* (Guen.) through Newer Insecticides in Brinjal

Hansa Kumari Jat [a++*] and V. K. Shrivastava [a#]

[a] *Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, (Madhya Pradesh), India.*

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJPSS/2022/v34i242729

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/94261

Original Research Article

Received: 24/10/2022
Accepted: 30/12/2022
Published: 31/12/2022

ABSTRACT

Aims: This study aims to find out the most effective newer insecticides to control shoot and fruit borer in the brinjal.
Study Design: The experiment of field was carried out with randomized block design.
Place and Duration of Study: The field experiment on management of brinjal shoot and fruit borer *Leucinodes orbonalis* (Guen.) with newer insecticides were held on during October 2018 to April 2019 at Gwalior (Madhya Pradesh).
Methodology: Infestation of shoot was observed from each plot by counting the total number of plants and the plants infested by shoot and fruit borer from the beginning of shoot formation. Total number of healthy fruits and infested fruits were counted from five plants of each plot at the time of fruit picking. The weight of both type of fruits (healthy and infested) were recorded to calculate the fruit infestation by weight basis. The treatments were applied from the initiation of infestation to till

[++] *Research Scholar;*
[#] *Professor and Head of Department (Entomology);*
**Corresponding author: E-mail: bbhansika@gmail.com, bbhansiak@gmail.com;*

the complete harvest of the crop at 15 days interval regularly. The recorded data were subjected to statistical analysis after transformation. The count data also transformed and percentage were transformed to angular values.

Results: The treatment of spinosad 45 SC and indoxacarb 14.5 SC[1] (suspension concentrate) were found best among all treatments with 3.42 percent and 3.58 percent shoot infestation respectively and the treatments chlorantraniliprole 18.5 SC and flubendiamide 20 WG[2] were found least effective with 4.69 percent and 4.78 percent infestation of shoot respectively. Treatments spinosad 45 SC and indoxacarb 14.5 SC were significantly reduced the 3.11 percent and 3.28 percent fruit infestation respectively. Whereas the treatments flubendiamide 20 WG (Water-Dispersible Granule) and chlorantraniliprole 18.5 SC were the least effective with 4.99 percent, 4.69 percent fruit infestation, respectively.

Conclusion: Among all used treatments spinosad 45 SC and indoxacarb 18.5 SC, were the most effective treatments as they recorded higher yield and higher benefit cost ratio.

Keywords: Shoot and fruit borer; infestation; spray; chlorantraniliprole 18.5 SC; spinosad 45 SC; flubendiamide 20 WG; indoxacarb 14.5 SC.

1. INTRODUCTION

"The eggplant or brinjal or aubergine (*Solanum melongena* L.) is one among the most important solanaceous vegetables grown in south-east Asian countries including India. Brinjal is the native of India" [1,2] or Indo-Burma region, and it is known to be grown in India since ancient times [3]. "It is consumed by people in many countries viz., Central, South and South East Asia, some parts of Africa and Central America also [4]. It contains an important mineral potassium, which plays a key role in maintaining electrolyte balance in the human body, thus it help in neutralizing the effects of sodium in the entire human body and aiding in blood pressure control" [5]. "Bringal crop is attacked by more than 142 species of insects, 3 species of nematode and 4 species of mites from planting to harvest of crop" [6]. Among all insects shoot and fruit borer, *Leucinodes orbonalis* (Lepidoptera: Pyralidae) is the key pest throughout Asia [7,8,9]. It is the most destructive pest attacking brinial throughout the crop development period [10]. "Shoot and fruit borer damage occure all growing stages of brinjal [11]. The yield of brinjal crop decreases due to the shoot and fruit borer is to extend of 70-92%" [12,13]. "In India, this pest has distribution throughout the whole country and has been categorized as the most destructive and most serious pest causing huge losses in brinjal [14]. The pest has been reported to occure losses up to the tune of 41 percent in Himachal Pradesh [15], 20.7-60.0 percent in Tamil Nadu (Raja *et al*., 1990), 70 percent in Andhra Pradesh [16], 80 percent in Gujarat" [17]. "Shoot and fruit borer larvae bore into tender shoots in the early stage of crop resulting in drooping of shoots, which are readily visible in the infested fields of brinjal. At the later stage, caterpillars bore into flower buds and in fruits, rendering the fruits unfit for consumption and marketing, resulting in direct losses of yield. Many insecticides have been used extensively for the control of insect pest in brinjal. Despite diverse ill effects of the different chemical pesticides, insecticides use still constitutes major control option to tackle the pest" [18]. Even though control given by insecticides is one of the most common control measure for shoot and fruit borer [19]. Now a days many new developed chemicals including neonicotinoids are available in the market with high efficacy for pest control and safety to nontarget organisms. These chemicals is evaluated for their bio-efficacy against crop pests is warranted [20]. The present studies were conducted to evaluate the efficacy of some newer insecticides against shoot and fruit borer on brinjal to replace to old ones to cope up with the problems of insect resistence.

2. MATERIALS AND METHODS

The experiment were carried out during October 2018 to April 2019 at agriculture farm at College of Agriculture, Gwalior (Madhya Pradesh). The seven used treatments were Chlorantraniliprole 18.5 SC, Flubendiamide 20 WG, Thiacloprid 21.7 W/W[3], Carbosulfan 25 EC[4] , Indoxacarb 14.5 SC, Emamectin benzoate 5 SG[5] , and Spinosad 45 SC. The shoot infestation were observed from each plot by counting the total number of plants

[1] *SC (suspension concentrate)*
[2] *WG (Water-Dispersible Granule)*
[3] *W/W (weight per weight),*
[4] *EC (emulsifiable concentrate)*
[5] *SG (Soluble granules)*

and the number of infested plants by shoot and fruit borer from the initiation of shoot formation. At the time of fruit harvesting, total number of fruits and number of infested fruits were counted from five plants of each plot. The weight of healthy fruits and infested fruit was also recorded to find out the fruit infestation by weight basis. The treatments were applied from the initiation of infestation till the harvest of crop at 15 days interval. Data were subjected to statistical analysis after transformation of values. The count data were transformed, while percentages were transformed to angular values.

3. RESULTS

3.1 Effects of Newer Insecticides on Brinjal Shoot Infestation

The mean percent shoot infestation in brinjal per 5 plants recorded one day before spray application of insecticides show that the infestation of *L. orbonalis* varied between 6.60 to 7.70 percent in different test plots. At 7 days after first spray data indicated that all the treatments were effective and significantly superior to untreated control in bringing down the infestation of shoots. Among all the treatments, spinosad 45 SC and indoxacard 14.5 SC were most effective and significantly superior among all other treatments by recording the minimum infestation of shoots 1.15 per cent, and 1.20 percent respectively, and flubendiamide 20 WG and chlorantraniliprole 18.5 SC found least effective with 2.65 percent, 2.20 percent shoot infestation, respectively. At 14 days after the first spray, the treatments, spinosad 45 SC and indoxacarb 14.5 SC were the most effective and significantly superior to all treatments by recording the minimum infestation of shoots 5.15 percent and 5.35 percent, respectively and chlorantraniliprole 18.5 SC and flubendiamide 20 WG found least effective with 6.55 percent, 6.35 percent shoot infestation, respectively. The post treatment data of one day after second spray indicated that indoxacarb 14.5 SC and spinosad 45 SC found superior among all other treatments by recording the minimum infestation of shoots 4.95 percent and 4.80 percent, respectively. The maximum shoot infestation were recorded on chlorantraniliprole 18.5 SC and flubendiamide 20 WG with 6.20 percent, 6.10 percent, respectively after second spraying. After 7 days of second spray, the treatments, spinosad 45 SC and indoxacarb 45 SC was the most effective and significantly superior to all other treatments by recording the minimum shoot infestation of 0.90 percent and 1.00 percent respectively and flubendiamide 20 WG and chlorantraniliprole 18.5 SC found least effective with 2.30 percent, 1.95 percent infestation of shoot, respectively. At 14 days after second spray, the treatments, spinosad 45 SC and indoxacarb 14.5 SC were the best and most effective and significantly superior among all other treatments by recording the minimum infestation of shoots 2.90 percent and 3.30 percent, respectively and chlorantraniliprole 18.5 SC and flubendiamide 20 WG found least effective with 4.45 percent, 5.00 percent shoot infestation, respectively. The mean percent infestation of shoot after both sprays revealed that spinosad 45 SC and indoxacarb 14.5 SC were significantly reduced the shoot infestation with 3.42 percent and 3.58 percent, respectively. Both sprays data revealed that chlorantraniliprole 18.5 SC and flubendiamide 20 WG proved least effective with 4.69 percent, 4.78 percent shoot infestation, respectively (Table 1).

3.2 Effects of Newer Insecticides on Brinjal Fruit Infestation

The mean percent infestation of fruit before spray per 5 plants recorded one day before application of insecticides showed that the infestation of *L. orbonalis* varied from 8.10 to 9.45 percent in different test plots. The post treatment data of one day after first spray indicated that all the treatments were effective and significantly superior to untreated control in bringing down the fruits infestation of *L. orbonalis.* Among all the treatments, spinosad 45 SC and indoxacarb 14.5 SC were the best effective and significantly superior among all other treatments by recording the minimum infestation of fruits 4.90 and 5.10 percent, respectively and the least effective treatments were flubendiamide 20 WG and chlorantraniliprole 18.5 SC with 6.55 and 6.25 percent infestation of fruits, respectively. After 7 days of first spray the post treatment data were indicated that spinosad 45 SC and indoxacarb 14.5 SC found superior among all other treatments by recording the minimum fruit infestation i.e. 1.35 and 1.40 percent, respectively. After first spraying the maximum fruit infestation were recorded on flubendiamide 20 WG and chlorantraniliprole 18.5 SC with 2.90 and 2.65 percent, respectively. The post treatment data at 14 days after first spray indicated that spinosad 45 SC and indoxacarb 14.5 SC found superior among all other treatments by recording the minimum fruit infestation of 4.25 and 4.55 percent, respectively. After first spraying the maximum fruit infestation were recorded on flubendiamide 20 WG and chlorantraniliprole 18.5 SC with 6.15 and 6.10 percent, respectively. The post treatment data of one day after second spray indicated that all the treatments were effective and significantly superior against untreated control in bringing down the fruits infestation of *L. orbonalis*. Among the treatments, spinosad 45 SC and indoxacarb 14.5 were the best effective and significantly superior to all other treatments by recording the minimum infestation of fruits 3.65 and 3.80 percent, respectively and flubendiamide 20 WG and chlorantraniliprole 18.5 SC found least effective with 5.75 and 5.55 percent infestation of fruits, respectively. The post treatment data at 7 days after second spray indicated that spinosad 45 SC and indoxacarb 14.5 SC found superior among all other treatments by recording the minimum infestation of fruits 1.20 and 1.30 percent, respectively. The maximum fruit infestation after second spraying were recorded on flubendiamide 20 WG and chlorantraniliprole 18.5 SC with 2.70 and 2.25 percent, respectively. The post treatment data on 14 days after second spray indicated that spinosad 45 SC and indoxacarb 14.5 SC found superior among all other treatments by recording the minimum fruit infestation i.e. 3.30 and 3.50 percent, respectively. After second spraying the maximum fruit infestation of were recorded on flubendiamide 20 WG and chlorantraniliprole 18.5 SC with 5.90 and 5.35 percent, respectively. The mean percent infestation of fruits after both sprays data indicated that spinosad 45 SC and indoxacarb 14.5 SC significantly reduced the fruits infestation with 3.11 and 3.28 percent, respectively. Both sprays data were indicated that flubendiamide 20 WG and chlorantraniliprole 18.5 SC found least effective with 4.99 and 4.69 percent fruits infestation, respectively (Table 2).

4. DISCUSSION

Our experiment result shows that among all seven treatments spinosad 45 SC is found best effective for management of brinjal shoot and fruit borer following by indoxacarb 14.5 SC in both shoot and fruit infestation . The result of our study is in agreement with the findings of [21] who reported that mean infestation of shoot as well as fruit of *L. orbonalis* were recorded in brinjal plots treated by indoxacarb 14.5 SC 50 g a. i./ha (8.89 and 13.13%), followed by emamectin benzoate 5 SG 15 g a. i./ha (10.95 and 16.66%) [22,3,23,19,24,25]. Results are also in accordance with [26-28] which found spinosad is most effective treatment for the management of brinjal shoot and fruit borer. In Sinha SR, and Nath V [29] also carried out an experiment to evaluate six insecticides viz. is deltamethrin/fipronil, bifenthrin, indoxacarb, carbosulfan, endosulfan and the three mixtures viz. triazophos + deltamethrin, profenophos + cypermethrin and chlorpyriphos + cypermethrin against the insect pests of brinjal and reported that deltamethrin @50 g a. i./ha or indoxacarb @70 g a. i./ha gave minimum damage against brinjal shoot and fruit borer. Patra et al. [21], Shridhara M et al. [30] were also recorded minimum shoot as well as fruit infestation of *L. orbonalis* with emamectin benzoate insecticidal treatments [31].

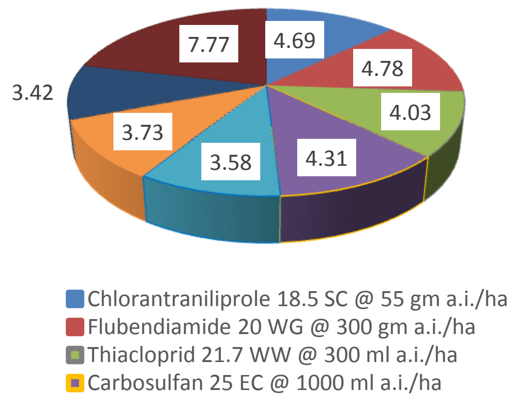

Fig. 1. Effect of newer insecticide on shoot infestation by shoot and fruit borer *Leucinodes orbonalis* (Guen.) in brinjal [6]

[6] *g a. i. (gram active ingredient)*

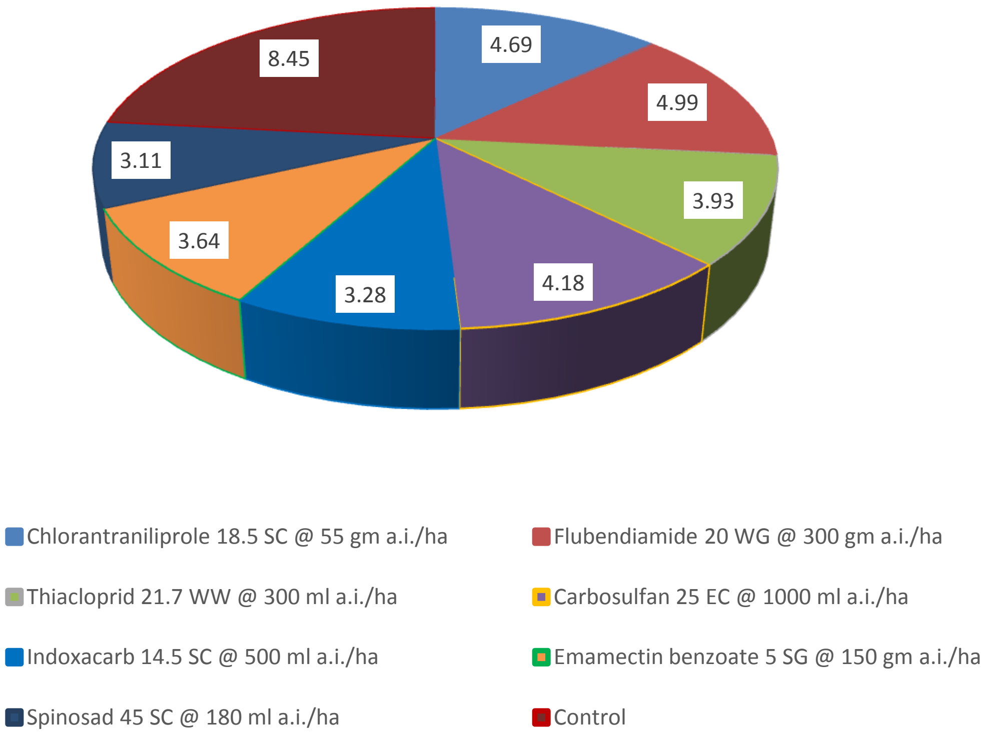

Fig. 2. Effect of newer insecticides on fruit infestation by shoot and fruit borer *Leucinodes orbonalis* (Guen.) in brinjal

Table 1. Effect of newer insecticides on shoot infestation by shoot and fruit borer *Leucinodes orbonalis* (Guen.)

Treatments	Percent shoot infestation days after spray							
	First spray				Second spray			
	One day before spray	1 DAS[7]	7 DAS	14 DAS	1 DAS	7 DAS	14 DAS	Mean (1 to 14 DAS)
Chlorantraniliprole 18.5 SC@ 55 g a. i./ha	7.50 (15.73)*	6.80 (14.87)	2.20 (8.31)	6.55 (14.52)	6.20 (14.26)	1.95 (7.85)	4.45 (11.87)	4.69 (12.18)
Flubendiamide 20 WG@ 300 g a. i./ha	6.60 (14.63)	6.25 (14.19)	2.65 (9.20)	6.35 (14.28)	6.10 (14.06)	2.30 (8.46)	5.00 (12.74)	4.78 (12.39)
Thiacloprid 21.7 W/W@ 300 ml a. i./ha	6.75 (14.80)	6.10 (13.97)	1.80 (7.42)	5.70 (13.56)	5.35 (13.17)	1.60 (6.96)	3.65 (10.60)	4.03 (11.24)
Carbosulfan 25 EC@ 1000 ml a. i./ha	6.80 (14.84)	6.20 (14.22)	2.10 (8.12)	6.00 (13.87)	5.75 (13.50)	1.90 (7.74)	3.90 (10.94)	4.31 (11.68)
Indoxacarb 14.5 SC@ 500 ml a. i./ha	7.05 (15.28)	5.70 (13.44)	1.20 (6.06)	5.35 (13.07)	4.95 (12.50)	1.00 (5.34)	3.30 (10.20)	3.58 (10.42)
Emamectin benzoate 5 SG@ 150 g a. i./ha	7.35 (15.58)	5.75 (13.53)	1.40 (6.67)	5.40 (13.15)	5.07 (12.82)	1.25 (5.98)	3.50 (10.50)	3.73 (10.72)
Spinosad 45 SC@ 180 ml a. i./ha	7.70 (15.94)	5.60 (13.30)	1.15 (5.97)	5.15 (12.79)	4.80 (12.28)	0.90 (4.91)	2.90 (9.40)	3.42 (10.14)
Control	6.55 (14.54)	6.95 (15.09)	7.45 (15.73)	7.70 (16.01)	7.95 (16.27)	8.20 (16.54)	8.35 (16.69)	7.77 (16.17)
SEm(±)	(1.78)	(2.18)	(0.64)	(2.05)	(0.68)	(0.86)	(0.32)	(0.52)
CD at 5%	(NS)	(NS)	(1.95)	(NS)	(2.08)	(2.65)	(0.97)	(1.50)

** Figures in parentheses are angular transformed values*

[7] *DAS (Days after spray)*

Table 2. Effect of newer insecticides on fruit infestation by shoot and fruit borer *Leucinodes orbonalis* (Guen.) in brinjal

Treatments	Percent fruit infestation days after spray							
	First spray				Second spray			
	One day before spray	1 DAS	7 DAS	14 DAS	1 DAS	7 DAS	14 DAS	Mean (1 to 14 DAS)
Chlorantraniliprole 18.5 SC@ 55 g a. i./ha	8.50 (16.85)	6.25 (14.31)	2.65 (9.07)	6.10 (14.15)	5.55 (13.43)	2.25 (8.38)	5.35 (13.15)	4.69 (12.29)
Flubendiamide 20 WG@ 300 g a. i./ha	8.45 (16.78)	6.55 (14.65)	2.90 (9.53)	6.15 (14.21)	5.75 (13.66)	2.70 (9.07)	5.90 (13.89)	4.99 (12.73)
Thiacloprid 21.7 W/W@300 ml a. i./ha	8.60 (16.95)	5.40 (13.22)	1.95 (7.68)	5.50 (13.36)	4.90 (12.56)	1.90 (7.67)	3.90 (11.06)	3.93 (11.18)
Carbosulfan 25 EC@1000 ml a. i./ha	8.45 (16.78)	5.60 (13.49)	2.15 (8.21)	5.90 (13.87)	5.10 (12.86)	2.00 (7.94)	4.30 (11.66)	4.18 (11.55)
Indoxacarb 14.5 SC@ 500 ml a. i./ha	9.45 (17.82)	5.10 (12.76)	1.40 (6.52)	4.55 (12.05)	3.80 (10.81)	1.30 (6.23)	3.50 (10.65)	3.28 (10.12)
Emamectin benzoate 5 SG@ 150 g a. i./ha	9.05 (17.43)	5.25 (13.03)	1.75 (7.31)	4.95 (12.60)	4.20 (11.53)	1.65 (7.18)	4.05 (11.33)	3.64 (10.75)
Spinosad 45 SC@ 180 ml a. i./ha	9.35 (17.72)	4.90 (12.51)	1.35 (6.38)	4.25 (11.64)	3.65 (10.58)	1.20 (5.92)	3.30 (10.21)	3.11 (9.85)
Control	8.10 (16.44)	8.25 (16.59)	8.00 (16.34)	8.25 (16.59)	8.45 (16.78)	8.75 (17.11)	9.00 (17.38)	8.45 (16.89)
SEm(±)[8]	(0.11)	(0.20)	(0.18)	(0.18)	(0.27)	(0.22)	(0.63)	(0.40)
CD[9] at 5%	(0.33)	(0.60)	(0.54)	(0.56)	(0.83)	(0.68)	(1.92)	(1.15)

[8] *SEm (Standard error of the mean)*
[9] *CD (Critical difference)*

5. CONCLUSION

It is concluded that spinosad 45 SC and indoxacarb 14.5 SC were the most effective treatments as they recorded lowest damage to shoots/fruits and registered higher yield of brinjal. The spinosad 45 SC and indoxacarb 14.5 SC were significantly reduced the shoot infestation with 3.42 and 3.58 percent and 3.11 and 3.28 percent fruits infestation, respectively. The management techniques based on use of newer insecticides may going to become more common in the future because of their effectiveness and more safer for the environment and natural enemies in comparison to harmful chemical pesticides that the Indian government and many countries currently banned due to high residual effect and long persistence on the environment. On a wide scale insect pest control may benefit greatly from the use of these more advanced pesticides in the coming years, protecting crops from production losses.

ACKNOWLEDGEMENTS

The authors are thankful to the Dean, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, M. P for providing necessary facilities and permission to conduct the study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Choudhary B. Vegetables. India: National Book Trust. 1970;25-50.
2. Pareet DJ. Bio-rational approaches for the management of brinjal shoot and fruit borer. M.Sc. (Agri.) [thesis]. Karnataka, India: University of Agricultural Sciences, Dharwad; 2006.
3. Yadav DK, Singh NN, Mishra VK, Singh SK. Bioefficacy of certain newer insecticides against brinjal shoot and fruit borer, (Leucinodes Orbona lis Guen.). J Entomol Res. 2015;39(1):25-30.
4. Harish DK, Agasimani AK, Imamsaheb SJ, Patil SS. Growth and yield parameters in brinjal as influenced by organic nutrient management and plant protection conditions. Res J Agric Sci. 2011;2(2): 221-5.
5. Sarsaiya V, Gangwar B, Kumar P, Ahirwar GK, Patel AK, Singh H. Cost benefit analysis of different bio-pesticides use in for control of brinjal shoot and fruit borer (*Leucinodes orbonalis*. Guenee) at Bundelkhand region (Uttar Pradesh). J Entomol Zool Stud. 2020;8(5):640-2. DOI: 10.22271/j.ento.2020.v8.i5i.7582.
6. Sohi GS. Pest of brinjal. Entomol Soc India, New Delhi. 1966;148.
7. Purohit ML, Khatri AK. Note on the chemical control of L. Orbona lis. (Lepidoptera; Pyralidae) on brinjal. Indian J Agric Sci. 1973;43:214-5.
8. Kuppuswamy S, Balasubramanian M. Efficacy of synthetic pyrethroids against brinjal fruit borer Leucinodes Orbona lis Guen. south Indian. Horticulture. 1980; 28:91-3.
9. Allam MA, Rao PK, Rao BHK. Chemical control of brinjal shoot and fruit borer Leucinodes Orbona lis (Guen) with newer insecticides. Entomon. 1982;7:133-35.
10. Sangma CD, Simon S, Nagar S. Pest control practices for the management of brinjal shoot and fruit borer (Leucinodes Orbona lis Guen.). J Pharmacogn Phytochem. 2019;8(3):4221-3.
11. Eswarareddy SG, Srinivas. Management of shoot and fruit borer (Leucinodes Orbona lis Guenee) in brinjal using botanicals/oils. Pestology. 2004;28: 50-2.
12. Chakraborti S, Sarkar P. Management of *Leucinodes orbonalis* Guenee on eggplants during the rainy season in India. J Plant Prot Res. 2011;51(4):325-8. DOI: 10.2478/v10045-011-0053-5
13. Jagginavar SB, Sunitha ND, Biradar AP. Bioefficacy of flubendiamide 480 SC against brinjal fruit and shoot borer (Leucinodes Orbona lis Guenee). Karnataka J Agric Sci. 2009;22(3):712-3.
14. Patil PD. Technique for mass rearing of the brinjal shoot and fruit borer, Leucinodes Orbona lis Guen. J Entomol Res. 1990; 14:164-72.
15. Lal OP, Sharma RK, Verma TS, Bhagchandani PM, Chandra J. Resistance in brinjal to shoot and fruit borer, Leucinodes Orbona lis Guenee (Pyralidae: Lepidoptera). Veg Sci. 1976;3:111-5.
16. Sasikala J, Rao PA, Krishnayya PV. Comparative efficacy of ecofriendly methods involving egg parasitoid, Trichogramma japonicum, mechanical control and safe chemical against Leucinodes Orbona lis Guenee

infesting brinjal. J Entomol Res. 1999; 23:369-72.

17. Jhala RC, Patel MG, Chanda AJ, Patel YC. Testing IPM strategy for Leucinodes Orbona lis in farmer's field. In: Subrahmanyam B, Ramamurthy VV, editors. Proceedings of the national symposium on frontiers of entomological research. 5-7 November. New Delhi. 2003; 256.
18. Singh DK, Yadava LP, Pati R, Gupta VK. Effect of insecticides in management of brinjal shoot and fruit borer (Leucinodes Orbona lis Guen.). Asian J Biol Sci. 2008;3:99-101.
19. Narayan HA, Zanwar PR, Vinay N, Shubash AS. Bioefficacy of novel insecticides against brinjal shoot and fruit borer, Leucinodes Orbona lis Guenee. J Entomol Zool Stud. 2019; 7(5):600-5.
20. Kumar A, Sachan SK, Kumar S, Kumar P. Efficacy of some novel insecticides against white fly (*Bemisia tabaci* Gennadius) in brinjal. J Entomol Zool Stud. 2017; 5(3):424-7.
21. Patra S, Chatterjee MI, Mondal S, Samanta A. Field evaluation of some new insecticides against brinjal shoot and fruit borer, Leucinodes Orbona lis (L.) Guen. Pestic Res J. 2009;21(1):58-60.
22. Sinha SR, Gupta RK, Gajbhiye VT, Nath V. Bioefficacy and persistence of indoxacarb on Solanum melongena. Ann Plant Prot Sci. 2010;18:278-80.
23. Sharma JH, Tayde AR. Evaluation of bio-rational pesticides, against brinjal fruit and shoot borer, Leucinodes Orbona lis Guen. O. Brinjal at Allahabad agroclimatic region. Int J Curr Microbiol Appl Sci. 2017; 6(6):2049-54.
DOI: 10.20546/ijcmas.2017.606.242
24. Khanal D, Pandey R, Dhakal R, Neupane N, Shrestha A, Nepali Joseph MN et al. Efficacy of bio-rational pesticides for the management of *Leucinodes orbonalis* Guenee in Rupandehi, Nepal. Heliyon. 2021;7(11):e08286.
DOI: 10.1016/j.heliyon.2021.e08286, PMID 34778578.
25. Sheojat BNKS, Dwivedi S, Kumar N, Naveen, Chand A. Efficacy and Economics of newer Insecticides for the Management of Brinjal Shoot and Fruit borer, Leucinodes orbona lis Guenee (Lepidoptera: Pyralidae) in the Gwalior region of Madhya Pradesh. Biological Forum – An International Journal. 2022; 14(2a):149-54.
26. Reshma M, Behera PK. Efficacy of some new insecticides against brinjal shoot and fruit borer Leucinodes Orbona lis Guenee. Int J Curr Microbiol Appl Sci. 2018; 7(5):1170-6.
DOI: 10.20546/ijcmas.2018.705.142
27. Khare KV, Sneha. Spinosad for control of brinjal shoot and fruit borer: Efficacy and economics. J Entomol Zool Stud. 2021; 9(1):1843-5.
28. Singh BK, Pandey R, Singh AK, Dwivedi SV. Efficacy of certain insecticides against brinjal shoot and fruit borer Leucinodes Orbona lis Guenee. Indian J Entomol. 2021;83(3):464-7.
DOI: 10.5958/0974-8172.2020.00207.2
29. Sinha SR, Vishwa N. Management of insect pests through insecticides and mixture in brinjal. Ann Plant Prot Sci. 2011;19:318-20.
30. Shridhara M, Hanchinal SG, Sreenivas AG, Hosamani AC, Nidagundi JM. Evaluation of newer insecticides for the management of brinjal shoot and fruit borer *Leucinodes orbonalis* (Guenee) (Lepidoptera: Crambidae). Int J Curr Microbiol Appl Sci. 2019;8(3):2582-92.
DOI: 10.20546/ijcmas.2019.803.306
31. Raja JB, Rajendran, Pappiah CM. Management of brinjal shoot and fruit borer (Leucinodes Orbona lis Guen.). Veg Sci. 1999;26: 167-9.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/94261