Original Research Article

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

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 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 (Choudhary B. 1970, Pareet DJ, 2006) or Indo-Burma region, and it is known to be grown in India since ancient times (Yadav *et al*. 2015). It is consumed by people in many countries viz., Central, South and South East Asia, some parts of

[1] SC (suspension concentrate)

[2] WG (Water-Dispersible Granule)

Africa and Central America also (Harish *et al*. 2011). 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 (Sarsaiya *et al*., 2020). 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 (Sohi, 1966). Among all insects shoot and fruit borer, *Leucinodes orbonalis* (Lepidoptera: Pyralidae) is the key pest throughout Asia (Purohit and Khatri 1973; Kuppuswamy and Bala subramanian, 1980; Allam *et al*., 1982). It is the most destructive pest attacking brinial throughout the crop development period (Sangma *et al*. 2019). Shoot and fruit borer damage occure all growing stages of brinjal (Eswara Reddy and Srinivas, 2004). The yield of brinjal crop decreases due to the shoot and fruit borer is to extend of 70-92% (Chakrabroti and Sarkar 2011 and Jagginavar *et al*., 2009). 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 (Patil, 1990). The pest has been reported to occure losses up to the tune of 41 percent in Himachal Pradesh (Lal *et al*., 1976), 20.7-60.0 percent in Tamil Nadu (Raja *et al*., 1990), 70 percent in Andhra Pradesh (Sasikala *et al*., 1999), 80 percent in Gujarat (Jhala *et al*., 2003). 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 (Singh *et al*., 2008). Even though control given by insecticides is one of the most common control measure for shoot and fruit borer (Narayan *et al*. 2019). 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 (Kumar A. *et al*. 2017). 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 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

[3] W/W (weight per weight) , [4] EC (emulsifiable concentrate),

[4] EC (emulsifiable concentrate)

[5] SG (Soluble granules)

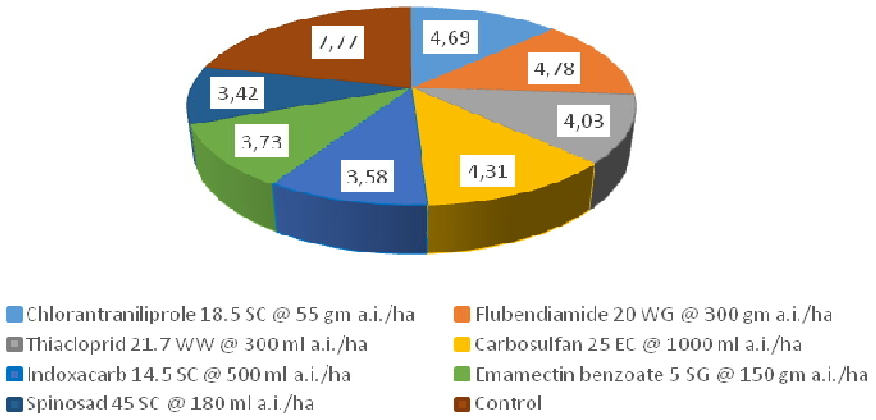
days interval. Data were subjected to statistical analysis after transformation of values. The count data were transformed, while percentages were transformed to angular values.

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).

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



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

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

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).

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

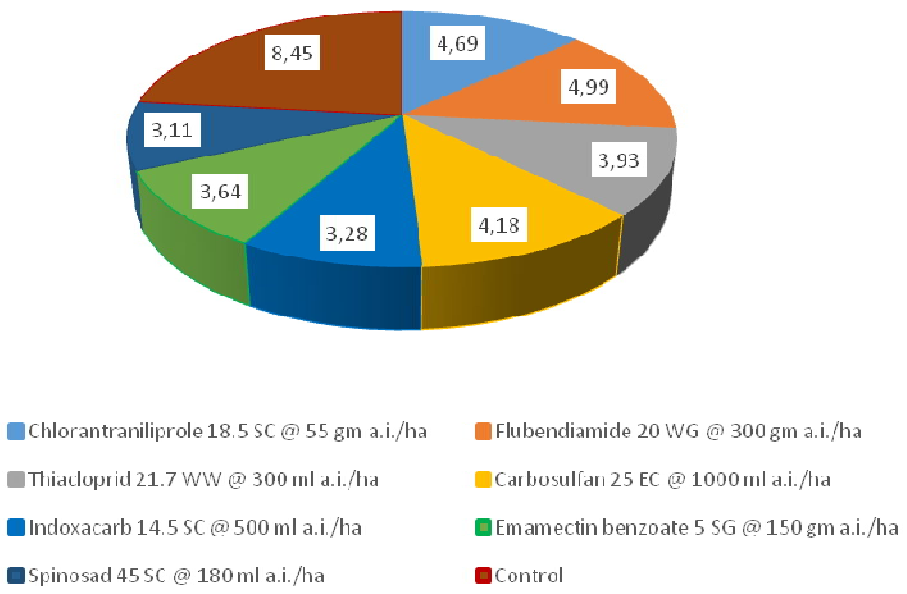


Table 1: Effect of newer insecticides on shoot infestation by shoot and fruit borer *Leucinodes orbonalis* (Guen.)

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)

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 (Patra S *et al.* 2009) 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%) (Sinha SR *et al*., 2010, Yadav DK *et al*. 2015, Sharma JH and Tayde AR 2017, Narayan HA *et al*. 2019, Khanal Deepak *et al*. 2021, Sheojat *et al.* 2022). Results are also in accordance with (Reshma M and Behera PK 2018, Khare, KV and Sneha 2021, Singh *et al.* 2021) which found spinosad is most effective treatment for the management of brinjal shoot and fruit borer. In 2011 Sinha SR, and Nath V. 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.* 2009, Shridhara M *et al.* 2019 were also recorded minimum shoot as well as fruit infestation of *L. orbonalis* with emamectin benzoate insecticidal treatments.

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 there 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.

6. References

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