International Journal of Environment and Climate Change

Volume 13, Issue 9, Page 2539-2544, 2023; Article no.IJECC.104194
ISSN: 2581-8627
(Past name: British Journal of Environment & Climate Change, Past ISSN: 2231–4784)

Comparative Efficacy of Selected Chemicals and Neem Oil against Okra Shoot and Fruit Borer [*Earias vittella* (Fabricius)] on Okra

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJECC/2023/v13i92488

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/104194

Original Research Article

Received: 24/05/2023
Accepted: 31/07/2023
Published: 01/08/2023

ABSTRACT

The field investigation was carried out in *Kharif* season of 2022 at Central Research Farm (CRF), Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India. The experiment was laid in Randomized Block Design with eight treatments each replicated thrice *viz.,* Emamectin benzoate 5% SG (5 g/lit), Lambda cyhalothrin 2.5% EC (0.5-1 ml/lit), Flubendiamide 480 SC (0.3 ml/lit), Imidacloprid 17.8% SL (1 ml/2.5 lit), Chlorantraniliprole 18.5% SC (0.5 ml/lit), Neem oil @2% (20 ml/lit), Spinosad 45% SC (0.3-0.4 ml/lit), and control plot. The result revealed that among all the treatments lowest percent shoot infestation and fruit infestation of okra shoot and fruit borer was recorded in Chlorantraniliprole 18.5% SC (13.90%), (13.11%) at both sprayers followed by Spinosad 45% SC (15.89%), (14.25%), Emamectin benzoate 5% SG (16.59%), (15.02%), Flubendiamide 480 SC (17.27%), (15.30%), Imidacloprid 17.8% SL (17.44%),

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(16.63%), Lambda cyhalothrin 2.5% EC (19.09%), (16.97%), Neem oil @2% (19.21%), (17.23%) and Control (30.87%), (25.44%). The highest yield and cost benefit ratio was recorded in Chlorantraniliprole 18.5% SC (158.33 q/ha), (1:6.1) followed by Spinosad 45% SC (153.33 q/ha), (1:5.4), Emamectin benzoate 5% SG (133.33 q/ha), (1:5.3), Flubendiamide 480 SC (116.66 q/ha), (1:4.7), Imidacloprid 17.8% SL (105 q/ha), (1:4.2), Lambda cyhalothrin 2.5% EC (83.33 q/ha), (1:3.3), Neem oil @2% (70 q/ha), (1:2.8) and Control plot (33.33 q/ha), (1:1.3).

Keywords: Okra; chemicals; cost benefit ratio; Earias vittella; insecticides.

1. INTRODUCTION

"Okra or Lady's finger, *Abelmoschus esculentus* (L.) Monech is an annual vegetable belonging to the malvaceae family; it originated from Africa and grown worldwide in summer as well as rainy season. Okra is commercially grown in various countries, including India, Turkey, Iran, Western Africa, Yugoslavia, Bangladesh, Afghanistan, Burma, Japan, Malaysia, Brazil, Ghana, Ethiopia, and the Southern United States. The fruit is harvested while still immature and is consumed as a vegetable. Okra lends itself to diverse cooking methods. Additionally, its roots and stems are utilized for cleaning cane juice, a process involved in the preparation of jaggery or brown sugar" [1].

"India leads globally in okra production with 5794.0 thousand tons (72% of total world production) from an area of 564.0 thousand hectares, achieving a productivity of 12.9 million tons/ha. Andhra Pradesh is the top-producing state with 884.2 thousand tons from 78.90 thousand ha at 15 tons/ha productivity. West Bengal follows with 862.1 thousand tons from 74.00 thousand ha at 11.70 tons/ha productivity. Uttar Pradesh's okra production is 176.26 thousand tons from 48.6 thousand ha at 8 tons/ha productivity" [2].

20 different insect species are known to attack okra which inflict qualitative and quantitative production losses of the crop. Among them fruit and shoot borer act as major constraint in achieving potential yield and recording up to 69% reduction in yield of crop [3].

Earias vittella is a significant pest that inflicts considerable damage to okra crops, accounting for 57.1% fruit infestation and resulting in a substantial 54.04% net yield loss. The damage caused by this pest occurs through two primary mechanisms. First, caterpillars bore into the terminal portion of the growing shoots, creating tunnels as they move downwards. This leads to drooping or drying up of the shoots. Second, the larvae penetrate the fruits by creating holes, making them unsuitable for human consumption. It is estimated that this pest can cause a substantial 36-90% reduction in the fruit yield of okra [4].

In certain regions of South East Asian countries, OSFB (Okra Shoot and Fruit Borer) has been reported to cause damage to okra fruit up to 40-50% by [5]. Similarly, Krishnaiah [6] observed fruit borer attacks affecting approximately 35% of harvestable okra fruit.

2. MATERIALS AND METHODS

The experiment was conducted during *kharif* season 2022 at Central Research Farm (CRF), SHUATS, Prayagraj, Uttar Pradesh, India, in a Randomized Block Design with eight treatments replicated three times using variety kasturi in a plot size of (2m×1m) at a spacing of (45×30cm) with a recommended package of practices excluding plant protection. The soil of the experimental site is well drained and medium high. Research field is situated at an Altitude of 98 meters above sea level at 25.27° North Latitude and 80.50° E Longitudes. The treatments used in experiment are *viz.,* Emamectin benzoate 5% SG (5 g/lit), Lambda cyhalothrin 2.5% EC (0.5-1 ml/lit), Flubendiamide 480 SC (0.3 ml/lit), Imidacloprid 17.8% SL (1 ml/2.5 lit), Chlorantraniliprole 18.5% SC (0.5 ml/lit), Neem oil @2% (20 ml/lit), Spinosad 45% SC (0.3-0.4 ml/lit) and Control.

Five randomly selected plants per plot were tagged. Initial counts of infested and total shoots were taken before treatment. Subsequently, counts were repeated on the 3rd, 7th, and 14th days after treatment. Data was then converted to percentage shoot infestation using a specific formula. Similar observations were made for fruit infestation, and percentage calculations were performed accordingly [7].

$$\% \text{ Shoot infestation} = \frac{\text{Number of infested shoots}}{\text{Number of total shoots}} \times 100$$

$$\% \text{ Fruit infestation} = \frac{\text{Number of infested fruits}}{\text{Number of total fruits}} \times 100$$

Ultimately, the cost benefit ratio was calculated on the basis of prevailing market price of okra, insecticides and spraying cost.

$$\text{B: C Ratio} = \frac{\text{Gross return}}{\text{Total cost of cultivation}}$$

3. RESULTS AND DISCUSSION

The results (Table 1) after 1st and 2nd spray revealed that all the treatments were significantly superior over the control in managing the pest infestation of *Earias vittella* in okra. The data on the percent infestation of *E. vittella* in okra after first spray revealed that the overall mean of 3rd, 7th and 14th lowest per cent shoot infestation was recorded in Chlorantraniliprole 18.5% SC (13.90%) followed by Spinosad 45% SC (15.89%), Emamectin benzoate 5% SG (16.59%), Flubendiamide 480 SC (17.27%), Imidacloprid 17.8% SL (17.44%), Lambda cyhalothrin 2.5% EC (19.09%) Neem oil @2% (19.21%). The treatment Chlorantraniliprole 18.5% SC (13.90%) was most effective among all the treatments and is significantly superior over the control plot (30.87%) infestation.

Among all the treatments the overall mean of 3rd, 7th and 14th lowest per cent fruit infestation after second spray was recorded in Chlorantraniliprole 18.5% SC (13.11%) followed by Spinosad 45% SC (14.25%), Emamectin benzoate 5% SG (15.02%), Flubendiamide 480 SC (15.30 %), Imidacloprid 17.8% SL (16.63%), Lambda cyhalothrin 2.5% EC (16.97%) and Neem oil @2% (17.23%). The treatment Chlorantraniliprole 18.5% SC (13.11%) was most effective among all the treatments and significantly superior over the control plot (25.44%) infestation.

The crop yield and cost benefit ratio ranged between (33.33 q/ha to 158.33 q/ha), (1:6.1 to 1:1.3) the highest being in Chlorantraniliprole 18.5% SC (158.33 q/ha), (1:6.1) followed by Spinosad 45% SC (153.33 q/ha), (1:5.4), Emamectin benzoate 5% SG (133.33 q/ha), (1:5.3), Flubendiamide 480 SC (116.66 q/ha), (1:4.7), Imidacloprid 17.8% SL (105 q/ha), (1:4.2), Lambda cyhalothrin 2.5% EC (83.33 q/ha), (1:3.3), Neem oil @2% (70 q/ha), (1:2.8) and Control plot (33.33 q/ha), (1:1.3).

The observations obtained in the first and second spray in Chlorantraniliprole were (13.90%) and (13.11%). These results are supported by Chandran et al. [8], Naidu and Kumar [9] and Reddy et al. [10]. Spinosad 45% SC was also found to be very effective in reducing the infestation of shoot and fruit borer (15.89%), (14.25%). The same results were observed by Chandar et al. [11] and Kaveri and Kumar [12]. Emamectin benzoate 5% SG on shoot and fruit borer in first and second spray were (16.59%) and (15.02%) respectively. These results are as per the findings of Manikanta and Kumar [7] and Javed et al. [13]. Yield data was collected based on the healthy fruits harvested at each picking. The cost-benefit ratio was then calculated using the prevailing market prices of okra, insecticides and spraying expenses. The cost benefit ratio ranged between (1:6.1) and (1:1.3). Maximum cost benefit ratio and yield (1:6.1), (158.33 q/ha) was obtained in chlorantraniliprole which is supported by Chandran et al*.* [8] and Reddy et al. [10]. The cost benefit ratio and yield of Spinosad was (1:5.4), (153.33q/ha) and the results were similar to the findings of Chandar et al. [11] and Kaveri and Kumar [12]. Emamectin benzoate also had a profitable yield of (133.33 q/ha) and cost benefit ratio (1:5.3) according to Javed et al. [13] and Manikanta and Kumar [7], [14,15].

Table 1. Efficacy of selected chemicals and neem oil against okra shoot and fruit borer [*Earias vittella* (Fabricius)] on okra

S.No	Treatments	Doses	Percent shoot and fruit infestation of *Earias vittella*										Yield	C:B ratio
			First spray (Shoot infestation)					Second spray (Fruit infestation)						
			1DBS	3 DAS	7 DAS	14 DAS	Mean	1DBS	3 DAS	7 DAS	14 DAS	Mean		
T_0	Control	____	27.40	29.31^{c}	30.71^{cd}	32.60^{bc}	30.87^{c}	22.52^{bc}	23.61^{de}	25.50^{c}	27.22^{cd}	25.44^{ef}	33.33	1:1.3
T_1	Emamectin benzoate 5% SG	5 g/lit	23.08	17.49^{a}	15.14^{a}	17.14^{a}	16.59^{a}	18.31^{a}	16.13^{a}	13.63^{a}	15.32^{a}	15.02^{a}	133.33	1:5.3
T_2	Lambda cyhalothrin 2.5% EC	0.5-1 ml/lit	25.52	20.63^{bc}	17.86^{bcd}	18.79^{bc}	19.09^{c}	20.64^{bc}	18.40^{cde}	15.44^{bc}	17.07^{bcd}	16.97^{de}	83.33	1:3.3
T_3	Flubendiamide 480 SC	0.3 ml/lit	24.47	18.17^{b}	15.88^{b}	17.77^{b}	17.27^{b}	18.58^{abc}	16.50^{bc}	14.02^{b}	15.38^{bc}	15.30^{bc}	116.66	1:4.7
T_4	Imidacloprid 17.8% SL	1 ml/2.5 lit	25.38	18.37^{bc}	16.13^{bcd}	17.83^{b}	17.44^{c}	20.52^{bc}	18.29^{bcd}	15.18^{bc}	16.43^{bcd}	16.63^{cde}	105	1:4.2
T_5	Chlorantraniliprole 18.5% SC	0.5 ml/lit	19.40	14.84^{bc}	13.03^{bc}	13.83^{b}	13.90^{c}	17.78^{abc}	14.14^{bc}	11.86^{b}	13.34^{bc}	13.11^{bcd}	158.33	1:6.1
T_6	Neem oil @2%	20 ml/lit	27.00	20.76^{c}	17.96^{d}	18.91^{c}	19.21^{d}	20.78^{c}	18.51^{e}	15.46^{c}	17.74^{d}	17.23^{f}	70.00	1:2.8
T_7	Spinosad 45% SC	0.3-0.4 ml/lit	21.04	16.94^{b}	14.73^{b}	16.02^{b}	15.89^{b}	18.00^{ab}	15.01^{b}	12.95^{b}	14.81^{b}	14.25^{b}	153.33	1:5.4
	F- test		NS	S	S	S	S	S	S	S	S	S		
	CD.at 0.05%		____	3.63	3.10	3.83	2.93	2.29	2.29	2.15	2.62	2.11		
	S. Ed. ($\pm$)		____	1.69	1.44	1.78	1.62	1.37	1.06	1.006	1.22	1.17		

DBS- Day Before Spraying, DAS- Day After Spraying

4. CONCLUSION

From the present study, the results showed that chlorantraniliprole 18.5% sc (t5), is most effective treatment against okra fruit and shoot infestation and producing maximum yield and recorded the highest cost-benefit ratio compared to other treatments. While spinosad 45% sc (t7), emamectin benzoate 5% sg (t1), flubendiamide 480 sc (t3) and imidacloprid 17.8% sl (t4) have shown average results. Lambda cyhalothrin 2.5% ec (t2) and neem oil @2% (t6) found to be least effective in managing *earias vittella*. Therefore, it is recommended to alternate the use of effective insecticides in coordination with existing integrated pest management (ipm) programs. This approach helps prevent issues related to insecticidal resistance and pest resurgence. Botanicals play a crucial role in ipm by mitigating the indiscriminate use of pesticides, which can lead to environmental pollution, while also posing minimal harm to beneficial insects.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/104194