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Comparative Efficacy of Insecticides, NSKE and Karanj Oil against 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.

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ABSTRACT

A field trail was conducted at Central Research Farm, SHUATS, Naini, Prayagraj, U.P. during *kharif* season of 2021. The field was laid in Randomised block Design with seven treatments replicated thrice *viz.,* Neem oil 3%, Indoxacarb 14.5% SC, Lambda cyhalothrin 5% EC, NSKE 5%, Emamectin benzoate 5SG, Karanj oil 2%, Flubendiamide 480 SC along with control plot. The results after first and second spray revealed that among the different treatments, Emamectin benzoate 5SG (10.82% and 11.64%) recorded lowest percent infestation of *Earias vittella* followed by Flubendiamide 480 SC (15.92% and 17.25%), Indoxacarb 14.5SC (17.06% and 18.45%), Lambda cyhalothrin 5% EC (18.13% and 18.52%), Neem oil 3% (20.44% and 20.69%), NSKE 5% (21.44% and 21.12%) and Karanj oil 2% (24.16% and 23.61) was the least effective among all treatments with percent shoot and fruit infestation respectively. Among all treatments studied, the best and most economical treatment was Emamectin benzoate 5SG (1:5.60), Flubendiamide 480 SC (1:5.44), Indoxacarb 14.5SC (1:5.33), Lambda cyhalothrin 5% EC (1:5.08) followed by Neem oil 3% (1:4.89), NSKE 5% (1:4.81) and the least cost benefit ratio was observed in Karanj oil 2% (1:4.66) when compared to control plot (1:2.82).

Keywords: Botanicals; Earias vittella; Emamectin benzoate; flubendiamude; Karanj oil; NSKE; okra.

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1. INTRODUCTION

"Okra (*Abelmoschus esculentus* L.) belongs to family Malvaceae, which is locally known as Bhendi and Lady's finger worldwide. It is very popular summer vegetable for home gardening while it is also grown commercially throughout the world especially in Indo-Pakistan sub-continent. It is probably originated in Ethiopian region of Africa and is one of the most common and popular vegetable grown in tropical and subtropical regions in India" [1].

"Okra fruits are considered as good source of protein besides carbohydrates, minerals and fats. Its fruits and fibre from stall are used in paper industry. The nutritive value of okra/100 g of edible portion contains carbohydrates (1.5%), protein (2.0 g), total fat (0.1 g), dietary fibre(9%), folates (88mcg), niacin (1.00mg), pantothenic acid (0.245mg), riboflavin (0.060 mg).thiamine (0.200 mg), vitamin C (21.1 mg), vitamin A (375 IU), vitamin E (0.36 mg), vitamin K (53 mcg), sodium (8 mg), potassium (303 mg), calcium (81 mg), copper (0.094 mg), iron(0.80 mg), magnesium (57 mg), phosphorus (63 mg), selenium (0.7 mcg), zinc (0.60 mg).carotene (225 mcg) and lutein and zeaxanthin (516 mcg)" [2].

"Globally India ranks first in okra production of around 5794.0 thousand tonnes (72% of total world production) having area of 564.0 thousand hectares with an annual production of 6371 thousand million tonnes and productivity of 12.9 million tonnes/ha. Andhra Pradesh is the leading okra producing state which has production of around 884.2 thousand tonnes from an area of 79.90 thousand hectares, with a productivity of 15 tonnes/ha" [3].

Kamble et al. [4] reported "shoot and fruit borer infestation on okra as 32.14 percent on number basis and 31.31 percent on weight basis. The adult female of okra shoot and fruit borer, *Earias vitella* lays eggs individually on leaves, floral buds and on tender fruits. Small brown caterpillars bore into the top shoot and feeds inside the shoot before fruit formation and the shoot will become wilted and dry. A larva attacks a number of stems and pods one after another.

"Okra is grown during summer and Kharif seasons. Among insect pests infesting okra, shoot and fruit borer [*Earias vittella* (Fabricius)] is one of the serious pests causing 40-50 per cent damage to okra fruits during both seasons" [5].

Farmers rely solely on the chemical insecticides for the management of insect pests of okra because of their easy adaptability, immediate and spectacular knockdown effects. But, as okra is a vegetable crop and harvesting of fruit is done at regular short intervals, safer and effective insecticides are needed for controlling. But due to the unconscious and unjustified use of synthetic pesticides create several problems in agro-ecosystem such as direct toxicity to beneficial insects, fishes, and man. Also, a number of previous studies on the sustainable management of insect pests on okra ecosystem through IPM technologies based on the intensive use of botanicals along with other environmentally safer insecticides considerable success in mitigating the insect pests damage, reduction in the pesticide usage and restoration of ecological balance.

1.1 Objectives

1. To evaluate the effect of certain insecticides, NSKE and karanj oil on percent incidence of shoot and fruit borer, *Earias vittella* (Fabricius.) on okra.
2. To Calculate Cost – Benefit Cost ratio [B: C ratio] of treatments.

2. MATERIALS AND METHODS

The experiment was conducted during kharif season 2021 at Central Research Farm, SHUATS, Naini, Prayagraj, Uttar Pradesh, India, in a Randomized Block Design with seven treatments along with controlled plot replicated three times using variety Kasturi in a plot size of (2mx2m) at a spacing of (45x30cm) with a recommended package of practices excluding plant protection. The soil of the experimental site was well drained and medium high. The climate of the experimental site is sub-tropical characterized by normal rainfall. Research field is situated at an elevation of 98 meters above sea level at 25°87" North latitude and 80°05" East longitudes. The extremes of both summer and winter are experienced while the minimum temperature in winter was 4°C and the maximum temperature reaches up to 45°C in summer.

"The observations on infestation of *Earias vitella* were recorded visually per plant from five randomly selected plants and tagged plants in each plot. The insecticides were sprayed at recommended doses when percent infestation reaches ETL (5% of shoot damage and 10% fruit damage) level" Shirale et al*.* [6]. Number of infested shoots and fruits from 5 randomly selected plants per plot was counted and recorded at weekly interval after careful examination on the presence of borer and excreta at both vegetative and reproductive stage, which was further converted into percent infestation. Observations were recorded on the number of infested shoots and fruits in each plot a day on 3^{rd}, 7^{th} and 14th days after spraying on selected plants in a plot.

The following insecticides used in this field trail are Neem oil 3% @3ml/L, Indoxacarb 14.5% SC @0.25ml/L, Lambda cyhalothrin 5% EC @0.5ml/L, NSKE 5% @5ml/L, Emamectin benzoate 5SG @5gm/L, Karanj oil 2% @2ml/L, Flubendiamide 480 SC @0.25ml/L along with control plot. The basal application of fertilizers was done manually and insecticides were applied with the help of knapsack sprayer by considering ETL level for making spray decisions.

The healthy marketable yield obtained from different treatments was collected separately and weighed. The cost of insecticides used in this experiment was recorded during season of 2020-2021. The cost of botanicals used was obtained from nearby market. The total cost of plant protection consisted of cost of treatments, sprayer rent and labour charges for the spray. There were two sprays throughout the research period and the overall plant protection expenses were calculated. Total income was realized by multiplying the total yield per hectare by the prevailing market price, while the net benefit is obtained by subtracting the total cost of plant protection from total income. Benefit over the control for each sprayed treatment was obtained by subtracting the income of the control treatment from that of each sprayed treatment.

2.1 Data Analysis

Percent Shoot Infestation:

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

Percent Fruit Infestation:

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

Benefit cost ratio:

$$\text{B: C Ratio} = \frac{\text{Gross returns}}{\text{Total cost incurred}}$$

3. RESULTS AND DISCUSSION

Efficacy of different insecticides on the percent infestation of okra shoot and fruit borer showed that all the treatments were significantly superior in reducing the infestation of shoot and fruit borer resulting in increasing the yield, significantly as compared to control. On third day after first spray lowest percent infestation of 8.77 was recorded in Emamectin benzoate 5SG followed by Flubendiamide 480 SC (15.18) and Indoxacarb 14.5SC (15.39) treated plots, respective that differed significantly with other treatment plots but statistically at par with each other. The lowest percent infestation was recorded in Emamectin benzoate 5SG (10.64 and 13.06) treated plots followed by Flubendiamide 480 SC (15.84 and 16.72) and Indoxacarb 14.5SC (16.77 and 19.02) respectively on 7^{th} and 14^{th} day after first spray (Table 1).

Emamectin benzoate 5SG treated plots recorded lowest percent infestation in all observations on 3^{rd}, 7^{th} and 14^{th} day after second spray with 10.53, 12 and 12.4 followed by Flubendiamide 480 SC (16.33, 16.77 and 18.64). These results are supported by Sandip et al. [7] and Dhaka et al. [8], reported that Emamectin benzoate 5SG proved superior over other insecticides in reducing percent infestation of okra shoot and fruit borer. Ameta et al. [9] found Flubendiamide 480 SC as the most effective treatment.

The yields among the treatments were significant. The highest yield was recorded in Emamectin benzoate 5SG (138.5 q/ha), followed by Flubendiamide 480 SC (135.6 q/ha), Indoxacarb 14.5SC (132.84 ha), Lambda cyhalothrin 5% EC (124.9 q/ha), Neem oil 3% (121.7q/ha), NSKE 5% (118.3 q/ha) and Karanj oil 2% (109.2 q/ha) as compared to control plot (67q/ha). These findings are supported by Govindan et al. [10], Nilam and Patel [11], and Mahata et al. [12]. Among the treatments studied, the best and most economical treatment was Emamectin benzoate 5SG (1:5.60), followed by Flubendiamide 480 SC (1:5.44), Indoxacarb 14.5SC (1:5.33), Lambda cyhalothrin 5% EC (1:5.08), Neem oil 3% (1:4.89), NSKE 5% (1:4.81) and Karanj oil 2% (1:4.66) as compared to control plot (1:2.82). These findings are supported by Shridhara et al. [13], Jat and Ameta [14] and Lal et al. [15].

Table 1. Efficacy of insecticides, NSKE and karanj oil on percent shoot and fruit infestation of shoot and fruit borer on okra

S. No.	Treatments	Percent shoot and fruit infestation of shoot and fruit borer on okra						Yield (q/ha)	B:C Ratio
		First spray			Second spray				
		3 DAS	7 DAS	14 DAS	3 DAS	7 DAS	14 DAS		
T_1	Neem oil 3%	21.05^{b}	19.42^{cd}	20.84^{cd}	21.61^{b}	19.93^{bc}	20.52^{cd}	121.7	1:4.89
T_2	Indoxacarb 14.5% SC	15.39^{c}	16.77^{de}	19.02^{de}	17.00^{c}	19.14^{cd}	19.21^{d}	132.8	1:5.33
T_3	Lambda cyhalothrin 5% EC	17.6^{c}	18.36^{cde}	18.43^{de}	18.03^{c}	18.09^{cd}	19.45^{cd}	124.9	1:5.08
T_4	NSKE 5%	21.29^{b}	19.78^{c}	23.24^{bc}	21.69^{b}	19.98^{bc}	21.7^{c}	118.3	1:4.81
T_5	Emamectin Benzoate 5% SG	8.77^{d}	10.64^{f}	13.06^{f}	10.53^{d}	12.00^{e}	12.4^{e}	138.5	1:5.60
T_6	Karanj oil %	23.86^{ab}	23.63^{b}	25.00^{b}	23.82^{b}	22.45^{b}	24.55^{b}	109.2	1:4.66
T_7	Flubendiamide 480 SC	15.18^{c}	15.84^{e}	16.72^{e}	16.33^{c}	16.77^{d}	18.64^{d}	135.6	1:5.44
T_0	Control	25.91^{a}	28.27^{a}	29.27^{a}	33.36^{a}	34.6^{a}	36.82^{a}	67	1:2.82
	F-test	S	S	S	S	S	S	…..	…..
	S. Ed (±)	1.03	0.91	0.94	1.16	0.87	0.79	…..	…..
	C.D. (P = 0.5)	3.13	2.75	2.84	3.53	2.65	2.41	…..	…..

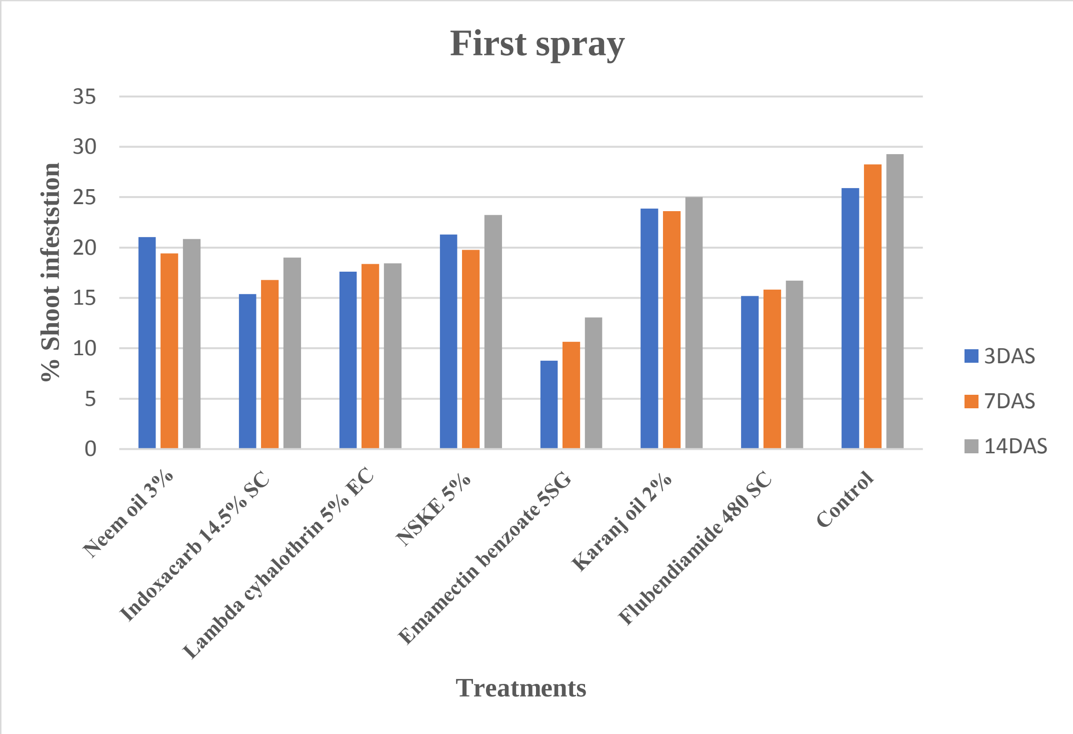

Fig. 1. Efficacy of insecticides, NSKE and karanj oil on percent infeststion of shoot and fruit borer, *Earias vittella* on okra (First spray)

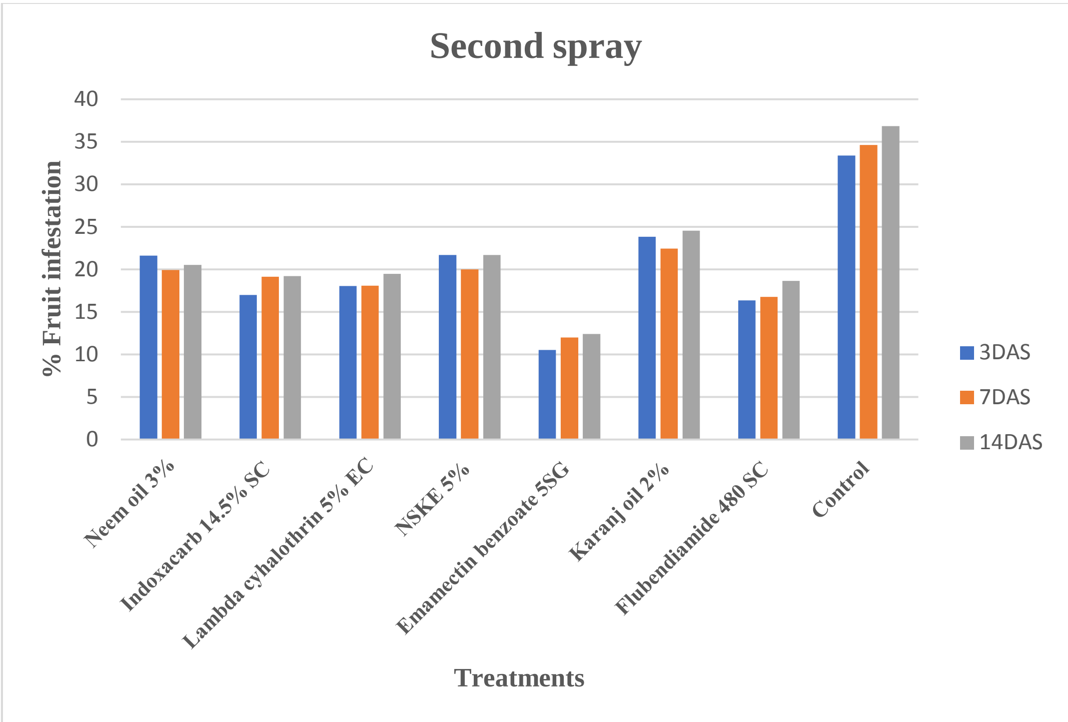

Fig. 2. Efficacy of insecticides, NSKE and karanj oil on percent infeststion of shoot and fruit borer, *Earias vittella* on okra (Second spray)

4. CONCLUSION

From the critical analysis of the present findings, it can be concluded that, among all the treatments Emamectin benzoate 5SG is more effective in controlling per cent infestation by okra shoot and fruit borer followed by Flubendiamide 480 SC, Indoxacarb 14.5SC, Lambda cyhalothrin 5% EC, Neem oil 3%, Neem Seed Kernel Extract (NSKE5%), Karanj oil 2% in managing *Earias vittella*. Among the treatments studied, Emamectin benzoate 5SG gave the highest cost benefit ratio (1:5.60) and marketing yield (138.5 q/ha) followed by Flubendiamide 480 SC (1:5.44 and 135.6 q/ha), Indoxacarb 14.5SC (1:5.33 and 132.8q/ha), Lambda cyhalothrin 5% EC (1:5.08 and 124.9 q/ha), Neem oil 3% (1:4.89 and 121.7 q/ha), NSKE 5% (1:4.81 and 118.3 q/ha) and Karanj oil 2% (1:4.66 and 109.2 q/ha) respectively as such more trials are required in future to validate the findings. Therefore, botanicals may be useful in devising proper IPM strategy as an effective tool against okra shoot and fruit borer.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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