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Komarasani Neelima
Department of Entomology,
Naini Agricultural Institute,
Sam Higginbottom University of
Agriculture, Technology and
Sciences, Prayagraj,
Uttar Pradesh, India

Amol Kakde
Department of Entomology,
Naini Agricultural Institute,
Sam Higginbottom University of
Agriculture, Technology and
Sciences, Prayagraj,
Uttar Pradesh, India

Sasya Thakur
Department of Entomology,
Naini Agricultural Institute,
Sam Higginbottom University of
Agriculture, Technology and
Sciences, Prayagraj,
Uttar Pradesh, India

U Venugopal
Department of Entomology,
University of Agricultural
Sciences, Bengaluru, Karnataka,
India

Corresponding Author
Komarasani Neelima
Department of Entomology,
Naini Agricultural Institute,
Sam Higginbottom University of
Agriculture, Technology and
Sciences, Prayagraj,
Uttar Pradesh, India

Efficacy of selected botanicals against shoot and fruit borer (*Earias vittela* Fab.) on okra [*Abelmoschus esculentus* (L.) Moench]

Komarasani Neelima, Amol Kakde, Sasya Thakur and U Venugopal

Abstract

Shoot and fruit borer (*Earias vittela* Fab.) is a economically important insect pest of okra to manage this pest indiscriminate use of insecticides its leads to high pest residues in crop, environmental pollution and high cost of cultivation and lower net returns. In this view, the present study eight botanical extracts i.e., papaya leaf extract 10%, jatropha leaf extract 5%, marigold leaf extract, onion bulb extract 5%, neem oil 3%, tobacco leaf extract 5%, cypermethrin 25 EC 2% against *E. vittela* and compared by measuring fruits and shoot infestation and cost-benefit ratio. Results revealed that the shoot and fruit infestation was significant lowest at cypermethrin 2% (9.67%, 11.25%) followed by neem oil 3% (10.74, 12.21), jatropha leaf extract 5% (11.98%, 14.20%), papaya leaf extract 10% (12.85%, 14.89%), onion bulb extract 3% and marigold leaf extract 5% were least effective botanicals (20.39%, 20.60%), (14.22%, 16.02%) compared with untreated control (24.39%, 23.72%). Benefit cost ratio was recorded highest in cypermethrin 2% (1:2.90, 98.88 q/ha), (treated as check) followed by neem oil 3% (1:2.68, 90.53 q/ha), tobacco leaf extract 5% (1:2.44, 86.33 q/ha), jatropha leaf extract 5% (1:2.46, 82.38 q/ha), papaya leaf extract 10% (1:2.29, 77.52 q/ha), onion bulb extract 3% (1:2.05, 68.70 q/ha), marigold leaf extract 5% (1:1.62, 54.21 q/ha) and untreated control (1:1.35, 43.78 q/ha) respectively. The results indicated that neem oil 3% helpful for managing the shoot and fruit borer.

Keywords: okra shoot and fruit borer pest, *E. vittela*, botanicals extracts and percentage of infestation

Introduction

Okra [*Abelmoschus esculentus* (L.) Moench] is most popular vegetable of the family Malvaceae which is commonly known as Bhendi and Lady's finger. In India, it grown both in summer and rainy seasons. It widely cultivated as a summer crop in North India and also as a winter crop in Gujarat, Andhra Pradesh, Karnataka and Tamil Nadu [3].

The importance of vegetable in human diet is well known since time immemorial as they supply all main component of human diet. It has good nutritional value, particularly the high content of vitamin C, vitamin A and B, Calcium, Iron and other minerals like magnesium and potassium, fats and carbohydrates [9].

The shoot and fruit borer, *Earias vittela* Fab. (Lepidoptera: Noctuidae) is an important insect pest of okra [*Abelmoschus esculentus* (L.) Moench]. In the larval stage, they bore into the growing shoots, the flowers buds, flowers and fruits of okra. The full-grown larva is brownish white a white median longitudinal strip and without finger shaped, forewings are green with white strike in each wing [7].

In India, okra occupies an area of 4.09 lac/ha with production of 41.92 lac MT/ha and productivity of 10.3 MT/ha. The use of alternative methods is not new and poor farmers have used it for many years. However, they remained largely untapped by high input agricultural concepts "Green Revolution" due to the introduction of broad spectrum synthetic pesticides. It is only since middle of the 80,s that the use of alternative plant protection methods and natural pesticides has been more widely appreciated-although still not widely enough. Okra is grown for immature fruits which are used as vegetables and mature fruits for seeds purpose it is attacked by a number of insect pests during different stages of its growth a wide range of recommended chemical insecticides are being used by the farmers for preventing losses caused by the pest but okra being a vegetable crop harvested every alternate day the residues of insecticides ought not to remain in the edible part use of chemical pesticides has been the most potent method of controlling the pests but excessive and indiscriminate use of these chemical lead to resistance in pests detrimental effects on beneficial insects health hazards and environmental pollution [10].

Due to unconscious and unjustified use of synthetic pesticide create several problems in agro-ecosystem such as direct toxicity to beneficial insects humans therefore there is an urgent need for safe and effective biodegradable pesticide with less toxic effects on non-target organisms the biologically active natural plant products may play a significant role in this regard botanical insecticide are broad spectrum in pest management and may are safe to apply unique in action and can easily be processed and used.

2. Materials and Methods

2.1 Land preparation and transplanting

The experiment was conducted during *kharif* season 2018 at central research farm, SHUATS, Naini, Prayagraj, Uttar Pradesh against shoot and fruit borer.

The land was cleared stubbles and weeds was picked up from the field. Ploughing and harrowing was carried out once during land preparation. Before sowing the land was leveled with the help of rake and the plots were demarcated. The eight treatments were laid out in the Randomized Block Design (RBD) with three replications. Seeds of okra variety Nayan-11 were sown on 22nd August 2018. The planting distance was 60 cm between row to row and 45 cm between plant to plant. Gap filling was done earlier after 20 days of sowing for the plants to attain the uniform maturity. Weeding was done 20, 40, 60 days after sowing. Irrigation is done whenever it necessary.

2.2 Preparation of extract

Leaves and bulbs were collected and shade - dried and were ground with a domestic grinder. Known quantity of well powdered leaf material was soaked in one-third of water and kept overnight. Stirring was done frequently. Then the material was filtered through a clean muslin cloth and the clear filtrate was mixed with the remaining two-third portion of water volume was made up to 1L.

2.3 Spraying procedure

The spraying was done with the help of knap-sac sprayer. The plots were sprayed as per treatments. The equipment was washed carefully after application of each treatment and curtains were placed between the plots to avoid drifting of spray particles to adjacent plots. In all, two sprays were applied during the investigation period.

The first spray was applied as soon as the pest level crossed the ETL i.e. 2-3 larvae per plant the second spray was given after 10 days respectively. All the respective spray fluids were sprayed thoroughly to cover each plant in every treatment

2.4 Data collection

The observations were recorded from the five randomly selected plants and recorded the incidence of the shoot and fruit borer one day before spray and 3, 7, 14 days after spraying. The percent shoot and fruit damage was computed by using formula (number basis).

$$\text{Percent shoot damage} = \frac{\text{Number of infested shoots}}{\text{Total number of shoots}} \times 100$$

$$\text{Percent fruit damage} = \frac{\text{Number of damaged fruits}}{\text{Total number of fruits}} \times 100$$

2.5 Data analysis

The data averaged after analysis, data was accommodated in the table as per the needs of objectives for interpretation of results. The interpretation of data was done by using the critical difference value calculated at 0.05. The level of significance will be expressed at 0.05 Probability. The F-test was used to determine the significant difference.

2.6 Yield

In order to evaluate the effect of the treatments on the yield, the weight of okra in a net plot was recorded. The okra fruits were plucked. The weights of bhendi in such a net plot of each treatment were summed-up to the total yield and computed on hectare basis by using hectare factor.

$$B: C = \frac{\text{Gross return}}{\text{Cost of treatment}}$$

3. Results and Discussion

3.1 Shoot damage

Shoot damage Means comparison of the data regarding shoot damage in okra caused by *E. vittella* revealed that significant differences between treatments (Table 1). The mean data of 1st spray show minimum shoot infestation was recorded in cypermethrin (Treated as check)(9.67%) followed by botanicals neem oil (10.74%), and tobacco leaf extract (11.52%), jatropha leaf extract (11.98%) and papaya leaf extract (12.85%). The maximum shoot infestation was recorded in onion bulb extract (14.22%), marigold leaf extract (20.39%) and untreated plots control (24.39%) respectively. Earlier findings supported by Ambekar *et al.* (2000) [1] Achook (0.5 per cent) as most effective treatment in reducing the fruit borer infestation in okra crop

Table 1: Efficacy of selected botanicals on okra shoot and fruit borer (*Earias vitella* Fab.) (First spray): percent shoot infestation

Treatment No	Treatments	Before Spray	After Spray Percent Infestation			
			3 DAS	7 DAS	14 DAS	Mean
T ₁	Papaya leaf extract	18.65 (25.58)*	13.41 (21.47)*	12.40 (20.60)*	12.74 (20.91)*	12.85 (21.00)*
T ₂	Jatropha leaf extract 5%	17.89 (24.99)*	12.38 (20.59)*	11.79 (20.07)*	11.77 (20.04)*	11.98 (20.24)*
T ₃	Marigold leaf extract 28.5%	20.91 (27.21)*	20.46 (26.89)*	20.32 (26.79)*	20.39 (26.84)*	20.39 (26.84)*
T ₄	Onion bulb 5%	20.08 (26.60)*	14.30 (22.11)*	14.13 (22.07)*	14.23 (22.16)*	14.22 (22.15)*
T ₅	Neem oil 3%	19.34 (26.02)*	11.27 (19.61)*	10.27 (18.68)*	10.68 (19.07)*	10.74 (19.12)*
T ₆	Tobacco leaf extract 5%	20.51 (26.91)*	11.88 (20.16)*	11.23 (19.58)*	11.46 (19.78)*	11.52 (19.84)*
T ₇	Cypermethrin 25 EC 10%	17.82 (24.96)*	10.39 (18.80)*	9.10 (17.54)*	9.54 (17.99)*	9.67 (18.11)*
T ₀	Untreated	19.72 (26.34)*	23.62 (29.07)*	24.54 (29.69)*	25.01 (30.00)*	24.39 (29.59)*
F- test		NS	S	S	S	S
S. Ed.(±)		1.35	0.61	0.54	0.49	0.34
C. D. (P = 0.05)		2.89	1.30	1.17	1.05	0.73

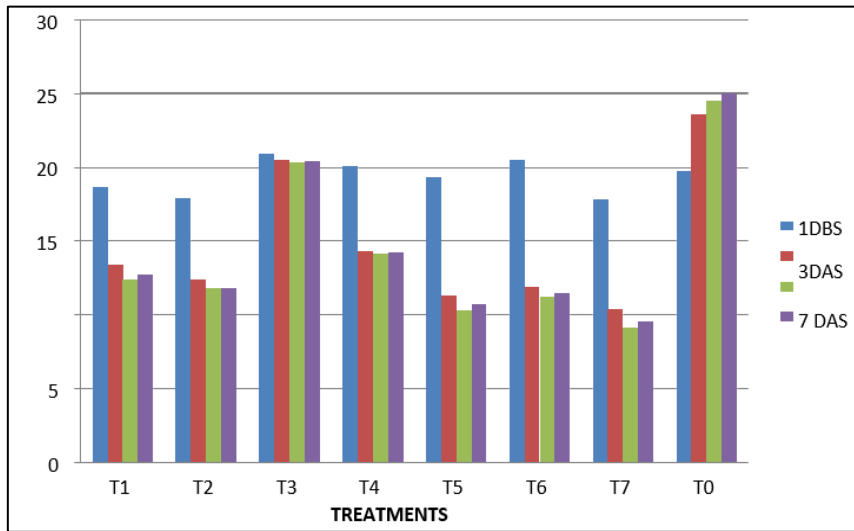


Fig 1: Efficacy of selected botanicals on okra shoot and fruit borer *E. vitella* Fab.): Percent shoot infestation (First spray).

Fruit damage

The data on the per cent infestation of shoot and fruit borer on (3, 7, 14) days after spray revealed that all the treatments were significantly superior over control. Among all the treatments lowest per cent infestation of shoot and fruit borer was recorded in Cypermethrin (11.25%) (Treated as check), Neem

oil (12.21%), Tobacco leaf extract (13.52%) and Jatropha leaf extract (14.20%) was statistically par followed by Papaya leaf extract (12.85%), Onion bulb extract (14.22%) and Marigold leaf extract (20.39%) was found to be least effective among all the treatments.

Table 2: Efficacy of selected botanicals on okra shoot and fruit borer (*Earias vitella* Fab.) (Second Spray): Percent fruit infestation

Treatment No.	Treatments	Before Spray	After Spray Percent Infestation			Mean
			3 DAS	7 DAS	14 DAS	
T ₁	Papaya leaf extract	20.70 (27.06)*	15.68 (23.32)*	14.23 (22.15)*	14.75 (22.58)*	14.89 (22.69)*
T ₂	Jatropha leafextract	19.89 (26.48)*	14.63 (22.48)*	13.89 (21.88)*	14.07 (22.01)*	14.20 (22.13)*
T ₃	Marigold leafextract	22.99 (28.64)*	21.21 (27.42)*	19.95 (26.53)*	20.63 (27.01)*	20.60 (26.99)*
T ₄	Onion bulb	21.67 (27.74)*	16.77 (24.17)*	15.17 (22.91)*	16.11 (23.66)*	16.02 (23.59)*
T ₅	Neem oil 3%	21.19 (27.40)*	12.69 (20.86)*	11.51 (19.82)*	12.43 (20.64)*	12.21 (20.45)*
T ₆	Tobacco leaf extract	21.90 (27.90)*	13.92 (21.90)*	13.26 (21.35)*	13.39 (21.45)*	13.52 (21.57)*
T ₇	Cypermethrin 25 EC 10%	20.59 (26.97)*	11.81 (20.09)*	10.75 (19.10)*	11.18 (19.53)*	11.25 (19.59)*
T ₀	Untreated	21.79 (27.80)*	21.90 (27.9*)	22.57 (28.36*)	23.70 (29.13*)	22.72 (28.47*)
F- test		NS	S	S	S	S
S. Ed.(±)		0.84	0.41	0.61	0.52	0.40
C. D. (P = 0.05)		1.79	0.87	1.31	1.12	0.85

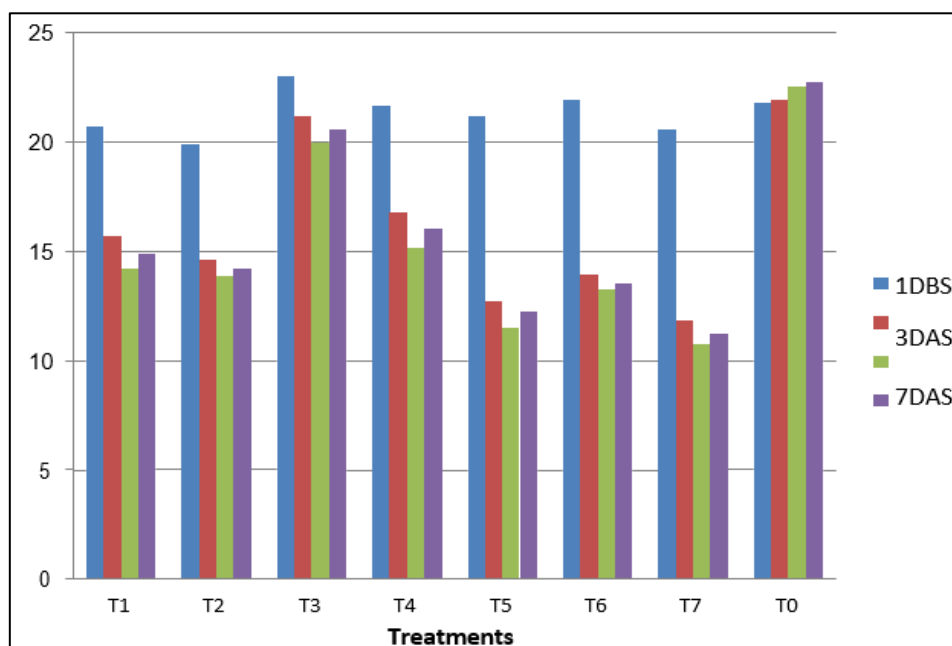


Fig 2: Efficacy of selected botanicals on okra shoot and fruit borer (*Earias vitella* Fab.): Percent fruit infestation (second spray)

Among all the treatments lowest per cent infestation of fruit was recorded in Neem oil (12.51%) is found to be the next best treatment which is in line with the findings of (Mochiah *et al.*, 2011) [4], (Bajad *et al.*, 2016) [2], (Sardana and Kumar, 1989) [8]. Tobacco leaf extract (13.81%) is found to be the next effective treatment which is in line with the findings (Mudassar *et al.*, 2018) [5]. Jatropha leaf extract (14.55%) is found to be the next effective treatment which is in line with the findings of (Purusottam *et al.*, 2006). Papaya leaf extract (15.18%) is found to be the next effective treatment which is in line with the findings (Mochiah *et al.*, 2011) [4]. The result of onion bulb extract (16.08%) is in support with, (Purusottam *et al.*, 2006). Marigold leaf extract (20.36%) is found to be least effective among all the treatments these findings are supported by (Gautam *et al.*, 2015) [3].

4. Yield and cost benefit ratio

The yields among the treatments were significant. The highest

yield was recorded in Cypermethrin (Treated as check) (98.88 q/ha), followed by Neem oil (90.53 q/ha), Tobacco leaf extract (86.33 q/ha), Jatropha leaf extract (82.38 q/ha), Papaya leaf extract (77.52 q/ha), Onion bulb extract (68.70 q/ha), Marigold leaf extract (54.21 q/ha), as compared to control plot (43.78 q/ha). These findings are supported by (Sardana and Kumar, 1989) [8], (Purusottam *et al.*, 2006), (Mudassar *et al.*, 2018) [5], (Subbireddy *et al.*, 2018). When cost benefit ratio was worked out, interesting result was achieved. The best and most economical treatment was cypermethrin 25EC (treated as check) (1:2.90) followed by Neem oil (1:2.68), Tobacco leaf extract (1:2.54), Jatropha leaf extract (1:2.46), Papaya leaf extract (1:2.29), Onion bulb extract (1:2.05), Marigold leaf extract (1:1.62), as compared to Control (1:1.35). The highest yield and cost benefit ratio was recorded in Cypermethrin 25 EC (86.33 q/ha), (1:2.90) followed by Neem oil these findings are supported by (Nalini and Kumar, 2016), (Barakzai and Lyall, 2014).

Table 3: Cost benefit ratio

Table Sr. No.	Treatment	Yield /ha	Cost of Yield (₹)	Total cost of Yield (₹)	Common cost (₹)	Treatme- nt cost (₹)	Total cost (₹)	C:B Ratio
1	Papaya leaf extract	77.52	1500	115500	48598	1821	50419	1:2.29
2	Jatropha leaf extract	82.38	1500	123570	48598	1613	50211	1:2.46
3	Marigold leaf extract	54.21	1500	81315	48598	1575	50173	1:1.62
4	Onion bulb extract	68.70	1500	103050	48598	1538	50136	1:2.05
5	Neem oil	90.53	1500	135795	48598	2010	50608	1:2.68
6	Tobacco leaf extract	86.33	1500	129495	48598	2378	50976	1:2.54
7	Cypermetherin 25EC	98.88	1500	148320	48598	2400	50998	1:2.90
8	Control	43.78	1500	65670	48598		1:1.35

5. Conclusion

From the critical analysis of the present findings of “Efficacy of selected botanicals against shoot and fruit borer (*Earias vittella* Fab.) on okra [*Abelmoschus esculentus* (L.) Moench]” It was concluded that among all treatments Cypermethrin 25EC @ 10% proved to be the best treatment followed by neem oil 3%, tobacco leaf extract, Jatropha leaf extract and Papaya leaf extract 10% in managing shoot & fruit borer reduction. Therefore, insecticides of short residual effect and neem oil 3% may be useful in devising proper integrated pest management strategy against okra shoot and fruit borer.

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