Archives of Current Research International

Volume 25, Issue 5, Page 445-456, 2025; Article no.ACRI.135925
ISSN: 2454-7077

Varietal Preferences of Major Insect Pests of Okra (*Abelmoschus esculentus* L. Moench.)

Arti Sharma [a++*], R. K. Meena [b#], Ram Narayan Sharma [a++], Heera Kumari [c++], Jyoti Sharma [d++] and Bablu Sharma [a++]

[a] Department of Entomology, Rajasthan Agricultural Research Institute, SKNAU, Jobner 303329, Jaipur, Rajasthan, India.
[b] Department of Entomology, College of Agriculture Lalsot, SKNAU, Jobner 303329, Jaipur, Rajasthan, India.
[c] Department of Entomology, SKN College of Agriculture, SKNAU, Jobner 303329, Jaipur, Rajasthan, India.
[d] Department of Entomology, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Gujarat, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors contributed equally to the conception and design of the study. All authors read and approved the final manuscript.

Article Information

DOI: https://doi.org/10.9734/acri/2025/v25i51223

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://pr.sdiarticle5.com/review-history/135925

Original Research Article

Received: 05/03/2025
Accepted: 08/05/2025
Published: 12/05/2025

[++] *Ph. D. Research Scholar;*
[#] *Professor;*
**Corresponding author: Email: sartivk2@gmail.com;*

Cite as: *Sharma, Arti, R. K. Meena, Ram Narayan Sharma, Heera Kumari, Jyoti Sharma, and Bablu Sharma. 2025. "Varietal Preferences of Major Insect Pests of Okra (Abelmoschus Esculentus L. Moench.)". Archives of Current Research International 25 (5):445-56. https://doi.org/10.9734/acri/2025/v25i51223.*

ABSTRACT

Aims: To evaluate the resistance of 12 okra varieties to major insect pests, including sucking pests and shoot and fruit borers, under natural infestation conditions in Rajasthan.
Study Design: A Randomized Block Design with three replications was used to screen twelve okra varieties for resistance to major insect pests. Each plot measured 2.25 x 1.5 m², with 45 cm row spacing and 30 cm plant spacing.
Place and Duration of Study: The investigations were conducted during the *Kharif* season of 2022 at the Horticulture Farm, S.K.N. College of Agriculture, Jobner.
Methodology: In this study, natural infestation of insect pests was observed from germination to harvest, with weekly population counts. Sucking pests (leafhoppers and whiteflies) were counted early in the morning on five tagged plants per plot, using absolute counting on three leaves (top, middle, bottom). Shoot and fruit borer (Earias spp.) infestations were recorded starting two weeks after sowing. The percent infestation was calculated by comparing infested shoots and fruits with healthy ones.
Results: In this study, twelve okra varieties were screened for resistance to major pests, including leafhopper (*Amrasca biguttula biguttula*), whitefly (*Bemisia tabaci*), and shoot and fruit borer (*Earias* spp.). For leafhopper resistance, varieties DOV-77, DOV-17, and 6126 were least susceptible, while Punjab Suhavani and Pusa Bhindi-5 were highly susceptible. Moderately susceptible varieties included Arka Abhay, DOV-66, Pusa Sawani, Kashi Kranti, PS, Arka Anamika, and A-4. In the case of whitefly, DOV-77 and DOV-17 were least susceptible, whereas A-4 and Punjab Suhavani were most susceptible. Moderately susceptible varieties were 6126, DOV-66, Arka Abhay, PS, Pusa Sawani, Kashi Kranti, Arka Anamika, and Pusa Bhindi-5. Regarding shoot and fruit borer resistance, DOV-66 and 6126 exhibited the least susceptibility to shoot infestation, while Pusa Bhindi-5 and Pusa Sawani were highly susceptible. For fruit infestation, PS and A-4 were least susceptible, while Pusa Sawani and Arka Abhay were highly susceptible.
Conclusion: The study identifies promising okra varieties with varying levels of resistance to key pests, including leafhopper, whitefly, and shoot and fruit borer. DOV-77, DOV-17, and 6126 showed the least susceptibility to leafhopper and whitefly, while DOV-66 and 6126 exhibited reduced shoot infestation. Pusa Bhindi-5 and Pusa Sawani were found to be highly susceptible to several pests. These findings offer valuable guidance for selecting resistant varieties for integrated pest management in okra cultivation.

Keywords: Okra; leafhopper; whitefly; Earias spp.; randomized block design; Kharif; Rajasthan; varietal screening.

1. INTRODUCTION

Okra (*Abelmoschus esculentus* L. Moench.), a crucial vegetable crop from the Malvaceae family, holds significant importance in tropical and subtropical agriculture, particularly in countries like India, Nigeria, and Sudan (FAO, 2023a). With India as the leading producer, contributing approximately 70% of the global supply, okra plays a pivotal role in both the food systems and economies of these regions (FAO, 2021). In 2022, global okra production reached an estimated 11,232,656 tons, cultivated across 1,142,996 hectares, yielding an average productivity of 9.81 tons per hectare (FAO, 2023a). The crop's nutritional profile, rich in vitamins A and B, protein, and minerals, enhances its value in global diets (Yadav *et al*., 2024). Furthermore, okra's iodine content has been identified as beneficial for the treatment of goiter, adding to its health benefits (Elkhalifa *et al*., 2021).

Despite its widespread cultivation, okra faces challenges, particularly from pests and diseases. Insects such as leafhoppers (*Amrasca biguttula biguttula*), whiteflies (*Bemisia tabaci*), and fruit borers (*Earias* spp.) pose substantial threats to crop yields (Sahito et al., 2019; Belete *et al*., 2022c). These pests, in conjunction with viral diseases like Okra yellow vein mosaic virus (OYVMV), lead to significant economic losses, reducing the quality and quantity of produce. The development of pest-resistant okra varieties and the implementation of integrated pest management (IPM) strategies are essential for mitigating these issues and sustaining production (Mohankumar et al., 2016). However, the limited availability of improved varieties and insufficient farmer education on effective pest control strategies remain key barriers to large-scale adoption (Jørs *et al*., 2017; Olaniyi & Fawole, 2023).

2. MATERIALS AND METHODS

The experiment was conducted at the Horticulture Farm, S.K.N. College of Agriculture, Jobner (Rajasthan), during *Kharif* 2022 to screen the okra varieties i.e. DOV-66, DOV-77, 6126, Pusa Sawani, DOV-17 A-4, Arka Abhay, PS, Arka Anamika, Pusa Bhindi-5, Kashi Kranti, Punjab Suhavani. Twelve okra varieties were screened for resistance to major insect pests in a Randomized Block Design with three replications. Each plot measured 2.25 x 1.5 m².

The crop was left to experience natural infestation for observing insect pests, with population counts recorded at weekly intervals from germination to harvest. Sucking pests, such as leafhoppers and whiteflies, were counted early in the morning (before 8 AM) when their activity was minimal. Five randomly selected and tagged plants in each plot were monitored, with pest populations counted visually (absolute counting) (Thakkar & Rote, 2001; Sharma & Sinha, 2009) on three leaves-one each from the top, middle, and bottom of the plant. All stages of nymphs and adults were included in the count. The pests were first counted on the upper surface of leaves, then on the lower surface, with care to avoid disturbing them. For shoot and fruit borer (*Earias* spp.), infestations were recorded on five tagged plants, starting two weeks after sowing and continuing until the last fruit picking. Percent infestation was calculated by comparing infested shoots and fruits with healthy ones. Data was collected from the first week of September 2022 until the final fruit harvest.

$$\%Shoot\ infestation = \frac{Number\ of\ infested\ shoot}{Total\ number\ of\ shoot} \times 100$$

$$\%Fruit\ infestation = \frac{Number\ of\ infested\ fruit}{Total\ number\ of\ fruits} \times 100$$

2.1 Interpretation of data

The data obtained on insect pest populations from experimental field were transformed using the formula log ($\sqrt{x + 0.5}$) and subjected to statistical analysis (Analysis of variance). The mean insect populations of okra varieties recorded during the crop season were categorized based on the formula given below:

$$\bar{X} \pm \sigma$$

Where,

$\bar{X}$ =Mean of peak insect population
σ = Standard deviation of peak insect population

Table 1. Interpretation of data

Mean insect population per plant/ shoot or/ three leaves	Category
Below $\bar{x}$ - σ	Least susceptible
$\bar{X}$ - σ to $\bar{X}$ + σ	Moderately susceptible
Above $\bar{X}$ + σ	Highly susceptible

3. RESULTS AND DISCUSSION

3.1 Leafhopper, *A. biguttula biguttula* (Ishida)

Leafhopper populations initially ranged from 1.93 to 5.13 per three leaves in late August and increased steadily until peaking on September 20th, with populations ranging from 11.75 to 31.20 per three leaves. Varietal differences in susceptibility were evident throughout the observation period. DOV-77 exhibited the lowest infestation levels, followed by DOV-17 and 6126, which were comparable. In contrast, Pusa Bhindi-5, Punjab Suhavani, and A-4 exhibited the highest infestation levels, with the latter two being highly susceptible.

Based on the overall mean population, the varieties were categorized into three susceptibility groups: least susceptible (mean < 7.01), moderately susceptible (mean 7.04-12.88), and highly susceptible (mean > 12.88). DOV-77, DOV-17, and 6126 were classified as least susceptible, while Pusa Bhindi-5, Punjab Suhavani, and A-4 were classified as highly susceptible. These findings emphasize the importance of selecting appropriate okra varieties for integrated pest management strategies, highlighting the significant variation in susceptibility to leafhopper infestations across different cultivars.

The results align with those of Nagar *et al*. (2017), who reported that the variety Pusa Sawani was moderately susceptible. The results partially align with those obtained by Bhat *et al*. (2007), who found that Arka Abhay was moderately susceptible, while Pusa Sawani and Arka Anamika were less susceptible. Nataraja *et al*. (2013) also found that Arka Anamika was negligibly preferred by leafhoppers.

Table 2. Categorization of different varieties of okra into degrees of susceptibility against Leafhopper, *A. biguttula biguttula*

S.No.	Mean Leafhopper population per three leaves	Name of variety	Category
1.	Below 7.04	DOV-77, DOV-17, 6126	Least susceptible
2.	7.04 to 12.88	Arka Abhay, DOV-66, Pusa Sawani, Kashi Kranti, PS, Arka Anamika, A-4	Moderately susceptible
3.	Above 12.88	Punjab Suhavani, Pusa Bhindi-5.	Highly susceptible

Table 3. Varietal preference of Leafhopper, *A. biguttula biguttula* on okra *A. esculentus* (L.) Moench

S.No.	Variety	Mean leafhopper population/three leaves*										
		16.8.22	23.8.22	30.8.22	6.9.22	13.9.22	20.9.22**	27.9.22	4.10.22	11.10.22	18.10.22	Mean
1	DOV-66	3.20 (1.92)	5.26 (2.40)	7.57 (2.84)	9.87 (3.22)	15.18 (3.96)	18.95 (4.41)	12.10 (3.55)	12.39 (3.59)	4.43 (2.22)	1.69 (1.48)	9.06 (3.09)
2	DOV-77	1.93 (1.56)	3.54 (2.01)	3.78 (2.07)	6.26 (2.60)	10.19 (3.27)	11.75 (3.50)	8.56 (3.01)	5.85 (2.52)	2.96 (1.86)	0.60 (1.05)	5.54 (2.46)
3	6126	2.33 (1.68)	4.33 (2.20)	5.45 (2.44)	8.44 (2.99)	13.16 (3.70)	14.38 (3.86)	9.00 (3.08)	8.14 (2.94)	4.17 (2.16)	1.04 (1.24)	7.04 (2.75)
4	Pusa Sawani	3.27 (1.94)	5.31 (2.41)	7.74 (2.87)	10.86 (3.37)	15.82 (4.04)	20.11 (4.54)	13.64 (3.76)	12.6 (3.62)	4.74 (2.29)	1.81 (1.52)	9.59 (3.18)
5	DOV-17	2.27 (1.66)	3.91 (2.10)	4.34 (2.20)	8.14 (2.94)	12.17 (3.56)	13.86 (3.79)	8.92 (3.07)	7.40 (2.81)	3.99 (2.12)	0.87 (1.17)	6.59 (2.66)
6	A-4	4.2 (2.17)	5.70 (2.49)	10.26 (3.28)	14.63 (3.89)	20.11 (4.54)	25.44 (5.09)	18.04 (4.31)	15.15 (3.96)	5.75 (2.50)	2.53 (1.74)	12.18 (3.56)
7	Arka Abhay	2.87 (1.83)	5.07 (2.36)	5.60 (2.47)	9.05 (3.09)	14.32 (3.85)	17.73 (4.27)	10.86 (3.37)	8.92 (3.07)	4.19 (2.18)	1.12 (1.32)	7.97 (2.91)
8	PS	3.73 (2.06)	5.55 (2.46)	9.80 (3.21)	12.24 (3.57)	18.16 (4.32)	22.64 (4.81)	15.42 (3.99)	13.34 (3.72)	5.02 (2.35)	2.32 (1.68)	10.82 (3.37)
9	Arka Anamika	4.00 (2.12)	5.65 (2.48)	10.13 (3.26)	13.34 (3.72)	19.93 (4.52)	24.30 (4.98)	17.22 (4.21)	14.02 (3.81)	5.26 (2.40)	2.39 (1.70)	11.62 (3.48)
10	Pusa Bhindi-5	5.13 (2.37)	7.51 (2.83)	12.90 (3.66)	19.57 (4.48)	26.33 (5.18)	31.20 (5.63)	20.11 (4.54)	17.99 (4.30)	7.62 (2.85)	3.30 (1.95)	15.17 (3.96)
11	Kashi Kranti	3.67 (2.04)	5.36 (2.42)	8.32 (2.97)	11.54 (3.47)	16.06 (4.07)	22.44 (4.79)	15.18 (3.96)	13.04 (3.68)	4.88 (2.32)	2.19 (1.64)	10.27 (3.28)
12	Punjab Suhavani	4.47 (2.23)	7.17 (2.77)	11.82 (3.51)	17.06 (4.19)	21.22 (4.66)	27.17 (5.26)	19.66 (4.49)	17.56 (4.25)	7.34 (2.80)	3.07 (1.89)	13.65 (3.76)
	SEm±	0.08	0.11	0.13	0.16	0.19	0.21	0.17	0.16	0.11	0.07	0.14
	CD (P=0.05)	0.24	0.33	0.38	0.47	0.57	0.62	0.51	0.48	0.34	0.20	0.43

** Mean of three replications*

*** peak population of leaf hopper*

Figures in the parentheses are $\sqrt{x + 0.5}$ values; these outside are retransformed values

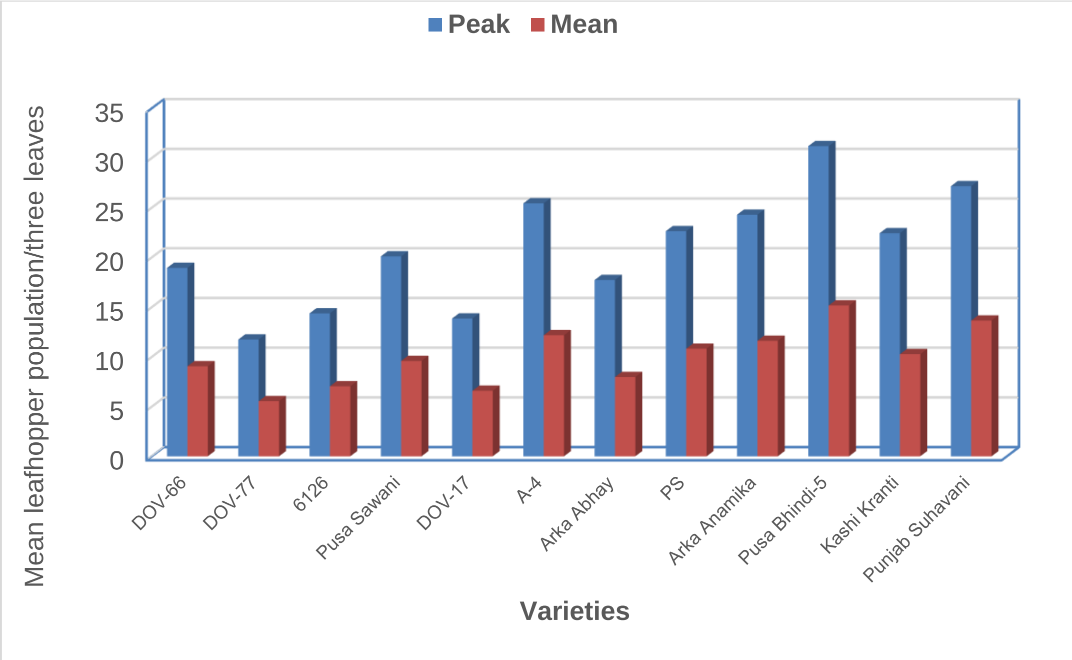

Fig. 1. Varietal preference of Leafhopper, *A. biguttula biguttula* on okra *A. esculentus* (L.) Moench

3.2 Whitefly, *B. tabaci* (Genn.)

Initial observations revealed a negligible whitefly infestation on varieties such as DOV-77, DOV-17, 6126, DOV-66, Arka Abhay, PS, Pusa Sawani, Kashi Kranti, Arka Anamika, and Pusa Bhindi-5. In contrast, varieties like A-4 and Punjab Suhavani were highly susceptible to infestation. Over the course of the study, the whitefly population steadily increased, reaching a peak on 13th September, with populations ranging from 5.50 to 22.44 whiteflies per three leaves. Punjab Suhavani exhibited the highest infestation (22.44 whiteflies), followed by A-4 (18.68 whiteflies). Conversely, DOV-77 and DOV-17 hosted the lowest populations, making them the least susceptible varieties. By 18th October, a gradual decrease in the whitefly population was observed across all varieties.

The overall mean whitefly population for the season categorized the varieties into three susceptibility groups: least susceptible (below 4.01 whiteflies), moderately susceptible (4.01-9.91 whiteflies), and highly susceptible (above 9.91 whiteflies). These findings align with the results of Nagar *et al*. (2017), who classified Pusa Sawani as moderately susceptible. Additionally, the variety Arka Anamika, which showed minimal whitefly infestation in the study by Nataraja (2013), partially supports the findings of the current investigation.

3.3 Shoot Infestation by *Earias spp.*

Shoot infestation varied significantly among the different okra varieties, with the minimum infestation observed in DOV-66 and 6126 (ranging from 1.06% to 4.07%) and the maximum infestation found in Pusa Bhindi-5 and Pusa Sawani. The infestation dynamics across the season showed that varieties like DOV-66, 6126, and PS exhibited relatively lower levels of infestation, classified as least susceptible (<2.94%). Varieties such as A-4, Arka Abhay, and DOV-17 showed moderate susceptibility (2.94-6.37%), while Pusa Bhindi-5, Pusa Sawani, and Punjab Suhavani were categorized as highly susceptible (>6.37%).

Throughout the observation period, shoot infestation fluctuated, peaking on September 20th, with infestations ranging from 5.90% to 16.40%. Infestation levels decreased after this peak in subsequent observations. Pusa Sawani and Pusa Bhindi-5 consistently exhibited the highest infestation, while DOV-66 remained the least affected throughout the study. Statistical analysis indicated significant differences in infestation levels between varieties, with Pusa Sawani showing the highest susceptibility and DOV-66 being the most resistant to *Earias* spp. infestation.

Table 4. Categorization of different varieties of okra into degrees of susceptibility against whitefly, *B. tabaci* (Genn.)

S.No.	Mean whitefly population per three leaves	Name of variety	Category
1.	Below 4.01	DOV-77, DOV-17	Least susceptible
2.	4.01 to 9.91	6126, DOV-66, Arka Abhay, PS, Pusa Sawani, Kashi Kranti, Arka Anamika, Pusa Bhindi-5	Moderately susceptible
3.	Above 9.91	A-4, Punjab Suhavani	Highly susceptible

Table 5. Varietal preference of whitefly, *B. tabaci* (Genn.) on okra *A. esculentus* (L.) Moench

S.No.	Variety	Mean whitefly population/three leaves*										
		16.8.22	23.8.22	30.8.22	6.9.22	13.9.22**	20.9.22	27.9.22	4.10.22	11.10.22	18.10.22	Mean
1	DOV-66	1.35 (1.36)	2.53 (1.74)	4.38 (2.21)	6.42 (2.63)	11.61 (3.48)	8.44 (2.99)	7.28 (2.79)	5.95 (2.54)	1.84 (1.53)	1.57 (1.44)	5.14 (2.37)
2	DOV-77	0.60 (1.05)	1.32 (1.35)	2.36 (1.69)	3.58 (2.02)	5.50 (2.45)	4.56 (2.25)	4.08 (2.14)	3.58 (2.02)	0.69 (1.09)	0.22 (0.85)	2.65 (1.77)
3	6126	1.09 (1.26)	2.26 (1.66)	3.99 (2.12)	5.80 (2.51)	9.93 (3.23)	7.85 (2.89)	6.42 (2.63)	5.40 (2.43)	1.57 (1.44)	1.01 (1.23)	4.53 (2.24)
4	Pusa Sawani	1.93 (1.56)	3.46 (1.99)	5.95 (2.54)	8.26 (2.96)	14.17 (3.83)	11.06 (3.40)	9.87 (3.22)	7.17 (2.77)	3.26 (1.94)	2.36 (1.69)	6.75 (2.69)
5	DOV-17	0.80 (1.14)	1.93 (1.56)	3.66 (2.04)	5.40 (2.43)	8.30 (2.97)	6.40 (2.63)	5.95 (2.54)	5.21 (2.39)	1.35 (1.36)	0.82 (1.15)	3.98 (2.12)
6	A-4	3.19 (1.92)	7.12 (2.76)	11.82 (3.51)	14.87 (3.92)	18.68 (4.38)	16.56 (4.13)	15.26 (3.97)	11.20 (3.42)	6.42 (2.63)	4.17 (2.16)	10.93 (3.38)
7	Arka Abhay	1.57 (1.44)	2.85 (1.83)	4.79 (2.30)	6.95 (2.73)	12.24 (3.57)	9.93 (3.23)	8.56 (3.01)	6.42 (2.63)	2.12 (1.62)	1.75 (1.50)	5.72 (2.49)
8	PS	1.75 (1.50)	3.07 (1.89)	5.40 (2.43)	7.68 (2.86)	13.04 (3.68)	10.39 (3.30)	9.23 (3.12)	6.79 (2.70)	2.67 (1.78)	1.96 (1.57)	6.20 (2.59)
9	Arka Anamika	2.53 (1.74)	4.12 (2.15)	6.68 (2.68)	9.30 (3.13)	15.90 (4.05)	12.17 (3.56)	12.10 (3.55)	8.14 (2.94)	5.12 (2.37)	3.70 (2.05)	7.98 (2.91)
10	Pusa Bhindi-5	2.81 (1.82)	6.05 (2.56)	8.92 (3.07)	13.04 (3.68)	17.31 (4.22)	14.71 (3.90)	13.56 (3.75)	8.26 (2.96)	5.26 (2.40)	3.91 (2.10)	9.38 (3.14)
11	Kashi Kranti	2.26 (1.66)	3.95 (2.11)	6.42 (2.63)	8.92 (3.07)	14.71 (3.90)	11.47 (3.46)	11.26 (3.43)	7.62 (2.85)	4.08 (2.14)	3.54 (2.01)	7.42 (2.81)
12	Punjab Suhavani	4.25 (2.18)	7.85 (2.89)	12.68 (3.63)	17.22 (4.21)	22.44 (4.79)	18.51 (4.36)	17.39 (4.23)	12.90 (3.66)	8.32 (2.97)	6.47 (2.64)	12.80 (3.65)
	SEm±	0.06	0.08	0.12	0.14	0.18	0.16	0.15	0.15	0.09	0.08	0.13
	CD (P=0.05)	0.19	0.25	0.35	0.42	0.53	0.49	0.44	0.44	0.28	0.23	0.38

** Mean of three replications*
*** peak population of whitefly*
Figures in the parentheses are $\sqrt{x + 0.5}$ values; these outside are retransformed values

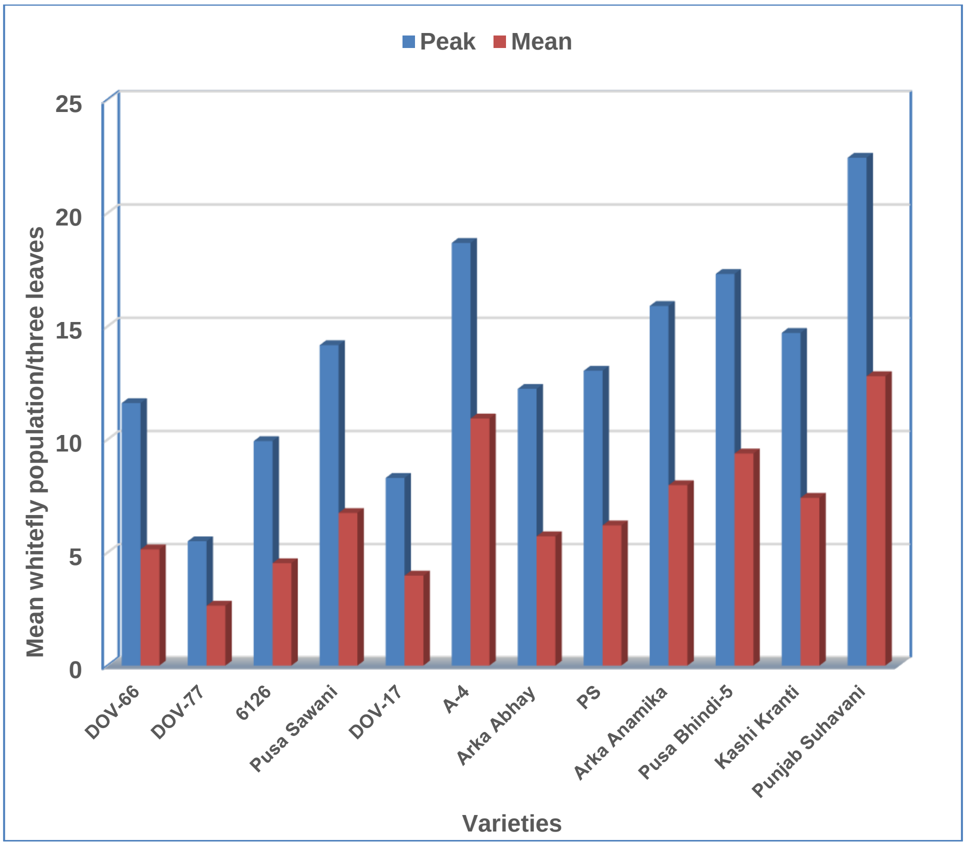

Fig. 2. Varietal preference of whitefly, *B. tabaci* (Genn.) on okra *A. esculentus* (L.) Moench

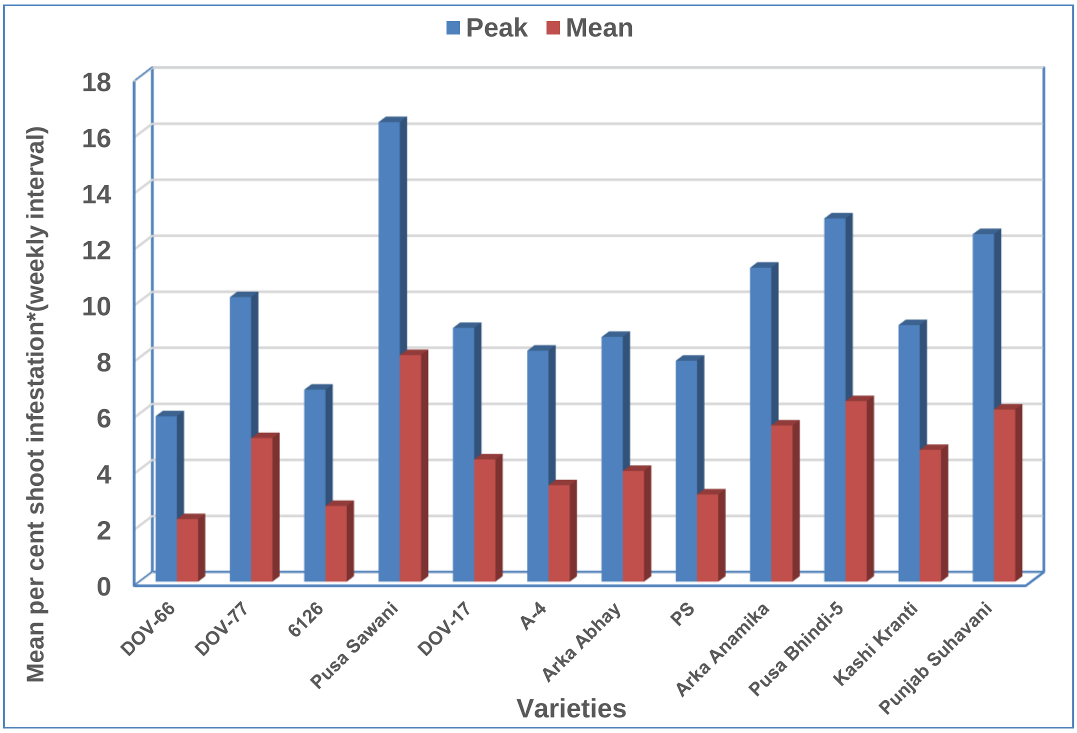

Fig. 3. Varietal preference of *Earias* spp. for shoot infestation on okra *A. esculentus* (L.) Moench

Table 6. Categorization of different varieties of okra according to their degree of susceptibility to shoot infestation by the shoot and fruit borer, *Earias* spp.

S.No.	Mean per cent shoot infestation	Name of variety	Category
1.	Below 2.94	DOV-66, 6126	Least susceptible
2.	2.94 to 6.37	PS, A-4, Arka Abhay, DOV-17, Kashi Kranti, DOV-77, Arka Anamika, Punjab Suhavani.	Moderately susceptible
3.	Above 6.37	Pusa Bhindi-5, Pusa Sawani	Highly susceptible

Table 7. Varietal preference of *Earias* spp. for shoot infestation on okra *A. esculentus* (L.) Moench

S.No.	Variety	Mean per cent shoot infestation*(weekly interval)										
		16.8.22	23.8.22	30.8.22	6.9.22	13.9.22	20.9.22**	27.9.22	4.10.22	11.10.22	18.10.22	Mean
1	DOV-66	1.06 (5.91)	1.39 (6.77)	1.54 (7.13)	2.60 (9.28)	3.16 (10.24)	5.90 (14.06)	4.79 (12.64)	1.13 (6.10)	0.49 (4.01)	0.27 (2.98)	2.23 (8.59)
2	DOV-77	2.71 (9.47)	3.27 (10.42)	4.72 (12.55)	6.86 (15.18)	7.43 (15.82)	10.15 (18.58)	7.88 (16.30)	4.03 (11.58)	2.52 (9.13)	1.60 (7.27)	5.12 (13.07)
3	6126	1.30 (6.55)	1.51 (7.06)	1.82 (7.75)	3.48 (10.75)	3.86 (11.33)	6.85 (15.17)	5.48 (13.54)	1.56 (7.17)	0.67 (4.69)	0.51 (4.10)	2.70 (9.46)
4	Pusa Sawani	4.07 (11.64)	4.35 (12.04)	6.58 (14.86)	9.82 (18.26)	10.94 (19.31)	16.4 (23.89)	14.56 (22.43)	7.24 (15.61)	3.61 (10.95)	3.26 (10.40)	8.08 (16.52)
5	DOV-17	2.15 (8.44)	2.69 (9.44)	3.95 (11.46)	5.77 (13.90)	6.39 (14.64)	9.05 (17.51)	7.13 (15.49)	3.45 (10.70)	1.83 (7.77)	1.21 (6.32)	4.36 (12.06)
6	A-4	1.85 (7.82)	2.14 (8.41)	2.81 (9.65)	4.34 (12.02)	4.35 (12.04)	8.24 (16.68)	6.23 (14.45)	2.59 (9.26)	1.08 (5.96)	0.79 (5.10)	3.44 (10.69)
7	Arka Abhay	1.97 (8.07)	2.46 (9.02)	3.32 (10.50)	4.97 (12.88)	5.61 (13.70)	8.73 (17.19)	6.84 (15.16)	3.01 (9.99)	1.44 (6.89)	1.12 (6.07)	3.95 (11.46)
8	PS	1.66 (7.40)	1.93 (7.99)	2.53 (9.15)	3.73 (11.14)	4.09 (11.67)	7.88 (16.30)	5.95 (14.12)	1.92 (7.96)	0.80 (5.13)	0.65 (4.62)	3.11 (10.16)
9	Arka Anamika	2.97 (9.92)	3.38 (10.59)	5.12 (13.08)	7.02 (15.36)	8.27 (16.71)	11.20 (19.55)	8.61 (17.06)	4.39 (12.09)	2.87 (9.75)	1.92 (7.96)	5.57 (13.66)
10	Pusa Bhindi-5	3.36 (10.56)	3.72 (11.12)	5.91 (14.07)	7.52 (15.92)	10.16 (18.59)	12.96 (21.10)	10.28 (18.70)	4.97 (12.88)	3.3 (10.46)	2.25 (8.63)	6.44 (14.70)
11	Kashi Kranti	2.36 (8.83)	3.05 (10.06)	4.23 (11.87)	6.21 (14.43)	6.92 (15.25)	9.15 (17.61)	7.58 (15.98)	3.86 (11.33)	2.18 (8.49)	1.44 (6.89)	4.7 (12.52)
12	Punjab Suhavani	3.12 (10.17)	3.58 (10.91)	5.27 (13.27)	7.43 (15.82)	9.80 (18.24)	12.40 (20.62)	9.96 (18.40)	4.61 (12.40)	3.10 (10.14)	2.18 (8.49)	6.14 (14.35)
	SEm±	0.39	0.45	0.51	0.66	0.70	0.95	0.84	0.52	0.39	0.33	0.63
	CD (P=0.05)	1.17	1.35	1.53	1.99	2.12	2.85	2.54	1.58	1.18	0.98	1.90

** Mean of three replications*
*** Peak shoot infestation*
Figures in the parentheses are angular transformed values

These results support the findings of Bhat *et al*. (2007), who reported that Pusa Sawani was highly susceptible, and Arka Abhay and Arka Anamika were found to be susceptible. Meena (2004) observed that Arka Anamika was less susceptible to shoot infestation, partially corroborating the present findings. Choudhary et al. (2014) found that Arka Anamika was less susceptible, Arka Abhay was moderately susceptible, and Pusa Sawani was highly susceptible to shoot and fruit borer infestations, supporting the present results. Patni (2000) also observed that Arka Anamika was less susceptible, which aligns with the current findings. Additionally, Mandal *et al*. (2006) reported Pusa Sawani as highly susceptible to shoot and fruit borer, while Arka Abhay and Arka Anamika were moderately resistant.

3.4 Fruit Damage by *Earias* spp.

The fruit infestation began in the second week of September, with infestation levels ranging from 2.75% to 8.11% across different varieties. The PS variety exhibited the least fruit infestation, followed by A-4, with no significant difference between the two. Other varieties, such as DOV-66, 6126, Kashi Kranti, DOV-17, Arka Anamika, DOV-77, Pusa Bhindi-5, and Punjab Suhavani, showed comparable levels of infestation. The highest infestations were observed in Arka Abhay and Pusa Sawani, which were statistically similar. Infestation levels progressively increased, peaking on October 14th, ranging from 15.30% to 39.98%. Arka Abhay exhibited the highest infestation, followed by Pusa Sawani and Punjab Suhavani. PS and A-4 consistently showed the lowest infestations, with varieties like DOV-66, 6126, and Kashi Kranti being less affected.

Based on overall mean fruit infestation, the varieties were classified as follows: those with less than 10.40% infestation were categorized as least susceptible, between 10.40% and 24.70% as moderately susceptible, and those with more than 24.70% as highly susceptible to *Earias* spp. Koujalagi *et al*. (2009) classified the Pusa Sawani variety in the moderately resistant category, which partially aligns with the present findings. Ghosh *et al*. (2010) reported Arka Anamika as moderately susceptible to fruit borer, which also partially corroborates the current observations.

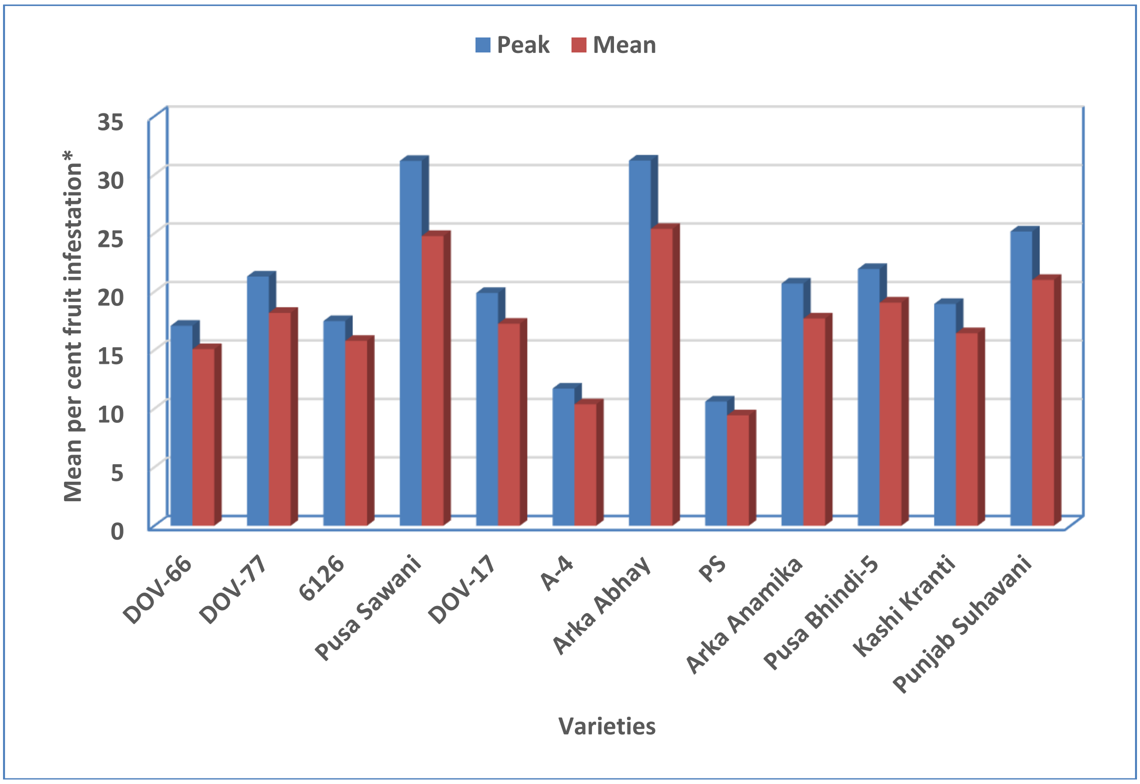

Fig. 4. Varietal preference of *Earias* spp. for fruit infestation (Number basis) on okra *A. esculentus* (L.) Moench

Table 8. Categorization of different varieties of okra into degrees of susceptibility against shoot and fruit borer, *Earias* spp. fruit infestation (Number basis)

S.No.	Mean per cent fruit infestation	Name of variety	Category
1.	Below 10.40	PS, A-4	Least susceptible
2.	10.40 to 24.70	DOV-66, 6126, Kashi Kranti, DOV-17, Arka Anamika, DOV-77, Pusa Bhindi-5, Punjab Suhavani	Moderately susceptible
3.	Above 24.70	Pusa Sawani, Arka Abhay	Highly susceptible

Table 9. Varietal preference of *Earias* spp. for fruit infestation (Number basis) on okra *A. esculentus* (L.) Moench

S.No.	Variety	Mean per cent fruit infestation*												
		11.9.22	**14.9.22**	**17.9.22**	**20.9.22**	**23.9.22**	**26.9.22**	**29.9.22**	**2.10.22**	**5.10.22**	**8.10.22**	**11.10.22**	**14.10.22**	**Mean**
1	DOV-66	4.82 (12.68)	6.12 (14.32)	7.26 (15.63)	9.38 (17.83)	12.03 (20.29)	12.87 (21.02)	17.59 (24.80)	17.10 (24.43)	21.04 (27.30)	22.19 (28.10)	24.41 (29.61)	26.40 (30.920)	15.10 (22.87)
2	DOV-77	6.75 (15.06)	8.05 (16.48)	9.30 (17.76)	11.20 (19.55)	15.18 (22.93)	16.76 (24.17)	21.87 (27.88)	21.31 (27.49)	23.33 (28.88)	26.17 (30.77)	28.27 (32.12)	30.27 (33.38)	18.20 (25.26)
3	6126	5.98 (14.15)	6.91 (15.24)	7.87 (16.29)	9.82 (18.26)	12.78 (20.95)	13.85 (21.85)	17.65 (24.84)	17.50 (24.73)	21.84 (27.86)	23.08 (28.71)	25.24 (30.16)	27.24 (31.46)	15.81 (23.43)
4	Pusa Sawani	7.83 (16.25)	11.78 (20.07)	14.07 (22.03)	18.25 (25.29)	22.93 (28.61)	25.18 (30.12)	29.92 (33.16)	31.19 (33.95)	32.33 (34.65)	33.94 (35.63)	34.70 (36.09)	35.10 (36.33)	24.77 (29.85)
5	DOV-17	6.59 (14.87)	7.78 (16.20)	8.50 (16.95)	10.33 (18.75)	13.50 (21.56)	15.30 (23.03)	19.53 (26.23)	19.90 (26.49)	22.64 (28.41)	25.20 (30.13)	27.99 (31.94)	29.98 (33.20)	17.27 (24.56)
6	A-4	3.24 (10.37)	4.73 (12.56)	6.97 (15.31)	7.40 (15.79)	8.95 (17.41)	10.09 (18.52)	10.19 (18.62)	11.73 (20.03)	13.07 (21.19)	14.20 (22.14)	16.40 (23.89)	17.67 (24.86)	10.39 (18.80)
7	Arka Abhay	8.11 (16.55)	11.96 (20.23)	14.36 (22.27)	18.53 (25.50)	23.14 (28.75)	25.38 (30.25)	30.03 (33.23)	31.22 (33.97)	32.59 (34.81)	34.20 (35.79)	35.07 (36.31)	39.98 (39.22)	25.38 (30.25)
8	PS	2.75 (9.55)	3.72 (11.12)	4.96 (12.87)	6.12 (14.32)	9.03 (17.49)	9.57 (18.02)	9.85 (18.29)	10.62 (19.02)	12.97 (21.11)	13.82 (21.82)	14.62 (22.48)	15.30 (23.03)	9.44 (17.90)
9	Arka Anamika	6.66 (14.96)	7.90 (16.32)	8.89 (17.35)	10.74 (19.13)	14.90 (22.71)	15.70 (23.34)	20.41 (26.86)	20.71 (27.07)	23.19 (28.79)	25.56 (30.37)	28.00 (31.95)	30.00 (33.21)	17.72 (24.90)
10	Pusa Bhindi-5	6.87 (15.20)	8.13 (16.57)	10.41 (18.82)	12.90 (21.05)	17.55 (24.77)	19.08 (25.90)	22.13 (28.06)	21.95 (27.94)	23.76 (29.17)	26.67 (31.09)	28.76 (32.43)	30.75 (33.68)	19.08 (25.90)
11	Kashi Kranti	6.25 (14.48)	7.16 (15.52)	8.17 (16.61)	10.09 (18.52)	13.12 (21.24)	14.60 (22.46)	18.30 (25.33)	18.96 (25.81)	22.40 (28.25)	24.10 (29.40)	26.20 (30.79)	28.21 (32.08)	16.46 (23.94)
12	Punjab Suhavani	7.06 (15.41)	8.75 (17.21)	11.27 (19.62)	14.72 (22.56)	19.07 (25.89)	19.97 (26.54)	27.25 (31.47)	25.15 (30.10)	27.41 (31.57)	29.03 (32.60)	31.09 (33.89)	31.50 (34.14)	21.02 (27.29)
	SEm±	0.58	0.75	0.90	1.00	1.17	1.26	1.42	1.43	1.53	1.62	1.71	1.79	1.14
	CD (P=0.05)	1.75	2.25	2.71	2.99	3.50	3.77	4.25	4.28	4.59	4.86	5.12	5.38	3.42

** Mean of three replications*

Figures in the parentheses are angular transformed values

4. CONCLUSION

In conclusion, this study provides valuable insights into the variability of pest susceptibility among different okra (*Abelmoschus esculentus*) cultivars, highlighting the significant role that cultivar selection plays in integrated pest management (IPM) strategies. The findings reveal substantial differences in the infestation levels of leafhoppers, whiteflies, shoot and fruit borers across the examined varieties. Cultivars such as DOV-77, DOV-17, and 6126 exhibited the lowest levels of infestation, positioning them as the least susceptible and ideal cultivars for pest management, while varieties like Pusa Bhindi-5, Punjab Suhavani, and A-4 showed high susceptibility, thereby necessitating more intensive pest control measures.

The clear differentiation in pest resistance across cultivars underscores the importance of choosing the right varieties for sustainable pest control and crop management. By prioritizing less susceptible cultivars, farmers can minimize the reliance on chemical insecticides, fostering more environmentally friendly and cost-effective agricultural practices. Moreover, the study emphasizes the need for continuous research into cultivar development to address evolving pest challenges, thereby enhancing pest management and maintaining high crop productivity. Ultimately, this research contributes to the development of sustainable agricultural practices that support environmental health while ensuring productive and resilient okra cultivation.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc have been used during writing or editing of this manuscript. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology.

Details of the AI usage are given below:

1. ChatGPT based on the GPT-4 architecture.

ACKNOWLEDGEMENTS

The authors are grateful to the Dean, SKN College of Agriculture, Jobner, for providing the necessary facilities. No funding sources were involved in the research.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

Belete, Y., Shimelis, H., & Laing, M. (2022). Wheat production in drought-prone agro-ecologies in Ethiopia: diagnostic assessment of farmers' practices and sustainable coping mechanisms and the role of improved cultivars. *Sustainability, 14*(13), 7579.

Bhat, O. K., Bhagat, K. C., Gupta, A., & Vijay, K. K. (2007). Screening of okra genotypes against *Amrasca biguttula biguttula* (Ishida) and *Earias vittella*. *Environment and Ecology, 25*, 434–439.

Choudhary, S., Chandra, A., & Yadav, P. K. (2014). Impact of irrigation levels and mulching on yield and nutrient uptake of okra cultivars under various planting geometry. *Annals of Agricultural Research, 33*(3).

Elkhalifa, A. E. O., Alshammari, E., Adnan, M., Alcantara, J. C., Awadelkareem, A. M., Eltoum, N. E., Mehmood, K., Panda, B. P., & Ashraf, S. A. (2021). Okra (*Abelmoschus esculentus*) as a potential dietary medicine with nutraceutical importance for sustainable health applications. Molecules, 26(3), 696.

FAO. (2021). *Okra production*. Food and Agriculture Organization of the United Nations.

FAO. (2023a). *FAOSTAT Statistical Database*. Food and Agriculture Organization of the United Nations. http://www.fao.org/faostat/en/#data/QC

Ghosh, S. K., Sonowal, M., Chakraborty, G., & Pal, P. K. (2010). Evaluation of okra cultivars (*Abelmoschus esculentus* L.) commonly grown under terai region of West Bengal against insect and mite pests. *Green Farming, 3*, 136–138.

Jørs, E., Aramayo, A., Huici, O., Konradsen, F., & Gulis, G. (2017). Obstacles and opportunities for diffusion of integrated pest management strategies reported by Bolivian small-scale farmers and agronomists. *Environmental Health Insights, 11*, 1178630217703390.

Koujalagi, M., Gangappa, E., Chakravrthy, A. K., Pitchaimuthu, M., Kumar, N. R. P., & Thippaiah, M. (2009). Screening of okra hybrids and varieties for resistance to fruit borers. *Pest Management in Horticultural Ecosystems, 15*, 141–146.

Mandal, S. K., Sah, S. B., & Gupta, S. C. (2006). Screening of okra cultivars against *E. vittella*. *Annals of Plant Protection Sciences, 14*, 471–472.

Meena, N. K. (2004). *Management of key insect pests of okra (Abelmoschus esculentus (L.) Moench)* [Ph.D. thesis, Rajasthan Agricultural University, Jobner].

Mohankumar, S., Karthikeyan, G., Durairaj, C., Ramakrishnan, S., Preetha, B., & Sambathkumar, S. (2016). Integrated pest management of okra in India. *Integrated Pest Management of Tropical Vegetable Crops*, 167-177.

Nagar, J., Khinchi, S. K., Kumawat, K. C., & Sharma, A. (2017). Screening different varieties of okra against sucking insect pests. *Journal of Pharmacognosy and Phytochemistry, 6*, 30–34.

Nataraja, M. V., Chalam, M. S. V., Madhumathi, T., & Rao, V. S. (2013). Screening of okra genotypes against sucking pests and yellow vein mosaic virus disease under field conditions. *Indian Journal of Plant Protection, 41*, 226–230.

Olaniyi, J. O., & Fawole, O. B. (2023). Breeding for disease resistance in okra. *Plant Breeding Reviews, 42*, 78–92.

Patni, S. K., & Pareek, B. L. (2000). *Effect of date of sowing and eco-friendly insecticides on the incidence and management of major insect pests of okra (Abelmoschus esculentus Moench)* [M.Sc. thesis, Swami Keshwanand Rajasthan Agricultural University, Jobner].

Sahito, H. A., Junejo, R., Kousar, T., Shah, Z. H., Mangrio, W. M., & Jatoi, F. A. (2019). Biology and damage caused by okra fruit borer, Earias vittella (F.) under laboratory and field conditions. *International Journal of Biology and Biotechnology, 16*(3), 731-738.

Sharma, R. K., & Sinha, S. R. (2009). Insect pest management in okra with baby corn as border crop and ecofriendly insecticides. *Journal of Insect Science, 22*, 254–258.

Thakkar, S. K., & Rote, N. B. (2001). Studies on integrated pest management in okra, *Abelmoschus esculentus* (L.) Moench. *Indian Journal of Applied Entomology, 15*, 35–39.

Yadav, B., Mehata, D. K., Bhandari, S., Shrestha, S., & Sangroula, G. (2024). Evaluation of different okra (*Abelmoschus esculentus* L.) cultivars for yield and biomass production. *Asian Journal of Research in Agriculture and Forestry, 10*, 99–105.

Peer-review history:
The peer review history for this paper can be accessed here:
https://pr.sdiarticle5.com/review-history/135925