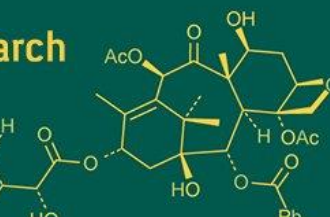
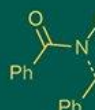


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Screening of different okra varieties/genotypes against shoot and fruit borer, *Earias vittella* (FAB.)

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Abstract

An investigation on "Screening of different okra varieties/genotypes against shoot and fruit borer, *Earias vittella* (Fab.)" was carried out at the Instructional Farm, Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh during *Kharif* 2025. The okra varieties/genotypes Pusa Savani, GO-2, VRO-6, GJO-3, Arka Abhay, Arka Anamika, JOL-20-4, JOL-21-02, JOL-21-08 and GO-6 were evaluated for their relative susceptibility to shoot and fruit borer during the *Kharif* season. The results indicated that none of these varieties/genotypes was found to be highly resistant or highly susceptible to shoot and fruit borer on *Kharif* okra. Out of the ten genotypes/varieties screened, the lowest (18.85%) shoot damage was noted in variety VRO-6 which was at par with GJO-3 (19.00%) were found to be resistant against shoot infestation. The lowest (26.64%) fruit infestation was observed in variety VRO-6 which was statically at par with GO-2 (26.88%). Among all screened varieties/genotypes, the highest yield (11818 kg/ha) was recorded from VRO-6 than the rest of varieties/genotypes followed by GJO-3 (11237 kg/ha) and GO-6 (10389 kg/ha).

Keywords: Shoot and fruit borer, okra, screening, resistance, susceptible, variety/genotype

1. Introduction

Okra [*Abelmoschus esculentus* (L.) Moench], a member of the family Malvaceae, is one of the most extensively cultivated vegetable crops in tropical and subtropical regions worldwide. The crop is generally considered to have originated in tropical Africa (Yawalkar, 1973) [15]. In India, where it is popularly known as "bhindi" or "lady's finger," okra occupies an important place among vegetable crops because of its wide adaptability, rapid growth, high yield potential and excellent economic returns to farmers.

Owing to its ease of cultivation, reliable productivity and wide adaptability to different agro-climatic conditions, okra is widely preferred by small and marginal farmers (Latha *et al.*, 2019) [7]. However, the productivity of this crop is adversely affected by a number of insect pests, which are among the major biotic constraints limiting its growth, yield and quality (Mandal *et al.*, 2007) [8].

Globally, okra is cultivated in several countries including India, Iran, Bangladesh, Pakistan, Turkey, Myanmar, Ghana, Malaysia, Ethiopia, Brazil and the southern United States (Swamy, 2023) [14].

India is the world's largest producer of okra, accounting for a substantial proportion of global production. During 2023-24, the crop was cultivated over an area of approximately 5.57 lakh hectares, yielding about 7.31 million tonnes with an average productivity of 13.12 tonnes ha⁻¹ (Anonymous, 2024) [2]. The major okra- producing states include Gujarat, Madhya Pradesh, West Bengal, Bihar and Andhra Pradesh. Among these, Gujarat ranks first in production, contributing nearly 15 per cent of the country's total okra output. Within the state, the crop is widely cultivated in districts such as Surat, Navsari, Tapi, Vadodara, Ahmedabad, Gandhinagar, Anand, Bhavnagar, Junagadh, Mehsana, Patan and Banaskantha (Anonymous, 2019) [1].

Okra crop is affected by various insect-pests at different growth stages. The okra crop is vulnerable to numerous insect and non-insect pests during all stages of its growth. Dhamdhare *et al.* (1984) [5] reported approximately 13 economically important pest species infesting the crop, whereas later investigations recorded more than 72 insect pest species associated with okra, emphasizing the diversity and severity of pest problems affecting its cultivation (Pal *et al.*, 2013) [11].

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Evaluation of okra varieties or genotypes for their resistance to the shoot and fruit borer is an effective approach for identifying cultivars with lower levels of pest infestation. The cultivation of resistant or tolerant varieties can substantially reduce reliance on chemical insecticides, thereby lowering production costs, minimizing environmental contamination and promoting sustainable pest management. Nevertheless, comprehensive assessment of the available okra germplasm under local agro-climatic conditions is still limited, highlighting the need for systematic varietal screening.

2. Materials and methods

To study the susceptibility of ten different *Kharif* okra varieties/genotypes (Table 1) against *Earias vittella*, a field experiment was conducted during the *Kharif* season of 2025 at the Instructional Farm, Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh. The experiment was laid out in a Randomized Block Design (RBD) with three replications. The ten okra varieties/genotypes were sown during the third week of July 2025 in plots measuring 5.10 m × 2.40 m (gross plot) and 3.90 m × 1.80 m (net plot), maintaining a spacing of 60 × 30 cm between rows and plants. All the recommended agronomic practices were followed throughout the cropping period, except that no insecticidal sprays were applied, to allow the natural infestation of *E. vittella* for assessing the susceptibility of the varieties/genotypes.

Data on the incidence of the shoot and fruit borer (*Earias vittella*) were collected at weekly intervals throughout the crop season. Five plants were selected randomly from each variety/genotype in every replication for recording observations. The total number of shoots and fruits, along with the number of infested shoots and fruits was recorded separately. The percentage of shoot and fruit infestation was determined by relating the number of infested plant parts to the total number of shoots or fruits observed. Fruits were harvested at each picking and the yield from each experimental plot was recorded. The recorded observations were statistically analysed to compare the response of the different okra varieties/genotypes and to identify those exhibiting lower susceptibility to *E. vittella*.

Categorization of Varieties/Genotypes

The different okra varieties/ genotypes were grouped into six categories of resistance to pest viz., highly susceptible, susceptible, moderately susceptible, moderately resistant, resistant and highly resistant based on parameters viz., per cent shoot damage, per cent fruit damage and fruit yield (Table 2).

For this purpose, the mean value of individual genotype ($\bar{X}$) was compared with the mean value of all genotypes ($\bar{X}$) and standard deviation (SD). The retransformed data were

used for computation of $\bar{X}$, $\bar{X}$ i and SD in case of this parameter. The scale used for categorizing different varieties/ genotypes were as under (Avula, 2024).

3. Results and discussion

The present investigation entitled “Screening of different okra varieties/genotypes against shoot and fruit borer, *Earias vittella* (Fab.)” was conducted during the *Kharif* season of 2025 under field conditions at the Instructional Farm, Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh. The results obtained are presented and discussed in relation to the findings of earlier studies conducted under different agro-climatic conditions.

Shoot Damage (%)

The data on per cent shoot infestation presented in Table 5 and illustrated in Figure 1 revealed that none of the evaluated okra varieties/genotypes was free from infestation by *Earias vittella*. Significant differences in shoot infestation were observed among the varieties/genotypes. The lowest shoot infestation (18.85%) was recorded in VRO- 6, which was statistically at par with GJO-3 (19.00%). The remaining varieties/ genotypes exhibited shoot infestation ranging from 20.60 to 23.48%. In ascending order of susceptibility, the varieties/genotypes were ranked as follows: VRO-6 (18.85%) < GJO-3 (19.00%) < GO- 6 (20.60%) < GO-2 (20.65%) < Arka Anamika (20.71%) < JOL-21-08 (21.97%) < Arka Abhay (22.06%) < Pusa Savani (23.28%) < JOL-20-4 (23.42%) < JOL-21-02 (23.48%). The highest shoot infestation (23.48%) was recorded in JOL-21-02 which was statistically at par with JOL-20-4 (23.42%) and Pusa Savani (23.28%).

Fruit Damage (%)

The data on per cent fruit infestation presented in Table 5 and illustrated in Figure 2 indicated that none of the evaluated okra varieties/genotypes was free from infestation by *Earias vittella*. Significant variation in fruit infestation was observed among the tested varieties/genotypes. The lowest fruit infestation (26.64%) was recorded in VRO- 6, which was statistically at par with GO-2 (26.88%).

The remaining varieties/genotypes exhibited fruit infestation ranging from 29.41 to 33.17%. Based on the level of fruit infestation, the varieties/genotypes were ranked in ascending order of susceptibility as follows: VRO-6 (26.64%) < GO-2 (26.88%) < GO-6 (29.41%) < GJO-3 (29.49%) < Arka Anamika (29.57%) < Arka Abhay (31.07%) < Pusa Savani (31.19%) < JOL-21-08 (32.99%) < JOL-21-02 (33.09%) < JOL-20-4 (33.17%). The highest fruit infestation (33.17%) was recorded in JOL-20-4, which was statistically at par with JOL-21-02 (33.09%) and JOL-21-08 (32.99%).

Table 1: List of different varieties/genotypes used for their susceptibility to shoot and fruit borer, *E. vittella* in *Kharif* season

Sr. No.	Varieties/genotypes	Sr. No.	Varieties/genotypes
1.	Pusa Savani	6.	Arka Anamika
2.	GO-2	7.	JOL-20-4
3.	VRO-6	8.	JOL-21-02
4.	GJO-3	9.	JOL-21-08
5.	Arka Abhay	10.	GO-6

Table 2: Scale for categorization of different varieties/genotypes on the basis of susceptibility

Category of resistance	Scale for resistance
Highly Resistant	$\bar{X} i \leq (\bar{X} - 2SD)$
Resistant	$(\bar{X} - SD) \geq \bar{X} i > (\bar{X} - 2SD)$
Moderately Resistant	$\bar{X} \geq \bar{X} i > (\bar{X} - SD)$
Moderately Susceptible	$\bar{X} < \bar{X} i \leq (\bar{X} + SD)$
Susceptible	$(\bar{X} + SD) < \bar{X} i \leq (\bar{X} + 2SD)$
Highly Susceptible	$\bar{X} i > (\bar{X} + 2SD)$

Categorization of okra varieties/ genotypes**Shoot Damage (%)**

Considering the data on per cent shoot damage, it's evident that none of the varieties/genotypes were found highly resistant and highly susceptible (Table 3). However, VRO-6 (18.85%) and GJO-3 (19.00%) were categorized as resistant varieties/genotypes. The category moderately resistant included GO-6 (20.60%), GO-2 (20.65%) and Arka

Anamika (20.71%) while, JOL-21-08 (21.97%) and Arka Abhay (22.06%) were categorized as moderately susceptible. The varieties/genotypes Pusa Savani (23.28%), JOL-20-4 (23.42%) and JOL-21-02 (23.48%) proved to be susceptible to shoot damage.

Fruit Damage (%)

Based on the data of per cent fruit damage, it's evident that none of the varieties/genotypes were found highly resistant and highly susceptible (Table 4). However, VRO-6 (26.64%) and GO-2 (26.88%) were categorized as resistant varieties/genotypes. The category moderately resistant included GO-6 (29.41%), GJO-3 (29.49%) and Arka Anamika (29.57%) while, Arka Abhay (31.07%) and Pusa Savani (31.19%) and were categorized as moderately susceptible. The varieties/genotypes, JOL-21-08 (32.99%), JOL-21-02 (33.09%) and JOL-20-4 (33.17%) proved to be susceptible to fruit damage.

Table 3: Categorization of okra varieties/genotypes for their susceptibility to shoot damage against shoot and fruit borer

Category of resistance	Scale	Varieties/Genotypes (Per cent shoot damage)
	$\bar{X} = 13.38$	$SD = 2.02$
Highly resistant	$\bar{X} i \leq 9.32$	-
Resistant	$11.35 \geq \bar{X} i > 9.32$	VRO-6 (10.44) GJO-3 (10.60)
Moderately resistant	$13.38 \geq \bar{X} i > 11.35$	GO-6 (12.38) GO-2 (12.45) Arka Anamika (12.51)
Moderately susceptible	$13.38 < \bar{X} i \leq 15.40$	JOL-21-08 (14.00) Arka Abhay (14.10)
Susceptible	$15.40 < \bar{X} i \leq 17.43$	Pusa Savani (15.62) JOL-20-4 (15.79) JOL-21-02 (15.88)
Highly susceptible	$\bar{X} i > 17.43$	-

Note: $\bar{X}$ = Mean value of all varieties/genotypes

$\bar{X} i$ = Mean value of individual varieties/genotypes Figures in the parenthesis are per cent shoot damage SD = Standard deviation

Table 4: Categorization of okra varieties/genotypes for their susceptibility to fruit damage against shoot and fruit borer

Category of resistance	Scale	Varieties/Genotypes (Per cent fruit damage)
	$\bar{X} = 25.61$	$SD = 3.62$
Highly resistant	$\bar{X} i \leq 18.36$	-
Resistant	$21.99 \geq \bar{X} i > 18.36$	VRO-6 (20.10) GO-2 (20.44)
Moderately resistant	$25.61 \geq \bar{X} i > 21.99$	GO-6 (24.11) GJO-3 (24.23) Arka Anamika (24.35)
Moderately susceptible	$25.61 < \bar{X} i \leq 29.23$	Arka Abhay (26.63) Pusa Savani (26.82)
Susceptible	$29.23 < \bar{X} i \leq 32.85$	JOL-21-08 (29.65) JOL-21-02 (29.81) JOL-20-4 (29.94)
Highly susceptible	$\bar{X} i > 32.85$	-

Note: $\bar{X}$ = Mean value of all varieties/genotypes

$\bar{X} i$ = Mean value of individual varieties/genotypes Figures in the parenthesis are per cent fruit damage SD = Standard deviation

Konsam *et al.* (2015) [6] studied that Arka Anamika showed medium level resistance fruit damage against *E. vittella*. Dave and Pandya (2017) conducted a field study, the results showed that Arka Anamika had minimum fruit damage (11.61%) and highest yield (67.61 q/ha). Mouli and Tayde (2017) conducted a screening experiment in which Pusa Savani and IC-45831 were categorized as susceptible. According to Navneet and Tayde (2018) [10], significantly minimum shoot infestation was registered by genotypes VRO-6 (check) (7.91%) and categorized as moderately

resistant to *E. vittella*, indicating comparatively lower shoot and fruit incidence than susceptible and highly susceptible lines.

Subbireddy *et al.* (2018) [13] screened that GAO-5 and GJO-3 were resistant and recorded the highest fruit yield in both seasons. Sharma *et al.* (2025) [12] evaluated that varieties Pusa Bhindi-5 and Pusa Sawani susceptible to shoot borer, while for fruit infestation, Pusa Sawani and Arka Abhay were susceptible. Thus, present findings are more or less similar with earlier findings.

Fruit Yield (kg/ha)

The data on fruit yield of different varieties/genotypes of okra tested against *E. vittella* for their susceptibility represented in Table 5 and graphically depicted in Figure 2 revealed notable differences among treatments. The chronological order as per the highest fruit yield (kg/ha) of various varieties/genotypes given in bracket was: VRO-6 (11818 kg/ha) > GJO-3 (11237 kg/ha) > GO-6 (10389 kg/ha) > GO-2 (10356 kg/ha) > Arka Anamika (9997 kg/ha) > JOL- 21-08 (8435 kg/ha) > Arka Abhay (8068 kg/ha) > Pusa Savani (6954 kg/ha) > JOL- 21-4 (6819 kg/ha) > JOL-21-02 (6446 kg/ha). Among the different varieties/genotypes VRO-6 found the best variety and recorded significantly higher (11818 kg/ha) fruit yield than rest of the varieties/genotypes and was statically at par with GJO-3 (11237 kg/ha). However, it was followed by GO-6 (10389 kg/ha) which was statically at par with GO-2 (10356 kg/ha) and Arka Anamika (9997 kg/ha). While, JOL-21-08

(8435 kg/ha) was statistically in line with Arka Abhay (8068 kg/ha). There was no statistical difference in fruit yield obtained from the genotype Pusa Savani (6954 kg/ha), JOL-21-4 (6819 kg/ha) and JOL-21-02 (6446 kg/ha). Among all screened varieties/genotypes JOL-21-02 recorded significantly the lowest (6446 kg/ha) fruit yield under the investigation.

Conclusion

The variety/genotype VRO-6 and GJO-3 identified as resistant (R) and varieties/genotypes Pusa Savani, JOL-20-4 and JOL-21-02 were categorized under susceptible (S) category against *E. vittella* infesting shoot of okra. While in case of fruit infestation the variety/genotype VRO-6 and GO-2 found to be resistant (R) and varieties/genotypes JOL-21-08, JOL-21-02 and JOL-20-4 were categorized under susceptible (S) category against *E. vittella* in okra.

Table 5: Relative susceptibility of different varieties/genotypes of okra against shoot and fruit borer, *E. vittella* during Kharif-2025 (based on pooled over period)

No.	Name of varieties/Genotypes	Shoot damage (%)	Fruit damage (%)	Fruit yield (kg/ha)
1.	Pusa Savani	23.28(15.62)	31.19(26.82)	6954
2.	GO-2	20.65(12.45)	26.88(20.44)	10356
3.	VRO-6	18.85(10.44)	26.64(20.10)	11818
4.	GJO-3	19.00(10.60)	29.49(24.23)	11237
5.	Arka Abhay	22.06(14.10)	31.07(26.63)	8068
6.	Arka Anamika	20.71(12.51)	29.57(24.35)	9997
7.	JOL-20-4	23.42(15.79)	33.17(29.94)	6819
8.	JOL-21-02	23.48(15.88)	33.09(29.81)	6446
9.	JOL-21-08	21.97(14.00)	32.99(29.65)	8435
10.	GO-6	20.60(12.38)	29.41(24.11)	10389
	S. Em. $\pm$	0.33	0.50	478
	C.D. at 5%	0.92	1.38	1419.6
	C. V. (%)	9.31	8.94	9.14

Note: Figures outside the parenthesis () are arc sin transformed values and those inside the parenthesis are retransformed values

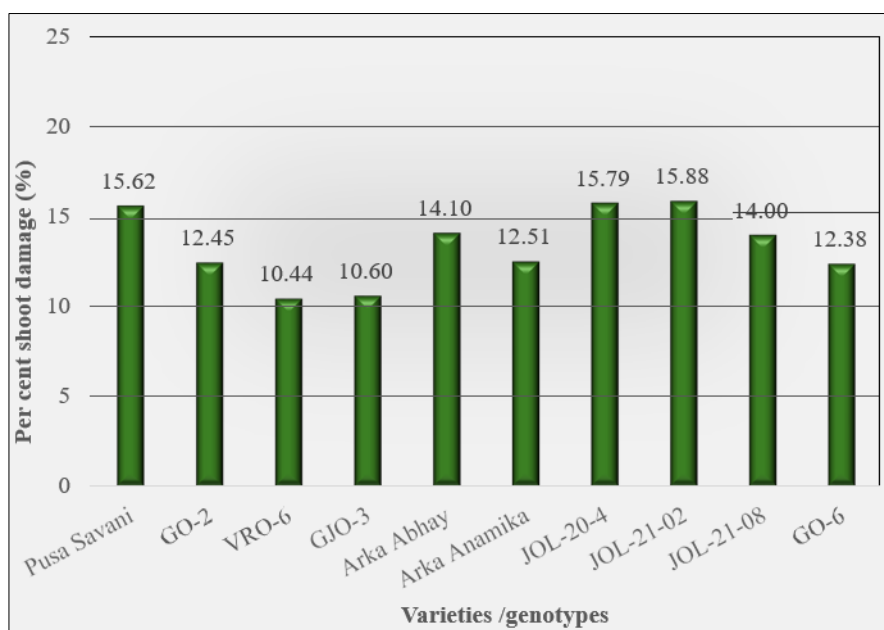


Fig 1: Screening of different varieties/genotypes for their susceptibility to shoot damage against *E. vittella* in Kharif okra

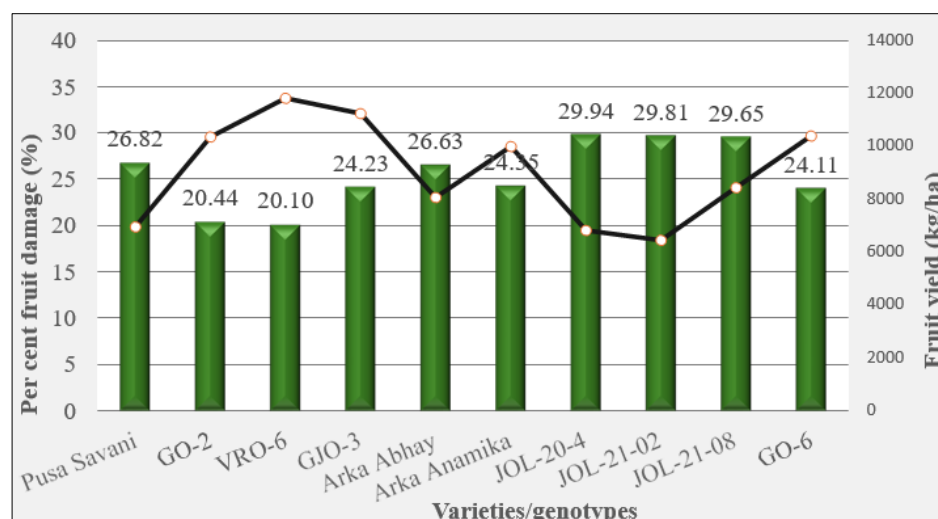


Fig 2: Screening of different varieties/genotypes for their susceptibility to fruit damage against *E. vittella* in Kharif okra

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Author contribution

Mamta J.: She is main researcher for the said research findings. Gadhiya V.C.: He has served as major advisor of the research findings.

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