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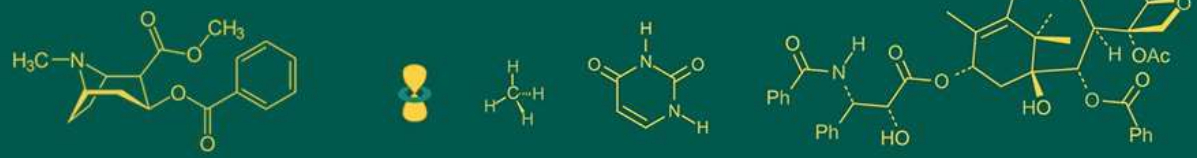

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Field screening of varieties/genotypes against mite infesting okra

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Abstract
Field screening of varieties/genotypes against mite infesting okra revealed that the lowest mite population was observed on GAO-5 (0.70 mites/2 cm^2), while highest mite population was found in Pusa sawani (7.48 mites/2 cm^2). From the categorization, it can be revealed that GAO-5 (0.70 mites/2 cm^2) was found highly resistant to mite population while, GO-2 found resistant to the mites. Conversely, JOL- 14-10 (6.06 mites/2 cm^2), Pusa sawani (7.48 mites/2 cm^2) and JOL-20-5 (6.31 mites/2 cm^2) are susceptible.

Keywords: Mite, varieties, *Tetranychus urticae*, genotypes

Introduction
Okra [*Abelmoschus esculentus* (L.) Moench] is most delicious vegetable relished world over. It belongs to the family Malvaceae. The place of origin of okra is contradictory among the scientists. Rao (1985) [7] reported that the origin of okra is Northern India. Okra is particularly cultivated in almost all countries of the world (Saifullah and Rabbani, 2009) [8]. It is commercially cultivated in different parts of world viz., India, Iran, Pakistan, South Africa, Yugloslavia, Brazil, Thailand, Ethopia, Malaysia, Myanmmar, Afghanistan, Bangladesh, United States, Turkey and Cyprus (Benjawan *et al*., 2007) [2]. India ranks first in area and production in the world. It is a major commercial vegetable cultivated all over India particularly in the states of Andhra Pradesh, West Bengal, Jharkhand, Orissa, Uttar Pradesh, Madhya Pradesh, Karnataka, Gujarat and Maharashtra. In Gujarat, okra is grown throughout the year providing continuous and good source of income to the farmers in fetches lucrative price due to shortage of other vegetables in the market.
In Gujarat, Surat, Gandhinagar, Junagadh, Surendranagar, Baroda, Navsari, Sabarkantha, Kheda, Anand, Banaskantha, Jamnagar and Bhavnagar have been identified as major okra-growing districts with total area under okra cultivation of 0.94 lakh ha with a production of 11.48 lakh tonnes (Anon., 2023) [1]. Like other vegetable crops, okra is also attacked by a wide range of biotic and abiotic on strains. The incidence of insect pests is a major constraint for low productivity. Okra crop harbours to a large number of insect pests including vectors (Showkat *et al*., 2010) [9]. Nearly, 72 insect species have been recorded on okra (Srinivasa and Rajendran, 2003) [11]. The major pests those attack okra crop include aphid, *Aphis gossypii* Glover; leafhopper, *Amrasca biguttula biguttula* Ishida; whitefly, *Bemisia tabaci* (Gennadius); red spider mite, *Tetranychus* spp. and shoot and fruit borer, *Earias vittella* Fab. Which cause damage to okra plants results into yield losses. *Tetranychus urticae Koch* is also called a two-spotted spider mite. In India, it is found in all states and very common in Bihar, Mysore, Rajasthan, Uttar Pradesh, Punjab, Haryana, and Gujarat. It is a polyphagous pest that feeds on 183 species of plants including vegetables. Both nymphs and adults cause damage by sucking the cell sap from the under surface of leaves and produce white spots which later get covered by a thick web. It results in discoloration of infested leaves, which turn bronze and dry up. Severely infected plants remain stunted with reduced flowering and fruiting. In various crops loss is reported as 10 to 15 percent in rice, 15 to 20 percent in tea, 10 to 25 percent in sugarcane as well as 13 to 31, 20 to 25 and 27 to 39 percent loss in brinjal, okra and chilies, respectively (Rachna, 2004) [6].

To avoid the yield losses caused by red spider mite and encourage cultivation as well as to increase the production and productivity of okra crop, our efforts are needed to tackle the pest by varietal screening is helpful to selection of suitable the resistant variety against red spider mite. Extensive and indiscriminate use of chemicals on okra gives the chance of contamination of fruits with pesticides residues. In order to avoid the adverse consequences of insecticides, it was become necessary to evaluate safe and effective insecticides to develop a safe management schedule. In view of the importance of the okra crop and seriousness of this pest, it become necessary to have comprehensive detailed studies on "field screening of varieties/genotypes against mite infesting okra" under the Junagadh condition. Therefore, the present investigation was carried out with this aspect; To evaluate the field screening of varieties/genotypes against mite infesting okra.

Methodology

The present investigation on "field screening of varieties/genotypes against mite infesting okra" was carried out at the Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh during *Kharif*, 2023. The methodology to be adopted on various aspects during the course of present investigations has been presented here under.

To study the field screening of varieties/genotypes against mite infesting okra, an experiment was carried out on different varieties/genotypes of okra during *Kharif*, 2023. Two lines of each varieties/genotypes were grown with the spacing of 60 x 30 cm and the same would be followed for other replication. All other agronomical practices were followed as per the scientific recommendations and varieties/genotypes under the experiment were free from insecticides throughout the season. For recording observations, five plants were randomly selected and tagged in each plot area. The mite population was recorded from three (upper, middle and lower) leaves of 2 cm^2leaf area of same selected five plants. The observation was started from one week after germination and continued till the removal of the crop at a weekly interval.

Table 1: Treatment details of okra varieties/genotypes

1.	GO-6
2.	VRO-6
3.	KS-404
4.	JOL-20-4
5.	AOL-03-01
6.	GO-2
7.	JOL-14
8.	HRB-108-2
9.	JOL-18-12
10.	JOL-16-06
11.	GAO-5
12.	HRD-55
13.	Pusa Sawani
14.	JOL-20-5
15.	JOL-2K-19

The different okra varieties/genotypes were grouped into six categories of resistance to mite viz., highly resistant, resistant, moderately resistant, moderately susceptible, susceptible and highly susceptible. For this purpose, the mean value of individual genotype ($\bar{X}i$) was compared with the mean value of all genotypes ($\bar{X}$) and standard deviation (SD). The retransformed data was used for computation of $\bar{X}$, $\bar{X}i$ and SD in case of this parameter. The scale used for categorizing different varieties/genotypes are given as under.

Table 2: Scale for categorization of Okra Varieties/ Genotypes for their resistance against mite

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	$\bar{X}i > (\bar{X} + 2SD)$

Results and Discussion

Field screening of varieties/genotypes against mite infesting okra

Considering the economic importance of insect pests infesting okra, fifteen varieties/genotypes of okra viz., GO-6, VRO-6, KS-404, JOL-20-4, AOL-03-01, GO- 2, JOL-14-10, HRB-108-2, JOL-18-12, JOL-16-06, GAO-5, HRD-55, Pusa sawani, JOL-20-5 and JOL-2K-19 were selected and screened against mite under field conditions for their susceptibility/resistance at the Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh during kharif, 2023. The observations on the basis of numbers of mite/2 cm2 leaf area were recorded for each varieties/genotypes.

The mean population of mite, as shown in Table 3 ranged from 0.70 to 7.48 mites/2 cm^2 leaf area. The lowest population of mite was observed on GAO- 5 (0.70 mites/2 cm^2) followed by GO-2 (2.68 mites/2 cm^2), VRO-6 (3.04 mites/2 cm^2), AOL-03-01(3.52 mites/2 cm^2), JOL-18-12 (4.03 mites/2 cm^2). JOL-18-12 was at par with JOL-20-4 (4.16 mites/2 cm^2), HRD-55 (4.29 mites/2 cm^2) and JOL-2K-19 (4.40 mites/2 cm^2). The next best varieties/genotypes were KS-404 (4.83 mites/2 cm^2), HRB-108-2 (4.95 mites/2 cm^2), GO-6 (5.15 mites/2 cm^2), JOL-16-06 (5.80 mites/2 cm^2), JOL-14-10 (6.06 mites/2 cm^2) and JOL-20-5 (6.31 mites/2 cm^2) whereas the highest population was observed in Pusa sawani (7.48 mites/2 cm^2).

Table 3: Incidence of mite in okra in different varieties/genotypes (*kharif*, 2023)

Sr. No.	Varieties/Genotypes	No. of mites/2 cm^2 leaf
1	GO-6	2.27(5.15)
2	VRO-6	1.74(3.04)
3	KS-404	2.20(4.83)
4	JOL-20-4	2.04(4.16)
5	AOL-03-01	1.88(3.52)
6	GO-2	1.64(2.68)
7	JOL-14-10	2.46(6.06)
8	HRB-108-2	2.23(4.95)
9	JOL-18-12	2.01(4.03)
10	JOL-16-06	2.41(5.80)
11	GAO-5	0.84(0.70)
12	HRD-55	2.07(4.29)
13	Pusa sawani	2.73(7.48)
14	JOL-20-5	2.51(6.31)
15	JOL-2K-19	2.10(4.40)
S. Em. ±		0.03
CD at 5%		0.09
CV%		10.15

Note: Figures in parentheses are retransformed values; those outside are square root transformed values

Categorization of okra varieties/genotypes for their resistance

The categorization of mite infestation based on mites/2cm^2 leaf area. Among them, GAO-5 (0.70 mites/2 cm^2) was found highly resistant to mite population, while, GO-2 was categorized as resistant to the mite population (Table 4). Six genotypes/varieties were categorized as resistant to mite population, viz., VRO-6 (3.04mites/2 cm^2), JOL-20-4 (4.16 mites/2 cm^2), AOL-03-01 (3.52 mites/2 cm^2), JOL-18-12(4.03 mites/2 cm^2), HRD-55 (4.29 mites/2 cm^2) and JOL-2K-19 (4.40 mites/2 cm^2). Four genotypes/varieties were proved to be moderately susceptible, viz., GO-6 (5.15 mites/2 cm^2), KS-404 (4.83 mites/2 cm2), HRB-108-2 (4.95 mites/2 cm^2) and JOL-16-06 (5.80 mites/2 cm^2). Three genotypes/varieties included in susceptible category to mite population, viz., JOL-14-10 (6.06 mites/2 cm^2), Pusa sawani (7.48 mites/2 cm^2) and JOL-20-5 (6.31 mites/2 cm^2). None of the genotypes/varieties were found highly susceptible to mite population.

According to Siddhapara *et al*. (2016) [10] reported that cultivar GAO-5 emerged out as highly resistant to *T. urticae* with lowest mite population were as GO-2 found to be resistant and variety Pusasawani was susceptible to the mite population. Dabhi (2008) [3] found that the variety VRO-6 resistant to mite. Naga (2012) [5] also found that the variety VRO-6 less susceptible while variety Pusasawani was highly susceptible to the mite population. Mani and Singh (2012) [4] reported that the maximum population of *T. urticae* was observed in cultivar Pusasawani. Rachna (2004) [6] found that the maximum number of mites observed in variety Pusasawani.

Table 4: Categorization of okra varieties/genotypes for their resistance

Category of resistant	Scale		Varieties $\bar{X}$i
Based on no. of mites/2 cm^2 leaf area : $\bar{X}$= 4.49 SD = 1.60			
Highly resistant	$\bar{X}$i ≤ ($\bar{X}$− 2SD)	$\bar{X}$i ≤ 1.29	GAO-5 (0.70)
Resistant	($\bar{X}$− SD) ≥ $\bar{X}$i> ($\bar{X}$−2SD)	2.89 ≥ $\bar{X}$i> 1.29	GO-2 (2.68)
Moderately Resistant	$\bar{X}$≥ $\bar{X}$i> ($\bar{X}$− SD)	4.49 ≥ $\bar{X}$i> 2.89	VRO-6 (3.04), JOL-20-4 (4.16), AOL-03-01 (3.52), JOL-18-12 (4.03), HRD-55 (4.29), JOL-2K-19 (4.40)
Moderately susceptible	$\bar{X}$<$\bar{X}$i ≤ ($\bar{X}$+ SD)	4.49 <$\bar{X}$i ≤ 6.09	GO-6 (5.15), KS-404 (4.83), HRB-108-2 (4.95), JOL-16-06 (5.80)
Susceptible	($\bar{X}$+ SD) <$\bar{X}$i ≤ ($\bar{X}$+ 2SD)	6.09 <$\bar{X}$i ≤ 7.69	JOL-14-10 (6.06), Pusasawani (7.48), JOL-20-5 (6.31)
Highly Susceptible	$\bar{X}$i> ($\bar{X}$+ 2SD)	$\bar{X}$i> 7.69	--

Note: Figures in parentheses are no. of mites/2 cm^2 leaf area
Where, $\bar{X}$i = Mean value of individual varieties/genotypes
$\bar{X}$= Mean value of all varieties/genotypes
SD = Standard deviation

Conclusion

A minimum mite population (0.70 mites/2 cm^2) was recorded in the variety/genotype GAO-5, while the Pusa sawani recorded a maximum population of 7.48 mites/2 cm^2.The varietie/genotype GAO-5 was found highly resistant to the mite population, while the varieties/genotypes JOL-14-10, Pusa sawani, and JOL-20-5 were classified as susceptible.

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