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VARIETAL SCREENING OF OKRA, *ABELMOSCHUS ESCULENTUS* (L.) MOENCH AGAINST MITE, *TETRANYCHUS CINNABARINUS* (BOISDUVAL)

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ABSTRACT

The experiment conducted during 2004 and 2005 revealed that Pusa Sawani recorded maximum population of mite while Arka Anamika recorded the lowest mite population per leaf. The result indicates a positive correlation between total soluble sugar and total soluble protein with mite population.

key words : Total soluble sugar, mite, okra

Among vegetable crops okra and brinjal are the most affected by mites causing economic loss throughout the country. The red spider mites *viz.*, *Tetranychus cinnabarinus* (Boisduval), *Tetranychus ludeni* Zacher and *Tetranychus neocaledonicus* Andre are of major significance to vegetable crops in India (Rai *et al.*, 1991).

Among the mite pests, *T. cinnabarinus* is common and causes appreciable damage to okra crop particularly during dry months of the year, even under drought conditions, as high as 20 per cent loss in okra has been estimated (Shankarappa *et al.*, 1981). The crop loss in Parbhani Kranti variety of okra was reported at Navsari (23.7%); Hisar (11-25%); Varanasi (13-13.6%) and Pusa (45-52%) (Anonymous, 2004).

Expanding vegetable cultivation due to availability of high yielding hybrids is providing sufficient food and congenial environment for the mite to multiply on regular basis. Little work has been done in India on the management of red spider mite *T. cinnabarinus* through plant resistance; therefore, the present investigation was under taken with the objective to screen different varieties of okra against *T. cinnabarinus*.

MATERIALS AND METHODS

The trials were laid out at Horticulture Farm of S.K.N. College of Agriculture, Jobner during *Kharif*, 2004 and 2005, under Randomized Block Design with three replications. The plot size was 2.25 × 3.90 m^2. In both the years, the crop was sown in second week of July with plant to plant distance of 30 cm and row to row distance of 45 cm. Ten okra varieties, *viz.*, Arka Anamika, Parbhani Kranti, Bhanu Priya, Varsha Uphar, VRO-6, Pusa Sawani, VRO-5, GO-2, D-108 and Hybrid No. 18 were used in the trial. Standard cultivation practices were followed as and when needed. Plants under test were kept unsprayed throughout the crop period.

Weekly numerical counts of *T. cinnabarinus* were recorded on different varieties of okra in the field commencing from one month after germination to the last picking of fruits. The observations were recorded on randomly selected five plants of each variety per plot. Three leaves, one each from top (young), middle (mature) and bottom (old) portions of tagged okra plants were plucked randomly, collected in separate properly labelled polythene bags and brought to the laboratory without disturbing mites for assessing population under stereo binocular microscope. Both upper and lower sides of the leaves were examined. The data obtained were subjected to statistical analysis.

To study the relative susceptibility, different varieties of okra were grouped in different categories as less susceptible (< $\bar{x}$–S.D.), moderately susceptible ($\bar{x}$–S.D. to X + SD) and highly susceptible and (> $\bar{x}$ + S.D.) as per method described by Jat *et al.* (1992). Grouping was done on the basis of value calculated considering the general mean ($\bar{x}$) and standard deviation (S.D.) of mite population density in different okra varieties. The data thus collected were analyzed statistically using $\sqrt{X+0.5}$ transformation.

The biochemical attributes, *viz*., Total soluble sugars, Total soluble proteins, Total phenols and Total silica content in healthy as well as damaged leaves of all okra varieties at peak infestation period were analyzed using standard techniques described by Dubois *et al.* (1951),

Lowry *et al.* (1951), Bray and Thorpe (1954) and Jackson (1962), respectively. The correlation coefficient (r) between different biochemical constituents of varieties and mite population was worked out.

RESULTS AND DISCUSSION

Population of *T. cinnabarinus*

The observations on mite population were recorded at weekly intervals starting from initiation of population (second week of August) to population disappearance (second week of October) during both the years.

Pooled analysis of data (Table-1) revealed that maximum population of mite was recorded on Pusa Sawani (4.07 mites/3 leaves), whereas, it was minimum on Arka Anamika (1.90 mites/3 leaves). However, this trend continued till peak population was observed in the third week of September, where varieties Arka Anamika, VRO-6 and VRO-5 harboured mite population ranging from 3.71 to 3.98 mites/3 leaves and remained statically at par to each other being regarded as less susceptible. Whereas, Parbhani Kranti, Varsha Uphar and Pusa Sawani harboured maximum population (6.78 to 7.14 mites/3 leaves) and proved highly susceptible. The other varieties ranked in middle order of susceptibility. The ascending order of susceptibility was : Arka Anamika, VRO-6, VRO-5, Hybrid No. 18, D-108, Bhanu Priya, GO-2, Parbhani Kranti, Varsha Uphar and Pusa Sawani.

Categorization of the varieties was done on the basis of $X \pm s$, the general mean (8=2.40) and standard deviation (S.D. = 0.28) as given below:

S. No.	Group	Varieties
1.	Less susceptible	Arka Anamika, VRO-5 and VRO-6
2.	Moderately susceptible	Bhanu Priya, D-108, Hybrid No. 18 and GO-2
3.	Highly susceptible	Pusa Sawani, Varsha Uphar and Parbhani Kranti

Table 1: Screening of different okra varieties/cultivars against mite, *Tetranychus cinnabarinus* (Boisduval) *Kharif*, 2004 and 2005 (Pooled)

S. No.	Varieties/cultivar	Mean mite population / 3 leaves at weekly interval										
		I	II	III	IV	V	VI	VII	VIII	IX	X	Mean
1	Arka Anamika	1.90 (1.55)	2.30 (1.67)	2.43 (1.71)	2.70 (1.79)	3.37 (1.97)	3.63 (2.03)	11.79 (3.50)	5.09 (2.36)	3.29 (1.94)	0.50 (1.00)	3.71 (2.05)
2	Parbhani Kranti	3.83 (2.08)	4.27 (2.18)	4.37 (2.20)	4.63 (2.26)	5.30 (2.40)	5.63 (2.47)	17.69 (4.26)	10.89 (3.37)	8.90 (3.06)	2.37 (1.69)	6.78 (2.69)
3	Bhanu Priya	2.67 (1.78)	3.10 (1.89)	3.13 (1.90)	3.60 (2.02)	4.30 (2.19)	4.43 (2.22)	14.30 (3.84)	7.29 (2.79)	5.69 (2.48)	1.23 (1.31)	4.97 (2.34)
4	Varsha Uphar	3.77 (2.06)	4.17 (2.16)	4.40 (2.21)	4.80 (2.30)	5.37 (2.42)	5.73 (2.49)	17.99 (4.29)	10.79 (3.35)	9.50 (3.16)	2.43 (1.71)	6.89 (2.71)
5	VRO-6	1.97 (1.57)	2.30 (1.67)	2.47 (1.72)	2.70 (1.79)	3.47 (1.99)	3.73 (2.06)	11.99 (3.53)	5.09 (2.36)	3.29 (1.94)	0.57 (1.03)	3.73 (2.06)
6	Pusa Sawani	4.07 (2.13)	4.23 (2.17)	4.43 (2.22)	4.77 (2.29)	5.63 (2.47)	5.90 (2.53)	18.69 (4.38)	11.09 (3.40)	9.89 (3.22)	2.70 (1.79)	7.14 (2.76)
7	VRO-5	1.91 (1.55)	2.10 (1.61)	2.73 (1.80)	2.87 (1.83)	3.60 (2.02)	3.80 (2.07)	12.50 (3.60)	5.60 (2.47)	4.10 (2.14)	0.70 (1.09)	3.98 (2.11)
8	GO-2	3.83 (2.08)	4.30 (2.19)	3.33 (1.95)	4.53 (2.24)	5.30 (2.40)	5.43 (2.43)	17.49 (4.24)	10.40 (3.30)	8.99 (3.08)	1.87 (1.53)	6.54 (2.65)
9	D-108	2.57 (1.75)	3.17 (1.91)	3.16 (1.91)	3.50 (1.99)	4.13 (2.15)	4.37 (2.20)	14.00 (3.79)	7.29 (2.78)	5.39 (2.42)	1.30 (1.34)	4.88 (2.31)
10	Hybrid No. 18	2.77 (1.81)	2.87 (1.83)	3.10 (1.90)	3.43 (1.98)	4.17 (2.16)	4.37 (2.21)	13.79 (3.78)	7.59 (2.84)	5.37 (2.42)	1.23 (1.32)	4.86 (2.31)
	SEm±	0.040	0.043	0.042	0.046	0.050	0.052	0.096	0.071	0.063	0.028	0.056
	CD at 5%	0.116	0.124	0.123	0.132	0.145	0.149	0.274	0.203	0.182	0.081	0.161

Value in parentheses are $\sqrt{x + 0.5}$

Almost a similar trend was also observed by Gulati, 2004, who found that *T. cinnabarinus* population was higher in okra cultivar of Pusa Sawani and Varsha Uphar in summer as well as winter season crops which support the present finding. Likewise, different varieties of okra were screened against mite, *T. cinnabarinus* and cultivar Pusa Sawani was found most susceptible.

Biochemical factors

The observations recorded on different biochemical attributes for both the years indicated that total soluble sugars and silica contents were higher in healthy leaves in comparison to damaged leaves while, protein and phenols were low in healthy leaves as compared to infested leaves.

The data presented in Table-2 indicated a significant positive correlation between total soluble sugars (r = 0.927, 0.919) and total soluble protein (r = 0.933, 0.944) with mite population in 2004, while such correlations were significantly negative with regards to total phenols (r = –0.945, –0.927) and total silica (r = –0.762, –0.499) in healthy and infested leaves.

Table 2: Biochemical constituents of different okra varieties/cultivars leaves in relation to infestation of okra mite, *Tetranychus cinnabarinus* (Boisduval) *Kharif*, 2004

S. No.	Variety/ cultivar	Mite # population	Total soluble sugars (Mg. g^{-1})		Total soluble protein (Mg. g^{-1})		Total phenols (µg. g^{-1})		Total silica (Mg. g^{-1})	
			Healthy	Infested	Healthy	Infested	Healthy	Infested	Healthy	Infested
1.	Arka Anamika	4.98 (2.34)	4.20	4.10	3.80	3.90	6950	7375	2.0	1.5
2.	Parbhani Kranti	10.80 (3.36)	5.10	4.70	4.60	4.80	5925	6100	1.5	1.0
3.	Bhanu Priya	7.38 (2.80)	4.80	4.40	4.30	4.50	6775	6850	2.5	2.0
4.	Varsha Uphar	10.98 (3.38)	5.00	4.90	4.70	5.00	5950	6100	2.0	2.0
5.	VRO-6	5.19 (2.38)	4.40	3.80	3.80	3.90	7035	7375	2.5	2.0
6.	Pusa Sawani	10.98 (3.38)	5.10	4.80	4.80	5.10	6015	6150	1.5	1.5
7.	VRO-5	5.40 (2.43)	4.20	4.00	3.80	4.00	7025	7415	2.5	2.0
8.	GO-2	10.59 (3.33)	5.20	4.80	4.90	5.00	6400	6810	1.5	1.0
9.	D-108	7.20 (2.77)	4.80	4.20	4.30	4.40	6915	6890	2.5	2.0
10.	Hybrid No. 18	6.99 (2.74)	4.80	3.80	4.50	4.70	6935	6875	2.0	1.5
	SEm±	0.09	0.34	0.31	0.31	0.32	427.83	461.68	0.14	0.12
	CD at 5%	0.29	1.00	0.92	0.92	0.99	1271.15	1371.74	0.43	0.35
	Correlation coefficient (r)	–	0.927**	0.919**	0.933**	0.944*	–0.945**	–0.927**	–0.762*	–0.499*

= Mean mite population/3 leaves Figures in parentheses are $\sqrt{X + 0.5}$

* Significant at p = 0.05, **Significant at p = 0.01

Table 3: Biochemical constituents of different okra varieties/cultivars leaves in relation to infestation of okra mite, *Tetranychus cinnabarinus* (Boisduval) *Kharif*, 2005

S.No.	Variety/ cultivar	Mite # population	Total soluble sugars (Mg. g^{-1})		Total soluble protein (Mg. g^{-1})		Total phenols (µg. g^{-1})		Total silica (Mg. g^{-1})	
			Healthy	Infested	Healthy	Infested	Healthy	Infested	Healthy	Infested
1.	Arka Anamika	5.19 (2.38)	4.30	4.10	3.90	4.00	7000	7450	2.5	2.0
2.	Parbhani Kranti	10.98 (3.38)	5.00	4.60	4.80	4.90	5950	6100	1.5	1.0
3.	Bhanu Priya	7.20 (2.77)	4.90	4.30	4.30	4.40	6875	6900	2.0	1.5
4.	Varsha Uphar	10.59 (3.32)	5.10	4.80	4.90	5.10	5975	6125	2.0	2.0
5.	VRO-6	4.98 (2.34)	4.40	3.90	3.80	3.90	7045	7415	2.5	2.5
6.	Pusa Sawani	11.19 (3.42)	5.20	4.80	4.90	5.10	6025	6115	1.0	1.0
7.	VRO-5	5.79 (2.51)	4.10	3.90	3.90	4.00	7025	7450	2.0	1.5
8.	GO-2	10.20 (3.27)	5.10	4.70	5.00	5.10	6410	6835	1.5	1.0
9.	D-108	7.38 (2.80)	4.80	4.00	4.40	4.50	6925	6875	2.0	1.5
10.	Hybrid No. 18	8.19 (2.95)	4.90	3.90	4.50	4.60	6945	6775	2.0	1.5
	SEm±	0.10	0.34	0.30	0.32	0.33	452.29	462.04	0.12	0.10
	CD at 5%	0.30	1.00	0.90	0.94	0.97	1343.84	1372.81	0.37	0.30
	Correlation coefficient (r)	–	0.896**	0.873*	0.974**	0.977**	-0.926**	-0.942*	-0.847**	-0.680*

= Mean mite population/3 leaves Figures in parentheses are $\sqrt{X + 0.5}$

* Significant at p = 0.05, **Significant at p = 0.01

The results presented in Table-3 indicated more or less similar trend with regards to biochemical parameters in 2005. The corresponding figures for total soluble sugars and total soluble protein were (r = 0.896, 0.873) and (r = 0.974, 0.977) in healthy and infested leaves, respectively. However, such values were (r = –0.926, –0.942) and (r = – 0.847, –0.680) for total phenols and total silica in healthy and infested leaves, respectively.

A perusal of available literature revealed that little information is currently available on the biochemical characterization of okra leaves for screening their resistance against *T. cinnabarinus*. The tolerance of okra cultivars to jassid, *A. biguttula biguttula* was found to be inversely correlated with total phenols present in the leaves (Kaur *et al.*, 1996). During present investigation it was found that total soluble sugar and silica content were higher in healthy leaves in comparison to damaged leaves, while protein and phenols were low as compared to infested leaves in all the varieties. The reduction in total soluble sugar in mite infested leaves may be due to impaired photosynthesis and subsequent utilization by *T. cinnabarinus* (Nangia *et al.*, 1999). Likewise, Bhagel *et al.* (1994) reported significantly high total soluble sugar content in healthy mango panicle as compared to malformed panicle infested by *Aceria mengiferae*.

During the present investigation protein and phenols were higher in infested leaves. Kielkievicz (1991) were also of the opinion of increased phenolic content in infested leaves of tomato infested by *T. cinnabarinus* and he further reported that this could be considered as a part of defense system which developed in plant shortly after mite feeding.

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