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SCREENING OF OKRA VARIETIES AGAINST OKRA YELLOW VEIN MOSAIC VIRUS (OYVMV) UNDER FIELD CONDITIONS IN SOUTHERN RAJASTHAN

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ABSTRACT

Seventeen cultivars of okra (bhindi) were screened for resistance agaist Okra Yellow Vein Mosaic Virus (OYVMV) under field conditions. The vector of OYVMV is *Bemisia tabaci* Genn. On the basis of mean disease incidence percentage and susceptibility rating cultivars Mahyco Bhindi No.64, Marval No. 1003 and 1004 were found to be resistant to OYVMV infection. Besides, fairly high degree of tolerance was obtained in seven lines *viz*., Mahyco No. 55, JK 045, JK-7315, *Sonal*, *Kirthi*, *Karina, Malav-27* and *Arka Anamika* under field conditions, which showed disease incidence ranging from 1.92 to 55.63 per cent. The yields among the germplasm differed significantly. The lowest mean yield of 39.42 q/ha was obtained for Arka Anamika; whereas, the highest mean yield 112.38 q/ha was recorded in Mahyco B. No. 55.

Keywords: *Bemisia tabaci*, Okra Yellow Vein Mosaic Virus (OYVMV), disease incidence

INTRODUCTION

Okra [*Abelmoschus esculentus* L. (Moench)] is an important vegetable crop grown in tropical and sub-tropical regions of the world (Benchasri, 2011). It contains vitamin A, B, C and protein, carbohydrates, fats, minerals, iron and iodine. India is the highest producer of okra with a production of 5.78 million tons (72% of the total world production) from over 0.498 million hectares (Sanwal *et al*., 2014). Okra gets infected by a number of fungi, bacteria, viruses, mycoplasma, nematodes, and infested by pestiferous insects (Petlamul *et al*., 2009; Prakasha *et al*., 2010). Several viruses are reported to infect and one of the destructive viral diseases is yellow vein mosaic disease (OYVMD). The yield loss in okra due to the disease mentioned has been estimated up to 20-30 per cent that may increase up to 80-90 per cent in case of severe infection (Ali *et al*., 2005). Okra yellow vein mosaic virus (OYVMV) belongs to the family *Geminviridae* and is known to be transmitted by the vector whitefly (*Bemisia tabaci* Genn) and consisting of a monopartite begomovirus (Sindhumole and Manju, 2013). Symptoms appear as homogenous interwoven network of yellow veins enclosing islands of greentissues. The infected leaves show yellowing of veins and vein-lets, and in later stages, complete yellowing of leaves occur in infected plant and even infected fruits also show yellow color, small, deformed and tough in texture. At the early stages, plants become stunted. Several attempts have been made to manage whitefly and the disease by chemical means, but none of the chemicals was found effective; therefore, an attempt was made to identify tolerance in okra from the locally available cultivars under natural field screening method.

MATERIALS AND METHODS

Plant Material: Fifteen varieties of okra [Mahyco No: 10, 55 and 64; JK: 045 & 7315; Nuziveedu: 1003 & 1004; Nunhems: Sonal; Ankur: 40 & 41; Mahindra: Karina; Kirti; Malav-2; Swathi (Local Variety) and Arka Anamika (Check)] were procured from the local market at Banswara and Udaipur.

Planting and experimental design

Fifteen okra varieties were sown in the research area of Agriculture Research Station, Banswara. Seeds were planted in a growing season during *Zaid* (*Jhaid*) 2012 and 2013. Each variety was replicated three times with 45cm row to row and 20cm plant to plant distance. All the recommended cultural practices were followed to raise the crop; however, no plant protection measures were taken up.

Data sampling: The virus disease assessment was conducted six times during the growing season starting from 30 DAS at an interval of 15 days. The per cent disease incidence (PDI) was calculated by the given formula:

$$PDI = \frac{\text{Number of diseased plants}}{\text{Total number of plants}} \times 100$$

The disease on each test entry was assessed in according to disease rating scale given by Ali *et al*. (2005) (Table 1). Fresh fruits were harvested in the plot at three days interval over one month period and pooled; later the yield was extrapolated on a per hectare basis.

Statistical analysis: Data regarding OYVMV was recorded and subjected to statistical analysis. All possible interactions were determined through ANOVA.

Table 1. Disease rating scale of OYVMV

Rating Scale	Severity Range (%)
0) Immune	0%
1) Highly resistant	1% - 10%
2) Moderately resistant	11% - 25%
3) Tolerant	26% - 50%
4) Moderately susceptibility	51% - 60%
5) Susceptibility	61% - 70%
6) Highly susceptibility	71% - 100%

RESULTS AND DISCUSSION

Summer Season 2012:

The response of fifteen okra varieties against OYVMV was observed under natural conditions. Data on the reaction of various varieties of okra to YVMD is given in Table (2). Results indicated a wide range of response within the tested varieties, ranging from resistance to highly susceptible. On the basis of disease incidence percentage, lower disease incidence was observed in varieties like JK-7315 (1.50%), Mahyco B. No.55 (2.92%) and Nuziveedu-1003 (8.33%), while higher disease incidence was observed in Ankur-41(64.85%), Ankur-40 (89.00%) and Mahyco B No. 10 (65.42%). All other varieties showed medium range disease incidence. *Swathi* as a local variety recorded 50.83 per cent and Arka Anamika recorded 55.83 per cent disease incidence.

Summer season 2013:

The mean percentage of disease incidence was higher in 2013 than in 2012 (Table 2). Except few varieties all other varieties exhibited different reaction to the disease when compared to the previous year's observation. JK-7315 and Mahyco B. No. 55 recorded lower disease incidence being 2.33 and 3.58 per cent, respectively. Less than 50 per cent disease incidence was observed in varieties *viz*., Mahyco B No. 64, JK seeds 045, Nuziveedu 1003, Nuziveedu 1004, Sonal, Kirti and Karina; whereas, Mahyco B No. 10, Ankur-40 & 41, Malav-21, Swati and Arka Anamika recorded more than 50 per cent disease incidence and the highest was recorded in Ankur 40.

The mean disease incidence of both the years and disease rating scale of different varieties are shown in Table (3). It indicated that the JK-7315 had great potential of resistance against OYVMV, only 1.92 per cent plant infection was observed on this variety, followed by that in Mahyco B. N0.55 (3.25%). The variety JK-045 recorded disease incidence percentage of 28.71 and showed tolerance in nature against OYVMV. Most okra varieties (6 of 15 varieties) were categorized as of moderate resistance level. Two varieties were classified to each of moderate susceptible and highly susceptible. Mahyco B No. 10 and *Swathi* showed 65.25 per cent and 61.04 per cent plant infection, respectively, thus were rated as susceptible.

Ali *et al*. 2005 reported Safal, Subz Pari and Surkh Bhindi varieties against OYVMV in a field trial (3.36-24.40%). Saurabh *et al*. (2016) studied nineteen okra varieties andreported that Soumya F1 (OH-4002) and Hybrid No.-10 was moderately resistant, while Hybrid No-8 was resistance against OYVMV. Bhendi No-18, Tanvi, CK-7, Ankur, Prabha kranti, Pusa A4 , Harbhajan, Lakshmi, Versa Upahaar, 40 days bhendi, Ankur- 40, Arka abhaya, Arka Anamika, Reshma were susceptible, while Pusa Sawani, Varsha were highly susceptible to OYVMV. The highest fruit yield was recorded on Hybrid No-10 at 232.48 and 225.41q/ha in summer 2013 and kharif 2013, respectively; whereas, Pusa Sawani produced the lowest yield (85.41 and 80.71 q /ha in summer and kharif 2013).

This study indicated that resistant okra varieties against OYVMV could be a useful source of resistant genes and could be exploited in breeding okra cultivars resistant to insect pests and yellow vein mosaic virus..

Table 2. Incidence of different okra varieties against *Okra yellow vein mosaic virus* under natural condition during 2012 & 2013.

Varieties	Disease Incidence (%)		Yield (q/ha)		
	2012	2013	2012	2013	Mean
Mahyco B No. 10	65.42 (54.01)	65.08 (53.80)	71.56	74.33	72.95
Mahyco B No. 64	12.33 (20.51)	20.33 (26.77)	90.12	86.78	88.45
Mahyco B. No. 55	2.92 (6.02)	3.58 (10.75)	115.12	109.64	112.38
JK seeds 045	20.83 (26.95)	36.58 (37.21)	95.90	80.75	88.33
JK seeds7315	1.50 (5.85)	2.33 (8.74)	114.50	107.58	111.04
Nuziveedu 1003	8.33 (16.77)	14.83 (22.64)	103.70	90.45	97.08
Nuziveedu 1004	10.67 (19.06)	17.00 (24.35)	97.53	88.16	92.85
Sonal(Nunhems)	16.25 (23.65)	20.33 (26.78)	113.68	103.76	108.72
Kirti	5.17 (13.09)	31.83 (34.30)	118.81	91.50	105.16
Karina (mahindra)	10.83 (18.89)	12.25 (20.47)	96.25	84.42	90.34
Ankur 40	89.00 (70.66)	84.17 (66.64)	63.62	56.70	60.16
Ankur 41	64.85 (53.64)	78.58 (62.43)	66.23	68.33	67.28
Malav-27	47.50 (43.55)	63.75 (53.01)	63.01	52.83	57.92
Arka Anamika (Check)	55.83 (48.35)	66.25 (54.48)	41.75	37.08	39.42
Swathi (Susceptible variety)	50.83 (45.47)	58.50 (44.14)	67.50	54.83	61.17
CD	6.50	3.18	13.18	18.38	

Table 3. Disease rating scale of different okra varieties against *Okra yellow vein mosaic virus* under natural condition.

Varieties	Mean Disease Incidence*	Disease rating	
	(%)	Category	Reaction
Mahyco B No. 10	65.25	5	S
Mahyco B No. 64	16.33	2	MR
Mahyco B. No. 55	3.25	1	HR
JK seeds 045	28.71	3	T
JK seeds 7315	1.92	1	HR
Nuziveedu 1003	11.58	2	MR
Nuziveedu 1004	13.84	2	MR
Sonal(Nunhems)	18.29	2	MR
Kirti	18.50	2	MR
Karina (mahindra)	11.54	2	MR
Ankur 40	86.59	6	HS
Ankur 41	71.72	6	HS
Malav-27	55.63	4	MS
Swathi (Susceptible variety)	61.04	5	S
Arka Anamika (Check)	54.67	4	MS

* On the basis of two years mean data

HR-Highly resistant; MR-Moderately resistant; T-Tolerant; HS-Highly susceptible; MS-Moderately susceptible; S-Susceptible

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