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Screening of okra [*Abelmoschus esculentus* (L.) Moench] hybrids for yellow vein mosaic virus (YVMV) resistance under Allahabad agro-climatic condition

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Abstract

One of the major limiting factor of okra is the incidence of okra yellow vein mosaic virus, it's transmitted by white fly (*Bemisia tabaci* Gen.) is the most serious disease of okra affecting both yield and fruit quality. Infection of 100% plants in a field is very common and yield losses range from 50 to 94% depending on the stage of crop growth at which infection occurs. Since the disease cannot be controlled properly by chemical means, the only practical solution of this problem is to develop tolerant/resistant varieties or hybrids. The present investigation for the Screening of Okra [*Abelmoschus esculentus* (L.) Moench] Hybrids for Yellow vein Mosaic Virus was carried out at Allahabad region with 11 hybrids and 3 check varieties during kharif -2014 under randomized block design with three replications. The data was recorded for sixteen quantitative characters including YVMV incidence viz., days to 50% germination, plant height(cm), number of leaves/plant, number of branches/plant, inter nodal length(cm), days to first flower appears, days to emergence of 50% blooming, first pod (fruit) occurring node, length of fruit (cm), fruit girth (cm), fresh weight of fruit (g), number of seeds per fruit, number of fruits per plant, fruit yield per plant (g), fruit yield per hectare (t) and per cent incidence of YVMV, to obtain and estimate the best hybrid for YVMV resistance and yield (quantitative) attributes. Out of which only 3 hybrids (OKHYB-6, OKHYB-7 and OKHYB-13) were found to have highly disease resistant and highest yield per hectare was found in the hybrid OKHYB-15 (24.5 t/ha) followed by OKHYB-10 (23.1 t/ha) and hybrid OKHYB-12 produced the lowest yield (14.7 t/ha) followed by Arka Anamika (15.4 t/ha).

Keywords: Okra, hybrids, disease incidence, resistance, YVMV

Introduction

Okra is one of the most popular vegetable crops cultivated throughout India for its tender green fruits. Okra requires a long and warm growing season for its optimum growth and development. India is the largest producer of okra in the world with total area of 0.52 million hectares and production 6.26 million tones green pods, whereas productivity of the crop is 12.1 MT/ha (Anonymous, 2012). Okra can be grown twice a year in the Indian plains (rainy season and summer season). The major limiting factor for its cultivation is the incidence of okra yellow vein mosaic virus (OYVMV) which is transmitted by whitefly (*Bemisia tabaci* Gen.) (Rana *et al.*, 2006) [9]. This disease is caused by a complex, consisting of the monopartite *Begomovirus*, okra yellow vein mosaic virus (family: Geminiviridae) and a small satellite DNA β component (Jose and Usha, 2003). This disease and its insect vector cause heavy losses to okra by affecting the quality and yield of the fruits. Infection of 100% plants in a field is very common and yield losses range from 50 to 94% depending on the stage of crop growth at which infection occurs (Sastry and Singh, 1974) [10]. The initial symptom on young leaves is a diffuse, mottled appearance. Older leaves have irregular yellow interveinal areas. Clearing of the small veins starts near the leaf margins, at various points, about 15 to 20 days after infection. Thereafter, the vein clearing develops into a vein chlorosis. The newly developed leaves exhibit an interwoven network of yellow vein, which enclose the green patches of the leaf. Fruits developing on infected plants have irregular areas which follow a longitudinal alignment. Due to heavy infestation the fruits become malformed and reduced in size. The fruits are mostly yellow, small, tough and fibrous (Brunt *et al.*, 1996) [5]. If plants are infected within 20 days after germination, their growth is retarded; few leaves and fruits are formed (Sastry and Singh, 1974) [10]. The extent of damage declines with delay in infection of the pathogens. Plants at 50 and 60 days after germination suffer a loss of 84 and 49%, respectively (Sastry and Singh, 1974; Khan *et al.*, 2005) [10, 6]. With this severe production constraint in purview,

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the objective of this study were to identify okra hybrids for resistance/tolerance to OYVMV based on a percent disease incidence of infection in okra under Allahabad agro climatic condition. The outcome of the study could open avenues for utilization of these hybrids for OYVMV tolerance/resistance in okra.

Materials and methods

The present investigation was carried out using 14 okra hybrids including 3 check varieties viz., (OKHYB-1, OKHYB-2, OKHYB-4, OKHYB-5, OKHYB-6, OKHYB-7, OKHYB-8, OKHYB-10, OKHYB-12, OKHYB-13, OKHYB-15, Pusa Sawani, Arka Anamika and HOK-152) were collected from Indian Institute of Vegetable Research (IIVR), Varanasi (U.P) and sown during rainy season of the year 2014-2015 in randomized block design with three replications at Vegetable Research Farm, Department of Horticulture, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad (Uttar Pradesh), Row –to- Row and Plant –to- Plant 60cm and 30cm respectively. All the agronomic packages of practices were adopted to grow a healthy crop in each replication. Randomly 5 plants in each genotype were marked for observation. The data was recorded for sixteen quantitative characters including YVMV incidence viz., days to 50% germination, plant height(cm), number of leaves/plant, number of branches/plant, inter nodal length (cm), days to first flower appears, days to emergence of 50% blooming, first pod (fruit) occurring node, length of fruit (cm), fruit girth (cm), fresh weight of fruit (g), number of seeds per fruit, number of fruits per plant, fruit yield per plant (g), fruit yield per hectare (t) and percent incidence of OYVMV. The soil of the plot was sandy loam in texture having good fertility, properly leveled and well drained.

The rating of disease severity scale followed was: 1: no disease symptoms, 2: up to 10% leaf area affected of a plant, 3: up to 20% leaf area affected of a plant, 4: up to 35% leaf area affected of a plant, 5: up to 40% leaf area affected of a plant, 6: up to 70% leaf area affected of a plant, 7: more than 70% leaf area affected of a plant.

Number of plants infected in each entry was recorded and Percent disease incidence (PDI) was calculated with the following formula:

$$\text{PDI} = \frac{\text{Number of Infected plants}}{\text{Total Number of plants observed}} \times 100$$

Results and discussion

Based on disease rating scale, the data presented in Table-2, of screening of 14 different hybrids of okra against yellow vein mosaic virus (YVMV) under Allahabad agro climatic condition revealed that out of 14 hybrids tested, three hybrids were found completely free (immune) to YVMV incidence. Similar results were also reported by Srivastava *et al.*, (1995) [12] and Jeyarajan *et al.*, (1988) [7]. Four hybrids, (OKHYB-2,

OKHYB-5, OKHYB-15 and Arka Anamika) were resistant to YVMV, similar results have been reported by Sunnigrahi and Choudhury., (1998) [11] while one hybrid (OKHYB-10) was tolerant and five hybrids (OKHYB-1, OKHYB-4, OKHYB-8, Pusa Sawani and HOK-152) were susceptible to YVMV similar results have been reported by Singh and Jain., (2007) and remaining hybrid (OKHYB-12) was highly susceptible reaction. Pusa Sawani and Arka Anamika earlier showed to be resistance to OYVMV (Borah *et al.*, 1992) [3], were highly susceptible with much faster development of disease symptoms than other tested hybrids (Venkataravanappa *et al.*, 2013) [14]. The yield differed significantly (Table 3).

The highest yield (24.5 t ha⁻¹) was recorded in OKHYB-15, followed by OKHYB-10 (23.1 t ha⁻¹).

The lowest yield (14.7 t/ha) was obtained in hybrid OKHYB-12, followed by Arka Anamika (15.4 t/ha).

Table 1: Disease rating scale of OYVMV

Category	Severity Range (%)	Rating Scale
Immune or free from disease	0-0 %	1
Highly Resistance (HR)	1-10 %	2
Resistance (R)	11-20%	3
Tolerant (T)	21-35 %	4
Moderately susceptible (MS)	36-40%	5
Susceptible (S)	41-70%	6
Highly Susceptible (HS)	>70 %	7

Table 2: Response of different hybrids of okra against YVMV incidence under Allahabad agro climatic condition.

Name of the hybrids	Rating scale	Severity Range (%)	Reaction or Level of Resistance
OKHYB-1	6	60.1	Susceptible (S)
OKHYB-2	3	12.16	Resistance (R)
OKHYB-4	6	49.97	Susceptible (S)
OKHYB-5	3	14.97	Resistance (R)
OKHYB-6	1	0	Immune (I)
OKHYB-7	1	0	Immune (I)
OKHYB-8	6	47.2	Susceptible (S)
OKHYB-10	5	31.5	Tolerance (T)
OKHYB-12	7	64.17	Highly Susceptible (HS)
OKHYB-13	1	0	Immune (I)
OKHYB-15	3	19.4	Resistance (R)
Pusa Sawani (c)	6	45.48	Susceptible (S)
Arka Anamika (c)	3	16.67	Resistance (R)
HOK-152 (c)	6	42.37	Susceptible (S)

Conclusion

It is concluded that based on the mean performance of all the sixteen yield attributes along with YVMV, hybrids OKHYB-6, OKHYB-7 and OKHYB-13 were found to have highly disease resistant over the check varieties and highest yield per hectare was found in the hybrids OKHYB-15 (24.5 t/ha) followed by OKHYB-10 (23.1 t/ha) were found superior and resistant to YVMV in the performance other than check varieties.

Table 3: Performance of okra hybrids for yield, yield attributes and OYVMV incidence during kharif season under Allahabad agro climatic conditions.

Name of the hybrids	Plant height (cm)	Number of branches	Internodal length (cm)	Pod length (cm)	Pod girth (cm)	Avg. pod weight (g)	Number of seeds/pod	Number of pods/plant	Pod yield/plant (g)	OYVMV incidence levels (%)
OKHYB-1	121	3.07	4.16	11.36	6.02	13.52	45.47	24.63	332.97	60.1
OKHYB-2	127.67	2.67	3.85	11.15	6.33	13.81	48.33	24.8	342.35	12.16
OKHYB-4	137.07	4.2	4.32	11.55	6.16	13.65	62.67	28.47	388.47	49.97
OKHYB-5	113.73	3.2	4.16	11.62	6.09	13.22	54.42	22.32	295.08	14.97
OKHYB-6	134.13	3.53	3.55	11.68	6.19	13.36	49.07	27.81	371.54	0
OKHYB-7	112.27	2.87	3.57	10.95	5.83	13.82	47.47	22.38	309.14	0

OKHYB-8	108.59	2.67	3.83	11.34	6.04	13.34	49.93	23.07	307.87	47.2
OKHYB-10	141.27	3.47	3.64	12.28	6.11	14.09	44.83	29.47	415.19	31.5
OKHYB-12	93.6	2.87	4	10.32	5.72	12.62	51.13	21	265.11	64.17
OKHYB-13	113.6	2.73	3.73	10.5	5.83	13.16	57.33	24.87	327.24	0
OKHYB-15	163.07	3.8	3.73	13.26	6.23	14.12	64.33	31.27	441.48	19.4
Pusa Sawani (c)	115	2.8	4.42	10.54	6.25	12.59	55.93	22.87	287.86	45.48
Arka Anamika (c)	110.4	4.6	4.24	10.54	5.66	11.18	47	24.7	276.43	16.67
HOK-152 (c)	126.53	4.33	3.77	10.77	5.79	11.15	64.2	27.45	306.05	42.37

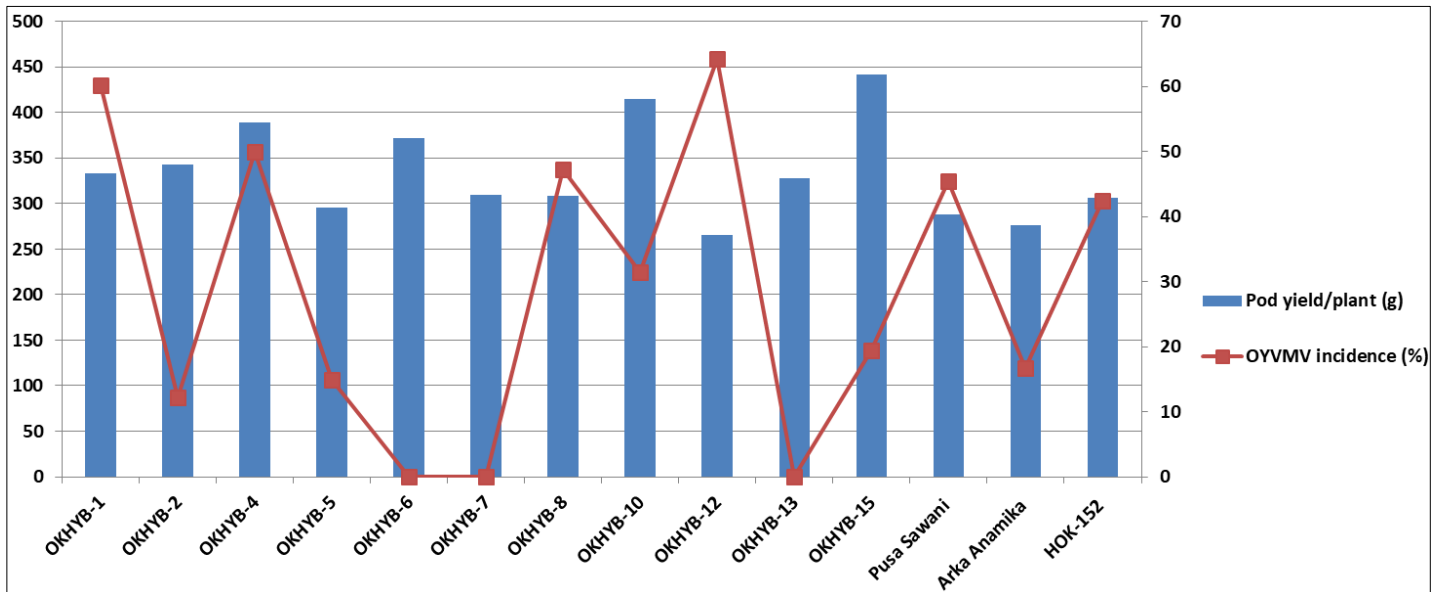


Fig 1: Performance of promising Okra hybrids for YVMV incidence and Yield attributes.

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