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ORIGINAL ARTICLE

Screening of Advanced Breeding lines for Resistance to Yellow Vein Mosaic Virus under Field Conditions in okra

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ABSTRACT
Sixty four entries consisting of fifty seven inbred lines and seven checks (four hybrids and three commercial varieties) were screened for reaction to okra yellow vein mosaic virus in three replications of Partial balanced lattice design (triple lattice) under unprotected conditions during summer 2011. The results exhibited that four lines were highly resistant to yellow vein mosaic virus, ten lines showed moderate resistant, 26 lines tolerant, 10 lines moderate susceptible, 6 susceptible and one highly susceptible. High range was observed for the traits viz., fruit yield per hectare (10.02-21.98 T) and disease incidence to yellow vein mosaic virus (0.00-85.09%). High genotypic and phenotypic coefficients of variation were noticed for disease incidence and fruit yield per hectare. The highest yield per hectare was found in the DBh-25 (21.98 T/ha) followed by DBh-33 (19.9 T/ha) and DBh-7 (19.54 T/ha).
Keywords: *Resistance, Tolerant, Okra Yellow Vein Mosaic Virus*

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INTRODUCTION

Okra (*Abelmoschus esculentus* (L.) Moench), originated in tropical Africa, is an important vegetable throughout the tropical and subtropical regions of the world. It is one of important vegetable crops in india and called lady's finger in England, gumbo in the United States of America, guino-gombo in Spanish, guibeiro in Portuguese and bhendi in India. Viruses pose serious constraints to its production. Yellow Vein Mosaic Virus (YVMV) transmitted by white fly (*Bemisia tabaci* Gen.) is the most serious disease of okra. Infection of 100 percent plants in a field is very usual and yield losses range from 50 to 94 percent depending on the stage of crop growth at which infection occurs [7]. The disease cannot be controlled properly by chemical means. Uprooting of infected plants is not practical and economical because of heavy infection rate in the field. The only practical solution of this problem is to develop tolerant varieties. Therefore, an extensive search for tolerance in cultivated okra was started by screening available germplasm. Studies were also undertaken to transfer genes for tolerance to YVM from related wild species to susceptible cultivated varieties [5].

MATERIALS AND METHODS

Sixty four entries consisting of fifty seven inbred lines and seven checks (four hybrids and three commercial varieties) were screened for reaction to okra yellow vein mosaic virus in three replications of Partial balanced lattice design (triple lattice) under unprotected conditions during summer 2011. Row-to-

row and plant-to-plant distances were maintained at 60 cm and 30 cm, respectively. Cultural practices were carried out as required to raise a good crop.

Observations were recorded on five competitive plants excluding border plants in each replication for fruit yield per hectare and incidence of Okra Yellow Vein Mosaic Virus and were used to calculate the mean values for each genotype/ replication. The mean values obtained were used for analysis of variance and to estimate genotypic and phenotypic coefficient of variation and genetic advance as percent of mean. The phenotypic and genotypic coefficients of variation were estimated as per formula suggested by [4]. The number of plants showing okra yellow vein mosaic disease from 10 randomly chosen plants was counted. Counting was done early in the morning between 7 and 10 am. The disease on each test entry was assessed according to [6], following disease rating scale by [1] and [2] presented in Table 1.

Disease incidence of yellow vein mosaic virus was recorded 60 days after planting. The fruits were picked regularly and weighed separately for each plot. The data obtained with respect to disease incidence of yellow vein mosaic virus was recorded and yield components subjected to statistical analysis. Data collected was subjected to the analysis of variance using the mixed model procedure. Mean separation were done where there is significant differences using Duncan Multiple Range Test. Significance was accepted at $P \leq 0.01$.

RESULTS AND DISCUSSION

The analysis of variance carried out for the fruit yield and its component characters is presented in Table 2. Variance due to genotypes was found highly significant for fruit yield per hectare and disease incidence to yellow vein mosaic virus which indicated that the genotypes differ significantly for both the traits.

High range was observed for the traits *viz*., fruit yield per hectare (10.02-21.98 T) and disease incidence to yellow vein mosaic virus (0.00-85.09%). Since the variation for fruit yield per hectare and disease incidence to yellow vein mosaic virus is found to be quite high, this might be responsible for the wide range in yield potential of different genotypes. [9] and [10] reported wide range of variability for traits studied in okra. The mean for fruit yield per hectare and disease incidence to yellow vein mosaic virus varied from 10.02 T/ha to 21.98T/ha and 0.00-85.09% respectively. High genotypic and phenotypic coefficients of variation were noticed for disease incidence and fruit yield per hectare. A lot of variability for fruit yield per hectare and disease incidence to yellow vein mosaic virus indicates a great scope for selection of desirable types (Table 3).

Range of the disease incidence to yellow vein mosaic virus from 0% to 85.09% and grouped in to seven groups. Four lines *viz*., DBh-30 (1.45%), DBh-39 (8.25%), DBh-37 (9.96%) and DBh-47 (10.43%) showed highly resistant to yellow vein mosaic virus, ten lines showed moderate resistant, 26 lines were tolerant, 10 lines were moderate susceptible, 6 were susceptible and one was highly susceptible. None of the lines was immune. Commercial varieties like Arka Anamika (85.09%) and Arka abhay (56.21%) recorded highly susceptible and susceptible reactions. [7] screened eight okra varieties against OYVMV and found Okra No.6, LORM-1, VRO-3 and P-7 were free from disease whereas VRO-4 showed mild reaction. [2] reported Safal, Subz Pari and Surkh Bhindi varieties against OYVMV in a field trial (3.36-24.40%). Moreover, OYVMV resistance among different okra cultivars has also been reported by other researchers such as [3] who evaluated 157 advanced germplasm and 7 cultivars/hybrids of okra for two years and observed that Punjab Padmini and EMS-8 were free from the OYVMV. [8] also reported that Punjab Padmini and Punjab-7 varieties of okra were high yielding and resistant to OYVMV. Four lines *viz*., DBh-30 (1.45%), DBh-39 (8.25%), DBh-37 (9.96%) and DBh-47 (10.43%) showed highly resistant to yellow vein mosaic virus (Table 4). The highest yield per hectare found in the DBh-25 (21.98 t/ha) followed by DBh-33 (19.9 t/ha) and DBh-7 (19.54 t/ha) (Table 5).

Table 1: Disease rating scale of OYVMV (Ali *et al*., 2005a,b)

Rating scale	Type	Severity Range (%)
0	Immune	0
1	Highly resistant	1-10
2	Moderate resistant	11-25
3	Tolerant	26-50
4	Moderate susceptible	51-60
5	Susceptible	61-70
6	Highly susceptible	71-100

Table 2: Analysis of variance (ANOVA) for evaluation and screening of advanced breeding lines for okra yellow vein mosaic virus (OYVMV) disease of inbred lines in okra

Sources of variation	Fruit yield per hectare (T/ha)	Disease Incidence (%)
Replications	10.975	549.296
Treatment (unadjusted)	22.597	1552.723
Treatment (adjusted)	23.364**	1472.802**
Blocks within Reps (adj.)	19.781	1160.837
Intrablock error	6.286	311.855

Table 3: Estimates of mean, range and coefficients of variation for disease incidence and fruit yield per hectare

Characters	Fruit yield per hectare (T/ha)	Disease incidence (%)
Mean	14.94	61.57
Range	10.02-21.98	0.00-85.09
Genotypic variance (GV)	5.03	385.35
Phenotypic variance (PV)	13.36	811.07
Genotypic coefficient of variation (GCV %)	15	31.88
Phenotypic coefficient of variation (PCV %)	24.46	46.25

Table 4: Mean performance of fifty seven inbred lines, four hybrids and three commercial varieties with respect to fruit yield and disease incidence in okra

Lines/ hybrids/ popular varieties	Fruit yield per hectare (T/ha)	Disease incidence (%)	Type of reaction	Lines/ hybrids/ popular varieties	Fruit yield per hectare (T/ha)	Disease incidence (%)	Type of reaction
DBh-1	18.68	21.14	MR	DBh-33	19.9	62.65	S
DBh-2	17.7	38.64	T	DBh-34	11.39	67.98	S
DBh-3	14.77	51.18	MS	DBh-35	14.19	19.24	MR
DBh-4	13.8	39.23	T	DBh-36	13.74	26.65	T
DBh-5	17.55	48.84	T	DBh-37	13.73	9.96	HR
DBh-6	14	36.14	T	DBh-38	14.4	32.45	T
DBh-7	19.54	52.95	MS	DBh-39	11.94	8.25	HR
DBh-8	11.76	41.62	T	DBh-40	12.85	30.29	T
DBh-9	18.22	65.91	S	DBh-41	10.33	29.36	T
DBh-10	19.06	39.38	T	DBh-42	14.7	36.49	T
DBh-11	17.86	51.38	MS	DBh-43	13.89	14.75	MR
DBh-12	18.14	44.84	T	DBh-44	15.78	62.6	S
DBh-13	18.83	57.94	MS	DBh-45	12.21	18.29	MR
DBh-14	16.21	49.9	T	DBh-46	15.49	29.65	T
DBh-15	13	33.7	T	DBh-47	12.56	10.43	HR
DBh-16	15.19	66.29	S	DBh-48	13.7	44.19	T
DBh-17	17.05	66.41	S	DBh-49	13.43	29.54	T
DBh-18	12.5	57.08	MS	DBh-50	13.89	41.43	T
DBh-19	14.08	55.68	MS	DBh-51	12.26	19.94	MR
DBh-20	15.55	60.4	MS	DBh-52	12.12	19.26	MR
DBh-21	14.96	50.72	MS	DBh-53	11.45	36.81	T
DBh-22	13.41	52.96	MS	DBh-54	15.76	15.95	MR
DBh-23	14.21	23.34	MR	DBh-55	13.07	14.72	MR
DBh-24	13.32	32.04	T	DBh-56	11.96	55.78	MS
DBh-25	21.98	84.26	HS	DBh-57	13.41	34.41	T
DBh-26	10.02	34.5	T	Syngenta 152	12.71	15.49	MR
DBh-27	16.57	47.79	T	Mahyco No. 55	16.2	0	I
DBh-28	15.16	26.66	T	JKOH-7315	17.92	0	I
DBh-29	12.85	49.8	T	Mahyco No. 64	10.78	0	I
DBh-30	18.49	1.45	HR	Drwad local	20.58	61.82	S
DBh-31	17.59	27.8	T	Arka Abhay	19.02	56.21	MS
DBh-32	11.83	22.7	MR	Arka Anamika	15.84	85.09	HS

I = immune, HR = highly resistant, MR = moderate resistant, T= tolerant, MS = moderate susceptible, S = susceptible, HS = highly susceptible

Table 5: Performance of top 10 lines for fruit yield per hectare and their disease incidence and type of reaction in okra

Lines	Fruit yield per hectare	Disease incidence (%)	Type of reaction
DBh-25	21.98	84.26	HS
DBh-33	19.9	62.65	S
DBh-7	19.54	52.95	MS
DBh-10	19.06	39.38	T
Arka Abhay	19.02	56.21	MS
DBh-13	18.83	57.94	MS
Line1	18.68	21.14	MR
DBh-30	18.49	1.45	HR
DBh-9	18.22	65.91	S
DBh-12	18.14	44.84	T

I = immune, HR = highly resistant, MR = moderate resistant, T= tolerant, MS = moderate susceptible, S = susceptible, HS = highly susceptible

CONCLUSION

The easiest and method of reducing *Okra mosaic* disease of okra is planting of resistant varieties against this disease. Disease incidence of yellow vein mosaic virus was recorded 60 days after planting. Four lines *viz*., DBh-30 (1.45%), DBh-39 (8.25%), DBh-37 (9.96%) and DBh-47 (10.43%) showed highly resistant to yellow vein mosaic virus which indicate that resistant and tolerant lines are source for controlling disease incidence and contributes yields to plant.

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