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Inheritance of resistance to mungbean yellow mosaic virus in mungbean

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ABSTRACT

The inheritance of resistance to mungbean yellow mosaic virus (MYMV) was studied in crosses involving three resistant (HUM 1, DPM 90-1 and DPM 90-2) and four susceptible (MH 84-1, K 851, China Mung and Kopergaon) genotypes of mungbean. The parents, F_1, F_2 and F_3 generations were grown along with MH 84-1 as spreader rows. Artificial inoculation with MYMV was done through the insect vector, whitefly. Susceptibility to MYMV was dominant over resistance in the F_1 generation of all the crosses. Observations on disease incidence of F_2 and F_3 generations indicated that two recessive genes imparted resistance against MYMV in each of the crosses.

Key words: Mungbean, mungbean yellow mosaic virus, Resistance, *Vigna radiata*

Mungbean (*Vigna radiata* L. Wilczek) is one of the important and widely cultivated crops in different seasons in India. Mungbean Yellow Mosaic Virus (MYMV) is one of the most devastating pathogens transmitted through whitefly (*Bemisia tabaci Genn*). For developing high yielding MYMV resistant varieties of mungbean, it is desirable to understand the inheritance of resistance. Saleem *et al.* (8) and Khattak *et al.* (3) reported that resistance to MYMV is governed by a single recessive gene, whereas Dahiya *et al.* (2) and Reddy and Singh (5) reported that resistance is governed by a single dominant gene. In contrast, Singh (6), Solanki *et al.* (7), Verma and Singh (11), Sirohi *et al.* (10) and Ammavasai *et al.* (1) have reported that resistance is governed by two recessive genes. The present study was taken up with new sources of resistance to MYMV. Different generations were subjected to artificial inoculation so as to get a clear cut idea about the inheritance of resistance to this prevalent disease.

MATERIALS AND METHODS

Three MYMV resistant genotypes of mungbean, namely HUM1, DPM 90-1and DPM 90-2 were crossed with four susceptible genotypes *viz.*, MH 84-1, K 851, China Mung and Kopergaon. The crosses were made in line x tester fashion to obtain 12 crosses. However, out of 12 crosses, adequate quantity of F_2 seeds of only 11 crosses could be obtained. The parents, F_1, F_2 and F_3 of 11 crosses were grown in a randomized block design with three replications at Agricultural Research Farm, Banaras Hindu University, Varanasi during *Kharif* 2003. Each plot was consisted of 2 m length with row to row and plant to plant distances being 45 and 10 cm, respectively. One row of MH 84-1 was planted as infector row for MYMV after every two rows of the test entries to intensify MYMV inoculum in natural condition. In order to maintain a good natural population of whiteflies, no pesticide was sprayed. Artificial inoculation of individual plant was also done in each of the parents and F_1 using especially designed insect proof transparent plastic picule pots with screw caps (4). Mass inoculation of 18-20 plants at a time was also done in F_2 and F_3 progenies, using muslin cloth covered iron cage of 60 x 90 x 120 cm size (5). Scoring of disease was done after 15-20 days of inoculation of individual plant using 1-9 scale where; 1&3 scale was treated as resistant and 5 to 9 scale was treated as susceptible. The segregation in F_2 and F_3 generations was tested for goodness of fit by using Chi-square test.

RESULTS AND DISCUSSION

The total number of plants, the mean disease score and disease reaction of parents and F_1 are presented in Table 1. Four genotypes of mungbean, namely MH 84-1, K 851, China Mung and Kopergaon exhibited susceptible whereas, HUM1, DPM 90-1 and DPM 90-2 showed resistant reaction to MYMV. The F_1 generation of all the crosses showed susceptible disease reaction. This indicated dominance of susceptibility over resistance which was in conformity with earlier reports (1, 3, 6, 7, 8, 9, 10, 11). In contrast, Dahiya *et al.* (2) reported that resistance was dominant over susceptibility. The segregation for resistance in the F_2 and F_3 generations is presented in Table 2. The F_2 population from all the crosses showed digenic inheritance with 15 (susceptible): 1 (resistant) ratio. The F_3 progenies were observed in three classes (susceptible, resistant and segregating). Segregating population of F_3 progenies also showed 15 (susceptible):1 (resistant) ratio. It clearly indicated that resistance to MYMV was under the control of two recessive genes which is in agreement with earlier reports (8, 9, 11). In contrast to the present findings, the importance of monogenic recessive gene (3, 6, 10) as well as one dominant and one recessive gene (5) for resistance to MYMV have been also on record. Differences in the nature of gene(s) contributing resistance to MYMV might be attributed due to differences in the source(s) of resistance used in the investigation and/or variation in the virus strains and the environments.

Table 1. Reaction of parents and F_1 hybrids of mungbean to MYMV during *kharif* 2003

Parent / Hybrid	Total plants	Mean disease score	Disease reaction
Parents			
HUM1	25	1.0	Resistant
DPM 90-1	25	1.0	Resistant
DPM 90-2	25	1.0	Resistant
MH 84-1	25	8.0	Susceptible
K 851	25	7.0	Susceptible
China Mung	25	5.0	Moderately susceptible
Kopergaon	25	8.0	Susceptible
F_1 Generation			
HUM1 x MH 84-1	25	8.0	Susceptible
HUM1 x K 851	25	6.5	Susceptible
HUM1 x China Mung	25	6.5	Susceptible
HUM1 x Kopergaon	25	8.0	Susceptible
DPM 90-1x MH 84-1	25	8.0	Susceptible
DPM 90-1x K 851	25	8.0	Susceptible
DPM 90-1x China Mung	25	8.0	Susceptible
DPM 90-1x Kopergaon	25	9.0	Susceptible
DPM 90-2 x MH 84-1	25	8.0	Susceptible
DPM 90-2 x K 851	25	7.0	Susceptible
DPM 90-2 x China Mung	25	6.5	Susceptible

Table 2. Segregation for MYMV resistance in F_2 and F_3 (segregating progenies) generations in mungbean crosses during *kharif* 2003.

Cross	Generation	Number of plants		Expected genetic ratio	X^2 value
		Susceptible	Resistant		
HUM 1 x MH 84-1	F_2	134	7	15:1	0.396
	F_3	178	6	15:1	2.805
HUM 1x K 851	F_2	105	10	15:1	1.062
	F_3	172	5	15:1	3.606
HUM 1 x China Mung	F_2	112	5	15:1	0.778
	F_3	169	6	15:1	2.348
HUM 1 x Kopergaon	F_2	181	7	15:1	2.048
	F_3	225	8	15:1	3.161
DPM 90-1 x MH 84-1	F_2	244	9	15:1	3.137
	F_3	182	7	15:1	2.097
DPM 90-1 x K 851	F_2	127	11	15:1	0.700
	F_3	158	5	15:1	2.771
DPM 90-1 x China Mung	F_2	217	9	15:1	1.980
	F_3	152	6	15:1	1.617
DPM 90-1 x Kopergaon	F_2	220	7	15:1	3.885
	F_3	153	6	15:1	1.535
DPM 90-2 x MH 84-1	F_2	210	11	15:1	0.605
	F_3	198	7	15:1	2.820
DPM 90-2 x K 851	F_2	188	6	15:1	3.407
	F_3	173	7	15:1	1.712
DPM 90-2 x China Mung	F_2	199	6	15:1	3.861
	F_3	212	7	15:1	3.486

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