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INHERITANCE OF RESISTANCE TO MUNGBEAN YELLOW MOSAIC VIRUS IN BLACKGRAM

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ABSTRACT

The inheritance of resistance to mungbean yellow mosaic virus (MYMV) was studied in crosses involving three resistant lines, BR 61, Sel 1, and NP 21, and a susceptible line, UL 2. The parents, F_1, F_2 and F_3 generations were grown along with UL 2 spreader rows after every 5th row. Artificial inoculation with MYMV was done through the insect vector, whitefly (*Bemisia tabaci*). Susceptibility to MYMV was dominant over resistance in the F_1 generation of all the crosses including the reciprocals. The F_2 and F_3 observations indicated that two recessive genes are involved in imparting resistance against MYMV. No maternal effect was observed.

Key words: Blackgram, *Vigna mungo*, mungbean yellow mosaic virus, *Bemisia tabaci*.

Blackgram (*Vigna mungo* (L.) Hepper) is one of the important and widely cultivated grain legumes in India and mungbean yellow mosaic viral (MYMV) disease is one of its most devastating diseases. The disease is transmitted through whitefly (*Bemisia tabaci* Genn.) and not through sap, seed or soil [1–3]. For developing high yielding MYMV resistant varieties of blackgram, it is essential to identify the sources of resistance and study the inheritance of resistance. Several sources of MYMV resistance have been reported [4, 5]. But only a few reports are available on the inheritance of resistance to this disease in blackgram. The present study analyses the inheritance of MYMV resistance in three resistant germplasm lines.

MATERIALS AND METHODS

Three MYMV resistant, black seeded germplasm lines of blackgram, BR 61, Sel 1, and NP 21, were reciprocally crossed with UL 2, a susceptible and green seeded line. The resistant lines are late in maturity with spreading plant type. UL 2 has erect growth habit and early maturity. The parents, F_1, F_2 and F_3 generations were grown in the field in kharif (rainy) season of 1985. Row-to-row and plant-to-plant spacings were 50 and 10 cm, respectively, and row length 5 m. UL 2 was planted as spreader after every five rows of the test materials to intensify MYMV inoculum from natural sources. In order to maintain a good natural population of whiteflies

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no pesticide was sprayed. Artificial inoculation of individual plants was done in each parent and F_1 using specially designed insect proof transparent plastic pickle pots with screwcaps [3]. Mass inoculation of 18–20 plants at a time was also done in the F_2 and F_3 generations using muslin cloth covered iron cages of 60 × 90 × 120 cm size [3]. In both cases, viruliferous whiteflies were released under the cover at the rate of 8–10 flies per plant for inoculation. The disease score was recorded 15–20 days after inoculation on individual plants using 1–9 scale [6]. The mean disease score for parents and F_1 was calculated as Σ (infection rate × frequency)/total number of plants. The F_2 plants were classified into resistant (1 score) and susceptible (3–9 score) groups for two reasons: first, all the resistant parents used in the study had the mean disease score of 1.0, and second, we did not find any plant with disease score of 2.0. The F_3 progenies were classified as resistant, segregating, and susceptible types. The χ^2 test was used to test the goodness of fit. Yate's correction was used for χ^2 calculation when a class had less then 10 plants/progeny.

RESULTS AND DISCUSSION

The total number of plants, mean disease score, and disease reaction of the parents and F_1 are presented in Table 1. UL 2, the susceptible cultivar, showed highly susceptible reaction to MYMV, while the three resistant lines, BR 61, Sel 1 and NP 21, showed resistant reaction. The F_1 generation of all the crosses and their reciprocals had moderately susceptible disease reaction. This indicates dominance of susceptibility over resistance. Similar results were also reported in varietal [6, 7] and interspecific [8] crosses of blackgram.

Table 1. Reaction of parents and F_1 hybrids of blackgram to MYMV during kharif 1985

Parent/hybrid	Total plants	Mean disease score	Disease reaction
UL 2	118	8.17	Susceptible
Sel 1	36	1.00	Resistant
BR 61	41	1.00	Resistant
NP 21	36	1.00	Resistant
UL 2 × Sel 1	20	6.30	Susceptible
Sel 1 × UL 2	4	5.50	Susceptible
UL 2 × BR 61	13	6.38	Susceptible
BR 61 × UL 2	8	5.25	Susceptible
UL 2 × NP 21	9	5.88	Susceptible
NP 21 × UL 2	2	6.00	Susceptible

The segregation for resistance in the F_2 and F_3 generation is presented in Table 2. The F_2 populations from all the crosses and their reciprocals showed digenic inheritance with 15 (susceptible) : 1 (resistant) ratio. The F_3 progenies fit in the ratio of 7 (susceptible) : 8 (segregating) : 1 (resistant). It was observed that about half of the heterozygous F_3 families segregated in 15 (susceptible) : 1 (resistant) and the remaining half in 3 (susceptible) : 1 (resistant) ratios (Table 3). The segregation pattern between and within F_3 progenies was in agreement with the

Table 2. Segregation for MYMV resistance in F_2 and F_3 generation during kharif 1985

Cross/generation		No. of plants (F_2) or families (F_3)			Expected ratio	χ^2	p
		susceptible	segregating	resistant			
UL 2 × Sel 1	F_2	229	—	22	15:1	2.701	0.20–0.10
	F_3*	10	12	1	7:8:1	0.990	0.70–0.50
Sel 1 × UL 2	F_2	138	—	11	15:1	0.326	0.70–0.50
	F_3*	3	6	1	7:8:1	0.879	0.70–0.50
UL 2 × BR 61	F_2	210	—	17	15:1	0.595	0.50–0.30
	F_3*	11	12	1	7:8:1	0.667	0.80–0.70
BR 61 × UL 2	F_2	93	—	7	15:1	0.027	0.90–0.80
	F_3*	6	9	1	7:8:1	0.353	0.90–0.80
UL 2 × NP 21	F_2	213	—	15	15:1	0.042	0.90–0.80
	F_3*	10	12	1	7:8:1	0.643	0.80–0.70
NP 21 × UL 2	F_2	125	—	11	15:1	0.784	0.50–0.30
	F_3*	3	5	1	7:8:1	0.533	0.80–0.70

*Yate's correction used for χ^2 calculation.

results of F_2 observations, confirming digenic recessive manifestation of MYMV resistance. Two recessive genes for resistance to MYMV have earlier been reported in blackgram [6–8]. However, a single dominant gene for MYMV resistance has also been reported [9], but this could be due to differences in the source(s) of resistance used and/or variation in the virus strain. The possibility of environmental modification of disease occurrence also cannot be ruled out. It has been observed that decreasing temperature reduces the transmission of MYMV in blackgram [1]

Table 3. Segregation for MYMV resistance within two segregating F_3 families of blackgram crosses during kharif 1985

Cross	Total segregating F_3 families	No. of families segregating as	
		15 S : 1R	3 S : 1R
UL 2 × Sel 1	12	7	5
Sel 1 × UL 2	6	3	3
UL 2 × BR 61	12	6	6
BR 61 × UL 2	9	5	4
UL 2 × NP 21	12	7	5
NP 21 × UL 2	5	3	2

Since two recessive genes for MYMV resistance are involved in the resistant donors of blackgram studied, it will be desirable to grow large segregating populations to recover enough resistant plants, coupled with other useful characters to have a successful breeding programme.

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