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Inheritance of Resistance to Yellow Mosaic Virus in Blackgram (*Vigna mungo* (L.) Hepper)

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Summary. The inheritance of resistance to mungbean yellow mosaic virus (MYMV) was studied in blackgram (*Vigna mungo* (L.) Hepper). The highly resistant donors Pant U-84 and UPU-2 and a highly susceptible line, UL-2, their F_1's, F_2's and backcrosses were grown with spreader located every 5 to 6 rows. The resistance was found to be digenic and recessive in all the crosses and free from cytoplasmic effect.

Key words: Blackgram – *Vigna mungo* – Yellow Mosaic Virus – *Bemisia tabaci* – Resistance

Introduction

Mungbean yellow mosaic virus (MYMV) is one of the most devastating diseases and is prevalent on mungbean, blackgram and soybean throughout India, being most severe in the north. Infected plants are stunted in growth and usually mature late (Grewal 1978). They produce very few flowers and pods, the pods are curled and reduced in size and the percentage of shrivelled seeds is increased (Nariani 1960; Nene 1969). Yield losses up to 100 per cent have been reported in artificial inoculations by Nair (1971) in Mahaillupalam-1 and Vohra (1976) in UL-2 varieties of blackgram. The virus is transmitted by the whitefly, *Bemisia tabaci* Genn. (Nariani 1960; Nene 1972) and not through sap (Nariani 1960; Nair 1971), seed or soil (Nair 1971).

The MYMV resistance is of prime importance in blackgram breeding programmes. Therefore, this investigation was undertaken to study the inheritance of resistance in UPU-2 and Pant U-84, the resistant donors.

Materials and Methods

Two resistant lines of blackgram, UPU-2 and Pant U-84, and one susceptible line, UL-2, were used in the present study. UPU-2 is derived from the D 6-7' variety and is highly resistant to MYMV (Nene 1972), Pant U-84 is also resistant to MYMV, an inheritance from collections containing natural variability. Both of these are spreading types with ovate leaf and black seed. UL-2 is highly susceptible to MYMV; it has hastate leaf and green seed and is an erect plant type.

The F_1's, UPU-2 × UL-2, UL-2 × Pant U-84 and Pant U-84 × UL-2; the backcrosses, (UL-2 × Pant U-84) × UL-2, (UL-2 × Pant U-84) × Pant U-84 and Pant U-84 (UL-2 × Pant U-84); the F_2 population of a cross, UL-2 × Pant U-84 and their parents were grown in the wet season (July to October) of 1978. One F_1, UL-2 × Pant U-84; one backcross, (UPU-2 × UL-2) × UL-2 and three F_2's, UPU-2 × UL-2, UL-2 × Pant U-84 and Pant U-84 × UL-2, along with the parents were grown in the wet season (July to October) of 1979. The row length was 5 m. The row to row and plant to plant spacings were 50 and 10 cm, respectively. UL-2, the highly susceptible parent, was replicated after every 5 rows in 1978 and after every 6 rows in 1979 as spreader to intensify MYMV inoculum from natural sources. No chemical was sprayed in order to maintain high populations of the vector, the whitefly (*Bemisia tabaci* Genn.). Individual plants of the parents, F_1's, F_2's and backcrosses were scored after 100 per cent of the plants in infector rows showed MYMV. The disease severity was scored on a 1-9 scale (Fig. 1), where 1 = completely free; 3 = traces of necrotic mottle; 5 = moderate necrotic mottle; 7 = restricted yellow mottle and 9 = complete yellow mottle. The mean disease score of parents and F_1's was calculated as: Σ (infection rate × frequency)/total number of plants scored. The plants in the F_2 and backcross generations were classified as resistant (1 score) and susceptible (3 to 9 score). This was done because the resistant and susceptible parents showed the mean disease score of 1.00 and 9.00, respectively (Table 1).

Results and Discussion

The total number of plants, mean disease score and disease reaction of parents and F_1's is presented in Table 1. The highly susceptible as well as the resistant parents showed similar disease reaction type in both years. In all, where the three F_1's involved UL-2 as the susceptible parent and Pant U-84 and UPU-2 as resistant parents, susceptibility was dominant over resistance. The UL-2 × Pant

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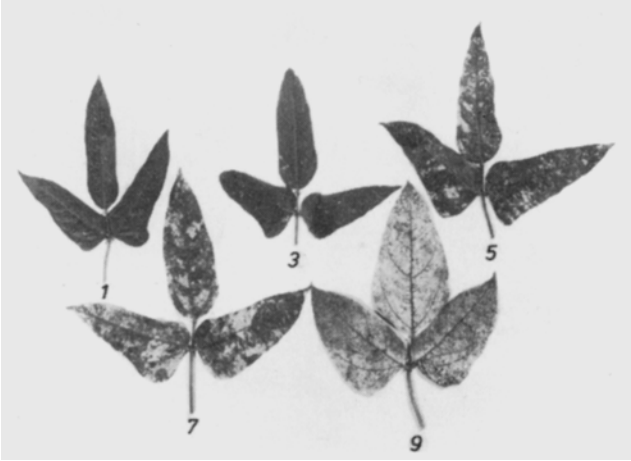

Fig. 1. The rating scale for resistance to yellow mosaic virus in blackgram

U-84 and its reciprocal cross showed the same degree of susceptibility, indicating the involvement of only nuclear genes. The dominance of susceptibility over resistance has also been observed for MYMV in mungbean (Shukla et al. 1978) and in soybean (Singh and Malick 1978); for bean yellow mosaic virus (Reeder et al. 1972) and cowpea chlorotic mottle virus (Roger et al. 1973) in cowpea; for bean yellow mosaic virus and watermelon mosaic virus 2 (Schroeder and Provvidenti 1971) and for bean yellow mosaic virus in interspecific crosses of *Phaseolus vulgaris* × *P. coccineus* (Bagget 1956).

The F_2 populations from all three crosses showed a digenic duplicate factor interaction (Table 2). The segregation in the ratio of 1 (resistant):15 (susceptible) was observed. The backcrosses involving a susceptible parent showed susceptible reaction on all the plants while the backcrosses with the resistant parents segregated in the ratio of 1 (resistant : 3 (susceptible) (Table 2), indicating that two recessive genes are responsible for resistance in the Pant U-84 and UPU-2 resistant parents. This confirmed the segregation pattern of the F_2 generation. The double recessive inheritance of resistance has been reported by Shukla et al. (1978) in mungbean and Singh and Malick (1978) in soybean for the same virus and for some virus-like abnormalities in snapbean (Bagget and Frazier 1957). However, only one major recessive gene has been reported for different viral diseases of grain legumes (Reeder et al. 1972; Roger et al. 1973 and Drijfhout 1968).

Since two recessive genes for MYMV resistance are involved in the resistant donors of blackgram, Pant U-84 and UPU-2, it is suggested that in a resistance breeding programmes large populations of segregating generations should be grown to recover enough resistant plants.

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Table 1. Reaction of parents and F_1's to yellow mosaic virus

Parents/Hybrids	Year	Total number of plants tested	Mean disease score	Disease reaction
UL-2	1978	31	8.74	Susceptible
	1979	30	9.00	Susceptible
UPU-2	1978	10	1.00	Resistant
	1979	29	1.00	Resistant
Pant U-84	1978	23	1.00	Resistant
	1979	30	1.00	Resistant
UPU-2 × UL-2	1978	13	6.07	Moderately susceptible
	1979	13	6.54	Moderately susceptible
UL-2 × Pant U-84	1978	4	7.00	Susceptible
	1979	9	7.67	Susceptible
Pant U-84 × UL-2	1978	28	6.71	Moderately susceptible

Table 2. Segregation for resistance to yellow mosaic virus in F_2 and backcross generations

Cross	Generation	Year	Observed segregation		Expected genetic ratio	P-value between
			Resistant	Susceptible		
UPU-2 X UL-2	F_2	1979	44	586	1:15	0.50-0.25
UL-2 X Pant U-84	F_2	1978	98	1320	1:15	0.50-0.25
UL-2 X Pant U-84	F_2	1979	7	101	1:15	0.25-0.10
Pant U-84 X UL-2	F_2	1979	45	555	1:15	0.50-0.25
(UPU-2 X UL-2) x UL-2	BC	1979	–	22	1: 3	> 0.010
(UL-2 X Pant U-84) x UL-2	BC	1978	–	50	1: 3	> 0.005
(UL-2 X Pant U-84) x Pant U-84	BC	1978	17	41	1: 3	0.50-0.25
Pant U-84 X (UL-2 X Pant U-84)	BC	1978	10	25	1: 3	0.75-0.50

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