

Inheritance of resistance to cercospora leaf spot in mungbean involving interspecific hybrids

M.N. SINGH and S.K. SINGH

Department of Genetics and Plant Breeding, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi 221 005, U.P., India

ABSTRACT

The inheritance of resistance to cercospora leaf spot (CLS) in mungbean was studied in eight interspecific crosses involving four resistant (Pant U 30, PDU 1, BHU U 1 and DPU 88-31) and three susceptible (K 851, China Mung and Kopergaon) genotypes of urdbean and mungbean. The infector row technique as well as artificial inoculation with *Cercospora canescens* culture was applied to screen the material. Resistance to CLS was dominant over susceptibility in the F₁ generation of all the eight crosses. Observations on disease scoring of F₂ and F₃ generations indicated a single dominant gene governing resistance against CLS in each of the three crosses studied.

Key words: *Cercospora* Leaf Spot, Resistance, *Vigna radiata*, *Vigna mungo*

Mungbean (*Vigna radiata* L. Wilczek) is one of the important pulse crops and being cultivated in different seasons in India. Cercospora leaf spot caused by *Cercospora canescens* is a widely prevalent disease of mungbean especially in kharif season. For developing high yielding CLS resistance varieties, it is pre-requisite to identify the stable resistance source as well as to understand its inheritance. Genotypes available for resistance to CLS in mungbean are limited. However, in urdbean, there are several genotypes which are highly resistance to CLS and thus may be used as donor source for transferring resistance genes in mungbean. Genetics of resistance to CLS has been reported by a few workers. Thakur *et al.* (1977) and Kaushal and Singh (1991) reported a single dominant gene for resistance to CLS. In contrast, Mishra *et al.* (1998) reported a single recessive gene in its inheritance. However, Frey and Dukes (1977) indicated that in *Vigna unguiculata*, resistance to CLS was under the control of two genes (CLS₁ and CLS₂); CLS₁ was completely dominant while CLS₂ showed incomplete dominance. The present study was undertaken to have a clear cut picture about the inheritance of resistance to this prevalent disease of mungbean involving some new resistance sources to CLS of urdbean genotypes.

MATERIALS AND METHODS

Four CLS susceptible genotypes of mungbean, namely K 851, China Mung, MH 84-1 and Kopergaon were crossed with four resistant genotypes of urdbean *viz.*, Pant U 30, PDU 1, DPU 88-31 and BHU U 1. The crosses were made in line x tester fashion to obtain 16 interspecific crosses. However,

out of 16 crosses attempted, only 12 crosses were successful. Twelve interspecific F₁ hybrids alongwith the parents were grown in randomized block design with 3 replications at Agricultural Research Farm, Banaras Hindu University, Varanasi during Kharif 2002. Each plot consisted of single row of two meter 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 CLS after every two rows of the test entries to intensify CLS inoculum in natural conditions. In order to maintain good natural inoculum, no

Table 1. Reaction of parents and F₁ hybrids of interspecific crosses involving mungbean and urdbean to CLS during kharif 2002 and 2003

Parents / F ₁ hybrids	Number		Disease score (1-9 scale)	Disease reaction
	Seed sown	Plant survived		
<i>Kharif, 2002</i>				
Parents				
K 851	30	30	7.0	Susceptible
China Mung	30	29	7.0	Susceptible
Kopergaon	30	29	8.0	Highly susceptible
MH 84-1	30	30	9.0	Highly susceptible
Pant U 30	30	30	1.0	Resistant
PDU 1	30	30	1.0	Resistant
BHU U 1	30	30	1.0	Resistant
DPU 88-31	30	30	1.0	Resistant
F₁ Generation				
K 851 x Pant U 30	40	05	1.0	Resistant
K 851 x PDU 1	40	04	1.0	Resistant
K 851 x BHU U 1	40	04	1.0	Resistant
K 851 x DPU 88-31	40	03	1.0	Resistant
Kopergaon x Pant U 30	25	02	3.0	Moderately resistant
Kopergaon x PDU 1	25	01	3.0	Moderately resistant
Kopergaon x BHU U 1	25	03	1.0	Resistant
Kopergaon x DPU 88-31	25	00	-	-
China Mung x Pant U 30	40	00	-	-
China Mung x BHU U 1	25	01	1.0	Resistant
MH 84-1 x PDU 1	40	00	-	-
MH 84-1 x Pant U 30	25	00	-	-
<i>Kharif, 2003</i>				
Parents				
K 851	30	30	7.0	Susceptible
Pant U 30	30	28	1.0	Resistant
PDU 1	30	30	1.0	Resistant
BHU U 1	30	30	1.0	Resistant
F₁ generation				
K 851 x Pant U 30	30	03	1.0	Resistant
K 851 x PDU 1	30	02	1.0	Resistant
K 851 x BHU U 1	30	03	1.0	Resistant

Table 2. Segregation for CLS resistance/susceptible in F_2 and F_3 (segregating progenies) generation during *kharif* 2003

Cross	Generation	Total plants	Observed segregation		Expected ratio R:S	X^2 values	
			Resistant	Susceptible		Calculated	Tabulated
K 851 x Pant U 30	F_2	21	18	3	3:1	1.284	3.841
	F_3	56	46	10	3:1	1.522	3.841
K 851 x PDU 1	F_2	48	40	8	3:1	1.777	3.841
	F_3	64	50	14	3:1	0.333	3.841
K 851 x BHU U 1	F_2	34	29	5	3:1	1.921	3.841
	F_3	41	34	7	3:1	1.373	3.841

fungicide was sprayed. Following the method of Thakur *et al.* (1977), artificial inoculation was also done to 40-45 days old plants of each of the parents and F_1 by spraying spore suspension (500-1000 conidia/ml) of *Cercospora canescens* to avoid any chance of escape (Thakur *et al.* 1977). Scoring of disease was done after 15-20 days of inoculation using 1-9 scale where; 1 and 3 scales were treated as resistant and 5 to 9 scales as susceptible. Out of 12, only 11 crosses could germinate and 8 crosses attained pod maturity. All the 8 crosses were selfed to procure seeds for F_2 generation. However, sufficient seeds for raising F_3 generation of only three crosses could be obtained. Each of the 3 F_3 populations were grown and selfed to procure seed for F_3 generation. Fresh three crosses were also made. Final experiment consisting of F_1 , F_2 and F_3 along with the parents of three crosses was laid down in a randomized block design with three replications at Agricultural Research Farm, Banaras Hindu University, Varanasi during *kharif* 2003. Natural and artificial inoculations were done as described earlier. The segregation in F_1 and F_2 generation was tested for goodness of fit by using chi-square test.

RESULTS AND DISCUSSION

The total number of plants, mean diseases score and disease reaction of parents and F_1 over two years *i.e.*, *kharif* 2002 and 2003 are presented in Table 1. Four genotypes of mungbean, namely K 851, China Mung, Kopergaon and MH 84-1 exhibited susceptible whereas Pant U 30, PDU 1, DPU 88-31 and BHU U 1 showed resistant reaction to CLS.

The F_1 generation of all the crosses showed resistance reaction. This indicated that resistance to CLS was dominant over susceptibility. Segregation for resistance and susceptibility in the F_2 and F_3 (segregating progenies) population (Table 2) showed monogenic inheritance with 3 (resistance): 1 (susceptible) ratio which is in the agreement with earlier reports (Thakur *et al.* 1977, Kaushal and Singh 1991). In contrast to the present findings, Mishra *et al.* (1988) indicated a single recessive gene for the inheritance of resistance to CLS in mungbean. Differences in the nature of gene (s) contributing resistant to CLS might be attributed due to differences in the source (s) of resistance used in the investigation and/or variation in the strains of the pathogen and the environments.

REFERENCES

- Frey RL and Dukes PD. 1977. An assessment of two genes for *Cercospora* leaf spot resistance in the southern pea (*Vigna unguiculata*). Horticultural Sciences. 12(5):454-456.
- Kaushal RP and Singh BM. 1991. Heritability of resistance in urdbean to leaf spot caused by *Cercospora canescens*. Indian Phytopathology 44(1): 131-132.
- Leabeuon U and Oupadissakoon S. 1984. Inheritance of resistance to *Cercospora* leaf spot in mungbean. Kasetsart. Journal of Natural Science 18(1): 14 -19.
- Mishra SP, Asthana AN and Yadav Lallan. 1988. Inheritance of *Cercospora* leaf spot resistance in mungbean, *Vigna radiata* (L.). Plant Breeding 100(3): 228-229.
- Thakur RP, Patel PN and Verma JP. 1977. Genetical relationships between reaction to bacterial leaf spot, yellow mosaic and *Cercospora* leaf spot diseases in mungbean (*Vigna radiata*). Euphytica 26: 765-775.