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Inheritance of rust resistance in lentil (*Lens culinaris* Medik)

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Abstract

The inheritance of lentil rust (*Uromyces fabae* f. sp. *lentis*) resistance was studied in two cross combinations under glasshouse conditions and over locations in fields. The results revealed that resistance to rust was controlled by two duplicate dominant genes.

Key words : Lentil, inheritance, rust resistance, *Uromyces fabae*

Introduction

One of the major limitation in realising high yield of lentil (*Lens culinaris* Medik) is the incidence of lentil rust caused by *Uromyces fabae* f. sp. *lentis*. The crop is attacked at all the stages of its growth but is more susceptible at flowering [1]. Damage to the crop depends on the stage at which it is attacked, and yield losses up to 60-69% have been reported in India [2]. The ineffective chemical control of this disease necessitates the production of resistant varieties. Earlier some workers [3, 4] reported that rust resistance was under the control of single dominant gene. However, recent finding [5] indicated that resistance was controlled by more than one dominant gene. Therefore, the meagre and inconclusive information about the genetic basis of resistance motivated the present study to determine the number of genes responsible for *Uromyces fabae* resistance.

Materials and methods

The resistant, *macrosperma* genotypes Precoz was crossed with two susceptible genotypes (L-259 and PL-639) belonging to *microsperma* group of lentils. The resistant line Precoz was immune to lentil rust (*Uromyces fabae* f. sp. *lentis*), while the other two lines showed high degree of susceptibility. Parents, F_1 and F_2 progenies were tested to study the inheritance pattern under glasshouse conditions at Palampur and at two different locations which are hot spots for lentil rust (CSK HPKV, Research Sub-station Akrot, 425 m amsl; 31° 4' N and 76° 1' E with average rainfall 1200 mm; and YSPUHF Research Station Jaacch; 428 m amsl; 32° 18' N 75° 55' E with average rainfall 1500 mm). Multiplication of lentil rust was done from a single colony of rust on L-259. After multiplication spore suspension of lentil rust was sprayed on the plants in glasshouse. The humidity and temperature were kept congenial for heavy incidence of disease. In the field the disease spreads fast as these locations are hot spots for this disease. The susceptible line L-259 was used as the spreader parent. The disease reaction was recorded at the time of flower initiation by classifying the plants as resistant (R) and susceptible (S).

Results and discussion

Data on the reaction of individual parents, F_1 & F_2 crosses are presented in Table 1. The F_1s of two crosses showed resistant reaction to *Uromyces fabae*. This indicated dominance of resistance over susceptibility. The F_2 segregation revealed that in Precoz the resistance was controlled by two dominant genes. Chi-square analysis of these crosses revealed a close fit to the ratio of 15 resistant : 1 susceptible which confirms that resistance to *uromyces* was under the control of two dominant genes. However, some workers [3, 4] have reported that resistance was controlled by a single dominant gene. The variance in the results may be due to the different genetic background of the material used. The previous studies did not use *macrosperma* lentil as a source of resistance to determine the mode of inheritance of rust resistance. Therefore, more *macrosperma* genotypes should be screened to identify new genes, if any, conferring resistance to *Uromyces fabae*. This will broaden the resistance base. Previous workers had reported segregation ratio of 3 resistant : 1 susceptible. This, most likely means that those recessive complementary genes mentioned above do not play a role in crosses with resistant genotypes because different loci are involved, whereas the present study gave a segregation of 15 resistant : 1 susceptible. It is typical for segregation of two independent duplicate genes and proves that resistant parent has two nonallelic nonlinked dominant genes for rust resistance.

Table 1. Inheritance of resistance to *Uromyces fabae* f. sp. *lentis* in lentil

Cross	Observed number of plants		χ^2 (15:1)	P
	R	S		
Glass house conditions				
Precoz × L-259				
F_1	16	0		
F_2	131	11	0.543	0.30-0.50
Precoz × PL-639				
F_1	15	0		
F_2	124	8	0.08	0.90-0.95
Arkot location				
Precoz × L-259				
F_1	17	0		
F_2	151	12	0.140	0.70-0.80
Precoz × PL-639				
F_1	12	0		
F_2	121	9	0.100	0.70-0.80
Jaacch location				
Precoz × L-259				
F_1	14	0		
F_2	142	10	0.028	0.80-0.90
Precoz × PL-639				
F_1	9	0		
F_2	95	7	0.065	0.70-0.80
Pooled over three locations				
Precoz × L-259				
F_1	47	0		
F_2	434	33	0.446	0.50-0.70
Precoz × PL-639				
F_1	36	0		
F_2	340	24	0.072	0.70-0.80
Pooled over location over crosses				
F_1	83	0		
F_2	774	57	0.362	0.50-0.70

R = Resistant; S = Susceptible.

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