RUST RESISTANCE GENE BLOCK IN COMMON BEAN CV. OURO NEGRO IS NOT *Ur-5* OR *Ur-11*

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Identification of different rust resistance genes with large resistance spectra and knowledge about the allelic relationship among them are basic conditions for works aiming at pyramiding rust resistance genes in common bean. Cultivars Ouro Negro, Mexico 309 and Belmidak RR-3 are resistant to various *Uromyces appendiculatus* pathotypes identified in Central Brazil (Faleiro et al., 1999; 2001). In order to determine the allelic relationships between the resistance locus present in Ouro Negro, a widely used rust resistance source in Central Brazil, and genes *Ur-5* (Mexico 309) and *Ur-11* (Belmidak RR-3), we analyzed the inheritance of rust resistance in bean segregating populations derived from crosses between Ouro Negro and these two cultivars. The inheritance of the rust resistance present in Mexico 309 and Belmidak RR-3 was also analyzed in crosses involving susceptible cultivar Rudá.

$F_{2:3}$ populations derived from crosses between Rudá and Belmidak RR-3 and F_2 populations derived from crosses between Rudá and Mexico 309 were obtained. Twelve seeds each of 57 $F_{2:3}$ families derived from the cross Rudá vs. Belmidak RR-3, and 222 F_2 plants derived from crosses between Rudá and Mexico 309 were sown in the greenhouse. Fourteen days after sowing the first leaf from each plant was inoculated on the lower and upper surfaces with spore suspensions (2×10^4 spores/ml) of *U. appendiculatus* race 6 (Rudá vs. Belmidak RR-3) and race 10 (Rudá vs. Mexico 309), with a aid of a De Vilbiss no. 15 atomizer powered by an electric compressor. The plants were then incubated for two days in a mist chamber, which was maintained at 20-22 ^{o}C and 100% relative humidity. The plants were returned to the greenhouse where they were evaluated for disease symptoms 15 days after inoculation, using a scale reported by Stavely et al. (1983). Resistant (R) phenotype was assigned to plants with no or limited symptoms (grades 1 to 3), whereas plants graded 4 or greater were considered to be susceptible (S). The phenotypic class frequencies obtained were tested for goodness-of-fit to theorical ratios with chi-square tests. To avoid cross-contamination, each experiment was done in a separate chamber.

For allelism tests seeds from cultivars Ouro Negro, Mexico 309, Belmidak RR-3, and F_2 seeds derived from crosses Ouro Negro vs. Mexico 309 and Ouro Negro vs. Belmidak RR-3 were sown in the greenhouse. The inoculation conditions and symptom evaluations were as described before, but in this case *U. appendiculatus* race 10 was used.

The good fit to the segregation ratio expected (homozygote resistant:heterozygote: homozygote susceptible) ratio in the $F_{2:3}$ families and F_2 plants derived from crosses between Rudá vs. Belmidak RR-3 and Mexico 309, respectively, confirm that resistance of these cultivars is controlled by single dominant genes (Table 1). In the allelism tests the segregation ratios of rust resistance genes (Table 2) were of 15 resistant (R) to 1 susceptible (S) plant in the F_2 populations derived from crosses between Ouro Negro and Mexico 309 (*Ur-5*) and Belmidak RR-3 (*Ur-11*) indicating that two independent genes govern resistance in these populations. These results showed that the gene (or complex gene locus) present in Ouro Negro is different from genes *Ur-5* and *Ur-11*. Thus, cultivars Ouro Negro, Mexico 309 and Belmidak RR3 can be used simultaneously as rust resistance sources in breeding programs for Central Brazil.

Table 1- Segregation for resistance to rust in the crosses between Rudá vs. México 309 (*Ur-5*) and Belmidak RR-3 (*Ur-11*)

Locus tested	Race	Generation	Expected ratio	Observed ratio	χ^2	P
Ur-11	6	$F_{2:3}$	1:2:1	12RR:28Rr:13S	0.578	74.87
Ur-5	10	F_2	3:1	183:29	1.3	24.9

Table 2. Allelism studies of the rust resistance gene present in cultivar Ouro Negro using race 10 of *Uromyces appendiculatus*

Cross	Gene	Observed ratio		Expected ratio	χ^2	P value
		R	S			
Ouro Negro x Mexico 309	*Ur-5*	193	15	15:1	**0.328**	**56.67**
Ouro Negro x Belmidak RR-3	*Ur-11*	60	4	15:1	0.000	100.00

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