
Pathogenic Variability, Resistance Sources, and Progress Towards
Developing Stable Resistance to Bean Rust

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Nine additional races of the bean rust fungus, Uromyces appendiculatus, were obtained in the United States in 1984 (4). Races 33 and 52 (3) and two new races, tentatively designated T67 and T68 were obtained from single uredinium isolates from collections obtained from R. T. McMillan, Homestead, Florida, in April 1985. There are now 31 races, designated 38 through T68, in the Beltsville collection. Among the more broadly resistant differential cultivars Mexico 309, AXS37, NEP-2, Aurora, and 51051 are susceptible (S) (6) and Compuesto Negro Chimaltenango (CNC) is moderately susceptible (MS) to race T67. However, California Small White (CSW) 643, Kentucky Wonder (KW) 765, Ecuador 299, Mexico 235, and Olathe have small uredinium resistance (R) or necrotic hypersensitive resistance (HR) to T67. CNC is immune (I), HR, or R to the other 30 races. Race T68 produces a MS reaction on Olathe, but has relatively narrow virulence among the other differential cultivars (3).

Comparison of their reactions to each of the 31 races reveals certain likely significant similarities among the responses of certain Phaseolus vulgaris cultivars. Ecuador 299 and Mexico 235 have very similar reactions. For many races, especially those giving necrotic HR, these cultivars also are remarkably similar to NEP-2, Aurora, and 51051. Except for races 38 and 39, to which most snap and kidney cultivars are very S, Early Gallatin and KW 780 show great similarity and they appear to be related to Brown Beauty. Golden Gate Wax, KW 765, and CSW 643 each have reactions to certain races that are like those of Olathe. Such comparisons suggest that cultivars with identical or very similar reactions to many races have the same HR genes and may have the same R genes.

Significantly different reaction patterns to this set of races are of greater significance than the similarities. By combining the resistances of cultivars with differing reaction patterns, resistance to all races can be obtained from several different sources and it becomes possible to obtain more than one resistance gene per race. Of significance for navy beans is the complementary resistances in C-20 and Fleetwood, each of which are S to 11 races. There are only 2 races to which both are S or MS.

Genetic studies indicate most, if not all, rust resistance in beans is oligogenetic (1). Gene pyramiding may be the best way to obtain stable rust resistance. Identification of linked or pleiotropic genes effective against multiple races is essential. However, CNC, Mexico 309, and Mexico 235 have proven to have considerable identity of linked genes conditioning R to many specific races (2,5). Nevertheless, Mexico 235 also has an independent, pleiotropic gene giving HR to at least four and

probably 8-10 additional races (5) and this same gene is probably also in Ecuador 299, NEP-2, Aurora, and 51051. Olathe contains R and HR genes, most of which are independent of those in the above cultivars.

During the past two years, BARC-Rust Resistant-2 through -7 snap bean lines (7), having HR, R, or MR reactions (6) to all races, have been released upon obtaining homozygous combinations of the HR and R genes of Mexico 309 derived B-190 with the HR and MS genes already present in snap beans. The HR and R genes of CNC, Olathe, and Mexico 235 are being combined into pinto lines that will have either of these reactions to each race. Upon the recent discovery of race T67, to which CNC is MS, these pinto lines maintained their resistance because they contained the R genes of Olathe and Mexico 235.

References

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