Inheritance of resistance to fusarium wilt race 3 in tomato

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Two dominant genes, I-1 and I-2, have provided effective resistance to races 1 and 2 of Fusarium oxysporum f. sp. lycopersici in Bowen since 1965 and 1969 respectively. Both races are distributed throughout the world (1). In 1979, a third race was confirmed in Bowen (2). Since then a new race has also been identified in Florida (3). Several sources of resistance to Race 3 have been found in Lycopersicon esculentum and L. pimoinellifolium and are now being transferred to commercial varieties. In the study reported here, we investigated the inheritance from L. esculentum US73B638.

Materials and Methods

The susceptible Cv. Floradade was crossed with resistant genotype L. esculentum US 638. F3 families were grown in replicated field plots at three sites heavily and uniformly infected with race 3. In a subsequent field trial the same F3 families were exposed to races 1 and *2* only, i.e. where race 3 had not been detected. A wilt index was obtained for each plot using time to onset of symptoms as the criterion. Yield and average fruit size were recorded for the former trials.

Results and Discussion

Segregation ratios of F2 and F3 generations have previously shown this resistance to be governed multigenically. Frequency distributions of F3 family means at each of the three trial sites were continuous and unimodal for the wilt index variate. In each case the distribution was statistically similar to normal, confirming the quantitative control indicated earlier.

Significant genetic variation among F3 family means was found in each trial. Heritabilities expressed on a mean family basis at each location ranged from .67 to .82. A combined analysis across three sites indicated a large amount of genetic variation available for selection; heritability was .76 expressed on a mean F3 family basis.

When the same families were exposed to Races 1 and 2 only in the field, no evidence of symptoms was found. Therefore, symptoms observed in other trials were most likely the result of Race 3 alone, unconfounded by the other races present. Yield and average fruit size were uncorrelated with wilt index in the field.

The study revealed a fundamental difference in the nature of resistance under transfer in the Bowen Fusarium breeding program. Commercial varieties in Bowen, as elsewhere, have relied exclusively on single dominant genes for effective resistance, imposing strong selection pressure for mutation in the pathogen. Changes in Bowen tomato varieties have been determined principally by the evolution of new races; at best, varieties have lasted for no more than eight years.

The resistance is known to confer protection to all three races. This may provide some long-term protection to the new varieties being bred. The multi-genic character of these resistances implies that breeding programmes will be more laborious and difficult, although the benefits which follow may be substantial.

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