Control of an Epidemic of Septoria Leaf Spot of Tomato by Resistance

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ABSTRACT

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Tomato breeding lines deriving resistance to Septoria leaf spot from PI 422397 were entered in a replicated field test to assess their performance during an artificially induced epidemic. The level of resistance was sufficient to maintain a foliage canopy over the fruit until harvest. Disease increase on resistant lines was slow by comparison with increase on susceptible cultivars, which were severely defoliated.

Additional key words: epiphytotic

Resistance to Septoria leaf spot caused by *Septoria lycopersici* Speg. in the cultivated tomato, *Lycopersicon esculentum* Mill., or in other *Lycopersicon* species has been reported (1,2,4,5). Barksdale and Stoner (3) recently demonstrated single dominant gene resistance in PI 422397. In greenhouse tests, inoculated leaves of this line or of resistant breeding lines developed from it showed small necrotic flecks. These resistant type lesions had fewer pycnidia per lesion and fewer conidia per pycnidium than did lesions on leaves of susceptible plants.

Because some pycnidia and conidia were produced on resistant plants, a field test was needed to determine whether the level of resistance obtained through a greenhouse screening program would prevent severe defoliation during an epidemic. During the summer of 1980, a replicated field test was performed to measure and compare Septoria disease development on several resistant or susceptible lines under artificially induced epiphytotic conditions.

MATERIALS AND METHODS

There were 15 entries in this test (Table 1). The two susceptible checks, typical of processing cultivars grown in the eastern United States, were US28 and Merit; the latter has been used by MacNab to screen candidate fungicides for control of several tomato diseases (6). The Septoria-resistant PI 422397 and the susceptible 76B137, a horticulturally advanced breedling line, were crossed. These parents and nine F_4 progeny of the first backcross to 76B137 comprised the bulk of the entries. The backcross lines had been selected for Septoria resistance in the greenhouse and for horticultural stability in the field. A line derived from PI 111406, previously reported resistant (3), and a line developed at Purdue University were also included in the test.

One-month-old tomato seedlings were transplanted in the field on 3 June. Eight-plant plots of each entry were planted in randomized blocks within each of three replications. Between each plot were three plants of the susceptible Wakefield cultivar, which served as a spreader. On 9 July, the entire field was inoculated by being sprayed with a spore suspension containing 5×10^5 spores per milliliter. The spores had been harvested from 3-wk-old cultures growing on cornmeal agar plates, and a total volume of 10 L was used.

Plants in this test were never sprayed with a fungicide, but an insecticide was occasionally applied as needed.

Septoria symptoms were first evident on 21 July. Observations of disease severity were made on 29 July and 7 and 19 August. Severity ratings were made on each plant by two independent observers using a 0–9 scale where 0 was healthy and 9 approached total defoliation. Observations of severity were a combination of defoliation and necrotic leaf area. The ratings for each plant were used to derive plot means, and these means for each entry and observation data were subjected to an analysis of variance and Duncan's multiple range test.

Because rain is important in the dispersal of *Septoria* conidia, this test was planted in a field that had a permanent sprinkler irrigation system. Rainfall occurred on 11 days scattered throughout the period between inoculation and the final disease assessment, and it was necessary to irrigate only twice to maintain an interval of 5 days or less between rains.

RESULTS

The greatest separation in terms of the statistical significance of disease severity among entries occurred on the last observation date, which was 41 days after inoculation, near the end of the epiphytotic (Table 1).

During the epidemic, disease increase for the resistant PI 422397 and for all of its selected progeny lines was more gradual than for the susceptible lines. The level of resistance in these resistant lines was sufficient to maintain a foliage canopy over the fruit until harvest.

Although the line developed from PI 111406 had previously shown some resistance in a greenhouse test, this level of resistance did not prevent moderately severe defoliation in the field. Defoliation of the Purdue line, PU60-01-1, was not significantly different from the resistant PI 422397 and most of its progeny.

Early blight caused by *Alternaria solani* is another common disease causing defoliation of tomatoes grown in the eastern United States. However, early blight did not appear in this field until late in the season and caused no appreciable defoliation in this test.

DISCUSSION

It is encouraging that most lines

Table 1. Severity of Septoria leaf spot on tomato breeding lines and cultivars at the end of an artificially induced epidemic[a]

Entry	Description	Disease severity on 19 August
Merit	Cultivar	8.3 a
US28	Cultivar	7.7 a
76B137	P1	6.2 b
PI 422397	P2	2.1 hi
80B1214	F_4 of P1(P1 × P2)	4.2 d
80B1218	F_4 of P1 (P1 × P2)	4.0 de
80B1217	F_4 of P1 (P1 × P2)	3.7 def
80B1222	F_4 of P1 (P1 × P2)	3.6 def
80B1216	F_4 of P1 (P1 × P2)	3.6 def
80B1213	F_4 of P1 (P1 × P2)	3.2 efg
80B1215	F_4 of P1 (P1 × P2)	2.9 fgh
80B1223	F_4 of P1 (P1 × P2)	2.5 ghi
80B1212	F_4 of P1 (P1 × P2)	1.8 i
80B1221	F_4 of P1 (P1 × P2) PI 111406)	5.3 c
PU60-01-1	Breeding line	2.9 fgh

[a]Severity was estimated on a scale of 0–9, where 0 = healthy and 9 approached total defoliation. Values are means for two observers and three replications. Values followed by the same letter are not significantly different at the 0.05 level by Duncan's multiple range test.

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selected for resistance on the basis of tests in the greenhouse had sufficient resistance to prevent serious defoliation during an epidemic in the field. This should hasten the development of Septoria-resistant cultivars. However, since there were some differences in defoliation among resistant entries in the field, it would be prudent to use a Septoria field plot together with greenhouse screening in a cultivar development program.

Although resistance is thought to be inherited as a single dominant gene, the range of disease expression observed may be caused by slight differences in plant maturity, in plant growth habit, or in the density of foliage canopy among lines.

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