Resistance in Tomato Transplants to Bacterial Speck

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ABSTRACT

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Reactions of 20 cultivars of tomato transplants during a natural epidemic of bacterial speck were observed in southern Georgia. Although cultivars were susceptible, significantly higher levels ($P = 0.05$) of resistance occurred in Campbell 28, Hunt 62, and Ohio 7663 tomato than in the other cultivars. Greater disease severity occurred in the lower one-third of foliage in 8-wk-old plants. However, the rating of a cultivar in relation to resistance in other cultivars was relatively unaffected whether the upper, middle, or lower third of the foliage was evaluated.

Additional key words: *Lycopersicon esculentum*, *Pseudomonas syringae* pv. *tomato*

Bacterial speck caused by *Pseudomonas syringae* pv. *tomato* (Okabe) Young, Dye & Wilkie has been a problem in the production of tomato transplants in Georgia since 1978. The primary concern of growers is quality control to produce certified disease-free plants for shipment to the northern United States and Canada. Protective bactericides applied at 5- to 10-day intervals have been recommended as a control measure, but bacterial plant diseases are extremely difficult to control once an epidemic has begun. An alternative solution would be the use of tomato cultivars with a high level of disease resistance. Yunis et al (9) reported sources of resistance to bacterial speck of tomato in Israel. Pitblado and Kerr (6) observed resistance in cultivar ONT 7710. This report presents data on differences in foliar resistance in the field by 20 tomato cultivars currently used in tomato transplant production in south Georgia.

MATERIALS AND METHODS

Twenty tomato cultivars were seeded with Stanhay precision planters in Lakeland sand soil on 1 April 1980. Each cultivar was planted in raised beds of four rows spaced 35 cm apart, and plants were 1 cm apart within the seed row. The beds were 24.4 m long and were arranged parallel to the long axis, with 1.8 m between centers of the beds. Recommended fertilizer and pest control practices were maintained (4).

A natural epidemic of bacterial speck occurred in early May, and bactericides were applied on 19 and 24 May to help control the pathogen. Cupric hydroxide at 4.48 kg/ha and maneb-zinc at 3.36 kg/ha were applied as a tank mix in 300 L of water per hectare with a Myers downdraft sprayer.

Plants about 8 wk old were harvested on 5 June and evaluated for disease severity using the Horsfall-Barratt rating system (3). Samples of 20 plants each were randomly selected from four random sites (n = 1,600) and were evaluated for disease severity in the upper, middle, and lower third of foliage. Data were analyzed with a one-way classification analysis of variance and Duncan's new multiple range test (7).

DISCUSSION AND RESULTS

Despite the chemical applications, a considerable amount of disease developed. Typical bacterial speck symptoms (raised, black lesions 2–3 mm in diameter surrounded by yellow halos) developed on the foliage. Causal bacteria were Gram-negative, aerobic rods that produced a diffusible fluorescent pigment on King's medium B (5). Bacteria were negative for arginine dihydrolase, oxidase, and utilization of erythritol but induced a hypersensitive response in tobacco. These characteristics conform to those produced by *P. syringae* pv. *tomato*.

Generally, bacterial speck was most severe on the lower one-third of the foliage, where disease severity ranged from 0.5% with tomato cultivar Campbell 28 to 95% for Heinz 1630 (Table 1). Necrosis was occasionally so extensive on lower foliage that it was difficult to determine whether all the damage could be attributed to *P. syringae* pv. *tomato*. However, responses in the middle and upper thirds of foliage were attributed to the bacterium with a great deal of certainty. Disease severity in the middle third of foliage ranged from 0.5 to 50% and in the upper third from 0.1 to 6.0% in Campbell 28 and FM 6203, respectively (Table 1).

The rating of a cultivar in relation to resistance in other cultivars was relatively unaffected whether the upper, middle, or lower third of the foliage was evaluated. This was especially evident for those cultivars exhibiting the most resistant or most susceptible reactions. Cultivars such as Heinz 1630 and FM 6203 ranked as the most susceptible cultivars in all foliar positions evaluated, and Ohio 7663 and Campbell 28 consistently ranked as the most resistant cultivars for all foliar positions. This consistency is evidence that much of the damage in lower foliage was caused by bacterial speck. Except for the fairly resistant response of Heinz 2653, our results generally agree with observations made by state plant inspectors (J. M. Brown, Georgia State Department of Agriculture, *personal communication*) in growers' fields in

Table 1. Bacterial speck severity on foliage of 20 tomato cultivars

Cultivar	Disease severity (%) on third of foliage[y]		
	Lower	Middle	Upper
Heinz 1630	95.0 a[z]	29.5 bc	4.5 a
FM 6203	94.5 a	50.0 a	6.0 a
Campbell 38	92.5 a	21.0 def	2.0 d
Libby 8990-A	90.5 a	35.0 b	4.0 ab
UC 134-1-2	78.0 b	16.0 efg	2.5 d
Heinz 722	75.0 bc	23.5 cd	4.0 ab
Libby 68	75.0 bc	8.5 hi	0.7 gh
New Yorker	67.0 bc	6.0 ijk	1.4 f
Heinz 727	61.5 c	15.0 fg	3.5 bc
Chico III	46.0 d	22.0 de	4.0 ab
Heinz 1706	17.0 e	11.5 hi	1.5 ef
Libby 7241	17.0 e	7.5 ij	0.8 g
Peto 80	16.0 e	11.5 gh	2.0 ef
Veepro	10.0 ef	5.5 jk	2.5 f
Heinz 2653	8.5 f	13.0 ij	3.0 cd
Heinz 318	6.5 f	2.5 m	0.7 gh
Campbell 37	6.0 f	4.5 kl	0.8 g
Hunt 62	1.0 g	3.0 lm	0.3 gh
Ohio 7663	0.8 g	1.0 n	0.1 h
Campbell 28	0.5 g	0.5 n	0.1 h

[y] Percentage of disease severity based on conversions from Horsfall-Barratt ratings (3).
[z] Mean separation in columns by Duncan's multiple range test, 5% probability level.

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recent years.

The type of resistance observed was quantitative. This type of resistance can be affected detrimentally by environmental conditions favorable for disease development (8). A cultivar's reaction would be predictable to the extent of knowledge of the environmental impact, which is affected by microclimate as well as macro environmental conditions. Southern-grown transplants affected with bacterial speck late in the transplant season are in an unfavorable environment for disease development because temperatures often exceed 32 C. The speck pathogen has an optimum temperature of 23–25 C (1). Transplants of susceptible cultivars with limited bacterial speck development because of high temperatures could set the stage for severe epidemics when plants are shipped to cooler regions in the northern United States and Canada. Therefore, use of resistant cultivars should be coordinated with recommended spray programs and cultural practices for a complete disease control program. Resistance in cultivars such as Campbell 28, which was also reported to be resistant to bacterial canker (2), would maximize the effectiveness of chemical disease control in order to produce certified disease-free transplants.

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