Susceptibility of Geraniums to *Pseudomonas solanacearum* and *Xanthomonas campestris* pv. *pelargonii*

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ABSTRACT

Strider, D. L. 1982. Susceptibility of geraniums to *Pseudomonas solanacearum* and *Xanthomonas campestris* pv. *pelargonii*. Plant Disease 66:59-60.

Three weeks after root inoculations with *Pseudomonas solanacearum*, all plants of 20 geranium cultivars tested were dead. Disease development was similar but slower in plants inoculated with *Xanthomonas campestris* pv. *pelargonii*.

Southern bacterial wilt of geranium, *Pelargonium hortorum* Bailey, caused by *Pseudomonas solanacearum* E. F. Smith (*Ps*) was recently described (7). Bacterial blight caused by *Xanthomonas campestris* pv. *pelargonii* (Brown) Dye (*Xcp*) has long been considered the most important disease of geranium (1,2,4–6). Symptoms of the two diseases are similar, ie, both are vascular diseases resulting in wilting and death.

Susceptibility of florists' geranium to *Xcp* is variable, but all cultivars tested were susceptible (2,4). Resistance to *Xcp* is found among other *Pelargonium* species (2). Susceptibility of cultivars of florists' geranium to *Ps* has not been reported.

The objective of this study was to determine whether currently popular cultivars of florists' geranium are resistant to either *Xcp* or *Ps*.

Paper 6700 of the Journal Series of the North Carolina Agricultural Research Service, Raleigh.

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Accepted for publication 27 April 1981.

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0191-2917/82/01005902/$03.00/0

MATERIALS AND METHODS

Rooted cuttings of geranium were provided by Oglevee Products, Inc., McDonough, GA; Yoder Brothers, Inc., Barberton, OH; and Fred C. Gloeckner and Co., Inc., New York, NY. Rooted cuttings were transplanted to unamended Metro Mix 220 potting medium (W. R. Grace and Co., Cambridge, MA) in 10-cm clay pots and grown for 4 wk before inoculation. Four cultivars were grown from seed furnished by the Vaughan-Jacklin Corp., Downers Grove, IL. Plants were grown in a greenhouse with an evaporative-cooling system and whitewash shading to maintain temperatures of 20–35 C before inoculation. After inoculation, plants were transferred to a greenhouse without evaporative cooling where temperatures were maintained between 24 and 40 C to favor the development of southern bacterial wilt.

Ps strains NC 437 and NC 446 from geranium and tobacco, respectively, and *Xcp* strain NC 457 from geranium were

Table 1. Susceptibility of geranium cultivars to *Pseudomonas solanacearum* and *Xanthomonas campestris* pv. *pelargonii*

Cultivar	Disease development[a] after inoculation with				
	P. solanacearum		*X. campestris* pv. *pelargonii*		
	1 wk	3 wk	1 wk	3 wk	4 wk
Blaze	3.5	5.0	1.0	3.2	4.4
Cherry Blossom	3.2	5.0	...[b]	...	...
Cherry Glow	3.7	5.0	...	...	...
Crimson Fire	2.8	5.0	...	...	...
Galilee	3.2	5.0	1.0	2.2	4.2
Genie Irene	1.2	4.8	1.8	3.0	4.5
Improved Minnetonka	2.2	5.0	1.0	2.1	4.2
Irene	1.2	5.0	...	...	...
Knockout	3.0	5.0	...	...	...
Penny	3.8	5.0	1.0	3.0	4.8
Pink Camellia	2.8	5.0	...	...	...
Red Express	3.8	5.0	...	...	...
Red Perfection	4.0	5.0	1.0	3.4	4.8
Sincerity	4.0	5.0	1.0	3.0	4.5
Snowmass	3.8	5.0	1.8	3.9	4.8
Springfield Violet	1.2	5.0	1.0	1.6	4.0
Springtime Irene	1.2	5.0	...	...	...
Sprinter Mix	3.8	5.0	...	...	...
Sybil Holmes	2.0	5.0	1.0	3.0	4.5
Yours Truly	3.8	5.0	1.0	2.5	4.5
LSD 0.05	1.2	1.1	1.2	1.4	1.2

[a] Rated on a scale where 1 = no symptoms, 2 = stunting, 3 = chlorotic or necrotic leaves, 4 = wilted leaves, and 5 = dead plant.
[b] ...Not tested.

maintained in sterile distilled water at room temperature. Inoculum was grown 48 hr at 28 C on nutrient agar. Ten milliliters of an aqueous suspension of about 10^7 colony-forming units (CFU) as determined by dilution series was poured on roots severed on one side, 1 cm from the base of stems (7). Preliminary inoculation with 10^6 or fewer colony-forming units per milliliter failed to cause wilting or resulted in inconsistent disease development.

Four plants of each cultivar were inoculated with each strain, and four plants of each cultivar served as uninoculated controls. Each plant was considered a replicate. Roots of control plants were severed as above and sterile water was poured over them. Plants were incubated in a warm greenhouse (24–40 C) and kept moist with overhead irrigation. Plants were arranged on a greenhouse bench in a randomized block design. The test was repeated once.

Disease development was rated weekly according to a scale of 1–5, where 1 = no symptoms, 2 = stunting, 3 = chlorotic or necrotic leaves, 4 = wilted leaves, and 5 = dead plant (7).

RESULTS AND DISCUSSION

Rate of disease development varied 1 wk after inoculation, but at 3 wk after inoculation all plants of all cultivars inoculated with the geranium and tobacco strain of *Ps* were dead (Table 1). Disease development was similar but slower in plants inoculated with *Xcp*; however, again after 4 wk, no differences in susceptibility were noted among cultivars. These results support those obtained earlier with *Pelargonium hortorum* (2,4).

It is possible that the inoculum level used in this study was too high to detect differences in susceptibility. However, the same inoculum level and inoculation technique fail to cause symptoms on tobacco inoculated with the geranium strain (6). In those tests, disease severity on tobacco inoculated with the tobacco strain averaged 4.5 at 3 wk after inoculation. Moore et al (3) used similar concentrations of inoculum in screening tobacco cultivars for resistance to southern bacterial wilt. They also distinguished resistant from susceptible cultivars after inoculation by dipping roots of tobacco transplants in a suspension of 10^9 CFU/ml. Similar techniques and inoculum levels are currently being used to screen tobacco and tomato cultivars for resistance to southern bacterial wilt (N. T. Powell, Eddie Echandi, and S. F. Jenkins, *personal communications*).

The fact that the inoculum was applied to the potting medium and not directly on an infection site must be taken into consideration in discussing the effective inoculum level. It is believed that little or no wilting occurred with 10 ml of 10^6 CFU/ml because most of those cells were bound by the organic potting medium or leached from the medium; 10 ml of 10^7 CFU/ml provided enough additional cells for infection to occur.

The geranium cultivars tested lacked the level of resistance that is required for tobacco cultivars grown in fields infested with *Ps*. Further, all geranium cultivars tested were more susceptible to *Ps* than to *Xcp*, which has long been considered the most important pathogen of geranium.

Except for the rate of disease development, symptoms of the two diseases were very similar. Portions of all inoculated and uninoculated cultivars became chlorotic under the conditions of this test. Marginal foliar phytotoxicity in plants sprayed with the recommended rate of acephate also occurred. Both of these symptoms were thought to be associated with the high temperatures that prevailed during the tests.

ACKNOWLEDGMENT

I wish to thank Nancy House for technical assistance.

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