Bacterial Leaf Blight Incited by *Pseudomonas cichorii* in *Schefflera arboricola* and Some Related Plants

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ABSTRACT

Chase, A. R., and Brunk, D. D. 1984. Bacterial leaf blight incited by *Pseudomonas cichorii* in *Schefflera arboricola* and some related plants. Plant Disease 68:73-74.

A leaf blight of *Schefflera arboricola* (dwarf schefflera) was found to be caused by *Pseudomonas cichorii*. Isolates of the pathogen from dwarf schefflera were also pathogenic on *Brassaia actinophylla* (schefflera), *Chrysanthemum morifolium* (florists' chrysanthemum), *Cichorium endivia* (endive), *Dizygotheca elegantissima* (false aralia), *Fatshedera* sp. (tree ivy), *Fatsia japonica* (Japanese aralia), *Gerbera jamesonii* (Transvaal daisy), *Hedera helix* (English ivy), *Lactuca sativa* (lettuce), and *Polyscias fruticosa* (parsley aralia). Isolates from chrysanthemum and Transvaal daisy were pathogenic on dwarf schefflera, causing symptoms similar to those caused by dwarf schefflera isolates. This is the first report of *P. cichorii* as a pathogen of dwarf schefflera.

Schefflera arboricola Hayata ex Kanehira (dwarf schefflera) is susceptible to few foliar fungal diseases, and no bacterial diseases have been reported on this host. During the winter of 1982–1983, a severe foliar blight of dwarf schefflera occurred, with 75% of the plants in one nursery affected. Symptoms included large (1 cm) blackish lesions on leaf margins, tips, and centers (Fig. 1), often resulting in leaf abscission, that resembled lesions caused by *Alternaria panax* Whetzel (1). Lesion centers appeared tan as affected tissue dried. The purpose of this research was to identify the causal agent of this foliar blight of dwarf schefflera and determine the pathogenicity of this agent to related foliage plant genera.

MATERIALS AND METHODS

Blighted leaf tissue was washed in tap water, ground in a scintered glass tissue grinder, and streaked onto nutrient agar medium (NA, BBL Microbiology Systems, Div. Becton, Dickinson & Co., Cockeysville, MD 21030). Typical lesions were excised, surface-disinfested in 0.52% NaOCl for 3 min, rinsed in sterilized, deionized water (SDW), and placed onto potato-dextrose agar (infusion from 250 g boiled potatoes, and 20 g each dextrose and agar per liter) amended with 100 μg streptomycin sulfate per milliliter of medium (PDAS). All cultures were incubated at 24–26 C for 2–7 days under 25 μE m^{-2} sec^{-1} fluorescent light (12 hr/day). The NA plates were not illuminated. A suspect pathogen was chosen on the basis of recovery frequency and was reisolated onto fresh culture media and tested for pathogenicity on dwarf schefflera. Four isolates were obtained from separate plants during a 3-mo period. Bacterial cultures were judged free of contaminants after four successive single-colony transfers.

The suspect pathogen was grown on NA plates for 48 hr. A bacterial suspension was made and adjusted to about 10^8 cells per milliliter using a spectrophotometer (600 nm). Schefflera plants were produced from rooted cuttings or seeds obtained from growers and grown in steam-sterilized potting medium consisting of Canadian peat, Cypress shavings, and pine bark (2:1:1, v/v). The medium was amended with 4.4 kg Osmocote (19:6:12 NPK, slow-release fertilizer from Sierra Chemical Co., Milpitas, CA 95035), 4.2 kg dolomite, and 0.9 kg Micromax (micronutrient source also from Sierra Chemical Co.) per cubic meter of medium. Plants were grown in 10-, 12.5-, or 15-cm plastic pots, depending upon their size, and maintained on a greenhouse bench with about up to 200 μE m^{-2} sec^{-1} natural light and temperatures of 18–32 C. Plants were wounded with a sterilized dissecting needle (three puncture locations in each of three leaves per plant), inoculated by spraying to runoff with a bacterial suspension, and wrapped individually in polyethylene bags for 72 hr. Three plants were inoculated with each of four bacterial isolates or treated with SDW as the control in each of three tests. Plants were removed from bags and arranged in a randomized complete block design. The number of lesions was recorded 1 wk after inoculation, before reisolation was attempted.

Fig. 1. Pseudomonas leaf spot of *Schefflera arboricola* (dwarf schefflera) after natural infection by *Pseudomonas cichorii*.

The same test procedure was used to determine susceptibility of the following plants also in the Araliaceae: *Brassaia actinophylla* Endl. (schefflera or umbrella tree), *Dizygotheca elegantissima* (Hort. Feitch) R. Vig. & Guillaum (false aralia), *Fatshedera* Guillaum sp. (tree ivy), *Fatsia japonica* (Thunb.) Decne. & Planch (Japanese aralia), *Hedera helix* L. (English ivy), and *Polyscias fruticosa* (L.) Harms (parsley aralia). Plants were collected from growers or produced as described. This test was performed three times. In addition, two isolates of the suspect pathogen were tested for pathogenicity on *Chrysanthemum morifolium* Ramat. (florists' chrysanthemum), *Cichorium endivia* L. (endive), *Gerbera jamesonii* H. Bolus ex Hook. f. (Transvaal daisy), and *Lactuca sativa* L. (lettuce), all known hosts of *P. cichorii*.

The suspect pathogen was identified using the following tests: arginine dihydrolase production using Thornley's medium 2A (15); oxidase reaction using the method of Kovacs (9); hypersensitivity reaction on *Capsicum annuum* L. (Early Calwonder pepper), *Lycopersicon lycopersicum* (L.) Karst. ex Fariv. (Bonny Best tomato), and *Nicotiana tabacum* L. (Hick's tobacco) (8); oxygen requirement and β-glucosidase production (4) using Hugh-Leifson's medium (5); fluorescin production using King's medium B (7); levan production on NA amended with sucrose (5%, w/v) (13); gram reaction (13); and number and position of flagella (10).

RESULTS AND DISCUSSION

A fluorescent, gram-negative, rod-shaped bacterium with a single polar

Florida Agricultural Experiment Stations Journal Series No. 4769.

Accepted for publication 20 September 1983.

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Table 1. Pathogenicity of *Pseudomonas cichorii* from *Schefflera arboricola* on *S. arboricola* and some related plants

Plant tested	Mean no. lesions per three leaves[x]		
	Test 1	Test 2	Test 3
Brassaia actinophylla	1.2 a[y]	7.2 ab	3.1 ab
Dizygotheca elegantissima	4.5 a	7.7 bc	6.0 abc
Fatshedera sp.	1.5 a	2.8 ab	0.8 a
Fatsia japonica	4.0 a	10.8 c	9.0 bc
Hedera helix	NT[z]	6.2 abc	4.2 abc
Polyscias fruticosa	3.8 a	1.8 a	2.6 ab
Schefflera arboricola	5.5 a	2.7 ab	10.2 c

[x]Nine lesions were possible per plant at wound sites on three plants per species per test. Numbers greater than nine indicate that lesions formed in unwounded tissue.
[y]Mean separation in columns by Duncan's new multiple range test ($P = 0.05$).
[z]Not tested.

Table 2. Biochemical, physiological, and pathogenicity tests characterizing strains of *Pseudomonas cichorii* from *Schefflera arboricola* and from other hosts

Characteristics tested	No. strains positive	
	From other hosts (total 6 strains)[a]	From *S. arboricola* (total 4 strains)[a]
Oxidase (+)	6[b]	4
Asparagine utilization	6	4
Arginine dihydrolase production	0	0
Levan production	0	0
Oxygen requirement (obligate aerobe)	6	4
β-glucosidase	6	3
Hypersensitive reaction on		
Pepper	4	4
Tobacco	3	2
Tomato	6	4
Pathogenic to *S. arboricola*	5	4

[a]Some strains supplied by J. B. Jones, J. W. Miller, G. W. Simone, and R. E. Stall.
[b]Number of isolates positive for the test.

flagellum was isolated consistently from dwarf schefflera with leaf blight. At no time was *Alternaria panax* or any other fungus isolated from this tissue. Each of four isolates tested was pathogenic on dwarf schefflera, causing symptoms similar to those seen on naturally infected plants within 5 days of inoculation. Lesions were initially water-soaked areas 2–4 mm wide on all parts of leaf laminae (2 days). Within 1 wk, they enlarged to 1–2 cm and turned black and tan with some centers of each color. Severely affected leaflets abscissed. The pathogen was reisolated from symptomatic tissue but not from the control plants.

Each of the other six species of Araliaceae was susceptible to one isolate from dwarf schefflera. The degree of susceptibility differed (Table 1), but each plant developed black or tan lesions at wound sites. Japanese aralia and schefflera also developed lesions in inoculated tissue that was not artificially wounded. Dwarf schefflera and Japanese aralia were the most susceptible hosts and tree ivy was the most resistant (Table 1). Differences in symptom development on each host occurred in the three tests and were perhaps due to varying environmental conditions at the time of each test. The pathogen was reisolated from symptomatic plants but not from the asymptomatic control plants.

Isolates of *P. cichorii* from Transvaal daisy and chrysanthemum were pathogenic to dwarf schefflera, causing symptoms identical to those caused by dwarf schefflera isolates within 5 days. Isolates from dwarf schefflera were pathogenic to Transvaal daisy, lettuce, endive, and chrysanthemum.

Results of biochemical and physiological tests are summarized in Table 2. The close agreement in the test results between *P. cichorii* and isolates from dwarf schefflera identify the latter as *P. cichorii*.

P. cichorii has been a serious pathogen of numerous plant genera, including lettuce (3), chrysanthemum (6,11), Transvaal daisy (12), celery (14), cabbage (16), geranium (2), and many members of the important foliage plant family Araceae (17). This is the first report of *P. cichorii* causing a serious foliar blight of a species of the Araliaceae, although this bacterium has been a serious problem in the foliage industry for at least 18 yr (17).

ACKNOWLEDGMENTS

We wish to thank Central Florida nurseries for their generous donations of plant materials and M. Salt and W. McLees for technical assistance.

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