Root Rot of Japanese Umbrella Pine, *Sciadopitys verticillata*, Caused by *Phytophthora cinnamomi*

R. C. LAMBE, Associate Professor, and W. H. WILLS, Professor, Department of Plant Pathology and Physiology, College of Agriculture and Life Sciences, Virginia Agricultural Experiment Station, Virginia Polytechnic Institute and State University, Blacksburg 24061

ABSTRACT

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Japanese umbrella pine was found for the first time to have a severe root rot and wilt disease caused by *Phytophthora cinnamomi* in container-grown nursery plants. Seedlings artificially inoculated with *P. cinnamomi* from umbrella pine developed root rot and wilt and the pathogen was recovered from the symptomatic plants.

In 1974, we first observed a root rot of container-grown Japanese umbrella pine (*Sciadopitys verticillata* (Thunb.) Siebold. & Zucc.) in a Virginia nursery. The root rot was causing economically significant loss of plants as tall as 60 cm. The nurseryman eventually discontinued production of this species because of the disease. The plants were growing in a soil-bark medium that was excessively wet because of frequent rain and irrigation. Affected plants showed wilting and off-green color, with needles turning yellow. These plants were devoid of fibrous roots and had a brown discoloration in the wood at the base of the stem extending about 2.5 cm up the stem. Isolations from the roots on a *Phytophthora*-selective medium (1) consistently yielded *Phytophthora cinnamomi*, a pathogen previously isolated from other hosts in that nursery. We have found no other report of *P. cinnamomi* causing root rot of this ornamental tree (2).

Pathogenicity of *P. cinnamomi* isolated from *S. verticillata* was tested on seedlings 10–15 cm tall that had grown for 1 yr in plastic containers of 1-L capacity. The medium was steam-pasteurized and contained ground pine bark and soil (1:1, v/v). Fertilizer (4-9-3), ground dolomitic limestone, and minor elements in amounts customary for nursery practice were added. Because nonmycorrhizal seedlings developed poorly in earlier attempts to grow *S. verticillata*, a homogenate of roots collected from a large healthy umbrella pine with well-developed ectomycorrhizae in addition to vesicular-arbuscular mycorrhizae (E. Hacskaylo, *personal communication*) was uniformly distributed in the potting medium before planting. *P. cinnamomi* was grown in flasks of 10% V-8 broth at 27 C for 20 days, then commixed in a blender, restored to original volume with tap water, and poured over the roots of the test plants at a rate of 100 ml per container. Containers were placed in aluminum pans in a greenhouse at 15–20 C in December and January and watered to maintain water above the drainage holes in the containers. Twelve plants were used in each of two tests, with two inoculated sets and one control set of four plants each. Test 1 was concluded after 43 days and test 2 after 39 days.

After 5 wk, symptoms appeared in the inoculated plants as wilting and yellowing of the needles. Plants colonized by *P. cinnamomi* were mycorrhizal but had fewer than normal fibrous roots and brown discoloration in the roots and stem base. In contrast, control plants treated with only V-8 broth had abundant white fibrous roots and normal green color. A rating system based on a scale of 1 (healthy) to 5 (dead) was used to evaluate the roots. Roots from all plants in the test were plated on the selective medium. Average root ratings of 4 (range 2–5) and 2.2 (range 1–4) were obtained in test 1 and test 2, respectively. The pathogen was reisolated from all inoculated plants and from none of the uninoculated controls. No symptoms were observed in the controls.

This study extends the host range of *P. cinnamomi* to yet another woody ornamental species. Japanese umbrella pine is a slow-growing ornamental tree that has not been found diseased in landscapes. In container culture under conditions of excessive moisture, the plant is highly susceptible to root rot caused by *P. cinnamomi*. Additional research will be needed to determine the pathogenicity of *P. cinnamomi* from umbrella pine to other *Phytophthora*-susceptible ornamentals.

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