

Phytophthora Root Rot of Port-Orford-Cedar in California

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ABSTRACT

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The Port-Orford-cedar stands on federal, state, and private lands in northern California were surveyed in the spring of 1980 for *Phytophthora* root rot caused by *Phytophthora lateralis*. The disease was present at six sites on the Gasquet Ranger District, Six Rivers National Forest, and Jedediah Smith Redwoods State Park, Del Norte County, and on six ornamental cedars at a residence in Eureka, Humboldt County.

Port-Orford-cedar (*Chamaecyparis lawsoniana*) has a limited range, growing along the Pacific Coast from near Coos Bay, Oregon, to the Mad River drainage in Humboldt County, California (2). In California, the tree's range extends east to near Indian Creek in northern Siskiyou County; the species reappears further inland on the upper Trinity and Sacramento river systems in southern Siskiyou and northern Shasta counties, predominantly on serpentine soils (2). The species is widely planted as an ornamental in the Pacific Coast states.

The estimated volume of Port-Orford-cedar in California is 240 million board feet. Most of the Port-Orford-cedar harvested is exported to Japan where the wood has religious significance and is used in shrines and temples (3). Because of this significance, present stumpage prices in coastal northern California average \$3 per board foot.

Root rot of Port-Orford-cedar caused by *Phytophthora lateralis* Tucker & Milbrath was first reported in the United States near Seattle in 1923 on nursery stock imported from France (5). The disease has been reported on Port-Orford-cedar in its native range in Oregon (6) and on several species of *Chamaecyparis* used as ornamentals and planting stock in Oregon, Washington, and British Columbia (1,7). The disease has not been previously reported in California. In Oregon, the disease has spread over long distances through movement of infested planting stock and through movement of infested soil during construction, forest road maintenance and use, and logging operations (5).

Because Port-Orford-cedar is an important resource in northwestern

California, a survey was conducted in the spring of 1980 to determine if *P. lateralis* is present in California and, if so, to determine its distribution and impact.

MATERIALS AND METHODS

Stands of Port-Orford-cedar on the Six Rivers, Klamath, and Shasta-Trinity national forests, in state parks, and on private lands were surveyed for dead cedar, cedar with fading foliage, and discoloration at the root collar.

Final diagnosis of the disease was based on isolation of *P. lateralis* from affected trees by the following procedure: Bark and wood tissues were collected from margins of discoloration on cedar stems, surface-sterilized in 0.5% sodium

hypochlorite, and then plated on either 3% antibiotic medium (4) or on Difco corn meal agar with 100 ppm ampicillin. Plates were incubated at 20 C. Identification of *P. lateralis* was based on the characteristics of the mycelium, chlamydospores, oospores, and sporangia produced in culture (8,9).

RESULTS AND DISCUSSION

Phytophthora root rot was found on Port-Orford-cedar at eight of 50 surveyed sites (Fig. 1). Of the seven sites in Del Norte County, six were on the Gasquet Ranger District, Six Rivers National Forest, and one was at Jedediah Smith Redwoods State Park. The eighth infested site was in the city of Eureka in Humboldt County. *P. lateralis* was the only *Phytophthora* sp. isolated from the affected cedar trees.

The seven infested sites in Del Norte County were within the Smith River drainage system. Four of the seven sites were along the south fork of the Smith River. One of these sites, at the Rock Creek subdivision, was apparently infested for some time, with reports of dying cedar in the general area dating

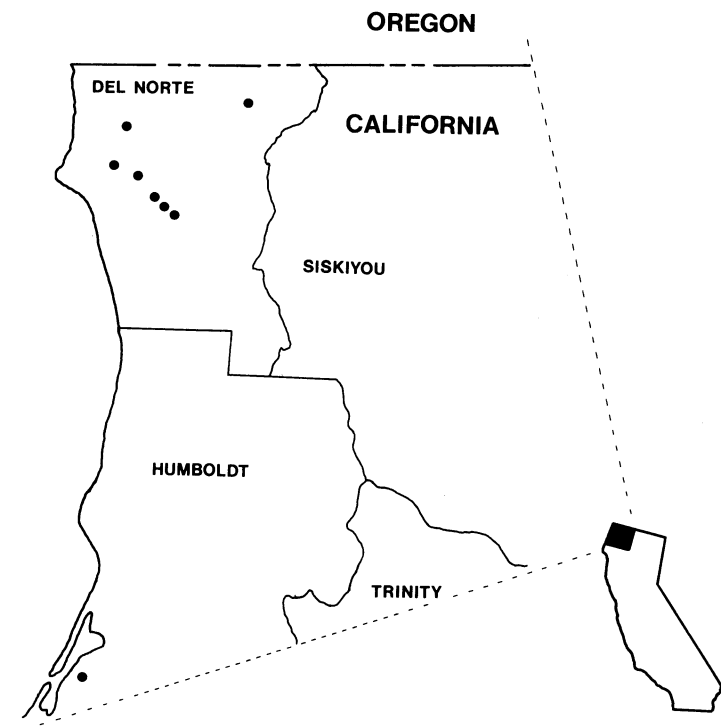


Fig. 1. Distribution of *Phytophthora* root rot of Port-Orford-cedar in northern California, as surveyed in the spring of 1980. ● = infested sites.

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back to the mid-1960s. The other three sites along the south fork appeared to have been infested within the last few years, with dead cedars at the road and cedars with fading crowns downslope.

The fifth infested site in Del Norte County was near the middle fork of the Smith River at the entrance to Jedediah Smith Redwoods State Park. Ten Port-Orford-cedar planted at the entrance were infected, with the decline of the trees progressing from one end of the row to the other. *Phytophthora* root rot was not observed on natural Port-Orford-cedars in the park.

The two remaining infested sites in Del Norte County were at a drainage crossing the Knopki Creek road and at an area on the upper Myrtle Creek drainage that was clear-cut in the 1960s. The equipment used to clear-cut this area came from and was stored at the Rock Creek subdivision.

Six Port-Orford-cedar at a residence in Eureka were infected. These trees were transplanted as seedlings from near Coos Bay, Oregon, in 1949 or 1950.

The disease was not found at 18 sites examined on the Orleans Ranger District

in Humboldt County, seven sites on the Happy Camp Ranger District in northern Siskiyou County, or at 10 sites on the Shasta-Trinity National Forest in Siskiyou and Shasta counties.

This survey indicated that a substantial portion of the Port-Orford-cedar sites on the Smith River drainage system are infested with *P. lateralis*. The infestation in Eureka was probably the result of moving cedar stock or soil from infested areas in Oregon. Nevertheless, considerable areas of Port-Orford-cedar in California are presently free of the disease, and they should be protected from introduction of *P. lateralis*.

Stands of Port-Orford-cedar that are presently uninfested can be protected by taking steps to minimize the spread of the pathogen from infested into noninfested areas. Vehicles and logging equipment used recently in infested Port-Orford-cedar sites in Oregon or on the Smith River drainage system in California may aid dissemination of the pathogen. Restricted entry of contaminated vehicles and equipment into noninfested areas would reduce risk of new infections.

LITERATURE CITED

1. Atkinson, R. G. 1965. *Phytophthora* species inciting root rot of *Chamaecyparis lawsoniana* and other ornamentals in coastal British Columbia. Can. J. Bot. 43:1471-1475.
2. Griffin, J. R., and Critchfield, W. B. 1972. The distribution of forest trees in California. U.S. Dep. Agric. For. Serv., Res. Paper PSW-82. 118 pp.
3. Henley, J. W. 1973. Port-Orford-cedar . . . an American wood. U.S. Dep. Agric. For. Serv. FS-228. 6 pp.
4. McCain, A. H., Holtzmann, O. V., and Trujillo, E. E. 1967. Concentration of *Phytophthora cinnamomi* chlamydospores by soil sieving. Phytopathology 57:1134-1135.
5. Roth, L. F., Bynum, H. H., and Nelson, E. E. 1972. *Phytophthora* root rot of Port-Orford-cedar. U.S. Dep. Agric. For. Serv. For. Pest Leaflet 131. 7 pp.
6. Roth, L. F., Trione, E. J., and Ruhmann, W. H. 1957. *Phytophthora* induced root rot of native Port-Orford-cedar. J. For. 55:294-298.
7. Torgeson, D. C., Young, R. A., and Milbrath, J. A. 1954. *Phytophthora* root rot diseases of Lawson Cypress and other ornamentals. Oreg. State Coll. Agric. Exp. Stn. Bull. 537. 18 pp.
8. Trione, E. J. 1974. Sporulation and germination of *Phytophthora lateralis*. Phytopathology 64:1531-1533.
9. Waterhouse, G. M. 1963. Key to the species of *Phytophthora* deBary. Mycol. Paper 92. Commonw. Mycol. Inst., Kew, Surrey, England. 22 pp.