

Hansen, E.M. 2011. *Phytophthora lateralis*. Forest Phytophthoras 1(1). doi: 10.5399/osu/fp.1.1.1816

Phytophthora lateralis

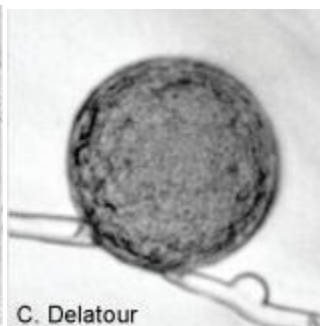
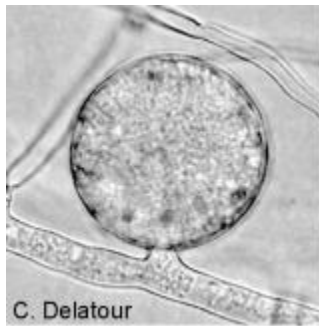
Overview

Phytophthora lateralis was named by Tucker and Milbrath in 1942. There are no known synonyms. *P. lateralis* was classified in morphological group V by Stamps et al. (1990); the group includes homothallic species with paragynous antheridia and nonpapillate, proliferating sporangia.

Etymology: refers to the development of chlamydospores in a lateral or sessile position on the hyphae.

Morphology

Sporangia (average 26–60 μm x 12–20 μm) in water are ovoid, obovoid, or obpyriform. They are non-papillate and persistent, on simple sympodial sporangiophores with internal proliferation. Hyphal swellings are absent. Thin-walled chlamydospores (20–77 μm , average 40 μm) are formed in broth or agar. They are sub-globose to globose or irregular, terminal or intercalary, sometimes positioned laterally or are sessile on hyphae. Considered homothallic, but oogonia normally not seen in culture.



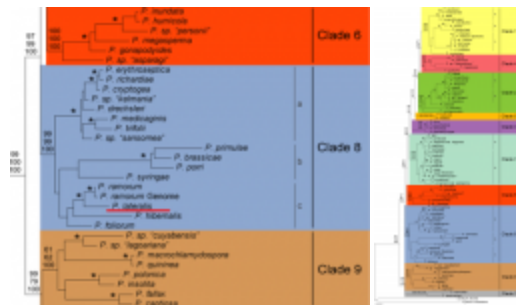
Terminal chlamydospore on short stalk (top).



Lateral chlamydospore (bottom) with external proliferation (left) and internal proliferation (right).

Genetics

Molecular studies place *Phytophthora lateralis* in clade 8 (Blair 2008), as a sister group to *P. ramorum*, although the two species are morphologically distinct. More information about the phylogenetics of this species can be found at <http://www.phytophthoradb.org/lateralis>.

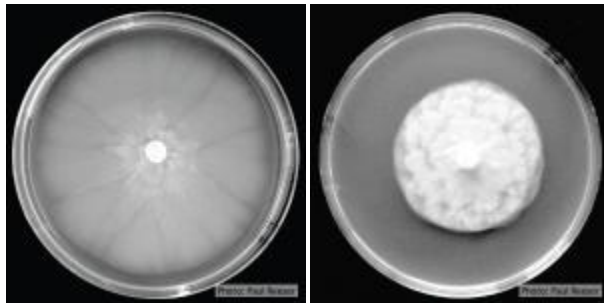


Phylogenetic tree from

<http://www.phytophthoradb.org/lateralis> (Blair et al 2008).

Growth

Temperature optimum ca. 20°C, min. <10°C, max. ca. 25°C. Growth at 20°C on V8 agar 2.1 mm/d, on cornmeal agar with 20 ppm β -sitosterol 1.3 mm/d, on cornmeal agar with pimarin, ampicillin, and rifampicin 0.6 mm/d, potato dextrose agar 1.4 mm/d.



Growth morphology at 14 days on V8 (left) and potato

dextrose agar (right).

Distinguishing characteristics for identification

Colony morphology on V8 agar is nearly patternless and appressed with no aerial hyphae. In combination with the lower maximum temperature for growth, this feature is especially useful in distinguishing *P. lateralis* from taxon "pg chlamydo" which also forms lateral chlamydospores. Microscopically on CMAB hyphae are usually tortuous, irregularly branched, and often irregularly swollen. Sporangia develop on washed mycelial mats grown in pea broth and transferred to natural stream water. Occasionally isolates exhibit caducous sporangia.

The searchable web-based database Phytophthora-ID is useful for rapid identification of *Phytophthora* species based on sequencing of the ITS or Cox spacer regions, followed by BLAST searching the database. *Phytophthora-ID* maintains a database of sequences that is selective for sequence accessions that come from trusted sources including published, peer-reviewed studies whenever possible.

Disease History

Port-Orford-cedar (POC) root disease was first reported on ornamental cedars in the USA Pacific Northwest near Seattle, Washington, in 1923, but the pathogen was not named until 1942 (Tucker and Milbrath 1942). *P. lateralis* was found in the native range of POC in about 1950 and by 1970 it had been spread throughout the tree's range in Oregon (Zobel et al. 1985). It was first reported from California in 1980, and is now present in all areas where POC grows as a native forest tree (northern California and southwest Oregon) (Betlejewski et al. 2003). *P. lateralis* was detected in France in 1998 and the Netherlands in 2004 and 2010 on nursery-grown plants (Hansen et al. 1999, Meffert 2007, Netherlands Plant Protection Service 2010). A disease outbreak on hedgerow cedar trees has recently been reported in northwest France (Robin et al. 2010). It has also been reported in a country park on the shores of Loch Lomond in Scotland (BBC News Scotland 2010). Disturbingly, in Europe the pathogen appears to be spreading as windblown sporangia, causing foliar infections. The discovery of *P. lateralis* in an old growth *Chamaecyparis obtusa* forest in Taiwan (Brasier et al. 2010) suggests that this may be the geographic center of origin for the species.

Impacts in the Forest

The behavior of *P. lateralis* in Oregon and California clearly marks it as an exotic, invasive pathogen. It is carried uphill and between watersheds in mud on vehicles and equipment. Domestic and wild animals, as well as humans, also transport the pathogen. Once introduced into a drainage, it washes downhill along stream courses, attacking and killing any POC encountered (Hansen et al. 2000, Jules et al. 2002). In Europe, *P. lateralis* is now established in several countries and killing POC trees planted as windbreaks and in landscape plantings. Although *P. lateralis* was recently discovered in forest soils in Taiwan, there are no acute disease symptoms in the native forests.



Port Orford Cedar mortality caused by *P. lateralis* (top), cut away basal canker (bottom).

Forest and Wildland Hosts and Symptoms

P. lateralis is essentially host specific on Port-Orford-cedar (*Chamaecyparis lawsoniana*). Pacific yew (*Taxus brevifolia*) may also be killed when growing among diseased cedars, although more slowly (DeNitto and Kleijunas 1991, Murray and Hansen 1997). Other *Chamaecyparis* species and other Cupressaceae that have been tested are much more resistant, although *C. nootkatensis* (Alaska cedar) and *Thuja occidentalis* (Arborvitae) are rarely infected. Reports on other hosts from other parts of the world have proven to be based on misidentification, or otherwise impossible to confirm. *P. lateralis* is found in landscape plantings throughout the Pacific Northwest (British Columbia to northern California) and increasingly in Europe. In the forest it has now spread throughout the native range of Port-Orford-cedar, which spans southwest Oregon and Northern California.

In Europe *P. lateralis* was reported from POC ornamental nursery stock in France (Hansen et al. 1999) and the Netherlands (Meffert 2007). It appeared to have been eradicated from those countries but was recently reported from landscape plantings in France and Scotland. In Asia (Taiwan), no acute disease or mortality of the host (*Chamaecyparis obtusa* var. *formosana*) by the pathogen has been observed in native forests.

Host Latin Name	Host Common Name	Symptoms	Habitat	Region
<i>Chamaecyparis lawsoniana</i>	Port-Orford-cedar	Root rot	Ornamental Nursery	France, Netherlands
<i>Chamaecyparis lawsoniana</i>	Port-Orford-cedar	Canker, Root rot	Parklands	France, Scotland
<i>Chamaecyparis lawsoniana</i>	Port-Orford-cedar	Root rot	Forest, Ornamental	USA - Pacific Northwest

Host Latin Name	Host Common Name	Symptoms	Habitat	Region
<i>Chamaecyparis lawsoniana</i>	Port-Orford-cedar	Root rot	Nursery, Parklands Ornamental Nursery, Parklands	Canada
<i>Chamaecyparis obtusa</i> var. <i>formosa</i>	Hinoki cedar	None, found in streams or soil	Forest	Taiwan
<i>Taxus brevifolia</i>	Pacific yew	Root rot	Forest	USA - Pacific Northwest
<i>Thuja occidentalis</i>	Arborvitae	Canker	Ornamental Nursery	USA - Pacific Northwest

Education and Management Materials

- [Ground Verification of Aerial Survey for Port-Orford-Cedar Root Disease in Southwest Oregon](#)
- [Reforestation Burned Areas with Port-Orford-cedar using Genetically Resistant Planting Stock in Post-Fire Reforestation Efforts](#)
- [Port-Orford-cedar Root Disease](#)
- [Management of Port-Orford-cedar in SW Oregon](#)
- [Guide to identification of Lawson cypress and Symptoms of Phytophthora lateralis](#)

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