EPPO Datasheet: *Coniferiporia weirii*

Last updated: 2023-01-25

IDENTITY

Preferred name: *Coniferiporia weirii*
Authority: (Murrill) L.W. Zhou & Y.C. Dai
Taxonomic position: Fungi: Basidiomycota: Agaricomycotina: Agaricomycetes: Hymenochaetales: Hymenochaetaceae
Other scientific names: *Fomitiporia weirii* Murrill, *Fuscoporia weirii* (Murrill) Aoshima, *Inonotus weirii* (Murrill) Kotlaba & Pouzar, *Phellinidium weirii* (Murrill) Y.C. Dai, *Phellinus weirii* (Murrill) Gilbertson, *Poria weirii* (Murrill) Murrill
Common names: laminated butt rot of conifers, root rot of conifers, yellow ring rot of conifers
view more common names online...
EPPO Categorization: A1 list
view more categorizations online...
EU Categorization: A1 Quarantine pest (Annex II A)
EPPO Code: INONWE

Notes on taxonomy and nomenclature

The two species *Coniferiporia weirii* (Murrill) L.W. Zhou & Y.C. Dai and *Coniferiporia sulphurascens* (Pilát) L.W. Zhou & Y.C. Dai had previously been described as two different forms [a cedar form affecting mainly *Thuja plicata* (often called western red cedar) and a Douglas-fir form affecting *Pseudotsuga menziesii*, *Pinus* spp., *Abies* spp., and some other conifers] of one species *Inonotus weirii* (Murrill) Kotlaba & Pouza. These two forms were qualified as distinct species in 2016 based on the phylogenetic analysis (Zhou *et al.*, 2016) although existence of two separate species had already been suggested in the 1990s based on the enzyme-linked immunosorbent assay (ELISA) tests (Banik *et al.*, 1993). After this phylogenetic analysis of the *Phellinidium* genus, these two species were segregated to the genus *Coniferiporia* (they had previously been included in the genera *Inonotus, Phellinus*, and *Phellinidium*).
The new genus *Coniferiporia* included three forest pathogens (Zhou *et al.*, 2016) – *Coniferiporia weirii* (Murrill) L.W. Zhou & Y.C. Dai, comb. nov., *C. sulphurascens* (Pilat) L.W. Zhou & Y.C. Dai, and *C. qilianensis* B.K. Cui, L.W. Zhou & Y.C. Dai, each having a specific geographical distribution and a strong host specificity as a forest pathogen of coniferous trees (Mao *et al*., 2019; Wang *et al.*, 2022). Wang *et al.* (2022) added a fourth new species to this genus, *Coniferiporia uzbekistanensis* L.W. Zhou, Xue W. Wang & Gafforov, which is affecting *Juniperus polycarpos* var. *seravschanica* and was found in Uzbekistan.

HOSTS

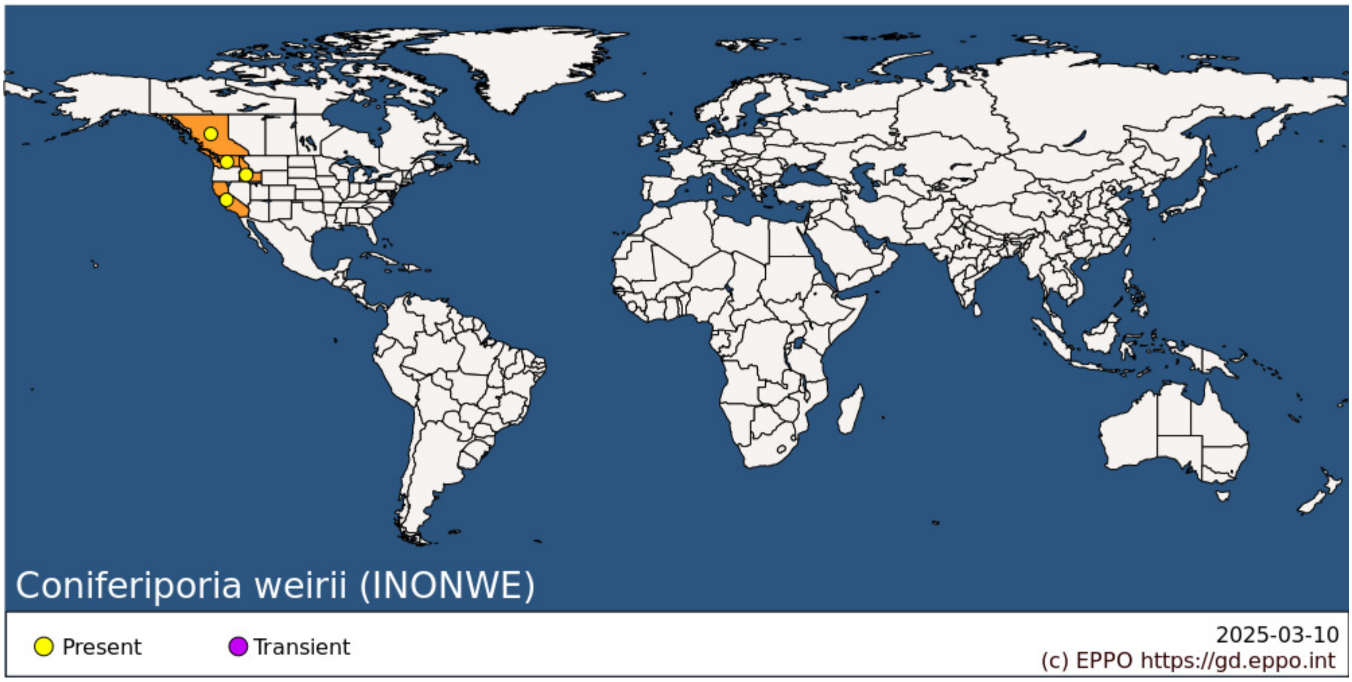
Coniferiporia weirii (before it was split into two species) had long been reported as an aggressive forest pathogen mainly of *Pseudotsuga menziesii* and *Thuja plicata* but also of many other conifers (Wang *et al*., 2022). However, the analysis of *Coniferiporia* species diversification in association with both biogeography and host plants resulted in distinction of two clades: one containing only *C. sulphurascens* which infests *P. menziesii, Pinus* spp., *Abies* spp. and other conifers; the other comprises *C. qilianensis*, *C. uzbekistanensis*, *C. weirii*, and *Coniferiporia* sp. (Wang *et al.,* 2022). Regarding *C. weirii*, it mainly infests *T. plicata* and *Callitropsis nootkatensis* which are its major hosts (Hagle, 2009), and both of which are naturally distributed in western North America (Mao *et al*., 2019; Wang *et al.*, 2022). The fungus was also found on *Calocedrus decurrens* (Zhou *et al.*, 2016).

In the EPPO region, *C. weirii* could infect *T. plicata*, *Callitropsis nootkatensis*, and *Calocedrus decurrens* (urban trees) and, possibly, other conifer species.

Host list: *Callitropsis nootkatensis*, *Calocedrus decurrens*, *Thuja plicata*

GEOGRAPHICAL DISTRIBUTION

Each species of *Coniferiporia* can infest specific coniferous plants and has a specific geographic distribution in the Northern Hemisphere (Zhou *et al.*, 2016). Four geographic origins (i.e., Eastern Eurasia, Central Asia, western North America, and Eastern Europe) were set according to voucher information of *Coniferiporia* species (Wang *et al.*, 2022). Concerning the identification of *C. weirii*, the presence of this pathogen was confirmed for specimens from British Columbia (Canada), Idaho, and California (USA) on *Thuja plicata* and *Calocedrus decurrens* (Wang *et al.*, 2022). Other specimens from Canada, Russia, Japan, China, and the USA (California, Idaho, and Montana) were identified as *C. sulphurascens* (Wang *et al*., 2022). Chinese specimens of *C. weirii* represent a distinct species that was renamed *Coniferiporia qilianense*, whereas for Central Asian specimens from Uzbekistan the taxonomic identity was recently clarified, and they were described as *C. uzbekistanensis* (Wang *et al*., 2022). The geographic distribution of *C. weirii* should be reconsidered because most of observations consist of findings of both *C. weirii* and *C. sulphurascens* and data are not given specifically for *C. weirii* and *C. sulphurascens* (EFSA 2018).



North America: Canada (British Columbia), United States of America (California, Idaho, Washington)

BIOLOGY

As *C. sulphurascens* and *C. weirii* had previously been described as one species and the latest species segregation took place very recently (Zhou *et al*., 2016; Jeger, 2018; Wang *et al*., 2022), there is limited information regarding *C. weirii*. The host ranges of the two pathogens differ and their biology is rather distinctive (Banik *et al.*, 1993; EFSA 2018; Wang *et al*., 2022). *C. weirii* occurs in North America and causes laminated root and butt rot mainly in *Thuja plicata* (Larsen *et al.*, 1994; EFSA 2018; Wang *et al*., 2022). Decay caused by all *Coniferiporia* species is considered to be initiated by mycelium from residues of former forest trees because the fungus persists in decaying roots and logs for many years and the pathogen is able to infect healthy trees via contact with roots (Sinclair and Lyon, 2005). *C. weirii* forms thin, resupinate and perennial (2–3 years) basidiocarps (Hagle, 2009), the latter so far being found only on *T. plicata* (EFSA, 2018). Basidiocarps of *C. weirii* form at the base of affected trees, most commonly between buttress roots, however they can occasionally be located up to 6 feet (=183 cm) high (Hagle, 2009). Sporulation occurs in spring and summer (Larsen *et al*., 1994). Further research is needed on spore infection of wounds (Sinclair and Lyon, 2005).

DETECTION AND IDENTIFICATION

Symptoms

Most of the symptoms were described for *C. sulphurascens* on *P. menziesii*, so there is a lack of detailed information on symptoms of *C. weirii* infection. The fungus can cause laminated root rot in a few conifer species, mainly *T. plicata*. Following the first signs of *C. weirii* infection (Murill, 1914), infected trees show reduced growth, thin, chlorotic, and asymmetric foliage and sometimes smaller cones than normal. The pathogen usually affects a group of trees in patches that enlarge over several years (Sinclair and Lyon, 2005). Many trees in the adjacent stand will be infected but will not show crown symptoms for some time. Wind-throw of living trees is common, even before crown symptoms are discernible (Murill, 1914; Hagle, 2009). Young, infected trees often die before disease expansion. In advanced stages, the wood breaks down in a yellow, laminated, pitted rot (Murill, 1914). Brown, crust-like basidiocarps with a broad to narrow, white to cream sterile margin may form on the underside of decayed stems and roots (Hagle, 2009; Zhou *et al*., 2016). The early stage of decay may be seen as a crescent-shaped/spherical reddish brown to chocolate brown stain in the outer heartwood. Wood in the late stage of decay is yellowish and tends to laminate over the annual ring with many tiny cavities 0.5 x 1.0 mm (Sinclair and Lyon, 2005). Infected trees are frequently attacked by bark beetles and pathogens such as blue-stain fungi or *Armillaria* species (Sinclair and Lyon, 2005). Wounds and patches where the bark has detached may provide entry points for spores and may also increase the decay in already infected trees due to increased aeration (Hagle, 2009; Hansen *et al*., 2018). For additional information for *C. weirii* (*Phellinus weirii*) see Sinclair and Lyon (2005).

Morphology

Observation with a hand lens will reveal abundant, characteristically long, superficial, reddish brown setal hyphae, 5–10 µm in diameter and up to 3 mm long, with a thickened wall (1.5–2.5 µm) between the sheets of decayed wood. Mycelium lacks clamp connections (Sinclair and Lyon, 2005; EFSA, 2018).

Basidiospores are globose becoming oblong-ellipsoid, with a small apiculus, smooth and hyaline; 3.7–4.5 x 2.9–3.7 µm (Zhou *et al.*, 2016).

Detection and inspection methods

In areas where *C. weirii* is already present, isolated disease foci in extensive forests can be detected by aerial photography (Wallis and Lee, 1984).

A polymerase chain reaction (PCR) test based on the internal transcribed spacer (ITS) regions can be used to identify species from the *C. sulphurascens/weirii* complex. PCR tests with specific primers make it possible to distinguish the different species within the complex (Zhao *et al.,* 2016; Wang *et al*., 2022).

PATHWAYS FOR MOVEMENT

Natural dispersal by spores is considered significant only over short distances (Sinclair and Lyon, 2005; Wang *et al*., 2022). Long-distance movement is possible, most likely by transportation of infected coniferous logs or bark. Spore infection of wounds has not been adequately studied and the role of basidiospores in disease spread has not been confirmed (Sinclair and Lyon, 2005). Nearly all infections in forest stands with trees of the same age are considered to be initiated by mycelium which survived in roots, butts, logs etc. remaining in the forest for decades and which penetrates into new trees through intact or injured bark (Sinclair and Lyon, 2005).

PEST SIGNIFICANCE

Economic impact

In North America, *C. weirii* causes root and butt rot of *T. plicata* and *Callitropsis nootkatensis* which are widely spread and highly valued species that have economic and cultural significance (McMurtrey *et al.*, 2023). *C. weirii* causes a heart rot, affecting all infested trees between 6 years and rotation age, causing root decay leading to direct mortality or accelerated wind-throw. *T. plicata* is the most susceptible as a seedling and sapling, then becomes more resistant to root disease infections over time (McMurtrey *et al*., 2023).

Control

Control of *C. weirii* is rather difficult. Treatment would need to focus on the stumps of harvested trees, where the fungus can persist for decades (Sinclair and Lyon, 2005). These stumps provide one of the main sources of inoculum for the spread of the fungus through root contacts. Therefore, to reduce overall losses from *C. weirii* root rot, foresters need to identify and to remove infested stumps when feasible. Slash burning will not significantly reduce the level of inoculum in the soil. However, planting of resistant and less susceptible species around infected material (inoculum) with a buffer zone planted with a deciduous species can control the disease successfully (Wallis, 1976; Sturrock *et al.,* 2010).

Phytosanitary risk

The phytosanitary risk posed by *C. weirii* is low (Sturrock *et al*., 2010). As spores are probably of minor importance in spreading the infection, the disease occurs in patches which originate, for the most part, when healthy roots contact the fungus (mycelium) in roots and stumps of the previous stand (Wallis 1976). The fungus grows for only a short distance through soil; consequently, spread from tree to tree occurs only where a healthy and diseased root touch each other or when they grow in close proximity (Wallis 1976; Sinclair and Lyon, 2005). Within the EPPO region, establishment of the fungus is unlikely but if happens it may lead to economic and ecological losses of *Calocedrus decurrens*, *Callitropsis nootkatensis*, and *Thuja plicata* which are reported as major hosts in North America (Wang *et al.*, 2022). Other conifers, such as *Abies* spp. and several other conifers in the family Pinaceae are resistant to *C. weirii,* but susceptible to *C. sulphurascens* (Zhao *et al.*, 2016; Wang *et al*., 2022).

PHYTOSANITARY MEASURES

It should be noted that the phytosanitary measures outlined below refer to both *C. sulphurascens* and *C. weirii* because they were proposed before the species was split into new species with different biogeography and hosts.

The main phytosanitary measures recommended by EPPO are listed in the Standard PM 8/2 (3) Coniferae for *C. weirii* (EPPO, 2018). Import of plants for planting (except seeds) and cut branches of Coniferae originating in countries where *C. weirii* is present is allowed only from pest-free areas (EPPO, 2018). Import of wood of Coniferae (except *Cryptomeria* and *Taxus*) originating in countries where *C. weirii* is present is allowed only from pest-free areas for *C. weirii*, or after heat-treatment according to EPPO Standard PM 10/6 (EPPO, 2009), or after appropriate fumigation, details to be specified on the phytosanitary certificate (EPPO, 2018). Import of isolated bark of Coniferae (except *Cryptomeria* and *Taxus*) originating in countries where *C. weirii* is present is allowed only from pest-free area for *C. weirii* or heat-treated to achieve a minimum temperature of 56°C for a minimum duration of 30 continuous minutes throughout the entire profile of each piece of the bark (EPPO, 2018). Cut branches (including cut Christmas trees without roots or soil) of *Abies* originating in countries where *C. weirii* is present is allowed only from pest-free areas for *C. weirii* (EPPO, 2018). The wood should be inspected for staining and presence of fungal mycelium because roots, wood and stumps infected by *C. weirii* can serve as viable inoculum sources for decades (Sinclair and Lyon, 2005; EFSA, 2018; Leal *et al.*, 2019).

REFERENCES

Banik MT, Paul JA, Burdsall Jr HH, & Cook ME (1993) Serological differentiation of two forms of *Phellinus weirii*. *Mycologia* **85**(4), 605–611. https://doi.org/10.2307/3760507

Dai YC (2004) First report of laminated root rot on *Sabina przewalskii* caused by *Phellinus weirii* sensu stricto in China. *Plant Disease* **88**(5), 573–573. https:// doi.org/10.1094/PDIS.2004.88.5.573C

EFSA Panel on Plant Health (2018) Jeger M, Bragard C, Caffier D, Candresse T, Chatzivassiliou E, Dehnen-Schmutz K, Gilioli G, Grégoire J-C, Jaques Miret JA, MacLeod A, Navajas Navarro M, Niere B, Parnell S, Potting

R, Rafoss T, Rossi V, Urek G, Van Bruggen A, Van der Werf W, West J, Winter S, Boberg J, Gonthier P & Pautasso M. Pest categorization of *Coniferiporia sulphurascens* and *Coniferiporia weirii*. *EFSA Journal* **16**(6), 5302 https://doi.org/10.2903/j.efsa.2018.5302

EFSA (2019) Baker R, Gilioli G, Behring C, Candiani D, Gogin A & Tramontini S (2019) Report on the methodology applied by EFSA to provide a quantitative assessment of pest?related criteria required to rank candidate priority pests as defined by Regulation (EU) 2016/2031. *EFSA Journal* **17**(6), e05731. https://doi.org/10.2903/j.efsa.2019.5731

EPPO (2009) EPPO Standards. Phytosanitary Treatments. PM 10/6(1) Heat treatment of wood to control insects and wood-borne nematodes. *EPPO Bulletin* **39**(1), 31. https://doi.org/10.1111/j.1365-2338.2009.02227.x

EPPO (2018) EPPO Standards. Commodity-specific phytosanitary measures. PM 8/2(3) Coniferae. *EPPO Bulletin* **48** (3), 463–494. https://doi.org/10.1111/epp.12503

EPPO (2021) EPPO Standards. PM 1/002(30) EPPO A1 and A2 lists of pests recommended for regulation as quarantine pests. https://gd.eppo.int/standards/PM1/ (accessed on 1st August 2022).

FAO (2017) ISPM 39. International movement of wood. FAO, IPPC, Rome, 20 pp. https://www.fao.org/3/cb2621en/cb2621en.pdf

FAO (2019) ISPM 15. Regulation of wood packaging material in international trade. FAO, IPPC, Rome, 24 pp. https://www.fao.org/3/mb160e/mb160e.pdf

Jin L, Kamp BJVD, Wilson J & Swan EP (1988) Biodegradation of thujaplicins in living western red cedar. *Canadian Journal of Forest Research* **18**(6), 784–788. https://doi.org/10.1139/x88-119

Hansen EM, Lewis KJ & Chastagner GA (2018) Compendium of conifer diseases (second edition). St. Paul, MN, APS Press, 184. https://doi.org/10.1094/9780890545980

Harrington CA (2010) Tale of Two Cedars: International Symposium on Western Redcedar and Yellow-Cedar (Vol. 828). DIANE Publishing.

Hagle SK (2009) Management guide for laminated root rot. Forest Insect and Disease Management Guide for the Northern and Central Rocky Mountains. *In cooperation with the Idaho Department of Lands and the Montana Department of Natural Resources and Conservation. USDA, Forest Service*. 20.

Hepting GH (1971) Diseases of forest and shade trees of the United States. *Agriculture Handbook, Forest Service, US Department of Agriculture* No. 386, pp. 20–24, 131–133, 480–495.

Larsen MJ, Lombard FF & Clark JW (1994) *Phellinus sulphurascens* and the closely related *P. weirii* in North America. *Mycologia* **86**(1), 121–130. https://doi.org/10.2307/3760727

Leal I, Bergeron MJ, Feau N, Tsui CKM, Foord B, Pellow K, Hamelin RC & Sturrock RN (2019) Cryptic speciation in western North America and Eastern Eurasia of the pathogens responsible for laminated root rot. *Phytopathology* **109**(3), 456–468. https://doi.org/10.1094/PHYTO-12-17-0399-R

McMurtrey S, Alcalá-Briseño RI, Showalter D & LeBoldus JM (2023) Draft genome resource for the forest pathogen *Coniferiporia weirii* – a pathogen of *Thuja plicata* and *Callitropsis nootkatensis*. *Plant Disease* **107**(2), 534-537. https://doi.org/10.1094/PDIS-04-22-0917-A

Mao K, Ruhsam M, Ma Y, Graham SW, Liu J, Thomas P, Milne RI, Hollingsworth PM (2019) A transcriptome-based resolution for a key taxonomic controversy in Cupressaceae. *Annals of Botany* **123**(1), 153–167. https://doi.org/10.1093/aob/mcy152

Murrill WA (1914) An enemy of the western red cedar. *Mycologia* **6**(2), 93–94.

Sinclair WA & Lyon HH (2005) Diseases of Trees and Shrubs (No. Ed. 2). Comstock Publishing Associates. 650 pp.

Sturrock RN, Pellow KW & Hennon PE (2010) *Phellinus weirii* and other fungi causing decay in western redcedar and yellow-cedar. A tale of two cedars, 47.302 https://www.fs.fed.us/pnw/pubs/pnw_gtr828.pdf

Zhou LW, Vlasák J & Dai YC (2016) Taxonomy and phylogeny of *Phellinidium* (Hymenochaetales, Basidiomycota): a redefinition and the segregation of *Coniferiporia* gen. nov. for forest pathogens. *Fungal Biology* **120**(8), 988–1001. https://doi.org/10.1016/j.funbio.2016.04.008

Wallis GW (1976) *Phellinus* (*Poria*) *weirii* root rot. Detection and management proposals in Douglas-fir stands. *Technical Report, Forest Service, Canada* No. 12, 16 pp.

Wallis GW & Lee YJ (1984) Detection of root disease in coastal Douglas-fir stands using large scale 70-mm aerial photography. *Canadian Journal of Forest Research* **14**, 523–527. https://doi.org/10.1139/x84-09

Wang X W, Jiang JH, Liu SL Gafforov Y & Zhou LW (2022) Species diversification of the coniferous pathogenic fungal genus *Coniferiporia* (Hymenochaetales, Basidiomycota) in association with its biogeography and host plants. *Phytopathology* **112**(2), 404–413. https://doi.org/10.1094/PHYTO-05-21-0181-R

ACKNOWLEDGEMENTS

This datasheet was extensively revised in 2023 by Kateryna Davydenko, Ukrainian Research Institute of Forestry and Forest Melioration and Swedish University of Agricultural Science. Her valuable contribution is gratefully acknowledged.

How to cite this datasheet?

EPPO (2025) *Coniferiporia weirii*. EPPO datasheets on pests recommended for regulation. Available online. https://gd.eppo.int

Datasheet history

This datasheet was first published in the EPPO Bulletin in 1979 and revised in the two editions of 'Quarantine Pests for Europe' in 1992 and 1997, as well as in 2022. It is now maintained in an electronic format in the EPPO Global Database. The sections on 'Identity', ‘Hosts’, and 'Geographical distribution' are automatically updated from the database. For other sections, the date of last revision is indicated on the right.

CABI/EPPO (1992/1997) *Quarantine Pests for Europe (1st and 2nd edition)*. CABI, Wallingford (GB).

EPPO (1979) Datasheets on quarantine organisms No.19, *Phellinus weirii*. *EPPO Bulletin* **9**(2), 83-87. https://doi.org/10.1111/j.1365-2338.1979.tb02454.x

Co-funded by the European Union