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Data Sheets on Quarantine Pests

Phellinus weirii

IDENTITY

Name: *Phellinus weirii* (Murrill) R.L. Gilbertson
Synonyms: *Inonotus weirii* (Murrill) Kotlaba & Pouzar
Poria weirii (Murrill) Murrill
Fomitiporia weirii Murrill
Taxonomic position: Fungi: Basidiomycetes: Aphyllophorales
Common Names: Laminated butt rot, yellow ring rot (English)
Pourridié des racines des conifères (French)
Podredumbre de las raíces de las coníferas (Spanish)
Bayer computer code: INONWE
EPPO A1 list: No. 19
EU Annex designation: I/A1

HOSTS

In North America, the following species have been noted as hosts: *Pseudotsuga menziesii* (principal host), *Abies amabilis*, *A. grandis*, *A. lasiocarpa*, *Larix occidentalis*, *Picea sitchensis*, *Pinus contorta*, *P. monticola*, *P. ponderosa*, *Tsuga heterophylla*, *T. mertensiana*.

In Japan, other species are attacked: *A. mariesii*, *A. sachalinensis*, *Chamaecyparis* sp., *Picea jezoensis*,*T. diversifolia*. *Thuja plicata* is highly to moderately resistant.

In the EPPO region *P. weirii* could infect *Pseudotsuga menziesii* and possibly many other conifer species.

GEOGRAPHICAL DISTRIBUTION

EPPO region: Absent.
Asia: China (Jilin), Japan (Honshu and Middle Hokkaido).
North America: Canada (throughout the range of *Pseudotsuga menziesii* in southern British Columbia), north-western USA (Alaska, California, Idaho, Montana, Oregon, Washington, Wisconsin).
EU: Absent.
Distribution map: See IMI (1994, No. 490).

BIOLOGY

I. weirii occurs in forms with annual and perennial sporophores, the latter being found only on *Thuja plicata*. *I. weirii* clones are strikingly incompatible in culture. Single-spore isolates from the same fruiting body are mostly incompatible while those from different fruiting bodies are compatible (Hansen, 1979b).
Infection occurs when roots of healthy trees grow in contact with infected roots. After initial contact with a living root, the mycelium grows ectotrophically on the bark, extending only 1-5 mm into the surrounding soil. Ectotrophic mycelium usually grows in advance of

mycelium in the wood, penetrating via sound or injured bark, often well in advance of the main body of decay. Although highly variable, the average annual radial extension of infection centres is about 20-40 cm. Experimental inoculations have shown that the fungus can readily infect roots of trees cut for at least 3 months and that, in certain instances, roots of trees cut for at least 12 months may becolonized. The fungus can persist with a high inoculum potential in roots and stumps of *Pseudotsuga menziesii* for 50 or more years. It appears that *I. weirii* can spread only to a very limited extent in unsterilized soil. Sporophores are formed periodically on decayed wood, but spores are probably unimportant in spreading the disease. No conidia have been reported. For more information see Aoshima (1953), Buckland *et al*. (1954), Wallis (1967), Childs (1970), Childs & Nelson (1971).

DETECTION AND IDENTIFICATION

Symptoms

The disease occurs in patches or centres of infection. *I. weirii* can kill seedlings 1-2 years old, but disease foci are not usually noticed until the stand reaches 10-20years of age. Above ground, symptoms only become apparent 5-15 years after initial infection, when the root system is in an advanced stage of deterioration. Infected trees show reduced leader growth, thinning of the foliage and sometimes a distress crop of smaller than normal cones. In *Pseudotsuga menziesii*, the foliage shows a yellowing or reddening, falls, and trees subsequently die. Major roots which are decayed break close to the root collar,producing characteristic 'root-balls'. Wind-throw of living trees is common, even before crown symptoms are discernible. In advanced stages, the wood breaks down in a yellow, laminated, pitted rot. Callus tissue may also be observed on the ends of roots that were decayed for some period before the tree fell. Brown, crust-like sporophores with a broad to narrow, white to cream, sterile margin may form on the underside of decayed stems and roots.

It should be remembered that many trees in the adjacent stand will be infected but will not show crown symptoms. A better appreciation of the total extent of an infection will be gained by examining the root collar of trees on the margins of an infection centre for mycelium. A brown crust-like mycelial growth can often be found below the duff layer, particularly in the crotches of roots. Some trees beyond those with mycelium at the root collar will be infected, but an extensive exposure of the root system would be required to identify them. As a general rule, it can be considered that trees within 5 m are usually infected, while at distances of 15 m, infection from the same source is uncommon (Childs & Nelson, 1971). Incipient decay is characterized by a crescent-shaped to spherical reddish-brown stain in the outer heartwood. In living trees, the infection will not usually extend more than 2-4 m up the bole. For additional information see Buckland *et al*. (1954), Childs (1970), Childs & Nelson (1971), Hepting (1971), Wallis (1976).

Morphology

Observation with a hand lens will reveal abundant, characteristically long, 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.

Basidiospores are globose to subglobose becoming oblong-ellipsoid, with a small apiculus, smooth and hyaline; 3.6-4.5 x 2.7-3.5 µm (Pegler & Gibson, 1972).

DETECTION AND INSPECTION METHODS

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

dispersalNatural dispersal occurs only over short distances, so movement is most likely to occur by transport of infected coniferous logs or bark.

PEST SIGNIFICANCE

Economic impact

I. weirii causes a serious disease, affecting all trees between 6 years and rotation age, causing root decay leading to direct mortality or accelerated wind-throw. *Pseudotsuga menziesii* is most seriously affected, with an estimated annual growth impact in 1967 of about 3.2 million m^3 in the USA and annual mortality of over 1 million m^3 in British Columbia (Canada). Losses are expected to persist and probably increase. Local spread of the fungus has been successfully controlled by trenching but this is not economically viable.

Control

Control of *I. weirii* has proved rather difficult. Emphasis is placed on the stumps of harvested trees, where the fungus can persist for over 50 years (Hansen, 1979a). These stumps provide one of the main sources of inoculum for the spread of the fungus. Recent studies indicate that a combined chemical and biological control of these stumps might be possible through fumigation (Nelson, 1989) and the application of *Trichoderma* spp., which show antagonism (Goldfarb *et al.*, 1989) and are less affected by the fumigation than *I. weirii* (Nelson, 1989).

The replacement of *Pseudotsuga menziesii* with less susceptible conifers like *Pinus contorta* (Filip & Schmitt, 1979) might be another promising method to decrease the spread of the disease. For additional information, see Wallis (1967; 1976).

Phytosanitary risk

I. weirii has A1 quarantine status for EPPO (OEPP/EPPO, 1979) and for IAPSC. Within the EPPO region, especially in Nordic countries, establishment of the fungus could lead to substantial economic losses.

PHYTOSANITARY MEASURES

Isolated bark of conifers from non-EPPO countries should, if no import prohibition exists, be heat-treated or composted by an EPPO-approved quarantine procedure. Wood of conifers from non-EPPO countries must have been debarked or kiln-dried (OEPP/EPPO, 1990). It should be inspected for staining and presence of fungal mycelium.

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