FUNGI AND DECAY IN WESTERN REDCEDAR UTILITY POLES[1]

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ABSTRACT

Three decay fungi were isolated from the heartwood and six from the sapwood of western redcedar poles. None had previously been reported in poles of this species in North America. There was little radial extension of heartwood infection beyond the advanced decay.

Keywords: Decay, fungi, western redcedar, poles.

INTRODUCTION

There are relatively few published reports of the basidiomycetes causing decay in western redcedar (*Thuja plicata* Donn ex D. Don) (WRC) poles in North America. Southam and Ehrlich (1950) reported the following species in sapwood of WRC poles: *Coniophora arida* (Fr.) Karst., *C. olivacea* (Fr.) Karst., *C. puteana* (Schum.:Fr.) Karst., *Fibroporia* (*Poria*[3]) *vaillantii* (DC.:Fr.) Parm., *Hypochnicium punctulatum* (Cke.) J. Erikss., (*Corticium albostramineum* (Bres.) Wakef.), *Leucogyrophana* (*Coniophora*) *olivascens* (Berk. et Curt.) Ginns et Weresub, *L.* (*Merulius*) *pinastri* (Fr.) Ginns et Weresub, *Paxillus panuoides* Fr., and *Ptychogaster rubescens* Boud.

Duncan and Lombard (1965) listed *Fomitopsis* (*Fomes*) *cajanderi* (Karst.) Kotl. et Pouz. and *Gloeophyllum* (*Lenzites*) *trabeum* (Pers.:Fr.) Murr. as occurring in WRC poles.

Eslyn (1970) identified cultures of the following species from decay in WRC poles in the United States: *Coniophora puteana, F. cajanderi, Lentinus lepideus* Fr., *G. trabeum, P. rubescens, Scytinostroma* (*Corticium*) *galactinum* (Fr.) Donk, and *Tyromyces* (*Polyporus*) *balsameus* (Pk.) Murr. He also listed eight species associated with decay in WRC in British Columbia: *C. puteana, G. trabeum, Heterobasidion* (*Fomes*) *annosum* (Fr.) Breff., *Merulius* sp., *Perenniporia* (*Poria*)

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[3] Fungal names in parentheses are those cited in the reviewed papers.

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subacida (Pk.) Donk. *Phelleinus* (*Fomes*) *nigrolimitatus* (Rom.) Bourd. et Galz., *P.* (*Fomes*) *pini* (Fr.) A. Ames, and *P.* (*Poria*) *weiri* (Murr.) Gilbertson.

Clark and Smith **(1979)** listed cultures of the following species from WRC poles, principally in British Columbia: *C. puteana, Coriolus* (*Coridus*) *hirsutus* (Wulf.: Fr.) Quél., *G. trabeum, Perreniporia subacida, Phellinus nigrolimitatus, Serpula lacrimans* (Wulf. in Jacq.:Fr.) Schroet., and *Tyromyces caesius* (Schrad.:Fr.) Murr.

As part of ongoing studies at Oregon State University concerning the use of improved chemical sprays to control "shell rot" and the use of fumigants to control internal decay in utility poles, a number of fungi causing heartwood and sapwood decay of WRC poles in the northwestern United States were identified.

Our examination of WRC fungi was aimed at determining not only the fungal species involved but also how the heartwood decay was distributed in the poles and whether the fungi could be consistently isolated without special culturing. The latter information would indicate whether culturing from increment cores of the heartwood could be used to assess the effectiveness of treating WRC poles with fumigant chemicals, as is presently done with Douglas-fir poles (Graham et al. 1976).

METHODS

Distribution of visible heartwood decay

Heartrot was examined in 15 WRC poles removed from service in Oregon because of severe decay. In all but one pole, the rot was centrally located, as is true in most cases of WRC decay. The extent of fungal infection beyond the visible rot was determined by sawing short boards from seven poles and isolating cultures from the wood of these boards at various distances from the rot zone.

Isolation of fungi

Heartwood. – Because isolation of fungi from WRC heartwood is generally considered to be difficult, we tried several isolation techniques and culturing media. Isolations were attempted from firm wood within or just outside the zone of visible decay. Although this zone was narrow, it proved to be ample for culturing. Samples were obtained for culturing in several ways. These included aseptically extracting very small chips or slivers from the boards or removing short cores with an increment borer. Also, a leather-punch was used to remove 4-m plugs from the end grain of cross sections. The increment cores and plugs were surface-sterilized by momentary flaming. All isolations were made in 100- × 15-mm petri dishes. In an attempt to find a suitable nutrient medium for the growth of WRC fungi, the following media were used: malt extract agar. potato-dextrose agar, potato-malt agar (PMA), and PMA incorporating WRC heartwood sawdust or with a 4- × 25- × 25-mm heartwood wafer on the surface. Because the extractives from the wafer diffused into the medium, the wafer provided a gradient of extractive concentrations. Some of the PMA medium was acidified to pH 4.0, and 1 ppm of benomyl was added to reduce bacterial and nonbasidiomycete growth.

Sapwood. — Sapwood isolations were made from nine poles that had been in service near Boise, Idaho. Small slivers were taken from wood adjacent to streaks of advanced decay on poles that otherwise were free of visible infection; the slivers were then quickly flamed and cultured on malt agar.

FIG. 1. Brown rot by an unidentified fungus in heartwood of a WRC pole. Note typical checking across the grain and narrow zone of transition between decay and sound wood.

Identification of fungi

Fungi were initially selected as probable decay species by the presence of clamp connections or the capacity to decay small sticks of wood in culture. For the stick tests, steam-sterilized birch stirring sticks and WRC heartwood sticks of com-

TABLE 1. *Basidiomycetes isolated from western redcedar poles.*

Area of Isolation and species	Decay type[a]
Heartwood	
Aleurodiscus lividocoeruleus (Karst.) Lemke[b]	W
Poria rivulosa (Berk. et Curt.) Cke.	W
Coriolus versicolor (L.:Fr.) Quél.	W
Sapwood	
A. lividocoeruleus (Karst.) Lemke	W
Gloeophyllum saepiarium (Wulf.:Fr.) Karst.	B
Peniophora pseudo-pini Weresub et Gibson	W
Poria latemarginata (Dur. et Mont.) Cke.	W
Schizophyllum commune Fr., haploid	W
C. versicolor (L.:Fr.) Quél., haploid	W

[a] W = white rot; B = brown rot.
[b] From heartwood of a recently felled tree.

parable size were inserted deeply into malt agar in test tubes, the agar was inoculated with the fungus to be examined. and the tubes were incubated at room temperature for 60–70 days. The sticks were then bent manually, so that the portion submerged in the agar and the upper portion over which the fungus had grown were each stressed separately. If the portion above the agar was clearly more prone to break brashly than the portion below, which normally will not decay, a basidiomycetous fungus was suspected.

Cultures that appeared to be basidiomycetes were identified at the Center for Forest Mycology Research (CFMR), Forest Products Laboratory, Madison, Wisconsin. Identification methods used there involve comparative study of the macroscopic and microscopic characters of the unknown isolate with those of one or more named species from the Reference Culture Collections at CFMR according to the system devised by Davidson et al. (1942). The Bavendamm method as modified by Davidson et al. (1938) is used to test for the oxidase reaction. As a further aid to positive identification, haploid (monokaryon) isolates, isolated directly from the wood or secured from fruiting in an unknown isolate, are paired with haploid isolates of known species when necessary and when the haploids are available.

RESULTS AND DISCUSSION

Visual examination of the boards sawed from poles indicated that in all cases radial extension of incipient heartwood infection beyond the zone of advanced decay was very short, often no more than about 2 cm.

Approximately three-fourths of the poles had white rot and the others brown rot. The white rot was distinguishable by the stringy character of the residual wood and absence of checking across the grain. The brown rot was denoted by typical checking across the grain (Fig. 1).

No particular method of sampling the heartwood in the zone adjacent to the advanced decay affected success in isolating decay fungi. Moreover, none of the special nutrient media proved more effective than conventional malt agar.

Cultures of only two basidiomycetes were obtained from pole heartwood. A

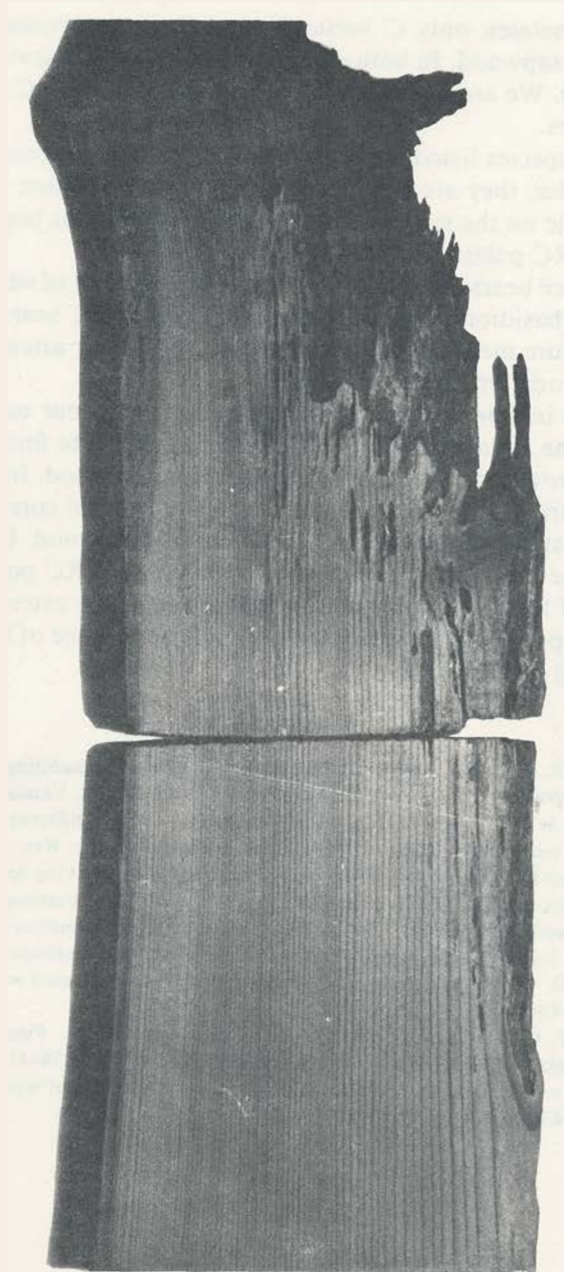

FIG. 2. White rot caused by *Coriolus versicolor* in heartwood of WRC pole. Note pockets In the narrow zone of early decay.

third came from heartwood of a recently felled pole-size tree. All of the species isolated from heartwood cause white rot. Six basidiomycetes were obtained from sapwood, two of which were haploids. *Gloeophyllum saepiarium* was the only brown rot species isolated from sapwood; the other species cause white rot (Table 1).

Among our isolates, only *C. versicolor* and *A. lividocoeruleus* came from both heartwood and sapwood. In both cases, the early *C. versicolor* rot produced small pockets (Fig. 2). We are not aware of pocket formation by *C. versicolor* in other than WRC poles.

Because the species listed in Table 1 are the result of a comparatively limited sampling of poles. they are significant mainly as an addition to the information already available on the subject. None of these species has been previously listed as infecting WRC poles.

Our experience bears out that of previous observers, all of whom obtained small percentages of basidiomycetes in isolations from WRC heartwood. Although a specialized culture medium did not prove helpful in our attempts, conceivably a more suitable medium could be found.

Inasmuch as incipient heartwood decay seems to occur mainly in close conjunction with the advanced decay, observers can expect to find viable decay fungi only in the narrow zone near the visibly deteriorated wood. Increment core specimens for culturing should be taken from the end of the core next to the deteriorated wood, usually out of the first 2 to 4 cm of firm wood. Culturing, however, does not appear practical as a means of monitoring WRC poles to ascertain the effectiveness of fumigant treatment in killing fungi; the extensive isolations and purification steps needed to verify the presence or absence of living decay species probably would be prohibitive.

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