SURVIVAL OF *PORIA WEIRII* IN
CONIFER, ALDER, AND MIXED CONIFER-ALDER STANDS

by

Earl E. Nelson, Plant Pathologist

ABSTRACT

Cubes of Douglas-fir heartwood naturally infected with *Poria weirii* were buried for up to 18 months in soil beneath stands of conifers, alder, and mixed alder and conifers. Survival of the fungus under the pure conifer stand was better than under either of the alder-containing stands. It is proposed that lower survival in alder soils is due to high levels of nitrate nitrogen. Many fungi, bacteria, and Actinomycetes competing with *P. weirii* for soil nutrients are able to use this form of nitrogen while *P. weirii* cannot. This difference in physiologies could be a major reason for higher mortality of *P. weirii* in alder soils.

INTRODUCTION

*Poria weirii* Murr., the cause of a destructive root disease of conifers in the Northwest, destroys 32 million cubic feet of Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) annually in western Oregon and Washington.1

---

Survival of *P. weirii* in roots and stumps of harvested stands and reinfection of ensuing reproduction are responsible for the continuation of this root disease at highly destructive levels. Nelson suggests that antagonistic micro-organisms are responsible for the eventual replacement of *P. weirii* in these residues. Other studies at the Forestry Sciences Laboratory and Oregon State University indicate that red alder (*Alnus rubra* Bong.), a nonleguminous nodulated tree, may play an important role in biological control of *P. weirii* root rot.

Soils from stands containing a large proportion of red alder have relatively large amounts of nitrogen combined as nitrate, a form used by many microbes but not usable by *P. weirii* which lacks the enzyme, nitrate reductase. Consequently, in these soils, less usable nitrogen is available to *P. weirii*—a disadvantage which could result in reduced longevity of this pathogen.

METHODS

This study was conducted on the Cascade Head Experimental Forest near the Oregon coast in areas originally designed to compare growth of pure conifer, pure red alder, and mixed alder-conifer stands. Conifers in the mixed and pure conifer stands include Douglas-fir, western hemlock (*Tsuga heterophylla* (Raf.) Sarg.), and Sitka spruce (*Picea sitchensis* (Bong.) Carr.). All three stands were established in 1937. After 40 years, basal areas of the alder, conifer, and mixed stands were 156, 268, and 221 cubic feet, respectively.

---


5/ See footnote 3.
Soils beneath all stands are Astoria-like Sols Bruns Acides developed from deeply weathered tuffaceous siltstone of Eocene epoch and have been described in detail by Franklin et al. A complete description of vegetation of the three stands has also been published.

In each of the above three stands, three 3- by 6-foot plots gridded at 1-foot intervals were established. In June 1966, 2-inch cubes were cut from heartwood of Douglas-fir naturally decayed by *P. weirii* and 18 buried on each of the nine plots. The decayed cubes were buried to a depth of 9 inches by driving a 3-1/4 inch stainless steel tube into the soil, extracting the core, placing a cube at the bottom of the hole, and returning and lightly tamping the extracted core in place. This procedure resulted in minimal soil disturbance.

After 3 and 6 months, three cubes (and after 12 and 18 months, 6 cubes) were removed at random from each plot. Each cube was brushed clean in running tapwater and split in half approximately along the radial plane. Small chips were taken aseptically from four points on the freshly split surface (fig. 1) and placed on malt agar slants. After 10 to 20 days, developing *P. weirii* colonies were identified.

RESULTS AND DISCUSSION

Survival of *P. weirii* in the cubes was always greater in the conifer stand than in either the alder or mixed alder-conifer stands.

---


8/ Representative decayed cubes were shown to contain viable *P. weirii* by culturing of small chips taken aseptically from a freshly split surface of each selected cube.
Figure 1.—Split cube showing four points from which cultures were made (a, b, c, and d). The cube was split by driving a chisel a short distance into the upper transverse surface.

except in the sample from the alder stand at 6 months (fig. 2). After 18 months, the fungus survived only in the conifer stand. Although these decayed cubes are much smaller than roots and stumps of harvested stands where \( P. \) weirii would almost certainly survive longer, it is likely that the effect of stand composition would be similar.

Figure 2.—Survival of \( Poria \) weirii in 2-inch wood cubes buried in three stands. (Percentages at 3 and 6 months are computed from nine cubes each time; at 12 and 18 months, from 18 cubes each time.)
The action of antagonistic micro-organisms probably is primarily responsible for failure of *P. weirii* to survive in wood in soil.\(^9\) During one year, Bollen et al.\(^10\) found that soil nitrate nitrogen was always higher in both the alder and mixed alder-conifer stands than in the pure conifer stand. Most soil micro-organisms competing with *P. weirii* for nutrients are able to utilize nitrate as a source of nitrogen. The inability of *P. weirii* to utilize nitrate could be a significant factor in its ability to survive. Whether or not relative abundance of nitrate under alder is the major factor reducing longevity of *P. weirii* can only be speculated.

Conclusions from this study, while encouraging, must be accepted with some reservation. Further studies are needed with greater replication in areas where design does not seriously limit statistical procedures. Trends found in the present study, however, give hope to foresters that *P. weirii* root rot of Douglas-fir can be reduced through natural controls and forest management.

\(^9\) See footnote 2.

\(^10\) See footnote 4.