

Rust-Red Stringy Rot and Red Heart Rot

Indian paint fungus and bleeding Stereum in firs

Pathogen—Rust-red stringy rot is caused by *Echinodontium tinctorium*. It is one of the few pathogens that has a common name—Indian paint fungus. Red heart rot is caused by *Stereum (Haematostereum) sanguinolentum*, also known as the bleeding Stereum.

Hosts—Indian paint fungus attacks firs, hemlocks, and less commonly other species in western North America, but it is primarily found on white fir in the Rocky Mountain Region. Bleeding Stereum occurs primarily on subalpine fir and Engelmann spruce in this Region, though it can also attack other conifers.

Signs and Symptoms—Indian paint fungus produces conks frequently at branch stubs, at wounds, and even inside hollow stems. The conk is hard and woody, hoof-shaped, and perennial (figs. 1-3). The upper surface is blackish and rough with crevices. The lower surface is grey-brown with hard, blunt, thick teeth. The inside is brilliant brick- or rust-red, but it fades over time after exposure. This tissue was ground into a powder and used as paint by some Native Americans, giving the fungus its name. The only other indicator of this disease is punk knots known as “rusty knots.” Although there is no swelling as with punk knots caused by *Porodaedalea pini*, the interior of the knot shows the rust-red color characteristic of the decay.

Bleeding Stereum fruits frequently on logs and slash, but infrequently on live trees. Conks are small, thin, inconspicuous, and leathery (fig. 4). Portions are appressed to the bark, often with a projecting cap. The lower surface has neither pores nor teeth; it is fairly smooth. The upper surface is slightly hairy with concentric zones of different shades of brown, orange, and grey; the lower surface is also shades of light brown with a white margin. If the conk is wounded when fresh and moist, it bleeds red liquid, giving the fungus its name. There are no other external indicators, except wounds that may be points of infection.

Rust-red stringy rot begins as golden tan patches in the wood. Fine radial tunnels may develop, presumably following the rays. Rust-red streaks and patches begin to appear; the wood becomes noticeably soft and eventually has a tendency to separate along the annual rings (laminated rot). Finally, it becomes stringy and darker brown with rusty patches (fig. 5).

Wood in the early stage of red heart rot is water-soaked and reddish brown (figs. 6-7). Thin, white fungal tissue may appear, and as decay advances, the wood becomes drier, soft, and finely stringy.



Figure 1. Indian paint fungus; upper view of conk. Note that the conk was removed with the branch stub at which it fruited. Photo: Jim Worrall, USDA Forest Service.



Figure 2. Indian paint fungus; lower view of conk. Photo: Jim Worrall, USDA Forest Service.



Figure 3. Indian paint fungus; inner view of conk. Photo: Jim Worrall, USDA Forest Service.



Figure 4. Small, leathery fruiting bodies of the bleeding Stereum. Photo: Jim Worrall, USDA Forest Service.

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Disease Cycle—Spores of Indian paint fungus do not require wounds to infect a tree. Small wounds or tiny, shade-killed twigs may be infected. The fungus becomes dormant after infection. Eventually, after it is incorporated into heartwood, the fungus may resume growth and initiate decay. Conks form years later and spores produced on the teeth are wind-blown to start the cycle over.

Red heart rot is frequently associated with conspicuous trunk wounds and broken tops, so presumably those are common sites of infection. Fruiting is uncommon on infected trees but common on logs and slash. Apparently, the spores come from those substrates, and parasitism of live trees may be a reproductive “dead end” for the fungus.

Impact—Rust-red stringy rot can form huge, long decay columns in old white fir. There may be less than 1 inch (2.5 cm) of sound shell left on a 30-inch

(76-cm) DBH tree. Decay extends 10-16 ft (3.0 to 4.9 m) beyond a conk, so a single conk indicates extensive decay. In addition to substantial cull, the disease poses significant hazards in developed sites. Hazard tree inspectors dealing with white fir should carry binoculars to look for conks, carefully sound the trees, and core if needed.

Red heart rot is the most important stem decayer in subalpine fir and the second most important in Engelmann spruce.

Management—Rust-red stringy rot can be detected by conks, rusty knots, sounding, and coring. In timber management, remove infected trees. Cull factors are available based on indicators for cruising. In developed sites, hazard should be mitigated immediately, either by closing affected sites or by removing the tree. Infection sites are not conspicuous wounds, so there is no practical way to prevent infections.

Red heart rot is more difficult to detect, as the only indicators are usually potential sites of infection. Decay columns are usually not hollow so sounding may be less definitive. Infected trees should be preferentially removed where appropriate. Avoid wounding trees because red heart rot is likely to infect such wounds in spruce-fir stands.



Figure 5. Longitudinal section through stem, branch, and conk of Indian paint fungus, showing discolored, decayed wood. Photo: Kelly Burns, USDA Forest Service.



Figure 6. Log with decay and stain of red heart rot. Photo: Rocky Mountain Region, USDA Forest Service.



Figure 7. Balsam fir stem with advanced red heart rot in cross section. Photo: Jim Worrall, USDA Forest Service.

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