Root Rots, Butt Rots & Stem Decays of Alaskan Trees

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Root and Butt Rots

Root and Butt Rots

Hosts: All tree species in Alaska.

ID: Decayed roots and butts. Mushrooms, conks, or other fungal structures on the root collar or roots (nonpathogenic mushrooms and conks can also be found near tree bases). Uprooted trees have few remaining roots (root ball, root wad). The direction of tree fall may be inconsistent rather than with the direction of prevailing wind.

Remarks: The known root and butt diseases in Alaska are caused by internal wood decay (rot) fungi that may overlap with stem decay fungi. Butt rot fungi decay the heartwood at the base of the stem. Trees can live with butt rot for years or decades. Tree mortality usually occurs due to uprooting or snapping associated with the loss of structural integrity.

Armillaria species

Armillaria Root Rot

Armillaria species

Hosts: All tree species in Alaska.

ID: Mycelial fans and black shoestring-like structures (rhizomorphs) are the best indicator and are common on the roots or lower bole. The mushroom is uncommon, variable, and difficult to identify; occurs at tree base when present.

- Top: honey colored, sometimes with dark brown scales; occurs in clusters.
- Bottom: white gills attached to both stalk and cap.
- Stalk: ring around stalk below gills.

Damage: White stringy rot, often spongy and wet. On hardwoods, often with gelatinous pockets.

Remarks: Also called shoe-string rot and honey mushroom. Species of *Armillaria* can form very large clones with one dubbed the "humungous fungus". The mycelium also glows in the dark! *Armillaria* species vary in their aggressiveness and ecological role; some are highly pathogenic, while others attack trees already stressed or killed by other factors.

Armillaria images: David Shaw, Oregon State University

Heterobasidion occidentale Heterobasidion Root Rot

Heterobasidion occidentale Heterobasidion Root Rot

Hosts: Western hemlock, Sitka spruce; perhaps other hemlock and spruce species.

ID: Perennial, woody conk found at base of live or dead trees; uncommon and usually hidden in duff, hollow logs, or stumps; shelf- or crust-like.

- Top: concentrically ringed, irregular shape, dark brown to black.
- Bottom: white to tan with angular-shaped pores and a wide, irregular sterile margin (i.e., margin has no pores).

Damage: In advanced stages, decay is a white stringy or spongy mass with small black flecks, eventually leaving the tree butt hollow. *H. annosum* is a parasite that typically attacks the roots of young trees and the butt of older trees.

Remarks: Can be very difficult to diagnose. Conks often not present or hidden in duff or inside hollow stumps. The more aggressive type, primarily found on pines, has not been found in Alaska.

Top left image: William Jacobi, Colorado State University, Bugwood.org
Top right image: Paul A. Mistretta, USDA Forest Service, Bugwood.org
Bottom left image: Joseph OBrien, USDA Forest Service, Bugwood.org
Bottom right image: William Jacobi, Colorado State University, Bugwood.org

Onnia tomentosa Tomentosus Root Rot

Onnia tomentosa Tomentosus Root Rot

Hosts: Primarily white and black spruce; but also Sitka spruce and lodgepole pine.

ID: Annual, leathery mushroom < 4“ diameter, often has embedded litter; on ground attached to roots or tree base.

- Top: distinctly felty, yellow-brown to rusty-brown with a blunt, rounded, yellowish-white margin.
- Bottom: creamy-white with small round pores (no gills).
- Stalk: thick central stalk has pores that run partway down and there is often brown felt along the portion closest to the ground.

Damage: White pocket rot of roots, pitted to honeycombed decay; look carefully for honeycombed roots on uprooted spruce.

Remarks: Can be very difficult to diagnose. Conks often not present. Formerly known as *Inonotus tomentosus*.

Phaeolus schweinitzii Schweinitzii Butt Rot

Phaeolus schweinitzii Schweinitzii Butt Rot

Hosts: Spruce and hemlock; rare on shore pine in Alaska.

ID: Large**,** annual, layered, and shelf-like on lower bole and nearby roots; circular and stalked with sunken center on ground, soft and spongy. Fruiting body develops on both live trees and dead trees/logs. Can be abundant on the ground around root collar.

- Top: velvety, yellow to orange when young, turning brown with a olive brown to yellowish margin.
- Bottom: large, irregularly shaped pores, bright yellow to orange when young becoming greenish yellow or olive and eventually brown; quickly bruises dark brown.
  Entire cap turns dark red brown and brittle when dead (resembles cow pie).

Damage: Brown cubical butt rot, often extensive. Rapid loss of tensile strength, even at fairly early stages of decay, leads to bole breakage near tree base.

Remarks: Also known as the cow pie fungus, velvet top fungus or dyer's polypore. Can be used to create yellow, brown, and green dyes. Sometimes confused with *Onnia tomentosa*, which is smaller.

Pholiota species

Yellow Cap Fungus

Pholiota species — Yellow Cap Fungus

Hosts: Aspen; sometimes birch, cottonwood, balsam poplar, spruce and hemlock.

ID: Yellowish tender mushrooms on lower bole or base of living trees, or on the ground near base, usually in clusters.

- Top: yellow-brown and scaly when young, becomes sticky with age and loses scales.
- Bottom: gills yellow at first, later turning brown.
- Stalk: usually scaly when young, may or may not have a ring.

Damage: Incipient decay is a yellow stain in the heartwood. Advanced decay is yellow-white with yellow or yellow-brown streaks; thin strands of yellow-brown mycelium occur along the grain.

Remarks: *P. squarrosa* var. *squarrosa* causes root and butt rot of trembling aspen. *Pholiota* require microscopic examination to determine species.

Stem Decays

Stem Decays

Hosts: All tree species in Alaska.

ID: Rotting or deteriorating wood that primarily develops in the trunk, rather than roots and butt. Presence of conk, mushroom, or other fungal structure on bole. Heart rot develops primarily in the heartwood (inner wood) of living trees. Sap rot develops in the sapwood (outer wood beneath bark) and is usually extensive only in dead trees. Bole wounds and cracks provide entry points for many stem decay fungi. Wildlife holes, cavities, and hollows also indicate the presence of stem decay on live trees.

Damage: Stem decays predispose trees to bole breakage.

- Brown rots are particularly detrimental to tree strength. They degrade cellulose fibers leaving behind brownish lignin, which dries in brittle cubes.
- White rots decompose all wood components (cellulose and lignin); wood remains fibrous until very late stages of decay. The color and texture of white rots is dependent upon the causal fungi.

Remarks: Tree defense mechanisms in living trees include bark, sapwood, and cambium. Heartwood contains defense compounds that degrade over time.

Echinodontium tinctorium Paint Fungus

Echinodontium tinctorium Paint Fungus

Hosts: Western and mountain hemlock; occasionally spruce.

ID: Perennial, woody, hoof-shaped conk anywhere on bole. Forms as a parasite on living trees, usually on or under branch stubs or dead branches.

- Top: rough and cracked, dull black to dark grey.
- Bottom: grey-brown to black; thick, blunt spines or teeth.
- Inside: brick red to rust red or orange. The pigment extends into the adjacent wood.

Damage: Laminated stringy white rot, usually mid-trunk. Trunk may become completely hollow.

Remarks: Presence of conk indicates substantial heart rot. In Alaska, occurs in the northern Panhandle near Haines and Skagway and in south-central Alaska within the distribution of mountain hemlock. Identified at one location on Mitkof Island, so may be present elsewhere on the Panhandle. Traditionally used to prepare red paint pigments.

Fomes fomentarius Tinder Conk

Fomes fomentarius Tinder Conk

Hosts: Birch; possibly alder, balsam poplar and cottonwood.

ID: Perennial, woody, dull, and usually distinctly hoof-shaped conk. Extremely common saprobe of dead trees, but occasionally occurs parasitically in both heartwood and sapwood of live trees.

- Top: zones of light grey to brown, dark grey, or black; smooth.
- Bottom: concave, tan to brown with small regular pores.
- Interior: thin brown layer between thick surface crust and several distinct layers of tubes; the dark brown tubes partially filled with white mycelium.

Damage: Early decay light brown. Advanced decay soft and spongy yellowish white rot, which frequently contains blackish zone lines. Small radial cracks may be filled with yellow, leathery mycelium.

Remarks: Traditionally used to make fire tinder. The presence of fruiting bodies indicates extensive advanced decay. Sometimes confused with *P. igniarius*, but is more hoof-shaped, lighter in color, and lacks cracks on a slightly shiny upper surface.

Fomitopsis officinalis Quinine Conk

Fomitopsis officinalis Quinine Conk

Hosts: Spruce(especially Sitka spruce), hemlock, larch and shore pine.

ID: Perennial, woody, hoof-shaped to elongated-columnar conk. Usually occurs as a parasite high on bole of living old-growth trees, but also persists for many years as a saprobe on dead trees. Rare.

- Top: zoned, white or yellow-white turning to grey or light brown with age, chalky coating, sometimes greenish with algae.
- Bottom: white when fresh with tiny round uniform pores, drying to light brown.
- Inside: white to grey, cheesy to chalky with age, distinctly bitter taste.

Damage: Early decay light yellow to red-brown. Advanced decay is a crumbly brown cubical rot. Thick, white, bitter-tasting mycelial felts may form in shrinkage cracks.

Remarks: A single fruiting body indicates extensive heart rot and hazard of tree failure. Conks have long been used in traditional medicine & show promise i modern research. Many cultures, including the Tlingit, have carved conks into shaman grave guardians.

Quinine Conk Images: Karen Dillman, USFS

Fomitopsis pinicola Red Belt Conk

Fomitopsis pinicola Red Belt Conk

Hosts: Spruce, hemlock and pine; occasionally western redcedar, birch and aspen.

ID: Perennial, leathery to woody, flat to hoof-shaped conk. Found as a firm, rounded white mass on wood surface when young. Primarily saprobic and extremely common on dead wood. Also commonly associated with wounds of live trees, especially Sitka spruce.

- Top: dark brown to grey to black, zoned, often with reddish brown band near rounded margin.
- Bottom: creamy white with minute round pores.
- Inside: creamy white with corky texture.

Damage: Incipient (early) decay has a yellow-brown to brown stain. Wood with advanced decay is a crumbly brown cubical rot. Thick white mycelial felts may form in shrinkage cracks. The mycelial felts are similar to that of the quinine conk but do not taste bitter.

Remarks: Sometimes confused with artist's conk but bottom pore layer does not immediately bruise when touched. In Southeast Alaska, considered an important stem decay of live spruce, but its brown cubical decay may be confused with that of *Phaeolus schweinitzii*.

Ganoderma applanatum Artist's Conk

Ganoderma applanatum Artist's Conk

Hosts: Mainly hardwoods; but sometimes western and mountain hemlock, and white and Sitka spruce.

ID: Perennial, woody, fan- or shelf-shaped conk. Usually occurs as a saprobe on decaying logs and stumps. Occasionally found as a heart rot on wounds of living trees.

- Top: dull brownish to greyish brown with concentric ridges. dusty brown
- Bottom: white pore surface that immediately browns when touched.
- Interior: dark brown to cinnamon.

Damage: Spongy mottled white rot of sapwood and heartwood.

Remarks: Known as the artist's conk because the fresh pore surface bruises dark brown when touched or scratched. Intricate etchings can be preserved for years if properly dried.

Ganoderma tsugae Varnish Conk

Ganoderma tsugae Varnish Conk

Hosts: Western hemlock; occasionally other conifers.

ID: Annual, shelf or fan-shaped conk. Usually saprobic on large, old stumps or logs.

- Top: surface distinctly varnish-like and shiny reddish brown, at first knobby or elongated becoming somewhat fan-shaped.
- Bottom: white pore surface, becoming brownish with age. Usually bruises brown. Pores minute.
- Stalk: lateral (from side), varnished reddish brown, sometimes absent.

Damage: White rot decay appears wet, spongy, soft, straw-colored or white in the butt or stem. May have large black spots scattered throughout.

Remarks: Also called lacquer conk, this fungus has long been used in traditional medicine; modern research has shown potential medicinal benefits, including wound healing and anti-tumor activity in mice.

Inonotus obliquus Cinder Conk

Inonotus obliquus Cinder Conk

Hosts: Birch.

ID: Perennial, woody, cinder-like mass on trunk, often large. Occurs as a parasite on living and recently dead trees.

- Outside: very hard, rough and deeply cracked, black to dark brown, exterior looks like something that has been burned.
- Interior: yellow to rusty-brown, often with flecks of white.

Damage: White rot; incipient decay has yellowish white streaks and spots. Advanced decay is white, soft, with fine black zone lines throughout.

Remarks: Superficially resembles Diplodia gall (*Diplodia tumefaciens*) which occurs on tembling aspen and balsam poplar, while *I. obliquus* occurs on birch (rare on *Populus* spp.). Cinder conks, also called clinker conks or Chaga, are sterile (not true conks, which produce spores). Short-lived fertile conks may appear after the tree dies. Has been traditionally used as a tonic or tea in Siberian folk medicine. Recently Chaga has been the subject of much research. Specimens on birch contain inotodiol, which has active anti-tumor properties. Can also be prepared for use as yellow or sepia dyes.

Laetiporus sulphureus Chicken of the Woods

Laetiporus sulphureus Chicken of the Woods

Hosts: Spruce and hemlock; occasionally shore pine, cottonwood, balsam poplar and aspen.

ID: Annual, shelving, in clusters, fleshy; usually on lower bole. Primarily saprobic on dead trees and stumps, but occasionally causes heart rot on living trees.

- Top: bright orange to yellow when fresh; crumbly white after it dies.
- Bottom: sulfur-yellow with small pores often in clusters.
- Inside: yellow, watery, and soft when fresh; white and chalky or soggy after it dies.

Damage: Brown cubical rot, may have white mycelial felts.

Remarks: Edible when young, some think the conk tastes like chicken. The fungus is also called Sulfur Shelf fungus. The mycelial felts in decayed wood is somewhat similar to that of the quinine conk but do not taste bitter. Use caution when harvesting fungi for consumption.

Phellinus hartigii Hartig's conk

Phellinus hartigii Hartig's Conk

Hosts: Western and mountain hemlock.

ID: Light brown perennial conk, often occurs on undersides of limbs or branch stubs, also on tree bole; may be velvety and flattened against tree bole.

- Top: dark brown to black, cracked.
- Bottom: tan to rusty-brown with very small, uniform pores. The pore layer of the conk may cover a much greater area than the upper surface. Appears velvety when fresh.
- Inside: yellow- to rusty-brown with streaks of white mycelium.

Damage: White rot of the sapwood and heartwood of living trees. Incipient (early) decay appears as irregular patches of brown to purple discoloration. Advanced decay appears bleached and laminated on radial sections with brown zone lines. Decay is usually limited to the area just above and below the conk. Bark may appear sunken around conks when the sapwood is killed.

Remarks: Conks are difficult to remove from trees. Hartig's conk is named after Robert Hartig, a 19th century German forest scientist regarded by many as the father of forest pathology.

Phellinus igniarius, P. tremulae False Tinder Conk

Phellinus igniarius, P. tremulae False Tinder Conk

Hosts: Birch (*P. igniarius*), trembling aspen (*P. tremulae*) and possibly balsam poplar.

ID: Perennial, woody, hoof-shaped conk. Occurs on live trees but can persist as a saprobe years after trees die.

- Top: dark brown to greyish-black to black, many small cracks.
- Bottom: light brown with tiny circular pores.
- Interior: rusty-brown with numerous white flecks.

Damage: Initial decay is yellowish to yellowish-white surrounded by a distinct dark zone line. Advanced decay is spongy or punky with numerous irregular, black zone lines. The presence of conks indicates considerable heart rot.

Remarks: *P. igniarius* is very common on live birch and looks identical to *P. tremulae* on aspen. While less common than the birch variant, *P. tremulae* is the most important heart rot organism of aspen; in its commercial range in the Lower 48, it is reported to cause more volume loss than any other disease of aspen.

Piptoporus betulinus Birch Conk

Piptoporus betulinus Birch Conk

Hosts: Birch.

ID: Annual, leathery, shelving, light and corky conk. Extremely common saprobe of dead trees, also occurs on dead portions of live trees.

- Top: whitish to tan to mousy-brown, smooth or somewhat scaly. Lower margin of the cap incurving and projecting below the pore surface.
- Bottom: white pore layer when fresh, becoming yellowish to tan and slightly tooth-like when older.
- Interior: thick, white, firm, spongy when fresh and separates easily from the pore layer. Becomes corky with age.

Damage: Yellowish brown cubical rot of sapwood and heartwood. Advanced decay is very light weight and crumbles easily.

Remarks: Used as a bandage to prevent bleeding and infection in traditional medicine and has anti-inflammatory properties. Also called the Razor Strop fungus as barbers used the flesh to sharpen their razors.

Porodaedalea pini Red Ring Rot

Porodaedalea pini Red Ring Rot

Hosts: Hemlock, spruce and shore pine; occasionally western redcedar.

ID: Perennial, woody, fan-, shelf-, to hoof-shaped conk. Occurs as a parasite anywhere on bole of live or recently dead trees. Often associated with branch stubs.

- Top: reddish brown to dark brown with a narrow, velvety golden margin; usually zoned in concentric rings; becoming furrowed and rough.
- Bottom: yellowish brown to rusty brown, pores angular to nearly slot-like.
- Interior: bright rusty brown; corky to woody.

Damage: White pocket rot. Incipient (early) decay is a red stain in the heartwood that appears as a well-defined ring in cross-section. In advanced decay, small flecks of fungal mycelium are evident and once-separate areas of decay merge.

Remarks: Formerly known as *Phellinus pini*. Decay can progress from the heartwood to the sapwood and cause tree death.