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Management Guide for

Limb Rusts

Cronartium arizonicum Cummins
(aecial stage *Peridermium filamentosum* Peck)

Primary hosts:

- **Ponderosa pine**
- **Jeffrey pines**

Alternate Hosts:
various species of *Castelleja* (paintbrush), *Othocarpus* (cow-wheat) and *Pedicularis* (lousewort).

Pines of all sizes can be infected, but limb rust is most evident on mature trees.

The fungi involved belong to several species, only one of which is completely described.

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Key Points

- Trees of all size classes can be infected.
- Once inside the host, the rust can move around systemically in xylem tissues.
- The fungus only sporulates on small branches on the pine host.
- Infected trees are reservoirs for bark beetles.
- Remove infected trees during thinnings.
- Limb rust appears to be decreasing in occurrence in many areas.

Distribution and Damage

The limb rusts are widely distributed, ranging from the Black Hills of South Dakota, through the western United States and south through Mexico and even into Guatemala. When present they are some of the most destructive diseases of ponderosa and Jeffery pines in the western U.S.

Trees of all size classes can be infected, but limb rust is most evident on mature pines. These fungi are unusual for rust diseases in that they are capable of extensive growth in the sapwood after first infecting needle bearing branches. Mycelium of the fungus spreads at a rate of about 18–21 cm/year, either up or down the stem, a rate of growth substantially slower than most stem rusts. When a tree is infected in the center of its crown this growth pattern leads to a distinctive "hole in the crown" type symptom (Figure 1).

The slow growth of the fungus leads to slower damage than most rust diseases, and host trees usually aren't killed until 80% or more of the crown has been killed.

Figure 1. Trees infected with limb rust sometimes develop a distinctive "hole in crown" symptom.

Limb Rust Management

- **Limit damage.** Select against infected trees during stand management activities and keep cutting cycles short.
- **Inoculum reduction.** Eradicate infected trees around nurseries.
- **Chemical.** Apply fungicides to protect seedlings.

Limb rusts cause gradual, progressive crown dieback due to systemic movement in the xylem.

Limb rusts are easy to tell from the other stem rusts in that they only sporulate on small branches.

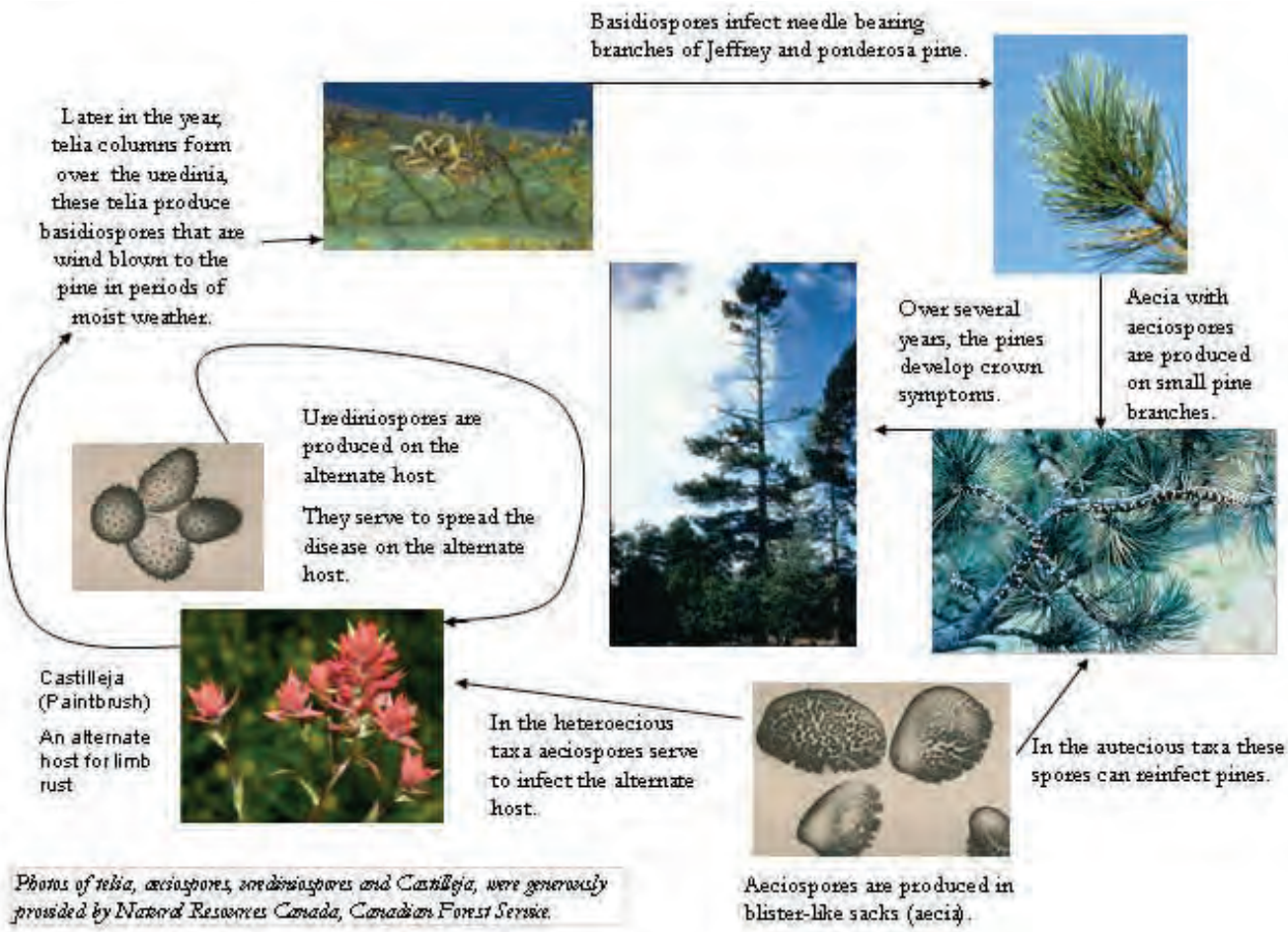
Endemic bark beetle populations frequently attack limb rust infected trees hastening tree death. There is evidence that there is less limb rust now than there was 30–40 years ago due to reduced infection rates and silvicultural discrimination against infected trees.

Life History

The fungi involved belong to several species, only one of which is completely described. *Cronartium arizonicum* Cummins (aecial stage *Peridermium filamentosum* Peck) is the best known causal fungus of limb rust, but there are at least 4 other incompletely described taxa involved.

At least 2 of the races of *Peridermium* that cause limb rust appear to be heteroecious, with 2 hosts, the pine and an alternate host such as *Castilleja* (Figure 2). Two other limb rust fungi appear to be autoecious; they don't need an alternate host to complete their life cycle. It may be that we are seeing some interesting evolution in action. In other words, have some of the races of the rust lost the need for an alternate host thus simplifying their life cycle?

Figure 2. Limb Rusts Life Cycle



Photos of telia, aeciospores, urediniospores and Castilleja, were generously provided by Natural Resources Canada, Canadian Forest Service.

After aeciospores from the pine host infect *Castilleja miniata*. (common name: giant red paintbrush, one alternate host) it takes about 18–20 days for the spore stage (urediniospores) that can re-infect the alternate host to be produced. After 39–50 days the telia that produce the basidiospores that infect the pine host are produced. In periods of moist weather, the basidiospores that can infect the pine host are produced, completing the life cycle. In some races of limb rust the aecia are persistent and still contain aeciospores well into the fall, and in some cases aecia can persist for 2 or even 3 years on the same small branch, which is unusual for stem rusts.

Once the fungus infects small branches it moves into the xylem tissues. This means of growth allows the disease to become systemic in the host, spreading throughout the crown rather than being restricted to a gall or canker. Mycelium of limb rust have been found in wood as much as 60 years old, and mycelium from a single infection can be over 100 feet in length. The disease can then move out from the sapwood and sporulate on and kill small branches resulting in gradual, progressive crown dieback and tree death.

Other Reading

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Sinclair, Wayne A., and Howard H. Lyon. 2005. Disease of trees and shrubs. Second Edition, Cornell University Press, 676 p.

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