5. Eastern and Western Gall Rusts

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Revised from chapter by Glenn W. Peterson, William Merrill, and Darroll D. Skilling, 1989.

Hosts

Eastern gall rust (or pine-oak gall rust), caused by one of several formae speciales of the fungus *Cronartium quercuum*, affects jack, Scots, shortleaf, Virginia, and other hard pines. Alternate hosts needed to complete its life cycle include a number of red oak species (section *Lobatae*) and bur oak. The disease may be misidentified as fusiform rust that is common on southern pines. In contrast, western gall rust (or pine-pine gall rust), caused by the fungus *Peridermium harknessii* (syn. *Endocronartium harknessii*), is an autoecious fungus and needs no alternate host. Western gall rust affects many native hard pines of Canada and the United States, including ponderosa, lodgepole, jack, Monterey, Jeffrey, Coulter, knobcone, bishop, and gray pines. Nonnative hosts that are naturally infected by the pathogen include Scots, Aleppo, mugo, and Canary Island pines.

Distribution

Eastern gall rust occurs east of the Great Plains from Canada to the Gulf of Mexico where the oak alternate hosts are present. Western gall rust is generally found throughout the pine forests of Western Canada and the United States. In the Eastern United States, it is found as far south as Virginia.

Damage

Seedlings affected by eastern or western gall rust in a nursery usually do not die in the nursery. Losses in the nursery are incurred, however, when diseased seedlings are culled before shipping. Seedling death often occurs after outplanting or in older trees from wind breakage of weakened stems at galls. Reduced wood quality is associated with main stem galls on older trees. Once outplanted, infected seedlings and young trees serve as foci for new infections, especially seedlings infected with *P. harknessii,* because the fungus can spread directly from pine to pine. Infection of oak seedling leaves and older trees by *C. quercuum* results in small necrotic or chlorotic areas, but harm to the tree is minimal. Infected oak, in and around nurseries, serve as foci for new infections of susceptible pine.

Diagnosis

Look for swellings or globose to irregularly shaped galls on the stem (figs. 5.1 and 5.2). Galls are rarely evident until the summer after the year of infection. Galls formed by either western or eastern gall rust fungi are similar in size and shape and the species cannot be distinguished based on gall shape. The presence of the characteristic brown, hair-like spore-bearing structures (telial stage of fungus) on oak leaves in the vicinity, however, suggests that the affected pine seedlings may be infected by the eastern (pine-oak) rust fungus. Conversely, the absence of oak hosts, or the absence of infected leaves on

Figure 5.2—*Aeciospores of* Cronartium quercuum *on gall.* Photo by Michael E. Ostry, USDA Forest Service.

Figure 5.1—*Gall caused by* Cronartium quercuum *on pine seedling.* Photo from USDA Forest Service Archive.

nearby oaks suggests that observed galls are caused by the western (pine-pine) rust fungus. The presence of numerous globose to elongate galls on established pine stems and branches in the vicinity of the pine fields or nursery are indicative of the presence of gall rust fungi. These galls are particularly conspicuous in the spring when they are covered by bright orange masses of powdery spores called aeciospores (fig. 5.3). Aeciospores of these rust fungi rarely develop on galls found on nursery seedlings. Although the aeciospores of the two fungi are morphologically identical, they can be distinguished in the laboratory based on characteristics of the germ tube length on culture plates; extended in pine-oak rust and limited in pine-pine gall rust.

Figure 5.3—*Aeciospores of* Cronartium quercuum *being dispersed from galls.* Photo by Michael E. Ostry, USDA Forest Service.

Biology

Aeciospores of *C. quercuum* form on galls of saplings and trees. These spores are wind-disseminated to oak leaves less than 3 weeks old, where they infect and produce repeating spores (urediniospores) and teliospores. Basidiospores produced by the teliospores are then wind-disseminated to pine in late summer-early fall where they infect needles. The fungus grows within needles and into the stem where galls form about 1 year after infection. Timing of the different types of spore production differs by region. *P. harknessii* form orange spores on galls that morphologically resemble aeciospores but function like teliospores. On the galls, *P. harknessii* forms orange spores that morphologically resemble aeciospores but function like teliospores. Following dispersal, these spores germinate and infect needles on current year pine shoots early in the growing season.

Control

Prevention

If practical, remove both oak and infected pines within and around nursery fields. Pines resistant to both gall rusts exist and additional resistant selections may be available in the future. Jack pine seedlings from various sources have been found to be resistant to both gall rusts, but the resistance to both is not correlated. Thus, separate screenings are required for the diseases on this host for areas where both occur.

Cultural

Culling seedlings with galls, either within beds or after lifting, minimizes shipping of gall rust infected stock.

Chemical

Routine fungicide sprays with selected chemicals are effective in preventing infection by gall rust fungi. Fungicide use by nurseries varies by geographic region, however. In the Southeastern United States, fungicide sprays for fusiform rust will be effective against eastern gall rust as well.

Selected References

Anderson, G.W.; French, D.W. 1965. Differentiation of *Cronartium quercuum* and *Cronartium coleosporiodes* on the basis of aeciospore germ tubes. Phytopathology. 55: 171–173.

Burnes, T.A.; Blanchette, R.A.; Stewart, W.K.; Mohn, C.A. 1989. Screening jack pine seedlings for resistance to *Cronartium quercuum* f. sp. *banksianae* and *Endocronartium harknessii*. Canadian Journal of Forest Research. 19: 1642–1644.

Cummins, G.B.; Hiratsuka, Y. 2003. Illustrated genera of rust fungi, 3rd ed. St. Paul, MN: American Phytopathological Society Press. 225 p.

Peterson, G.W.; Merrill, W.; Skilling, D.D. 1989. Eastern and western gall rust. In: Cordell, C.E.; Anderson, R.L.; Hoffard, W.H.; Landis, T.D.; Smith, Jr., R.S.; Toko, H.V., tech. coords. Forest nursery pests. Agriculture Handbook 680. Washington, DC: USDA Forest Service: 36–37.

Sinclair, W.A.; Lyon, H.H. 2005. Diseases of trees and shrubs, 2nd ed. Ithaca, NY: Cornell University Press. 660 p.

White, E.E.; Allen, E.A.; Ying, C.C.; Foord, B.M. 2000. Seedling inoculation distinguishes lodgepole pine families most and least susceptible to gall rust. Canadian Journal of Forest Research. 30: 841–843.