Eastern Gall Rust

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A common disease of hard pines is Eastern gall rust, often called pine-oak gall rust. In certain areas it seriously hinders hard pine production in nurseries, plantations, and natural stands. Losses in nurseries frequently exceed 25 percent. Because of these losses production of susceptible species has been greatly decreased or even discontinued in some nurseries. In plantations and natural stands local epidemics of this rust have so deformed the trees that they are unfit for timber purposes.

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Figure 1.—Galls on 2—0 jack pine.

Galls that form on the main stem of seedlings (fig. 1) usually kill the trees. Experiments in the Lake States showed that 25 percent of the infected 2–0 stock was killed within 4 years from date of inoculation. Galls on the main stem of saplings (fig. 2) and pole-sized trees greatly weaken the stems and make them subject to wind breakage—if they are not killed by the rust. Eastern gall rust is mainly a problem in the maintenence of forest tree nurseries and in the management of seedling, sapling, and pole-sized stands.

Hosts

In the United States, the disease is present from Minnesota eastward to the New England States and south to the Gulf of Mexico. Twenty-seven species of pine have been successfully inoculated. Hard pines are, in general, more susceptible than soft pines. Jack, Scotch, and Austrian pines in the North and pitch, loblolly, and shortleaf pines in the East and South are a few of the more important, susceptible species. Red or black oaks are the main alternate hosts, although white oaks are occasionally infected. In the South, species of chestnut and chinkapin may also

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be infected. Although the disease is found throughout the Eastern United States, it apparently is considered a major problem only in Minnesota, Wisconsin, and Michigan.

The Parasite

The fungus that causes this disease is *Cronartium quercuum* (Berk.) Miyabe ex. Shirai (*C. cerebrum* (Peck) Hedge and Long). Its life cycle is as follows: In the spring, bright orange aeciospores are formed on the surface of the globe-shaped galls on infected pines. These spores are carried by the wind to oaks where infection takes place on the underside of the leaf. Urediospores then form on the oak leaves and reinfect other oaks. Eventually, brown hairlike columns of teliospores replace the uredia on the oak leaves (fig. 3).

The telia mature in late winter and early summer (February to June) in the Southern States or in the summer (June, July) in the North. At maturity, the telia produce windborne basidiospores, which complete the life cycle and infect the young pine needles. Globose swellings or galls appear on the stem of infected pine seedlings near the end of the first or during the second growing season following infection.

Any needle-bearing tissue is a potential infection site for this fungus, and in many areas the fastest growing and most vigorous trees are the most susceptible to it. However, growth is little affected unless stem galls are present. Studies have shown that older trees with numerous branch galls are as tall as uninfected trees.

Epidemiology

The environmental conditions that allow this rust disease to become epidemic were studied by J. E. Nighswander. He reported that 16 to 20 hours of 100-percent relative humidity plus free water are necessary for the infection of oak leaves by aeciospores. The time that aeciospores are liberated is also important; oak leaves less than 2 weeks old showed the heaviest infection, whereas leaves 3 to 4 weeks old and older bore no sign of infection. Both late spring frosts that defoliated the oak and a period of dry weather during aeciospore dissemination greatly limited the amount of infection on the oaks. Infection of oak leaves by urediospores also took place in 16 to 20 hours if free water was available. The oak foliage most susceptible to infection by urediospores is the sprout and sucker

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Figure 2.—Pine-oak rust galls on a 10-year-old jack pine.

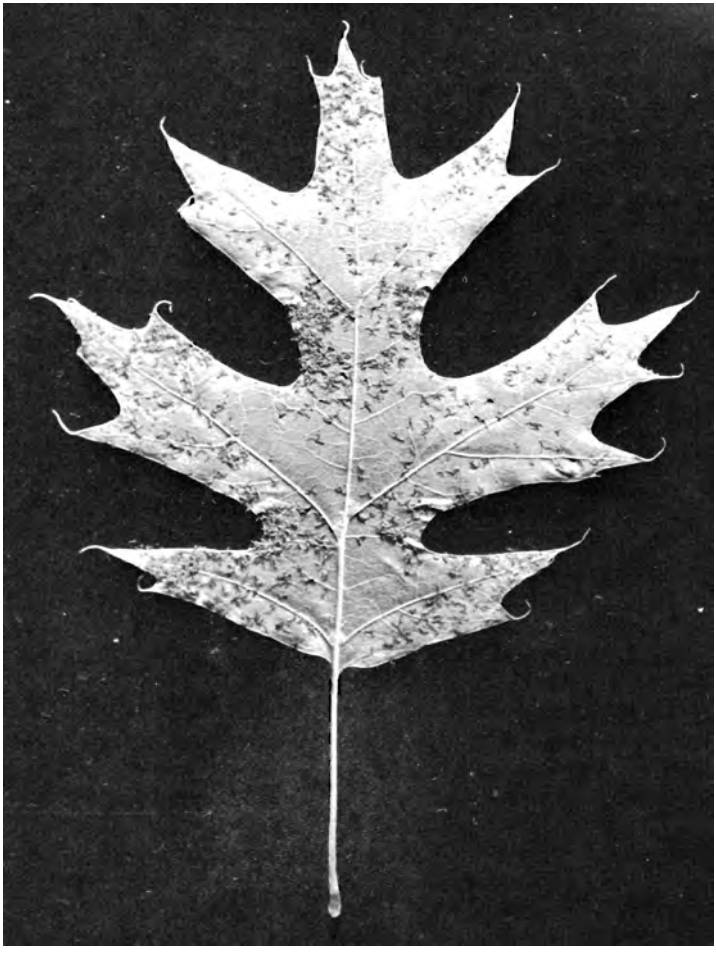

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Figure 3.—Telial columns of *Cronartium quercuum* on the lower side of a northern pin oak leaf.

leaves that form during the growing season.

The formation and discharge of the basidiospores take up to 9 hours, and the germination of these spores, 4 hours. Nighswander stated that the minimum time for the basidiospores to form, germinate, and infect pine is about 18 hours if the temperature is between 12° and 24° C., the atmosphere is saturated, and free water is present. The two critical periods in the development of an epidemic of this rust disease are the period of aeciospore dissemination and the period when the basidiospores are formed and infect the pine.

Control

All oak trees within half a mile of a nursery should be removed.

Care should be taken that the oak does not sprout, because young sprout leaves are much more susceptible to rust infection than are older leaves.

All nursery stock should be carefully inspected and infected stock culled before it leaves the nursery. In the South, galls usually develop during the same year that pines are infected. In the North, galls usually are not noticeable until 1 year after infection; consequently, 2–0 seedlings planted in the spring may be infected, but symptoms will not be evident.

Control of Eastern gall rust is not now economically feasible in forest stands. In thinning operations, however, trees with cankers on the main stem should be removed since they are likely to die or be badly deformed. Susceptible species should not be planted in areas known to have had a high incidence of this disease.

Resistance to this disease is frequently noted in the field. Adjacent trees often appear to vary from highly susceptible to resistant. Studies are in progress to determine the mechanism of disease resistance and its inheritance. Once these are better understood, disease-resistant trees may be developed by artificial breeding methods.

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