Southern Cone Rust

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A rust disease that can completely destroy newly formed cones of slash and longleaf pine has attracted attention frequently since its discovery in Florida in 1892. Its attack has periodically been severe enough to materially reduce cone crops, particularly those of slash pine, in south Georgia, north Florida, and along the coast of the Gulf of Mexico. As long as the slash pine seed supply was more than ample for natural regeneration and for the needs of nurseries and direct seeding in the field, the cone rust was not an economic problem. However, since the demand for seed is now often greater than the supply and since in specific areas—such as seed production areas and orchards—seed is the main crop, this rust has recently assumed major importance.

Symptoms and Damage

The disease becomes evident in the new conelet shortly after pollination. The affected conelets increase rapidly in size so that by April they are usually three or four times larger than healthy ones (fig. 1), and their scales have a reddish color. During spring, nectar-loving insects gather about diseased cones and feed upon the sweet pycnial liquid exuded by the infected swollen cones. In late spring, the diseased cones become yellow-orange because of the great quantities of fungus aeciospores produced, and at this stage they can be identified as far as they can be seen (fig. 2). The diseased cones then fall, and practically all are shed by late summer. Diseased cones are usually heavily attacked by insects, particularly of the genus *Dioryctria,* which can multiply in them and then attack healthy cones.

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Figure 1.—Large slash pine cone on left is rust infected. Small cones on right are healthy.

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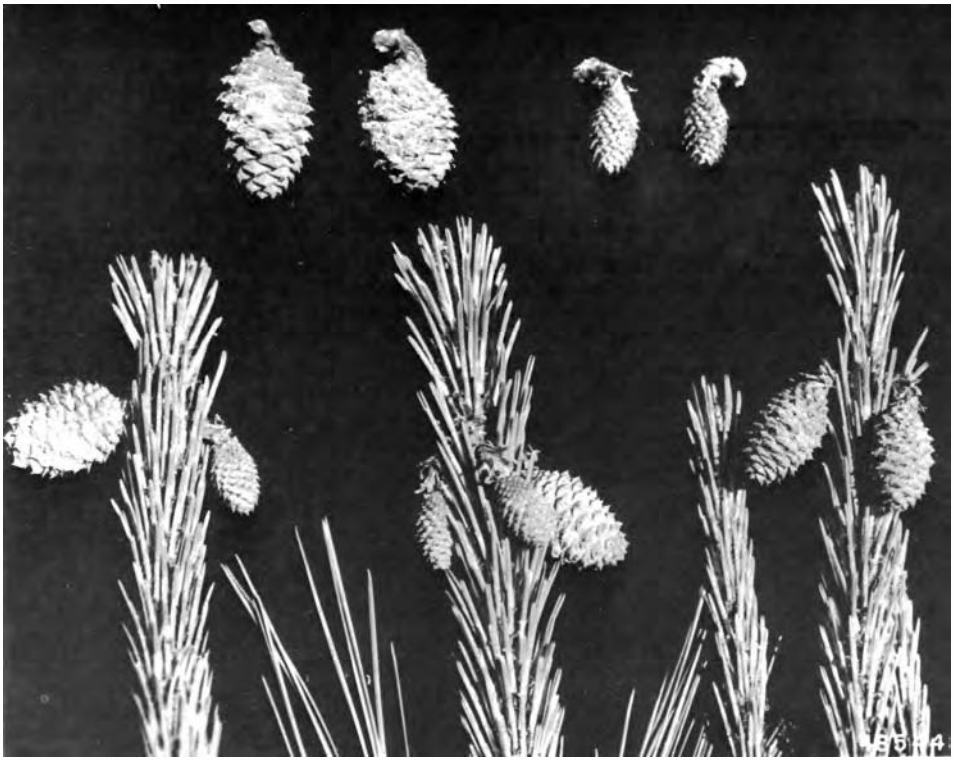

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Figure 2.—Slash pine: The five smaller cones are healthy; the six larger ones are rust diseased. Surface irregularities of the diseased cones indicate production of spores.

The disease is endemic in nature, but heavy cone losses from rust have been reported from time to time. In 1919, between 25 and 90 percent of the slash and longleaf cone crop was destroyed in areas near Dunedin, Fla. In 1956, there were reports of heavy losses in Florida. Surveys in 1957–59 showed an average loss of about 20 percent of the slash pine cones in south Georgia and Florida, with losses approaching 100 percent in some areas. These are merely examples of measured cone rust losses. The rust has caused heavy damage in many other years, along the Mississippi and Alabama Gulf Coast as well as farther east.

Cause

The fungus *Cronartium strobilium* causes southern cone rust. Sporidia of this fungus, which are produced on oak leaves, infect the mature female pine flowers about the time of pollination. The fungus grows through the developing conelet, causing it to swell. In early spring, pycniospores exude from infected cones in viscid droplets. Between early April and late May, or occasionally later, cavities in the cones caused by the fungus burst; the cone scale tissue above them sloughs off; and masses of yellow-orange aeciospores are exposed to be distributed by the wind.

The aeciospores infect the leaves of many species of oak. The next stage, produced also on oak leaves, is the uredinial stage and can be observed as small, yellow, powdery pustules on the undersides of the leaves. Urediniospores infect additional oaks and intensify the rust during the summer. When the leaves of the deciduous oaks fall in autumn, they present no hazard to the pines. But on the leaves of evergreen oaks, such as live oak (*Quercus virginiana* and varieties), runner oaks (*Q. pumila* and *Q. minima*), or others, the fungus produces a telial stage. The hairlike, telial spore horns mature on the underside of the leaves during the winter and produce the sporidia that infect the developing female pine flowers sometime between mid-December and the end of February. Studies have shown that the female flowers are susceptible to infection from the time they emerge from the bud scales through the pollination stage. The flowers are resistant after pollination is completed and when the scales of the conelet have closed.

The incidence of cone rust in any given year depends upon many factors, and conditions pertaining to all of these factors must be favorable to the rust for an epidemic to result. Cone rust can become severe only (1) if air moisture and temperature conditions during the summer result in a buildup of the rust on the evergreen oaks, (2) if suitable weather conditions promote the development of viable telia in the winter, and (3), and most important, if there is enough atmospheric moisture and suitable air temperature so that sporidia are produced on the telia and are carried to the susceptible pine flowers, where they germinate and infect. While we do not yet know the particular air temperature and moisture conditions that are essential to each stage of rust development, recent experience and experiments with fusiform rust, a disease with a similar life cycle, have shown the importance of local weather factors on rust damage.

Control

If possible, slash pine seed orchards should be established outside the natural range of live oak.

Southern cone rust control measures are directed primarily to slash pine seed orchards. In seed orchards where controlled pollination is practiced, cone rust should be nonexistent because the pollination bags prevent spore deposit on the strobili. Losses can be expected, however, in open-pollinated orchards if the orchard is located in south George, north Florida, or on the Gulf Coast of Alabama and Mississippi where evergreen oaks are common near the site. These losses can be reduced significantly by spraying with ferbam at a concentration of 2 pounds of the 76 percent wettable powder (1.52 lbs. active ingredient) plus ½ pint of a commercial spreader-sticker in 100 gallons of water. Hydraulic sprayers operating at pressures of 400-600 pounds per square inch are recommended. The spray mixture must be continuously agitated during the spraying operation, and should be applied to the flower-bearing portion of the crown until runoff occurs.

Spraying should commence as soon as any of the female flowers begin to emerge from the bud scales and should continue on a regular 5-day schedule until all natural pollination has ceased. This schedule would mean that five or six sprays should be ap-

plied during a normal flowering season. Retardation of strobilus development by cold weather will lengthen this flowering period and may necessitate the application of additional sprays. The developing strobili must be protected with the fungicide at all times, especially during prolonged periods of high atmospheric humidity. Ferbam has no adverse effect on slash or longleaf pine pollen germination or seed set.

Caution

Ferbam is a mild poison. In handling this chemical, follow directions and heed precautions given on the container.

Store pesticides in original containers under lock and key—out of the reach of children and animals—and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment if specified on the container.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

Do not clean spray equipment or dump excess material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicides from equipment, do not use the same equipment for insecticides or fungicides that you use for herbicides.

Dispose of empty pesticide containers promptly. Have them buried at a sanitary land-fill dump, or crush and bury them in a level, isolated place.

NOTE: Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the U.S. Department of Agriculture, consult your county agricultural agent or State Extension specialist to be sure the intended use is still registered.

References

Preventing cone rust on slash pine by pollination techniques used in breeding purposes. F. F. JEWELL. Phytopathol. 47: 241–242. 1957.

A comparison of the pine-oak rusts. GEORGE G. HEDGCOCK and PAUL V. SIGGERS. U.S. Dep. Agr. Tech. Bull. 978, 30 p. 1949.

Southern cone rust: Distribution and control. OTIS C. MALOY and FREDERICK R. MATTHEWS. Plant Dis. Reptr. 44: 36–39. 1960.

Some aspects of the biology and the control of southern cone rust. FRED R. MATTHEWS. J. Forestry 62: 881–884. 1964.

Dioryctria cone moth attack as related to cone rust of slash pine in North Florida. E. P. MERKEL. J. Forestry 56: 651. 1958.

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Pesticide-Information Disclaimer

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