

FOREST AND SHADE TREE PESTS

Fusiform Rust of Pines

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Fusiform rust, caused by the fungus *Cronartium quercuum* f.sp. *fusiforme*, is the most serious disease affecting pines in the southern United States. Estimates of commercial timber losses to this disease in Florida alone have reached several million dollars annually. Fusiform rust is very serious on loblolly and slash pines, but can occasionally be problematic on longleaf pines as well. The disease affects seedlings in commercial forest and ornamental nurseries as well as trees in the field. Severe outbreaks of fusiform rust in commercial forest nurseries within the state in 1979 and 1980 resulted in losses of millions of seedlings valued at nearly \$150,000. Infected seedlings are rarely killed in the nursery by fusiform rust infections. Instead, they are rendered essentially useless because they will often die within 2 to 3 years following outplanting. If they survive, they are generally deformed, grow poorly, and frequently break off at the point of infection several years later.

RECOGNITION

Fusiform rust infection typically results in definitive swellings called galls on infected branches and stems (Fig. 1-A). Galls vary in appearance, but are most often spindle or fusiform in shape. On older trees, it is not uncommon for galls to appear somewhat depressed and canker-like on one or more sides of stems. “Witches brooms” – marked proliferations of small branches – are often associated with galled tissues, especially on seedlings, young trees, and branches. Stem galls are often associated with branches or branch stubs as a result of the rust fungus growing from infected branches into the main stems. Sometimes branches and stems are killed beyond the point of the galls. Stem breakage at galls is common. Pitch exudation is often associated with fusiform rust galls due to infestation by certain insects and/or infection by the



Fig. 1-B. First-year pine seedlings with pronounced lower stem swellings (galls) resulting from infection by the fusiform rust fungus.

pitch canker fungus. In the early spring, masses of showy, yellow-orange blisters called aecia (sing., aecium) appear on the surface of active galls. The aecia soon rupture and expose masses of powdery, yellow-orange spores (aeciospores).

Fusiform rust infections of first-year nursery seedlings appear as distinct knots or elongated swelling (galls) at or near the base of seedlings (Fig. 1-B). Occasionally, galls occur below the soil line in commercial forest nurseries and are therefore hidden from view. This may be especially true with longleaf pines due to their grass-stage growth habit; seedling galls (knots) appearing just below the terminal bud. In general, seedling galls are not well developed until late in the growing season (fall or early winter). However, latent gall

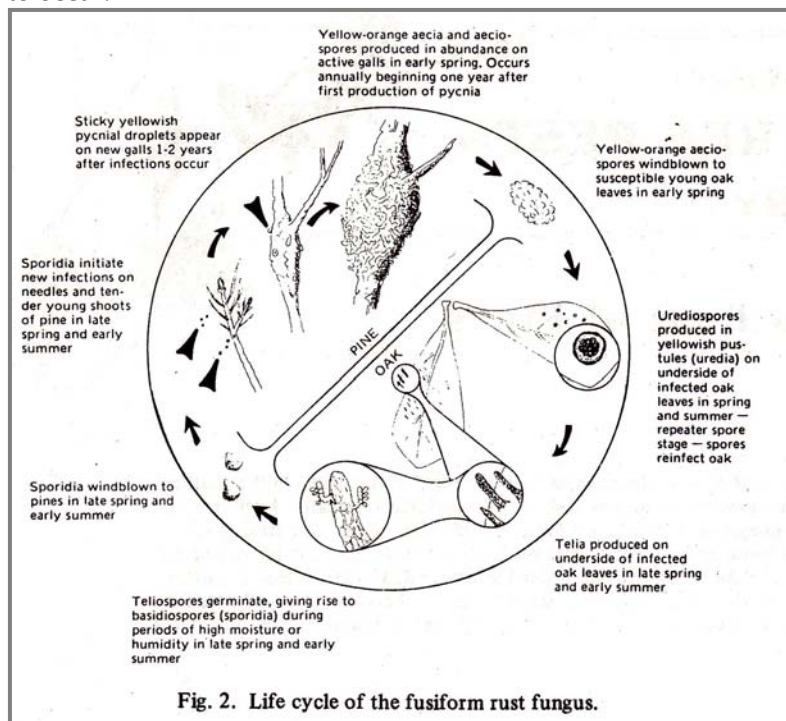
development, in which galls do not develop until after seedlings are lifted and outplanted in forest plantations, can also occur.



Fig. 1-A. Young pine with fusiform rust infections on both the main stem (right) and branch stub (left).

INFECTION BIOLOGY (Fig. 2)

Aeciospores produced on infected pines do not reinfect other pines. Instead, they are disseminated by wind and initiate infections on the tender young leaves of a variety of oaks. Oaks in the red or black oak group are particularly susceptible as alternate hosts with water, willow and laurel oaks heading the list. Later, in the spring and early summer, two different spore types (urediniospores and teliospores) are produced on the undersurface of infected oak leaves. Urediniospores are produced first and are often called “repeaters,” because they serve to initiate new infections on the leaves of susceptible oaks, thus repeating the infection cycle on the oaks. Teliospores are produced later in red-brown, hair-like structures called telial columns, telial horns, or simply telia (sing., telium). Under conditions of warm temperatures and high relative humidities (60-80 F & 97-100% RH) the teliospores germinate, giving rise to minute spores called basidiospores or sporidia. Sporidia are wind-disseminated and initiate new pine infections on susceptible pine tissues including needles and succulent green bark. Sporidia are extremely delicate and can quickly lose their ability to cause infections if weather conditions are excessively dry. However, only a few hours of warm temperatures and adequate moisture on the surface of susceptible tissues are required for infection to occur.



CONTROL

Fusiform rust is readily controlled in seedling nurseries with the careful application of appropriately registered fungicides. Planting pines which are genetically resistant to fusiform rust infections is recommended in commercial forestry operations, especially in high hazard areas. Avoid excessive site preparation when establishing pine plantations because this sometimes increases the incidence of infections, apparently by stimulating the growth of trees resulting in either greater susceptibility, or larger target areas for infection (shoots of tender, succulent tissues). Delaying fertilization of young pine stands in high hazard areas until pines have grown beyond the size of critical vulnerability (about 8 years

of age) is often advisable for similar reasons. Stem infections occurring after this period are usually located in the upper crown and are of little consequence. Reduction of oak populations where economy and management allow may be effective in reducing pine infections on a local scale. Salvage thinnings or complete harvest should be considered in severely diseased stands of marketable age. Destroy severely infected young stands and reestablish stands with either less susceptible species, or genetically resistant planting stock. Avoid outplanting infected nursery stock. In urban areas, remove infected trees that represent stem breakage hazards. Prune infected branches, especially if galls are within 30 cm of the main stem. Branch galls more than 30 cm from the stem are unlikely to pose a significant threat to stems. Branches with these types of infections are likely to die, killing the fungus at the same time, before the pathogen can grow into the stem. Careful surgery, removing the bark around galls encompassing less than 30% of the circumference of young, vigorously growing stems, is an apparently effective treatment in certain cases.

FORESTRY OFFICES

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11650 Munson Highway
Milton, FL 32570
850/ 957-6140

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Chipola Forestry Center
715 West 15 Street
Panama City, FL 32401
850/872-4175

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865 Geddie Road
Tallahassee, FL 32304
850/ 488-1871

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Perry District Office
618 Plantation Road
Perry, FL 32348
850/ 838-2299

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137 SE Forestry Circle
Lake City, FL 32025
386/ 758-5700

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7247 Big Oaks Road
Bryceville, FL 32009
904/ 266-5001

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Waccasassa Forestry Center
1600 N.E. 23rd Ave
Gainesville, FL 32609
352/ 955-2005

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5001 US Highway 1, North
Bunnell, FL 32110
386/ 446-6785

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Withlacoochee Forestry Center
15019 Broad Street
Brooksville, FL 34601-4201
352/ 754-6777

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8431 S. Orange Blossom Trail
Orlando, Florida 32809
407/856-6512

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5745 S. Florida Ave.
Lakeland, FL 33813
863/ 648-3163

15. Manatee, Desoto, Hardee, Sarasota and Charlotte Counties

Myakka R. District Office
4723 53rd Ave., E.
Bradenton, FL 34203
941/ 751-7627

16. Okeechobee, St. Lucie, Martin, Highlands, Indian River, and Glades Counties

Okeechobee District
5200 Hwy. 441 North
Okeechobee, FL 34972-8697
863/ 462-5160

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Caloosahatchee District Office
10941 Palm Beach Blvd.
Fort Myers, FL 33905
239/ 690-3500 ext. 100 or 101

18. Palm Beach, Broward, Miami-Dade, and Monroe Counties

Everglades District
3315 S.W. College Ave.
Davie, FL 33314
954/ 475-4120

Prepared by Dr. Edward Barnard, Forest Pathologist, Florida Forest Service. Illustrations by Chris Walton, Illustrator, Division of Plant Industry, and Dr. Wayne Dixon, Forest Entomologist, Florida Forest Service. For further information, please contact your local office of the Florida Forest Service.