

SOUTHERN CONE RUST

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Southern cone rust has been recognized in Florida since 1892 (5,6) and is perhaps the most serious disease affecting the cones of commercially important pines in the state. This disease has been reported on slash (*Pinus elliotii* Engelm. var. *elliotii*) and to a lesser extent longleaf (*P. palustris* Mill.) pines throughout much of north Florida, as well as parts of south Georgia and the gulf coastal plain into Louisiana (3,4,5,6,11,12). Infections (occasionally heavy) have also been observed on South Florida slash pines (*P. elliotii* var. *densa* Little & Dorman) as far south as southern Highlands County (authors-unpublished). In some years, cone (and therefore seed) losses directly attributable to southern cone rust infections have ranged from 20 to nearly 100% in certain areas (4,5,6,7,10,11). Additional, indirect losses undoubtedly result from insects (especially cone moths; *Dioryctria* spp.) which are attracted to infected cones where they lay eggs, and expanding populations then infest and destroy nearby disease-free cones (4,6,10,11). To the typical homeowner, southern cone rust may be nothing more than a curiosity since it is often sporadic in occurrence and damages only cones. To foresters, however, southern cone rust can be cause for concern due to its potential to substantially reduce the production of seed for forest regeneration. This potential was recently underscored by the loss of ca. 25% of one year's cone and seed crop to southern cone rust in one high-value, genetically improved seed orchard in north Florida (C. W. Fatzinger, U. S. Forest Service, SEFES - personal communication).

THE PATHOGEN AND ITS LIFE CYCLE. Southern cone rust is caused by the macrocyclic, heteroecious rust fungus *Cronartium strobilinum* (Arth.) Hedgc. & Hahn (formerly, *Caeoma strobilina* Arth.) (1,5). Pycnial and aecial spore stages are produced on infected cones of susceptible pines while the uredial and telial stages are produced on the leaves of evergreen oaks which serve as alternate hosts; particularly, live oak (*Quercus virginiana* Mill.), running oak (*Q. pumila* Walt.), and dwarf live oak (*Q. minima* (Sarg.) Small), as well as a variety of others. First-year female strobili of host pines are susceptible to infection by aerially disseminated sporidia (= basidiospores produced by the germinating teliospores on the oak hosts) from the time they emerge from the bud scales until natural pollination has ceased (ca. late January into mid-February for slash pine). Shortly after the pollination season, infected conelets swell rapidly so that by April they are often 3-4 times larger than their disease-free counterparts (Fig. 1-A). During this time, scales of infected cones display a reddish discoloration, and diseased cones exude a sweet pycnial fluid which is attractive to nectar-loving insects (above). In late spring (April-June), infected cones are readily visible at long distances due to the production of large powdery masses of cadmium yellow to yellow-orange aeciospores (Fig. 1-B).

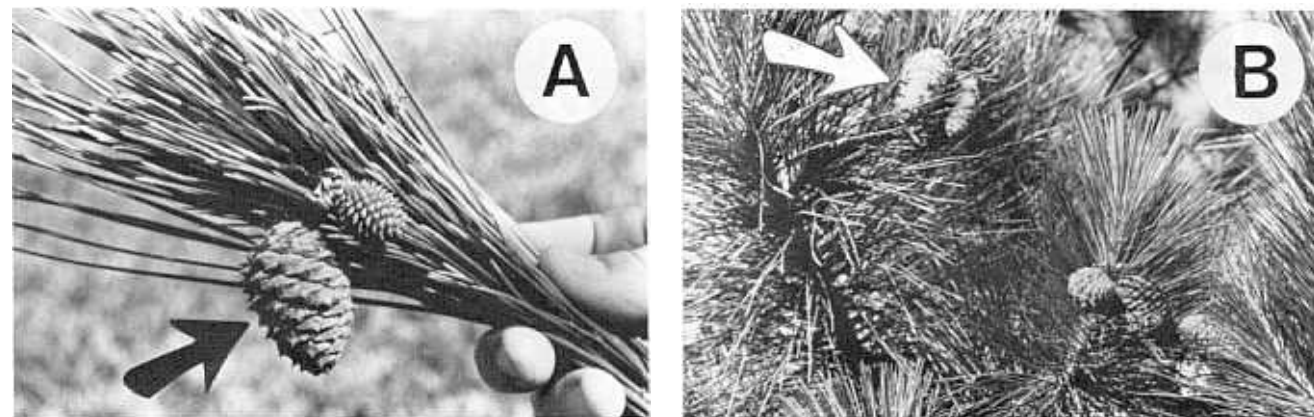


Fig. 1. Symptoms and signs of southern cone rust on *Pinus elliotii* var. *densa*. A) Infected (arrow) and disease-free first-year conelets. B) Infected first-year cones displaying profuse powdery masses of yellow-orange aeciospores (arrow). (DPI Photo #702257)

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Aeciospores are wind disseminated to the leaves of the susceptible, alternate host oaks where they initiate infections which give rise to the uredial and telial stages of the pathogen. Diseased cones abort and usually drop from the tree by mid to late summer, although some hypertrophied red-brown to brown, somewhat shriveled "mummies" may cling to the trees for longer periods. Uredia can be found in September, and telia are produced coincident with the emergence of the female strobili on the host pines the following January and February, thus completing the life cycle. The production and liberation of the pine-infective sporidia are greatly enhanced by periods of high atmospheric humidity (2,4,5,6,8,10,11).

CONTROL. Southern cone rust can be effectively controlled by spraying with ferbam at a concentration of 2 pounds of the 76% wettable powder plus 1/2 pound of a spreader-sticker in 100 gallons of water (6,9,10,11). Applications should be made to run-off at 5-day intervals, beginning as soon as female strobili begin to emerge from the bud scales and continuing until all natural pollination has terminated, a period of about 25-30 days in most years, although this may be extended by colder weather, etc. Fungicidal protection is especially critical during prolonged periods of high atmospheric humidity (6,11). In cases where the option is available, it is wise to locate slash and longleaf pine seed orchards away from heavy concentrations of oaks which serve as alternate hosts for the pathogen. Alternate host eradication in areas of silvicultural seed production (seed orchards, seed production areas, etc.) may also be helpful in reducing overall disease pressure. Whether or not the systemic (and eradicant) fungicide Bayleton[®], so effective against fusiform rust (caused by *C. quercuum* (Berk.) Miyabe ex. Shirai f. sp. *fusiforme*) on pine seedlings (13) would be effective against *C. strobilinum* is unknown, but the possibility warrants testing. Some degree of natural biological control is apparently provided by the fungus, *Darluca filum* (Biv. Bern. ex Fr.) Cast., but practical utilization of this hyperparasite is untested and uncertain at present (8).

SURVEY AND DETECTION. Look for enlarged and discolored first-year conelets in the early spring. These conelets will usually be covered with sticky pycnial fluid and will frequently be supporting larvae of insects such as *Dioryctria* spp. In late spring (April - June) look for greatly enlarged conelets supporting profuse, powdery masses of yellow-orange aeciospores.

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