Cylindrocladium Root Rots of Sweetgum Seedlings in Southern Forest Tree Nurseries

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ABSTRACT

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Sweetgum seedlings have been killed or stunted by *Calonectria crotalariae, Calonectria kyotensis,* and *Cylindrocladium scoparium* in North Carolina, South Carolina, and Mississippi forest nurseries. In one affected seedbed, 24% of 2,400 seedlings had root rot symptoms. This first report of *Calonectria crotalariae* damage in forest tree nurseries includes new host records for all three fungal species.

Additional key words: basal stem canker, *Cylindrocladium floridanum*, homothallic, *Liquidambar styraciflua*

Cylindrocladium root rots caused by *Cylindrocladium scoparium* Morg. and *Calonectria kyotensis* Terashita (=*Cylindrocladium floridanum* Sobers and Seymour stat. conid.) cause widespread mortality of both conifer and hardwood seedlings in the eastern United States (5). The primary conifer hosts are eastern white pine (*Pinus strobus*), red pine (*P. resinosa*), black spruce (*Picea mariana*), and Fraser fir (*Abies fraseri*); the primary hardwood hosts are black walnut (*Juglans nigra*) and yellow-poplar (*Liriodendron tulipifera*) (1-3, 5, 7, 8).

Isolates of *Calonectria crotalariae* (Loos) Bell & Sobers from peanuts were extremely virulent to yellow-poplar compared with *Cylindrocladium scoparium* and *Calonectria kyotensis* from hardwoods (1,6). This paper reports sweetgum (*Liquidambar styraciflua* L.) seedlings as hosts for two *Calonectria* spp. and *Cylindrocladium scoparium.*

MATERIALS AND METHODS

Diseased sweetgum seedlings were collected from nursery beds near Lumberton, NC; Summerville, SC; and Brooklyn, MS. Since the causal agent was not known, infected root tissues were surface-sterilized for 1 min in 0.5% or 2.0% sodium hypochlorite or 65% ethyl alcohol and plated on potato-dextrose agar, malt extract agar, water agar, pentachloronitrobenzene agar (11), corn meal agar with PCNB, or Czapek's agar amended with 100 ppm streptomycin sulfate (CzS). The plates were incubated at room temperature (approximately 18 C) under cool-white fluorescent lights on a 12-hr day or in a laboratory without supplemental light.

The pathogenicity of *Cylindrocladium crotalariae, Calonectria kyotensis,* and *Cylindrocladium scoparium* to sweetgum seedlings was confirmed with two soil inoculation procedures. In one method, 10 g of oat inoculum was added to each of 35 pots of seedlings for each fungus (6). Three months later roots were examined for symptoms. In a second test, each of 25 seedlings was inoculated with 3 ml of a microsclerotial suspension of each fungus (1,13). Five months later seedling death was recorded.

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RESULTS

Sweetgum seedlings were diseased in several beds at the nurseries. Many seedlings were wilted and dead. Other seedlings had discolored and wilted foliage and were severely stunted but remained alive. Infected root tissue was blackened in contrast to white healthy root tissue. Lateral roots were frequently rotted, leaving only scattered healthy sections on the taproots (Fig. 1). In one

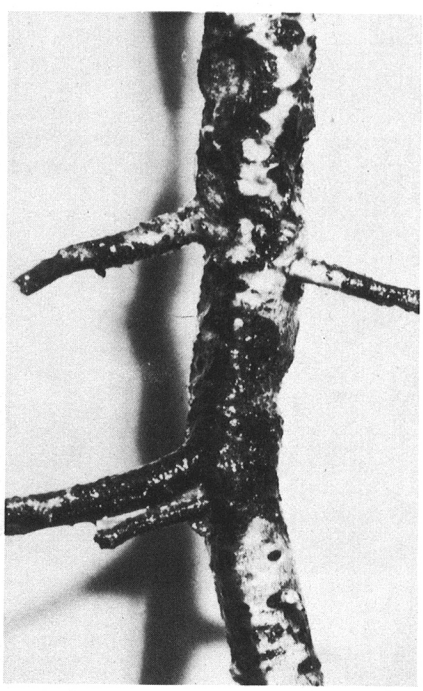

Fig. 1. Root rot symptoms associated with *Calonectria kyotensis* infection on sweetgum seedling roots. Note the extensive blackened and necrotic areas on the primary taproot and on lateral roots.

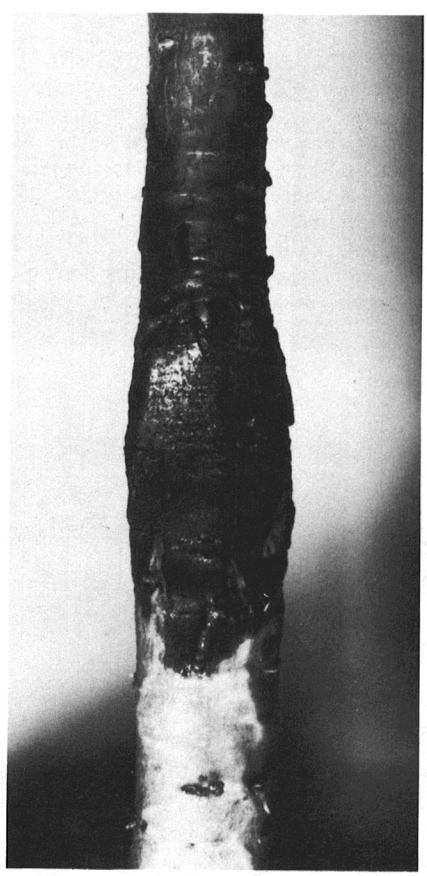

Fig. 2. Basal stem canker on a sweetgum seedling. *Calonectria kyotensis* was isolated from this type of canker.

Table 1. Relative pathogenicity of *Cylindrocladium scoparium, calonectria kyotensis,* and *Calonectria crotalariae* to sweetgum seedlings with two inoculation procedures.

Inoculum	No. of seedlings per fungus	Symptoms	Percentage incidence		
			C. scoparium	*C. kyotensis*	*C. crotalariae*
Infested oats	35	Root lesions	84	89	84
Microsclerotia	25	Death	20	90	94

seedbed in the Summerville nursery, 24% of 2,393 seedlings had root rot symptoms at lifting in late February 1979. Basal stem cankers were observed on 1% of the seedlings (Fig. 2).

Cylindrocladium crotalariae was recovered from 67% of 255 tissue samples from 14 of 15 symptomatic sweetgum seedlings at the Lumberton nursery. *Calonectria kyotensis* was recovered from the other seedling, from 32% of 96 sweetgum root tissue samples, and from 6% of 16 basal stem cankers sampled at Summerville. *Cylindrocladium scoparium* was isolated from 30% of the sweetgum roots from the Brooklyn nursery.

Calonectria spp. were recovered on all six media and varied from 29% on amended Czapek's agar to 97% on malt extract agar. The *Cylindrocladium* stages were present in 7–14 days. Incubation with 12-hr days for approximately 30 days was sufficient for formation of mature perithecia by both species of *Calonectria.* The homothallic nature of the isolates of *Calonectria crotalariae* was confirmed by single sporing 25 germinating ascospores and 15 germinating conidia on potato-dextrose agar. Perithecia with ascospores formed within 30 days after incubation at room temperature with 12-hr days in all 40 single-spore isolates. The homothallic nature of some isolates of *Calonectria* has been reported (10).

In the pathogenicity tests, all three fungi caused large black necrotic areas on the roots of sweetgum seedlings when infested oats were used as inoculum (Table 1). When microsclerotia were used as inoculum, *Cylindrocladium scoparium* caused fewer seedling deaths than the other two species. The fungi were readily isolated from necrotic spots and dead seedlings to confirm Koch's postulates.

DISCUSSION

These pathogenicity tests confirm sweetgum as a host for these fungi. Cordell (1) indicated that sweetgum is one of the most susceptible hardwood species. The threat of the three Cylindrocladium root rot organisms to plantations established with infected seedlings must be considered, since *Cylindrocladium scoparium* has been associated with mortality in a pole-size sweetgum stand and a yellow-poplar plantation (4,12). However, in outplantings of black walnut in eastern North Carolina and yellow-poplar in western Tennessee, Cordell (1) indicated that seedlings with a root collar diameter of 9.5 mm (3/8 in.) or larger and with less than 25% root rot at planting had approximately the same field survival as apparently healthy seedlings of the same size, age, and species. Consequently, recommendations were made to the Lumberton and Summerville nurseries to cull all sweetgum seedlings of less than 9.5-mm root collar diameter with any visible root rot along with larger seedlings with 25% or more root rot. In addition, sweetgum seedlings at the Summerville nursery with various amounts of root rot were outplanted near Summerville in April 1979. This outplanting is scheduled for annual measurements of survival, growth, and root rot and should provide information on the long-term effect of planting infected seedlings.

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