Cylindrocladium Root Rot of Kiwifruit

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ABSTRACT

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A new disease of kiwifruit (*Actinidia chinensis*) has been confirmed in South Carolina. Symptoms appear as a rapid wilting of the foliage and subsequent death of plants in newly established vineyards. Extensive reddish brown to black root rot is common, and a brown discoloration of stem tissue below the bark may extend 2–6 cm above the soil line. Reddish orange perithecia occasionally develop on the lower stems of severely affected plants. A species of *Cylindrocladium* was consistently isolated from infected stem and root tissues of kiwifruit plants from two widely separated vineyards in the state, and proof of pathogenicity was demonstrated in greenhouse tests. Morphological observations tentatively indicate the pathogen is *Cylindrocladium crotalaria* (perfect stage *Calonectria crotalaria*). In a greenhouse test, a North Carolina isolate of *C. crotalaria* from peanut caused root rot symptoms on kiwifruit plants similar to those caused by an isolate of the fungus from kiwifruit.

Kiwifruit (*Actinidia chinensis* Planch.) recently has been introduced as a potential commercial crop in South Carolina. In 1985, rapid wilting and death of numerous kiwifruit plants was observed within a year of transplanting in two of the state's earliest established vineyards in widely separated Florence and Charleston counties. Both vineyards have a recent history of soybean production. Extensive reddish brown to black root rot of affected plants was characteristic, and a brown discoloration of stem tissue below the bark often extended 2–6 cm above the soil line. Reddish orange perithecia occasionally developed on the bases of affected plants.

Studies were initiated to determine the etiology of this kiwifruit disorder.

MATERIALS AND METHODS

To isolate the pathogen, small pieces of basal stem tissue were surface-disinfested in 1% sodium hypochlorite for 2–10 min, then rinsed in sterile, distilled water and plated on acidified potato-dextrose agar (PDA). After 3 days of incubation at 23 C, mycelium from the edge of advancing colonies was transferred to PDA in petri plates for maintenance. Conidia, conidiophores, and vesicles from these cultures were examined.

Perithecia were induced by culturing the fungus under continuous light on oatmeal agar and on sterilized kiwifruit stems on water agar at 23–26 C for 21 days. Microscopic examination was made of perithecia, asci, and ascospores from these cultures.

Microsclerotia were produced in cultures by growing the fungus in 250-ml flasks containing 75 ml of 2% malt extract broth. After 5 wk, 100 ml of sterile distilled water was added to each flask and the contents were comminuted in a Waring Blendor for 15 sec. Three 3-ml aliquots of the fungal suspension were injected by syringe 3 cm below the soil surface around the bases of 18-mo-old kiwifruit plants (cultivar Hayward) grown in a peat moss-vermiculite medium in 15-cm-diameter plastic pots. Three plants were inoculated with the fungal suspension, and three uninoculated control plants were treated with diluted malt extract broth only. The plants were maintained in a greenhouse at 25 ± 6 C for 11 wk before examination of roots and reisolation of the suspected pathogen. Reisolation from the roots of inoculated plants was made by the method previously described. The inoculation

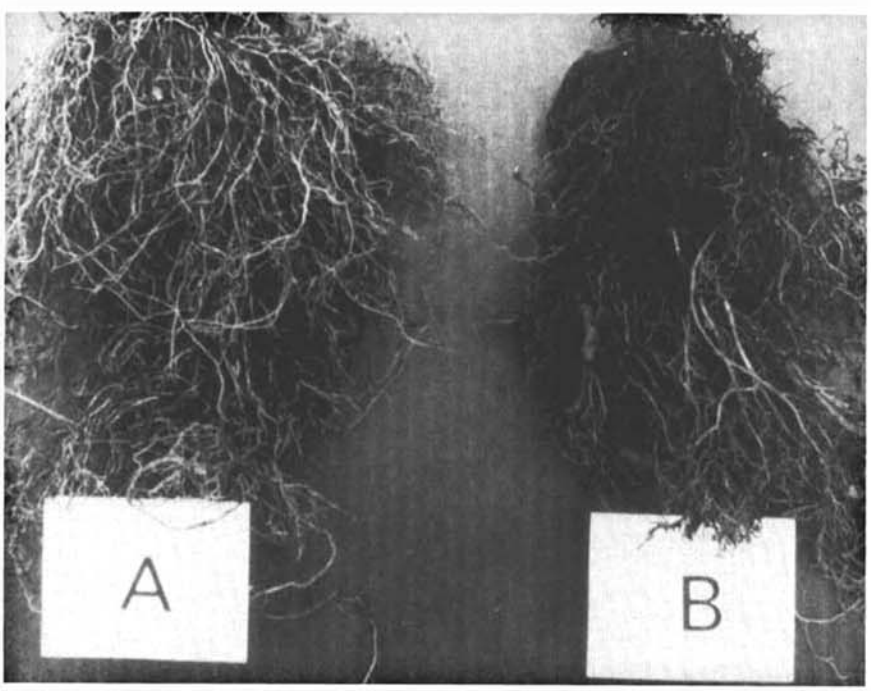

Fig. 1. Kiwifruit root systems **(A)** uninoculated and **(B)** inoculated with an isolate of *Cylindrocladium crotalaria* from kiwifruit after an 11-wk incubation.

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test was repeated using four plants per treatment and separately inoculating with an isolate of *Cylindrocladium crotalaria* from peanut and the isolate from kiwifruit.

RESULTS AND DISCUSSION

In the initial test of pathogenicity, kiwifruit plants inoculated with the suspected pathogen developed extensive root rot within 11 wk of inoculation (Fig. 1). An average of 25% of the root system of each plant was necrotic and discolored, including primary, secondary, and tertiary roots. The control plants showed no root necrosis. The fungus isolated from necrotic roots of inoculated plants was similar to the fungus initially isolated from basal stem tissue of naturally infected plants. In the second inoculation test, both the isolate of *C. crotalaria* from peanut and the isolate from kiwifruit caused similar root necrosis of inoculated plants. The fungus again was isolated from necrotic roots of these plants.

The fungus grows well on PDA and oatmeal agar and in malt extract broth. On PDA, it produces light gray to white weblike aerial mycelium and a burnt orange to dark brown submerged growth consisting mostly of microsclerotia. Perithecia are readily produced on oatmeal agar and on sterile kiwifruit stems on water agar. The perithecia are reddish orange, globose to obovate, averaging 390 × 303 μm, and have a papillate ostiole. The asci are clavate, thin-walled, long-stalked, and contain eight spores. The ascospores are fusoid, hyaline, granular, and mostly three-septate when mature.

The conidia are of the genus *Cylindrocladium*. They are hyaline, granular, cylindric, rounded at both ends, slightly wider at the base than at the apex, mostly three-septate, and average 56.3 × 6.6 μm. Conidiophores are borne laterally on a stipe and are dichotomously or trichotomously branched. The stipes terminate in a hyaline, globose vesicle.

The pathogen is a species of the genus *Calonectria* with a *Cylindrocladium* imperfect stage. A review of the literature shows seven species of *Calonectria* with *Cylindrocladium* imperfect stages previously reported. Among these, the description of *Calonectria crotalaria* (Loos) Bell & Sobers (1,2) resembles the species isolated from kiwifruit.

This is the first report of *Calonectria crotalaria* (imperfect stage *Cylindrocladium crotalaria*) infecting kiwifruit. On the basis of this tentative identification, it is suggested that kiwifruit vineyards not be established on soil with a recent history of soybean or peanut production, because these crops are common hosts of *C. crotalaria* (4,5). Because of the costly investment in establishing a kiwifruit vineyard and the length of time the kiwifruit plants are expected to produce, it may prove practical to assay prospective vineyard sites for microsclerotia of *Cylindrocladium* following the method of Phipps et al (3) before choosing a planting location.

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