

A Newly Recognized Symptom of Sugar Beet Root Infection Caused by *Phoma betae*

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ABSTRACT

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A symptom of infection of sugar beet roots by *Phoma betae* is the black color of vertical growth fissures on the hypocotyl. Standard isolation procedures and surface disinfection treatments of infected roots showed that tissue penetration by the fungus was shallow and restricted largely to the hypocotyl.

Phoma betae (Oudem.) Frank (= *Pleospora bjoerlingii* Byford) infects almost every part of the sugar beet plant (*Beta vulgaris* L.) (2,3). Black color is commonly associated with sugar beet tissue infected with *P. betae*, including seedling black leg, black necrosis on seed stalks, and blackening associated with crown and root rot in stored beets. Blackening is also associated with the fungus grown in culture. The black color of infected tissue is a symptom useful for diagnosing older roots infected with *P. betae*. Evidence to support this conclusion is presented.

MATERIALS AND METHODS

Sugar beet (*B. vulgaris*) seeds of cultivar US H20, obtained from the West Coast Beet Seed Co., Salem, OR, were more than 95% naturally infected with *P. betae*.

Surface-disinfested seeds were planted (6-10 seeds per pot) in autoclaved soil in 15-cm clay pots in a glasshouse where daytime temperatures were 17-29 C and nighttime temperatures were 20 ± 3 C. After emergence, seedlings were thinned to one per pot and allowed to grow for 90 days. Thirty roots were harvested,

washed in running water for 30 min, and dried. Roots were suspended for 2 min in 2% sodium hypochlorite, 75% ethanol, or water, then rinsed several times in distilled water. Crowns (stems) of the treated roots were removed. The remaining parts were divided into three zones: hypocotyl, upper, and lower root. Each zone was divided into 5-7 disks 1.5-2 mm thick. Disks of the same zone were cultured on selective agar (1) either individually or in groups of two or three. A 2-mm cork borer was used to take disks from the edges of the three zonal disks and place them adjacent to their source in the same plates for incubation at 20 ± 2 C with 24 hr of incandescent light. Plates were examined microscopically for hyphal growth every 24 hr for 10 days. The procedure was repeated twice, and 60 roots were used each time.

Fifty roots of cultivar ACH 17 were harvested by hand from a commercial field in the Red River Valley in 1978 where *Phoma* leaf spots were prevalent. The harvested roots were washed and stored in perforated plastic bags at 10 ± 4 C for 48 hr. Specimens (1-cc) with dark fissures were removed from roots and then surface disinfested with 2% sodium hypochlorite for 2-3 min. The specimens



Fig. 1. Greenhouse-grown roots with black vertical fissures (arrows) on the hypocotyl.

were then cultured on selective agar (four or five per plate) (1). Plates were incubated at room temperature. Data were recorded every 48 hr for 2 wk. This procedure was repeated with 50 roots that were harvested from a field plot at the North Dakota Agricultural Experiment Station, Fargo.

A 200-seed sample of ACH 17 from the same seed lot used to plant the commercial field was assayed for *P. betae* on selective agar (1).

RESULTS AND DISCUSSION

Black fissures were present on hypocotyls of plants grown from infested seed in the greenhouse (Fig. 1). In this case, seed was the primary source of inoculum. The results of culturing root tissues from greenhouse-grown plants are summarized in Figure 2. *Phoma betae* was detected in 75% of 927 hypocotyl sections, in 25% of 1,447 upper root sections, and only 2% of 1,430 lower root sections. The prevalence of *P. betae* in tissues treated with sodium hypochlorite was nearly identical to that in tissues treated with water. There was no recovery of *P. betae* from tissues after treatment with 75% ethanol. Evidently, *P. betae* is restricted to the tissue near the surface of the root, and ethanol penetrated the tissues far enough during the 2-min exposure to kill the fungus. Additional evidence of shallow penetration of *P. betae* was that the fungus initiated growth

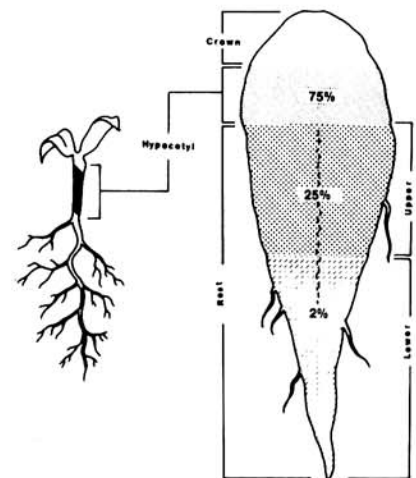


Fig. 2. A sugar beet seedling diagram showing the hypocotyl (black) where most of the colonization by *P. betae* takes place. The greenhouse roots grown from infested seed showed that 75% of hypocotyl, 25% of upper, and 2% of lower root tissues were infected with *P. betae*.

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Fig. 3. Field-grown roots with black fissures. *Phoma betae* was isolated from black fissures on left root (arrow) from a commercial field. Arrow on right root from the field plot indicates normal color of uninfected fissures.

only from the epidermal edges of disks taken from greenhouse-grown roots.

Shallow, longitudinal fissures developed

in the hypocotyl region of roots grown in the commercial field (Fig. 3). The fissures were probably caused by expansion

during growth. If these fissures were black, *P. betae* could be isolated from them. Uninfected fissures were tan. A sample of seed used to plant this field was free of *P. betae*; therefore, the black color of the fissures and *Phoma* leaf spots on plants in this field probably were caused by soilborne inoculum.

Attempts to isolate *P. betae* from roots harvested from the field plot were unsuccessful. *Phoma* leaf spots and black fissures were not found.

The prevalence of fungi, other than *Phoma*, that could be cultured from black fissures was very low. Therefore, we now recognize the symptom of black vertical fissures on sugar beet hypocotyls as evidence of infection by *P. betae*.

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