



PHYSODERMA BROWN SPOT OF CORN

Physoderma brown spot disease of corn and of the closely related teosinte (*Zea mays* subsp. *mexicana*) is caused by the fungus *Physoderma maydis* (*P. zeaemaydis*). Brown spot occurs primarily in the southeastern United States, the Gulf Coast, and the lower Mississippi Valley where yield reductions from loss of grain and lodging of 25 percent or more have been recorded.

Brown spot is usually a minor disease in Illinois, restricted by weather conditions to the warmest and most humid regions of the state. The disease has appeared only occasionally in Illinois since first being found in 1911. A localized outbreak of the disease



Symptoms of Physoderma brown spot on corn leaf blades. Yellow halos darken as the corn plant matures.

occurred in southeastern Illinois in 1971 after considerable rainfall during the early growth of the corn crop. In a number of bottomland fields near the Wabash and Ohio Rivers, 80 percent or more of the corn plants lodged because of extensive infection at the nodes under the leaf sheaths, greatly weakening the stalks. Yield losses caused by the lodging of infected plants increased further during windy weather as the crop matured.



Figure 2. Physoderma maydis infection of a corn leaf and leaf sheath. Under favorable conditions, severe stalk rot will develop at nodes beneath the leaf sheath.

Symptoms

Brown spot lesions first appear as very small, round-to-oblong, yellowish spots on the leaf blade (Figure 1), leaf sheath (Figure 2), stalk, and rarely on the husks and tassel of the outer ear. The spots may occur in bands across the leaf blade. Infected tissues turn a chocolate brown to reddish brown and merge to form large blotches with an irregular, angular appearance (Figure 3). Cells of infected corn tissue disintegrate to expose dusty pustules (brown blisters) containing enormous numbers of microscopic sporangia (18 to 24 by 30 to 30 microns). The sporangia are a golden brown to dark brown. Infection at the nodes beneath the leaf sheaths and the premature death of plants from leaf blights favor stalk rot and lodging (Figure 4).

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Disease Cycle

The thick-walled, brown sporangia (resting spores) formed within infected cells enable *P. maydis* to overwinter in corn debris or in the soil. The sporangia are released from infection pustules, disintegrating corn debris, and soil and are carried to susceptible plants by air currents, insects, splashing rain or flowing water, and humans. Corn becomes increasingly susceptible to *Physoderma* until the plants are about 45 to 50 days old; susceptibility declines steadily after that.

Free water is required for infection. When moisture is present in the whorl or behind the leaf sheaths and temperatures are relatively high (73° to 90°F, 23° to 30°C), a sporangium “germinates” to release 20 to 50 swimming zoospores. The zoospores move about in water for 1 to 2 hours before settling down, becoming amoeba-like, and penetrating young meristematic tissue with fine infection hyphae. The resulting mycelium enters mesophyll or parenchyma cells and forms larger, vegetative structures (Figure 5). Infection commonly occurs in a diurnal cycle, resulting in alternating lateral bands of infected and healthy leaf tissue as it emerges from the whorl. Zoospores of *P. maydis* can infect corn tissue only during certain hours of the day and within a few hours after being released. The development of symptoms and the germination of new sporangia occur approximately 6 to 20 days after infection, completing the disease cycle (Figure 5).

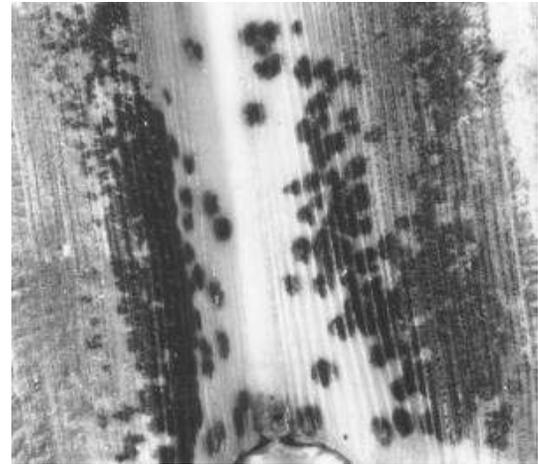


Figure 3. Close-up of a corn leaf blade showing the chocolate brown blotches, an advanced stage of *Physoderma* brown spot. Infected corn tissues contain large numbers of sporangia that may be released as the corn leaf ruptures and dies. Brown spot symptoms are most prominent in the leaf midrib area.

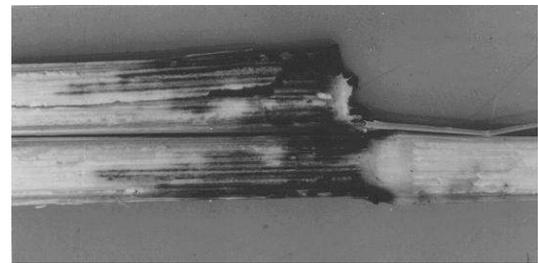


Figure 4. Severe stalk rotting and lodging may occur when *Physoderma maydis* invades the nodes of susceptible corn hybrids. (Courtesy G.L. Scheifele)

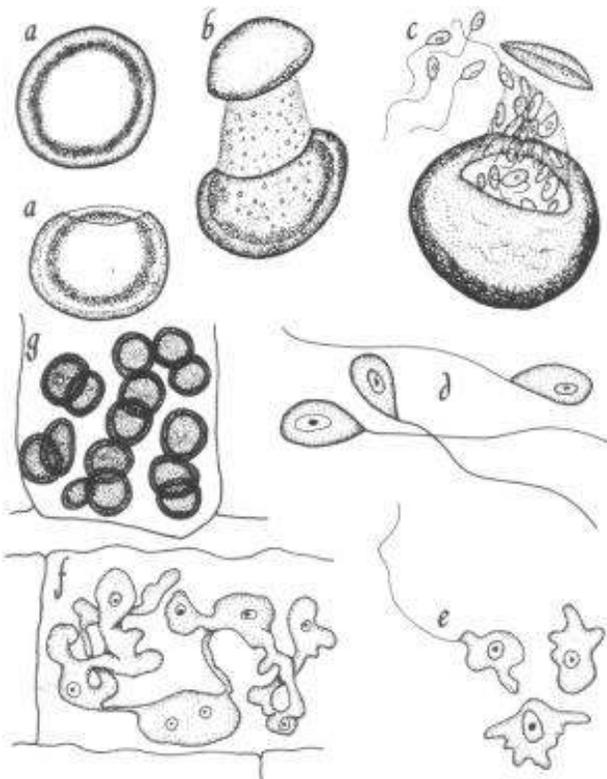


Figure 5. Stages in the life cycle of *Physoderma maydis* as seen through a high-power microscope. Stages a through g can occur in as short a period as 16 to 20 days. (a) Two sporangia (resting spores), top view and side view. (b) stage in opening of a sporangium, showing the early stage of zoospore formation. Note the dehisced operculum (lid) being carried up by the enlarging sporangium. (c) Mature zoospores escaping through the ruptured apex of the resting spore. (d) Three zoospores with a single flagellum from a germinated resting spore. (e) Germinating zoospores, amoeboid stage. (f) Rhizomycelium within a corn epidermal cell showing young sporangia at the ends of short hyphae. (g) Corn leaf cell filled with mature resting sporangia (Drawing by Lenore Gray).

Control

1. Plant resistant hybrids and varieties adapted to your area.
2. Shred infected corn debris in the fall and chisel plow. Tillage may be done in the fall or spring, depending on the conservation tillage practices recommended for the area.
3. Avoid planting known susceptible varieties in river-bottom soils or other high-humidity locations.
4. Rotate crops, since this may contribute to a reduction of inoculum. *Physothermum* is known to remain viable in the soil, as sporangia, for about 3 years. Spore-trapping data indicate that the sporangia can be blown or carried long distances and be spread easily to adjacent fields. Infected plants transported for silage can also move considerable numbers of sporangia into disease-free areas.

