Oak Wilt

Red oaks die quickly; white oaks may recover

Pathogen—Oak wilt is caused by the fungus *Ceratocystis fagacearum*. This disease occurs in Kansas, Nebraska, and South Dakota.

Vectors—Beetles in the Nitidulidae family and oak bark beetles (*Pseudopityophthorus* spp.) can transmit the fungus.

Hosts—Oak wilt is a disease of oak species. Species in the red oak group die more quickly than species in the white oak group.

Signs and Symptoms—The only visible signs are the black and gray fungal mats (fig. 1) that are common in infected red oaks but less common or less apparent in white oaks. The mats form beneath the bark soon after mortality. These mats occasionally raise and crack the bark (fig. 2). Other signs of the pathogen are microscopic. Laboratory tests and fungal culturing on agar media can be used to confirm the pathogen's presence.

Figure 1. Fungal mat of oak wilt disease. *Photo: Fred Baker, Utah State University, Bugwood.org.*

Figure 2. Cracked bark caused by fungal mat of oak wilt disease. *Photo: Joseph O'Brien, USDA Forest Service, Bugwood.org.*

For the red oak group, symptoms are often expressed in spring but can continue into the summer. Symptoms start from the tip and outer edges of leaves and move toward the midrib and base of leaves, often with a distinct margin (fig. 3). First, leaves turn dull green or bronze, can appear water-soaked, and wilt. Later, the leaves turn yellow and/or brown, curl around the midrib, and are shed at branch tips. Finally, both green and symptomatic leaves throughout the crown fall. Symptoms often develop quickly throughout the crown in red oak (fig. 4). Trees may die only 1 or 2 months after symptoms appear and seldom survive more than a year.

Figure 3. Oak wilt symptoms on red oak leaves. *Photo: D. W. French, University of Minnesota, Bugwood.org.*

Figure 4. Typical crown symptoms of oak wilt on red oak. *Photo: Joseph O'Brien, USDA Forest Service, Bugwood.org.*

Disease symptoms are more variable for species in the white oak group. Symptoms can be the same as those of red oaks with quick mortality, but typically, white oaks die slowly over several years, with only a few branches showing symptoms and dying per year. The leaves often remain attached with discoloration only at the margins. Other times, however, white oaks seem to recover. Brown to black discoloration commonly develops in the outer sapwood of infected white oaks (fig.5). This symptom is less common in infected red oaks.

Figure 5. Black streaks in the new sapwood caused by oak wilt disease. *Photo: Fred Baker, Utah State University, Bugwood.org.*

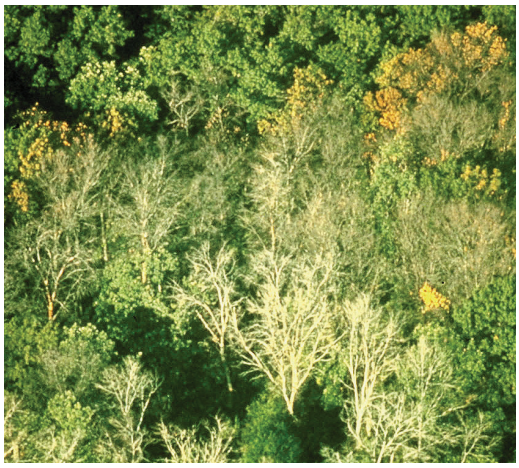

Figure 6. Oak wilt spread by root grafts. *Photo: D. W. French, University of Minnesota, Bugwood.org.*

Figure 7. Older fungal mat with bark beetle galleries. *Photo: C. E. Seliskar, North Carolina State University, Bugwood.org.*

Figure 8. Adult Nitidulidae beetle. *Photo: Pennsylvania Department of Conservation and Natural Resources, Forestry Archive, Bugwood.org.*

Figure 9. Adult oak bark beetle. *Photo: J. R. Baker & S. B. Bambara, North Carolina State University, Bugwood.org.*

Disease Cycle—Root grafts and insect vectors spread the oak wilt fungus. Root grafts are an effective means of transmitting the fungus from infected to nearby healthy trees. These grafts are a major factor in local spread of the oak wilt pathogen, especially in areas with deep, sandy soils and where oaks grow close together (fig. 6).

The fungal mats can enlarge and crack the bark (fig. 7). These aromatic mats attract insects such as sap-feeding Nitidulidae beetles and the fungal spores adhere to their bodies as they crawl over the mats (fig. 8). The beetles carry the spores to wounds on healthy oaks throughout the summer.

Oak bark beetles, Pseudo-pityophthorus spp., can also transmit the fungus (fig. 9). The beetles form breeding galleries in recently dead or dying oak stems and branches, including wilt-infected infected trees. The adults carry spores on their bodies when they emerge the following spring and infect healthy trees as they feed in spring and early summer.

This disease is a vascular wilt. Trees respond to infection by forming tyloses (where living parenchyma cells balloon into vessels as a defense response) that restrict water flow in the vessels. The pathogen spreads rapidly within vessels of red oaks and often more slowly in white oaks. The fungus overwinters as mycelium in infested trees and as fungal mats on dead trees.

Impact—The disease quickly kills red oaks and can cause reduced growth and mortality of white oaks. The disease range is expanding, and, in some areas, the incidence of disease is increasing.

Management—Sanitation (removal of infected materials) can significantly reduce new infections. If the mats or beetle galleries are present, trees should be cut, and the wood should be burned, buried, or chipped. The fungus can persist in cut wood with attached bark and in dead trees. After trees die, fungal mats continue to form and may attract beetles. Trees should not be pruned in spring or early summer when beetles are most active.

Mechanical and chemical barriers and severing root grafts between diseased and healthy trees are effective ways to prevent the spread of oak wilt through root grafts. New root grafts will not form between dead/dying trees and healthy trees.

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