



CENTRAL HARDWOOD NOTES

Elm Diseases

Dutch Elm Disease

Dutch elm disease was found in Cleveland, Ohio, in 1930, and is now in most of the contiguous 48 states. The disease is caused by a fungus that has killed millions of wild and planted elms. Losses have been the greatest in the eastern United States. The fungus attacks all elms, but our native species, American, slippery, and rock elm have little or no resistance to the disease. The most important and common of these, the American elm, is found on a wide range of forest sites and old fields.

Dutch elm disease produces wilted yellowing foliage, followed by dead, brown leaves dropping from the trees. In late summer, disease symptoms may be confused with typical fall coloration. Infected branches die after leaf drop. Affected branches develop a brown stain just under the bark, or a discoloration of the outer annual ring in a cross section of the branch. Disease symptoms usually start at the tips of one or more branches in the tree crown, followed by infection of all branches. Infected trees usually die within a year, but some die within weeks. Trees that become infected in the spring usually die quickly, whereas trees that are infected in the late summer or fall usually die the following season.



Figure 1 .-An American elm with Dutch elm disease. (U.S. Forest Service)

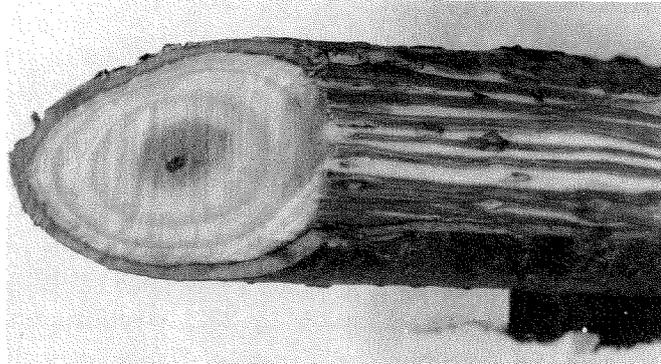


Figure 2.-Twig from American elm discolored from Dutch elm disease. (U.S. Forest Service)

In the U.S., the principal carriers of the Dutch elm disease fungus are two small, dark brown beetles: the smaller European elm bark beetle and the native elm bark beetle. The European species is the more common vector in most of the U.S., except in northern areas. Both of these beetles reproduce in diseased elms. Adults emerge from infected trees and carry fungus spores on their bodies to healthy elms. The spores germinate in feeding wounds and the fungus spreads throughout the tree, plugging the water conducting tissue and killing infected portions of the tree.



Figure 3.-Galleries of smaller European elm bark beetle. (U.S. Forest Service)

Dutch elm disease can also pass from infected trees to adjacent healthy elms via natural root grafts. When grafts occur, disease symptoms can develop suddenly throughout the entire tree. In some stands where elms are abundant, this form of disease transmission can be more significant than the spread resulting from beetles.

Even though Dutch elm disease has been present in the eastern U.S. for over 50 years, and despite the loss of millions of elms, this disease continues to cause significant mortality. The disease will cause significant losses in the future because elm continues to reproduce prolifically in many habitats.

It is difficult to predict the impact of Dutch elm disease in a hardwood stand. In general, large and closely spaced elms are susceptible to both beetle and root graft transmission of the disease thus promoting the rapid spread of the disease. Saplings and smaller trees are also susceptible to the disease and may serve as a reservoir of both beetles and the fungus. Control of Dutch elm disease in a forest stand is seldom feasible, but dead and dying trees can be salvaged if the quantity and quality are adequate for local markets. On a positive note, Dutch elm disease has increased the number of suitable nesting sites for birds and other animals.

Elm Yellows (Elm Phloem Necrosis)

Elms can be killed by a phloem infection commonly called elm yellows (previously known as elm phloem necrosis). The disease is caused by an organism intermediate between viruses and bacteria that is transmitted by the whitebanded elm leafhopper, or through root grafts between adjacent trees. Infections are known to occur naturally in American elm, slippery elm, cedar elm, winged elm, September elm, and slippery elm-Siberian elm hybrids. The susceptibility of rock elm is unknown. There have been localized epidemics of the disease in the east-central U.S. The range of elm yellows now includes portions of 22 states.

The foliar symptoms of the disease in American, cedar, September, and winged elms begin in mid-July to mid-September when the leaves yellow and droop and begin to fall prematurely. This sequence may take only a few weeks, and in most cases all branches have the symptoms. Occasionally, only a single branch shows symptoms, followed shortly thereafter by symptoms appearing on the remaining branches. Bright yellow leaves may be interspersed with green leaves on a branch, but usually all leaves become yellow-green, then yellow. The yellowing and premature leaf fall are similar to symptoms produced by water stress or poor nutrition. Symptoms that first occur in late summer or early autumn are difficult to distinguish from normal fall coloration. Twigs and small branches in elms killed by elm yellows seldom show the crooking or bending commonly seen in trees killed by Dutch elm disease. The phloem of yellows-infected trees is characterized by a butterscotch to dark brown color, particularly in the roots and butt. In larger stems, this discoloration occurs as vertical bands; in smaller crown branches, discoloration is usually absent.

Perhaps the most distinguishing character of yellows-infected elms is the presence of an oil-of-wintergreen odor on the surface of freshly exposed bark, especially in summer. This odor is sometimes present even before the phloem becomes discolored. When a tree has both Dutch elm disease and elm yellows, the symptoms of Dutch elm disease usually mask those of the yellows.

In cedar, September, and winged elms foliar symptoms usually develop first on a single branch, and trees often live more than one year while showing symptoms. As in American elm, they do not recover. In infected slippery elms, witches'-brooms usually form during the final season before death and the wintergreen odor is never present.

The whitebanded leafhopper that efficiently transmits the organism among American elms has the distinctive white band across its back only in its immature stage. Adult leafhoppers (dark brown with whitish spots on the wing covers) are present from early June until killed by frost, which coincides with the period when most disease inoculations occur. Other insect vectors are probably involved in disease transmission.

Epidemics of elm yellows, which can cause great losses, are geographically localized, spreading slowly (if at all) into surrounding areas. The disease can be endemic in an area for many years, so once an outbreak occurs, most of the elms in a locality die. Yellows epidemics proceed more slowly than Dutch elm disease. The disease is prevalent in stands having large elm populations, but very likely the symptoms and the significance of elm yellows is overshadowed by the presence of the more aggressive Dutch elm disease.

The injection of certain antibiotics into yellows-infected elms has arrested the disease for a short time. However, no practical means for vector control or long-term disease prevention or cure is available.

References

- Gibson, Lester P. 1977. Distribution of elm phloem necrosis in the United States. *Plant Disease Reporter*. 61: 402-403.
- Schreiber, Lawrence R.; Peacock, John W. 1979. Dutch elm disease and its control. *Inf. Bull.* 193. Washington, DC: U.S. Department of Agriculture. 13 p.
- Stipes, R. Jay; Campana, Richard J., eds. 1981. *Compendium of elm diseases*. St. Paul, MN: The American Phytopathological Society. 96 p.

John W. Peacock
Northeastern Forest Experiment Station
USDA Forest Service
Delaware, Ohio