CAES
The Connecticut Agricultural Experiment Station
Putting Science to Work for Society since 1875

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DUTCH ELM DISEASE

Dutch elm disease (DED) is the most destructive vascular disease of elm and the leading cause of elm mortality. All elm species native to North America are susceptible to the disease. After it was first introduced to North America in the 1930s, DED killed over millions of American elm trees along city streets and in landscapes throughout the eastern United States.

Symptoms and diagnostics

DED is a systemic vascular disease. The DED infection and the tree's reaction to the fungal growth result in blocked vascular tissues that prevent water movement from the root to the upper canopy. This causes the tree to suddenly wilt, develop dull green to brown leaves, and drop leaves in the spring or summer. As the disease develops, significant diebacks are noticeable throughout the canopy (Figure 1). When a tree is infected through bark beetles, the initial symptoms

Figure 1. Wilting of leaves and declining of an elm tree

Figure 2. Brown streaking of vascular tissues under the bark

Figure 3. Discoloration of vascular tissues (indicated by arrow)

Figure 4. Insect galleries in the wood under the bark

appear as yellowing and wilting of leaves on individual branches (flagging). When a tree is infected through root grafts from affected adjacent trees, leaves on one side or the entire canopy turn brown, and the tree dies rapidly. A characteristic symptom of DED is a brown discoloration along the vascular tissues of infected branches (Figure 2). In a cross section of a branch or twig, it appears as a brown circle under the bark tissues or in the wood (Figure 3).

Disease development

Two fungal pathogens of DED, *Ophiostoma novo-ulmi* and *O. ulmi,* have relatively narrow host ranges and only infect elm trees. Both fungi can overwinter in the wood of infected, dying elm trees. DED can be spread by elm bark beetles, pruning tools, and through natural root grafts of adjacent elm trees. Female beetles lay eggs between bark and wood tissues. After hatching, larvae feed on wood and create numerous tunnels called galleries (Figure 4). The pathogen sporulates in the galleries. When young adult beetles emerge through the bark and feed on a new tree, they introduce fungal spores attached on their bodies into the xylem vessels. The fungi can spread rapidly throughout the tree in vascular tissues, which may result in tree mortality within one to several years.

Management

Resistant species and cultivars: Development and use of disease-resistant elms is a long-term solution to DED. Several Asian elm species, such as Chinese elm (*Ulmus parvifolia*), Japanese elm (*U. japonica*), and Siberian elm (*U. pumila*), have high levels of resistance to DED. Some DED resistant hybrids between these Asian elms and native elm species have been developed, which includes Accolade™, Cathedral, Discovery, Triumph™, Commendation™, and Danada Charm™. And many American elm selections, such as Princeton, Valley Forge, Prairie Expedition, New Harmony, and St. Croix, were found to be resistant or tolerant to DED.

Culture: Avoid monocultures of elm trees along streets to prevent disease spread through root-grafting between trees. If a new DED infection is detected early enough, remove flagged branches including a portion of 6-10 feet symptomless stem and check for brown streaking in the sapwood. If vascular staining is observed, send a sample to a diagnostic laboratory for a DED confirmation. Remove and destroy severely diseased or dead trees to reduce breeding materials for bark beetles by burning, burying, chipping, or debarking. Disinfect pruning tools with 10% bleach or denatured alcohol between pruning cuts.

Chemicals: Fungicide injections are effective to prevent new infections, but not effective to cure the disease. Fungicides labeled for protection against DED include thiabendazole hypophosphite, propiconazole, and tebuconazole. Fungicide treatments are suggested for high value or historically important trees.

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