RESEARCH LABORATORY TECHNICAL REPORT

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Dutch Elm Disease

Identification, Biology and Management

By the Bartlett Lab Staff
Directed by Kelby Fite, PhD

Dutch elm disease is one of the most well-known plant diseases in the world. The close relationship between the fungal pathogens *Ophiostoma ulmi* and *O. novo-ulmi* (the more recently introduced and more aggressive species) and the elm bark beetle vectors make for a complex disease cycle. The disease entered into the United States inside logs from Europe and has been spread by the beetle vectors and humans to most places where elms grow. All elms native to North America and all European elm species are susceptible to the disease. Dutch elm disease has certainly wreaked havoc on the native American elm, one of the most durable, versatile, and elegant trees found in the United States.

Figure 1: Early yellowing and dieback of limbs in crown

Symptoms and Signs

Symptoms usually develop two to four weeks after infection and appear as wilting/flagging, leaf yellowing, dieback, leaf drop, and discoloration of the xylem tissue under the bark. Wilting begins at the tips of branches and progresses downward from there (Figure 1). Gradually, the entire crown may be affected as the fungus colonizes the vascular system and further inhibits water transport.

Figure 2: Discoloration of vascular tissue

The fungus also produces toxins within the vascular system that contribute to symptom development. Brown streaking/discoloration occurs in the current year's growth ring within the branches, stems, and roots. Shaving off some of the bark or making a cross cut into the branch should reveal this discolored tissue if you are looking for evidence of infection (Figure 2). The fungus can survive for several years as a saprophyte in the infected wood of dead trees, for a single year in other organic material, and can also be spread by the movement of these contaminated materials to other places.

Vectors

Dutch elm disease has caused such devastation due primarily to its insect vectors. Two species of bark

Figure 3: Elm bark beetle gallery

beetles (ambrosia-type beetles) can move the fungus several miles from an infected tree to a healthy one. The native elm bark beetle, *Hylurgopinus rufipes*, and the smaller European elm bark beetle, *Scolytus multistriatus*, are of primary concern because of their widespread distribution in the US and their capability of both visiting and creating fresh wounds in the sapwood of elms. When these beetles emerge from infected elms, they usually carry spores of the fungus (stuck to their bodies) with them. The fungus sporulates within the galleries the insects create in the wood and when the beetles emerge, they are coated with the fungal spores (Figure 3). When feeding on healthy trees, the beetles create wounds and inoculate the tree with spores as they tunnel inside the wood spreading the infection.

The native elm bark beetle, 2.3 mm in length, transmits the fungus to major branches and small trunks by boring directly into the wood to feed and breed. This beetle is of concern in the northern parts of the United States and Canada. The primary vector of Dutch elm disease, the smaller European elm bark beetle (2.7mm in length), feeds at twig crotches and causes dieback that begins at the twig. In addition to the beetle vectors, the Dutch elm disease fungus can spread from tree to tree via root grafts that occur between closely planted elms.

Management

Sanitation plays a key role in the prevention of Dutch elm disease by eliminating known sources of the fungus and vectors; principally diseased trees. This process includes monitoring for diseased trees along with the immediate removal and destruction of the diseased wood to prevent spread to adjacent trees. Removal of trees that have been dead for more than one year is not of utmost importance for disease control because the dead wood is only used as a breeding site for one year. Keep in mind that dead trees, however, can be a significant hazard. Beetles will be less attracted to trees that are healthy and have few dead or dying branches in the canopy.

By promoting tree health through fertilization and watering as necessary, avoiding construction damage, and reducing defoliation from other diseases and insect pests, trees will naturally be more resistant to attack by the beetle vectors. Preventive applications of fungicides will provide a barrier of protection from the pathogen as well. Fungicidal products can be injected into the xylem of the tree that provide systemic protection from the pathogen for one to three years, depending on the product (Figure 4). A biological control agent that is injected into the trunk to prevent infection is now commercially available for use in certain cases.

Figure 4: Macroinjection of fungicide

Breeders have also been working for years to develop resistant and tolerant selections of American elm to replace susceptible trees in the landscape. Asian elms are resistant to Dutch elm disease and have been used in breeding programs along with American elms. There are over 20 selections, species and hybrids, displaying high levels of resistance or tolerance. Of the true American elms developed, 'Valley Forge,' 'Jefferson,' 'Princeton,' and 'New Harmony' cultivars have shown higher levels of tolerance to infection than most.

Founded in 1926, The Bartlett Tree Research Laboratories is the research wing of Bartlett Tree Experts. Scientists here develop guidelines for all of the Company's services. The Lab also houses a state-of-the-art plant diagnostic clinic and provides vital technical support to Bartlett arborists and field staff for the benefit of our clients.