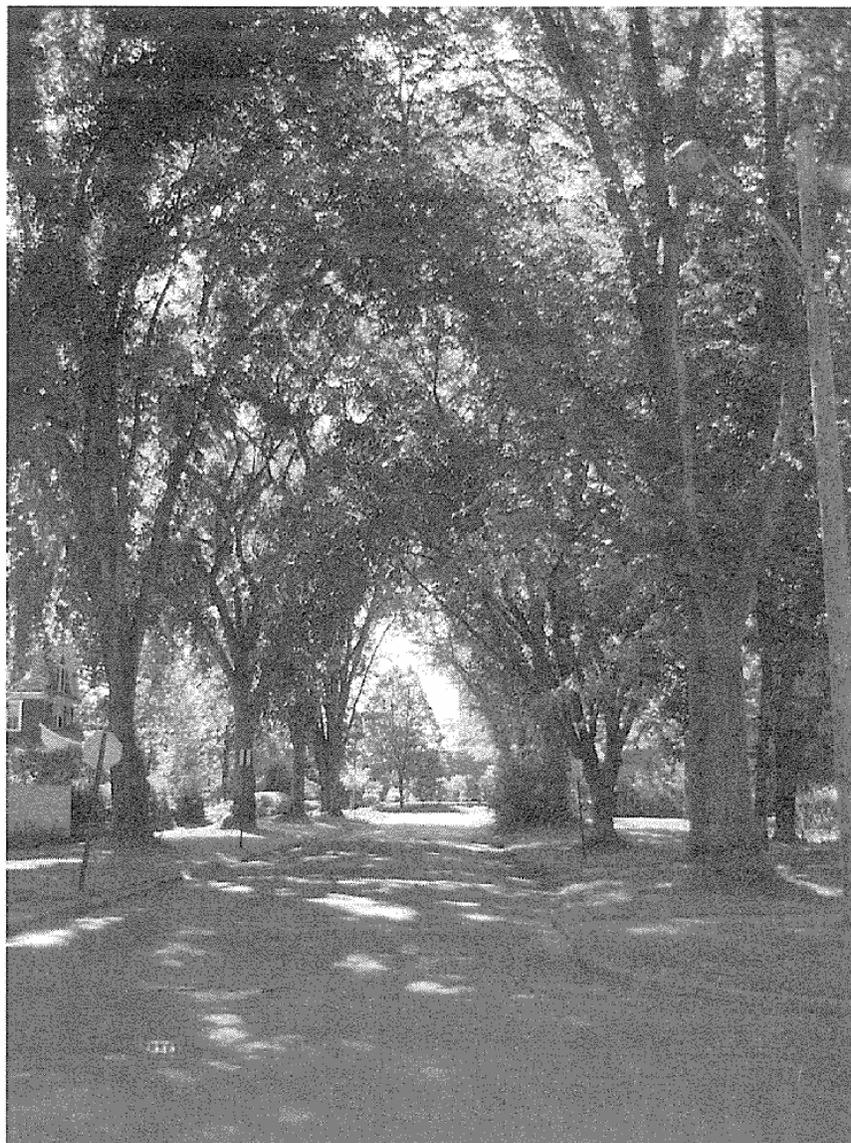


DUTCH ELM DISEASE

in State College,
Pennsylvania



Gary W. Moorman, Bill Elmendorf, and the
State College Tree Commission



The first sign of Dutch elm disease is the wilting and yellowing of one or two branches. This is called flagging.

WHAT IS DUTCH ELM DISEASE?

Dutch elm disease (DED) is caused by a living organism; a fungus called *Ophiostoma ulmi*. The disease was first described in the Netherlands in 1921. Although the United States imposed regulations to prevent the importation of live elms from Europe, no such rule covered the movement of logs. As a result, the fungus and one of the insects that moves the fungus from tree to tree, the European bark beetle, were brought to the U.S. in the 1930s in elm logs imported for the production of veneer. Elms native to North America had never been exposed to this fungus before and were, and continue to be, highly susceptible to the disease. American, slippery (red), September, and winged elms are highly susceptible. European elms are moderately resistant, while Asiatic elms such as the Siberian elm (*Ulmus pumila*) and the Chinese elm (*Ulmus parvafolia*) are highly resistant.

Since its introduction to North America, Dutch elm disease has spread to all places where elms are grown, killing large numbers of trees. The elms currently surviving in the State College area are either 'escapees' (those trees that by chance have not been visited by fungus-carrying beetles), have been protected from the beetle by timely sprays, or have been treated with a fungicide to protect them. Seedlings from many of the trees on the Penn State University campus have been tested and found highly susceptible to DED.

SYMPTOMS OF DED

Leaves on one or more branches will prematurely wilt and then start to yellow, any time from late spring or early summer into late summer and fall. Progressively more branches will exhibit symptoms. Outer layers of sapwood, the wood just below the bark, are affected, and branches will show brown streaks. Brown streaking can extend from the branches, down the main trunk, and into the roots. As major branches die and the bark falls away, tunnels can be seen in the wood, radiating from main tunnels where the bark beetle larvae develop.



Another example of flagging in an American elm tree

FOR FURTHER INFORMATION

Moorman, G. 1997. Scouting and Controlling Woody Ornamental Diseases in Landscapes and Nurseries. Moorman, G. Woody Ornamental Insect, Mite, and Disease Management. Penn State College of Agricultural Sciences Cooperative Extension, 112 Agricultural Administration Building, University Park, PA 16802-2602. (814) 865-6713.

MANAGEMENT OF DED

A combination of sanitation and beetle control is necessary to slow the spread of DED. All dead and dying elms should be cut down as soon as DED is detected. The wood and all branches $\frac{1}{2}$ inch or more in diameter should be burned or buried to kill the beetles, or debarked immediately to eliminate places where the beetles will continue to develop. The wood must be debarked if it is to be stored for later use as firewood. Even the stump should be buried, or debarked to below the soil line. To prevent the fungus from moving through root grafts to neighboring elms, the grafted roots must be cut or killed. This can be done by trenching to depth of 3 feet between trees that are 50 feet apart or less. Another method of treatment is to pour a mixture of one part Vapam (a soil fumigant) and three parts water into holes made one foot apart, 1-2 inches in diameter, and 3 feet deep. The holes should then be plugged with soil or a piece of sod. Grass along the line of fumigation will be killed, but once the fumigant has dissipated, the grass can be replanted. Applications of an appropriate insecticide to control bark beetles should be timed to kill each of the 2 or 3 different broods (groups of young beetles) produced by the beetles each summer.

One tactic being used against the beetles by the State College Borough Arborist is to inject infected elms with cacodylic acid or monosodium methylarsonate. The treated tree becomes very attractive to the beetles as the trees die. However, beetle brood production is greatly suppressed by the chemical in the trees. Thus, the injected elms serve to trap and reduce the numbers of beetles in the area.

Curative treatments can be attempted if large, economically important trees have only one or two branches with symptoms. Treatment has been successful in a number of instances, but is expensive. First, patches of bark are peeled from the wilting branch, working down the branch in order to find the lowest point of brown streaking in the wood. The branch is then pruned off at least 12 feet below the lowest point of streaking. Finally,

one of two specific fungicides is injected into the tree. Also, it is prudent to promptly trench or fumigate the soil in order to cut root grafts between this tree and its neighboring elms. Yearly injection may be required, and the tree must be monitored closely for wilting on additional branches. If more than about 5% of the branches have DED symptoms, this treatment is not likely to be successful. Injection must be done by an arborist licensed by the Commonwealth to apply pesticides.

When a tree is killed by DED, a resistant elm, or a tree species not susceptible to DED, should be used to replace it. Resistant cultivars of elms are currently difficult to obtain, but are gradually becoming more available from nurseries. Resistant varieties include Accolade, Sapporo Autumn Gold, Regal, New Horizon, New Harmony, Valley Forge, Independence, Cathedral, Urban, Princeton, Pioneer, Prospector, Frontier, Homestead, Patriot, Ohio, Pathfinder, and Dynasty.

DED DISEASE CYCLE

Insects that spread the disease include the native elm bark beetle (*Hylurgopinus*) and the European elm bark beetle (*Scolytis*), both of which are now found in North America. Fungus-infested bark beetles feed on small twigs and introduce the fungus into the water-conducting tissue, or sapwood. The fungus then kills the twigs. Bark beetles later return to the tree and lay eggs under the bark of recently killed branches. After the beetle eggs hatch, their larvae tunnel to form galleries under the bark. The fungus in the tree grows into the galleries and forms spores. Maturing beetles emerge from galleries with their bodies infested with spores, then they fly to other elms, where they feed on twigs and introduce the fungus. The disease needs the beetle to spread the fungus long distances and the beetle needs the fungus to kill twigs to provide a place for laying eggs. Once inside the tree, the fungus moves up and down the tree, even into the roots, through the water-conducting sapwood. The roots of large elms within 50 feet of one another often are grafted together. The fungus can move through the graft union, thus from one tree to another through shared root systems.