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The Dutch Elm Disease



Elm trees killed by the Dutch elm disease fungus along a city street of a midwestern city.

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As of 1960, the Dutch elm disease is not known to be in Minnesota but is present in southeastern Wisconsin and in southeast and central Iowa. It was first found in the United States in 1930 but probably was introduced a few years earlier in elm logs from Europe. It since has spread from the New England states west to Colorado, north to eastern Canada and Wisconsin, and south to Virginia and Tennessee, and has caused serious losses of elms in the New England and central states (cover picture and figure 1).

What Are the Symptoms?

The Dutch elm disease results in rather rapid wilting of the foliage. Some trees are killed a few weeks after they are infected. Other trees may wilt slowly and survive for a year or longer. A brown, discontinuous ring forms in the sapwood of wilting branches, usually in the springwood vessels of the current year's growth (figure 2). Other fungus diseases and wounds may result in similar discolorations. The disease can be identified with certainty only by isolating the fungus from suspected trees.

What Causes It?

Dutch elm disease is caused by a fungus (*Ceratocystis ulmi*) which is spread in this country by the small European elm bark beetle (*Scolytus multistriatus*) and the native species (*Hylurgopinus rufipes*) (figure 3). The European species overwinters in the larval stage under the bark of dead elm trees, branches, or logs (figures 4 and 5). The



Fig. 1. The result of Dutch elm disease on a midwestern city street.

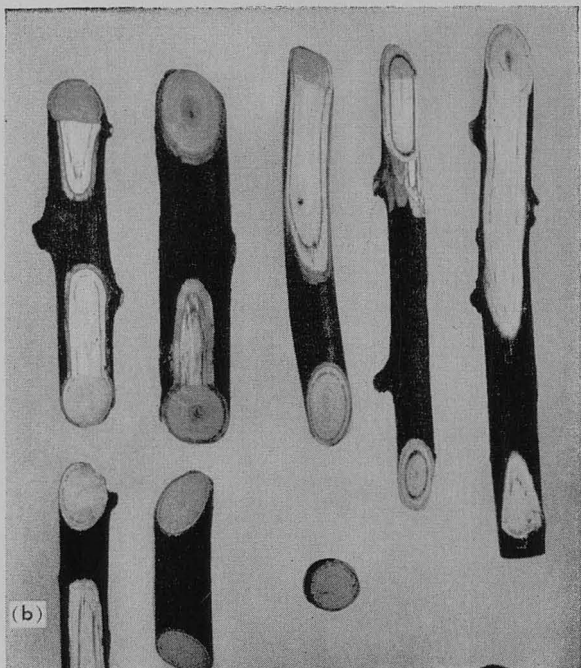


Fig. 2. Vascular discoloration that occurs in the outer sapwood of an elm infected with the Dutch elm disease fungus.

larvae pupate and adult beetles emerge from May through the summer. The beetles fly a short distance, normally not more than 500 feet, and feed on small branches, concentrating in twig crotches (figure 6). However, they have been found feeding on elms as far as 2 miles from the nearest breeding place. If the beetles are carrying the fungus they will inoculate the tree with it by this feeding. The fungus can also be spread from tree to tree through root grafts.

Once the fungus has entered the tree it can spread rapidly throughout the vessels of the tree. The fungus produces a toxin which induces the tree to produce gums which plug the vessels and the tree soon wilts and dies.

After feeding on the twig crotches of healthy trees, the bark beetles seek breeding sites under the bark of dead or dying elm trees or recently cut logs. They may fly greater distances to find a suitable breeding place than they do to feed. The Dutch elm disease fungus will develop in the galleries formed by the bark beetles and produce the spores which are picked up by the bark beetles when they emerge the following spring.

The habits of the native elm bark beetle are like those of the small European elm bark beetle to the extent that it also breeds in dead and dying trees. It also transmits Dutch elm disease. But instead of feeding on small twig crotches it introduces the fungus into healthy trees when it constructs feeding and overwintering tunnels in the bark. Apparently the native species is much less efficient in transmitting the disease than the European species. This explains why most control measures are directed toward the small European elm bark beetle.

Elms are most susceptible to fungus infection during the spring when the large, springwood vessels are forming. The European elm bark beetle in Wisconsin and probably Minnesota has two main periods of emergence, the first in June coinciding with the springwood formation in the host, and the second in August. Thus the fungus is most likely to be spread in June and to a minor extent in August. As a general rule the bark beetles do not spread the disease more than 100 to 200 feet and seldom carry the fungus more than 500 feet.

Control

At present, the most effective control of Dutch elm disease is to reduce or eliminate the elm bark beetles. This can be done by eliminating dead and dying elms in which the beetles breed (sanitation) and by using a dormant spray on living trees.

Sanitation

Sanitation alone will not stop the Dutch elm disease but should be used along with spraying. In

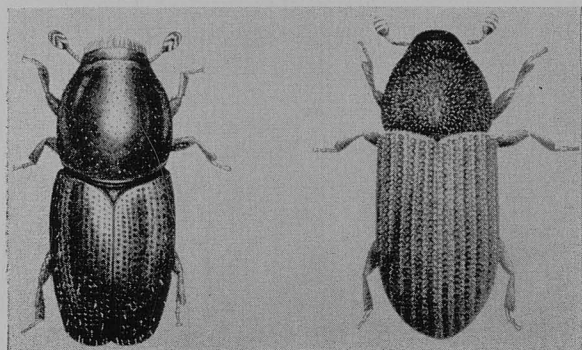


Fig. 3. The two elm bark beetles that can disseminate the Dutch elm disease fungus: Small European elm-bark beetle and Native elm-bark beetle

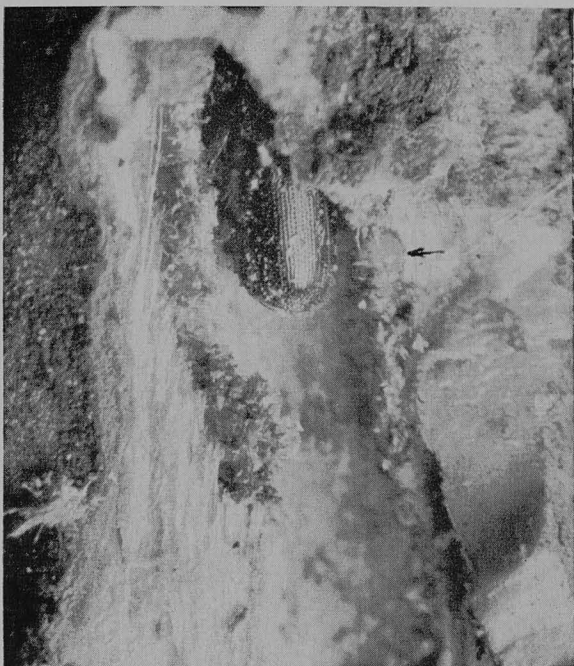


Fig. 4. Female of *Scolytus multistriatus* in the process of constructing a broad gallery and ovipositing.

areas where the disease is not yet present, sanitation is of major importance in metropolitan areas where elms are of high value. Spraying to prevent bark beetle feeding on healthy trees is not practical until the fungus has been introduced.

It has been stated that when 90 percent of the dead elm trees and branches are eliminated each year, the disease is suppressed to minor proportions. Adults of the European elm-bark beetle, in search of suitable breeding material, may spread the fungus for at least 3 miles. However, where spread takes place from known sources, the newly infected trees occur mostly within 100 to 200 feet of the source. If bark beetle breeding material within 500 feet of a diseased elm is removed, the local spread generally is halted.

Sanitation measures should not be confined to merely removing and destroying infected trees. Any elm that provides a breeding place for the bark beetles can be the source of inoculum or build-up of the fungus. Thus, it is very important to remove or clean up all dead and dying elms to prevent any population build-up of the bark beetles.

All the elm material that is likely to be infested with bark beetles should be destroyed, preferably during the winter. Breeding material found during the growing season should be burned, or the bark should be removed and burned, or it should be sprayed with a 1 percent emulsion of DDT in No. 2 fuel oil.

Spray Concentrations and Dosages

DDT may be applied in a hydraulic sprayer or a mist blower. A 25-percent DDT emulsifiable concentrate is recommended at the rate of 4 gallons per 100 gallons of water in a hydraulic sprayer. For application in mist blowers, mix 1 part of a 25-percent DDT emulsifiable concentrate with 3 parts of water thus making a 6¼-percent DDT emulsion. In larger quantities this is equivalent to using 25 gallons of the 25-percent DDT concentrate mixed with water to give 100 gallons of spray mix.

When a hydraulic sprayer is used, apply enough spray to thoroughly wet bark surfaces. For an average 50-foot elm, 20 to 30 gallons is needed and if a mist blower is used 2 to 3 gallons of spray is enough. It is important that all bark surfaces are completely covered, especially in the upper part of the crown.

Time to Spray

Spray elm trees in late winter or early spring before the European elm-bark beetle becomes active.

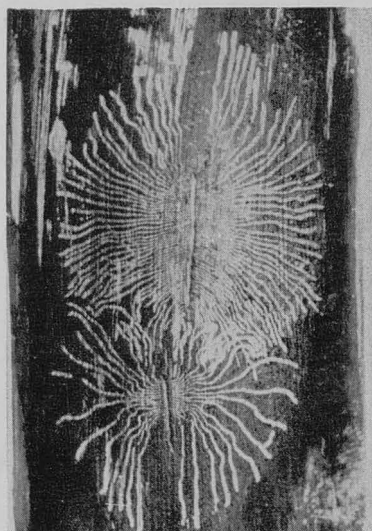


Fig. 5. Characteristic galleries of the European elm-bark beetle.

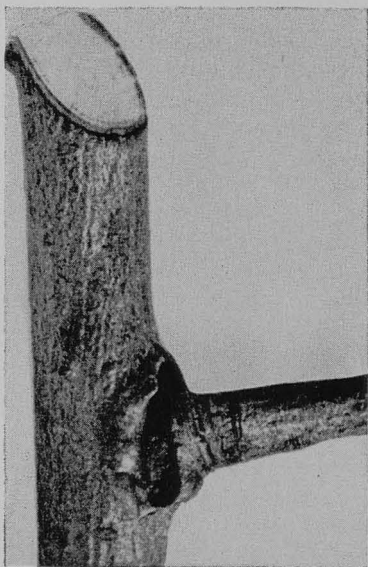


Fig. 6. Feeding scar in a healthy elm twig made by the European elm-bark beetle.

DDT spray, if properly applied, will last for a long time and thus could be applied any time after leaf fall. However, recent work indicates that bark beetle control is much more effective if the trees are sprayed in late winter or early spring. Foliar sprays applied in the summer are not likely to help much in controlling Dutch elm disease and will lead to a build-up of other pests such as scale insects, aphids, and mites. Foliar sprays are more likely to kill birds than are the dormant sprays.

Resistant Elms

Trees resistant to Dutch elm disease have been found in this country and in the Netherlands. The Christine Buisman elm (*Ulmus carpinifolia*) is the best of these for use in the United States but it is not winter-hardy in Minnesota. So far none of the selections that have proven to be tolerant or resistant to Dutch elm disease have been successfully grown in Minnesota. The alternative, then, is to plant elm in mixture with other species.

Other tree species are subject to other species of fungi and other kinds of pests. In view of this, it is better to plant mixtures of trees rather than elm alone or any other species alone. The elm has too many good qualities to be dropped from future planting plans, and if mixed with other species the loss from Dutch elm disease could be reduced.

Recommended Shade Tree Species

The following trees can be planted in place of elm or in mixed plantings with elm.

SUGAR MAPLE—Reasonably free of insect and disease pests but requires better soil; it is subject to *Verticillium* wilt which will disfigure or kill an occasional tree. However, this is not considered as serious a disease problem as Dutch elm disease.

NORWAY MAPLE and its varieties—Reasonably free of insect and disease pests but is subject to *Verticillium* wilt.

SILVER MAPLE—Fast-growing species subject to tar spot and mites which are of no serious consequence; it also is very subject to decay.

GREEN ASH and its varieties—Has been reasonably free of pests but in some parts of the country, including Minnesota, some ash are dying from an unknown cause.

BASSWOOD—Reasonably free of insect and disease pests, though it is more subject to decay than many other species.

HACKBERRY—Slow-growing and is subject to witches-broom and gall forming psyllids. Neither of these pests will cause serious damage to the tree. Possibly by selecting the right strain of hackberry, witches-broom could be avoided.

FLOWERING CRABAPPLES—Small trees subject to fire blight, cedar apple rust, as well as other diseases and insects.

Other species to add to this list are: Red maple, which has no major pests; Northern Pin Oak, subject to oak wilt (not likely to be much of a problem in boulevard plantings); ironwood, free of pests but apparently difficult to transplant; honey locust (especially the thornless varieties) may be reasonably free of pests; Littleleaf Linden; and others.

For additional information on deciduous trees see Ext. Bul. 267, *Woody Plants for Minnesota*. In northern Minnesota such conifers as red pine and white pine may be excellent substitutes for elm (see Ext. Bul. 258, *Evergreens*).

The photographs were supplied by: On the cover and Fig. 5, USDA; Fig. 1, University of Illinois; Figs. 2, 3, and 4, Michigan State University; and Fig. 6, Illinois State Natural History Survey Division.

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