

DUTCH ELM DISEASE  
IN CONNECTICUT



Connecticut  
Agricultural Experiment Station  
New Haven

## DUTCH ELM DISEASE (GRAPHIUM ULMI) IN CONNECTICUT

Any disease that threatens the existence of the American elm strikes very deeply in the hearts of all New Englanders. Planted in almost every state in the Union, nowhere is this tree more highly prized for pure beauty than here on the eastern seaboard. It has become an essential feature of village greens, rural roads and stately avenues. It is a part of the New England tradition.

For the last two summers Connecticut citizens have viewed anxiously the progress of Dutch elm disease in New Jersey and New York. The number of cases confirmed has increased 10-fold in the past year and the disease has been detected farther and farther north. It attacks nearly every variety of elm, but the American elm, generally planted in this section, is highly susceptible.

In reading about the disease and the control program recommended it is well to have several things in mind:

Connecticut is the gateway to New England. It stands between the territory where the epidemic is prevalent and the elm belt to the north and east. Therefore any measures that control the disease within the borders of this State are also preventive measures for all New England.

The public holds most valuable those grand old trees that arch above highways and streets or beautify estates. Growing as they do under adverse conditions, surrounded by concrete and asphalt, these very trees are the ones most likely to be in poor health. In their weakened state they attract the beetles that are known carriers of Dutch elm disease.

### Extent of the Disease in Connecticut

A year ago last November the first case of Dutch elm disease was found in Connecticut. The tree stood in Glenville on the southern border of the State where Westchester County, New York, joins Fairfield County, Connecticut. Since that time 55 other trees in Greenwich, Stamford, Darien, Norwalk and Fairfield—all in Fairfield County—have been found infected with the disease; and a state survey of elms last September located one badly infected tree at Black Hall, Old Lyme, 50 miles from Fairfield. All of these trees have been cut down and destroyed.

### History of the Disease in Europe and America

The origin of the Dutch elm disease is unknown. Some scientists hold that the World War was responsible for its introduction into Europe. At any rate it was discovered in the Netherlands 15 years ago and has been popularly called Dutch elm disease ever since, although *Graphium* of elms is a more accurate name. Many historic trees along the canals and through-

out the countryside died as a result of the epidemic. In the following decade *Graphium* killed trees in 12 European countries. It appeared in England in 1927.

As early as 1930 Dr. Christine Buisman, who had been working on the disease in Holland, came to New Haven to examine specimens from a sick elm that previously had been brought to the Station for examination and from which cultures had been made. Happily the trouble was not Dutch elm disease.

The same year, however, Dr. Buisman and Dr. Curtis May of the Ohio Experiment Station identified a case near Cleveland. In all, nine elms in Ohio were found infected in 1930 and 1931, and were promptly cut down and destroyed. Ohio reported no other cases until 1933.

A much more serious outbreak was reported from New York and New Jersey in the summer of 1933. At the same time burl-elm logs infested with European elm bark beetles, known carriers of the disease, were found in the port of Baltimore. Investigation revealed that the logs contained the causal fungus and that similar shipments had been coming into American ports for at least nine years. Thence they were sent to furniture factories in the Middle West and used in the manufacture of Carpathian elm veneer. (The importation of elm logs from Europe is now prohibited.)

Immediate search for other cases of Dutch elm disease began. It was found that *Graphium* was well established in the area centering about the tip of Manhattan and reaching out into New Jersey, Staten Island, Long Island, and Westchester County, New York. In 1933, 1200 infected trees were found and by the end of the summer of 1934 the number had mounted to 7,000. In addition, the city of Baltimore, Maryland, reported one case; Norfolk, Virginia, 1; Ohio, three aside from the original nine; and Indiana, four.

### What Is Dutch Elm Disease?

Although there is much yet to be learned, research in Europe and the United States has contributed a large body of information about Dutch elm disease. It is caused by a fungus, *Ceratostomella ulmi* (Schwarz) Buisman—called *Graphium* in its imperfect state—that attacks the circulatory system of an elm tree. It may work slowly or rapidly, killing the subject in a few weeks or, more generally, over a period of years. Healthy and weak elms, old trees and saplings, alike are susceptible. Sprays do not control the disease because they do not reach into the wood where the fungus develops.

The common name, Dutch elm disease, is unfortunate because the fungus by no means confines itself to varieties of elms grown in Holland. In fact, a few Asiatic species alone seem to be resistant, although some cases of resistance in usually susceptible varieties have been recorded.

Spores of *Graphium* are carried into a tree by certain kinds of elm bark beetles. Finding favorable conditions the spores germinate quickly under the cambium layer, sending out thread-like filaments into the sapwood. Eventually this growth causes a blockade of the passages through which nourishment is carried between roots and foliage. Leaves on infected twigs wilt, turn a dull green and then yellow, and the end of the

twig itself twists over in a characteristic fashion. These wilting symptoms usually appear first towards the crown of the tree. As the disease progresses, whole branches may die and break off.

Another visible symptom may be found by cutting a cross-section of a twig or limb that is under suspicion. The growing fungus leaves dark brown flecks in the outer rings of the specimen. This discoloration is seen as streaks on the wood when the bark is removed. However, these outward signs so closely resemble disorders caused by other elm diseases and injuries that there is no positive field identification. At present the disease can be confirmed by laboratory culture only.

#### The Carrier Beetle

In Europe scientists found that *Graphium* is carried by certain species of elm bark beetles. The most conspicuous known vectors abroad are the larger *Scolytus scolytus* Fab. and the smaller *Scolytus multistriatus* Marsh. Both beetles were found infesting imported logs in American ports but the larger has never been seen in the field. The second, or smaller beetle, is accused of spreading the disease in this country and is now well established in southern New England, New Jersey, along the Hudson Valley of New York, in Pennsylvania and part of Virginia. Entomologists believe that research will uncover other carriers one of which is described later.

The elm bark beetles are one-tenth to one-eighth of an inch long and have glossy, reddish black wing covers. The grub is a crescent-shaped, white, legless creature, slightly larger than the beetle. Both adults and larvae live and feed on elms, breeding and spending the winter under the bark of weak or dying trees or parts of trees.

In spring, and again in August or September in this section, bark beetles bore their way into the bark of weak elms,—each carving out a channel from one to two inches in length. Along the sides of this the beetle lays from 80 to 140 eggs. When the larvae hatch they eat their way to the surface of the bark, leaving a network of tunnels that form a delicate, fan-like etching in the wood. The late summer generation of beetles hibernates under the bark until spring.

By their habits these creatures aid in the development and spread of the Dutch elm disease. *Graphium* comes to its fruiting stage in sheltered places in cracks of the bark or between the bark and wood. The breeding channels of the beetles provide proper chambers for its growth. The coremia, or fruiting bodies, are clusters of dark colored threads bound together in definite, erect bundles with a whitish head—not unlike a tiny mushroom in appearance. The top is made up of a mass of viscid spores borne on the end of each thread.

If spores are present in the wood, they are likely to cling to the bodies of the beetles. Emerging from the elm, making minute holes in the bark as they go, these insects fly directly to healthy trees. They feed in the crotches of twigs, carrying the spores into their feeding tunnels. Thus the disease enters a vigorous elm.

#### A Native Carrier Discovered

In examining the infected elm at Old Lyme, the single Connecticut tree with Dutch elm disease outside of Fairfield County, station botanists and entomologists noted some new and disturbing facts. A species of native elm bark beetle, *Hylurgopinus rufipes* Eich, infested the tree. Further scouting located no European elm bark beetles in the district. The breeding channels of this native beetle usually extend horizontally under the bark, while those of the European species are approximately vertical. Horizontal channels only were found in the Old Lyme tree, indicating that there had been no European beetles present.

In the botanical laboratory, cultures of *Graphium* were obtained from specimens of the native beetle found in the diseased wood. Even more significant was the result of an experiment placing adult beetles in a test tube with twigs of healthy elm. Immediately the insects bored into the bark. A culture taken later from these twigs gave positive evidence of *Graphium*. These tests proved that *Hylurgopinus rufipes* Eich, a beetle common in New England, is a potential carrier.

Examining the condition of the Old Lyme tree, the botanists found that no other elm in this State had been so badly infected. There was an abundance of the *Graphium* in the fruiting stage under the bark and in the adjacent wood.

Other insects that inhabit the bark of elms may also transmit Dutch elm disease but at present experimental evidence is lacking.

#### What Has Been Done in Connecticut?

The Agricultural Experiment Station is the state agency with authority to act in an emergency of this kind. The Botanical Department has kept in touch with the Dutch elm disease situation ever since the outbreak was reported from Holland. As was stated above, Dr. Buisman was invited to the Station in 1930 to examine a tree under suspicion, and the Botanist made a partial survey of Fairfield County in the autumn of 1933 without finding any trees infected with the fungus.

When the first case of *Graphium* was discovered in Connecticut, the United States Department of Agriculture established an office for Dutch elm disease control at Stamford. Scouts from that office directed a survey of elms in the southern part of Fairfield County, employing men under the C.W.A. and later the E.R.A. A second infected tree was found in February despite the extreme difficulty of detecting the disease in the field in winter.

After the trees began to leaf out in spring other infected elms were reported. In all, federal scouts identified 36 cases in Greenwich, 9 in Stamford, 8 in Darien, 1 in Norwalk and 2 in Fairfield. The Experiment Station cooperated with the Federal Government in this work. All of these trees have been cut down and burned.

In August, 1934, the Experiment Station initiated a survey of elms in sections of the State not covered by the federal scouts. In August and September six experienced men covered the main highways visiting every

town. Although they could not see all of the millions of elms in Connecticut in the short season before the leaves began to turn and fall, they did inspect about 90,000 trees.

Of these, 1,977 were examined as possible *Graphium* victims and samples of wilting twigs were taken. Cross-sections of 120 showed brown discoloration in the rings and these specimens were sent to New Haven for laboratory culture. Only a single case of *Graphium ulmi*, that at Old Lyme mentioned above, was confirmed.

The scouts further indicated on maps districts where the trees were in reasonably good, fair, or poor condition. Their findings are not exhaustive but they show that elms in many parts of the State are in poor health and are possible centers for breeding beetles and establishing disease.

All ailing trees, and especially 52 that were badly infested with elm bark beetles, were tagged for future reference. Members of the Botanical Department examined these trees and many more, and will continue to check on suspicious cases. Although little aside from sanitation work can be done during the winter, the Experiment Station plans to make another more intensive survey of elms next spring.

Late in December the Federal Government made an emergency allotment of \$527,000 of P.W.A. funds to finance sanitation measures in New York, New Jersey, and Connecticut. By sanitation is meant cutting down and burning diseased trees, and also removing elms and parts of elms that are dead or dying. The object is to diminish the number of breeding places of elm bark beetles and so to reduce the population of carriers.

Meanwhile Governor Cross signed an order issued by Director Slate establishing two Dutch elm disease control areas in the State. It gave authority to federal agents to remove trees in these areas and became effective on January 2, 1935.

Towns named in the order are those where diseased trees have been found and others within a range of 10 miles. (See page 8.) Work does not cover territory outside of these zones.

#### Other Measures Recommended by the Station

With the enemy on the threshold and the federal army occupied in the invaded territory, citizens outside the infected area want to know what they can do to minimize the danger to their elms. It is essential to take every known step to check the spread of *Graphium*. Elms should be kept in such condition that the least possible danger of infection will exist over the area as a whole. At present the only *known* means by which the disease spreads from tree to tree is through the transportation of the fungous spores by bark beetles. Any measures that eliminate the breeding places of these carriers and decrease their numbers will help reduce the danger of infection to healthy trees.

To reduce the bark beetle population, two general procedures should be followed: First, all dead and dying elm trees or parts of elm trees in bad condition should be removed, before May 1 if possible, and either completely burned or so treated as to kill all insects contained in them. Second, elm trees should be so cared for that they remain in vigorous condition, for the beetles breed in weak trees. This may be accomplished by

spraying for defoliating insects or leaf diseases and by proper fertilization, watering, prevention of root injury and similar measures.

#### Committees Formed in New England

Various committees have been formed in the New England states to rouse public sentiment on the Dutch elm disease. The New England Committee has an office at 4 Joy Street, Boston. Officers are: William P. Wharton, chairman, and Harris A. Reynolds, secretary. Each state is represented in this central body and each has its own committee as well. The chairman for Connecticut is the Station Forester, Walter O. Filley, and the secretary is Robert M. Ross of the Forest and Park Association. Mr. Filley is also the station representative coöperating with the federal office at Stamford.

#### How to Look for the Dutch Elm Disease

The best season to detect Dutch elm disease is in the late spring or early summer. Visible symptoms are a premature withering or yellowing of foliage on terminal twigs. Frequently leaves drop from a diseased limb or twig early. When these signs are noted, cut a specimen of the dying branch and examine the cross-section for brown markings in the outer rings and under the bark. If these are present, samples of the affected parts should be forwarded to the Connecticut Agricultural Experiment Station, New Haven, for laboratory examination. For proper results send about half a dozen samples six to eight inches long and about half an inch in diameter. Be sure that the specimens show brown discoloration in the rings or under the bark. Give the exact location of the tree and the name and address of the sender.

K. M. P.

**ORDER ESTABLISHING  
DUTCH ELM DISEASE CONTROL AREAS**

WHEREAS, the parasitic fungus known as Dutch Elm Disease has been found on elm trees in five towns of Fairfield County and one town of New London County, and

WHEREAS, it has been determined that the disease is spread from tree to tree by various forms of bark beetles which breed only in dying or dead elms, the removal and destruction of which will greatly reduce the beetle population, thus reducing the chances for spreading of the disease, and

WHEREAS, the United States Department of Agriculture has funds available for the removal of such trees, as well as those infected with the disease,

Now, therefore, I, William L. Slate, Director of the Connecticut Agricultural Experiment Station, by authority of Section 2124 of the General Statutes, do hereby declare and order that the following described areas shall constitute DUTCH ELM DISEASE CONTROL AREAS:

- a. In Fairfield County, the towns of Danbury, Bethel, Newtown, Ridgefield, Redding, Monroe, Shelton, Trumbull, Easton, Weston, Wilton, New Canaan, Greenwich, Stamford, Darien, Norwalk, Westport, Fairfield, Bridgeport and Stratford, and in New Haven County the towns of Milford and Orange.
- b. In New London County, the towns of Old Lyme, East Lyme and Lyme and Waterford; and in Middlesex County, the towns of Old Saybrook, Essex, Saybrook and Westbrook.

Regulation No. 1.

Within these control areas, any tree or part of a tree which is dead or in weakened condition, or any tree or part of a tree which is infected with the Dutch Elm Disease, may be removed and disposed of by agents of the Connecticut Agricultural Experiment Station, or of the United States Department of Agriculture. Before any tree is removed, written notice will be given the owner or his agent.

Regulation No. 2.

In case the owner objects to the removal of a tree or part of a tree as provided in Regulation No. 1, he shall file a letter of protest with the said Director or his duly appointed agent within three days after the serving of said notice. Said Director shall then review the facts in the case and render a decision within one week after receipt of such protest and such decision shall be final.

This order shall become effective January 2nd, 1935.

Approved:

WILBUR L. CROSS,  
Governor of Connecticut

WILLIAM L. SLATE, *Director,*  
Connecticut Agricultural Experiment Station