SERVICE IN ACTION

COLORADO STATE UNIVERSITY EXTENSION SERVICE

Dutch elm disease—occurrence of root grafts

Jeffrey G. Wischer and Wayne A. Fithian[1/]

no. 2.901

Quick Facts

- Dutch elm disease is transmitted primarily by the elm bark beetle in Colorado, but the DED fungus also can spread from tree to tree through root grafts.
- The occurrence of root grafts between adjacent trees is directly dependent on their size and proximity.
- Large mature elms within 30 feet (9 meters) of each other have the highest probability of being grafted.
- Symptoms of DED transmitted through root grafts are not always classic and can be misleading.
- The Colorado State Forest Service root graft control policy is that a single girdling cut is made immediately after diagnosis and before removal; if stain is seen below the girdling cut, then root graft breakage by mechanical means is recommended.
- Prevention of root graft transmission is best accomplished by recognizing situations where it may be a hazard and to be prepared to act promptly and effectively should the disease occur in those situations.

Dutch elm disease (DED) is transmitted primarily by insect vectors: the smaller European elm bark beetle *(Scolytus multistriatus)* is the primary vector throughout the United States and is the only one present in Colorado.

The importance of the insect and its control has led many people to identify DED with "the beetle" and forget entirely about *Ceratocystis ulmi*, the casual fungus. The fungus, in fact, does have a means of spreading from tree to tree on its own. When two trees of the same species grow in close proximity to each other, their roots can grow in contact with sufficient pressure to cause the formation of a union of the two roots, commonly called a root graft. (See Figure 1.)

Figure 1: A root graft of two adjoining elm trees.

The graft is completely functional—water, nutrients, growth regulators, and unfortunately, fungal spores can be transmitted through root grafts. It is through grafted roots that *Ceratocystis ulmi* can infect an elm tree without the aid of its insect vector.

The occurrence of root grafts between adjacent trees (see Figure 2.) is directly dependent on their size and proximity. The larger and closer the trees are, the greater the probability that they have become grafted. While there never is **complete** certainty about the presence of grafts between two individual trees without digging them up, experience has generated the following rule of thumb: large, mature elms within 30 feet (9 meters) of one another have the highest probability of being grafted. Unfortunately, a community's most prized and valuable elms are often quite large and mature, and many were planted well within 30 feet (9 m) of each other. These are the situations that should be suspected for possible root graft transmission.

DED Detection

Root graft infected trees wilt rapidly along the side where infection takes place, with flagging first showing on suckers and lower branches. However, symptoms are not always classic, and can be misleading. In particular, the suddenness of the symptom development is quite variable.

A root graft infected elm tree may die as a "carryover" the following spring. This often occurs when root graft transmission takes place in late summer. Under these circumstances, movement of the fungus is slowed because of the tree's normal reduction in growth and transpiration as fall approaches. This restriction of fungal movement may cause symptoms to be absent or occur late enough to be masked by fall coloration. Although the tree appears healthy, the deadly fungus is well established.

The tree resumes growth in spring and the fungus becomes active. Large vessels formed at that time, known as "springwood," are ideal for rapid movement of the fungus through the tree. The stage is set for a sudden wilting and death.

[1/] *Jeffrey G. Wischer, DED activities coordinator, and Wayne A. Fithian, extension Dutch Elm Disease Project (9/1/80)*

Symptoms shown at this time may not be the classic advance of flagging up the side of root graft transmission. Wilting often will develop more uniformly throughout the crown of the tree. Therefore, symptoms themselves can be a rather poor indication that root graft transmission was involved.

The result of late-summer root graft transmission can be a 9 to 12 month separation between death of the two trees. This lag makes it more difficult to reconstruct the chain of events that occurred, and root graft transmission may not receive the blame it deserves.

The second way that root graft transmission can be "acquitted" prematurely is when a barrier is installed between the healthy tree and diseased tree, but the healthy tree still becomes infected. The explanation is that both infections were due to bark beetles since the barrier precluded root graft transmission. However, the lesson to be learned is that not all barriers are successful.

The Colorado State Forest Service root graft control policy is that a single girdling cut is made **immediately** after diagnosis and before removal. If stain is seen below the girdling cut, then root graft breakage is recommended (preferably by mechanical means), isolating the diseased tree plus any elm within grafting distance from the adjacent tree(s). This is a sound policy and the most effective of any in use today.

The fungus is not bound, however, to cooperate with these procedures. There are certain delays inherent in the process (i.e. time between the beetle infection and symptom detection, time to process the sample and report the results), which, under conditions favorable to the fungus, can allow it to be just ahead of the attempts to check its advancement.

First, a barrier **must be** placed between the first and second healthy elms adjacent to the diseased elm. This is of the utmost importance when a row of closely spaced elms is involved because it insures the eventual halting of the fungus. Second, persons responsible for control should not let a few unsuccessful barrier installations rule out root graft transmission in their community.

Root graft transmission of Dutch elm disease is not always obvious or spectacular. Still, under the right conditions, it can kill elm trees in spite of an excellent sanitation program. (See Figure 3.)

The significance of those trees lost may not be in their numbers; often the relatively few elms that a community would least want to lose, in a park or cemetery for example, are the most vulnerable due to their age and proximity.

Understanding what root graft transmission is and how it occurs and identifying where it is likely to pose a threat to high value elms are the first steps in controlling Dutch elm disease through root graft transmission.

For information on what control measures are available and where they can be effectively applied as well as knowing when to use the controls with a minimum delay and maximum efficiency see Service in Action sheet 2.903.

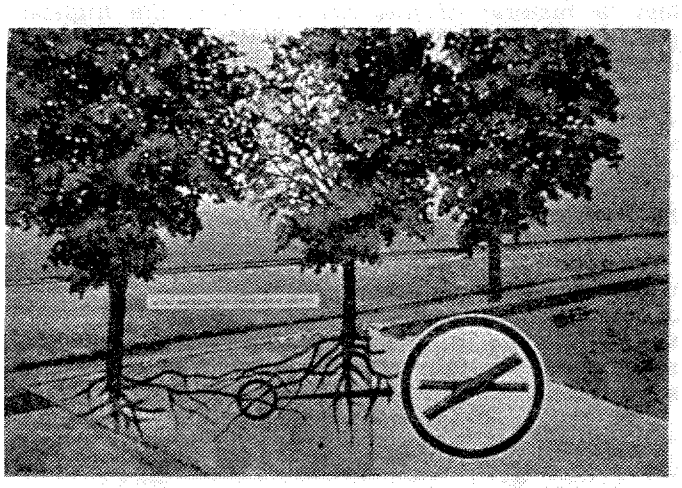

Figure 2: The occurrence of root grafts between adjacent trees.

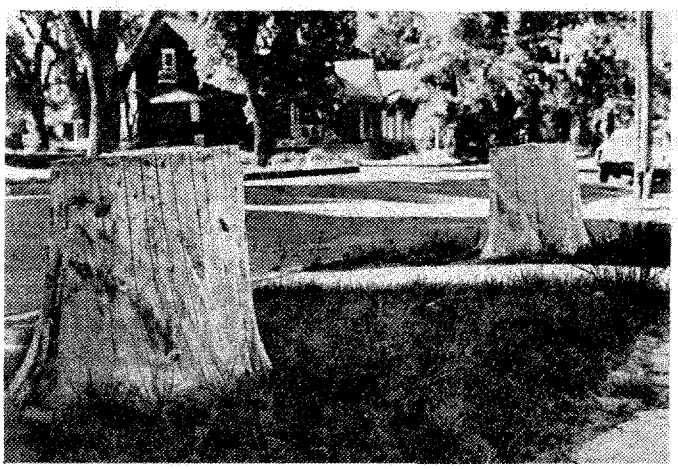

Figure 3: Elm trees often can die from Dutch elm disease transmission by root grafts despite excellent sanitation methods.

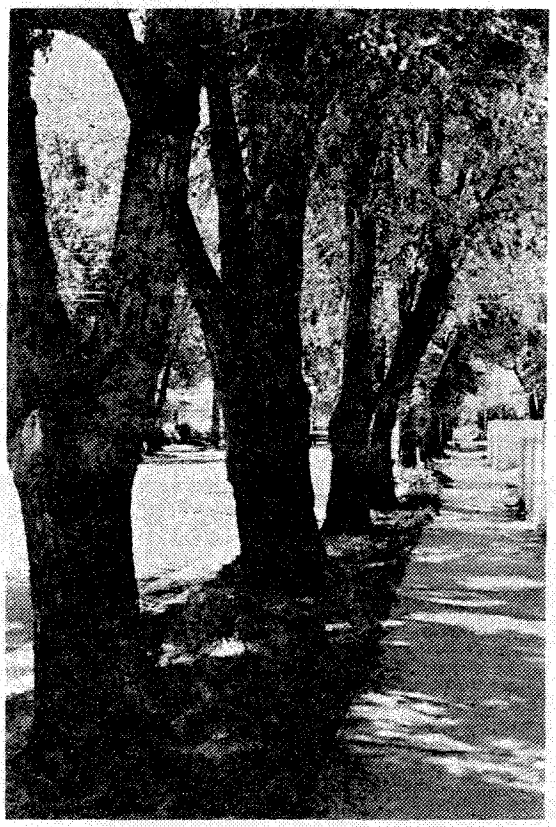

Figure 4: One of the keys to controlling root graft transmission of DED is to recognize situations where it may be a hazard, such as with mature trees spaced close together.