**Wisconsin Pathology Report**

# *Maple decline on Wisconsin golf courses*

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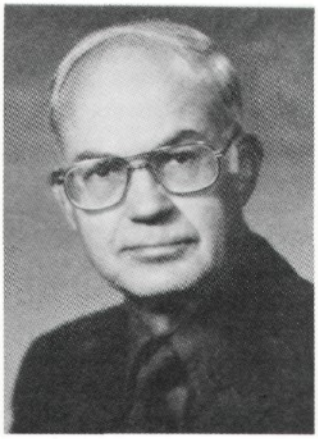

Even though the sugar maple is Wisconsin's state tree, it doesn't hold forth without problems, at least in the urban environment, including our golf courses. Other maples come in for their share of problems from time to time—even a silver maple. But the sugar maple seems to face more problems, and some of them have not been explainable. That's why the special project on sugar maple decline was initiated in the Department of Plant Pathology several years ago. Funds for the research came primarily from state "consortium" support, but the International Society of Arboriculture made several grants over the past four years, and private citizens and state arborist organizations also made important contributions.

Mike Drilias was the graduate student involved. He's just finishing his work, prior to joining the faculty at the University of Tennessee, after working with Drs. Jim Kunz and Gayle Worf on the project for nearly five years.

Mr. Drilias found some very important aspects about maple trees in the urban environment. This article shares some of those results with you.

Typical symptoms of maple decline include premature autumn coloration, early leaf fall, twig and branch dieback, and often accompanied by a heavier than normal seed set on the plant parts showing these symptoms. A number of factors can cause such symptoms to develop, including drouth, soil compaction, girdling roots. Somewhat mimicking symptoms may also be associated with nutrient disorders or Verticillium wilt. Salt damage (from road deicing) also occurs along city boulevards. However, none of these could account for **most** decline symptoms we encounter in such settings as golf course roughs and landscapes. Mr. Drilias' work turned up two pathogenic problems that are damaging to many Wisconsin maples, and one of them is now established as the primary cause for the decline of some of our maples.

The first is an "annual canker" caused by the soilborne fungi *Fusarium solani* and *F. oxysporum*. These organisms are soilborne, but most of these cankers occur on the trunks. Some occur at the root collar. Fusarium cankers generally are elongate or elliptical in shape and never have been found to entirely encircle, or girdle the trees. Drilias found that this fungus is active for only one year, and it rarely attacks vigorous maples. Consequently, we believe Fusarium canker may contribute to, but not cause maple decline.

The second disease has proven to be much more common and important. It is called "collar rot," and is caused by the fungus *Phytophthora citricola.* Collar rot is a progressive, perennial canker. Cankers are initiated at apparently nonwounded root collars located below ground level, or at wounds sometimes made by girdling roots. Collar rot progresses around the root collar, up the trunk, and down buttress roots. Collar rot usually girdles infected trees. Because collar rot is initiated at root collars located below ground level, careful examination is required to find infected tissues in most instances.

The bark and wood symptoms of collar rot will vary with the time of year. In late summer and in autumn, when *P. citricola* is active in host tissues, characteristic collar rot symptoms develop. A dark fluid occasionally discharges from apparently healthy bark (as also can happen from annual cankers); this symptom often is the only external evidence of collar rot on otherwise healthy trees and on trees with initial decline symptoms. Recently infected inner bark is discolored, light red-brown and remains tightly attached to the underlying sapwood which also is light red-brown in color. The canker margin is distinct; the inner bark and cambium at the margin are discolored olive-green and this discoloration is most prominent near the cambium, eg, the inner bark area. Inner bark infected during previous years is discolored dark red-brown. As the bark dries, it often cracks and loosens from the underlying sapwood which is similarly discolored.

One of the best diagnostic tools we have for collar rot at this time is a pocket knife, used to tap around the base of a suspect tree. Bark in the condition as we've just described usually is loose, but we can't see it. "Knife tapping" around the base of the tree gives a hollow sound, rather than the firm sound of a healthy tree. The inner symptoms that we've described obviously requires the use of a hatchet, chisels and similar equipment to make the observations, and the symptoms are usually found below ground level. However, they typically move up the trunk over time.

Advanced wood decay often is present at the center of the cankers. Such decay is not a part of the collar rot syndrome, but follows in afterward, or in conjunction with collar rot. This occurs only after trees have first been girdled by collar rot.

Phytophthora collar rot is a perennial canker. That is, it can continue working on the tree in successive years. As a result, it can eventually surround the tree just beneath the bark, and if that happens the tree will die.

Evidence indicates that the

disease is inactive in the maple tree in spring and early summer. Consequently, symptoms are not as characteristic then. Inner bark is uniformly discolored red-brown and lacks the distinct olive-green margin. This bark remains tightly attached to the sapwood until cambial growth of surrounding nonaffected tissues (tissues that will become infected in late summer) causes the bark to crack and loosen.

Phytophthora collar rot occurs on maples with or without crown symptoms. In fact, some maples without crown symptoms were found to have been girdled by collar rot. In some cases, infected trees die within two years after crown symptoms first appear. Some infected trees live longer, but eventually are girdled and die.

**What can be done for trees with collar rot?**

Drilias tried drenching trees with Subdue, Banol and similar water mold-controlling chemicals without success. This was apparently true for two reasons: first, the fungus was unusually tolerant to Subdue in laboratory tests; second, once the fungus had gained a good "foothold" in the tree, it was not reached by the fungicide. Composted hardwood mulches have suppressive activity against Phytophthora in some situations. It might be useful to open up the area about the base of the tree by carefully removing the soil without damaging the stem and roots. Then leaving the area open to dry out, or possibly adding the hardwood mulch might help, but there was no good way to test these ideas.

**Can collar rot be prevented?**

Collar rot has only been observed on transplanted trees! Woodland trees, or trees coming up from seed in urban settings are apparently unaffected. Much of Drilias' work in the last year was spent in trying to gain an understanding of this interesting point. At first it was thought that the fungus might be hitchhiking in from the nurseries. Or there may be antagonists present in forest floor litter that stops Phytophthora growth. There still might be something to the latter, but Drilias found the organism to be present nearly everywhere he looked in soil samples from both urban and rural woodland sites. So we have to assume that it's not just the presence or absence of the pathogen that is involved here.

The evidence suggests that transplanted maples ultimately become subject to the disease because we establish a favorable environment for the pathogen. Trees that are planted deeply enough so that the roots do not flare out over the soil surface as they do in the woodlands are good candidates for the disease. Water probably traps periodically at the soil line by the trunk, which is below ground on such transplanted trees, and consequently becomes subject to ultimate infection over time.

So it would appear that we can greatly increase the probability of long time survival of sugar maples by planting them shallow. Mulching these trees with a layer of composted hardwood bark may also help keep the fungus from getting started.

Drilias' work required the excavating of many roots systems. It also involved some comparison of woodland root systems versus urban tree root systems, at least in the proximity of the collar. Many urban tree root systems appear horribly disoriented!! Rather than roots radiating outwardly in an orderly manner, on many trees they grow in "circles" and fail to develop properly. Whether such disorientation is directly damaging to the tree's welfare can only be surmised at this time. However, he encountered many trees—with and without Phytophthora collar rot—where girdling roots had developed. That is, roots of the same tree eventually grew into and around the trunk so as to strangle them. Dis-oriented root systems and girdling roots will have to remain as a subject for another time, but it would certainly appear that the time taken to plant and establish sugar maples so that the roots are not confined too tightly, so that they are not planted too deeply, and they are examined periodically to insure good establishment are requirements for their long time health. One sees many venerable old sugar maples doing well in an urban environment. Could it be that they were planted at a time when time was not the premium it is today, and attention to good planting details was common practice?