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COLLAR ROT AND BASAL CANKER OF SUGAR MAPLE[1]

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Abstract. Two types of trunk symptoms are associated with urban maple decline in Wisconsin. One is a "basal canker," caused by *Fusarium spp.*, and the other is a "collar rot" caused by a *Phytophthora* sp. Phytophthora collar rot appears to be more destructive. Trunk girdling by these diseases, both occasionally observed on the same tree, was greatest on trees with severe decline (Class V) and least on trees with initial decline (Class II). Incipient cankers were found on trees still healthy in outward appearance (Class I). Buttress roots of planted trees were deeper than the roots of naturally seeded, woodland trees. Moreover, woodland trees exhibited no similar cankers. We believe that the fungi and the diseases they incide are causes of urban maple decline in Wisconsin. They may be associated with maple tree production in nurseries or with planting practices in urban situations.

Sugar maple (*Acer saccharum*) and other maple species have always been important trees of the urban forest. Since the 1950's, their popularity has increased in the replacement of dead and dying elm trees. Unfortunately, maple losses also have increased. Roadside salt, girdling roots, Verticillium wilt, manganese deficiency, graft incompatibility, sun scald, and various urban environmental stresses are reported as causes of maple losses in urban settings (4,6,7). However, these causes, either individually or collectively, do not provide acceptable explanations for the extensive loss of most planted maples in Wisconsin, particularly the sugar maples. Sixty-nine percent of 633 sugar maples surveyed in Madison and 34% of 123 Milwaukee sugar maples examined in 1977 showed one or more decline symptoms in early July (2).

Important symptoms include premature "fall coloration," usually on one side of the tree or over all of the tree top, heavy seed set, especially on affected branches, small leaves, early leaf drop, and loose bark at the root collar (Fig. 1). Symptoms increase each year. Affected trees eventually appear lighter in color than do nearby healthy maples and dead branches are usually present. Eventually, affected trees die.

Except for the fact that the trees were transplanted, and most were in an urban environment, no other site factors are correlated with maple decline. Backyard trees, landscape maples in parks and on golf courses, street trees, and occasional farmstead maples have been observed with these symptoms. This syndrome of combined symptoms has not been observed in natural forests, however.

High rootlet mortality, and a considerable amount of internal wood discoloration have been observed in maples that have been sacrificed and examined critically for possible disease causation (1,2). However, the most apparent critical symptom is the deterioration of bark and wood in the root collar area, both above and below the soil line. On some trees areas of bark have sloughed in a manner suggesting lawn mower injury. More commonly, however, the bark remains in place, but somewhat loosely attached. The cambium is killed and the cankered areas sound hollow when lightly tapped with a heavy knife. This research examined the progressive "cankering" just described.

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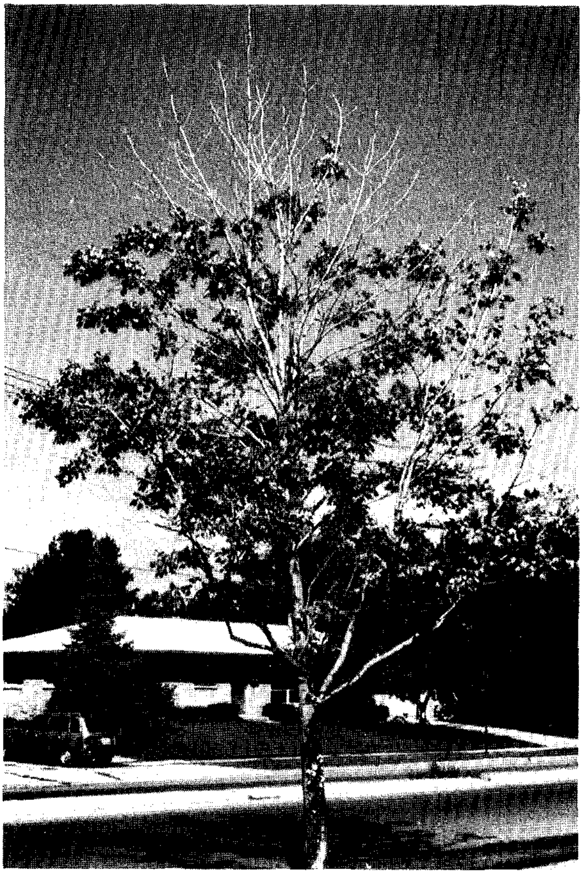

Figure 1. Sugar maple in advanced stages of decline. Upper branches had exhibited smaller leaves, heavy seed set, and premature coloration for several previous years.

Materials and Methods

In detection and appraisal surveys, basal trunk cankers were found on transplanted trees, but never on naturally seeded woodlot maples. For example, in the University of Wisconsin Arboretum, declining trees with basal cankers were found in sugar maple plantings. In Madison, Wisconsin, root collars of 45 sugar maples, ranging in dbh from 14 to 70 cm, were carefully excavated with a spade and garden trowel. These trees were free of salt contamination, soil compaction, or visible physical abuse. Each of the five crown-vigor classes developed by Bassett et al (1) were represented by seven or more trees. Symptoms ranged from those in Class I ("healthy trees" without external evidence of cankers or foliage symptoms) to those in Class V (trees that were virtually dead). For comparative purposes, approximately 30 naturally seeded woodland maples, located 20 miles northwest of Madison, were similarly examined in August 1980.

Throughout the year, bark and wood tissues from cankers of different sizes were isolated on common and selective nutrient media to determine the presence of possible fungal or bacterial pathogens. The presence or absence of girdling roots was noted; the apparent depth of planting and the pattern of root distribution also were examined.

Suspect fungi isolated from cankers were wound-inoculated into ten-year-old sugar maples from June through September. These trees were located at the Arlington Experimental Farm located north of Madison. A section of the culture medium, containing mycelium, was placed in a fresh, 2 x 10 mm, horizontal bark wound cut in the lower trunk. Moist cotton was placed over each wound and secured with masking tape. Sterile agar was placed in similar wounds to serve as noninoculated "controls."

Results and Discussion

Eleven Class I trees, apparently "healthy" trees with no visible decline symptoms, were examined in the spring and early summer of 1980 and showed no external evidence of cankers. However, in late summer and early fall, two distinct types of incipient cankers were found on seven of the trees. One type of canker, which shall be referred to as "basal canker," (Fig. 2a, 2b) discharged sap from what appeared to be healthy bark. This exudate caused the bark surface to turn gray to black. Sources of bleeding areas were confined to within 30 cm of the ground. The bark beneath the bleeding site was moist, dark red-brown in color; it could be separated easily from the sapwood. The underlying sapwood ranged in color from red-brown to chocolate-brown and was delimited by greenish-brown margins. Soil excavations revealed the presence of trunk cankers below the soil level, but they were infrequent on buttress roots. Cankers were circular, elliptical or elongate, and varied from 1 cm^2 to 25 cm in vertical length by 10 cm in horizontal width. Some larger cankers were ir-

Figure 2a. Basal trunk canker associated with *Fusarium* sp. Small cracks in the bark are discernible near the soil line.

Figure 2b. Dead cambium and discolored wood under affected bark of the basal trunk canker. Fusarium was associated with this canker.

regular in shape and may have resulted from the coalescing of several smaller cankers. On one tree, there were as many as 37 small cankers within an area of approximately 225 cm^2 at the root collar.

The second type of incipient canker, referred to as "collar rot," (Fig. 3a, 3b) could be found only by removing soil from the root collar and by probing the bark below the soil with a knife. Attention was directed toward such apparently healthy trees adjacent to declining trees with advanced cankers. There was no external indication of collar rot in its incipient stages. There was no bleeding, and infected bark remained attached to the sapwood. Examination revealed that the cankers were initiated at the root collar commonly buried in planted street trees from 15 to 25 cm below the soil surface. Such cankers escaped detection without soil excavation and careful probing of the bark at the root collar. Scraping off the outer bark exposed moist, light red-brown inner bark with a distinct olive-green margin. The sapwood beneath the discolored bark also was light red-brown.

Examination of trees with maple decline symptoms (Classes II-V) revealed progressive development of basal canker and collar rot. The extent of trunk girdling by basal cankers and collar rot, occasionally found on the same tree, was greatest

Figure 3a. Collar rot associated with *Phytophthora citricola*. Loose bark over dead cambium has remained in place at the base of this Class II tree.

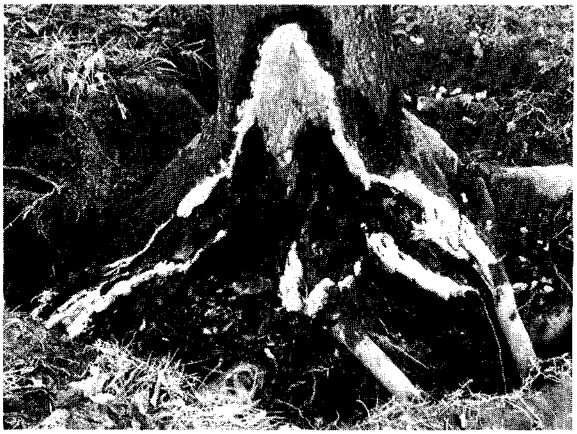

Figure 3b. Dying cambium and discolored wood, or "collar rot" was observed when the collar area was excavated and the bark removed.

on Class V trees and least on Class II trees. Trees of Classes III and IV exhibited a continuum of girdling between the extremes. It was difficult to differentiate between basal canker and collar rot in more advanced stages. Cankers ultimately progressed down into buttress roots and in some cases, as far up the trunk as 5 meters. Dead bark dried, cracked, and eventually sloughed off to expose wood that can be invaded by wood decay organisms. Decay of roots and root collars was advanced on severely declining maples.

Fusarium spp. were the only fungi isolated consistently from bark and wood chips taken from canker margins through late summer and from incipient basal cankers in late summer and early fall. At this time, *Phytophthora citricola* was isolated consistently from the margins of active collar rot. *Fusarium* spp. also were isolated occasionally from such infected areas. Successful isolation of *Phytophthora* is apparently influenced by seasonal or environmental conditions. Early spring examinations or isolation attempts during dry periods were usually unsuccessful, even in trees known to be infected.

When tested for pathogenicity in the manner described previously, only *Fusasium* spp. induced bark and wood discoloration characteristic of incipient basal cankers (Fig. 4). The isolates of *Fusarium* were reisolated consistently from the discolored bark and wood. The *Phytophthora* sp. induced characteristic collar rot symptoms and was reisolated consistently from infected bark and wood (Fig. 4b). Noninoculated "control" wounds closed with wound callus (Fig. 4c). Because of limited time, so far crown symptoms of maple decline have not developed but all inoculated trees will be observed periodically for canker development and possible decline. *Phytophthora* may be the more important of the two pathogens.

Girdling roots were observed on several of the trees examined. However, many declining maples were without girdling roots. Cankers were found on declining trees with or without girdling roots. We suspect that the deeply girdling roots, where present, contribute to the decline of those maples. Buttress roots of planted maples were always located more deeply than were roots of the natural, woodland maples examined (Fig. 5).

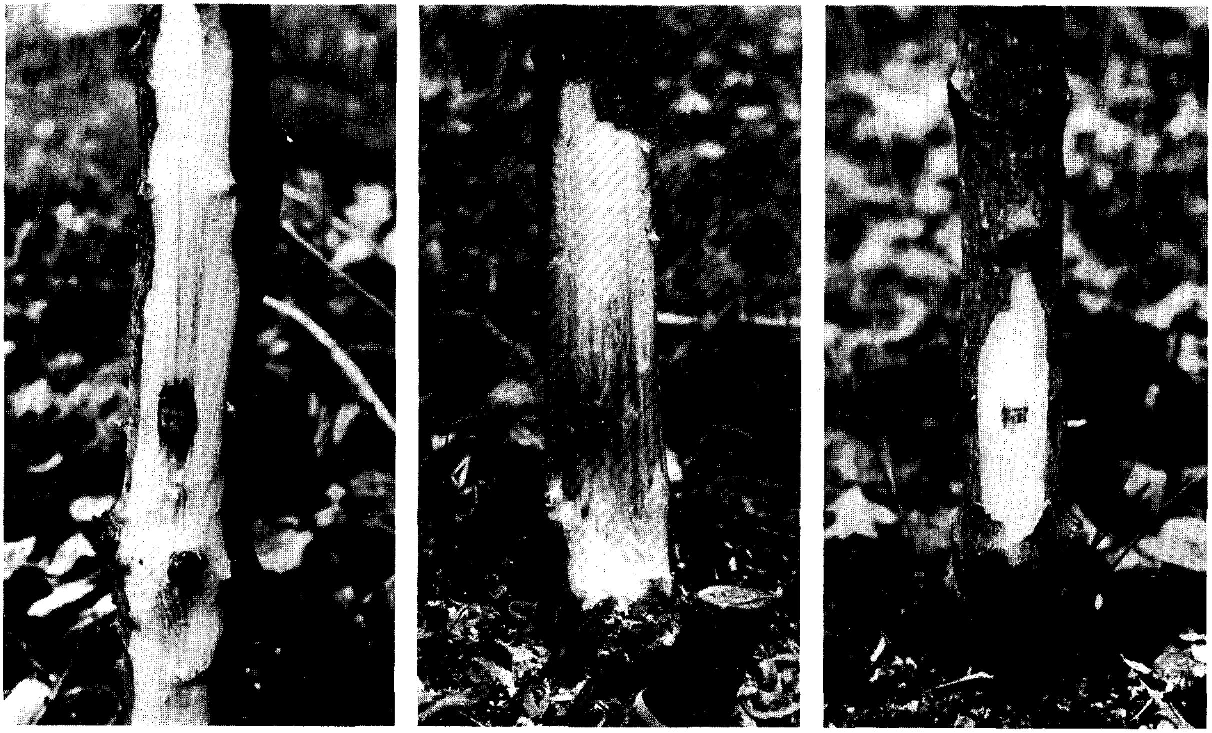

Figure 4. Wood discoloration 30 days after wound inoculations with mycelium of fungus isolates. a) *Fusarium* sp.; b) *Phytophthora citricola*; and c) noninoculated control (sterile agar only).

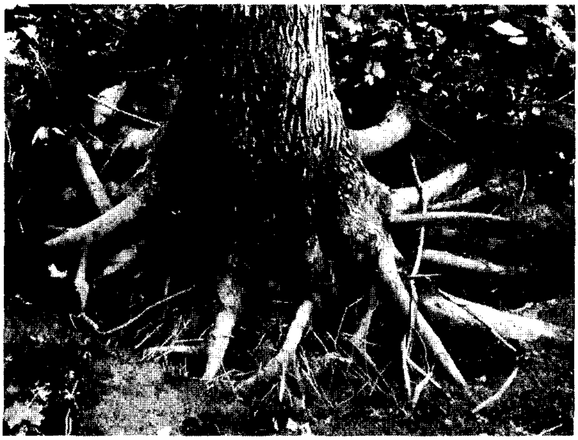

Figure 5. Partly exposed roots of a woodland maple. Buttress roots are near the soil surface and the trunk usually flares above the soil line. (Compare with Figures 2a, 2b, 3a, and 3b).

Roots of seeded trees were located on or very near the soil surface, while the uppermost roots of some planted maples were found as deep as 30 cm in the soil. Neither cankers nor severely girdling roots were observed in the woodland maples. Whether infection can be initiated in nursery seedlings and transplants and whether deep planting in urban sites favors the development of basal canker and collar rot deserve additional study.

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ABSTRACT

JOHNSTONE, DAVE. 1981. **Short-term rentals may help you match equipment to market.** Weeds, Trees & Turf 20(3): 16-17.

If you bid on a maintenance or installation contract, you may have your equipment specified for you by someone who has consulted a computer or who has a friend with that equipment. In any event, you are likely to have to field a lot more questions about completion time and equipment capacities than in the past. You can't very well go out and buy new equipment for each job or you would soon be bankrupt, and so you must find an alternative means of acquisition. It's not leasing, because leasing involves a long-term commitment, generally of a year or more. It's renting, a concept that you may not have thought about recently. The disadvantage of renting is that you cannot depreciate the equipment (depreciation is a source of capital) but must treat the equipment as a straight expense. Renting does have its advantages. These are usually promoted as: 1) conservation of capital, 2) provided maintenance, 3) saving of storage space, 4) inventory control, 5) mobility, 6) eliminating disposal costs, 7) matching equipment to task, 8) minimizing idle equipment, and 9) eliminating personal property taxes and licensing costs.