

Fungal Cankers *of* Trees



Figure 1

Cankers are localized dead areas in the bark of stems, branches, or twigs of many types of trees and shrubs (Figure 1). Most canker diseases are caused by fungi, which grow between the tree's bark and the wood, killing the living portion of the bark.



Cankers are among the most destructive and hard-to-manage problems of woody plants. Branches die when canker fungi girdle them, marring the beauty of landscape trees and shrubs. Cankers also create openings for other fungi, bacteria, and insects, which can speed up a tree's decline and death.

The most effective strategy against cankers is to prevent them from occurring. Cultural management techniques discussed in this bulletin can help to reduce the risk of canker diseases.

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Figure 2



Figure 3

Symptoms

Symptoms of canker diseases include dying or dead branches, sometimes with wilted leaves still attached, scattered among healthy-looking foliage. On shoots of thin-barked hardwood trees, canker-infested areas appear dark or discolored compared to healthy bark, and the canker may be sunken below the level of nearby healthy bark. On older, thick-barked hardwoods, surface discoloration may not be visible, but cankers often are sunken, the branch or trunk may appear flattened, and the bark at the canker edges may be swollen and cracked.

On conifers, a common canker symptom is resin leaking from a trunk or branch; the resin is clear at first, but gradually dries to a whitish, sticky mass on the bark (Figure 2).

Cankered sapwood (the wood just beneath the bark) often is dark or discolored (Figure 3). Numerous, tiny bumps may protrude from the bark in or around cankers (Figure 1). Spores in these structures can be examined under a microscope to identify the canker-causing fungus.

Most canker fungi do not damage healthy, vigorous trees, but only those that are already severely weakened or stressed. Common environmental stresses include drought, flooding, low temperatures in fall or early spring, extreme temperature fluctuations, mineral element deficiencies, defoliation, chemical injury, transplant shock, and mechanical injury such as lawn mower damage.

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Figure 4



Figure 5

In the 1970s, Don Schoeneweiss, a plant pathologist at the Illinois Natural History Survey, demonstrated that cankers caused by the fungus *Botryosphaeria dothidea* grew more rapidly when plants were under stress. In Iowa, trees often are exposed to multiple stresses, and are especially stress-prone in the first few years after transplanting.

The starting point of a fungal canker usually is a wound or branch stub. The canker expands in all directions from the fungus' point of entry. Because cankers typically expand most rapidly along the main axis of the limb, they tend to be oval or elongated in shape (Figure 4).

Canker symptoms vary depending on the species and health of the host plant, as well as the fungus that causes the canker. Diffuse cankers (Figure 4) form little or no callus (a mass of woody tissue at the outer margins of a canker, created by rapid cell growth) because the fungus grows too quickly for callus to form. Because diffuse cankers girdle trees rapidly, they are among the most destructive types of canker. Target-shaped cankers (Figure 5) result from accumulation of callus caused by a tree's attempt to defend itself. The canker fungus eventually overcomes the resistance response and grows through the callus barrier. When this cycle of callus formation and breaching occurs over many years, concentric rings are formed, giving the appearance of a target.

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Common Fungal Canker Diseases in Iowa

Because canker symptoms vary so widely, it is helpful to be able to recognize some of the more common cankers. The following section describes several canker diseases that are relatively common in Iowa.

Thyronectria canker (Figure 4), caused by the fungus *Thyronectria austro-americana*, is most common on honeylocust (*Gleditsia triacanthos* var. *inermis*) that are drought-stressed or weakened by adverse environmental conditions.

Symptoms include cankers on trunks and branches of all sizes. Branches develop yellow or wilted foliage and dieback when growth of the canker encircles the branch. *Thyronectria* cankers usually are elongated and slightly sunken when young, with callus ridges at the edges (Figure 6). On young trunks or limbs, the surface of killed bark is frequently orange-brown at first and later bleaches to bright yellow-orange. Reddish-brown discoloration occurs in the sapwood beneath and around cankers. Common sites of infection on landscape trees are pruning wounds and sunburned bark on the southwest side of the trunk. Thornless honeylocust (cultivar 'Skycole') appears to be relatively resistant to *Thyronectria* canker, the cultivars Imperial and Skyline are intermediate in resistance, and sunburst honeylocust (cultivar 'Suncole') has relatively low resistance to the disease.

Nectria canker (Figure 1) is caused by fungal species in the genus *Nectria*. *Nectria* attacks deciduous shade trees as well as crabapples (*Malus* spp.) and pear (*Pyrus* spp.). Among the hardwood trees susceptible to *Nectria* canker are quaking aspen (*Populus tremuloides*), black walnut (*Juglans nigra*), American elm (*Ulmus americana*), red maple (*Acer rubrum*), sugar maple (*A. saccharum*), basswood and linden (*Tilia* spp.), red oak (*Quercus rubra*), and honeylocust. *Nectria* sometimes produces target-shaped cankers around bud scars, wounds, and branch stubs of landscape trees (Figure 5). Pruning wounds are common points of entry in nurseries. When *Nectria* canker occurs on the main stem, the tree is subject to wind breakage.

Sphaeropsis canker (Figure 3) is caused by the fungus *Sphaeropsis sapinea* (also known as *Diplodia pinea*). The disease causes considerable damage to landscapes



Figure 6

and pine windbreaks. In Iowa, it is most common on Austrian pine (*Pinus nigra*) but also attacks Scots (*P. sylvestris*), red (*P. resinosa*), ponderosa (*P. ponderosa*), mugo (*P. mugo*), and white (*P. strobus*) (Figure 7) pines as well as white fir (*Abies concolor*) (Figure 8) and other conifers. Resin leakage (Figure 9) and sapwood discoloration (Figure 3) also are common symptoms of *Sphaeropsis* canker. The most common symptom caused by this fungus on Austrian pine is not canker, but tip blight (Figure 10). Unlike tip blight, however, *Sphaeropsis* canker often attacks older portions of limbs rather than the current year's shoot growth. Both *Sphaeropsis* tip blight and canker can occur on the same tree.

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Figure 7



Figure 8



Figure 9



Figure 10

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Figure 11



Figure 12



Figure 13

Cytospora canker (Figure 2), also known as Leucostoma canker, is caused by the fungus *Leucocytophora kunzei*. It attacks many species of fruit trees, hardwood forest trees, shrubs, and more than 70 species of conifers. Cytospora canker is the most common and damaging disease of ornamental and windbreak spruces in the Midwest, especially Colorado spruce (*Picea pungens*) (Figure 11). The disease is most severe on trees weakened by low or high temperature injury, drought, poor nutrition, mechanical injury, or other diseases. Whole trees are rarely killed, but they are disfigured when branches are killed and large amounts of sticky, whitish resin (Figure 2) are exuded from cankers on branches or trunks. Characteristic disease symptoms are dying or dead branches. Older branches are more susceptible than younger branches. In the spring and early summer, needles on girdled branches gradually turn brown. Brown needles remain on the tree during the growing season and fall off during the winter, leaving ornamental spruces bare and ugly. Damage typically begins to show

when the tree is more than 15 years old.

Cytospora spores are spread by running or splashing water during wet weather in spring, summer, and fall. Most infections occur in early spring through breaks in the bark caused by mechanical stresses such as the weight of ice and snow.

Phomopsis canker (Figure 13), caused by several species of *Phomopsis*, occurs on both conifers and broadleaf trees. Seedlings and saplings of Russian olive (*Elaeagnus angustifolia*) usually are killed by *Phomopsis arnoldiae*, which causes cankers and die-back on older plants (Figure 12). Foliage shrivels, turns brown, and remains attached to dead branches or entire small trees from midsummer through fall. On smooth bark or young main stems, cankers are reddish-brown to nearly black in contrast to the dark olive-green of healthy bark (Figure 13). Scores of tiny, spore-producing structures appear in the killed bark at the canker's center.

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Figure 14



Figure 15



Figure 16

Hypoxylon canker (Figure 14) is caused by species of fungi in the genus *Hypoxylon*. In Iowa, Hypoxylon canker, caused by *H. atropunctatum*, commonly attacks species of oak, including white and red oak. Trees weakened by high temperatures, drought, or root injury are especially susceptible to Hypoxylon canker. Because the fungus also can invade healthy oaks without causing cankers, it is often already present when environmental stresses occur, setting the stage for canker development.

Symptoms of Hypoxylon canker include yellowing or wilting of leaves followed by dieback. Outer bark characteristically sloughs off in strips that may be several yards long. When the outer bark sloughs off, tan-colored masses of fungus, called stromata, are exposed. Clouds of spores are released when stromata are disturbed. The stromata gradually turn black as fungal fruiting structures form and mature (Figure 14).

Botryosphaeria canker (Figure 15) occurs on forest, fruit, and landscape shade trees. It is caused by various species in the genus *Botryosphaeria*. On Rocky Mountain juniper (*Juniperus scopulorum*), for example, Botryosphaeria canker is caused by *B. stevensii*. Cankers and dieback (Figure 15), along with sapwood discoloration (Figure 16), are typical symptoms. Symptoms vary with host species and predisposing conditions and include fruit rots, leaf spots, and blights. Spore-producing structures develop beneath the surface of killed bark and release spores during wet weather. Spread of spores by dripping or splashing rainwater occurs throughout the year, but especially in the spring and summer. Infections occur through wounds, lenticels (openings in the stems of woody plants that allow the exchange of gases), and cracks in the bark.



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Canker Management Strategies

Several cultural management strategies can help reduce plants' susceptibility to cankers and slow the advance of cankers, thereby improving the appearance of trees and shrubs.

Pruning out cankers can remove most of the canker fungi from the tree, reducing the risk of new infections. Because spread of canker pathogens is favored by rain-fall, pruning should be completed during dry weather only. In general, it is advisable to make pruning cuts at least 4 inches below the edge of the canker. Cankers on the main stem can sometimes be cut out, but a more common strategy is to replace the tree. For more detailed advice on pruning of trees, consult local Iowa State University Extension specialists, professional arborists, or the ISU Extension bulletin SUL 5, "Pruning Trees and Shrubs," available from ISU Extension Distribution Center, Printing and Publications Building, Iowa State University, Ames, IA 50011 (telephone: 515-294-5247).

Planting well-adapted species and cultivars can avoid canker diseases. Species and cultivars should be well-adapted not only to your plant-hardiness zone, but also to the soil type, drainage, sun exposure, and other environmental conditions in your yard or acreage. In other words, match the plant with the site. Contacting local experts, such as extension specialists and reputable nursery personnel, in advance about the best species

and cultivars to plant can save the frustration of coping with cankered trees.

Stress prevention or reduction starts with selecting suitable plants, but does not end there. Use proper techniques for transplanting, and follow recommended maintenance practices after transplanting. Drought-prone trees can be kept healthy by practices such as mulching and timely watering. Excessive nitrogen fertilization should be avoided, since it can result in succulent growth that causes trees to become especially susceptible to certain canker diseases. Ask local extension specialists or arborists for advice on proper mulching, fertilization, and watering techniques, or consult ISU Extension bulletin PM 1591, "Community Tree Planting and Care Guide," available from ISU Extension Distribution Center.

Stress avoidance is the most effective canker management strategy. Pruning can remove some of the canker fungi from a tree, and may slow the rate of disease spread, but a stress-weakened tree is likely to redevelop cankers even after all of the initial cankers are pruned out. Fungicides generally are ineffective against canker diseases. Wound dressings have not resulted in much benefit, and can be even more laborious and costly to apply than fungicide sprays. Prevention of cankers is crucial, and stress avoidance is the most effective canker-prevention strategy.

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