



CYTOSPORA OR LEUCOSTOMA CANKER OF SPRUCE

Cytospora or Leucostoma canker, the most common and damaging disease of spruce, is caused by the fungus *Leucocytospora kunzei*, synonym *Cytospora kunzei* (teleomorph or sexual state *Leucostoma kunzei*, synonym *Valsa kunzei*). This canker occurs on several conifers from New England to the western United States. Colorado or Colorado blue (*Picea pungens*) and Norway spruce (*Picea abies*), used for ornament and in wind-breaks, are the species most commonly affected in Illinois. The disease has reached epidemic proportions on Engelmann spruce (*Picea engelmannii*) and Douglas-fir (*Pseudotsuga menziesii*) in the eastern Rocky Mountains due to a succession of dry years in the area. Other trees reported as susceptible to the disease are given in Table 1.

Spruce trees less than 10 to 15 years old usually do not have Cytospora canker. In landscape nurseries, however, small branches of young Colorado blue and occasionally white spruces may be killed. Three varieties of *Leucostoma kunzei* are recognized by some specialists: var. *piceae* on spruces, var. *superficialis* on pines, and var. *kunzei* on other conifers.

Dead and dying branches call attention to Cytospora or Leucostoma canker with older branches more susceptible than young ones. The fungus kills areas of bark, usually at the bases of small twigs and branches, creating elliptical to diamond-shaped lesions. If the lesions enlarge faster than the stem and girdle it, the portion beyond the canker also dies. The disease normally starts on the lowest branches and slowly progresses to higher branches (Figure 1). The entire tree is rarely killed except when the trunk is girdled. In most conifers, the cankers are usually confined to the branches. Black, Engelmann, Norway, red, and white spruce trees develop trunk cankers more often than other affected species. In Illinois, Cytospora canker destroys the ornamental value of spruce trees by killing branches and causing profuse exudation of resin from cankers on branches or trunks (Figures 2 and 3).



Figure 1. Colorado spruce affected by *Cytospora* canker.

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Table 1. Other conifers reported as being susceptible to *Cytospora* or *Leucostoma* canker

Common name	Scientific name
Black spruce	<i>Picea mariana</i>
Koster's blue spruce	<i>Picea pungens</i>
Oriental spruce	<i>Picea orientalis</i>
Red spruce	<i>Picea rubens</i>
White spruce	<i>Picea glauca</i>
Eastern white pine	<i>Pinus strobus</i>
Red or Norway pine	<i>Pinus resinosa</i>
Himalayan white pine	<i>Pinus wallichiana</i>
Balsam fir	<i>Abies balsamea</i>
Canada or eastern hemlock	<i>Tsuga canadensis</i>
Giant arborvitae or western red cedar	<i>Thuja plicata</i>
Eastern larch or tamarack	<i>Larix laricina</i>
European larch	<i>Larix decidua</i>
Japanese larch	<i>Larix kaempferi</i>

Symptoms and Signs

In spring and early summer, the needle tufts at the tips of one or more branches fades and turns brown; the next symptom is death of the lower branches (Figure 1). Occasionally, the lower branches remain healthy and those at the center or top of a tree are attacked and killed. The brown needles may drop early from affected branches but usually persist for several months before dropping off during winter, leaving dry, brittle twigs and branches. This process recurs more or less each year moving from the older lower branches to younger higher ones destroying the symmetry of ornamental trees.

Unlike cankers on many plants, *Cytospora* cankers on spruce do not usually discolor the outer bark or cause it to become depressed. Clear amber resin exudes in large amounts from the edges of cankers, flows down the bark, or drips onto the lower branches and trunk or ground and hardens in patches into a conspicuous white crust (Figures 2 and 3). Several years, or sometimes a decade or more may pass before a trunk or large limb is completely girdled and killed. By that time the stem may be deformed because of one-sided growth and diseased tissue beneath the thin layer of outer bark is brown to reddish brown and infiltrated by resin. The underlying sapwood is colonized and killed by the fungus but is scarcely discolored. Black, pinhead-size, spore-producing bodies or stromata (pycnidia and perithecia) form in the dead inner bark near the edge of the cankers. The stromata are a positive sign of the disease. The fruiting bodies expand and are easier to see if the cankered stem is wrapped in a wet towel for 24 hours.

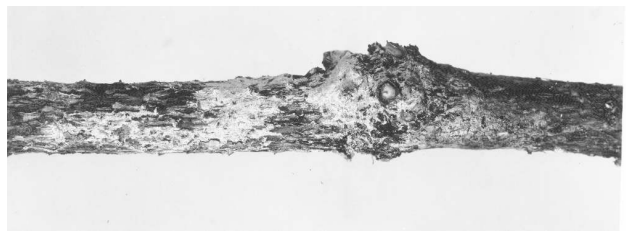


Figure 2. *Cytospora* canker on spruce is usually indicated by conspicuous white deposits or encrustations of resin on the bark (IL Nat. Hist. Survey photo)

Mite injury can cause some of the same symptoms as Cytospora canker. To check for mites, hold a white sheet of paper or a handkerchief under a branch and sharply rap the stem. If mites are present, some should be seen crawling on the paper or handkerchief.

Disease Cycle

The causal fungus survives as mycelium and spores in diseased and dead stems. The cankers grow slowly in size, eventually encircling and killing the twig or branch. As the fungus grows, it produces two kinds of spore-producing stromata which cannot be distinguished without a microscope: the perithecia of the sexual or teleomorph state, *Leucostoma* or *Valsa kunzei* (Figure 4, right), and the pycnidia of the asexual or anamorph state, *Leucocytospora* or *Cytospora kunzei* (Figure 4, left).

Pycnidial stromata, which are much more abundant than the perithecial stromata, are 1 to 2 millimeters (mm) in diameter with fertile chambers radiating from the center and opening to the bark surface by a common pore at the top of the stroma (Figure 4 left, A). When wet, the pycnidial stromata absorb water, swell, and exude millions of microscopic spores or conidia (Figure 4 left, C) in long, curled, amber to orange, sticky tendrils. An individual stroma exudes its pores only once. Conidial production is greatest during spring but the release of spores occurs throughout spring, summer, and autumn. The conidia can withstand freezing and germinate at temperatures of 68° to 91.4°F (20° to 33°C). The optimum temperature for conidial germination and growth is near 81°F (27°C).

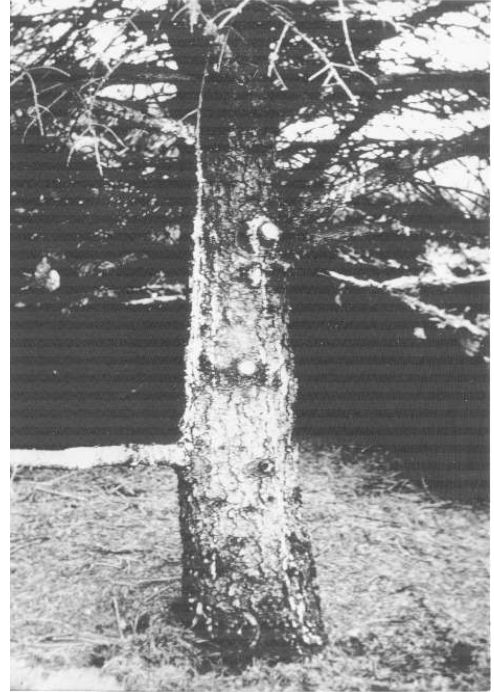


Figure 3. White resin flow on spruce, symptom of *Cytospora* canker (Purdue University. photo)

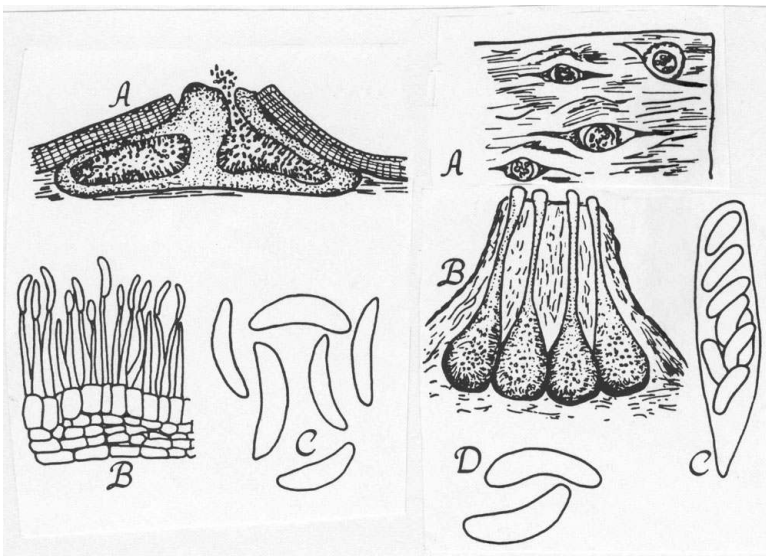


Figure 4. *Cytospora kunzei* (left) under high-power microscope. A, section through pycnidial stroma; B, pycnidial wall; C, six colorless, one-celled conidia. *leucostoma (Valsa) kunzei* (right). A, perithecial stromata; B, four perithecia; C, ascus with 8 ascospores; D, two ascospores (Lenore Gray drawing).

Perithecial stromata, which mature during spring, are 1 to 2 mm in diameter, gray to black on the surface, and found in dead bark beyond the cankers. Five to 30 perithecia are embedded in the pale yellow to grayish brown tissue of a stroma (Figure 4 right, A and B). The long necks of the perithecia converge at the disclike top of the stroma (Figure 4 right, B). The microscopic spores (ascospores, Figure 4 right, D) are released during wet periods in spring and early summer.

The conidia and ascospores are dispersed in wet weather by splashing rain and wind; they may also be dispersed by pruning tools, tree workers' hands and clothing, and by the movement of insects. The two types of spores are the principal means by which

the infection is spread to other branches and trees. Infection of both types of spores occurs through bark wounds resulting from injuries or other openings in the tree stems. Most infections are presumed to occur in wet weather in early spring when both conidia and ascospores are abundant, and shortly before symptoms appear. Tiny breaks in the outer bark, caused by mechanical stress such as the weight of ice and snow, are possible sites for infection. The fungus can also be found in the outer bark of apparently healthy twigs and branches.

Canker development is most severe if the tree has been under stress that is limiting its growth. Drought, insect damage, root-feeding nematodes, crowding, nutrient imbalance, hail, and other forms of mechanical damage to the branches, trunk, or roots predispose trees to infection. The susceptibility varies widely among species of spruce. Spruces growing outside their natural geographical range are generally more susceptible than native species. In Wisconsin, for example, Colorado and Norway spruce trees often develop the disease, while the native black and white spruces are rarely infected. No species of spruce is native to Illinois. Inherent susceptibility varies among individual trees as well as among species.

Control

1. **Plant healthy, vigorous, young spruces on sites favorable for their growth.** Avoid planting in shallow or excessively drained soils—for example, in light, sandy, or gravelly soils. Avoid crowding with other trees or buildings. If possible, do not plant in exposed sites such as a southwest-facing slope. A thick (4 to 6 inches), organic mulch helps maintain good soil moisture and prevents deep freezing, alternate freezing, and thawing. Avoid making unnecessary bark wounds. During extended dry periods, water thoroughly, moistening the soil to a depth of 12 to 14 inches. To help stimulate vigorous growth, take a soil test and apply fertilizer every few years.
2. **Severely cankered trees cannot be restored to good health.** These trees should be cut down and burned because they are a source of infection for other trees. On less severely diseased trees, all diseased and adjacent branches should be pruned back to the nearest living lateral branch or to the trunk. On major limbs or trunks, it is sometimes possible to cut out cankered parts. First, remove all brown, diseased tissue and 1 inch of apparently healthy bark and wood on all sides, cutting to a depth of 1/4 inch. Carefully clean your tools and disinfect them by swabbing or immersing them in a solution of 70 percent rubbing alcohol. Finally, scrape away the margins from the previous cut and shape the wound. Do NOT prune or work around trees when the foliage, twigs, and branches are wet.
3. **No chemical treatment has been shown to effectively prevent or arrest the development of cytospora or leucostoma canker on spruce trees.**