



CYTOSPORA CANCKER OF POPLARS AND WILLOWS

Cytospora canker of poplars—including aspens and cottonwoods—and willows is caused by the fungus *Cytospora chrysosperma* (perfect or teleomorph state *Valsa sordida*). Cytospora canker has been associated with the decline and/or death of many thousands of valuable ornamental trees in landscape, windbreak, and recreational areas as well as poplar (cottonwood) cuttings in storage and nursery propagation beds.

This stem disease commonly kills Lombardy poplars (*Populus nigra* cv. 'Italica') by the time they are 10 to 15 years old (Figure 1). The *Cytospora* fungus has been reported on a number of hosts (Table 1).

The disease is usually associated with trees growing outside their normal range or under unfavorable conditions due to a poor site, frost damage, periods of drought, extremely cold winter weather, transplant shock, or severe pruning (pollarding). The fungus kills areas of bark on branches and trunks creating circular to oval or elongate sunken lesions (cankers) (Figures 2 and 3). Frequently, as the lesions enlarge, affected stems are girdled and the portion beyond the canker is killed (Figure 1).



Figure 1. Lombardy poplar trees being killed by *Cytospora* canker.

SYMPTOMS

Discrete cankers first appear on young trees as brown, slightly sunken areas in the smooth bark of branches and trunks (Figure 3, left). These cankers are circular to oval or irregular in shape. Frequently, as the canker gradually enlarges, affected stems are girdled and killed. Twigs commonly die without the formation of typical lesions. Vertical cracks within the lesion and along the canker margins often occur in the bark (Figures 2 and 3, right). As the cankers enlarge the diseased outer bark may become black, brown, gray, reddish brown or yellow and sunken depending on the host species and stage of disease development. The inner bark turns black and sometimes gives off a foul salty odor. The sapwood appears reddish brown to black and water-soaked. Cankers frequently start at wounds or branch stubs or at the base of dead twigs. Cankers on large stems with thick, rough bark may be imperceptible except for yellowish to reddish brown spore horns (sticky, thread-like masses of spores) protruding from bark fissures (Figure 3, right).

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Highly susceptible trees, such as Lombardy poplars (Figure 1), may die within 2 to 5 years after becoming infected. Severely infected trees usually die branch by branch often producing sprouts at the base of the trunk which also become infected and die.

Cytospora chrysosperma is also the primary cause of blackstem disease of cottonwood seedlings and cuttings which causes severe losses in nursery beds and in prolonged or improper storage. Symptoms of blackstem occur in the fall as small lesions at the ends of cuttings or at leaf scars and lenticels, usually on stems but occasionally on the roots. The lesions enlarge during the winter, becoming dark brown to black and water-soaked with distinct margins.

DISEASE CYCLE

Cytospora chrysosperma and its perfect state *Valsa sordida* is generally considered to be a saprophyte or weak parasite living on dead bark. It can assume a parasitic role and quickly attack trees that have been weakened by stresses such as crowding, drought, extreme heat or cold, nutrient imbalance, transplant shock, severe pruning, fire, sunscald injury, frost, insect or mechanical injury, herbicide damage, root-feeding nematodes, insect damage, or



Figure 2. *Cytospora* cankers on a Simon poplar in a nursery. Note the sunken girdling cankers on the branches and trunk and the flow of gum oozing from the dead tissues (Illinois Natural History Survey photo).



Figure 3. *Cytospora* canker of willow. Left, canker on a dwarf arctic willow stem following transplant shock (courtesy Dr. D.F. Schoeneweiss); right, cankers on an older weeping willow (courtesy Dr. L.E. Dickens). Note the fruiting bodies of the *Cytospora* fungus which appear as pustules in the diseased bark.

infection by other pathogenic fungi. This opportunistic fungus often inhabits apparently healthy bark and buds and is thus in position to infect weakened tissue quickly and massively. A canker frequently begins at a wound, branch stub, or leaf scar.

Shortly after the bark dies two types of black, pinhead-sized, spore-producing bodies form in stromata in the outer diseased bark (Figure 2 and 3); the pycnidia of the asexual phase (*Cytospora chrysosperma*) and the perithecia of the sexual state (*Valsa sordida*) (Figure 4). The pycnidia are much more abundant than the perithecia. The stromata are shaped like short cones with flattened, gray-brown to black tips that break through the bark surface as small dark pimples or pustules (Figure 3). The pycnidia, under warm moist conditions, absorb water and swell, exuding long, thin, coiled, thread-like tendrils of microscopic spores, called spore horns. The yellowish to reddish brown spore horns consist of masses of one-celled spores (conidia) in a gelatinous matrix. As these structures dry, the conidia are released and are carried by dripping and splashing rain, wind, insects, birds, and tree workers' hands, clothing, and pruning tools to other trees.

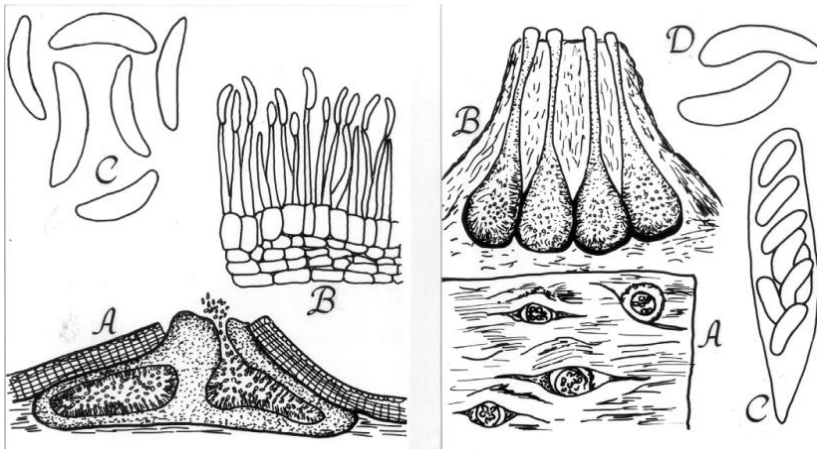


Figure 4. *Cytospora chrysosperma* (left) as it would be seen under a high-power microscope. A, Section through a pycnidial stroma showing two chambers and a pore releasing spores (conidia) from the right chamber; B, section of the pycnidial wall showing conidiophores bearing conidia at their tips; C, six colorless, one-celled conidia. *Valsa sordida* (right). A, Top view of four perithecial stromata erupting through the bark; B, section through a stroma showing four perithecia with the tips of their necks protruding from the stroma; C, an ascus with 8 ascospores; D, two ascospores. (Drawing by Lenore Gray).

The perithecia of *Valsa sordida* form in the same stromata with pycnidia or in new stromata beginning in autumn and winter after the formation of pycnidia. The perithecia are black, spherical, and several are arranged in a ring in the lower, outer part of the stroma. Their long necks converge to form a circle of openings in a disc which protrudes through the cracked bark (Figure 4a and b). When the stromata are wet for a prolonged period the asci (Figure 4c), each containing 8 ascospores, may exude from the perithecium much like the release of conidia. The colorless, one-celled ascospores (Figure 4d) may also be forcibly expelled into the air when the stromata in dry bark become saturated with water.

The *Cytospora (Valsa)* fungus overwinters as mycelia and conidia or ascospores in diseased bark and wood. Infection usually occurs through bark wounds typically resulting from mechanical damage. The fungus grows through the bark cells and the outer few rings of wood. Cankers usually develop in the fall, winter, and early spring and enlarge slowly at low temperatures (36° to 50°F or 2° to 10°C) and up to 40 millimeters per day at higher temperatures (68° to 86°F or 20° to 30°C). Bark susceptibility may be induced by heating to approximately 104°F (40°C) which is not uncommon on hot summer days. Rapid temperature shifts in the fall and spring between warm and subfreezing also predispose the bark to infection.

CONTROL

A. General Control Measures

1. Grow varieties of poplars and willows that are well adapted to the area and planting site. Select only vigorous, disease-free nursery stock. Avoid planting susceptible varieties such as Lombardy, Simon and Siouxlant poplars. Instead, grow one of the resistant varieties now available. Black and peach willows are reported as being resistant.
2. Remove all dead and dying branches on affected trees. If cankers are confined to twigs or branches, diseased bark and discolored wood may be removed with a sharp knife by cutting back 1 to 2 inches into surrounding live, healthy tissues. Whenever possible, the wound should be shaped into a vertical oval or ellipse with rounded ends. Avoid leaving branch stubs. Do not prune or work around trees when the bark is wet as this helps to spread the fungus. Pruning tools should be sterilized between cuts by swabbing them with 70 percent rubbing alcohol or fresh household liquid bleach (1 part of bleach to 9 parts of water). Remove and burn or bury all affected parts as soon as possible. Severely cankered trees cannot be restored to good health and should be cut down and burned because they are a source of infection for other trees.

3. Some trunk cankers, if less than halfway around the stem, can be successfully removed by careful surgery of all diseased bark and the underlying discolored wood. This work is best done by a licensed and experienced arborist.
4. Treat all bark and wood injuries promptly. Cut away all loose or discolored bark. Clean, smooth, and shape the wood into an oval or ellipse with rounded tips and its long axis oriented vertically. Swab the wound surface liberally with shellac or 70 percent alcohol. Many arborists then coat the wound with a tree wound dressing or paint. The use of commercial tree paints is not generally recommended as their effect is largely cosmetic. Surgery may prolong the lives of some severely affected trees.
5. Keep plants growing vigorously by (a) proper applications of a balanced fertilizer in mid to late autumn or early spring based on a soil test; (b) watering deeply (soil moist 10 to 12 inches deep) during hot, dry weather (repeat at 10-day intervals as long as the drought continues); (c) proper pruning; and (d) winter protection of young tree trunks using strips of burlap or special tree wrapping paper to prevent sunscald and bark injury.
6. Avoid all unnecessary bark wounds. Keep the trunk base as dry as possible and free of grass, weeds, or other debris that might attract rodents.
7. Avoid chemical injuries. Apply herbicides and other pesticides, salt, fertilizers, and other chemicals strictly according to label directions.
8. No chemical treatment has been shown to prevent or arrest the development of cytospora canker on poplars and willows.

B Disease Prevention in Nurseries and in Storage

1. Cytospora canker is common in cottonwood propagation blocks in nurseries. The disease appears to increase with the age of the blocks. It is suggested that propagation blocks not be used for more than a 4- or 5-year period.
2. All infected nursery stock, cuttings, and propagation material should be destroyed by burning to avoid introduction of the disease through commercial channels.
3. Precautions should be taken to prevent excessive moisture loss in nursery material during storage. Select scion wood of high moisture content.
4. Storage temperatures should be maintained above freezing and as close to 35°F (1°C) as possible with high humidity (95 to 98 percent) but without water forming on plant material and the walls, ceiling, or floor of the storage area.

Table 1. Poplar, Aspen, Cottonwood, Willow, and other hosts of Cytospora Canker

Poplars (<i>Populus</i>)	Willows (<i>Salix</i>)
Balsam (<i>P. balsamifera</i>)	Basket or common osier (<i>S. viminalis</i>)
Black (<i>P. nigra</i>)	Bay, lay-leaved or laurel (<i>S. pentandra</i>)
Lanceleaf (<i>P. x acuminata</i>)	Black (<i>S. nigra</i>)
Simon (<i>P. simonii</i>)	Brittle or crack (<i>S. fragilis</i>)
Western balsam (<i>P. trichocarpa</i>)	Creeping (<i>S. repens</i>)
White (<i>P. x alba</i>)	Ditchbank or sandbar (<i>S. exigua</i>)
<i>P. macdougalii</i>	Golden (<i>S. alba</i> var. <i>vitellina</i>)
<i>P. wilsonii</i>	Grayleaf (<i>S. glauca</i>)
<i>P. wislizenii</i>	Pacific (<i>S. lasiandra</i>)
Aspens (<i>Populus</i>)	Peach-leaved (<i>S. amygdaloides</i>)
Bigtooth or large-toothed (<i>P. grandidentata</i>)	Polished or red (<i>S. laevigata</i>)
European (<i>P. tremula</i>)	Purple or purple osier (<i>S. purpurea</i>)
Quaking or trembling (<i>P. tremuloides</i>)	Pussy, large (<i>S. discolor</i>)
Cottonwoods (<i>Populus</i>)	Shining (<i>S. lucida</i>)
Black (<i>P. heterophylla</i>)	Weeping (<i>S. babylonica</i>)
Eastern (<i>P. deltoides</i>)	White (<i>S. alba</i>)
Narrow-leaf or yellow (<i>P. angustifolia</i>)	<i>S. x aurita</i>
Plains (<i>P. Deltoides</i> subsp. <i>monilifera</i>)	<i>S. daphnoides</i>
	<i>S. lasiolepis</i>
	<i>S. nigricans</i>

Other Hosts

Apple, crabapple (<i>Malus sylvestris</i>)	Norway (<i>A. platanoides</i>)
Ash (<i>Fraxinus</i> spp.)	Red (<i>A. rubrum</i>)
Birches (<i>Betula</i>)	Rocky Mountain (<i>A. glabrum</i>)
Paper or canoe (<i>B. Papyrifera</i>)	Sugar (<i>A. sacchrum</i>)
Mountain or water (<i>B. occidentalis</i>)	Vine (<i>A. circinatum</i>)
Sandberg's (<i>B. x sandbergii</i>)	Mountain ash (<i>Sorbus</i>)
Chokecherry (<i>Prunus virginiana</i>)	American (<i>S. americana</i>)
Elder or elderberry (<i>Sambucus</i>)	Pacific or Sitka (<i>S. sitchensis</i>)
Blue (<i>S. caerulea</i>)	<i>S. scopulina</i>
American (<i>S. canadensis</i>)	Oaks (<i>Quercus</i>)
Maples (<i>Acer</i>)	English (<i>Q. robur</i>)
Douglas (<i>A. glabrum</i> subsp. <i>douglasii</i>)	Pin (<i>A. palustris</i>)
Japanese (<i>A. palmatum</i>)	Russian or Autumn olive (<i>Elaeagnus angustifolia</i>)
Mock-plane or sycamore (<i>A. pseudoplatanus</i>)	Spruce, Norway (<i>Picea abies</i>)