

## SPHAEROPSIS BLIGHT OR DIPLODIA TIPBLIGHT OF PINES

Sphaeropsis blight, previously known as Diplodia tipblight or dieback, is a major worldwide disease of pines, particularly of 2- and 3-needle pines in the United States from the East Coast to the Great Plains and the West Coast. It is mainly a disfiguring disease of trees growing under stress, with trees showing numerous brown, dead branch tips (Figure 1). Except for pine and white spruce (*P. glauca*) seedlings, Sphaeropsis blight rarely kills the host because only current-season needles, shoots (or candles), and seed cones are infected and killed. Where new candles have been killed several years in succession, however, entire branches may die back from "resinous bleeding cankers."



Figure 1. Sphaeropsis blight on an Austrian pine (Dr. P.C. Pecknold, Purdue University).

No species of pine is immune, but many are somewhat resistant. Austrian or black pine (*Pinus nigra*) is the most susceptible followed by Scots (*P. sylvestris*), and red (*P. resinosa*), Swiss mountain (*P. Mugo*), ponderosa (*P. ponderosa*), and eastern white (*P. strobus*) in decreasing order of susceptibility. Douglas fir (*Pseudotsuga menziesii*), big-cone spruce (*Pseudotsuga macrocarpa*), Norway spruce (*Picea abies*), Colorado blue spruce (*P. pun gens*), Sitka spruce (*P. sitchensis*), noble fir (*Abies procera*), silver fir (*A. alba*), and American larch (*Larix laricina*) are occasionally infected. Other evergreen genera reported as being susceptible include true cedars (*Cupressus* spp), *Chamaecyparis* spp, arborvitae (*Thuja* spp), hoop pine (*Araucaria cunninghamii*), junipers (*Juniperus* spp), and *Cedrus* spp. The *Sphaeropsis* fungus should be considered likely to colonize any pine and many other conifers growing under unfavorable conditions or among diseased, highly susceptible species such as Austrian pine.

The disease is caused by the fungus *Sphaeropsis sapinea* (synonyms *S. ellisii* and *Diplodia pinea*) which normally infects the young, healthy, unwounded needles of new candles. However, twigs of trees weakened by stress, such as drought, water shortage, compacted soil, root injury, excess shade, heat reflected from nearby roofs and walls, and wounds caused by hail, pruning tools, or insects (pine spittlebug, *Aphrophora parallela*, and a bark beetle, *Myelophilus piniperda*) are also infected. Trees 30 years or older are most severely damaged. The disease rarely occurs on young trees, possibly because the fungus builds up mainly in the tissues of old, dead seed cones. Thus, until a tree has acquired a quantity of old of old dead cones, its chances for infection remain low. Seedlings and young trees can become infected, however, if they grow near older infected trees. Seedlings are usually killed when the fungus

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For further information on diseases of ornamentals contact Nancy R. Pataky, Extension Specialist of Turf and Ornamentals, and Director of the Plant Disease Clinic, Department of Crop Sciences, University of Illinois at Urbana-Champaign.

girdles the stem at or near the soil line. Infected germinating pine seeds are killed by a decay of the radicle as it emerges.

## Symptoms

The most noticeable symptom of *Sphaeropsis* blight is a browning, stunting, and twisting of the new shoots and needle growth (the candles) (Figure 1). Usually the lower branches of the tree are the first and most seriously affected, and sometimes infection is concentrated over a small area or on one side of a tree. In wet springs, branches over an entire tree may show brown tips. Annual destruction of many buds and shoots causes gradual decline of ornamental trees. A brown discoloration first appears near the base of the needles and then progresses toward their tips. Infected needles usually die when they reach one-half to three-fourths their normal length. Generally, all needles developing on an infected shoot die.

Young candles that grow from infected buds are generally short, bent, and soon die, whereas, candles already developed from healthy buds stop elongating and become curled and twisted after infection. As infected stem tissue dies back, the whole candle droops. Resinous cankers often appear on infected stems at the youngest branch whorls and often on stems at the base of blighted needles. Death of the candle stimulates the formation of new lateral shoots in the healthy stem tissue below. These shoots eventually may become blighted, turning shades of yellow-green to straw color.

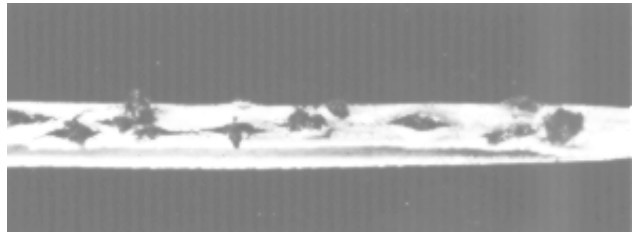


Figure 2. Austrian pine needle showing *Sphaeropsis* blight. (Dr. P. C. Pecknold, Purdue University).

Infected twigs commonly exude resin, resulting in the stunted, dead, brown needles sticking to the twig. Infected cones fail to mature. Black, pinpoint-sized specks – fungus fruiting bodies or pycnidia – form near the base of infected dead needles, mainly under the sheath (Figure 2), in the bark of infected twigs or branches, and on infected second-year cone scales. In older twigs that have been killed, the bark is dark brown and the sapwood is stained gray or blue-black. Top killing and death of entire trees result from a massive invasion of the wood and bark of trunks and, rarely, the major roots of trees stressed by an extended drought or other agents.

*Sphaeropsis* blight can be confused with symptoms caused by (1) low temperatures, (2) drought, (3) winter drying, and (4) Nantucket pine shoot moth (*Rhyacionia frustrana*) injury. These problems can be distinguished from *Sphaeropsis* blight because the dead tissues beginning in autumn lack the small black pycnidia. Twigs infected by the pine shoot moth are also distinguished from *Sphaeropsis* blight by the presence of frass and the hollow piths that are eaten out by the moth larvae; shoots killed by *Sphaeropsis* blight, in comparison, are solid, hard, brittle, and infiltrated with resin.

## Disease Cycle

The *Sphaeropsis* fungus overseasons as minute black pycnidia in the bark of woody stems, the needles (Figure 2), fascicle sheaths, seed cone scales, and the outer bark scales on an infected tree or on the ground. In wet weather, from early spring into late autumn, microscopic mostly one-celled dark brown spores (conidia) are liberated from the pycnidia and disseminated by wind and splashing rain, and in the fluid secreted by the spittlebug (*Aphrophora parallela*). The fungus can also be disseminated as mycelium on pine seeds.

The conidia are capable of germinating within a few hours at temperatures between 53°F and 96°F (12°C to 36°C). A wet period of 12 hours is sufficient for spore germination and infection. In warm weather, symptoms appear 3 to 4 days after infection takes place. The fungus makes rapid growth at about 82°F (26°).

Germinating conidia (Figure 3) invade new buds or new needle growth by stomatal penetration and sometimes through wounds. Penetration of young stems occurs through the intact epidermis. Most infections occur in mid to late spring. Young shoots are highly susceptible during the short period from bud swell to when the needles are about half grown. Second-year seed cones are also highly susceptible, but their susceptible period appears to start later than that of the shoots and extends later into the season. The seed cones of previously noninfected trees are more likely to become infected than the new shoots.

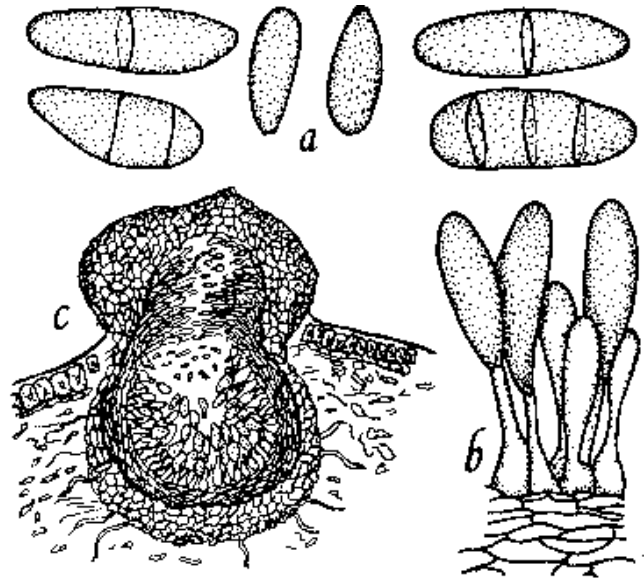


Figure 3. *Sphaeropsis sapinea*, the cause of *Sphaeropsis* blight or *Diplodia* tipblight as seen under a lab microscope: (1) conidia; (b) part of apycnidial wall and immature conidia; (c) vertical section of a pycnidium (L. Gray).

The *Sphaeropsis* fungus grows quickly through the needle tissue, then to the stem, and finally into adjacent needles. Dieback symptoms appear several weeks or more after infection. Later in the season, pycnidia (Figure 3c) appear on the tissue soon after it dies. Neither the mature needles or stems of previous years' growth are infected by the fungus, nor are the first-year seed cones. Pollen cones are seldom infected.

## Control

1. Fungicide protection is required from bud swell to when the needles are half grown. Three sprays are needed, spaced 10 to 14 days apart, starting just before budbreak. Effective fungicides are listed in the Illinois Homeowner's Guide to Pest Management. This manual is revised annually and should be available in every Cooperative Extension office. During rainy springs, a fourth application, 10 days after the third, will be necessary. Because new infections usually occur on the lower branches of a tree, good coverage of these branches is essential for optimal protection.
2. Keep pine trees in good vigor by watering thoroughly during dry periods, fertilizing regularly according to a soil test report, and applying insecticides suggested by University of Illinois Extension Entomologists. Pines stressed by adverse environmental conditions are, in general, much more susceptible to stem infections.
3. Where feasible, remove all infected twigs, branches, and seed cones from trees, or from the ground in dry weather, when first noticed. Pruning tools should be disinfected between cuts by dipping or swabbing in 70% denatured or rubbing alcohol or in fresh household bleach (1 part bleach in 9 parts of water). The plant debris should be collected and burned, buried, or placed in a compost pile and covered with a thin layer of soil.

4. Pruning should be done in autumn when the tree is dry.