

## 51. Diplodia Shoot Blight and Canker Disease

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The fungal pathogen, *Diplodia sapinea* (*D. pinea*, *Sphaeropsis sapinea*), causes shoot blights and cankers in pines (*Pinus* spp.) and some other conifers in much of the United States. Damage can be severe in landscapes, windbreaks, parks, and forests. A closely related pathogen, *D. scrobiculata*, occurs in the United States and may be present in the Great Plains although it has not been reported.

### Hosts and Distribution

Diplodia shoot blight and canker disease is a common and sometimes serious problem in the Great Plains. Pines are affected from seedling stage to maturity. The disease affects trees in nurseries, Christmas tree and ornamental plantings, plantations, and natural stands. Exotic and native two- and three-needle pines are commonly damaged in the United States. *D. sapinea* is widely distributed in the Great Plains and Diplodia shoot blight and canker disease can be locally severe, affecting Austrian (*P. nigra*), ponderosa (*P. ponderosa*), Scots (*P. sylvestris*), red (*P. resinosa*), and mugo (*P. mugo*) pines. Austrian pine, which has been widely used in landscape, windbreak, and park plantings since the early 1900s, is especially susceptible.

### Symptoms and Signs

Symptoms of Diplodia shoot blight on new shoots first occur during late May to late June. The first indications of infection are often resin droplets or one to a few short dead needles on emerging shoots, or a combination thereof. The most conspicuous symptom of Diplodia shoot blight is death of new shoots containing short, light brown, often wilting needles (fig. 51-1) that fade to gray and remain attached to stems. Both needles and stems can become stunted or crooked. *D. sapinea* commonly kills entire new shoots by mid- to late summer. Cankers, often resinous, develop in branches and stems with discolored brown phloem and cambium. Underlying xylem is often stained blue.



**Figure 51-1**—Typical symptom of Diplodia shoot blight: a dead, crooked new shoot with light brown needles that remain attached (James T. Blodgett, U.S. Forest Service).

Symptomatic, new shoots may be scattered throughout crowns, although damage is often first evident in lower crowns. Symptom severity can vary considerably among major branches. In some cases, damage may be confined to new shoots (fig. 51-2A), particularly on trees affected for the first time. After two or three successive years of damage, extensive branch and top mortality can occur (fig. 51-2B). Repeated outbreaks of Diplodia shoot blight and canker disease result in reduced growth, deformed trees, and tree mortality.

Small black asexual fruiting bodies (pycnidia) are easily observed with a 10× hand lens. However, microscopic examination of the asexual spores (conidia; fig. 51-3) or DNA sequence-based diagnostics are necessary for identification. Pycnidia are often numerous



**Figure 51-2**—Mortality caused by *Diplodia* shoot blight in (A) shoots, and (B) top/branches of ponderosa pine (James T. Blodgett, U.S. Forest Service).



**Figure 51-3**—Spores (conidia) of *Diplodia sapinea* with light young conidia and dark brown older conidia; approximate size 34 to 39  $\mu\text{m}$   $\times$  12 to 13  $\mu\text{m}$  (James T. Blodgett, U.S. Forest Service).

at the base of short, ash-gray needles killed the previous year (fig. 51-4). Pycnidia can develop in stems and may be numerous in scales of mature seed cones (fig. 51-5). To assist in diagnosis, needle and stem samples may be incubated in plastic bags with a piece of damp paper towel. Pycnidia with conidia may develop within two to three weeks.

### Disease Cycle

*D. sapinea* survives as mycelium or pycnidia in killed needles, bark of young shoots, and scales of mature seed cones. Numerous conidia are dispersed during rainfall, especially in

spring, but conidial dissemination can also occur throughout the year. Conidia are spread by rainsplash, wind-driven rain, or insects.

Needles and young elongating stems are most susceptible to *D. sapinea* infection in spring from budbreak until around mid-June. Conidia germinate and germ tubes can directly penetrate nonwounded, immature needle and stem tissues. The pathogen also can infect both current-year shoots and older tissues through wounds. Rain or high humidity coupled with cool to moderate temperatures favor spore germination, germ tube growth, and infection. If rain is sparse when new shoots are highly susceptible, disease incidence is usually low. After infection, new shoots are often killed quickly. Pycnidia may be produced within two weeks of shoot infection in spring, or throughout the summer in wet years.

Seed cones bearing pycnidia are often present on pines that otherwise appear healthy. These cones can be a source of large numbers of conidia. The conidia can germinate to initiate new infections on lower branches of the tree, nearby trees, and seedlings. Debris left onsite after harvesting also may serve as a source of conidia for several years.

This pathogen can persist on or in asymptomatic stems and branches of pines. Water stress has been demonstrated to act as a trigger, allowing *D. sapinea* to proliferate and



**Figure 51-4**—Fruiting bodies (pycnidia) of *Diplodia sapinea* at the base of pine needle with fascicle sheath removed (James T. Blodgett, U.S. Forest Service).



**Figure 51-5**—Second-year seed cone scales with (A) fruiting bodies (pycnidia) of *Diplodia sapinea*, and (B) uninfected scales (James T. Blodgett, U.S. Forest Service).

cause disease in these trees. This ability to act as a latent pathogen could explain the rapid mortality observed after outplanting or following hail or other wound events.

### Damage

*Diplodia sapinea* can cause shoot blight, canker, crown wilt, collar rot, and root disease. Although shoot blight is the most common type of damage, branch death, top dieback, and tree mortality can occur. *Diplodia* shoot blight and canker disease can predispose trees to other diseases and attack by insects, including the pine engraver (*Ips* spp.).

Increased damage from *Diplodia* shoot blight and canker disease has been associated with water deficits, competing vegetation, areas with high soil nitrogen, and offsite plantings. This disease often severely affects trees wounded by hail, snow, pruning, shearing, insects, or other damage. In the Great Plains, hail events are frequently associated with outbreaks of the disease and symptoms develop in one to two weeks. Wounded tissues remain vulnerable to *D. sapinea* infection for several days.

Although pines of all ages are susceptible to *D. sapinea*, damage is more severe in older plantings. In the Great Plains, windbreaks that are 20 to 22 years old have few

diseased pines. However, incidence and damage from Diplodia shoot blight and canker disease increase as trees approach 30 years, and damage is often severe in older pines with abundant mature seed cones.

## Management

Reducing water stress, avoiding wounds, and maintaining tree vigor are often the best options to manage Diplodia shoot blight and canker disease. Methods to reduce water stress include selecting species suited to the site, proper planting, managing competing vegetation, and stand thinning. In developed sites, watering during droughts is recommended. Avoid pruning or shearing in Christmas tree or other pine plantings during rain events. Conduct pruning during the dormant season, and disinfect pruning tools. Seedlings, including those in nursery beds, and small trees become infected when they are located close to diseased or cone-bearing pines. Remove cone-bearing trees or plant nonhost trees in the area. Nitrogen fertilization of pines at levels recommended for ornamental and shade trees can result in increased disease incidence and severity, and should be avoided.

Selecting nonhost species or more-resistant pine species is an option for long-term management. Studies have shown that pines differ in susceptibility, but most two- and three-needle pines are susceptible to this disease. Austrian pine is extensively damaged by Diplodia shoot blight and canker disease. Although ponderosa pine is susceptible to this disease, it is much more tolerant than Austrian, lodgepole, or red pine in the Great Plains. Ponderosa, Scots, and jack (*P. banksiana*) pine do not differ markedly in susceptibility to Diplodia shoot blight and canker disease. Scots pine is often recommended for landscape plantings, because it frequently experiences less damage from this disease than Austrian pine, and ponderosa pine planted offsite.

Infection of new shoots can be reduced significantly by applying an appropriate registered fungicide at the time when shoots are highly susceptible, which is usually between late April and mid-May, from budbreak to the end of shoot expansion. Fungicide applications will protect new shoots, but will not prevent infection of cones or eliminate the pathogen in colonized tissues. Fungicide treatments are usually applied to nursery seedlings, Christmas trees, or individual high-value landscape trees. Consult your state or local extension agent regarding appropriate registered fungicides.

## Selected References

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