Pine Diseases in Kansas: Tip Blight, Dothistroma Needle Blight, and Pine Wilt

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Although pine trees are not native to Kansas, they have been widely planted for ornamental, windbreak, and conservation purposes. Scots (*Pinus sylvestris*) and white pine (*P. strobus*) are particularly sensitive to drought. Several pines, including Austrian (*P. nigra*) and ponderosa (*P. ponderosa*), are reasonably adapted to Kansas conditions; however, they still can suffer environmental stresses, which are described below. Pines are also susceptible to several diseases, which can cause defoliation, dieback, and even death. This publication highlights the most common and serious of these diseases in landscapes and windbreaks in Kansas: tip blight, Dothistroma needle blight, and pine wilt. Pines also go through a healthy, normal process called natural needle drop. Accurate identification of pine problems is important, because control measures are different for each condition. A summary table is provided in Table 1.

Tip Blight

Tip blight is a fungal disease that affects Austrian, ponderosa, Scots, and mugo pines. The disease is most severe on mature trees (20 years or older). Repeated infections over many years can kill large sections of trees or entire trees.

Symptoms

The infection period for tip blight occurs when the buds start to expand, usually in late April. Wet spring weather increases disease severity. Tip blight symptoms first appear in late May or early June. The newly developing shoots (candles) fail to grow. The shoots are stunted, and the emerging needles are stunted and turn yellow or tan (Figure 1). Dried resin is often found on the dead shoot tips. The damage usually starts in the lower part of the tree and works its way up over several years. In trees that have been repeatedly infected for many years, damage is distributed throughout the crown. The disease can also act as a canker, invading older tissues and causing extensive branch dieback (Figure 2). White pines are not susceptible to the tip blight phase, but they are susceptible to the canker phase of the disease. Severe tip blight is sometimes confused with the early stages of pine wilt, described below. Be sure to understand both diseases and consider submitting a sample for diagnosis if you are not sure which disease is affecting the tree.

In late summer or fall, tiny black spore-producing structures (called pycnidia) are formed on the scales of

Figure 1. *Newly emerging (current-year) shoots are susceptible to tip blight. The shoots are stunted, and the needles are stunted and brown.*

Figure 2. *Severely infected trees can have tip blight throughout the crown. On some branches, the disease has progressed from the tips inward to older wood.*

Figure 3. *Black spore-producing structures of the tip blight fungus are visible on 2-year-old pine cone scales.*

2-year-old cones — it looks like black pepper has been shaken onto the cones (Figure 3). The same black specks are also sometimes visible at the base of the infected needles later in the summer.

Tip blight can be confused with winter damage or infestation by the pine tip moth. Winter damage usually results in shoot or needle death *before* new needles emerge in the spring, and it is sometimes restricted to one side of the tree (the side facing the prevailing wind). Unlike tip blight, the tip moth causes a hollowed-out area in the tip/bud area, and the larvae are sometimes present. In addition, tip moth attacks trees of any age, but tip blight is most common on mature trees.

Cause

Tip blight is caused by the fungus *Diplodia pinea*. The fungus survives from year to year in dead shoots, branches, and pine cones. Spores are produced in the tiny black pycnidia and are dispersed in splashing water. They require high humidity to germinate and infect the host tissue. The fungus also can survive latently in tissue that appears to be healthy.

Control

Cultural practices: Removal of dead branches can improve the appearance of diseased trees but will not prevent infection since many of the spores are produced on cones that remain attached to the tree. Trees with tip blight should be adequately watered and fertilized to maintain tree vigor.

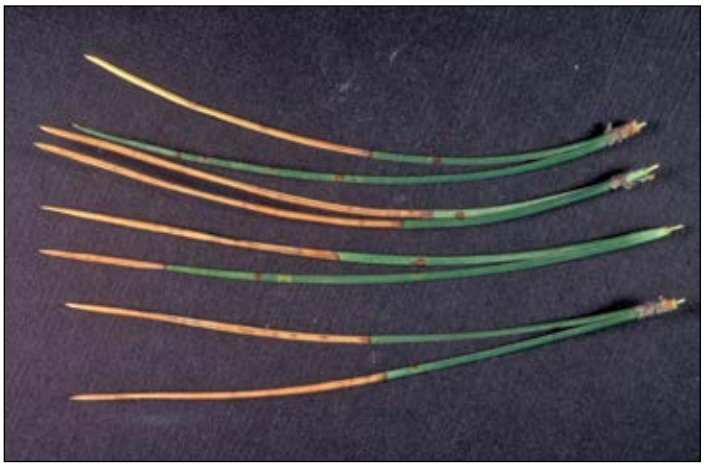

Figure 4. *Red banding and scorching (browning) is visible on the tips of Dothistroma-infected needles. The extent of scorching on each needle is variable.*

Fungicides: The critical time for chemical management is when the new shoots are expanding in the spring. Fungicides applied at that time can prevent new disease. Fungicides need to be applied each year to protect new annual growth. Each year, the first application should be made when new shoots start to elongate, which is usually around the third week of April. The tree should be sprayed again 10 to 14 days later, and possibly again 10 to 14 days after that, if it is a wet year and the site has a history of disease. Application timing should be slightly adjusted each year depending on host development in the spring. Spraying after this critical time will not be effective, because infection has already occurred and cannot be "cured."

Thorough coverage is essential. A high-pressure sprayer may be needed to deliver the fungicide to the tops of tall trees. Homeowners should consider using a professional tree-care service, especially for large trees where getting good coverage is difficult. Several active ingredients available for control of tip blight are summarized in Table 1. Fungicide injections have been studied, but so far results have been inconsistent and injections are not recommended.

Dothistroma Needle Blight

Dothistroma needle blight is a common and serious disease of Austrian and ponderosa pines in windbreaks and ornamental landscapes. Mugo pine also can be infected, but Scots pine and white pine are considered resistant. The disease causes premature needle drop the year *after* infection. Austrian and ponderosa pines usually retain needles for 3 to 4 years, so the loss of interior needles is a loss of important photosynthetic capacity. Repeated infection over many years can kill a tree. The disease tends to be more severe in crowded plantings.

Symptoms: New infections become apparent in late summer or early fall. Diseased needles develop dark green bands or scattered yellow/tan spots (Figure 4). The spots often enlarge and become red bands that are sometimes bordered by a light yellow region. Dothistroma is sometimes confused with environmental stress or natural needle

Figure 5. *Dothistroma needle blight causes a partial-needle scorch (browning) on interior needles (1-, 2-, or 3-year-old needles).*

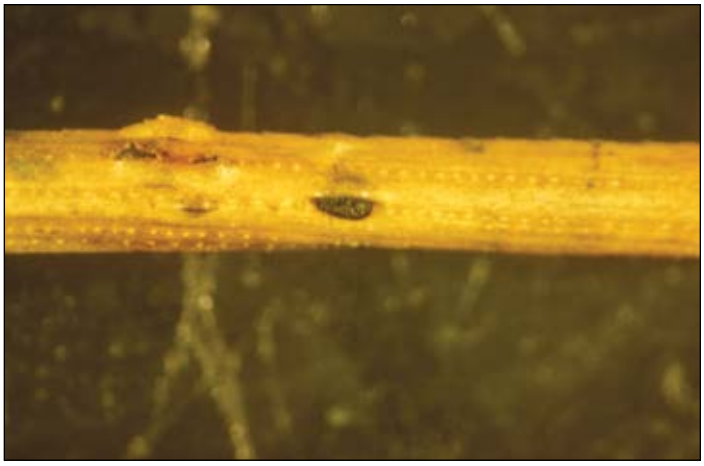

Figure 6. *Dothistroma spore-producing structures rupture the needle surface in late winter or early spring.*

drop (see below). However, a key indicator for Dothistroma is that the tip of the needle (beyond the red band) turns brown, but the base stays green for several months resulting in a partial needle scorch (Figures 4 and 5). The disease is usually most severe in the lower part of the tree on the interior parts (1-, 2-, or 3-year-old needles). The current needles sometimes show symptoms as well.

In late winter or early spring, the fungal spore-producing structures (from the previous-year's infection), visible as black bumps that rupture the needle surface (Figure 6). The green base turns brown, and the needles are shed throughout the spring and summer. The loss of old needles, combined with the growth of the newest needles, gives branches a tufted appearance. Heavily infected trees appear bare in the interior of the lower part of the tree.

Dothistroma can resemble damage by natural needle drop or environmental stress (see below). The heavy loss of older, internal needles plus the fungal spore structures are evidence of Dothistroma. In addition, environmental scorch usually causes all needles to turn brown at about the same length. In contrast, the length of browning from new Dothistroma infections is more variable (Figure 4).

Cause

The fungus, *Dothistroma septospora*, overwinters in infected needles and produces small, black, spore-bearing structures (acervuli), which break through the dead, needle epidermis in late winter or early spring (Figure 6). A 10X hand lens may be helpful in viewing these structures. The best time to confirm the presence of Dothistroma needle blight is December through April when these structures are present. Without the structures, the diagnosis is not clear. Getting a diagnosis at this time leaves plenty of time to make management decisions for spring fungicide applications.

Spores are dispersed in water droplets or aerosols during periods of rainfall from mid-May through October. Newly developed needles are resistant at first, but become susceptible by midsummer. Older needles are susceptible throughout the growing season**.**

Control

Some copper-containing fungicides can be used for control of Dothistroma needle blight. A single fungicide application in early June normally will protect foliage from infection. There is some risk in a single application since susceptible older needles are not protected in late May. Two fungicide applications in mid-May and mid- to late-June provide a more complete and dependable control. Make sure all needles are covered thoroughly with the fungicide. It is a good idea to spray adjacent susceptible pines. It may take multiple years of application to bring the disease under control.

Collection and removal of diseased needles on the ground around individual trees may reduce the severity of infection the following year. Nevertheless, sanitation probably will not eliminate the disease because diseased needles bearing fruiting structures of the fungus sometimes remain attached to the tree. Removal of dead needles is impractical in windbreak plantings.

Pine Wilt

Pine wilt is caused by the pinewood nematode, a microscopic worm. The pine sawyer beetle, a long-horned borer, spreads the nematode. The nematode feeds and multiplies in the tree's resin canals, causing wilting and death in several weeks to several months. The nematode and beetles spend the winter in the infected tree. The beetles start emerging around May 1, carrying nematodes to new trees and continuing the cycle of infection.

Pine wilt is common in the eastern two-thirds of the state, and it is spreading west through natural movement of the pine sawyer beetle as well as on infested firewood and nursery stock. Scots pines are particularly susceptible, and Scots pine plantings in eastern Kansas have been devastated. Austrian, white, and mugo pines are also hosts. In

Figure 7. *Pine wilt can kill an entire tree in weeks or months.*

particular, increasing numbers of Austrian pines have been affected in recent years.

Symptoms

In Kansas, new pine wilt infections are most apparent from August to December. Trees wilt and die in a short period of time, from several weeks to a few months (Figure 7). In the first stages, the needles turn gray-green, then yellow and brown. The discoloration sometimes occurs branch by branch, sometimes all at once. In early stages with branch-by-branch dieback, the symptoms can be confused with tip blight. Check for characteristic symptoms of tip blight. Also, remember that with pine wilt the entire tree will die within a few weeks or months compared to more gradual dieback with tip blight. The brown needles stay on the tree for up to a year after the tree has died. Another key symptom is reduced resin. During part of their life, the nematodes feed on plant cells in the tree's resin canals, stopping the flow of resin. On a healthy tree, sticky resin bleeds from the site of a wound. If a tree has pine wilt the resin is often reduced or absent, and branches become dry or brittle.

Cause

Pine wilt is caused by the pinewood nematode (*Bursaphelenchus xylophilus*), which is spread by the pine sawyer beetle (*Monochamus spp.*).

Control

1) Sanitation

The most important step to prevent the spread of pine wilt is sanitation. If a tree is suspected to have pine wilt, bring a sample to your local K-State Research and Extension office for submission to the K-State Plant Disease Diagnostic Lab. A branch that is at least 2 inches in diameter and 6 to 8 inches long, taken from right against the trunk, is adequate. Another option is a wedge or cross-section of trunk. If the test is positive, the tree should be cut down as soon as possible, or by May 1 *at the latest*, before the beetles emerge. April 1 is a better deadline to make sure no beetles emerge. Cut the tree to the ground — do not leave a stump. Chip or burn the wood immediately to destroy the beetles and nematodes. Do not save the wood for firewood.

2) Avoid stress

The beetles are attracted to drought-stressed trees. If possible, provide water during dry periods to prevent drought stress.

3) Preventative injections

There are products available for preventative injections (see Table 1). While they do not provide 100 percent control, several injectable products significantly decreased pine wilt infection when used preventively in research trials. Injections provide no curative activity. Once a tree is infected there is no way to stop the disease. The materials need to be applied by a trained tree care professional. Contact your local K-State Research and Extension office or the K-State Diagnostic Lab for more information.

4) Prevent new infestations

Measures to prevent new infestations are particularly important in western Kansas where pine wilt is not yet established. Do not import pine firewood from contaminated areas. Be wary of pine nursery stock from infested areas, and monitor nursery stock carefully. If pine wilt is introduced, remove the tree, chip or burn the wood, and continue to monitor surrounding pines to make sure it has not spread. Careful scouting and sanitation can eliminate sporadic outbreaks before they get out of control. Contact K-State, the Kansas Forest Service, or Kansas Department of Agriculture for assistance.

Environmental Stress

Plants affected: *All pines*

Kansas weather is a story of extremes, and fluctuations in moisture and temperature can be stressful for plants, including pines. Keep in mind that pines are not native to Kansas, and they are not adapted to the climate. For example, pines can suffer drought stress in any season, particularly in windy conditions during hot, dry summer weather or cold, dry winter weather. Pine needles lose water through their natural function (transpiration) in all seasons. If the soil is dry, the roots have no water to take up to replace the water lost in transpiration. This can cause needles to turn brown from the tips downward (scorch), resulting in a half- or full-needle scorch. Sometimes the scorch symptoms are found only on the side of the tree that faces prevailing winds. In other cases, the dieback is more sporadic. Environmental scorch can look similar to Dothistroma needle blight, but fungal fruiting bodies are not formed. Scorched needles are eventually shed, improving the tree's appearance.

Table 1. *Comparison chart for symptoms and control of tip blight, Dothistroma needle blight, pine wilt, environmental stress, and natural needle drop. Different products containing the same active ingredient can have different registered uses.*

Disease	Pine hosts	Symptoms	Time of symptom development	Cultural controls	Chemical control (active ingredient)*	Timing for chemical control
Tip blight	Primarily Austrian, also Ponderosa, Scots, and Mugo	Stunting and dieback of current year's growth, often starting in lower parts of tree. Black fungal specks at needle base and on cone scales	Late spring to early summer	Improve air flow. Prune to improve appearance. Provide appropriate water and fertility. Use proper spacing at planting.	propiconazole; thiophanate-methyl; mancozeb; copper; mancozeb + copper; thiophanate-methyl + chlorothalonil	First application when buds begin to swell (usually third week of April), again 10 to 14 days later, possibly a third application 10 to 14 days after application.
Dothistroma needle blight	Austrian, ponderosa, mugo	Half-needle scorch, defoliation, especially on lower, interior branches	Late summer	Improve airflow, collect and remove fallen needles. Use proper spacing at planting.	copper-containing fungicides such as copper hydroxide or copper sulfate	One application in early June, or two applications in mid-May and mid-June
Pine wilt	Scots, Austrian, mugo, white	Needles turn yellow-green then brown, branches brittle. Whole tree declines rapidly	Usually late summer or fall, sometimes winter	Sanitation: chip or burn.	abamectin, emamectin benzoate	Preventative only. Follow label instructions.
Environmental stress	All pines, especially white pines	Needles turn brown, especially during dry, windy conditions	Any season	Maintain proper watering and fertility.	None	
Natural needle drop	All pines	Browning and dropping of 2- to 4-year-old needles	Fall		None needed: natural part of tree life cycle	

**Always read the label. Some pesticides are restricted-use products, only allowed for use by certified applicators. Pesticide labels change and it is the responsibility of the user to follow all label instructions.*

Natural Needle Drop

Plants affected: *All pines*

Natural needle drop is not a disease. Rather, it is a natural part of the tree's life cycle. Contrary to the name, evergreens do not keep their needles (leaves) forever. The timing and pattern can vary with species and weather conditions. For example, Austrian and ponderosa pines usually retain their needles for 3 to 4 years.

With natural needle drop the older, inner needles throughout the tree turn brown and shed in the fall (Figure 8). The shedding takes 2 to 3 months to complete. The appearance of the tree eventually improves as it produces new growth. Browning and dropping of the current-season growth is not natural needle drop.

Figure 8. *During natural needle drop, inner needles turn brown and are shed. Note that the needles are brown from tip to base. They do not have the partial-scorch of Dothistroma needle blight.*

Contact the K-State Plant Diagnostic Laboratory at:

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