Common Diseases of Conifers in Oklahoma

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Foliage diseases of conifers can be of great importance to the survival and general vigor of these trees in Oklahoma. The green needles of conifers often represent several years of growth and the tree depends upon all of these needles for its photosynthetic needs.

Conifers will remain green throughout the year by gradually shedding the older inner needles and at the same time producing new needles from the tips of the branches. Unlike broadleaf, deciduous trees that completely replace only a portion of their needles. Complete defoliation of conifers is often fatal. Even partial defoliation can result in unhealthy, disfigured trees because appreciable loss of needles is not followed by a complete replenishment of the following year.

Conifer diseases are of most economic importance to homeowners due to the off-color of infected foliage and the poor appearance of the tree. In order to assist homeowners and commercial growers to understand several of the more important conifer diseases that occur in Oklahoma and their controls, the following diseases will be discussed: Dothistroma Needle Blight, Diplodia Tip Blight, Needle Casts, Phomopsis Blight of Junipers, Cedar Apple Rust, and Pinewood Nematode Disease.

Dothistroma Needle Blight of Pines

Dothistroma Needle Blight can cause the premature loss of needles of several varieties of pine. In Oklahoma, Dothistroma Needle Blight has been recorded from Austrian, Ponderosa and Mugho pines. This disease, if uncontrolled for several years, can severely weaken and eventually kill these trees.

Symptoms

Symptoms develop in the fall of the year in which the infection was initiated. Early symptoms consist of yellow and tan spots, and water-soaked bands on the needles. The bands and spots may turn brown to reddish brown and may be surrounded by yellow bands. the tips of the needles will die, with the base of the needles remaining green. The dead portion of the needle may break off leaving a blunted tip. Extensive damage may occur on the needles within two to three weeks of the initial appearance of symptoms. Infected needles will be shed or cast from the tree prematurely. Under Oklahoma conditions, needle fall is extensive following hot, dry summers. (Figure 1.)

Disease Cycle

The nonsexual stage of the fungus Dothistroma pini is the only stage found in Oklahoma. Conidia (spores) of the fungus are produced in stromata (a mass of fungal mycelium in or on which spores are formed) in the spots and bands on the needles. The stromata begin to form in the fall of the year, but most mature to produce conidia during the following spring. Conidia are spread by rainsplash throughout the growing season (May - October). Infection occurs throughout the growing season, but symptoms do not develop until late summer or early fall. Two seasons are required for completion of the disease cycle.

Control

Copper fungicides (Bordeaux mixture 8-8-100, Tenn-Cop5E, or Copper Fungicide 4E) effectively control Dothistroma Needle Blight. Two applications are recommended, the first in mid-May to protect the previous seasons' needles and the second in mid-June to July to protect the current-year needles. In addition, homeowners can help control this disease by collecting the infected needles and destroying them.

Diplodia Tip Blight

Symptoms

This fungal disease can seriously attack pine seedlings in nurseries, causing a rot that starts below the soil line in the collar area of the stem and extends upward into the main stem. The scales of young cones are also attacked. This disease also causes a dieback of the branches of older pine trees. Growth from these blighted terminals is usually stunted, the needles turn brown, and the terminal buds exude an excessive amount of resin (Figure 2). Diplodia can also infect the cones of these older pines and the minute black fruiting bodies can easily be seen on the scales of the cones (Figure 3).

Disease Cycle

Diplodia pinea infects the plants through the young needles. Infection takes place through small openings in the needles called stomates. Infection can also occur through wounds and cracks in the bark.

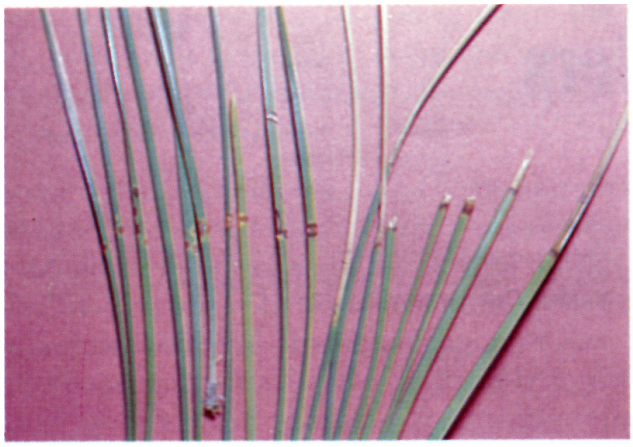

Figure 1. Dothistroma needle blight on Austrian pine.

Control

Seedlings and young trees that are infected with the stem rot phase cannot be treated successfully. When Diplodia Tip Blight has been a problem in seedling production, the use of steam-pasteurized soil or soil fumigants will help in controlling root and stem infection.

Diplodia Tip Blight on older trees can be controlled by pruning and sanitation. As soon as blighted terminals and cones are noticed, the needles, twigs and cones should be pruned to healthy tissue and destroyed. Do not prune when the branches are wet because the conidia of the fungus can easily be spread when moisture is present. Where infection has been severe, the use of Bordeaux mixture or Copper Fungicide 4E will control this disease. It should be applied early in the spring, when the buds open, and twice more at weekly intervals until the needles break through the needle sheaths. An application of fungicide in the fall may also aid in slowing the spread of the disease; however, fertilization and watering in the fall may be more beneficial. Homeowners who maintain vigorous trees through good tree health care will have fewer problems with Diplodia Tip Blight.

Needle Casts

Symptoms

The first indication of this tree disease is the scorched brown or yellowish appearance of most of the needles. Many pines are affected by this disease and it can become a severe problem in Christmas tree plantings. The initial discoloration of the needles is followed by needle fall or casting. Few trees are actually killed by this defoliation but sustained needle kill will eventually reduce the overall growth rate and make the tree more susceptible to other diseases and insect attack. Over 40 different species of fungi are capable of causing needle case. The more important ones are *Lophodermium pinastri*, *Hypoderma lethale*, and *Hypoderma hedgcockii*.

Disease Cycle

Small black elliptical fruiting bodies of the fungus are produced on the needles. These structures break open in the late spring or early summer during periods of wet weather and release great numbers of spores. The spores can be spread by splashing rain or wind to infect other needles or trees.

Figure 2. Stunted terminal branch of pine infected with *Diplodia pinea*.

Infected needles begin to turn brown during the late fall and early spring and will have a mottled appearance due to the death of needle tissue at the infection sites. Temperature and humidity are very important in determining the severity of the infection.

Control

In nurseries this disease can be controlled by the application of the fungicide after the needles are half grown followed by a second application when the needles are fully developed. No chemical control measures are normally recommended for homeowners even though the tree may appear unsightly. Collection of infected needles and their destruction will greatly reduce this disease. However, if a homeowner wishes to control this disease, the proper application of a fungicide will provide excellent control.

Phomopsis Blight of Junipers

This is the most common disease of cedar, juniper, and arborvitae in Oklahoma. Phomopsis Blight can be a severe problem in nursery plantings and can cause the death of many seedlings. Older trees are less affected by Phomopsis Blight and unless these trees are environmentally stressed or in poor health they are usually not affected enough to warrant chemical sprays.

Symptoms and Disease Cycle

Infected trees will exhibit browning of the foliage and dying of twigs and branches (Figure 4). Small black fruiting bodies of the fungus, *Phomopsis juniperovora*, are formed on this dead tissue. Conidia are produced in these structures and when moisture is present masses of conidia will ooze out to form tendrils or horns. The conidia are spread by rain and various other means such as mechanical disruption and insects. The fungus enters the plant through wounds as well as unbroken tissue. The browning of the needles and twigs begins at the tips and progresses downward toward the stem. Moisture is an important factor in disease spread and severity. Nurseries and Christmas tree plantations that utilize overhead irrigation

Figure 3. Pine cones infected with Diplodia pinea. The small black dots on the pine cone scales are fruiting bodies of this fungus.

usually have more severe disease problems because wetting of the foliage results in earlier spread of the conidia.

Control

Good sanitation is important in reducing disease occurrence in nurseries. Clean cultivation, good drainage and roguing are important techniques that should be followed. Fungicides are usually applied as protectants and a regular schedule of fungicide sprays must be applied to prevent the penetration of the fungus into the plants. Homeowners are encouraged to use at least two sprays, once when the disease is first noticed and another 10 to 14 days later. For best control, infected twigs should be pruned prior to the application of the fungicide.

Cedar Apple Rust

This disease is very common on juniper or cedar trees in Oklahoma. The most striking feature of this disease is the gall that appears on the cedar in the spring. Long, orange, gelatinous tendrils or horns develop from these galls and homeowners can easily recognize these structures and know that this disease is active. These galls can be pruned by the homeowner before the horns are formed to achieve control of this disease. For more information concerning this disease refer to OSU Extension Facts EPP-7611, Cedar Apple Rust.

Pinewood Nematode Disease of Pines

In 1972, Japan experienced severe wilting problems in pine forests. The problem was finally identified as being caused by a nematode, *Bursaphelenchus xylophilus*. A Japanese scientist visiting in Missouri in the spring of 1979 recognized the same symptoms on pines in that state. Later the disease was reported from Kansas, Arkansas, Oklahoma, and Illinois. In Oklahoma, the disease has been found as far west as Grady County.

Symptoms

The disease is typified by the rapid death of the pine tree. if the wood is cut from these trees, the wood will be dry and no pitch flow will be noted. These symptoms should not be confused with the slow decline of pines that may result from drought conditions. Needles of drought stressed trees will turn brown and die, but the tree may put on new growth, and pitch will flow when the wood is cut. Several species of pines

Figure 4. Juniper seedling infected with Phomopsis blight.

have been infected by this nematode disease. However, in Oklahoma, only Austrian, Scotch, and Japanese black and red pine have been found to be infected.

Disease Cycle

The nematode has a close relationship with a wood boring beetle sometimes called a long-horn beetle. When adult beetles emerge from infected trees they carry the nematodes with them in their tracheae (air tubes). The beetles then enter young tender tissue of healthy pines where they feed. The nematodes leave the beetles and enter the wood through the wounds made by the insect. They migrate to the resin canals and feed on the epithelial lining of these canals. The nematodes reproduce rapidly (in summer, one generation every five days). As the populations build up, the wilt symptoms begin to appear and within a few weeks the tree dies. During the winter, the nematode larvae accumulate beneath the tree bark around the chambers of pupating insect larvae. When the insects molt to the adult stage, the nematodes also molt and enter into the spiracles (air openings) of the insects to start the cycle again.

Control

1. **Sanitation** - On a local basis, as trees are diagnosed as being infected with the pinewood nematode, the trees should be removed and destroyed as quickly as possible. Sanitation will be more difficult in large forested areas.
2. **Chemical Control** - Insecticide sprays to control the long-horn beetle vector would be feasible in small localities if the severity of the disease warrants that type of control. In Japan, valuable forest areas have been successfully treated by aerial application of insecticides.
3. **Resistant Cultivars** - The Japanese have developed some promising pine selections that appear to be resistant to the nematodes. The University of Missouri at Columbia is also testing the host range of the nematode to help determine sources of resistance in our native pine trees.

If you have noticed pine trees that have died rapidly, we urge you to submit samples to the Plant Disease Diagnostic Laboratory for analysis. Rapid removal of these trees may slow the spread of the disease and reduce its severity.

General Recommendations

Many of these diseases will infect weakened trees more readily than healthy trees. Good tree care including watering during drought conditions, fertilization, insect control, and proper pruning will eliminate or reduce disease problems. Sanitation, which means the collection and destruction of diseased plant parts, is an easy and economical method for homeowners to use to reduce their disease problems. When disease is severe or valuable ornamentals must be protected, the use of fungicides will give excellent control. The rates of fungicide to be used can be found on the label. Be sure to **READ THE LABEL CAREFULLY** and follow any limitations and other instructions listed.

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