Forest Insect
& Disease
Leaflet
130

U.S. Department
of Agriculture
Forest Service

Scleroderris Canker of Northern Conifers

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Scleroderris canker, caused by the fungus *Gremmeniella abietina-Scleroderris lagerbergii* (Lagerb.) Morelet, has caused extensive mortality in conifer plantations and forest nurseries in the northeast and north central United States and eastern Canada.

Two strains of the fungus are known in North America. The Lake States strain, present throughout northeastern North America, attacks young trees but has caused only minor injury to trees over 2 m (6 ft) tall. The second strain, called the European strain, is found in New York and Vermont, where it is causing major mortality in pole-size red and Scots pine plantations in the northern part of these States.

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Scleroderris canker is probably not native to North America. The Lake States strain was identified in Canada in 1962 and in the United States in 1964. The European strain was identified as such in 1976, though *G. abietina* (strain undetermined) was identified in New York in 1964. The European *G. abietina* is identical to isolates of the fungus found in Norway and Finland.

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Distribution

The Lake States strain of *G. abietina* is present in the northern portions of Michigan, Wisconsin, Minnesota, Vermont, and New York. It is distributed throughout eastern Canada as well as the province of Alberta. Short growing seasons and heavy snowfall seem to favor its development. The European strain is present in New York and Vermont. Laboratory tests indicate that the European strain can develop in warmer climates than the Lake States strain. In North America, scleroderris canker has been found on Scots, red, pitch, white, ponderosa, Austrian, lodgepole, and jack pines, and on white, black, and Norway spruce.

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Figure 1.—Red pine with multiple branch tips infected by *S. lagerbergii*.

Life History

In the Lake States strain, primary infection is by windblown ascospores. These are disseminated during moist weather from April to October; the major spore discharge and infection is in June and July. The spores infect through buds or needles, and infected branch tips are usually dead the following summer (fig. 1). The fungus usually grows down the branch and into the main stem of the tree, where a canker commonly forms. The stem of a young seedling is quickly girdled, and the tree is killed.

A few months after an infected branch dies, pycnidia appear near the base of dead needle fasicles (cover). Asexual spores (conidia) ooze out of these pycnidia during wet weather from April to October. These spores are transported by rain splash to nearby branches, spreading the infection in individual trees and onto adjacent trees. Apothecial fruiting bodies appear in early summer on branches that have been dead for 1 or 2 years (fig. 2). The apothecia are also commonly found at the base of dead needle fasicles and are often found in association with the pycnidial stage.

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Figure 2.—Apothecial fruiting bodies of *S. lagerbergii*. Wind-desseminated ascospores are discharged during moist weather from late April until October.

The life history of the European strain is similar although several differences have been observed. The apothecia which produce windblown ascospores are either very rare or nonexistent in the European strain. At this writing the method of long-distance transmission is unknown although some asexual conidia are airborne. The European strain also produces a second crop of pycnidia during the late fall in New York. Conidia are being released by these fruiting bodies throughout the winter whenever the temperature exceeds 0° C and free moisture is present. Infection has occurred from these conidia as late as the last week in October. Disease symptoms have been observed within 2 or 3 months after infection by the European strain, compared to 9 months for symptom development with the Lake States strain.

Outplanting infected nursery stock contributes to the long-distance dissemination of scleroderris canker. The fungus may also be carried long distances on infected pine Christmas trees.

Symptoms and Damage

The first symptom of infection by *G. abietina* in plantations is usually the dieback of buds and the discoloration of needles on the previous season's growth. Needles infected with the Lake States strain turn orange at the base during early May, approximately 9 months after infection. By midsummer the needles are brown. These needles are very loose and usually drop off, leaving a bare branch tip as in figure 1. The European strain causes similar dieback symptoms during May, but a second dieback may occur during late July. The July dieback occurs on needles infected in early spring. After infection, the fungus grows down the branch until it reaches the main stem of the tree. Young trees are girdled quickly and die within a few months. On larger trees, branch infection is usually arrested before reaching the main stem by such things as competition from saprophytic fungi, or breakage of infected branches by heavy, wet snow. Stem infections frequently form a canker. This canker may eventually be overgrown, but usually will deform the stem. Small cankers are fairly common on branches infected with the European strain of *G. abietina*, but are rarely found on branches infected with the Lake States strain. A characteristic yellow-green stain color is commonly observed in the cambial zone of recently killed tissue.

The time that the Lake States strain first infects a plantation affects the severity of damage. A high percentage of trees may be killed in stands heavily infected during the first 5 years after planting. Infections that start in plantation trees 2 m (6 ft in height cause only minor damage. Although the lower branches of these trees are

killed, the disease does not move into the tops or the trunks of the trees and normally causes little tree mortality.

Damage from the European strain is much more serious. This strain is able to attack and kill branches throughout the entire tree. Infected branches have been observed 25 m (82 ft) above the ground. Large trees are killed when infection rapidly builds up throughout the entire crown and kills all the branches. In 1976, the European strain was found on some 14000 hectares (34,000 acres) in northern New York State. Serious damage has been primarily in red, jack, and Scots pine plantations planted during the 1930's (fig. 3). In several areas the fungus killed most of the natural Scots pine reproduction. The European strain is present in several plantations in Vermont, but the area involved is not large at the present time. The potential for this strain to spread into pine stands outside New York and Vermont is very real. If the damage pattern observed in New York is repeated throughout North America, our red, jack, ponderosa, lodgepole, Austrian, and Scots pines are in serious jeopardy.

Control

Cultural. — The Lake States strain of *G. abietina* can best be controlled by planting disease-free stock in areas where no infected trees are present. Ideally, nursery stock would be produced in areas where scleroderris canker is absent. Fall planting should be discouraged if the possibility of infected planting stock exists. Infected seedlings frequently cannot be recognized until the late spring. New planta-

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Figure 3.—Red and Scots pine killed by European strain of *S. laberbergii.*

tions of susceptible species should not be established in areas where trees infected with scleroderris canker are present.

Chemical. — The fungicide chlorothalonil is registered for the prevention of seedling infection by *G. abietina* in nurseries.

Regulatory. — The possibility of spreading the European strain of *G. abietina* on infected Christmas trees has caused considerable concern. Studies in New Brunswick have confirmed that the fungus can be spread on cut Christmas trees. Regulatory action by the United States and Canada now prohibit the movement of Christmas trees and nursery stock from areas where the European strain is present.

Resistant species.—Jack pines have been found in Ontario that are resistant to the Lake States strain of *G. abietina.* Scots pine selections have shown resistance to the European strain. Certain white pine and varieties of spruce are quite resistant to the European strain and balsam-fir is immune. No resistance to either strain has been observed in red pine.

Caution

Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in original containers under lock and key—out of the reach of children and animals—and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment if specified on the container.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

NOTE: Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the Environmental Protection Agency, consult your local forest pathologist, county agricultural agent, or State extension specialist to be sure the intended use is still registered.

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Revised March 1979

☆U.S. GOVERNMENT PRINTING OFFICE: 1979 0--288-314