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Leaflet
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Brown-Spot Needle Blight of Pines

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Brown-spot needle blight, caused by *Scirrhia acicola* (Dearn.) Siggers, delays growth and causes mortality of longleaf pine (*Pinus palustris* Mill.). Brown spot reduces total annual growth of southern pines by more than 16 million cubic feet (0.453 million cubic meters) of timber. Damage is most severe on longleaf seedlings in the grass stage; i.e., those that have not begun active height growth (fig. 1). Heavily infected seedlings may remain in the grass stage for 10 or more years.

Brown spot has also become a serious problem to certain varieties of Scots pine (*P. sylvestris* L.) and other pines grown in Christmas tree plantations in the north- and mid-central States (see photo). Thousands of dollars are lost annually by Christmas tree growers because this fungus causes needle drop, making trees unmerchantable.

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Distribution

The brown-spot fungus attacks 28 species of pine over a geographic range that includes all the coastal States from Virginia to Texas, into the mid- and north-central States, and into Oregon and Manitoba, Canada. Formerly brown spot caused economic losses only to longleaf pine, but now it is causing losses to Christmas tree plantations, especially Scots pine, in the mid-

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Figure 1.—Brown-spot-infected longleaf pine seedlings.

and north-central States. Short-needled Scots pine varieties such as Spanish and French-green are more susceptible to fungal attack than the long-needled varieties. Brown spot is also abundant on all sizes of loblolly pine, but causes little damage.

Symptoms

The fungus causes two kinds of needle spots on all pine species that it attacks. These appear on needles at any time of the year, but most commonly from May through October on longleaf (fig. 2), and during August on Scots pine (fig. 3).

The most common spot is straw yellow at first, later changing to a light brown, often with chestnut-brown borders. Dark-purplish borders are common after the advent of cool weather in the autumn. Individual spots are usually one-eighth inch (3.2 mm) in diameter. When the needle dies, the green tissue between the spots shrinks more than the diseased areas and the resulting embossed appearance is the most distinctive symptom. Needles with multiple infections take on a mottled appearance.

The second spot, called bar spot, is less common. It is a combination of a brownish spot on an amber-yellow band about one-eighth inch (3.2 mm) wide. The tissue between the bands often remains green. Bar spots are infiltrated with resin that prevents normal growth and fruiting of the fungus. Both spot types have distinctly defined margins, a feature which readily distinguishes them from those caused by other needle diseases.

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Figure 2.—Infected needles of longleaf pine.

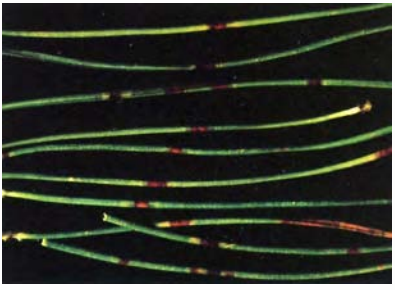

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Figure 3.—Infected needles of Scots pine.

The infected needle of longleaf pine usually has three distinct zones: the basal portion which is green, the middle portion which is mottled, and the apical portion which consists of dead needle tissue. With the gradual death of needles, the affected parts curve outward and down and finally assume an orange-red color similar to those killed by fire. The characteristic spots remain visible even after the needle dies.

With repeated infections, longleaf seedlings are characterized by a long needleless stem with a tuft of severely infected needles at the base of the terminal end. The unusual growth habit of longleaf pine makes it especially susceptible to brown spot. The normal 3- to 5-year grass stage presents an excellent target for fungal infection. Active height growth is inhibited for many years and the young trees may die.

The majority of infected Scots pine needles are found on the lower branches of the tree, especially on the north side. Infected needles of all ages start dying from the tips backward until the entire needle turns brown and drops during October and November. The result is mostly bare branches. In severe cases branches are killed, but usually buds of infected branches remain healthy and produce new foliage the following spring. The new foliage becomes infected, continuing the disease cycle.

Life History of the Fungus

On longleaf pine (fig. 4) the fungus causing brown spot generally produces two types of spores, ascospores and conidiospores (conidia); while on Scots pine (fig. 5) only conidiospores have been found.

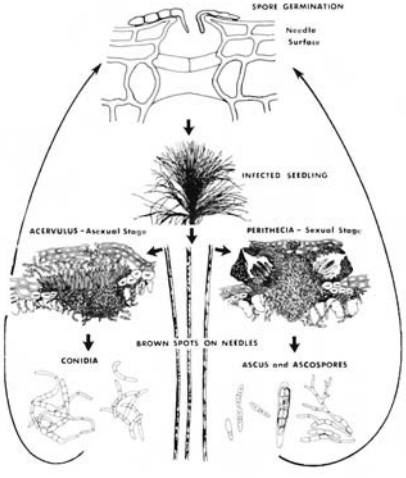
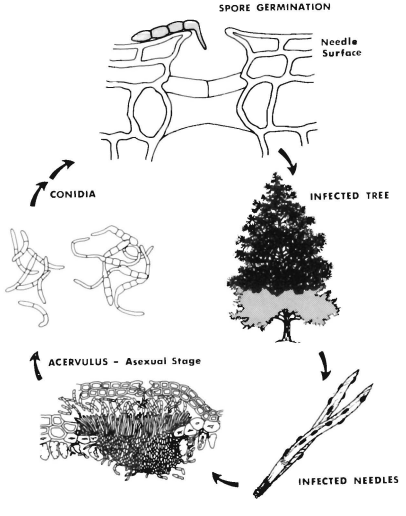


Figure 4.—Life cycle of the brown-spot needle blight on longleaf pine.



Firgure 5.—Life cycle of the brown-spot needle blight on Scots pine.

Ascospores.—These spores are windborne and cause scattered infections at great distances. They are probably the principal means by which brown spot starts in nursery beds and plantations established with disease-free seedlings. These spores also reinfect areas of planted or natural reproduction free of brown spot. They may cause infections in the crowns of saplings and larger trees. Ascospores have not been found outside Southern United States.

Conidiospores (Conidia). — Once the fungus is established in the area, it intensifies and spreads each spring by conidiospores. These are exuded in gelatinous masses that are washed and splashed by rain. Conidia cause primary infections near the tips of young elongating needles, usually in April. They also infect needle tips of subsequent needle flushes throughout the spring and summer. Conidia produced on the new needles have caused secondary infections, and in June the needle tips have begun to die back.

Conidia are the only type of spores that have been found in the north- and mid-central parts of the United States. The close spacing and dense foliage of Christmas tree plantations are ideal conditions for short-distance and within-tree spread of the disease. The dense foliage, a result of numerous shearings, provides a favorable microclimate for infection because moisture can remain on the needles for long periods. This is particularly true on the bottom half and shaded north sides of trees where the most severe infection occurs. A significant means of fungal dissemination within and between plantations is in the shearing process when the foliage is wet. The major infection period for Scots pine growing in the north- and mid-central States is in June and July, although some infection may occur through September. Infection is caused by conidiospores produced in overwintering fruiting bodies that release their spores during early summer in time to infect the new developing needles.

Pathogenicity of the Fungus

Pathogenic variation has been detected within *S. acicola.* Fungal isolates obtained from Scots pine in the North-Central States differ, both in cultural characteristics and in virulence, from isolates obtained from longleaf pine in the South. Variability in virulence was also found among isolates collected within a specific geographic area.

Control

Various silvicultural and chemical treatments will suppress brown spot. The latest and most important suppression measure is the use of resistant progenies and varieties. Recommendations for suppression of brown spot on longleaf pine and Scots pine are as follows:

Longleaf Pine

Cultural procedures. — (1) Before planting, completely eradicate dense hardwoods. (2) Plant in the spring at relatively low bed densities (15 seedlings per square foot, 0.1 square meter). (3) Plant in well drained beds. (4) Root prune seedlings to a depth of 7 inches (18 cm) 6 to 12 weeks before lifting. (5) Clip needles back to 5 inches (13 cm) immediately before planting on adverse sites. (6) Mechanically scarify droughty sites. Scalp or disk open sites in advance. Let disked strips settle for approximately 6 months before planting.

Controlled burns.—Under certain conditions, brown spot of longleaf pine can be suppressed by controlled burns of low intensity. Needles are scorched, thereby killing the fungus, without seriously damaging the seedlings. Vigorous seedlings in the grass stage with root-collar diameters greater than 0.4 inches (0.2 cm) possess a great ability to survive fire. A careful prescribed burn will destroy the infected needles and eliminate the inoculum source for several years. Timing of prescribed fires is very important. Burns should not be made at any set interval—only when brown spot has developed to a damaging extent. When most of the seedlings have one-third of their foliage dead in late November or December, a prescribed burn the following January or February is advisable. These burns must also be made before any large percentage of the seedlings have started active height growth. Longleaf seedlings in early stages of height growth are vulnerable to fire, particularly those already weakened by brown spot. Fire is both inexpensive and effective, and hence is widely used throughout the longleaf pine belt.

Shelterwood regeneration. — Another practical suppression method is shelterwood regeneration. This is the most promising approach to natural regeneration of longleaf pine in which seedlings are established as advanced reproduction under overstories of medium density. The pine canopy then protects the regenerated seedlings from serious brown-spot infection.

Fungicidal sprays. — Brown spot is easily suppressed by fungicidal sprays in nurseries, seed orchards, and plantations. Trees may be sprayed with 4–4–50 Bordeaux mixture [4 lb (1.8 kg) copper sulfate, 4 lb (1.8 kg) hydrated lime, and 50 gal (189 liters) water] for hydraulic sprayers and 12–12–50 for mist blowers. Bordeaux is applied at the rate of 60 gal/acre (237 liters/acre) in hydraulic sprayers and 40 gal/acre (151 liters/acre) in mist blowers. Chlorothalonil has also been found to be an effective suppression measure. It is applied at the rate of 2.5 lb/100 gal (1.1 kg/378 liters) of water for hydraulic sprayers and 6 lb/100 gal (2.7 kg/378 liters) of water for mist blowers.

Seedlings should be sprayed at 10- to 30-day intervals, depending on the amount of rainfall, from the beginning of April through October. It is important to initiate spraying in the spring when the newly emerging fascicled needles are 1 to 2 inches (2 to 5 cm) long. Usually four to six applications are sufficient. A final spray just prior to planting will insure protection during establishment of seedlings in the field.

Fungicide sprays also can be used on longleaf seedlings around the home, in landscape plantings, and in small fields and other places where burning is undesirable or impossible. Three or four spray applications 8 to 10 weeks apart beginning in April and ending in October should be sufficient. The same rates as recommended for nursery control would be adequate.

Resistant seedlings.—The latest and most important suppression measure to be recommended for brown spot is the use of resistant stock. Seed from resistant longleaf progenies and selections of resistant stock are now available in a limited supply and in the near future should be available to all.

Scots Pine

Cultural procedures. — (1) Plant healthy nursery stock. (2) Avoid planting Scots pine seedlings next to older pine windbreaks. (3) Cut and immediately remove small pockets (one to five trees) of brown-spot-infected trees. (4) Avoid leaving live branches on stumps when harvesting trees, especially in infected plantations. (5) Do not shear infected trees or plantations during wet weather.

Fungicidal sprays.—The same fungicidal sprays and concentrations as recommended for longleaf pine apply to Scots pine plantations (fig. 6). In the north-central region the first spray should be applied when the new needles are about half grown. In severely infected plantations or during wet years, a second spray should be applied when the new needles are about half grown. In severely infected plantations or during wet years, a second spray should be applied 3 to 4 weeks later.

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Figure 6.—A backpack mist blower used to apply fungicides to Christmas tree plantations.

Resistant varieties. — Longneedle varieties of Scots pine are somewhat resistant to infection and should be the preferred species in Christmas tree plantations. Varieties such as Austrian Hills or German should be planted to reduce brown spot in-

fections. A grower should avoid planting all his land to one species or variety to prevent catastrophic losses.

Caution

Improper handling, application, or disposal of pesticides may be injurious to man, animals, and plants. Follow the directions and heed all precautions given by the manufacturer.

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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