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Nursery Diseases of Southern Hardwoods

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Numerous diseases of hardwood tree seedlings are encountered in southern nurseries. Some nurseries may suffer heavy seedling loss due to disease, but minor losses occur in all nurseries. The use of selective herbicides for weed control in hardwood nurseries has reduced the use of soil fumigants, possibly resulting in an increase in soilborne diseases. Monitoring for soilborne pathogens should be done routinely in all nurseries where they have previously caused losses. To control specific diseases, the nursery owner is advised to contact a forest pathologist.

Damping-Off

Damping-off is a widespread disease of forest tree seedlings caused by certain soilborne fungi. This disease affects seedlings during the early stages of development. All southern hardwood species are susceptible. The damping-off pathogens most commonly encountered in southern nurseries are *Fusarium solani, F. oxysporum, Rhizoctonia solani, Pythium sylvaticum, P. irregulare, P. ultimum, Phytophthora cinnamomi, P. cactorum, Sclerotium bataticola, S. rolfsii,* and *Cylindrocladium* spp.

Preemergence damping-off occurs when the hypocotyl or epicotyl is infected before the seedling pops up (fig. 1). Postemergence damping-off occurs when the fungus invades the stem tissue near the ground line after the seedling appears (cover and fig. 2).

Necrotic stem lesions near the ground line are a characteristic symptom of damping-off, but this symptom may be confused with sun scald or heat lesions. Positive diagnosis usually requires the isolation and identification of a pathogen.

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Figure 1.—*Sweetgum seedlings showing symptoms of preemergence damping-off. Healthy seedling on left.*

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Figure 2.—*Sweetgum seedlings show symptoms of postemergence damping-off caused by* Fusarium *spp.*

Pathogens that cause damping-off do not usually kill seedlings unless environmental conditions for fungal development are optimum or conditions for seedling growth are poor. Soil fumigants, such as methyl bromide or a mixture of metam-sodium and chlorinated C_3 hydrocarbons, applied before planting will control damping-off. Drenching seedbeds with fungicides after disease symptoms are evident is of limited effectiveness because infected seedlings are usually doomed. However, postemergence applications of fungicides will protect healthy seedlings and inhibit spread of disease. Ethazol will control many different species of damping-off fungi. Metalaxyl is recommended for specific control of *Phytophthora*. The following cultural practices will aid in the control of damping-off:

1. Planting at relatively low bed densities with 10 to 20 plants per square foot (9.3 dm^2).
2. Planting in well-drained beds.
3. Planting in soil with a pH between 5.0 and 6.0.
4. Maintaining a relatively low level of available nitrogen during the first 6 weeks after spring seedling emergence.
5. Planting seeds at the proper depth.

Root Rot

Root rot is the most important disease of hardwood tree seedlings in southern nurseries. The pathogens most commonly involved are *Cylindrocladium scoparium, C. floridanum, C. crotalariae, Rhizoctonia solani, Pythium irregulare, P. sylvaticum, P. ultimum, Phytophthora cinnamomi, P. cactorum, Sclerotium bataticola, S. rolfsii, Fusarium solani, F. oxysporum,* and *Phymatotrichum omnivorum.*

In general, small feeder roots are the first to be attacked by the root rot fungi. The first noticeable symptom is discoloration and blackening of infected roots (fig. 3). These roots die and, in severe cases, the disease progresses to include the larger roots. Aboveground symptoms include stunting, top dieback, chlorosis, and premature defoliation (fig. 4). All hardwood species grown in southern nurseries are susceptible to one or more of the pathogens that cause root rot.

Soil fumigants are available to control many seedling root rot diseases. For example, methyl bromide-chlo-

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Figure 3.—*Root rot symptoms caused by* Fusarium solani. *Feeder roots are discolored, blackened, and necrotic; a healthy cherrybark oak seedling is on the left.*

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Figure 4.—*Black walnut seedling showing dieback, leaf necrosis, and stunting (*Cylindrocladium *damage).*

ropicrin formulations (such as methyl bromide 67%, chloropicrin 33%) will control most root rot pathogens. Drenching seedlings with fungicides may also control some root rots.

Nematode Injury

Nematodes pathogenic to several southern hardwood species include *Meloidogyne incognita, Pratylenchus penetrans, P. pratensis, Trichodorus christiei, Xiphinema chambersi, Hoplolaimus galeatus, Belonolaimus longicaudatus,* and *Helicotylenchus pseudorobustus*. These nematodes may injure seedlings by parasitizing feeder roots. This root injury may lead to infections by other pathogenic microorganisms. The resulting root rot/nematode complex often causes considerable loss in a seedling crop.

The aboveground symptoms of nematode injury include chlorosis, stunting, and wilting and may be confused with those of damping-off. Root symptoms vary depending on the species of nematode involved. Root-knot nematodes cause spheroid or spindly galls on large and small roots (fig. 5A). Root-lesion nematodes cause necrotic lesions, which resemble those initiated by certain fungi (fig. 5B). Diagnosis of nematode injury may require nematode assays and identification.

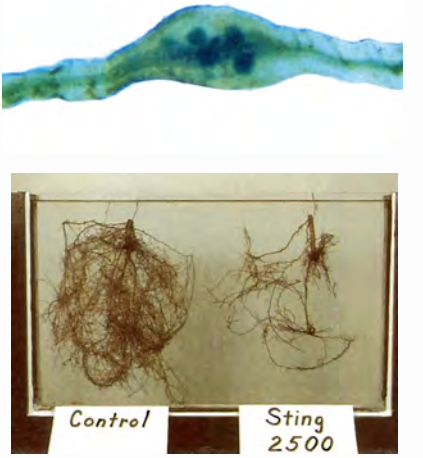

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Figure 5.—*Nematode damage on hardwood seedlings: (A) root knot on catalpa and (B) sting on sycamore.*

Although several effective nematicides are available, the use of broad-spectrum soil fumigants may be more desirable in areas where damping-off, root rot, or weeds also occur. A postemergence nematicide drench

may be applied if damage to roots is observed.

Dieback

Dieback, where the shoots die from the tips back, of hardwood species in southern nurseries is most frequently caused by the fungi *Cylindrocladium scoparium*, *C. floridanum*, *C. crotalariae*, *Botryosphaeria ribis*, *Botryodiplodia theobromae*, and *Phomopsis macrospora*.

Typical examples are *Cylindrocladium* spp. on yellow-poplar (fig. 6A), *Botryosphaeria* spp. on sweetgum (fig. 6B), *Botryodiplodia* spp. on sycamore (fig. 6C), and *Phomopsis* spp. on sycamore (fig. 6D).

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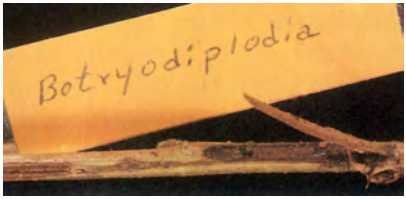

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Figure 6.—*Dieback caused by a small canker of the stems: (A) yellow-poplar with* Cylindrocladium, *(B) sweetgum with* Botryosphaeria, *(C) sycamore with* Botryodiplodia, *and (D) sycamore with* Phomopsis.

Depending on plant vigor and environmental conditions, dieback may cause the death of only a few shoot tips, a few seedlings, or an entire seedling crop. An early symptom of this disease is the presence of stem lesions with sunken areas at the base of stems or leaders. These lesions may be present on seedlings several weeks or months before their death. Rogueing, pruning, or spraying infected plants with benomyl, captan, or zineb will provide some control of dieback.

Crown Gall

Crown gall, caused by *Agrobacterium tumefaciens,* infects plants only through wounds. Black walnut, pecan, red oak, black locust, and hybrid poplars are the most important of the susceptible hardwood species. Galls, ranging up to several inches in diameter, are usually formed on stems at the ground line; however, they may also occur on roots or aerial parts. The bacteria are most active during warm summer months. They do not survive more than 2 years in soil without a host plant and are less active in acid than alkaline soils. The disease is controlled by rigorously excluding all infested plants from the nursery. Planting all infested areas for 2 successive years with resistant cover crops, such as oats, cowpeas, or crotolaria, will also control the disease. Since the bacteria must enter the plant through a wound, the prevention of human- and insect-caused wounds on nursery stock will provide some control of the disease. Soil fumigation with methyl bromide before planting will also control the disease.

Anthracnose

Gnomonia veneta, G. leptostyla, G. quercina, and *G. cingulata* are the fungi that cause anthracnose on different tree species. This disease results in defoliation and shoot mortality on several hardwood tree species. Anthracnose is most severe on sycamore, walnut, oaks, yellow-poplar, and cottonwood during years with wet springs. Small, circular to irregularly circular, brown or black spots are an early symptom of anthracnose. These spots gradually become more numerous, enlarge, and often merge to form large dead areas or blotches. Infected leaves or leaflets generally fall prematurely, but may remain attached to the seedings for most of the season. Stem lesions often develop into cankers with dark sunken centers. The fungus overwinters on infected twigs of large trees near the nursery and on fallen leaves. Removal of fallen leaves may provide some control of the disease. Fungicides such as benomyl, zineb, or maneb may also provide some protection if applied during early spring as leaves are emerging.

Foliar Diseases

The foliar diseases most frequently encountered in nursery plantings of southern hardwoods are leaf spot, caused by *Cylindrocladium* spp. *Phoma* spp., *Phyllosticta* spp., *Septoria* spp., and *Cercospora* spp.; leaf curl, caused by *Taphrina* spp.; and powdery mildew caused by *Erysiphe* spp. and *Phyllactinia* spp. Most of these diseases initially appear during late summer or early fall and cause very little injury. However, early season infections cause defoliation, reduce the size of planting stock, and reduce survival in outplantings.

Powdery mildew is the most common foliage disease on many hardwood species. It causes stunted growth

of foliage and twigs and is easily recognized by the white, feltlike patches of mycelial growth on leaf surfaces.

A number of fungicides are available for control of foliar pathogens. Early applications of protective sprays will control most leaf diseases.

For information on pesticides available for control, consult your local Cooperative Extension agents or forestry officials.

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Pesticides used improperly can be injurious to human beings, animals, and plants. Follow the directions and heed all precautions on 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 where 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 label.

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 U.S Environmental Protection Agency, consult your local forest pathologist, county agriculture agent, or State extension specialist to be sure the intended use is still registered.

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