Principal Nursery Diseases in the Northeastern Area

by
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In the northeastern area several seedling diseases can cause serious economic losses to nurseries if allowed to develop unchecked. Fortunately, one nursery seldom has all of these disease problems at one time. In fact, some nurseries, either through very good nursery management or pure luck, manage to avoid most of these problems over long periods. Eventually, however, at least some of these disease problems will develop in almost every nursery.

While nursery managers do not need to be able to identify every disease problem that appears on nursery stock, they should be able to spot unhealthy seedlings and know when to contact a pest management specialist. Some of the more common nursery diseases that have recently caused problems in nurseries in the northeastern area are described below. Knowing something about them will help in early identification so that control measures can be applied before serious economic losses are suffered.

Lophodermium Needlecast (Lophodermium seditiosum)

This needle disease eventually appears in almost every nursery that grows red and Scotch pine seedlings. When Lophodermium first became a major problem on pine nursery stock during the early 1960's, many nurseries lost almost all of their young seedlings to it. Infected seedlings that are outplanted often have poor survival due to lack of healthy foliage.

Life Cycle/Identification

The windblown spores, which are released during rainy weather, infect healthy needles in the north-central region from early August to October. In the Southern and Western States infection is usually earlier in the year. Symptoms do not appear until the next spring, usually March or April in the north-central region. The first signs of infection are tiny spots on the needles. These spots are gray-black at first, but later become brown in the centers with yellow margins. Eventually the entire needle turns yellow, then brown. The tiny, black, football-shaped fruiting bodies of Lophodermium are produced on dead needles in July and August. These fruiting bodies release the windblown spores to start a new life cycle.

Control

Both maneb and chlorothalonil are registered for use against Lophodermium. For maximum control, four sprays shoud be applied just before and during the period when Lophodermium fruiting bodies are releasing spores. Sprays should be applied about August 1, August 15, September 1, and September 15. In areas with a high incidence of infection, an October 1 spray may also be required if there is prolonged rainy weather.

Because red and Scotch pine windbreaks are frequently the source of Lophodermium infection, they should also be sprayed if possible.

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References

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Nicholls, T. H., and H. D. Brown. 1975. How to Identify Lophodermium and brown spot diseases on pine. USDA for. Serv., North Cent. For. Exp. Stn. "How To" Series.

Scleroderris Canker (Gremmeniella abietina)

This disease, two strains of which are present in North America, has recently caused major damage to conifer plantations. Fortunately, only a few nurseries are currently having problems with this disease. It is included here only because of the danger of its spreading into new areas on infected nursery stock. Damage results from branch-tip killing and stem cankers. Young seedlings are girdled quickly and die within a few months. Older trees are killed when all the branch tips become infected and the tree has no new green foliage. The North American strain kills primarily the hard pines, such as red, jack, and Scotch. The European strain is most severe on red, jack, Scotch, Austrian, ponderosa, and lodgepole pines. It is currently found in New York, Vermont, Maine, Quebec, New Brunswick, and Newfoundland.

Life Cycle/Identification

Most seedlings become infected in May and June, but infection of nursery stock may take place during the winter if beds are not snow-covered. The first symptoms on nursery stock are light-colored foliage and loose needles. An orange discoloration at the base of the needles appears the following May or June, but by this time the seedlings may already have been shipped. The buds on shoots with discolored needles are killed, preventing new growth. These shoots turn brown anytime from July to November.

The fungus can be transmitted by windblown and rainsplashed spores released from infected windbreaks or seedlings, by shipment of infected nursery stock, and by infected cut Christmas trees. Fruiting bodies are found on dead branch tips one year after infection. Spores are released during moist weather.

Control

The fungicide chlorothalonil is registered for use in nurseries to prevent seedling infection. The North American strain can be controlled with about eight sprays starting in early May. The European strain can infect throughout the year and may require many more spray applications, depending on rainfall and snow cover.

References

Skilling, D. D. and J. T. O'Brien. 1979. How to Identify Scleroderris Canker. USDA For. Serv., North Central For. Exp. Sta. "How To" Series.

Diplodia Shoot Blight (Diplodia pinea)

Diplodia shoot blight periodically causes serious losses to red pine seedlings in nurseries. Damage has also been reported in Scotch and Austrian pine. It appears that this disease has not always been accurately identified, especially in 1-0 seedlings. Infected nursery seedlings usually die within the first year.

Life Cycle/Identification

The spores are released during wet weather from spring until fall. Most shoot infection probably occurs in early spring when shoots are succulent. However, 1-0 stock is susceptible later in the growing season. Infected shoots are frequently stunted or curled and resin droplets are often found associated with the infected shoot. Diplodia may also cause root collar rot. The major sources of Diplodia spores are infected seedlings and cones from nearby windbreak trees.

Control

Diplodia infection can be reduced by eliminating infected seedlings and by removing pine windbreaks located close to seedbeds. Tests at the North Central Forest Experiment Station have shown that four benomyl sprays applied from mid-April to mid-June will give satisfactory control of this disease on 2-0 and 3-0 seedlings. Fungicides should be applied to fall-seeded 1-0 stock beginning in midsummer.

References

Peterson, G. W. 1981. Pine and juniper diseases in the Great Plains. USDA For. Serv. Gen. Tech. Rpt. RM-86, 47 p. Rocky Mt. For. and Range Exp. Sta.

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Cylindrocladium Root Rot (Cylindrocladium spp.)

Cylindrocladium root rot has probably caused more seedling losses in the Eastern United States than any other disease. Both hardwood and conifer seedlings are susceptible. At least two species of Cylindrocladium are involved in this disease complex. In the Lake States the main losses have been in red and white pine and black spruce, but many other species may be damaged.

Life Cycle/Identification

Cylindrocladium causes several kinds of damage, including root rot, damping-off, needle blight, and stem cankers. The most common symptom, however, is root rot. Infected roots become necrotic and discolored, and die from the tips back toward the root crown. As the seedlings enter periods of moisture stress, the needles start to yellow and later turn brown. Transplant stock is especially susceptible to this problem.

The fungus overwinters in infected roots or needles as resting bodies called microsclerotia. Under favorable environmental conditions these microsclerotia germinate and invade the roots of seedlings. The microsclerotia are very durable and require intensive fumigation for adequate control.

Control

Soil fumigation to a depth of at least 12 inches prior to seeding or transplanting is usually adequate. The best results have been obtained from using a soil fumigant containing 67 percent methyl bromide and 33 percent chloropicrin at a rate of 350 pounds of product per acre. Beds must be covered immediately with plastic tarping. It is extremely important that the entire nursery bed be fumigated to prevent early reinfection of fumigated areas.

Needle blight infection has been controlled using a foliar spray of Bordeaux mixture.

The most effective control is to avoid introduction of contaminated soil or plant material from other nurseries. Most nursery infection is the direct result of bringing in infected transplant stock.

References

Cordell, C. E. and D. D. Skilling. 1975. Cylindrocladium root rot in forest nursery diseases in the United States. USDA For. Serv. Agric. Handbook 470.

Thies, W. G. and R. F. Patton. 1970. The biology of Cylindrocladium scoparium in Wisconsin forest tree nurseries. Phytopathology 60: 1662-1668.

Swiss Needlecast (Phaeocryptus gaumanni)

This disease of Douglas-fir is primarily a problem of Christmas tree plantations. Field surveys, however, indicate that most plantation infection is the result of planting infected nursery stock. Thus, although the disease does not cause extensive damage in the nursery, the nursery manager has a responsibility to ensure that Douglas-fir seedlings are not infected at time of shipment. Nursery control is far cheaper than later plantation control.

Life Cycle/Identification

The fruiting bodies of this fungus appear in the rows of stomata on the underside of infected needles as early as August (more commonly November-March) in the Lake States. When magnified, fruiting bodies appear as lines of black dots emerging from the normally white stomates. These fruiting bodies produce airborne ascospores that are released in wet weather. Major spore release and infection coincides with bud break and new shoot growth, but some spores are released throughout the summer. Infected needles become yellow in late fall of the first year or during spring and summer of the second year. These needles later turn brown and are cast in late fall or winter. Nursery personnel may see only the black dots in the stomata prior to shipment of stock.

Control

Seedlings of Douglas-fir should be sprayed with chlorothalonil at 21/2 pounds per 100 gallons of water. Make first application in the spring at bud break. Make second and third applications at 2-week intervals. If rainfall is high, a fourth application may be necessary.

References

Skilling, D. D. 1981. Control of Swiss needlecast in Douglas-fir Christmas trees. Amer. Christmas Tree Journal 25: 34-37.

Skilling, D. D. and H. L. Morton. 1983. How to identify and control Rhabdocline and Swiss needlecast of Douglas-fir. USDA For. Serv., North Cent. For. Exp. Stn. "How To" Series. "In press"

Rhizosphaera Needlecast (Rhizosphaera kalkhoffii)

Rhizosphaera needlecast seriously damages blue spruce in nurseries and Christmas tree plantations in the Northeastern States. Although some trees are killed, the primary damage is premature needlecast, rendering the tree unmerchantable. In 1973 the Wisconsin Department of Agriculture reported that 12 percent of the blue spruce stock in 19 nurseries throughout the state was infected by R. kalkhoffii. Rhizosphaera, like Swiss needlecast, is less expensive to control in the nursery than in the plantation.

Life Cycle/Identification

Rhizosphaera symptoms are similar to those found on Douglas-fir affected by Swiss needlecast. Current-year needles are infected in May and June, although infection is possible from mid-April to October. Fruiting bodies of the Rhizosphaera fungus appear in the stomata of infected needles either in late fall of the same year or the following spring. When magnified, these stomata appear as fuzzy black dots instead of the usual white color. Spores are released from these fruiting bodies during wet weather in late spring, and are spread by rain-splash to uninfected needles. Infected 2-year-old needles turn yellow in July and purplish-brown in late August. Most infected needles are cast the second summer after infection, although some remain through the winter and produce spores the following spring. Newly infected needles show few symptoms the fall after infection and can easily escape detection at that time.

Control

Seedlings should be sprayed with chlorothalonil starting shortly after bud break. Repeat at 2-week intervals until July 1.

References

Skilling, D. D. and T. H. Nicholls. 1974. Rhizosphaera needlecast. Amer. Christmas Tree Journal 18: 21-23.

Skilling, D. D. 1980. How to identify and control Rhizosphaera needlecast. USDA For. Serv., North Central For. Exp. Stn. "How To" Series.

Sirococcus Shoot Blight (Sirococcus strobilimus)

Sirococcus shoot blight has recently caused damage to jack pine seedlings in a Lake States nursery. It has also caused losses in western nurseries on western hemlock and several pine species. Nursery losses are due to tree death and to misshapen stock.

The disease continues to cause major shoot damage in young red pine plantations in northern Wisconsin. It causes tip dieback and stem and branch cankers in the current year's growth. Trees with multiple infections are killed, while less heavily infected trees become misshapen.

Life Cycle/Identification

In the Lake States initial infection occurs in the juvenile needles in May and June. The fungus spreads down into the succulent stem tissue, causing a small canker. A small drop of resin is often seen at this site. Infected needles frequently collapse at the base, resulting in a "dropped" appearance. Infected shoots may curl if the tissue is still succulent at the time of infection. Infected needles later turn brown and then tan to gray. Fruiting bodies appear as tiny black dots under the needle fasicle. Spores are disseminated by rain-splash.

Control

Most infection appears to come from nearby red and jack pine windbreaks. Removal of infected branches from these trees will reduce the inoculum load.

Chlorothalonil should be applied to seedlings at 2 to 31/2 lbs. per 100 gallons of spray. First application should be made to newly emerging shoots in the spring, followed by additional sprays at 3 week intervals until needles are fully developed.

References

Smith, R. S., Jr. 1975. Sirococcus tip blight. In "Forest Nursery Diseases in the United States." USDA For. Serv. Agric. Handbook 470.

Gall Rusts of Hard Pine (*Cronartium* spp.) (*Endocronartium harknessii*)

Jack and Scotch pine seedlings are attacked by a number of stem rust fungi in the northeastern area that frequently cause mortality. These include pine-oak rust, sweetfern rust, comandra rust, stalactiform rust, and pine-pine rust (Western gall rust). With the exception of pine-pine rust, which is caused by *E. harknessii,* all of these fungi require an alternate host to complete their life cycle. These alternate hosts include oak, sweetfern, cowwheat, and false toadflax. Seedling losses often occur when an alternate host of these rusts is present near jack pine seedbeds. In the case of pine-pine rust, infection usually comes from nearby infected jack or Scotch pine in windbreaks.

Life Cycle/Identification

Infected seedlings usually produce some type of a gall on the stem one year after infection. Therefore, infections on fall and spring-lifted stock may not be visible. Identification of the species of rust involved is important because the different rusts have different infection periods. Since some laboratory work is necessary, proper identification usually requires the assistance of a forest pathologist.

Infected seedlings should be eliminated at the nursery; galls will eventually girdle the stems, resulting in poor quality stems, mortality, and possible plantation failure. Shipping infected stock may also spread gall rust fungi to regions where they do not already occur.

Control

Control can only be established after identification of the gall rust. Pine-pine rust can be controlled by removing galls from trees before they produce spores that can infect other pines. The weak link in the life cycle of the other rusts is their need to live for a time on a broadleaf host. Nursery-managers can take advantage of this weakness by removing the broadleaf hosts from the nursery area. The exact distance necessary to eradicate alternate hosts is not known, but is probably from 1/4 to 1 mile.

Recent work in California on Monterey pine Christmas trees has shown the fungicide triadimefon (Bayleton) to be effective in controlling pine-pine rust. The Forest Service, working in cooperation with the Wisconsin and Minnesota Department of Natural Resources, is currently testing this fungicide for control of gall rust in Lake States nurseries.

References

Skilling, D. D. 1975. Jack pine rusts. In "Forest Nursery Diseases in the United States". USDA For. Serv. Agric. Handbook 470.

Smith, R. S., Jr. 1975. Western gall rust. In "Forest Nursery Diseases in the United States". USDA For. Serv. Agric. Handbook 470.

Phomopsis Blight of Junipers (*Phomopsis juniperovora*)

Phomopsis blight is a serious nursery disease wherever junipers are grown in the northeastern area. Losses have been most severe in seedling and transplant beds of eastern redcedar and Rocky Mountain juniper. The fungus causing this disease infects new needles and rapidly invades young stem tissue. One-year-old infected seedlings are usually killed, but older stock usually only loses the infected branches. Mortality can be expected, however, if infected stock is outplanted.

Life Cycle/Identification

Small yellow spots appear on needles within 3 to 5 days after infection. The fungus spreads rapidly, killing the new needles and invading the stem tissue. Infected branches become light in color, then red-brown, and finally ashy gray. The fungus may girdle main stems less than 1 cm in diameter. The portion of the seedling above the girdled area then dies. The Phomopsis fruiting bodies may develop within 4 weeks after seedlings become infected, but usually are not well developed until the infected tissue turns gray. Spores are primarily dispersed by rainsplash. Spores need only 7 hours to germinate, enter, and infect seedlings. The fungus can produce spores for up to 2 years on infected plants.

Control

Seedlings need protection during the entire growing season, since spores are disseminated throughout the period. The only fungicide currently registered for Phomopsis blight is benomyl. Application at 7-to 10-day intervals combined with vigorous roguing of infected seedlings to reduce inoculum over the same period should give control. New growth is especially susceptible, and new growth commonly occurs on eastern redcedar early in spring and again late in summer.

References

Peterson, G. W. and C. S. Hodges, Jr. 1982. Phomopsis blight of junipers. USDA For. Serv., For. Insect and Disease Lfl. 154.

Peterson, G. W. 1981. Pine and juniper diseases in the Great Plains. USDA For. Serv. Gen. Tech. Rpt. RM-86 47 p. Rocky Mt. For, and Range Exp. Sta.

Gray Mold on Container Stock (Botrytis cinerea)

The fungus causing gray mold is universally present, but is seldom a problem under nursery conditions unless a highly susceptible genus like Sequoia is being grown. With the recent increase in container stock production, however, this disease now is becoming more of a problem in the northeastern area on a few tree species. Douglas-fir, several species of fir, and larch are moderately susceptible to Botrytis cinerea. The web-like mycelium invades the young lower branches where moisture conditions are more conducive to infection. Once established, it proceeds downward into young, succulent stem tissue, causing tip dieback. the disease is favored by cultural practices like high planting density or shade frames that limit air movement and raise humidity around the seedlings.

Life Cycle/Identification

The first sign of infection is the thin gray to brown mycelium that spreads like a web over the young foliage. Early infection is frequently missed, since the mycelium develops below the seedling canopy in the container block. Tufts of conidiophores bearing clusters of white to gray spores arise from the mycelium. When the conidiophores are brushed, clouds of spores are released.

Control

Because populations of this fungus can increase on dead plant material, good sanitation practices should be followed. Cultural practices that increase aeration and decrease humidity will reduce or prevent losses in most species. Reducing seedling density is the most practical control. Fans used in conjunction with automatic watering systems will help dry out container foliage quickly. With highly susceptible species, a fungicide treatment may be necessary. Benomyl , chlorothalonil, and dicloran have been used with good success. Fungicides must be applied at the first sign of the disease and continued as long as conditions are favorable for disease development.

Gray mold is also a serious problem during cold storage and transport of seedlings. To reduce losses, infected seedlings should be culled out and the seedlings should be sprayed with a fungicide just before packaging.

References

Smith, R. S., Jr. 1975. Grey mold of giant sequoia. In: Forest nursery diseases in the United States. Agric. Handb. 470. Washington, D.C. U.S. Dept. of Agric.

Peace, T. R. 1962. Pathology of trees and shrubs. 753 p. Oxford Univ. Press, London.

Walnut Root Rot (*Phytophthora* spp., *Cylindrocladium* spp.)

Black walnut frequently suffers severe root rot problems that result in loss of stock or extra costs of root rot control. The major fungi involved in this root rot complex are several species of *Phytophthora* and *Cylindrocladium*. *Pythium*, Sclerotium, and *Phymatotrichum* species occasionally affect black walnut in nurseries farther south. Low-lying, heavy, poorly drained soils are especially prone to walnut root rot problems.

Life Cycle/Identification

Infection by these fungi may occur any time after the seed splits prior to germination. If the germinating seed is invaded, the seedling may be killed before emerging from the ground. Young seedlings blacken and die in a few days. Older infected seedlings usually wilt and yellow before the plants are killed. These plants also turn black. Symptoms of Phytophthora root rot differ somewhat from those of Cylindrocladium, especially in the early stages of development. Phytophthora lesions first appear as water-soaked, greenish-black discolorations usually located at the root collar. Cylindrocladium lesions appear small and blackish and are scattered over the laterals as well as the tap root. Longitudinal cracking of the tap root often occurs with Cylindrocladium infections, but is rare with Phytophthora infections.

Control

Selecting nursery sites with light, well-drained soils will reduce problems with root rot fungi. By holding seed in cold storage until late spring or early summer, it is often possible to avoid the moist soils favorable to root rot development. Fumigants such as methyl bromide should be used to control root rot pathogens in nursery soils. Special attention should be given to proper soil temperature, moisture, and tilth during fumigation.

Seedlings should be inspected and graded when lifted in the fall for winter storage. Plants with dead or discolored lateral or fibrous roots at time of storage may develop root rot symptoms very rapidly the following spring during handling and shipping. Seedlings should not be held at temperatures above 4 °C any longer than necessary for processing and shipping. A captafol dip has been effective in preventing root rot in both heeling in beds and in storage, but this fungicide is not currently registered for this use. Avoid bringing nursery stock or machinery from other nurseries into clean nurseries.

References

Green, R. J., Jr. 1975. Phytophthora root rot of black walnut seedlings. In: Forest nursery diseases in the United States. Agric. Handb. 470. Washington, D,C, U.S. Dept. of Agric.

Kessler, K. J., Jr., 1982. Control of black walnut root rot diseases in nurseries. Res. Pap. NC-229. St. Paul, MN: U.S. Dept. of Agric. For. Serv., North Central For. Exp. Sta.

Stunting of Red Pine and White Spruce

Several nurseries in the northeastern area have experienced stunting of red pine and white spruce in recent years. Efforts to find a pathological cause for this

reduced growth have not been successful. Recent evidence found by Forest Service pathologists indicates that this problem is related to foliage phosphorus deficiency. Efforts continue to solve this problem.

References

Croghan, C. F., and L. A. LaMadeleine. 1982. Impact of stunting of white spruce at Eveleth nursery. Tree Planters Notes 33(4): 19-22.

Annotation

Provides information on the identification and control of 12 common nursery diseases found in the northeastern area.

Key Words

Nurseries, plantations, seedlings, fungicides, disease control

Abstract

Nurseries in the northeastern area are subjected to a variety of seedling disease problems, including: Lophodermium needlecast, scleroderris canker, Diplodia shoot blight, Cylindrocladium root rot, Swiss needlecast, Rhizosphaera needlecast, Sirococcus shoot blight, gall rusts of hard pines, Phomopsis blight of junipers, gray mold, walnut root rot, and stunting of red pine and white spruce. Early identification and control of these diseases will prevent serious losses.