

## Rhizosphaera Needle Cast (RNC)



RNC is a fungal infection caused by the pathogen, *Rhizosphaera kalkhoffii*. This fungus infects new needles, which then fall off in subsequent years as they succumb to the infection. Needle loss starts on the inner and lower branches. Over time, the extensive loss of photosynthetic capability eventually results in progressive branch death. In WNC, **Norway** and **Blue Spruce** are most often affected. If left untreated, **most** trees continue to decline and eventually die.

The initial treatment for RNC usually consists of foliar applications of the appropriate fungicides. Since it is the new growth that must be protected and the pathogen thrives in wet conditions, treatment **must** commence and continue throughout the spring vulnerability period. Sanitation (prompt removal of dead and/or dying material) is also vital since it serves as a fungal reservoir to infect new growth.

RTS uses an **organic** two-fungicide protocol consisting of copper and *Bacillus subtilis* (a helpful bacterium) applied via foliar spray to control RNC. In WNC, the initial fungicide application typically occurs sometime in late April, followed by two more applications approximately 7-21 days apart. The exact timing depends on initial needle expansion and the subsequent weather conditions.

Initially, 3 consecutive years of fungicidal treatment are recommended for the best results. Later, assuming appropriate cultural practices (sanitation, [supplemental watering](#), [fertilization](#), [mulch & compost](#)) are also instituted, the treatment frequency can usually be reduced.

# Common Diseases of Spruce in Kentucky

Julie Beale  
*Plant Disease Diagnostician*

Brenda Kennedy  
*Plant Disease Diagnostician*

Nicole Ward Gauthier  
*Extension Plant Pathologist*

## INTRODUCTION

Spruce trees, particularly blue spruce (*Picea pungens*) and Norway spruce (*Picea abies*), are popular specimen trees and screening conifers in Kentucky landscapes. Unfortunately, they can present problems for homeowners as a result of poor vigor, dieback, or needle drop. A combination of infectious disease and environmental stress is often to blame.

These popular spruce species have a native range that is much cooler than Kentucky's climate, and they prefer lighter, rockier soils. Kentucky's high summer temperatures and persistent winter rains can create excessive stress to trees. Ultimately, stress may lead to susceptibility to disease-causing pathogens. Common indications of plant disease include lower canopy needle loss, scattered branch dieback, rapid top-down browning, and tree death. These symptoms can result from needle cast, canker, or root rot diseases.

## NEEDLE CAST

### Symptoms & Signs

Needle cast disease, caused by the fungus *Rhizosphaera* sp., results in purple to brown discoloration of scattered needles and eventual needle cast (needle drop) (FIGURE 1). Symptoms develop on older needles and on lowermost branches first, and then progress upward. Infected needles are cast, but stem tissue remains supple and green; younger needles are not affected. Repeated needle loss may eventually lead to twig dieback and tree decline.



**FIGURE 1.** NEEDLES AFFECTED BY RHIZOSPHAERA NEEDLE CAST BECOME PURPLE TO BROWN AND DROP PREMATURELY.

*Rhizosphaera* fungal fruiting bodies (pycnidia) appear on needles as tiny, raised, grayish bumps topped with white waxy caps. They protrude through stomata (pores in needles), lining up in rows along the length of needles (FIGURE 2). Pycnidia are visible with a hand lens or magnifier.

Other fungi, such as *Stigmina* sp., have been implicated in spruce defoliation in a similar pattern





**FIGURE 2**



**FIGURE 3**

**FIGURE 2.** *RHIZOSPHAERA* PYCNIDIA APPEAR AS TINY BUMPS IN ROWS ON INFECTED NEEDLES. **FIGURE 3.** TINY BLACK BRUSH-LIKE FUNGAL STRUCTURES EMERGE FROM NEEDLES INFECTED WITH *STIGMINA* SP.

as *Rhizosphaera* needle cast. If *Stigmina* is present, tiny, brown to black, brush-like tufts emerge from infected needles through stomata (FIGURE 3).

### Disease Development

Needle cast fungi overwinter as pycnidia in diseased needles, with new infections occurring on emerging needles during wet weather in spring and early summer. Once infection takes place, the fungus colonizes needles, eventually leading to needle cast. Needles begin to drop in late summer or autumn within the same year as infection, but more often, symptoms develop 12 to 15 months *after* initial infection. Fallen needles and debris serve as a source of inoculum for new infections the following spring.

### Disease Management

- Improve air circulation by providing adequate tree spacing and thinning as needed.
- Avoid pruning wet foliage to reduce spread of pathogens.
- Practice good sanitation; rake and discard dropped needles from beneath trees.

- Fungicides are seldom recommended, but applications may be justified for specimen trees and young plantings. Apply fungicides in spring as new shoots begin to expand (usually mid-April), and follow with a second application 3 weeks later. Confirm needle cast disease through a diagnostic laboratory or county Extension office before using fungicides, since other problems may be mistaken for needle cast.

### Look-alike Symptom

Needle discoloration and drop may also be caused by mite feeding injury. In this case, affected needles appear dusty green to bronze at a distance; upon closer examination, tiny pale spots are visible; spider mite webbing may be present in severe cases (FIGURE 4). Injured needles tend to drop from the lower canopy (similar to needles with fungal disease). Using a hand lens, look for live or dead mites and/or mite eggs on needles (FIGURE 5) or tap symptomatic branches over white paper and examine fallen debris. Refer to UK Entomology fact sheet, *Spider Mites on Landscape Plants* (ENTFACT-438) for information on managing mites on spruce.





FIGURE 4



FIGURE 5

FIGURE 4. NEEDLES BECOME STIPPLED DUE TO SPIDER MITE FEEDING. FINE WEBBING MAY ALSO COVER INFESTED TWIGS AND NEEDLES. FIGURE 5. WITH THE AID OF A HAND LENS, SPIDER MITES AND THEIR EGGS MAY BE VISIBLE ON AFFECTED NEEDLES.

## BRANCH CANKERS & DIEBACK

### Symptoms & Signs

*Cytospora* canker, caused by the fungus *Cytospora kunzei*, is a common disease of stressed spruce. Cankers may appear as sunken or raised lesions on small twigs or larger branches (FIGURE 6). Enlarging cankers girdle twigs or branches, which then die upward to tips (FIGURE 7). Killed branches are often covered with dried resin (FIGURES 6 & 8). Tiny, pimple-like fungal fruiting bodies (pycnidia) form within cankers; these fruiting bodies are difficult to detect, even with a hand lens or magnifying glass.

### Disease Development

*Cytospora* overwinters as pycnidia and infects branches through small wounds or cracks in bark during wet spring weather. Visible cankers and branch dieback may not be noticeable until several weeks or up to a year later.

Stress from drought and other site-related factors plays an important role in disease development; stressed trees are more susceptible to infection by the *Cytospora* fungus. Even though blue spruce is considered to be a somewhat drought-tolerant spruce, a 1- to 3-year period of noticeable branch dieback often follows a severe drought. In many cases, drought events followed by extremely wet seasons may also predispose spruces to decline.



FIGURE 6

FIGURE 6. INFECTIONS BY *CYTOSPORA KUNZEI* CAUSE CANKERS TO DEVELOP ON SPRUCE TWIGS AND BRANCHES.





FIGURE 7

**FIGURE 7.** ENLARGING *CYTOSPORA* CANKERS GIRDLE BRANCHES, RESULTING IN BRANCH DEATH AND NEEDLE DROP.



FIGURE 8

**FIGURE 8.** BRANCHES KILLED BY *CYTOSPORA* ARE OFTEN COVERED BY DRIED RESIN.

Other stresses that may predispose spruce to *Cytospora* canker include planting into compacted soils or locations in which the tree outgrows the available space (FIGURE 9).

### Disease Management

- Prune cankered branches back to healthy tissue and remove dead branches. Discard or destroy prunings.
- Promote plant vigor and avoid stress: water during drought, mulch to conserve soil moisture, monitor drainage patterns to mitigate overly wet soil conditions that can kill roots even in the absence of a pathogen.
- Allow sufficient space for tree growth to maturity, taking into consideration adequate space for root development.
- Fungicides are not effective for management of cankers.

### Look-alike Symptoms

In many cases, fungal cankers are not the cause of dieback, and a specific cause will not be obvious on dead branches. General plant stress resulting from heavy soils, hot summer temperatures, and even fluctuating spring temperatures, result in loss of plant vigor. Diseases, such as *Cytospora* canker, may or may not develop as a result of abiotic stress.



FIGURE 9

**FIGURE 9.** SPRUCE TREES PLANTED IN SITES WITH INSUFFICIENT SPACE FOR ROOT DEVELOPMENT BECOME STRESSED AND MORE SUSCEPTIBLE TO *CYTOSPORA* CANKER.



# PHYTOPHTHORA ROOT ROT

## Symptoms

Phytophthora root rot is caused by several species of water molds. It affects many landscape plants, including spruce and other conifers, and occurs in locations with poorly drained soils. Above-ground symptoms of infected trees include stunted, pale brown needles, followed by uniform browning, and rapid tree death. Roots become soft, brown, and decayed. Spruces that succumb to Phytophthora root rot are typically younger trees that were planted into poorly drained (FIGURE 10) and/or compacted sites. Other conifers such as fir (*Abies* sp.) and pine (*Pinus* sp.) are often more susceptible to Phytophthora root rot than spruce.

## Disease Development

Phytophthora water molds infect roots of susceptible plants when free water is available. Motile (swimming) spores are produced by this pathogen and move through wet soils to infect nearby roots. Specialized resting spores allow water mold pathogens to overwinter and persist for long periods of time in soil.

## Disease Management

- Plant conifers in well-drained sites, or improve drainage by diverting water flow, tiling, installing raised plantings, etc. Refer to “Wet Feet” of *Ornamentals* in Additional Resources.
- Commercial producers may apply soil drenches using water mold-targeting fungicides (e.g., in nursery or Christmas tree plantations). Confirm disease through a diagnostic laboratory or county Extension office before using fungicides.
- Fungicides are ineffective if drainage problems are not corrected.
- Fungicides suppress pathogen development, but they do not cure infections.

## Acknowledgement

The authors are grateful to Elizabeth Bush, Virginia Polytechnic Institute, for her review of this publication.

**Photos:** Julie Beale (1 & 9), Paul Bachi (2 & 3) and Nicole Ward Gauthier (10), UK; Ward Strong, British Columbia Ministry of Forests (5), Joseph O’Brien, USDA-Forest Service (6 & 8), Michael Kangas, North Dakota State University, North Dakota Forest Service (7), and Petre Kapitola, Central Institute for Supervising and Testing in Agriculture (4), Bugwood.org

**Editor:** Cheryl Kaiser, Extension Support Staff

Revision/expansion of *Needle Cast Diseases of Conifers* (ID-85) by John R. Hartman & Deborah B. Hill

Educational programs of the Kentucky Cooperative Extension Service serve all people regardless of race, color, age, sex, religion, disability, or national origin.



**FIGURE 10.** PHYTOPHTHORA ROOT ROT CAN DEVELOP ON SPRUCE TREES PLANTED IN POORLY DRAINED SITES; NOTICE WATER PUDDLING IN THE FOREGROUND.

## ADDITIONAL RESOURCES

- Plant Pathology Extension Publications  
<http://www2.ca.uky.edu/agcollege/plantpathology/extension/pubs.html>
- Spider Mites on Landscape Plants (ENTFACT-438)  
<https://entomology.ca.uky.edu/ef438>
- “Wet Feet” of Ornamentals (PPFS-OR-W-04)  
[http://www2.ca.uky.edu/agcollege/plantpathology/ext\\_files/PPFShtml/PPFS-OR-W-4.pdf](http://www2.ca.uky.edu/agcollege/plantpathology/ext_files/PPFShtml/PPFS-OR-W-4.pdf)
- Woody Plant Disease Management Guide for Nurseries and Landscapes (ID-88)  
<http://www.ca.uky.edu/agc/pubs/id/id88/id88.pdf>

*June 2016*