

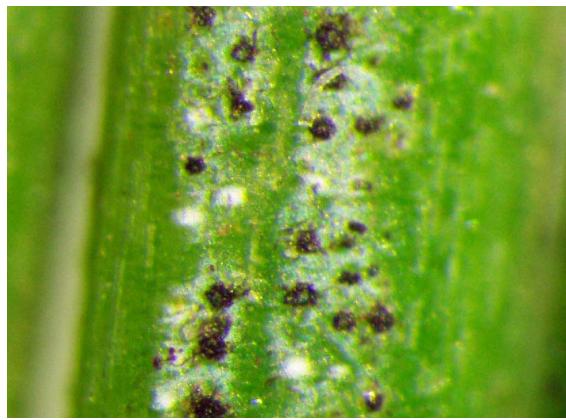
Diagnosing Spruce Disorders in North Dakota

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Spruce trees are planted throughout North Dakota, often as ornamental shade trees and shelterbelts. These conifers are beautiful, but they also suffer from many environmental and pest problems. Any given tree can be affected by several problems at the same time.

This guide will help the reader diagnose and understand what can – and can't – be done to maintain or improve the health of spruce trees in North Dakota. The guide begins with a section on spruce identification, followed by a listing of disorders and pests. When using pesticides, be sure to read, understand and follow all label directions.



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Spruce ID: Key Identifying Characteristics



(Aaron Bergdahl, North Dakota Forest Service)



Black Hills spruce

(*Picea glauca* var. *densata*)

Small (1.5- to 2-inch) brown cones, hairless glaucous (whitish) twigs and upright growth pattern.

Colorado blue spruce

(*Picea pungens*)

Thin, ragged edges of cone scales, yellowish cones, 2.5- to 4-inch-long, hairless reddish twigs and horizontal growth pattern.

Meyer spruce

(*Picea meyeri*)

Cones similar in length to those of Colorado blue spruce (2.5 to 4 inches) but wider, and the same color as Black Hills spruce, hairy twigs and very upright growth pattern.

* Norway spruce also occasionally is planted in North Dakota but only grows well in specific areas. The tree is characterized by its short, blunt needles, very large cones and drooping branchlets.

Cytospora canker of spruce

(Being renamed as Valsa canker of spruce, caused by the fungus *Valsa kunzei* (syn. *Leucostoma kunzei*). The imperfect stage is *Cytospora kunzei* (syn. *Leucocytospora kunzei*).



Orange arrows showing more recent infections and gray arrows showing older infections. (Aaron Bergdahl, North Dakota Forest Service)

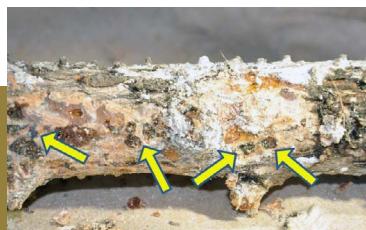
A close-up of a whitish, pitchy branch with yellow arrows pointing to black fruiting bodies revealed by scraping away the pitch and outer bark. (Aaron Bergdahl, North Dakota Forest Service)

Identifying characteristics:

- Infections enter via wounds and bark cracks; the fungus expands and kills the cambium tissue, causing bluish-white sap to ooze from cankered areas.
- Newly infected branches are indicated by pale, yellowish foliage, which turns purplish, then brown, later in the year.
- Spore-producing structures develop in the bark of infected areas and can be revealed by gently scraping the infected area with a knife.

Management:

- Maintain good tree health and avoid wounding and drought stress.
- Prune out dead branches during dry weather, sanitize pruning tools between cuts; burn or bury pruned branches.
- Controlling the fungus using injected or sprayed fungicides or growth regulators is unproven at this time.



Early symptoms indicating Cytospora canker of spruce infection. (Aaron Bergdahl, North Dakota Forest Service)



Spruce spider mites (*Oligonychus ununguis*)



Tiny spruce spider mites on a spruce twig. (Aaron Bergdahl, North Dakota Forest Service)

Discoloration and stippling typical of spruce spider mite feeding damage. (James A. Walla, Northern Tree Specialties)



Identifying characteristics:

- Individual spruce spider mites are very hard to see; however, feeding in large numbers results in mottling of individual needles and a “bronzed” appearance to the tree.

Management:

- Miticides work best when applied in the spring or fall, but not summer, because spruce spider mites enter dormancy during hot weather.
- Horticultural oils also may be effective, but test a small area of the tree first to ensure its tolerance to the oil.
- Syringing with a jet of water also may help dislodge mites.
- Traditional insecticides may not be effective against spruce spider mites and even may make the situation worse.

Stigmina Needle Cast of Spruce (*Stigmina lautii*)

Identifying characteristics:

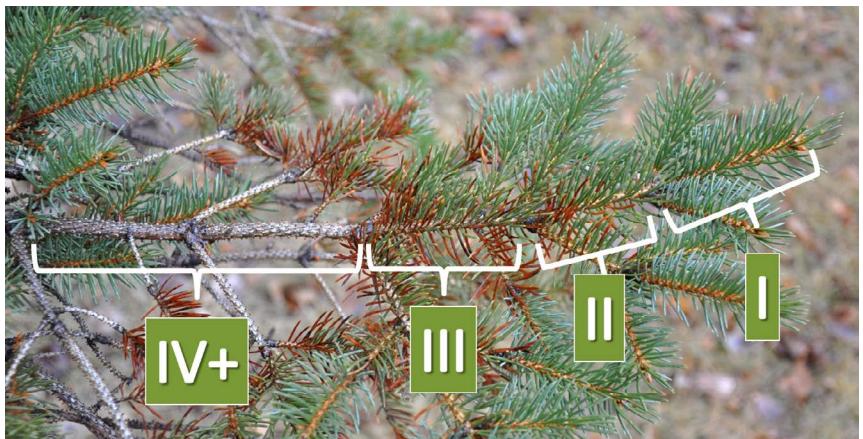
- Microscopic fuzzy-margined spore-producing structures emerge from the normally white stomatal pores on all sides of infected needles; may be confused with Rhizosphaera needle cast (see Page 5).
- Typical pattern of needle loss and branch dieback occurs from the bottom upward and interior outward; needles older than the third age class are dropped; entire branch dieback may occur.
- Several years of continuous infection eventually may kill a tree.

Management:

- Practices that promote drying of lower branches, such as ensuring adequate tree spacing and controlling vegetation growing into the lower crown, reduce humidity and, therefore, disease incidence.
- Application of preventative fungicides such as chlorothalonil or a Bordeaux mix in the spring when new needles begin to elongate, and again about one month later, has proven to be an effective management strategy.
- Continued yearly treatment with fungicide is required for Stigmina control.



Loss of needles on lower branches a typical symptom of Stigmina and Rhizosphaera needle cast infection. (Aaron Bergdahl, North Dakota Forest Service)



Needle age classes as they are affected by spruce needle cast infection. Class I is the youngest age class. (Aaron Bergdahl, North Dakota Forest Service)



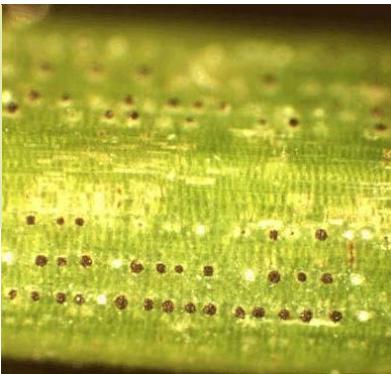
The fuzzy-looking fungal spore-producing structures of Stigmina needle cast and a close-up image of the fungal structures. (Aaron Bergdahl, North Dakota Forest Service)

Rhizosphaera Needle Cast of Spruce (*Rhizosphaera kalkhoffii*)

Needle loss typical of spruce needle cast diseases.
(Michael Kangas, North Dakota Forest Service)



The smooth, round spore-producing growths of Rhizosphaera needle cast. (Joseph Zeleznik, NDSU)



Withered new growth resulting from early instar feeding of YHSS. (James A. Walla, Northern Tree Specialties)



Second-year growth missing due to feeding by older YHSS larvae. (Scott Knoke, NDSU)



A close-up of a YHSS larva. Note, despite the name, the head capsule is often reddish, rather than yellow. (Joseph Zeleznik, NDSU)

Identifying characteristics:

- Round, smooth-margined spore-producing structures are found in stomates (pores) on all sides of infected needles; may be confused with those of Stigmina needle cast (see Page 4).
- Infected needles may turn yellow and then brown within six to eight months of infection; branch dieback occurs from the bottom upward; inner-most needles are lost first.

Management:

- Cultural practices that encourage drying of lower branches – ensuring adequate tree spacing, pruning lower branches and controlling vegetation growing into the lower crown – will reduce disease.
- Two consecutive years of application of preventative fungicides such as chlorothalonil or a Bordeaux mix in the spring when new needles begin to elongate, and again about one month later, will provide adequate control of Rhizosphaera needle cast.
- For more information about Rhizosphaera and Stigmina needle casts, see “The Old and the New: Two Needle Diseases of Spruce in North Dakota,” NDSU Extension Service publication F1680.

Yellow-headed spruce sawfly (YHSS), (*Pikonema alaskensis*)

Identifying characteristics:

- This insect pest is observed most often in central and western North Dakota after 830 growing-degree days (base temperature 40 F, usually in early to mid-June).
- A first sign of this pest is a withered appearance of new growth (Class I needles) from the feeding of younger caterpillars, followed by later feeding on second-year needles (Class II).
- Larvae seldom eat an entire needle, usually leaving a stub at the base.

Management:

- The larvae are controlled easily by many insecticides and certain alternative products, but correct timing is critical.

Herbicide damage

Identifying characteristics:

- Herbicide exposure to spruce trees results in a variety of visible symptoms, depending on the active ingredients and mode of application.
- Spruce are more sensitive to foliar herbicides in the spring, when new shoot growth is occurring.
- Uptake of herbicides from soil or into wounded roots results in a spiral pattern of needle-and-branch death up the stem of the tree; exposure to nonselective herbicides can lead to wilting, irregular growth and discoloration.

Management:

- Recovery may or may not occur, depending on dosage; supporting post-injury tree health is important.
- When applying herbicides near trees, take extreme care to avoid unintended exposure.



A spiral pattern of damage typical of spruce exposed to broadleaf weed herbicides. (Aaron Bergdahl, North Dakota Forest Service)



Wilting and abnormal new growth of spruce affected by a high dose of glyphosate. (Aaron Bergdahl, North Dakota Forest Service)

Whole-tree symptoms of acute exposure of spruce to glyphosate. (Aaron Bergdahl, North Dakota Forest Service)

Pine needle scale

(*Chionaspis pinifoliae*)

Disease characteristics:

- This insect attacks pine and spruce trees in North Dakota.
- Heavy infestations by these scale insects may cause discoloration and reduce vigor, although this is rare.

Management:

- These tiny insects are protected beneath the scale covering for much of the year and, therefore, are difficult to treat with contact insecticides unless timed perfectly to coincide with the crawler/hyaline stage in early spring (May or June).
- Horticultural oils may be effective but are practical only when applied on smaller trees and shrubs.

Small white scales on spruce needles. (Michael Kangas, North Dakota Forest Service)



A close-up of scales on needles. (Aaron Bergdahl, North Dakota Forest Service)



Various springtime symptoms indicating winter injury. (Michael Kangas, North Dakota Forest Service; Aaron Bergdahl, North Dakota Forest Service)



Pitching in response to heavy sapsucker damage.
(Joseph Zeleznik, NDSU)



A close-up of the neatly arranged holes characteristic of sapsucker feeding. (Aaron Bergdahl, North Dakota Forest Service)



Aphids, many genera in family Aphididae

While aphids are fairly common on trees, they are not found often on spruce. When they are found, they may be in large numbers. They feed on sap on developing branches and produce honeydew, which then is collected by ants. Damage is usually minimal, so no treatment is needed.

Aphids (light yellow-green) on a spruce twig, often tended and protected by ants.
(Joseph Zeleznik, NDSU)

Winter injury

Identifying characteristics:

- The most common cause of winter injury in spruce is the large temperature fluctuations seen in January to March leading to desiccation of needles.
- Spruce trees may de-harden with warm temperatures but cannot re-harden when cold temperatures return.
- Visible symptoms often are noticed first in March or April.

Management:

- Unless needle damage is severe, trees are likely to recover because buds usually are undamaged.

Sapsucker

Identifying characteristics:

- Horizontal or vertical rows of holes are signs of sapsucker injury. The birds excavate neat holes in the bark of many tree species and feed on the sap as well as on insects that are attracted to the wounds.
- Damage can result in branch and top dieback and may even kill trees.

Management:

- Due to the skittish nature of these birds, hanging bright, shiny objects in trees may prevent attack, and sticky repellants such as Tanglefoot also may be effective.
- Sapsuckers are protected by the Migratory Bird Act, so lethal control methods are not an option.

Spruce adelgids (Eastern spruce gall adelgid, Cooley's spruce gall adelgid), *Adelges* sp.

The conelike structures typically forming near branch tips are actually galls produced by spruce trees in response to a tiny, flylike insect known as an adelgid. The insect's life cycle is complex, and because the damage to spruce trees in North Dakota is usually minimal, treatment is not recommended.



Developing gall on a spruce branch, the product of an adelgid.
(Joseph Zeleznik, NDSU)

Lirula needle blight (*Lirula macrospora*)

Lirula needle blight was found more easily in eastern North Dakota in past decades but is encountered less frequently now. The long black fruiting bodies of this disease are easy to see on needles and are not easily mistaken for other diseases of spruce in our regions. Older needles persist on the tree and are ash gray. While this disease can be managed with fungicides, this is not warranted unless infection is severe, leading to extensive needle loss.



Long, black fungal spore-producing structures of Lirula needle blight visible on needles; ash-gray older needles persist on a spruce branch. (James A. Walla, Northern Tree Specialties)

Spruce bud scale (*Physokermes piceae* or *P. hemicyrphus*)

This insect is very inconspicuous and can be overlooked easily. While it is most often found on Norway spruce, it has been observed on Colorado blue spruce, especially in the eastern part of the state. Heavy infestations can result in a secondary problem with sooty mold, which will kill lower branches. Conventional insecticides are effective only in mid to late spring, when crawlers are active. Horticultural oils may be effective in late fall or early spring.



Female scales at the base of the previous year's twigs can be mistaken easily for actual buds. (Stevan Sagaser, NDSU)

Chrysomyxa rust (*Chrysomyxa* sp.)

This fungal rust disease leads to defoliation and reduces tree vigor. This disease is rare in North Dakota, and severe infections have not been reported.

Small, orangish, fingerlike spore-producing structures of Chrysomyxa rust are visible in late summer.
(James A. Walla, Northern Tree Specialties)



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