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## **UPDATE ON SELECT CONIFER DISEASES IN CONNECTICUT—WHAT TO EXPECT IN 2010**

The cool, cloudy, wet weather of 2009 was favorable for many different fungal diseases throughout Connecticut. Therefore, it might be prudent to allow extra time to scout for symptoms during late winter and early spring of 2010 in order to anticipate possible problems, and the need for early-season sprays to manage diseases in the upcoming season.

### **AUTOECIOUS (REPEATING) SPRUCE NEEDLE RUST**

**Causal Agent:** *Chrysomyxa weirii* (fungus)

**Key Hosts:** blue and white spruce

#### **Symptoms and Spread:**

Symptoms of repeating spruce needle rust were widespread throughout Connecticut in 2009. These appeared as yellow spots or flecks on one-year-old (occasionally two-year-old) needles. This needle rust is autoecious and only infects spruce, particularly on susceptible blue and white spruce. Since this disease is autoecious, no additional hosts are required to complete the life cycle of the fungus. One of the key features used to distinguish repeating needle rust from other needle rusts is the timing of symptom development. Symptoms appear in early spring, whereas

those of other heteroecious *Chrysomyxa* rusts appear in mid to late summer.

Symptoms first appear as yellow spots or flecks on one-year-old (occasionally two-year-old) needles in late winter and early spring. These spots eventually develop into pustules or blisters (telia) that burst open to reveal masses of yellow-orange spores (teliospores). The teliospores then produce another type of spore (basidiospores) that are readily blown by wind and splashed by rain onto newly emerging needles of the same tree or of adjacent trees. The new infections occur when needles are tender and immature in spring. Infections often go undetected for the remainder of the season, since outward symptoms are rarely visible. However, the following spring, diagnostic yellow spots and blisters develop on the infected needles and the disease cycle starts again. Blisters of *C. weirii* can be extensive and appear on both one- and two-year-old needles, giving heavily infected trees an overall yellow-orange appearance from a distance. As with most needle diseases that are not fatal, but result in needle drop, repeated defoliation may retard growth and reduce marketability.



Yellow spots or flecks develop on needles in late winter and early spring.

**Management:**

- Use healthy stock and maintain tree vigor. Fertilize at the proper time and rate as determined by a soil test--avoid excessive nitrogen and late- summer and early-fall fertilization.
- Rogue and remove heavily infected trees to reduce inoculum.
- Fungicide sprays.
  - in all cases, **coverage and timing** are **very** important;
  - although rust is not specifically listed on the label, chlorothalonil (Daconil 2787, Daconil Ultrex, Daconil Weather Stik, Bravo) is labeled for spruce and is effective for control;



Diagnostic rust symptoms develop on one-year needles in spring, before new growth has emerged.



Rust spores blown by wind and splashed by rain onto newly emerging needles.



Close-up of rust pustules.

- the label contains information on dosage rates and safety precautions;
- the first application should be made when 10% of the trees have broken some buds; applications should then be made at weekly intervals until needles are mature or until symptomatic needles have dropped to the ground; this is usually 3 sprays but in years where bud break is slow and the weather is cool and there is enough free moisture on the needles for infection (as in 2009), up to 5 sprays may be necessary.

## **SIROCOCCUS BLIGHT**

**Causal Agent:** *Sirococcus conigenus* (fungus)

**Key Host:** many conifers including Douglas-fir and blue and white spruce

### **Symptoms and Spread:**

Symptoms of Sirococcus blight were observed on Douglas-fir and blue spruce in plantation and landscape trees in 2009. This outbreak was likely associated with the wet spring weather. Young trees are usually more susceptible, although trees of any age can be infected. Sirococcus blight rarely kills trees, but can disfigure and reduce marketability. However, repeated infections of young trees can result in tree death.

Symptoms first appear on succulent shoots, and occasionally on one-year-old twigs, in midsummer. Affected shoots usually appear at random within the canopy of a tree. This disease can be confused with Botrytis blight, but Sirococcus usually shows up later in the season. Symptoms can also be more pronounced in the lower portions of older trees. This is because low light levels increase the susceptibility of

tissues to Sirococcus infection. Blue spruce is highly susceptible and one-year-old shoots are commonly killed.

The fungus attacks at needle bases, girdles the shoot, and results in tip dieback. Infected shoots turn brown and often develop a diagnostic shepherd's crook appearance. Pinpoint, brown fruiting structures of the fungus called pycnidia develop at the bases of infected needles or on infected shoots in mid to late summer or early-fall. These are often visible with a hand lens. The fungus overwinters in these killed shoots and in cone scales.



Multiple shoot tips exhibiting diagnostic shepherd's crook appearance of Sirococcus blight.



Close-up of diagnostic shepherd's crook on infected tips.



Black spots are fruiting structures of the fungus develop on needles in the shepherd's crook.

Spores of the fungus called conidia are spread by splashing rain during spring and into summer. Infections occur when conidia land on succulent tissues of newly emerging shoots, usually during periods of wet weather and when tissues are wet for 24 hours or longer at 10-25°C (50-75°F). The longer the tissues are wet, the more severe the infection. These were exactly the conditions throughout Connecticut in 2009. Infections result in stunting or disfigurement of the growing tips.

**Management:**

- Use healthy stock and maintain tree vigor with good weed control, proper fertilization, and attention to planting site.
- Rogue symptomatic trees.
- Prune and remove any dead or dying branches when the bark and needles are dry.
- Practice good sanitation.
  - spores can be spread from tree to tree by tools so shear healthy trees first or disinfest tools between cuts with household bleach (1 part bleach: 9 parts water) or 70% alcohol;
  - avoid shearing when the foliage is wet to reduce spread of disease;

- Use less susceptible varieties, when possible.
  - blue spruce is highly susceptible;
- Fungicide sprays.
  - in *all* cases, coverage is **very** important!
  - chlorothalonil (Bravo, Daconil 2787, Daconil Ultrex, Daconil Weather Stik), chlorothalonil + fenarimol (TwoSome), and thiophanate methyl + chlorothalonil + mancozeb (Spectro 90 WDG), and azoxystrobin (Heritage) are registered for use;
  - the label contains information on dosage rates and safety precautions;
  - begin applications before new growth is approximately ½” long and repeat at label intervals depending on rainfall. Sprays should continue until shoots are fully elongated and conditions are no longer favorable for disease.

**BOTRYTIS BLIGHT**

**Causal Agent:** *Botrytis cinerea* (fungus)

**Key Hosts:** all conifers, especially spruce and fir

**Symptoms and Spread:**

Botrytis blight appeared on a number of conifers in both plantations and landscapes in 2009, but white and blue spruce and Douglas-fir were particularly affected. *Botrytis* was observed on tender, succulent tips that had emerged during the extended cool, relatively moist May 2009 weather.

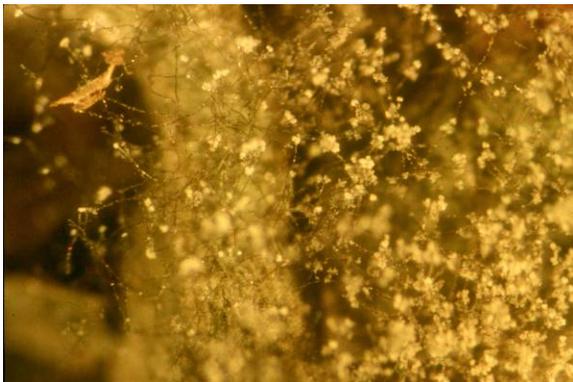
Botrytis blight can infect most conifers, but is particularly problematic on seedlings, young trees, and trees that have been weakened, but not necessarily killed, by frost or freeze injury. It is also prevalent during periods of extended cool weather when shoots are elongating and immature tissues are present for longer periods than usual. In 2009, many conifers exhibited

symptoms of *Botrytis* infection. Affected tissues initially appear water-soaked and then turn brown. Brown lesions girdle the shoots and cause them to wither and die.



Spruce tips infected with *Botrytis* blight. Note: easily confused with *Sirococcus* infections.

As the disease progresses, infections are identified by the gray, fuzzy, cottony growth of the fungus on the surface of needles and shoots. The fungus usually moves from the needles to the shoots and into the stems. With the exception of weak trees, infections usually do not extend beyond the current-season's growth and are often confined to tissues that have been damaged by frost.



Diagnostic fuzzy brown growth of *Botrytis* on infected tips.

*Botrytis* blight is easily confused with *Sirococcus* blight, since both diseases cause similar symptoms at the tips of shoots. However, one quick way to distinguish them is to put infected tips into a plastic bag with a moist paper towel. Leave this overnight in a warm location, but out of direct sun. If the symptoms are associated with *Botrytis*, the symptomatic tissues will be covered with fuzzy brown growth within 24-48 hours.

*Botrytis* blight is a more serious problem on seedlings or young trees than on established trees. On established trees, infected shoots are walled-off and usually drop. On seedlings, young, or weak trees, the fungus can spread into shoots or the main stem, where it causes cankers that eventually girdle and kill the shoot or tree. Refer to the fact sheet *Diseases of Christmas Tree Seedling and Transplant Beds* for more details. The fungus is an aggressive saprophyte, so infections often begin on shaded, senescent needles, and in other plant debris at the base of a tree.

#### **Management:**

- Follow sound cultural practices to keep trees as healthy as possible. Weak and frost-damaged tissues are particularly susceptible to infection so it is important to select appropriate planting sites. Fertilize at the proper time and rate as determined by a soil test--avoid excessive nitrogen and late- summer and early-fall fertilization.
- Avoid overcrowding to allow for good air circulation.
- Avoid overhead irrigation or water early in the day so the foliage has a chance to dry.
- Practice good sanitation.
  - spores can be spread from tree to tree by tools so shear healthy trees first or disinfest tools between cuts with household bleach (1 part bleach: 9 parts water) or 70% alcohol;

- avoid shearing when the foliage is wet to reduce spread of disease;
- diseased tissues should be removed as soon as they are evident in seedling beds;
- Fungicide sprays are usually not necessary for established trees. However, they can help to minimize damage to seedlings and new transplants.
  - among the compounds registered for use in Connecticut are: ferbam (Ferbam), mancozeb (Protect), chlorothalonil (Daconil, Bravo), chlorothalonil + fenarimol (TwoSome), thiophanate methyl (Cleary's 3336), and copper sulphate pentahydrate (Phyton 27);
  - the labels contain information on dosage rates and safety precautions;
  - applications can be made when new shoots emerge and are continued as necessary, since additional applications may be necessary in years with excessive rainfall.

### **PHYTOPHTHORA ROOT ROT**

**Causal Agent:** *Phytophthora* spp. (fungus-like organism)

**Key Hosts:** most conifers, especially true firs such as Fraser fir

**Symptoms and Spread:**

Wet conditions during both 2008 and 2009 provided optimum conditions for this disease, especially on highly susceptible species like Fraser fir. These conditions may possibly lead to continued problems in 2010.

Aboveground symptoms of Phytophthora root rot are not very distinctive and is a characteristic typical of most root rot diseases. Included among the symptoms are suppressed growth, poor vigor, yellowed or undersized needles, premature needle drop, branch dieback, wilt,

and death of trees at any time during the season.



Aboveground symptoms of Phytophthora root rot are not distinctive.

Diagnostic symptoms can usually be seen at the base of the infected tree, either as extensive resin-flow on the outer bark or cracking in the root-crown area. A characteristic and distinctive cinnamon-brown discoloration is usually evident when cuts are made into the wood in this area.

Phytophthora root rot is often associated with drainage problems and wet sites. This soil borne pathogen (previously called a “water mold”) produces motile spores that readily move in water. Therefore, declining trees often follow drainage patterns in plantations, especially those sited on hills: an infected tree at the top of the drainage pattern can effectively inoculate the trees below. Chlamydospores or oospores, are formed in infected roots, and enable the pathogen to survive in the soil between crops or during unfavorable periods. When these dormant structures are subjected to warm and saturated soils, even for a few hours, this pathogen can be activated.

Root rot can be severe in young Christmas tree plantations since young, newly planted trees are the most susceptible.



Red-brown discoloration of the cambium tissue (arrow) of Fraser fir infected by *Phytophthora*, contrasted with white, healthy cambium.

Fortunately, trees become more resistant, but not immune, with age. *Phytophthora* root rot can also be a problem in seedling and transplant beds. When seedlings are infected, the roots appear distinctly cinnamon brown in color and lack feeder roots. Refer to the fact sheet *Diseases of Christmas Tree Seedling and Transplant Beds* for more details.

#### **Management:**

- Use healthy stock. Carefully inspect transplants from seedling beds prior to planting.
- Avoid planting in poorly drained sites or take steps to modify or improve drainage.



Sporangia of *Phytophthora* that produce motile spores (zoospores) that swim in surface runoff or in irrigation water.

- Maintain vigor by proper fertilization (based on soil tests) and planting practices; avoid excessive irrigation.
- Rogue and remove symptomatic trees.
- Select resistant species such as Canaan, Grand, Nordemann, and Turkish firs in place of highly susceptible Fraser fir.
- Fungicides:
  - **NOTE: Fungicides are not curative**--infected trees cannot be cured.
  - healthy, uninfected plants adjacent to symptomatic plants can be *protected* with fungicides; fosetyl-Al (Aliette), mefenoxam (Subdue MAXX), and phosphorous acid or mono- and di-potassium salts of phosphorous acid (Alude, Magellan, Fosphite);
  - refer to the label for information on dosage rates and safety precautions.

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