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SPRUCE NEEDLE RUSTS IN CONNECTICUT

Although at least ten different rust fungi (*Chrysomyxa* spp.) have been reported on spruce in the United States, the key needle rusts of concern for Christmas tree growers in Connecticut at present are caused by *C. ledi*, *C. ledicola*, and *C. weirii*. *C. weirii* is considered to be a relatively new problem since its first appearance with any severity and frequency in 1996. However, this rust has undoubtedly been present in the state prior to 1996. *C. weirii* has also been reported in Pennsylvania, Vermont, New Hampshire, and New York and appears to be on the increase. This fact sheet serves as an update on the status of this and other needle rusts in Connecticut. Accurate diagnosis is critical and requires microscopic identification of the symptomatic needles. It is important to know which particular rust you have since this will determine how the disease spreads and the types of control measures that are effective.

One of the key features used to distinguish the needle rust caused by *Chrysomyxa weirii* from all other needle rusts is the fact that it is **autoecious**. This means it does not require an additional host or hosts in order to complete its life cycle. The other *Chrysomyxa* needle rusts are **heteroecious** and require more than one host to complete their life cycles. For example, the alternate hosts for *C. ledi* are Labrador tea and leatherleaf. This feature is important since it determines the types of strategies that are effective for disease management.

I. AUTOECIOUS SPRUCE NEEDLE RUST

1. Causal Agent: *Chrysomyxa weirii* (fungus)
2. Key Hosts: white, black, and blue spruce
3. Symptoms and Spread:
This needle rust is autoecious and does not require any additional hosts in order to complete its life cycle. Infected trees are rarely killed but the primary damage results in extensive needle discoloration and drop which reduces the marketability of the infected trees.

Symptoms first appear as yellow spots or flecks on needles in late winter and early spring (Figure 1). These spots eventually develop into pustules or blisters (telia) and burst open to reveal masses of yellow-orange spores (teliospores) (Figures 2, 3, and 4). The teliospores then produce another type of spore (basidospores), which are readily blown by wind and splashed by rain onto needles of the same tree or onto those of adjacent trees (Figure 5). Infection occurs when needles first emerge and are tender and immature. The following spring,

yellow spots and blisters develop on the infected needles and the disease cycle starts again. Blisters of *C. weirii* can appear on both 1st and 2nd year needles and heavily infected trees can appear distinctively yellow-orange from a distance. Accurate diagnosis requires microscopic examination since symptoms may easily be confused with those caused by other needle rusts. As with most diseases that are not fatal but result in needle drop, repeated defoliation may retard growth and reduce marketability.

Figure 1. Yellow spots or flecks develop on needles in late winter and early spring.

Figure 2. Diagnostic rust symptoms on one-year needles in spring, before new growth has emerged.

Figure 3. Rust spores blown by wind and splashed by rain onto newly emerging needles.

Figure 4. Close-up of rust pustules.

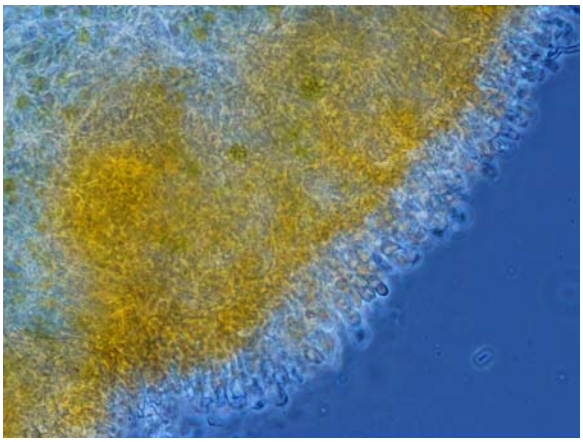

Figure 5. Photomicrograph of rust spores developing in pustules on one-year-old spruce needles.

4. Control:

a. Use healthy stock and maintain tree vigor.

b. Rogue and remove heavily infected trees to reduce inoculum.

c. Fungicide sprays.

- in all cases, **coverage and timing** are **very** important;
- although rust is not specifically listed on the label, chlorothalonil (Daconil 2787, Bravo, Thalonil) is labelled for spruce and is effective for control;
- 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 wet (this spring), up to 5 sprays may be necessary;

II. HETEROECIOUS SPRUCE NEEDLE RUSTS

1. Causal Agent: *Chrysomyxa ledi and C. ledicola* (fungi)

2. Key Hosts: white, black, and blue spruce

3. Symptoms and Spread:

These needle rusts are caused by fungi that require more than one host in order to complete their life cycles: the primary hosts are spruce and the alternate hosts are two shrubby evergreen members of the Heath family, Labrador tea (*Ledum groenlandicum*) and leatherleaf (*Chamaedaphne calyculata*). Therefore, these diseases are often first evident in stands located near swamps or wet areas where the alternate hosts are present. Infected trees are rarely killed but the primary damage results in needle loss which renders the trees unfit for sale.

Symptoms on spruce first appear as whitish blisters (aecia) on the surface of the current season's needles in mid-summer. These blisters burst open and reveal distinctive yellow-orange spores (aeciospores) which are readily wind-blown to the alternate hosts in the summer. Once on the alternate hosts, the fungal spores germinate and infect the leaves in which the fungus overwinters. The following spring, white blisters or pustules (telia) develop on the lower surfaces of the infected leaves and rupture the epidermis. Distinctive, yellow-orange spores (teliospores) germinate and produce another type of spore (basidiospores), which are released and carried by the wind to infect newly emerging and developing spruce needles. By mid-summer, symptoms are evident on the current season's needles and the disease cycle starts again. Symptoms on heavily infected trees can be quite dramatic as the trees appear golden yellow from a distance. Infected needles usually die and are cast by late summer--in severe cases, trees can lose up to 90% of their new needles. While spruce needle rust is not

considered fatal, repeated infections may retard growth and reduce marketability.

4. Control:

a. Use healthy stock and maintain tree vigor.

b. Avoid planting susceptible spruce trees near swampy areas where the alternate hosts may be prevalent.

c. Roguing and removing diseased trees *may* help to reduce inoculum.

d. Use resistant species, if possible.

- Norway and Black Hills spruce are fairly resistant.

e. Fungicides are essentially ineffective for control.

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