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FACT SHEET

DOOKS NEEDLE BLIGHT (FORMERLY CANAVIRGELLA NEEDLECAST) OF WHITE PINE

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Since 2009, many white pine in forests, woodlots, and landscapes throughout the Northeast have shown yellow and brown discoloration of current-season needles. Recurring outbreaks have also resulted in thin crowns and weakened trees due to stress caused by premature needle drop and loss of photosynthetic efficiency (Figure 1). Several fungal diseases were associated with this damage, with Canavirgella needlecast, caused by *Canavirgella banfieldii,* reported as a key component. Recently, however, the identity of *Canavirgella banfieldii* has been questioned, since there is evidence that it is really *Lophophacidium dooksii*, the fungus associated with Dooks needle blight—the two names are thought to be synonyms for the same fungal species. This was determined using morphologic, molecular, and phylogenetic analyses of samples collected from several locations in eastern Canada and the U.S. Therefore, Dooks needle blight is now considered to be the correct name for Canavirgella needlecast, since *L. dooksii* was described and published before *C. banfieldii*, and convention dictates the first name takes priority.

Dooks needle blight (formerly Canavirgella needlecast) was first diagnosed in Connecticut in 1998. The first report documenting *Canavirgella banfieldii* in the U.S. was published in 1996, and found to infect white pine throughout the eastern U.S. from North Carolina to Maine. Since then, the range and incidence of needle blight has expanded to Michigan and New Brunswick, Quebec, and Ontario, Canada.

Figure 1. Heavily infected young tree in spring. Note overall off-colored appearance and browning of one-year-old needles; lower branches are bare from cast needles.

SYMPTOMATOLOGY AND DISEASE CYCLE:

Dooks needle blight is a disease of *Pinus strobus* (Eastern white pine) and *Pinus peuce* (Macedonian white pine). The host range for this fungus has recently expanded to include western white pine (*Pinus monticola*) and Himalayan blue pine (*P. wallichiana*). Infected trees appear distinctly off-colored and brown from a distance in spring. Upon close inspection, symptoms are confined to last year's needles. The severity and prevalence of the disease have been associated with the cool, cloudy, wet spring and early summer weather that were suitable for spore formation, dispersal, and infection.

One of the diagnostic characteristics of Dooks needle blight is that not all needles within a fascicle are infected. Additionally, individual needles within a fascicle may exhibit differing amounts of symptomatic tissue (Figure 3). When needles are infected with *L. dooksii*, the bases of the symptomatic needles usually remain green and all five of the needles and the fascicle often remain attached to the tree. Symptomatic portions of individual needles may break off before the fascicles drop during periods of normal needle shedding. The general symptoms of this needle blight have frequently been confused with those associated with acute ozone injury, stress, and other needle blight diseases. However, with ozone, symptoms usually develop on all of the needles within a fascicle and all needles exhibit the same extent of injury.

Fruiting bodies (spermagonia) of *L. dooksii* begin to form under the epidermis on the stomatal (adaxial) surfaces of infected needles in late summer to winter. They appear as oval, blister-like, raised structures barely visible with a hand lens (Figure 4).

Figure 2. Diagnostic symptoms of Dooks needle blight. Note reddish-brown color of infected needles.

Figure 3. Individual needles in a fascicle show different levels of browning.

Additional fruiting bodies (called hysterothecia) develop on adaxial surfaces of symptomatic portions of the needles throughout the winter and spring. These structures first appear as dull gray stripes along the length of the symptomatic portion of the needle (Figure 5).

Figure 4. Developing fruiting body (spermagonium) of *L. dooksii*. Note oval shape of the raised, blister-like structure (arrow).

Figure 5. Dark gray stripes of developing fruiting bodies in spring.

Hysterothecia mature in late spring to early summer. Fruiting bodies can extend the entire length of an infected needle. These blacken as they mature—giving adaxial surfaces of infected needles distinctly raised black stripes (Figures 6, 7, and 8). These are visible with a hand lens or even the naked eye.

Each hysterothecium contains many asci or spore "sacs." Spores (ascospores) of the fungus develop and mature within each ascus. Mature asci usually contain eight ascospores. These spores are thought to be released during the early stages of needle elongation and during periods of favorable wet weather (Figures 9, 10, and 11).

Infection of succulent, elongating, current-season needles occurs in late June or early July. As with most needle blight pathogens, extended periods of free water on the needles are conducive for infection.

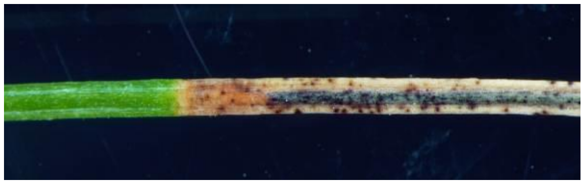

Figure 6. Developing fruiting body (black line) in infected portion of a needle.

Figure 7. Diagnostic blackened stripes on adaxial surfaces of infected needles.

Figure 8. Close-up of infected needles. Note black fruiting structures that develop in spring (arrows).

The disease does not appear to be site-specific, since heavily infected trees have been found on warm, exposed, south-facing slopes as well as on cool, moist, north-facing exposures.

Figure 9. Cross-section through an infected needle. Note fruiting body splitting through the epidermis on the adaxial surface of a needle (arrow).

Secondary fungi are often associated with infections by *L. dooksii*. Thus, the presence of these secondary organisms often creates problems with accurate diagnosis.

Not all white pines are susceptible to the disease, and it is believed that susceptibility may be hereditary. If this is the case, stands with related trees will show significant damage if susceptible, or relatively no damage if resistant.

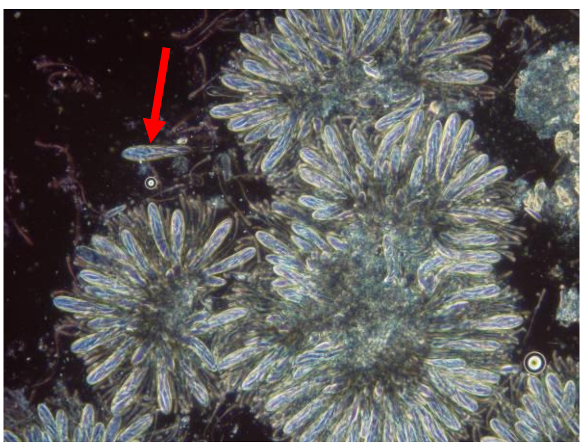

Figure 10. Microscopic view of many asci (arrow indicates spore sac(s)?) that contain ascospores.

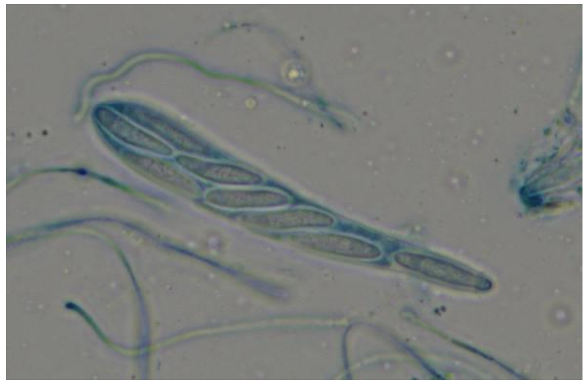

Figure 11. Each mature ascus (spore sac) usually contains eight spores (ascospores).

MANAGEMENT STRATEGIES:

As with most needle blights, Dooks needle blight rarely requires proactive management because it is usually considered more aesthetic rather than a life-threatening disease. However, there are situations when integrated, multifaceted management strategies might be necessary. These include following good sanitary and cultural practices. Tree vigor should be maintained by attention to watering, fertilizing (as determined by a soil test), and pruning. It is also helpful to avoid disturbing affected trees during periods of heavy symptom expression.

On the other hand, there are situations where recurring needle blights can be serious and cause permanent damage, disfigurement, or even tree death. Newly transplanted trees or trees weakened by environmental or site-related stress can be particularly sensitive to several years of repeated, premature needle drop. In such cases, chemical control may be beneficial, but is generally not suggested. However, once symptoms are visible on the needles, it is too late for chemical applications. Among the fungicides registered for homeowner use in Connecticut for managing Dooks needle blight are chlorothalonil, copper products, and mancozeb. The pesticide label will contain information on dosage rates, application intervals, and safety precautions. Since this fungus infects newly developing needles in spring to early summer, the first fungicide spray is applied as needles emerge. Additional applications at intervals stated on the fungicide label may be necessary under unusually wet or prolonged spring conditions until needles reach maturity.

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