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## DELPHINELLA SHOOT BLIGHT OF FIR

Delphinella shoot blight was first described in Denmark in 1902. In the United States, the disease was first recorded in 1957 and has been distributed in both east and west coasts. The disease only attacks true firs including corkbark fir (*Abies lasiocarpa* var. *arizonica*), Greek fir (*A. cephalonica*), Noble fir (*A. procera*), Nordmann fir (*A. nordmanniana*), European silver fir (*A. alba*), Spanish fir (*A. pinsapo*), subalpine fir (*A. lasiocarpa*), Siberian fir (*A. sibirica*), Turkish fir (*A. bornmulleriana*), Korean fir (*A. koreana*), white fir (*A. concolor*), and balsam fir (*A. balsamea*). The disease infects current year new growth and results in browning of needles and shoot blight (Figure 1).

### SYMPTOMS AND DIAGNOSTICS



Figure 1. Needle and shoot damages on Concolor firs resulted from Delphinella shoot blight in a Christmas tree farm

The initial symptoms appear on current year growth in the spring, which includes yellowing and wilting of needles. As the disease develops, affected needles turn reddish purple in color and curl downward along the needles (Figure 2). Severe early infections in the spring can result in death of all or most needles on a shoot and halts stem elongation for the season. Late infections may cause browning of partial needle tips on the current year growth (Figure 3). In late summer and fall, black fungal fruiting bodies (pycnidia and pseudothecia) develop on brown needles (Figure 4). Fungal spores are mature and released from pseudothecia in the following spring during the bud break of fir trees. Dead needles firmly attached to the stems at least for one or more years. Normally, new buds on affected shoots



Figure 2. Dead needles and shoots on the current year new growth of Concolor fir



Figure 3. Partial needle damages on the current year new growth of Concolor fir



Figure 4. Black fungal fruiting bodies on infected needles of Concolor fir

survive and form new growth in following spring. Browning and wilting of needles on current year shoots caused by *Delphinella* shoot blight resemble symptoms of frost damages, *Botrytis* blight, or current season needle necrosis. A laboratory examination is needed for an accurate disease diagnosis and recommendation for treatments.

### **DISEASE DEVELOPMENT**

Two fungal species, *Delphinella abietis* and *D. balsameae*, have been reported to cause *Delphinella* shoot blight in the United States. Both fungal species overwinter as black fungal fruiting bodies on infected needles. Dead needles that attached to affected shoots

serve as primary inoculum source of the disease. During bud break and shoot elongation in early spring, ascospores are released from the fungal fruiting bodies and infect new needles. Prolonged cool and wet spring weather conditions in the spring are conducive for the disease development. The disease thrives best in dense plantations where high humidity results in extended periods of free moisture on the needles after precipitation. A long distance spread of the disease may be associated with contaminated seed and infected transplants.

### **DISEASE MANAGEMENT**

*Resistance:* Subalpine firs with bluish foliage were reported more resistant to the disease than the ones with more green foliage. A selection of resistant species and lines is a more economical way to manage this disease compared to fungicide treatments.

*Cultural practice:* Purchase healthy and disease-free seedlings and transplants from reputable nurseries and farms. Maintain open stands with good airflow. Avoid overhead irrigation during bud break in nurseries and young plantations. Remove and burn infected shootings or whole trees when they are severely infected.

*Fungicide application:* Applications of chlorothalonil fungicides (Bravo Weather Stik, Daconil Weather Stik, and Echo DF) provide effective control of this disease, but timing of fungicide sprays is critical. Initial application need to be done as soon as bud breaks occur. Always read the label carefully and use only as directed.

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