

Douglas Fir Fusarium Root Rot



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11/03/03

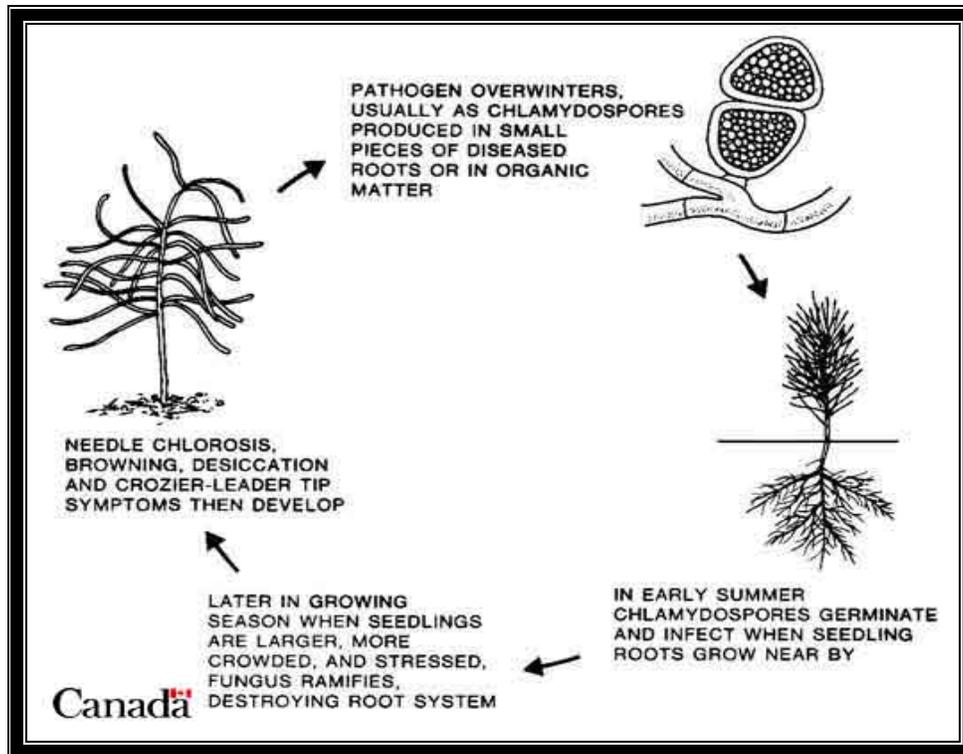
Several container-grown Douglas-fir seedlings (*Pseudotsuga Menziesii*) at the UI Forestry Nursery began to lose foliage and show signs of needle tip necrosis late this

summer. Upon initial inspection, nursery manager Sue Morrison determined that restricted water flow to the leaves, resulting in necrotic tissue, could have been caused by a number of factors. Drought, salt damage (fertilization), root rot, excessive heat and chemical injury were possible causes. Process of elimination revealed to both Sue and me that Fusarium root rot, caused by the fungus *Fusarium oxysporum*, to be the only plausible explanation for the Douglas-fir problem.

The overall health of the plants from which I took a sample was marginal and on the decline, as the fungus had not yet fully destroyed the root system. The seedlings were sown in March and had completed nearly one season of growth before symptoms began to appear. This was a sign to UI Forestry manager Sue Morrison and me that the fungus had germinated in the root systems, based on information taken from several sources on woody pests and diseases. Sources for diagnosis and remedy of this plant problem included the website www.bioworksinc.com from Bioworks, Inc. and Forest Nursery Pests, #680 of the USDA Forest Service Ag. Handbooks. Diseases of Douglas-fir seedlings caused by *Fusarium oxysporum*, a Phytopathology book written by W.J. Bloomberg, was also a helpful source.

Fusarium root rot is a disease that is a concern for container nurseries, particularly those in Western Canada and the Western U.S. Root rot causes seedling mortality, increased numbers of culls, and reduced survival after out-planting. Mortality occurs within the first growing season and is prevalent in Douglas-fir, Lodge-pole pine, Engelmann Spruce and White Spruce. The fungus over-winters in small pieces of roots or organic matter. When seedling roots grow near fungal spores called chlamydospores, germination occurs and the pathogen enters the roots.

(Life Cycle of *Fusarium oxysporum*)



Initial shoot symptoms appear on random seedlings as early as mid-July and include chlorosis of terminal needles, followed by all needles turning purplish to brown and dried out. Although these symptoms are the first to be noticed, they actually indicate a root problem. Diseased roots have few laterals and are dark in coloration and often swollen, lacking healthy white tips. Later in the growing season, when larger and more crowded seedlings are stressed for moisture and nutrients, the fungus develops rapidly throughout the root system and destroys it.

Once fusarium has developed in a young root system, plant mortality is inevitable. It is possible to treat the fungus by fumigating growing media, but this is usually not cost effective. The best way to treat *Fusarium oxysporum* in seedlings is to adopt preventative measures. Well-drained and aerated growing media, thorough cleaning of used containers, and lighter soils with reduced soil temperatures via sawdust mulching and irrigation are all possible ways to prevent spread of the disease. A new biofungicide called Rootshield has also recently proven effective as a form of preventative treatment.

Photographs of the Douglas-fir samples, depicting foliage and root damage, are included below:



(Pseudotsuga menziesii, needle necrosis)

(root ball with Fusarium oxysporum)
(below)

