FPL 61 – Fusarium Root Rot

The information accessed from this screen is based on the publication: Lock, W. 1973. Fusarium Root Rot on Douglas-fir Nursery Seedlings. Forestry Canada, Forest Insect and Disease Survey, Forest Pest Leaflet No. 61 7p.

Introduction

Fusarium root rot or "late" damping-off of Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco) seedlings, caused by the fungus *Fusarium oxysporum* Schlecht. f. sp. pini (Hartig) S. & H. (8) (Fungi Imperfecti), has been a chronic problem in coastal British Columbia forest nurseries, especially at Duncan (10) and more recently, to a lesser extent, at Green Timbers and Surrey nurseries.

Damping-off and root rot are the most serious diseases of coniferous nursery seedlings throughout the world. Damping-off is caused by a number of soil-inhabiting fungi that rapidly decay young succulent seedlings. Some of these fungi may cause root rot of older seedlings that have strong supporting stem tissues. This pest leaflet discusses the latter problem. Root rot kills seedlings and may also cause them to be culled because of chlorosis and stunting. Seedling vigor may also be reduced and adversely affect outplanting survival.

Hosts and Distribution

The genus Fusarium is worldwide in distribution and contains many species which vary morphologically and physiologically (12), and are pathogenic on numerous plants (Fig). The species *Fusarium oxysporum* includes most of the pathogenic forms or "formae speciales" (8, 9); one of these, F. oxysporum Schlecht. f. sp. pini is a serious conifer seedling pathogen in British Columbia.

The disease affects 1-0 Douglas-fir seedlings, most of which are grown in coast nurseries. These fungi can survive in soil in the absence of a host but, if seedlings are present and the environment is favorable, the succulent root tissues may be attacked and root rot will develop. The major host of Fusarium root rot on the coast is Douglas-fir; in the Interior, it has been found on ponderosa pine (Pinus Ponderosa Laws.) and on western larch (Larix occidentalis Nutt.).

Life History of the Causal Organism

Fusarium oxysporum belongs to the "Imperfect fungi" (Fungi Imperfecti). Fungi in this class apparently lack a perfect state (sexual state) and they reproduce by means of conidia (an asexual spore formed usually at the top of specialized hypha). The fungus survives for long periods in the soil as resting spores (chlamydospores). Evidence indicates that the fungus is activated only when a root tip of a host plant contacts or grows close to the mycelium or resting spores. The fungus may then invade the succulent root cells. Fungus invasion

advances at varying rates, causing root rot and seedling mortality, which can take place any time from approximately 2 to 10 months after seeds are sown. The rate depends on factors such as time of initial infection, pathogen virulence and climatic conditions. After killing the host plant, the fungus forms resting spores in the dead host or in the soil. These spores are the source of infection for the next crop.

Fusarium oxysporum is a high temperature fungus and grows most rapidly at approximately 74øF (24øC) (11). Bloomberg (3) found that high soil temperatures during the first month after seeding directly influences incidence of the disease, and symptoms appear from May to the following February, rising to a maximum in late August.

Conidio spores formed on the aerial part of the infected seedling may be disseminated by wind, insects and water. Infested soils may also be transported on seedlings, boots, clothing or agricultural implements. Generally *Fusarium oxysporum* is so widespread that the time and cost of necessary precautions to prevent its spreading would be impractical.

Recognition

Root rot or "late" damping-off is a disease that occurs on older seedlings with strong supporting stem tissues. Root rot-killed seedlings remain erect, dry out, turn brown, and remain in the nursery beds .or some time. If the seedlings have not hardened-off, the succulent shoot tips display the typical "Fusarium wilt" symptoms. The needles turn brown progressively from the lower to the upper part of the plant until it completely dead. At this stage of advanced root rot, many root laterals and some cortical tissue and bark will be sloughing off.

Fusarium root rot symptoms can be distinguished from weevil damage where the stem is completely girdled and the seedling bark is chewed off at or just above, the ground line. The purple-brown foliage of Fusarium root rot-damaged seedlings also distinguishes this disease from the reddish brown foliage early early frost damage. Generally root rot-killed seedlings appear at random throughout seedling beds, whereas frost or herbicide damage all seedlings in localized areas.

Damage

In British Columbia, the disease appears to be confined to seedlings in their first growing season. Rate of symptom development varies and the disease usually kills the seedling: occasionally, root rot development ceases after progressing upward from the lower roots to within approximately I inch of the soil surface where one or more healthy lateral roots sustain the seedling. Callus may then form on the healthy stub of the tap root and root regeneration may occur. Several new lateral roots may originate from the region immediately above the callus. Such seedlings are usually stunted.

Earlier surveys (6) showed the economic importance of the disease, and recent surveys

indicate that root rot losses annually average about 15% at Duncan and 2% at Green Timbers (3). The high cost of seed and the loss of thousands of seedlings make root rot an important economic problem in coastal nurseries.

Control

No practical biological control methods are available for root rot, but several chemicals have been used with varying degrees of success. Derr (7) found that one or more post-emergence applications of fungicide sprays helped to control root rot, and recent trials in British Columbia (4) with soil drench applications confirm these findings.

Soil fumigation with volatile chemicals have been widely tried and show several benefits over other root rot control methods (1, 2, 5). Trials over several years have shown that methyl bromide-based or other fumigants give best root rot control and may also control other soil-borne diseases and pests, such as weeds and nematodes. Soil fumigation may also produce larger seedlings, decrease culls, and may reduce the time required to produce suitable outplanting stock (5). Seedlings from fumigated beds are more tolerant of moisture stresses when outplanted (5). Consequently several eastern Canadian and United States nurseries regularly fumigate nursery beds. However, the disadvantage of some fumigants, e.g. methyl bromide or chloropicrin, is that they may be highly toxic gases and require special application equipment. Consequently, other fumigants such as Mylone and Vapam, which are safer and easier to apply but give somewhat less disease control than methyl bromide, might be acceptable alternatives.

Figures

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Figure 237-0002. Fusarium blight on elm.
