IDENTIFICATION & MANAGEMENT OF PHYTOPHTHORA ROOT ROT IN CHRISTMAS TREES

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INTRODUCTION

Phytophthora root rot (PRR) is a destructive, soil- and water-borne disease that threatens Christmas tree production in North America, particularly true firs, which are highly susceptible. The disease is caused by oomycetes (water molds) that thrives in wet, poorly drained soils and can persist for years. Over 326 species of Phytophthora have been identified; approximately 10 species of Phytophthora affect Christmas trees. PRR causes millions of dollars in damage to Christmas trees annually. In North Carolina alone, industry-wide losses are estimated at 9% of production, translating to approximately $9 million based on a $100 million industry.

SUSCEPTIBLE SPECIES

PRR affects various species and varieties of Christmas trees, primarily those in the genus Abies (true firs). The most affected species include:

1. Fraser fir (Abies fraseri)
2. Noble fir (Abies procera)
3. Balsam fir (Abies balsamea)
4. Grand fir (Abies grandis)
5. White fir (Abies concolor)
6. Nordmann fir (Abies nordmanniana) – less susceptible
7. Turkish fir (Abies bornmuelleriana) – less susceptible
8. Momi fir (Abies firma) - only true fir that displays true resistance

In addition to true firs, PRR can also affect other conifer species grown for Christmas tree production, including:

1. Douglas-fir (Pseudotsuga menziesii)
2. Spruce (Picea spp.)
3. Pine (Pinus spp.)

INFECTION

There are multiple vectors of infection for PRR in Christmas trees:

- Contaminated rootstock
- Field equipment and hand tools
- Contaminated water (typically retainment ponds)
- Excessive water movement and accumulation
- Poor biosecurity

Figure 1. Above ground symptoms of Phytophthora Root Rot including wilting and discoloration of foliage.

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Wet conditions and poor drainage favor the development of Phytophthora. Humans play the most significant role in the spread of this disease, mainly due to poor biosecurity. Phytophthora spreads in cool, rainy weather, typically in early spring and late fall. Flooded or soil saturated for periods of 6-8 hours can greatly promote the spread of infection. Symptoms often appear when trees are stressed due to environmental factors such as drought or excessive heat.

SYMPTOMS

Above ground symptoms include:

- Wilting of foliage
- Discoloration of foliage
- Needle loss
- Branch dieback/flagging
- Carmel colored cambium
- Stunted growth
- Stem cankers
- Seepage from cankers

Below ground symptoms include:

- Root sloughing
- Decomposition of fine roots
- Larger roots turn brown/black, soft and break easily

IDENTIFICATION

1. Perennia Plant Health Laboratory – Disease Analysis
2. Agriculture & Food Laboratory – DNA Screening

PREVENTATIVE MANAGEMENT

1. Select appropriate planting sites with good drainage
2. Soil test for phytophthora prior to planting a new area
3. Plant resistant species
4. Use clean, disease-free seedlings
5. Plant on raised mounds to improve drainage
6. Implement sanitation practices
    a. 2 ppm chlorine bleach in water with a 2-minute exposure is sufficient to kill zoospores of Phytophthora

Figure 2. Above ground symptoms of Phytophthora root rot including seepage.

MANAGEMENT: CULTURAL

1. Improve drainage and avoid overwatering
    i. Plant on mounds
    ii. Installation of tile drainage
    iii. Implement ditching
2. Replanting of Resistant Rootstock
    i. Turkish fir
    ii. Nordman fir
    iii. Momi fir
    iv. Hybridizations
3. Application of organic mulches/woodchips
    i. Single species fresh woodchips
    ii. Gypsum applications to increase soil acidity
    iii. Calcium within gypsum suppresses formation of Phytophthora

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MANAGEMENT: CHEMICAL

There are currently no fungicides registered for use for Phytophthora root rot in Christmas tree lots in Canada. However, there are registered fungicides for nursery use.

Figure 3. A bareroot transplant nursery infected with Phytophthora Root Rot.

Figure 4. Foliar symptoms of Phytophthora Root Rot.

CONCLUSION

Phytophthora has been documented in Quebec and Ontario, with confirmed pathogenicity on both Balsam and Fraser fir. There is currently limited published data on the prevalence and impact of Phytophthora in Nova Scotia Christmas trees. However, given Nova Scotia's ideal land for Christmas tree cultivation and the susceptibility of commonly grown species, the region remains at considerable risk. The lack of comprehensive surveillance further increases this vulnerability, underscoring the need for ongoing monitoring, targeted detection and the development of integrated management strategies to protect the Nova Scotia Christmas tree industry from potentially severe economic losses.

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