

RESEARCH LABORATORY TECHNICAL REPORT



Phytophthora Root and Collar Disease

Poorly Drained Soil-Tolerant Plant Lists

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Phytophthora root disease is a widespread but often overlooked disease of landscape plants. Several species of *Phytophthora* attack the fine-absorbing roots of plants and may invade larger roots as well as the root collar. The name, *Phytophthora*, is a Greek word literally meaning “plant destroyer.” These organisms grow in the cambium and sapwood causing death of the tissue. Loss of water, nutrient-absorbing capacity, and stored carbohydrate reserves in the root cause a gradual, or sometimes rapid, decline of the aboveground portion of the plant.

Phytophthora is a fungus-like organism commonly referred to as a water mold; diseases caused by these organisms are most common in soils that are poorly drained or receive excessive irrigation. The pathogen overwinters or persists in soil or on dead plant material. When soils are saturated with water, zoospores are released and swim to susceptible root tissues or may be transported longer distances in runoff. Infection is favored by warm temperatures (>65°F) and free water. Root disease is common on newly developed sites where the soil was severely disturbed or compacted from construction activities. It is also found in nurseries and decline and death of new plantings in the landscape may result from out-planting diseased stock. Several species of *Phytophthora* attack many woody ornamentals, resulting in various disease types. The pathogen *P. cinnamomi* commonly causes death of fine roots, while *P. cactorum* typically attacks root collars and stems.

Hosts

Plants under stress from drought, defoliation, low soil aeration, salinity, root collar disorders or other stress agents are most prone to *Phytophthora* root disease and collar rot. Stress stimulates secretions of metabolites by plant roots, which increases the likelihood of infection by *Phytophthora*.

Root disease and root collar rots commonly affect the following plant species which are intolerant of poor soil drainage:

Azalea	Rhododendron	Boxwood
Japanese holly	Hemlock	Dogwood
Mountain Laurel	Andromeda	Fir (<i>Abies</i>)
Camellia	White Pine	<i>Taxus</i>

Plants with soil or mulch covering their root collar are also very susceptible to infection. Oaks, beech, rhododendron, fruit trees (*Prunus*, *Malus*, *Citrus*, avocado), dogwood, sugar and red maple and *Zelkova* are particularly prone to collar rot from buried root collars.

Phytophthora is a poor saprophyte and is usually quickly overgrown by secondary microorganisms after plant tissue is killed. In these instances, *Phytophthora* will form survival structures (oospores) in dead tissue or soil. When soil moisture and temperature conditions favor disease development and a suitable host is present, *Phytophthora* can increase rapidly from undetectable levels to cause disease.

Symptoms

Symptoms of root disease vary depending on the susceptibility of the plant species, the virulence of the specific *Phytophthora* species, and site conditions. A chronic form of the disease causes a slow, progressive decline. Symptoms include a reduction in shoot growth; small leaves, thinning of the crown, chlorosis, twig and branch dieback and eventually death. Diseased roots are reddish brown and brittle (Figure 1). These symptoms are often confined to fine roots and lateral roots less than ¼" diameter. Decline occurs over a period of months or years before death occurs.

Figure 1: Healthy tissue on the left transitions to diseased tissue on the right



Rapid wilting and death of the entire plant characterize the acute form of the disease. Leaves turn red then brown and usually remain attached. Affected fine and large roots are reddish brown and brittle, lack fine roots, pull apart easily, and/or have bark that easily sloughs off (Figure 2). *Phytophthora* lesions may

Figure 2: Sloughing roots



extend into the root collar which causes girdling of the stem and rapid collapse of the crown.

Diagnosis

Infection can occur months or years ahead of first visible symptoms. On some plant species, symptoms do not appear until root disease or collar rot is advanced. When *Phytophthora* is found on a declining plant, it is likely to be the agent causing the problem, or at least, a significant contributing factor. On plants suspected to be infected with *Phytophthora*, an “in-field” lateral flow test may be used by trained Bartlett employees for immediate analysis of plant tissue. If results are inconclusive, symptomatic roots can be collected and submitted to the Bartlett Diagnostic Clinic for ELISA testing. Where lesions exist on the root collar, affected sapwood tissue can be chiseled from lesion margins and submitted to the Bartlett Diagnostic Clinic for analysis as well.

Prevention

Where soils are poorly drained and prone to inundation/flooding, use species that are tolerant to these soil conditions. Most moisture-tolerant species are resistant to root disease or tolerate infection. See Tables 1 and 2 for common shrubs and trees tolerant of poor soil drainage.

When using susceptible species in poorly drained soils, create raised beds or provide sub-surface drainage. Plant with the root collar exposed. If soil is compacted, prepare planting area by cultivating and incorporating organic matter.

Avoid excessive mulch on susceptible species. A 2" maximum mulch depth is recommended. Favor coarse mulches such as bark nuggets or wood chips. Avoid shredded bark products that tend to compact and hold water.

Irrigate as needed to maintain soil moisture, but not to excess. Use tensiometers to monitor soil moisture. *Phytophthora*-sensitive species planted on sites subject

to saturated soils may require periodic treatments (annual to biannual) to minimize new infections.

Treatment

Plants exhibiting chronic disease symptoms should be treated with an approved fungicide for managing *Phytophthora*. Treating surrounding susceptible plants on a preventative basis is also recommended. Repeat applications are recommended when soils are prone to saturation and temperatures favor infections. Improve soil drainage as needed. Proper mulching, irrigation and root collar excavation as outlined under preventative treatments are recommended to reduce the incidence and severity of the root rot.

Where soils are poorly drained and/or subject to inundation, consider moving *Phytophthora*-sensitive species to areas with good drainage. Replant a poorly drained bed with species from the tables below.

Table 1. Shrubs for Poorly Drained Soil
(*Phytophthora* root rot tolerant)

Common name	Scientific name
Butterfly bush	<i>Buddleja davidii</i>
Sweetshrub	<i>Calycanthus floridus</i>
Summersweet	<i>Clethra alnifolia</i>
Chinese witchhazel	<i>Hamamelis virginiana</i>
Inkberry holly	<i>Ilex glabra</i>
Yaupon holly	<i>Ilex vomitoria</i>
Winterberry holly	<i>Ilex verticillata</i>
Florida anise	<i>Illicium floridanum</i>
Crapemyrtle	<i>Lagerstroemia indica</i>
Mockorange	<i>Philadelphus coronarius</i>
Sarcococca	<i>Sarcococca hookeriana</i>
Arborvitae	<i>Thuja</i> spp.
Viburnum	<i>Viburnum</i> spp.

Table 2. Trees for Poorly Drained, Clay Soils and Urban Areas

Common name	Scientific name
Amur maple	<i>Acer ginnala</i>
Hedge maple	<i>Acer campestre</i>
Red maple	<i>Acer rubrum</i> *
River birch	<i>Betula nigra</i> *
European hornbeam	<i>Carpinus betulus</i>
Hackberry	<i>Celtis occidentalis</i> *
Cockspur hawthorn	<i>Crataegus crus-galli</i>
Leyland cypress	<i>Cupressus x leylandii</i>
Hardy rubber tree	<i>Eucommia ulmoides</i>
Ash	<i>Fraxinus</i> sp.
Ginkgo	<i>Ginkgo biloba</i>
Thornless honeylocust	<i>Gleditsia triacanthos</i> var. <i>inermis</i>
Crapemyrtle	<i>Lagerstroemia indica</i>
Sweetgum	<i>Liquidambar styraciflua</i>
Crabapple	<i>Malus</i> spp. (use disease resistant cultivars)
Dawn redwood	<i>Metasequoia glyptostroboides</i>
Blackgum	<i>Nyssa sylvatica</i> *
Norway spruce	<i>Picea abies</i>
White spruce	<i>Picea glauca</i>
London plane tree	<i>Platanus x acerifolia</i> *
Callery pear	<i>Pyrus calleryana</i> (use cultivars)
Sawtooth oak	<i>Quercus acutissima</i>
Swamp white oak	<i>Quercus bicolor</i>
Willow oak	<i>Quercus phellos</i> *
Japanese pagoda tree	<i>Styphnolobium japonicum</i>
Baldcypress	<i>Taxodium distichum</i> *
Arborvitae	<i>Thuja occidentalis</i>
Lacebark elm	<i>Ulmus parvifolia</i> *
Japanese zelkova	<i>Zelkova serrata</i> *

* Tolerates temporary flooding



Founded in 1926, The Bartlett Tree Research Laboratories is the research wing of Bartlett Tree Experts.