

Phytophthora Root and Crown Rot of Fruit Trees

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Phytophthora root and crown rots (sometimes called collar rot) are common and destructive diseases of fruit trees throughout the world. In Ohio, apple, cherry, and peach trees are usually attacked. Pear and plum trees appear to be relatively resistant. Trees declining and dying from Phytophthora root and crown rots are frequently misdiagnosed as suffering from “wet feet” (root asphyxiation) or are sometimes confused with those suffering from winter injury.



Figure 1. Apple root infected with Phytophthora root rot.

Symptoms

Diseased trees are commonly found in poorly drained areas of the orchard or yard. Heavy, wet soils that remain saturated for extended periods of time are required for disease development. Above-ground symptoms vary between tree species, but generally include reduced tree vigor and growth, yellowing or chlorosis of leaves, and eventual collapse or death of the tree. Infected trees may decline slowly over one or more years, or they may collapse and die rapidly after resuming growth in the spring. Trees may also appear healthy in the spring, but die suddenly in the latter part of the growing season. Rapid death of trees usually occurs following excessively wet periods. On trees that decline gradually, a reddish or purple discoloration of



Figure 2. The tree on the right has typical symptoms of Phytophthora root rot. Note the reduced vigor and yellow (chlorotic) leaves.



Figure 3. The tree on the right is infected with *Phytophthora* root rot. Leaves on infected trees often develop a reddish to purple color late in the growing season.

the leaves often occurs in autumn, while leaves on healthy trees remain green.

To observe below-ground symptoms, you need to remove several inches of soil around the base of the declining tree. A diagnostic reddish-brown discoloration of the inner bark and wood can be observed after cutting away the outer bark layer. A sharp line demarcates the reddish-brown (diseased) and white (healthy) portion of the crown. Similar symptoms can be found on roots, but it is generally difficult to see root symptoms without removing the tree. This reddish discoloration and line of demarcation between diseased and healthy tissue distinguishes *Phytophthora* root and crown rot from other causes of tree decline and collapse such as “wet feet” (drowning) or winter injury. Roots on trees killed by excessive water are usually completely black (have no line of demarcation) and often have an unpleasant smell. Discoloration from winter injury is usually confined to the above-ground part of the trunk, particularly on the southwest side of the tree, while the below-ground portion of the tree may still appear healthy.

Causal Organism and Disease Cycle

Phytophthora root and crown rots are caused by several *Phytophthora* species. These are all soilborne fungi, many of which are common inhabitants of most orchard soils. Some species that are not common inhabitants may be introduced to the orchard on contaminated planting stock or through movement of contaminated soil. While some species are much more destructive than others, depending on the type of fruit tree and rootstock, all species require extremely wet or saturated soils in order to infect and cause significant damage.

These fungi overwinter and persist in soil as mycelium in infected wood or as thick-walled spores (oospores). Oospores remain viable in the soil for long periods of time (years). When soils are wet, oospores germinate to form thread-like fungal filaments (mycelia). Mycelia from germinated oospores or from infected tissues produce reproductive structures called a sporangia. These sporangia are filled with infective spores called zoospores. Zoospores are released from sporangia only when soil is completely saturated with water (standing water). The zoospores use flagella to swim to susceptible plant tissue where they infect. They may also swim to the soil surface and move over longer distances in runoff water. The longer the period or periods of soil saturation, the greater the risk of infection.

Some rootstocks appear to be most susceptible during spring and autumn, which are also the times of year when soil temperatures are most conducive to fungus growth and zoospore production. Rootstock susceptibility and fungus activity are both low in the winter when trees are dormant.

Control

Control of *Phytophthora* crown and root rots is most successful using an integrated program of cultural practices, choosing the most resistant tree species or rootstock, and when necessary, chemical control.

1. Avoid sites that drain slowly or poorly or are subject to periodic flooding. Marginal sites should be modified (install drain tiles, create diversion ditches, rip underlying pan layers) to provide the additional drainage recommended for growing tree fruit crops. Planting trees on ridges or berms will raise their crowns above the primary zone of zoospore activity and provide an important margin of safety, especially in a wet year.
2. Select rootstocks or tree species that are less susceptible to *Phytophthora* and are best adapted to your individual site. Pears are the most resistant tree fruit crop and are most likely to remain healthy in a relatively wet site.

Among apple rootstocks, seedlings are relatively resistant. Among dwarfing-apple rootstocks, M-9, M-2, and M-4 are relatively resistant. The Canadian rootstock Ottawa-3 has M-9 type resistance. M-7 and MM-111 are moderately susceptible; M-26 and MM-106 are susceptible; and MM-104 is highly susceptible.

Among stone fruits, plums are relatively resistant, whereas the remainder are susceptible to very susceptible. Mahaleb is the most susceptible cherry rootstock, whereas Mazzard, Morello, and Colt are

somewhat more resistant and would be recommended on heavier soils.

3. Soil fumigation is generally considered ineffective because it never completely eradicates the fungus from orchard soils, and the Phytophthora fungi are easily reintroduced into fumigated soil.
4. New fungicides have recently been developed, which are effective in controlling these diseases when used preventively, but they are seldom effective in reviving trees once the crown has become infected and moderate symptoms of decline have appeared. Fungicides are most effective when used in combination with the cultural practices described above. For the most current fungicide recommendations, commercial growers are

referred to Bulletin 506-A2, *Midwest Commercial Tree Fruit Spray Guide*. This publication can be obtained from your county Extension educator or the Extension Publications Office; The Ohio State University; 216 Kottman Hall; 2021 Coffey Road; Columbus, OH 43210-1044. Backyard growers are encouraged to follow the previously mentioned cultural practices (good soil drainage) and select the more resistant rootstocks to eliminate the need for fungicide use.

Reference

Wilcox, Wayne F. *Fruit Crops IPM Disease Identification Sheet No. 7*. New York State Agricultural Experiment Station, Cornell University Extension.

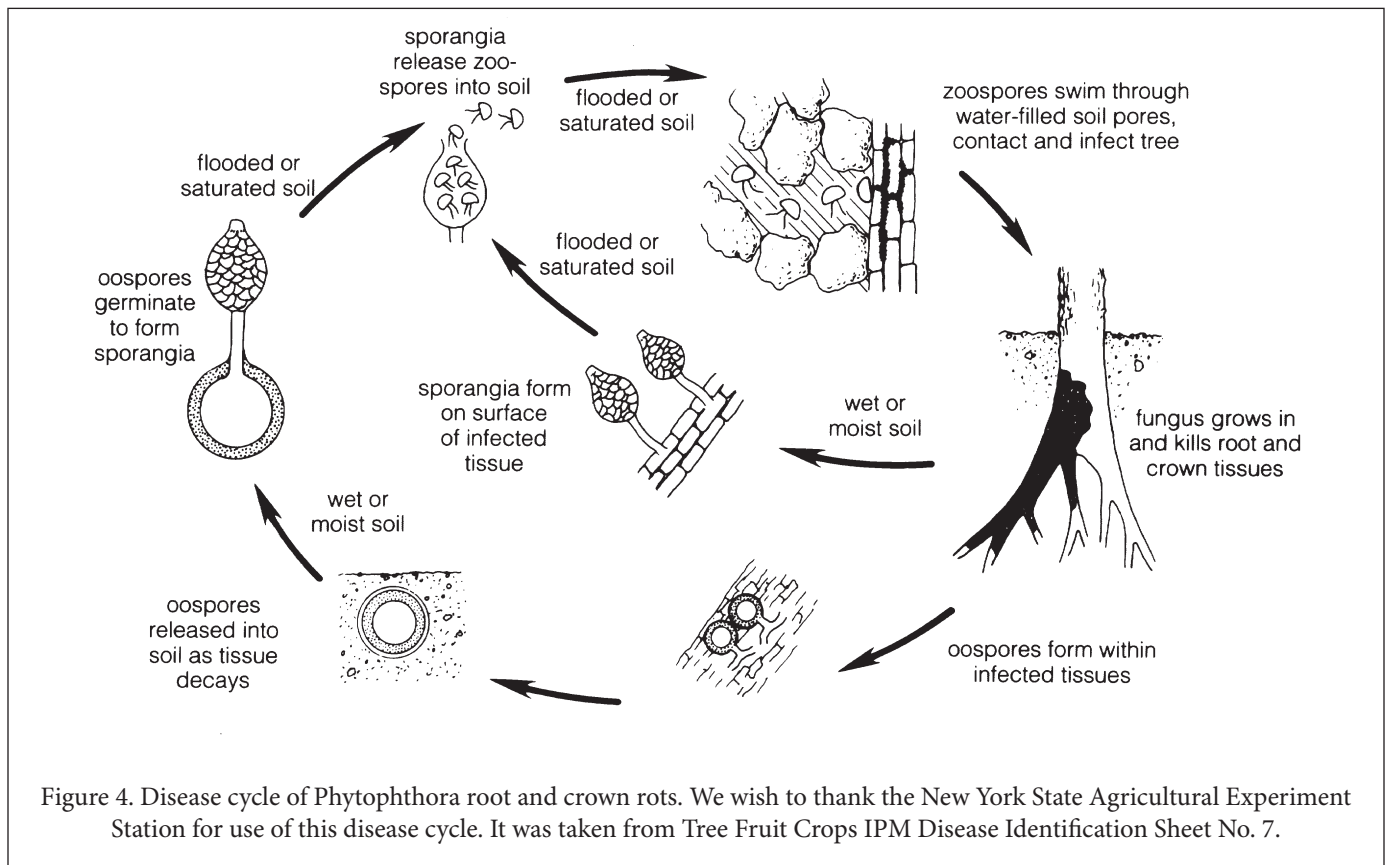


Figure 4. Disease cycle of Phytophthora root and crown rots. We wish to thank the New York State Agricultural Experiment Station for use of this disease cycle. It was taken from Tree Fruit Crops IPM Disease Identification Sheet No. 7.

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