TREE FRUIT CROPS

CORNELL COOPERATIVE EXTENSION

IPM Integrated Pest Management

Disease Identification
Sheet No. 7
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Phytophthora Root and Crown Rots

Phytophthora spp. (deBary)

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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 New York, apple, cherry, peach, and apricot trees are usually attacked, whereas pear and plum trees appear to be relatively resistant. Trees declining from Phytophthora root and crown rots are frequently misdiagnosed as suffering from "wet feet" (root asphyxiation) and are sometimes confused with those suffering from winter injury.

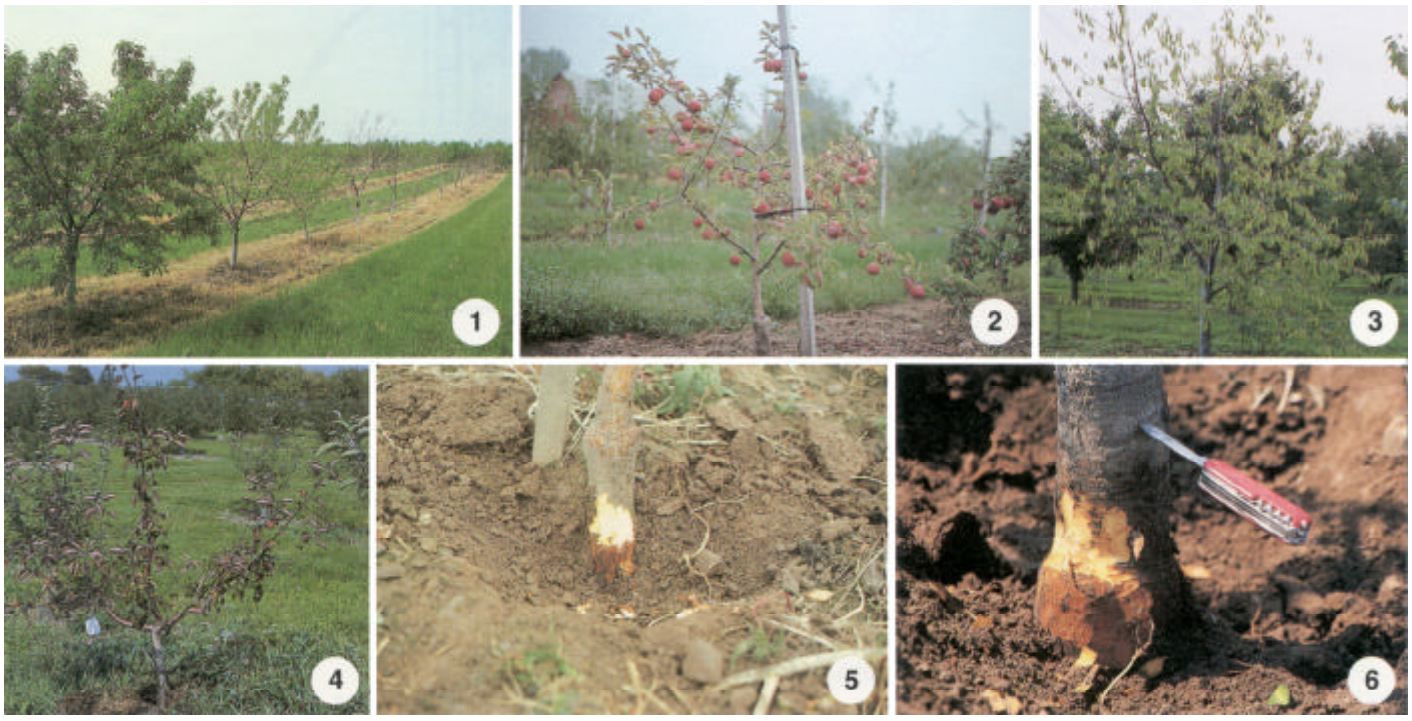
Symptoms

Diseased trees are most likely to be found in heavy, wet soils or sections of the orchard where water collects or is slow to drain (fig. 1; healthy tree in foreground). Symptoms visible aboveground vary among tree species and locations but include poor growth with sparse, off-color foliage (fig. 2), wilt, and collapse (fig. 3). Infected trees may decline over more than one season, and gradually declining apple trees in particular may show a purple discoloration in the autumn (fig. 4). In other cases, previously healthy trees may suddenly collapse and die shortly after resuming growth in the spring, often following an excessively wet autumn; or previously healthy trees may suddenly collapse during the latter part of the growing season, often following an excessively wet spring. A diagnostic reddish-brown discoloration of inner bark can be seen by removing several inches of soil around the base of declining trees and cutting away the outer bark layer on the exposed crowns (figs. 5 and 6; knife is inserted at the level of the soil line in fig. 6). The inner bark of infected roots may show a similar discoloration. This symptom distinguishes Phytophthora root and crown rots from other causes of decline and collapse. (Winter-injured bark—common on peach and apricot trees in New York—is usually confined to the aboveground portion of the trunk, particularly on the southwest side of the tree; in contrast, Phytophthora root and crown rots primarily involve below-ground tissues.)

Disease Cycle and Causal Organisms

Phytophthora root and crown rots are caused by a group of related soilborne fungi in the genus *Phytophthora*. Some of these fungi are common inhabitants of agricultural soils, whereas others are introduced on contaminated planting stock or through the movement of contaminated soil and water. Although the individual *Phytophthora* species vary somewhat in origin, particular biological characteristics, and destructiveness against different crops and rootstocks, all have one critical trait in common: they are capable of causing significant damage only when soils are extremely wet or saturated.

The *Phytophthora* fungi persist in the soil mainly as dormant resting spores (oospores, chlamydospores) or in a vegetative growing form within infected plant tissue. When the soil is moist or wet, reproductive structures (sporangia) are produced, either as the result of germinating resting spores or as direct outgrowths of the active fungus within infected roots and crowns. These sporangia are filled with the infective spores of the fungus (zoospores), which are expelled into the soil in significant numbers only when it is completely saturated with water—that is,



when water is standing or puddled on the soil surface. The microscopic zoospores then use tail-like structures to swim short distances through the water-filled soil pores and find susceptible plant tissues, to which they are chemically attracted. Zoospores may also swim to the soil surface, where they can be carried relatively long distances by runoff water and contaminate new soils or ponds and canals used for irrigation water.

Whether infection occurs once zoospores reach root or crown tissues depends largely on the inherent susceptibility of the rootstock and its physiological condition. Although many of the physiological factors that influence disease development are unknown, it appears that a tree's ability to resist infection is reduced when saturated soil conditions deprive its roots of oxygen. Therefore, episodes of soil saturation serve as infection periods for Phytophthora root and crown rots because they not only provide the conditions necessary for zoospore activity but also increase the tree's susceptibility to disease during that time. The minimum length of the saturated period necessary to produce an infection can be highly variable, depending on a wide variety of genetic, physiological, and environmental factors; however, the severity of the infection period is roughly proportional to the number of days the soil remains saturated and how quickly it drains thereafter. The number of saturation periods a tree is exposed to is also important because additional zoospores are produced and released by the fungus growing in new infection sites each time conditions become favorable.

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

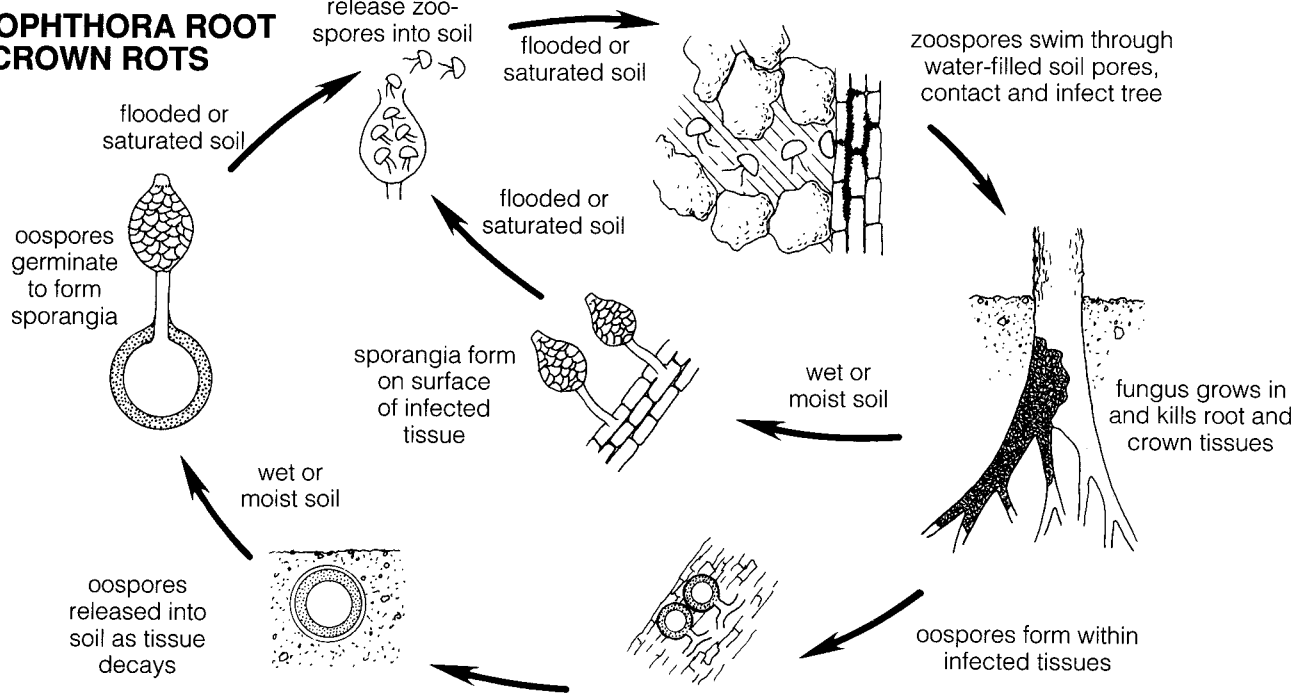
Control

Control of Phytophthora root and crown rots is most successful using an integrated program of cultural practices and, sometimes, chemical control. Soils that are excessively slow to drain or subject to periodic flooding should be avoided. 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.

Tree species and rootstocks should be selected to match the soil and drainage characteristics of an orchard. Pears are the most resistant tree fruit crop and are the most likely to remain healthy in a relatively wet site. Apple rootstocks vary widely in susceptibility but are generally more susceptible than pears and more resistant than stone fruits other than plums. Among apple rootstocks, seedlings are relatively resistant, as are M. 9, M. 2, and M. 4; M. 7, M. 26, and MM. 111 are moderately susceptible; MM. 106 is susceptible; and MM. 104 is very 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 the heavier cherry soils. Some of the newer clonal cherry rootstocks may have an additional measure of resistance, but these have not yet been sufficiently evaluated to determine. Seedling peach and apricot rootstocks are very susceptible, although the range of suitable soils may be expanded if these trees can be grown without other problems on plum-type rootstocks.

Soil fumigation before planting is ineffective in controlling Phytophthora root and crown rots because the fumigant never completely eradicates existing inoculum from the soil and *Phytophthora* spp. are easily reintroduced. 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. Check current labels and recommendations for approved materials and timings.

DISEASE CYCLE OF PHYTOPHTHORA ROOT AND CROWN ROTS



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