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report on
PLANT DISEASE

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PHYTOPHTHORA CROWN, COLLAR, AND ROOT ROTS OF APPLE

Phytophthora crown, collar, and root rots are caused by *Phytophthora* species. *Phytophthora cactorum* is often associated with the disease; however, *P. cambivora*, *P. cryptogea*, and other *Phytophthora* spp. have also been implicated in the disease.

Crown rot and collar rot, although similar, are distinct diseases. Collar rot is a disease of the scion portion of the tree, affecting bark tissues of the lower trunk at or above the soil line, a portion of the trunk infrequently referred to as the collar. Crown rot is a disease of the rootstock portion of the tree, affecting bark tissues of the root crown region (i.e., the point where the roots join the stem) and proximal ends of the primary roots.

Figure 1. Phytophthora root and crown rot. Infected issues show a delineated, reddish-brown discoloration of the inner bark.

Symptoms

The disease is characterized by cankers at or below the ground line in the root-crown area (Figure 1). Infected bark becomes brown and is often slimy when wet. Cankers may extend from the point of origin into the root systems and up the trunk to the bud union. If the scion is susceptible to *Phytophthora*, the disease may extend above the union. Older cankers from a definite outline when the bark dries out, and callus tissues may develop at the margins.

Cankers girdle the roots and lower trunk, resulting in poor terminal growth and foliage discoloration. Severely infected trees eventually die. The leaves on affected trees may be small and yellow in summer or turn reddish to purple in early autumn. Because other root problems cause similar symptoms, these symptoms only indicate the need for further examination of the root system, such as isolation of the pathogen for a positive diagnosis.

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Disease Cycle

Disease cycle and epidemiology many vary with the species of *Phytophthora*, the location, and the particular disease incited (i.e., crown, collar, or root rot). All species of *Phytophthora* that attack to apple trees are soilborne, and some (e.g., *P. cactorum* and *P. megasperma*) have host range that include a wide variety of plants. Once introduced, *Phytophthora* spp. persist primarily as mycelia or oospores in infected host tissue or as oospores in organic debris or soil.

The pathogens can survive in soil for several years as oospores. These thick-walled spores can resist periods of unfavorable environment, such as drought, and are relatively resistant to chemical treatment. Infected or infested nursery stock is another important source of the fungus.

Pathogen growth and infection are favored by damp, cool periods after harvest and in spring about the time leaves and flowers are emerging. The ability to produce many spores (primarily zoospores) allows the pathogen to build up to high levels from a few oospores under favorable conditions. Zoospores swim in films of moisture to the crown or roots, where they initiate infection. Others may be splashed onto the fruit and cause a rot. Rotten fruit are firm and light tan.

Disease Management

Management of Phytophthora root, crown, and collar rot is most successful using an integrated program of cultural practices and, sometimes, chemical application. The disease can be reduced by carefully selecting the orchard site and rootstocks for the new planting. Susceptible rootstocks should not be planted in the orchards (or areas of the orchards) with heavy poorly drained soil. 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.

Apple rootstocks vary widely in susceptibility to various species of *Phytophthora*. Among apple rootstocks, seedling is relatively resistant, as are M.9, M.2, and M.4; M.7 (and M.7a), M. 26, and MM. 111 are moderately susceptible; MM.106 and MM.104 are highly susceptible. The new CG (Cornell Geneva) rootstock series has been bred to show resistance to some *Phytophthora* species.

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. Some fungicides are effective in controlling these diseases when used preventively, but they are seldom effective in reviving trees once the crown has become infected and symptoms of decline have appeared. Fungicides are most effective when used in combination with the cultural practices described above. For the update on chemical management of apple Phytophthora diseases, refer to the “Midwest Fruit Pest Management Guide” (https://ag.purdue.edu/hla/Hort/Documents/ID-465.pdf). Check labels and recommendations for approved chemicals and timings.