

## Plant Pathology Fact Sheet

# Root and Collar Rots of Tree Fruits

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Fruit trees in decline may be suffering from one or more of the root and lower trunk decay diseases present in Kentucky. Potential diseases include: *Phytophthora* collar rot, southern stem blight, *Armillaria* root rot, and *Xylaria* root rot. While all of these diseases cause similar leaf and branch symptoms, they each produce key diagnostic symptoms and/or signs which can aid in their identification. To determine which disease is the cause of the decline, it will be necessary to look closely at the roots and lower trunk.

## GENERAL SYMPTOMS

Common above-ground symptoms include poor growth, yellowed or discolored leaves, premature defoliation, dieback, and crown thinning. These top symptoms are a natural consequence of the disruption and decay of the tree's phloem tissues in the lower trunk and roots. When the phloem (located in the inner bark) is damaged it can no longer carry the food synthesized in the leaves back to the roots. As the roots become starved, they are unable to take up water and mineral elements efficiently enough to sustain leaves and branches. The result is the decline and ultimate death of the tree. Top symptoms of root and collar rot diseases



FIGURE 1. APPLE TREE SHOWING DECLINE SYMPTOMS DUE TO COLLAR ROT DISEASE.

may be especially evident during periods of stress, such as hot, dry weather. Tree health may seem to deteriorate rapidly under these conditions.

## PHYTOPHTHORA COLLAR ROT

Phytophthora collar rot is an occasional, but serious problem in many Kentucky apple and peach orchards. This disease can also infect most other tree fruits, including nut trees. It is especially severe on apple trees that are grown on Malling Merton 106 (MM.106) rootstocks.

### Symptoms

Trees are often affected as they come into bearing, about 3 to 5 years after planting. One of the first indications of a collar rot problem is the production of reddish leaves in late summer. This is soon followed by general stress symptoms (FIGURE 1), which include poor terminal growth, small off-colored leaves, and numerous, small, brightly colored fruit.

Cankers at the base of the main trunk can be recognized by the dark, sunken appearance of the bark. Inner bark tissues will appear reddish brown instead of white. There is generally a sharp contrast between the healthy white tissues and the infected tissues in the root stock portion of the tree (FIGURE 2). The bark of the diseased trunk and buttress roots at or just below ground level will be soft. A laboratory culture can confirm the presence of *Phytophthora*.



FIGURE 2. PHYTOPHTHORA COLLAR ROT CANKER AT THE BASE OF AN APPLE TREE.

### Cause and Disease Cycle

Collar rot is caused by the soilborne pathogens *Phytophthora cactorum*, *P. cambivora*, and *P. cryptogea*. Other species, *P. syringae*, *P.*

*megasperma*, and *P. drechsleri*, have also been associated with this disease. Collar rot is most frequently associated with sites having heavy, poorly drained soil. Soils that are saturated from rain or over-watering provide the moist conditions necessary for *Phytophthora* spp. to thrive and spread. In addition, waterlogged soils inhibit new root growth making it hard for trees to survive low-level infections. The lack of oxygen in saturated soils may also increase the rootstock's susceptibility to this disease.

*Phytophthora* spp. overwinter as dormant resting spores or as mycelium within infected tissues. New infections occur when the pathogen releases motile spores that are carried via water to susceptible hosts. The *Phytophthora* pathogen attacks the roots, as well as the lower trunk just at or below the soil surface. Trees are relatively resistant to infection while they are dormant.

### Disease Management

- **PROVIDE GOOD SOIL DRAINAGE.** Orchard soils should be well-drained and leveled before planting. If subsurface drainage is a problem, the only solution may be the installation of drainage tile through the area in which trees are planted -- a task much more easily accomplished before trees are planted! If collar rot occurs after trees are planted, improve drainage in the vicinity of the trunk, being sure water is not allowed to pool in a soil "saucer" around the base of the trunk.
- **ROOTSTOCKS VARY IN THEIR SUSCEPTIBILITY** to *Phytophthora* collar rot. The apple rootstocks MM.106 and Ant.313 are particularly susceptible; M.4, M.7, M.26, Bud.490, P.18, and MM.111 are less susceptible, and M.9, Mark, Bud.118, Bud.9 and seedling are relatively resistant. However, these susceptibilities may vary with the *Phytophthora* species. Peach rootstocks are very susceptible.

- **FUNGICIDE APPLICATIONS** are suggested for those areas of the orchard likely to have collar rot problems. Because this disease occurs so sporadically and the cost of chemical treatments is high, growers should only spot-treat blocks where susceptible rootstocks are growing in poorly drained areas. Chemical control can be an effective option but must be applied before symptoms become obvious. Once symptoms appear the tree is usually girdled and it is too late to apply a fungicide.

Ridomil Gold EC (mefanoxam) is labeled for use on bearing apple and stone fruit trees. According to the label, Ridomil 2E can be applied to the soil around apple trees in the fall after harvest. Check the orchard for preliminary symptoms of collar rot (abnormally reddish leaves) and for chronic collar rot (smaller than normal, or somewhat yellowed leaves) or to determine areas of the orchard where trees are vulnerable. Remember that the fungicide will not revitalize trees showing moderate to severe crown rot symptoms. Notice that the application rates and instructions are different for apples and stone fruits. Aliette WDG is another fungicide registered for apple and stone fruit collar rot. Aliette is applied as a foliar spray and is normally used in spring and summer.

### **SOUTHERN STEM BLIGHT**

Southern stem blight (or southern blight) can sometimes be a serious problem on young apple trees. This disease has an extremely wide host range, which includes herbaceous and woody ornamentals, vegetables and weeds, as well as tree fruits. Southern blight is most severe on one- to three-year-old trees, generally only attacking trees in their first few years in the orchard.

### **Symptoms and Signs**

The causal fungus strikes the lower trunk and roots, killing the bark and girdling young

trees. Wilting and dieback develop as a result of decay of lower trunk or crown tissues. Tree death usually occurs rapidly. The southern blight fungus produces tell-tale signs on the bark surface at or just below ground level. Initially, typical white web-like mycelium can be observed fanning out over the infected surface. Later, numerous small mustard seed-sized (1/16 to 1/8 inch) sclerotia become embedded in the fungal mat (FIGURE 3). The spherical sclerotia are white at first, later becoming light brown, reddish-brown or golden brown in color.



FIGURE 3. THE WEB-LIKE MYCELIA AND SCLEROTIA THAT ARE DIAGNOSTIC FOR SOUTHERN STEM BLIGHT. (PHOTO: CLEMSON-USDA CES, WWW.IPMIMAGES.ORG)

### **Cause and Disease Cycle**

Southern blight is caused by the soilborne fungus, *Sclerotium rolfsii*. This fungus survives as sclerotia in the soil, as mycelia in decomposing plant material, and as mycelia in previously infected plants (including weeds). Sclerotia enable the fungus to survive long periods of adverse conditions. As apple trees age, the bark thickens and trees become resistant to infection.

### **Disease Management**

- **AVOID PLANTING INTO PREVIOUSLY INFESTED SITES.** Do not plant apples where the disease has been severe on previous crops, such as clover, tomato or soybean. Keep in mind that the fungus can also exist as sclerotia in old pasture soils from previously infested weeds.
- **PLOW OR TILL PLANTING SITES A YEAR IN ADVANCE** to allow organic matter to completely decompose before planting apple trees.

- **KEEP THE SOIL AROUND THE TREE BASE FREE OF DEAD ORGANIC MATTER.** Dead orchard weeds, including those killed by herbicides, may serve as a food base for the fungus.
- **ROOT STOCKS VARY IN THEIR SUSCEPTIBILITY** to southern blight. The most resistant apple rootstock currently used is M.9.
- **NO FUNGICIDES** are currently registered on apples for southern blight control.

### ARMILLARIA ROOT ROT

Armillaria root rot, also known as shoestring root rot, can affect several fruit crops, but it is most common in Kentucky on apple and peach trees. Its host range also includes numerous species of deciduous and evergreen trees, shrubs, and woody vines.

#### Symptoms and Signs

The *Armillaria* root rot pathogen causes a white rot of the wood; infected tissues have a bleached appearance. In addition, the decayed wood is often spongy and stringy. This fungus produces mycelial fans (fan-like mats of white mycelial growth) under the bark of infected trees. Even more diagnostic, however, is the presence of reddish-brown to black shoestring-like rhizomorphs, also formed under the bark (FIGURE 4). The presence of clusters of the characteristic light brown or honey-colored mushrooms (FIGURE 5) at the



FIGURE 4. SHOESTRING RHIZOMORPHS TYPICAL OF THE *ARMILLARIA* FUNGUS.

base of infected trees is also diagnostic; however, their production tends to be erratic. Mushrooms may form in late summer or fall. Interestingly, the *Armillaria* mycelium is bio-luminescent in actively decaying tissues.



FIGURE 5. THE HONEY-COLORED MUSHROOMS OF *ARMILLARIA MELLEA*

#### Cause and Disease Cycle

The causal fungus, *Armillaria mellea*, is commonly referred to as the honey mushroom. Under favorable conditions, this organism can survive for several decades as mycelia and rhizomorphs in stumps. Disease spread can occur via windblown basidiospores produced by the mushroom phase. However, it is believed that *Armillaria* more commonly spreads via mycelia when roots come into contact with each other and via rhizomorph growth in the soil.

#### Disease Management

- **AVOID PLANTING IN SITES WHERE *ARMILLARIA* IS KNOWN TO HAVE BEEN PRESENT.** If a woodlot has recently been cleared for an orchard, allow a year or two for the tree roots left behind to completely decompose before planting new fruit trees.
- **MAINTAIN TREE HEALTH** by following good cultural practices. Trees stressed by other biotic and/or abiotic factors may be more vulnerable to attack.

### XYLARIA ROOT ROT

Xylaria root rot is seen in Kentucky on mature apples and cherries. In addition to these tree fruits, Xylaria root rot can occur on black locust, elm, honey locust, maple, oak, hickory, sassafras, walnut, yellowwood, and possibly beech. Peaches are not affected.

## Symptoms and Signs

*Xylaria* produces an off-white decay of tree roots and results in thinning of the foliage and tree decline over a period of a few years (FIGURE 6). As is typical of other root and butt rot diseases, the weakened trees lean or break near the soil line.



FIGURE 6. THINNING FOLIAGE DUE TO XYLARIA ROOT ROT.

This disease is also called black root rot (not to be confused with black root rot caused by the fungus *Thielaviopsis basicola*) because of the black sheath of fungal stroma found on the surface of decaying roots. *Xylaria* produces clusters of black, finger-like or club-shaped fruiting structures that originate on the lower trunk or on major roots. These fungal structures resemble blackened

“fingers,” inspiring the common name, “dead man’s fingers” (FIGURE 7). They are unique and easy to recognize when they appear at the base of the tree, in the lawn, or in a nearby landscape bed.



FIGURE 7. XYLARIA FRUITING BODIES ARE APTLY CALLED “DEAD MAN’S FINGERS.”

## Cause and Disease Cycle

Two fungi, *Xylaria mali*, and *X. polymorpha*, can cause this root rot disease. Trees may become infected when their roots come into contact with roots or root pieces that are colonized by *Xylaria*.

## Disease Management

- REMOVE INFECTED TREES AND TREE-ROOTS. If replanting is necessary, deep plow the site and leave it fallow for as long as possible.
- AVOID PLANTING SUSCEPTIBLE TREES in sites with a history of this disease. Apple rootstocks can vary in their susceptibility; peaches are not susceptible.

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