Martin-Gatton
College of Agriculture, Food and Environment
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Plant Pathology Fact Sheet **PPFS-GEN-23**

Armillaria Root Rot of Woody Plants

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Introduction

Armillaria root rot, also referred to as shoestring root rot, mushroom root rot, and oak root rot, can affect numerous woody plants, including fruit and ornamentals. This disease is commonly associated with forests and is particularly problematic when wooded sites are converted to orchards or landscapes. While often considered a secondary disease associated with plant stress, it can be a primary pathogen of healthy trees. Armillaria root rot has become a serious threat to peach production in the Southeast.

Hosts

Armillaria root rot can affect a wide range of hosts, including hundreds of woody and herbaceous plants; however, this publication focuses on the following woody hosts affected in Kentucky:

Woody fruit crops—Fruit crops most often affected include apple, blueberry, grape, and brambles. Stone fruits (cherry, peach, plum) are also susceptible.

Woody ornamentals—Landscape plants most often affected include hydrangea, maple, and oak. Other susceptible ornamentals include ash, birch, dogwood, holly, redbud, rose, and sweetgum.

Symptoms & Signs

Armillaria root rot results in branch dieback, premature discoloration of foliage, crown thinning, undersized foliage, and eventual plant death. In some cases, trees may suddenly collapse in midsummer without other symptoms of decline. Bark at the base of infected trees becomes loose or decayed as the cambium dies.

Figure 1. Honey-colored *Armillaria* spp. mushrooms may develop from rotting roots underground (**A**), as well as in clusters at the base of infected trees (**B**).

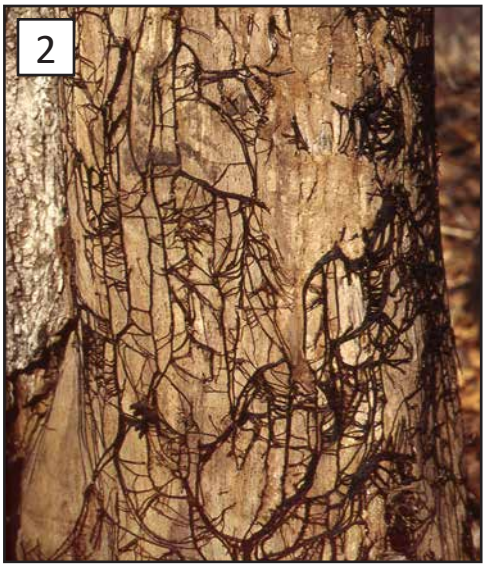

Figure 2. Dark brown to black *Armillaria* rhizomorphs, which resemble "shoestrings," develop under the bark of infected trunks and along the surface of decaying roots.

Figure 3. White fans of fungal mycelia may also be observed under the bark of hosts affected by Armillaria root rot.

Figure 4. Phytophthora root and collar rot results in dark brown, wet decay. Symptoms and lack of rhizomorphs or mycelial fans distinguish this disease from Armillaria root rot.

In orchards, disease may begin in one or two trees and spread to adjacent trees in a circular pattern.

While many of these symptoms are typical of any root rot or root disturbance, diagnosis of Armillaria root rot can be confirmed by the presence of any one of three distinctive signs: honey mushrooms, rhizomorphs, and/or mycelial fans.

Honey mushrooms—The mushroom stage of Armillaria root rot (Figures 1A & B) appears as dense mushroom clusters at the base of infected trees, as well as on decaying roots and logs, in late summer or autumn; mushroom production is erratic. Mushrooms are honey-colored, which has earned them the name "honey mushroom."

Rhizomorphs—Dark brown to black rhizomorphs (thick strands of mycelia) resembling "shoestrings" (Figure 2) develop on or underneath the bark surface of infected trunks and along the surface of decaying roots. Rhizomorphs give this disease the name "shoestring root rot."

Mycelial fans—Creamy white fans of fungal mycelia (thread-like strands that comprise the fungus) may also be observed when bark is removed (Figure 3).

Look-a-like Disease

Armillaria root rot may be confused with Phytophthora root and collar rot, which affects many of the same hosts as *Armillaria*. However, the decay associated with *Phytophthora* is usually a darker brown color, decayed bark is wet, and the there are no mushrooms, mycelia, or rhizomorphs (Figure 4). In addition, Phytophthora root rot is generally associated with wet planting sites, while Armillaria root rot is more frequently found in well-drained plantings.

Figure 5. Long after infected trees are removed, *Armillaria* spp. can survive and produce mushrooms on decaying trunks and roots (**A**) and rhizomorphs are often visible on decaying trunks (**B**).

Cause & Disease Development

Armillaria root rot is caused by various species of *Armillaria*; *A. mellea* is the species most often identified. *Armillaria* spp. can survive many years as mycelial fans or as rhizomorphs in the soil or on decaying roots. *Armillaria* spp. may already be present in forested land that has been cleared for commercial or residential use. Spread from tree to tree occurs via rhizomorphs or root-to-root contact, while spread to new sites occurs through movement of infested soil or infected roots.

The mushroom phase is not considered important in disease spread or infections, but it is a good indicator of the pathogen's presence. Long after infected trees are removed, the fungus can remain viable in soils, infect new plants, and continue to produce honey mushrooms and rhizomorphs (Figure 5).

Disease Management

Managing Armillaria root rot depends primarily on prevention. Following good cultural practices can prolong tree life but will not cure infected trees or shrubs. Chemical methods (such as fungicides or soil fumigants) have had mixed results in managing the pathogen once it is present, but these approaches are only feasible in large commercial orchards. Research into improved management techniques is ongoing in several peach-producing states in the Southeast.

- Avoid planting susceptible trees or shrubs in cleared woodlands or sites with a history of Armillaria root rot.
- Select less susceptible hosts when infested sites must be used. For example, peach is highly susceptible, whereas apple is less susceptible than peach, and pear is less susceptible than apple. Peach root stocks can vary in their susceptibility to Armillaria root rot; however, plant susceptibility can be affected by other factors, such as growing site, environmental conditions, disease pressure, and plant age.
- Clean cultivate and remove as much root debris as feasible prior to planting. This is especially important for previously wooded sites.
- Properly plant trees and shrubs for optimum health. Avoid planting or transplanting trees or shrubs too deeply. Look for a soil line or root flare on the trunk as a guide and set at ground level. Never mound soil or mulch around lower trunks.
- Protect plants from avoidable stresses. For example, winter injury, insect damage (defoliators and borers), and soil compaction can contribute to rapid decline of infected plants.

Disease Management (cont'd)

- Avoid mechanical damage to roots and trunk. Wounds from mowers, string trimmers, construction, and human activity provide entry points for invading pathogens.
- Irrigate during dry periods; avoid water stress (e.g., saturated or drought conditions).
- Fertilize as needed to promote vigor.
- Remove infected trees in landscapes before they become a hazard.

Additional Resources

- Extension Plant Pathology Publications https://plantpathology.ca.uky.edu/extension/publications
- Rootstocks for Kentucky Fruit Trees https://www2.ca.uky.edu/agcomm/pubs/ho/ho82/ho82.pdf
- Tree Wounds—Invitations to Wood Decay Fungi (PPFS-OR-W-01 https://plantpathology.ca.uky.edu/files/ppfs-or-w-01.pdf
- What's Bugging My Tree: Armillaria Root Rot (UK Forestry & Natural Resources video) https://www.youtube.com/watch?v=P0rAJDx_408
- Woody Plant Disease Management Guide for Nurseries & Landscapes (PPFS-OR-W-29) https://plantpathology.ca.uky.edu/files/ppfs-or-w-29.pdf

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Photos: University of Kentucky—Nicole Gauthier (4, 5B); Bugwood.org—Joseph OBrien, USDA Forest Service (2), William Jacobi, Colorado State University (3), Rebekah D. Wallace, University of Georgia (4), David Stephens (5A)

Revised from the fact sheet *Shoestring Root Rot—A Cause of Tree and Shrub Decline* (PPFS-OR-W-05) by John Hartman