



# Phytophthora Rots of Apple and Pistachio

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## APPLE



Collar rots and crown rots

Crown and root rot

## PISTACHIO



Sudden tree death with bronze leaves attached



Collar rot: trunk canker with oozing sap



Bark rot or death



Crown and root rot



Crown and root rot



Dark brown cambium with a sharp demarcation line

## Introduction

Fruit and nut trees are economically important crops in Arizona backyards or commercial orchards. The most common and most important diseases observed in fruit and nut trees are root diseases that cause a gradual and irreversible decline of the tree. Phytophthora rots of root, crown (rootstock) and collar (scion) are common and destructive diseases of fruit and nut trees worldwide. In Arizona, apple, pistachio, peach, and citrus are susceptible to Phytophthora rots, especially trees grown in heavy soils or under wet soils conditions resulting from excessive irrigation for extended periods.

## Pathogens

Several *Phytophthora* species including *P. cactorum*, *P. syringae*, and *P. citricola*. In Arizona, *P. nicotianae* has been recovered from symptomatic pistachio trees. The soil-inhabiting oomycete *Phytophthora* are commonly known as water molds (fungal-like organism because they are not true fungi). *Phytophthora* species have several unique stages in their life cycle including short-lived swimming zoospores (main infective structure), intermediate-lived mycelium and sporangium (intermediate survival

structures), and long-lived thick-walled oospores and chlamydospores (perennating survival structures).

## Aboveground Symptoms

A wide range of symptoms can be expressed by trees and depend largely on tree age and cultivars, as well as

how much of the root or crown tissues are girdled and how quickly the barks are destroyed. In general, symptoms of reduced tree vigor and growth, yellowing or chlorosis of leaves, early senescence and leaf fall are associated with chronic root infections; crown rots and collar rots advance rapidly following excessively wet periods and thus trees may appear healthy in spring, but wilt and die suddenly with dry brown leaves attached to the tree in the latter part of the growing season. Fruit rot is very rare in Arizona.

## Belowground Symptoms

Crown rots occur on rootstock below soil line. After removing the outer bark layer of crown, a sharp line demarcating the dark-brown (diseased) and white (healthy) portion of the inner bark and wood is usually diagnostic. Similar symptoms can occur on roots but can be difficult to observe. In addition, root symptoms include necrosis of fine roots and poor root development.

## Conditions Can Be Confused With

*Phymatotrichopsis* root rot, *Verticillium* wilt, winter injury, wet feet (root asphyxiation). Isolation of the pathogen on selective media in the laboratory is essential for diagnosis.

## Disease Cycle

*Phytophthora* inoculum may be present in the orchard soil or introduced through contaminated planting materials or soils, in irrigation water, or on equipment or tools. They reproduce by colonizing live or dead organs of host plants in an orchard. Bark may be infected directly through wounds, growth cracks or young fine roots. Mycelium in infected organs and oospores are survival structures. Under wet soils, oospores germinate forming thin thread of hyphae that can infect roots. Mycelium produce reproductive sporangia containing numerous swimming spores called zoospores, which move through the soil water to attack new roots.

## Factors Favoring Disease

Disease development is affected by the availability of water above ground and in the soil, soil type, tree age, the height of the graft union, and soil management techniques. *Phytophthora* root rot is favored by high soil moisture and soil temperatures of 80°F and above. Many areas of Arizona have soil that is heavy in clay, poorly drained with caliche, and conducive to this disease.

## Management

Most effective with a combination of 1) cultural practices to limit period of soil saturation by choosing well-drained planting site, monitoring irrigation, and improving soil structure; 2) resistant rootstock or tree species; 3) biological control (*Trichoderma*-, *Bacillus*- or *Streptomyces*-based biopesticides); and 4) chemical control via trunk spray or root zone drench (metalaxyl or mefenoxam, phosphorus acid or Fosetyl AL).

## Additional Resources

<https://extension.arizona.edu/pubs/vegetable-diseases-caused-phytophthora-capsici-Arizona>



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