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AVOCADO STEM CANKER OR COLLAR ROT

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Three species of Phytophthora have been associated with trunk, collar and crown cankers on avocado trees viz. *P. cinnamomi* Rands, *P. citricola* Sawada and *P. heveae* A Thompson. The most devastating and abundant is *P. citricola*, especially in the cooler coastal production areas of California, where it was first described on avocado in 1974. *P. citricola* is apparently present in approximately 90% of the avocado orchards in California, while the disease itself occurs in only around 5% of these orchards. *P. cinnamomi*, the major causal organism of root rot, has infrequently been reported to cause cankers in California, South Africa, Brazil and Australia. The only report of *P. heveae* being associated with cankers on avocado was from a small nursery planting in Guatemala (Faber et al. 1995, Faber and Ohr 1999, Manicom 2001, Zentmyer et al. 1998).

SYMPTOMS

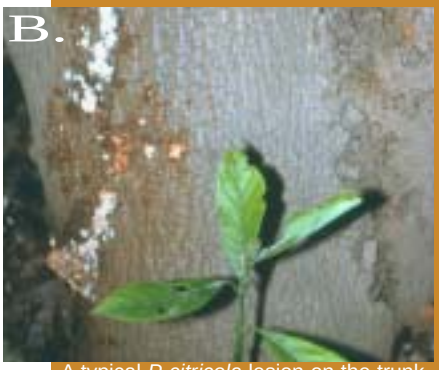
Trunk cankers caused by *P. citricola* are normally found at the base of the trunk extending to a height of approximately 18 in. The pathogen infects the crown, lower trunk and sometimes the main structural roots of avocados of all cultivars. The cankers usually originate at or below soil level, but can be found higher up in the tree if bark damage has occurred. This is because the pathogen can gain entrance through wounds caused by pruning tools, mechanical damage caused by pickers, or even limbs rubbing against each other during wind.

Canker lesions are discolored and the cankers give rise to copious amounts of a red resinous, water-soluble exudate through cracks in the bark. This exudate often dries to form a white crystalline deposit on bark. Cutting into a canker reveals an orange-tan to brown-pigmented outer layer of wood which has a fruity odor when exposed to air, instead of the normal white or cream-colored tissues. The cankers have distinct reddish-brown margins from which the fungus can readily be isolated (Bender 1999).

Foliar symptoms are similar to those caused by Phytophthora root rot (PRR). There always appears to be more leaf litter on the orchard floor than in the case of PRR, and there is usually an abundance of healthy, cream-colored feeder roots in the area of the root crown. The abundance of leaf litter is due to the fact that mildly canker affected trees develop a great deal more new flush during the growing season than do root rot affected trees. Moderately affected trees often appear quite healthy and may persist this way for several years until the canker progresses to a stage where it may start killing the cambium tissues around the trunk. Unless the trunk is inspected for lesions (and the tell-tale signs of white powdery exudates), the tree generally appears healthy. In some cases the disease can progress very rapidly, killing the tree in a few months by killing the cambium and effectually girdling the trunk. Sometimes trees have the disease without any above-ground signs of a canker. In these cases, cankers may girdle trees a few inches below the soil level before the disease is detected (Bender 1999, Faber and Ohr 1999, Zentmyer et al. 1965).

While of relatively minor importance in California, the disease may infect fruit under some conditions. During prolonged wet weather, particularly in northern growing regions, fruit still hanging on the tree may be infected with *P. citricola*. Affected fruit are often touching the soil or are hanging on the lower branches. Most damage occurs within 3 feet of the soil surface. Diseased fruit have a distinct circular black area that usually occurs at the lowest part of

Typical *P. citricola* canker on an avocado tree trunk. Often there is sugary exudate (bleeding) with a distinct pocket of wet dead tissue below the damaged bark.



A typical *P. citricola* lesion on the trunk of this tree. Note the sucker growing from below the ground nearby. Mechanical damage to the tree resulting from pulling suckers is thought to be a major point of entry for this disease.

Under the bark of a severely damaged tree. *P. citricola* will often girdle the tree, killing all living bark tissue resulting in eventual tree death.

Photos: H. Ohr

California AVOCADO COMMISSION

Photo: H. Ohr

Diseased fruit have a distinct circular black area that usually occurs at the lowest part of the fruit.

the fruit. While most infections occur at the bottom of the fruit, they can occur anywhere on the surface. Internally, the rot extends into the flesh, darkening it in the same pattern as the affected area on the surface (Faber and Ohr 1999).

Causal Organism and Epidemiology

The causal organism of this destructive disease in California is *P. citricola.* Previously uncommon, it has now become second to Phytophthora root rot in being limiting to avocado production. *P. citricola* has a wide host range and has been recorded on hosts such as walnut, cherry, cherimoya and fir trees. Phytophthora canker disease is favored by excess moisture, which is essential for the dissemination of the spores. Stress factors resulting from water deficit, salinity, excess fertilization and root disease caused by *P. cinnamomi,* are also conducive to infection by *P. citricola.* One of the primary ways in which the disease is spread is through infected nursery stock. Nurseries that do not take precautions to disinfect water used for irrigation purposes, sterilize potting media, and keep containers off the ground, may be responsible for disseminating the disease. Phytophthora canker differs from the root rot pathogen in that it infects through wounds created by gophers, sucker removal, wounds made during staking, and cold injury. It has been reported that severe pruning of canker infected trees increases the rate of demise of these trees. The pathogen can also be spread on contaminated pruning tools, harvesting equipment and vehicles, on the shoes of pickers climbing onto the trees, and by rodents which feed on the roots of the trees (Bender 1999, El-Hamalawi et al. 1995, El-Hamalawi and Menge 1994, Faber and Ohr 1999, Manicom 2001, Zentmyer et al. 1998).

Disease Management

The measures recommended for the control of Phytophthora canker diseases are similar to those described for Phytophthora root rot. The use of certified disease-free nursery stock cannot be over-emphasized. Unlike root rot infected trees which can be treated successfully to a state of total remission, it is very difficult to cure trees once they become infected with *P. citricola.* Some clonal rootstocks which are resistant to Phytophthora root rot, such as Thomas, may be susceptible to *P. citricola* (El-Hamalawi et al. 1994, Zentmyer et al. 1998). Current rootstock research in California now looks simultaneously for resistance to both diseases.

Chemical control of Phytophthora cankers caused by *P. citricola* has not been very successful in California. Field trials continue to test different chemicals and modes of application (Marais et al. 2001).

Greenhouse experiments at the University of California Riverside indicate that cutting away cankerous lesions on seedlings and applying Aliette® as a trunk paint, will arrest the infection (El-Hamalawi and Menge 1994). Scraping of cankerous tissues to remove active cankers and painting the area with copper Bordeaux has been employed by growers in the past, but some growers have reported an increase in the spread of the disease after this treatment. Preliminary research shows that if tree surgery is followed up by treatment with Aliette® or neutralized (buffered) phosphorous acid, disease spread is arrested. In much the same way, removing rootstock suckers in the field by cutting them above the ground and treating the cut surface with Aliette® or neutralized (buffered) phosphorous is likely to reduce potential infection.

Severely pruning canker affected trees should be avoided. Pruning tools should be disinfected before moving to the next tree. It is important to remove leaf litter from crotches of trees and from around the base of the trunk. Avoid sprinkler irrigation wetting the crotches of the trees and from spraying directly onto the trunks. Cankers frequently develop on the side of the trunk exposed to sprinklers (Faber and Ohr 1999).

In fruit, prevention of infection is challenging because it is likely caused by the splashing of Phytophthora spores from the soil surface to the fruit during rainy weather. Any practice that helps reduce splash, such as a layer of leaves or mulch, may help. Where *P. citricola* is a fruit problem, fruit lying on the ground should be removed because the fungus can grow and sporulate there, providing an abundant source of infection (Faber and Ohr 1999).

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