



Botryosphaeria Canker

Integrated Pest Management for Home Gardeners and Landscape Professionals

Botryosphaeria canker (Figure 1) is a common disease in many ornamental and crop plants. *Botryosphaeria* is a genus of fungal pathogens that can infect a wide range of woody plants (Table 1).

While *Botryosphaeria* fungi can cause many symptoms, they typically produce cankers on woody plants. These pathogens cause disease by growing around, along, or through the stem until the plant is girdled, killing tissue in its wake. It usually kills the bark and cambium but can also enter the wood. The most frequently reported *Botryosphaeria* species in California is *B. dothidea*.

IDENTIFICATION AND BIOLOGY

Identification involves both whole plant symptoms and examination of the wood for signs of the pathogen. Botryosphaeria canker diseases cause symptoms when the pathogen kills the sapwood of a branch, cutting off water flow to the leaves. The first indication of a *Botryosphaeria* disease is yellowing (or chlorosis) of leaves on a single branch while other branches appear normal (Figure 1). As the fungus girdles the last sections of living tissue, symptoms of yellowed and necrotic or dead leaves, wilting, or excessive leaf drop usually occur. Chlorotic leaves drop from infected branches, resulting in deadwood in the canopy (Figure 2). Blighted branches with brown leaves can appear relatively soon after infection, especially when infections move fast in younger shoots.

Since individual cankers kill branches at different times, trees and woody plants lose branches one after another, perhaps over several years. As cankers kill branches or even the main stem of a tree, large portions of a shrub or tree may die (particularly when trees are young). Stem girdling



Figure 1. The first symptoms of *Botryosphaeria* infection are yellowed foliage and thinning of the canopy.



Figure 2. Dead branches appear as *Botryosphaeria* canker disease advances.

Authors:

Arthur J. Downer, UC Cooperative Extension
Ventura County;

Dee Vega, Cal Poly Pomona;

Themis Michailides, Kearney Agricultural Research
& Extension Center

occurs slowly on larger branches. Branches may die back partially, with the inner portions retaining leaves if a canker is somewhere in the middle of a branch. Sometimes cankers spread down a branch to its attachment and onto the main stem, eventually killing all the branches above that point. Branches with active cankers sometimes exude droplets of yellowish pitch or sap.

To confirm *Botryosphaeria* canker, examine the wood for dark staining and look for fruiting bodies emerging from under the bark of infected tissues. The fruiting bodies resemble small black dots, smaller than fine ground pepper (Figure 3). They are scattered over distinct areas at first or may completely cover a colonized branch and only appear in dead tissues.

Sometimes canker symptoms look like wilt disease symptoms, but wood staining with *Botryosphaeria* canker is distinctive: dark and complete for most *Botryosphaeria* diseases, while it is streaked or patchy for *Verticillium* wilt. *Verticillium* wilt has a fairly narrow host range of landscape trees, while *Botryosphaeria* canker affects hundreds of woody shrubs and trees. Cross sections of younger infected stems will reveal dark wedge-shaped stains that resemble pizza slices (Figure 4). Eventually the canker and staining expand, girdling the entire stem. *Botryosphaeria* canker can less commonly move through the pith of a plant, leaving a hollowed straw-like appearance.

Native plants such as coastal redwood and giant sequoia are affected by this pathogen which causes tip dieback and death of moderate sized branches and the trunk. *Botryosphaeria* species can also infect the fruit of woody plants such as pistachio, avocado, grape, and apple.

There are many species of *Botryosphaeria* and most have both a sexual and an asexual phase of reproduction. Many asexual stages of these diseases have their own distinct names. Examples include *Diplodia*



Figure 3. Fruiting bodies (pycnidia, pseudothecia, or both) of *Botryosphaeria* species resemble small black dots in dead wood (*Ficus microcarpa*).

spp. which causes oak branch dieback and other diseases, and *Dothiorella* which causes branch canker on avocado, and *Neofusicoccum* which causes *Ficus* branch canker. These diseases are often lumped together in the trade as “Bot” diseases.

Spores can remain viable in cankers within plant debris, or both for over 6 years and can germinate within a short time when conditions are ideal (warm and wet). Spores of either phase may infect a susceptible host. Infection occurs when either the sexual spores (ascospores) become airborne or the asexual spores (pycnidiospores) are released during the spring or early summer and rainfall splashes them from one branch to another.

New infections occur on fresh wounds, branch junctions, or through natural openings in branches and leaves. Pruning cuts, broken branches, leaf and peduncle scars, or other bark or stem injuries (such as sunburn or frost damage), are typical entry points for the pathogen. The fungus rapidly colonizes the phloem and young sapwood and begins to grow through inner layers of wood.

When the branch is girdled or the wood fully colonized on or just beneath the bark of the dead branch, the fruiting bodies form scattered over distinct areas at first and may eventually

completely cover a colonized branch. Spores usually form by the end of the growing season, before rains begin. The life history repeats as rainfall splashes spores onto healthy twigs. Birds can also spread the disease especially when they land on damp shoots that bear fruiting bodies and when they eat infected fruit.

Infected plants sometimes do not show symptoms right away. Many *Botryosphaeria* fungi can live in their hosts as endophytes, resident fungi that have no outward impact on the host. *Botryosphaeria* is opportunistic and infects or becomes pathogenic in plants that are stressed. The conditions that cause stress vary by location and host, often stress factors are conditions the host is not adapted to grow in such as low or high relative humidity, soil salinity, or extremes in soil moisture content—dry or wet.

DAMAGE

Damage from canker diseases results in the loss of branches or the main stem of a tree causing disfigurement, loss of form, and loss of fruit production or quality. Extensive cankering of trees can deplete stored carbohydrates and possibly predispose the tree to attack from other pathogens. Deadwood accumulates in *Botryosphaeria* canker-infected trees, resulting in canopy



Figure 4. *Botryosphaeria* species infections can stain the wood of their host a dark color. Shown here is *Ficus* branch canker on *Ficus microcarpa*.

thinning and loss, attraction of insect pests (such as beetles) and increased fire risk. Secondary infections by wood decay organisms often follow on larger branches. For information on wood decay see the *Pest Notes: Wood Decay Fungi*.

evaporation from soil surfaces and conserve soil moisture. Sometimes understory shrubs and trees are made more susceptible to disease by heavy shade. Provide light for developing plants and decrease the incidence of canker disease.

MANAGEMENT

Cultural Control

Managing *Botryosphaeria* canker disease is primarily a matter of managing factors that predispose woody plants to the disease. Plant selections should be made with the site location in mind: choose plants that are best suited for their locations, sunlight, soil type, growth space, and water allocation. Successive dry years (low rainfall) exacerbate *Botryosphaeria* canker diseases as plants grown under drought stress conditions have abundant dead branches that have not been pruned away, many containing fruiting bodies. Apply supplemental irrigation during low rainfall periods (such as summer or fall) or in the spring of low rainfall years to help plants resist these canker-forming fungi. When irrigating, don't let water hit the canopy or trunk of the tree. Water should be applied under the canopy but away from the main stem or trunk. Consider using coarse wood chip mulches to retard

Mechanical Control

Remove and dispose of dead or dying branches. Since spores are usually formed in the center of the canker, prune a few inches below the canker on infected tree and shrub branches. Protect healthy trees by only using sanitized pruning equipment. Pruning shears used to cut a branch with fruiting bodies present can be contaminated with the pathogen with the next 2 to 3 subsequent cuts. Inspect cuts to ensure that no discoloration from the fungal infection exists where the cut was made. If discoloration is present, immediately disinfect pruning tools and then cut further back or remove larger stem sections to eliminate the infected portion of the plant. If discoloration has reached the main stem, consider removal or replacement of the affected plant. Be cautious when pruning so that you do not increase the risk for sunburn in thin barked susceptible plant species such as madrone.

Table 1. Some common woody plants susceptible to *Botryosphaeria* canker.

Almond	Oak
Apple	Olive
Ash	Madrone
Avocado	Manzanita
Chinese elm	Mountain lilac
Citrus	Pine
Cottonwood	Pistachio
Cypress	Peach, plum, cherry, and apricot
Douglas fir	Redwood (inland and coastal)
Dogwood	Rose
Eucalyptus	Sycamore
Fig	Victorian box
Liquidamber	Walnut
Maple	Willow

Chemical Control

Fungicides containing phosphorous acid (such as Agri-Fos) that induce a plant immune response are effective in protecting foliage and fruit and preventing new canker formation in susceptible plants. While fungicides are unlikely to save branches that are already infected, some may prevent new infections and limit further spread of disease. Aside from the many potassium phosphite containing materials, other fungicide products for this disease on ornamental plants are limited.

Monitor for scale insects or other sucking insects in the order Hemiptera (like planthoppers and leafhoppers) as they can predispose plants and aid in spread of the disease. For information on managing scale insects, see *Pest Notes: Scales*.



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WARNING ON THE USE OF PESTICIDES

Pesticides are poisonous. Some pesticides are more toxic than others and present higher risks to people, nontarget organisms, and the environment. A pesticide is any material (natural, organic, or synthetic) used to control, prevent, kill, suppress, or repel pests. "Pesticide" is a broad term that includes insecticides, herbicides (weed or plant killers), fungicides, rodenticides, miticides (mite control), molluscicides (for snails and slugs), and other materials like growth regulators or antimicrobial products such as bleach and sanitary wipes that kill bacteria.

Always read and carefully follow all precautions and directions provided on the container label. The label is the law and failure to follow label instructions is an illegal use of the pesticide. Store all chemicals in the original labeled containers in a locked cabinet or shed, away from food or feeds, and out of the reach of children, unauthorized persons, and animals. Never place pesticides in food or drink containers. Consult the pesticide label to determine active ingredients, correct locations for use, signal words, and personal protective equipment you should wear to protect yourself from exposure when applying the material.

Pesticides applied in your garden and landscape can move through water or with soil away from where they were applied, resulting in contamination of creeks, lakes, rivers, and the ocean. Confine pesticides to the property being treated and never allow them to get into drains or creeks. Avoid getting pesticide onto neighboring properties (called drift), especially onto gardens containing fruits or vegetables ready to be picked.

Do not place containers with pesticide in the trash or pour pesticides down the sink, toilet, or outside drains. Either use all the pesticide according to the label until the container is empty or take unwanted pesticides to your local Household Hazardous Waste Collection site. Contact your county agricultural commissioner for additional information on safe container disposal and for the location of the Hazardous Waste Collection site nearest you. Follow label directions for disposal of empty containers. Never reuse or burn the containers or dispose of them in such a manner that they may contaminate water supplies or natural waterways.

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ANR Associate Editor: AM Sutherland

Editor and Designer: B Messenger-Sikes

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