



BITTER ROT OF APPLE

Bitter rot of apple fruit, caused by the fungus *Colletotrichum gloeosporioides* (perfect state: *Glomerella cingulata*), is a common and widespread disease. Bitter rot is also common on pear. Of the three fruit rot diseases of apple (black rot, bitter rot, and white rot), bitter rot has the potential to be most destructive. The fungus can also cause leaf spot and canker, but they are not common. The disease is most common in warmer regions.

Symptoms

Fruit rot symptoms differ somewhat, depending on whether infection is initiated by spores from a perithecial type, which produces ascospores and conidia, or conidial type, which produces only conidia. Initial symptoms caused by either type are similar. Fruit infection can occur as early as bloom and appears as minute, gray-brown flecks, which usually do not develop further until fruit begin to ripen. Fruit infections occurring one month after petal fall begin as small, slightly sunken, light brown to dark brown lesions that may be surrounded by a red halo on mature fruit.

Lesions originated from infections by conidial types remain circular and become sunken as they enlarge (Figure 1). After lesions become 1/2 to 1 inch in diameter, acervuli are produced in concentric circles around the point of infection. Acervuli are sparse on some lesions and dense on others. Copious quantities of conidia are produced in acervuli on the surface of fruit. When dry, conidia in mass appear crystalline; under moist, humid conditions, the spores mass appear creamy and salmon to pink.

Lesions initiated by perithecial types are usually not sunken (Figure 2) and are often darker brown than those initiated by conidial types. Acervuli are widely scattered over the



Figure 1. Sunken lesions of bitter rot (conidial type) on apples, with concentric circles of acervuli (fruiting bodies of the pathogen).

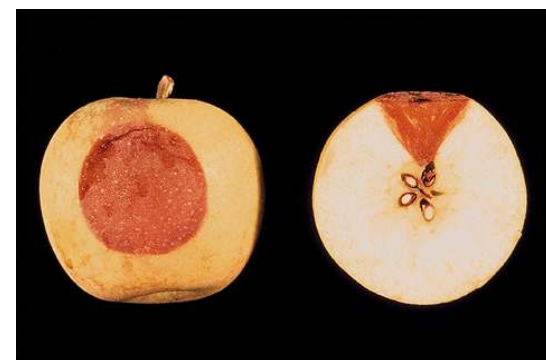


Figure 2. Bitter rot (perithecial type) on Golden Delicious apples. The lesion is not sunken and sporulation is sparse (left). The V-shaped decay (right), extends to the core, characteristic of bitter rot. (Courtesy T.B. Sutton).

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surface, and perithecia are found in dark brown to black clusters scattered over the surface of the fruit. Conidial masses associated with the perithecial types tend initially to be orange to salmon, but turn dark brown to black on older lesions.

Lesions initiated by both perithecial and conidial types extend in the shape of a cone toward the core. In cross section, the lesions appear v-shaped – a characteristic that differentiates bitter rot from white rot, which is characterized by lesions that tend to be more cylindrical (Figure 2, Figure 3). Some infected fruit drop, whereas others mummify and remain attached to the tree through the winter.



Figure 3. Bitter rot (left) and white (right) of apple. The lesion of bitter rot is a v-shaped decay to the core; while lesion of white rot is a cylindrical decay to the core.

The leaf spot phase, caused by perithecial types, is not common but can occur under warm, humid conditions. They begin as small, red flecks, which enlarge to irregular brown spots 1/16 to 1/2 inch in diameter. Severely infected leaves may fall prematurely. Bitter rot cankers are rare in the eastern United States. When they occur, cankers are target-shaped, (i.e., oval, sunken and often marked with zones of concentric rings).

Disease Cycle

The fungus survives from one season to another in apple orchards as mycelium, pycnidia, and perithecia in cankers, colonized dead bark, and mummified fruit. Conidia, produced in these overwintering sites, are the primary inoculum source in the spring, although ascospore inoculum is important in some orchards. Conidia are spread by splashing and windblown rain. Insects and birds are also involved in their dispersal.

Ascospores are released after rain and are airborne. Fruit infection can occur early but fruits are more susceptible to infection from three weeks after petal fall until harvest. The optimum conditions for disease development include rainfall, relative humidity of 80 to 100%, and warm temperatures (80-90°F). Epidemics can develop rapidly during prolonged warm, wet weather, and loss can be extensive (Figure 4). The most severe epidemics usually occur when the early season is warm and wet and primary infection occurs early, providing abundant secondary inoculum.



Figure 4. Epidemic of bitter rot in a Golden delicious apple orchard.

Control

Control of bitter rot is best achieved through an integrated program of cultural practices and chemical control practices.

1. Good orchard sanitation is critical for effective control of bitter rot. Piles of prunings are an important source of inoculum and should be removed from the perimeter of the orchard or burned.

Prunings can be left on the orchard floor if they are chopped with a flail mower, which removes much of the bark and allows them to decompose faster. Removal of mummified apples and pruning out dead wood in the tree are important for reducing the inoculum within the tree. Pruning out current-season shoots infected with fire blight is also important, because they can be colonized and serve as an inoculum source during the same growing season.

2. Any practice that helps to maintain trees in a healthy vigorous condition is important for controlling the canker phase of the disease. Cankers generally develop only on stressed or weakened trees. Prune trees annually and maintain a balanced fertility program based on soil and foliar nutrient analysis.
3. The use of fungicides combined with good sanitation is beneficial for controlling the fruit rot phase of the disease. For the most current fungicide recommendations, refer to the Commercial Tree Fruit Spray Guide* (<http://www.extension.iastate.edu/Publications/PM1282.pdf>). Home growers should follow recommendations provided in the “Home, Yard and Garden Pest Guide” (University of Illinois Extension Bulletin C139)*.

*These publications are available from the University of Illinois, Ag Services, P345, 1917 S. Wright St., Champaign, IL 61820 (1-800-345-6087).