



## BITTER ROT OF APPLE

Bitter rot, caused by *Colletotrichum gloeosporioides* and *C. acutatum*, is an important summer rot disease of apples and pears in Illinois and other apple and pear growing areas. *Glomerella cingulata* is the sexual stage of *C. gloeosporioides*. *Colletotrichum* spp. also cause a leaf spot and canker. More than 50% of fruit caused by *Colletotrichum* spp. has been observed on some cultivars in some orchards in Illinois.

### Symptoms

Fruit infections can occur soon after bloom. Fruit rot symptoms differ, depending on whether infection is initiated by ascospores from the sexual stage (*Glomerella cingulata*) or conidia of *C. gloeosporioides* and *C. acutatum*. Initial symptoms produced by either strain are similar.

The rot begins as a small, light brown, circular lesion. On mature fruit, lesions may be surrounded by red halos. Lesions caused by *C. gloeosporioides* and *C. acutatum* remain circular and become sunken as they enlarge (Figure 1). When lesions reach about one inch (25 mm) in diameter, fruiting bodies of the fungus appear near the center of the lesion. Conidia are produced in acervuli, which occur in concentric circles around the point of infection (Figure 2). Acervuli are sparse on some lesions and very dense on others. Under moist, humid conditions, the spore masses appear creamy and are salmon to pink.

Lesions initiated by ascospores of *G. cingulata* are usually not sunken and are often darker brown than those caused by *C. gloeosporioides* and *C.*



Figure 1. Bitter rot of apples in Illinois.

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Figure 2. Lesions and fruiting bodies of the pathogen of bitter rot of apple.

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*acutatum*. Acervuli are widely scattered over the surface, and perithecia (sexual reproduction bodies) are found in dark brown to black clumps scattered on the surface of lesions.

Lesions of bitter rot extend in a cone shape toward the core. In cross section, the lesion appears V-shaped (Figure 3). This is a reliable characteristic that can be used to distinguish bitter rot from white rot and black rot. The rotten area is brown but much firmer than areas affected by white rot. The number of lesions per fruit may vary from one to many. Infected fruit mummify, and some may remain attached to the tree through the winter.

Leaf spots caused by *G. cingulata* begin as small purple flecks that enlarge to irregular necrotic areas 1/8 to 1/2 inch in diameter. Severely affected leaves turn yellow and abscise. Bitter rot cankers are rare in the eastern United States. Cankers are oval, sunken, and often marked with zones or concentric rings, like target.

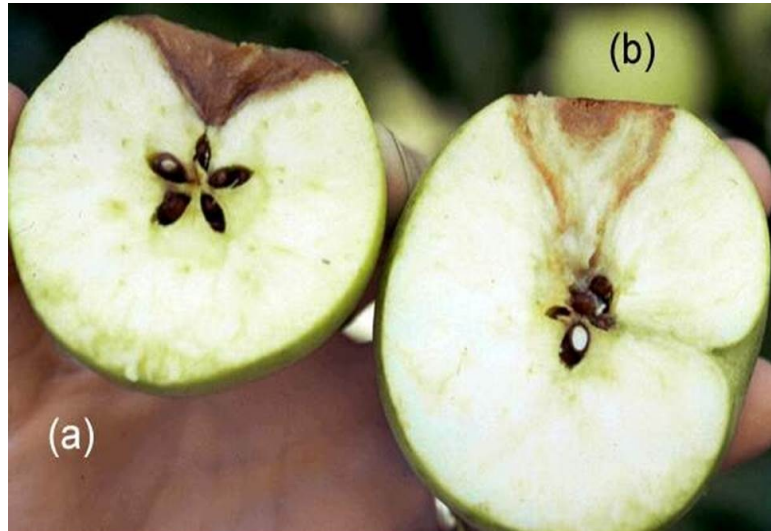


Figure 3. Apple fruit rots; left (a), bitter rot; right (b), white rot.

The bitter rot fungi survive the winter in dead wood and mummified fruit that remain on the tree. Other inoculum sources include stems of fruit that were torn from them at harvest or fruit mummified by chemical thinners. 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 primarily by rain. Ascospores are released by rain and are airborne. Fruit are susceptible from three weeks after petal fall until harvest. Temperature of 80 to 90°F are most favorable for disease development. Epidemics occur during prolonged periods of wet warm weather. Fruit infection can occur anytime (from soon after petal fall through harvest), but most infection occurs in the latter half of the season. Because of the large number of conidia produced in lesions on fruit and the rapid disease cycle, spread of the disease within the orchard can be very rapid.

## Disease Management

Bitter rot is management by cultural practices and fungicide applications. Removing mummified fruit, dead wood and fire-blighted twigs is important to help control the disease. Removing diseased fruit from the tree during the growing season reduces the spread of the disease. Fungicides applied from first cover until harvest on a 10- to 14-day schedule are effective if a good sanitation program is followed. If periods of warm, wet weather occur, it is imperative to spray more frequently than every 14 days. Although apple cultivars do not vary widely in their susceptibility, the disease is often more severe on cultivars 'Empire', 'Freedom', 'Golden Delicious', 'Fuji', 'Granny Smith', and 'Arkansas Black'.