



Fruit Diseases of Apple

Nicole W. Gauthier

Extension Plant Pathologist

IMPORTANCE

Apple fruit diseases can cause significant losses in yield and quality. Often, these diseases go unnoticed until just prior to harvest, during harvest, or after fruit has been stored. Although there are no curative treatments for infected fruit, many diseases can be prevented with cultural practices and (optional) fungicides. Accurate diagnosis, however, is critical to determine the best management practices and to prevent future losses.

Following is an overview of the various fruit diseases that occur on apple in Kentucky. Bitter rot, black rot, and white rot cause the most serious damage, while other diseases, such as apple scab, cedar-quince rust, powdery mildew, and sooty blotch/flyspeck, are less frequent and less damaging.

PRIMARY FRUIT ROTS

Bitter Rot (*Colletotrichum acutatum* complex, *C. gloeosporioides* complex)

Bitter rot infections produce sunken, circular brown spots (FIGURE 1) that may be surrounded by a red halo. As lesions expand, spores (conidia) or spore-bearing structures (acervuli) appear in concentric circles (FIGURES 1 & 2). The most common forms of bitter rot (caused by species in the *C. acutatum* complex) develop exuding spore masses that may take on a slight orange or pink color. Fruit decay extends from the outer skin into the flesh to form a cone-shaped rot (FIGURE 3). Infections can occur as early as bloom or petal fall, but symptom development may be delayed until later in the season. In Kentucky, bitter rot symptoms can occur as early as mid-June and as late as harvest/post-harvest.

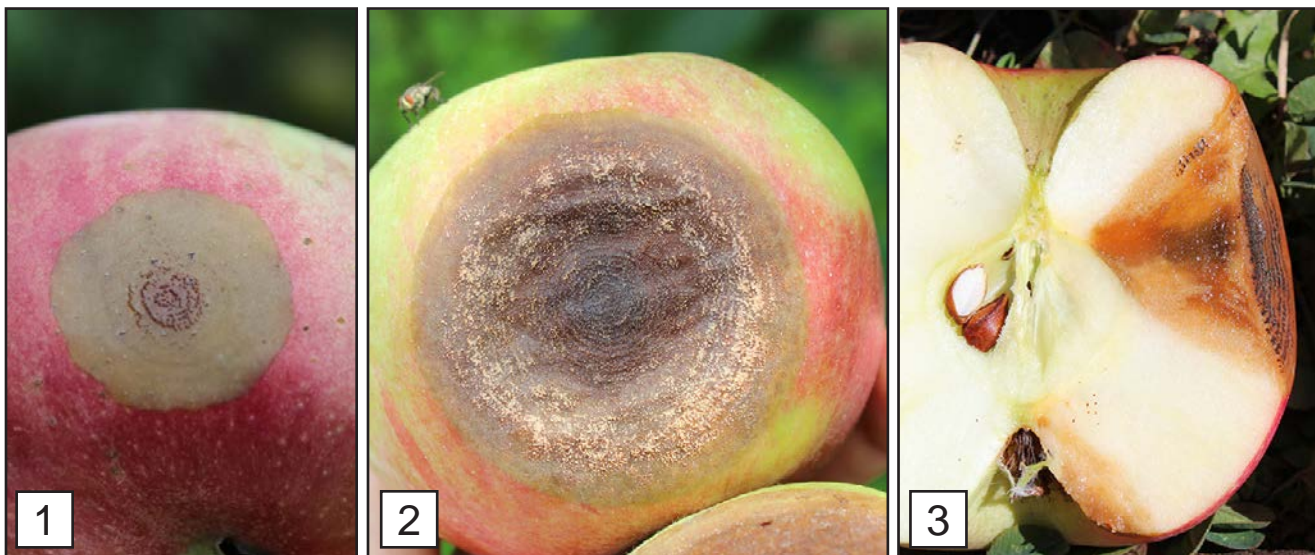


FIGURE 1. INITIAL BITTER ROT LESIONS ARE SMALL, CIRCULAR, AND TAN TO BROWN IN COLOR; FUNGAL FRUITING STRUCTURES MAY BE PRESENT IN LESION CENTERS.

FIGURE 2. ADVANCED BITTER ROT LESIONS ARE SUNKEN AND MAY INCLUDE ORANGE- TO PINK-COLORED SPORE MASSES ARRANGED IN CONCENTRIC RINGS.

FIGURE 3. DECAY FROM BITTER ROT DISEASE EXTENDS TOWARD APPLE CORES IN A V-SHAPE.

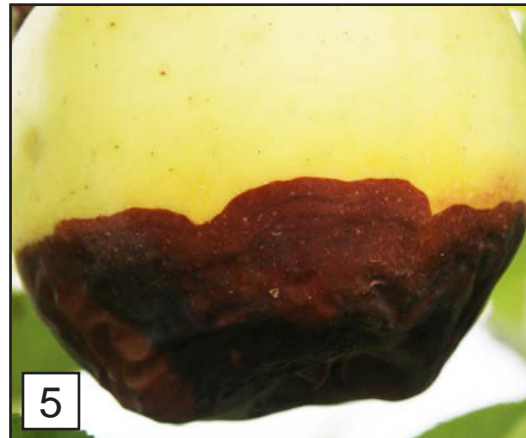
Black Rot (*Botryosphaeria obtusa*)

Black rot fruit infections usually develop in the blossom (calyx) end of fruit. As decay expands, it is often characterized by a series of bands alternating from black to brown; fungal fruiting structures (pycnidia) appear as black specks scattered over decayed fruit surfaces (FIGURE 4). As decay progresses, fruit lesions darken (FIGURE 5) but remain firm and not sunken. Eventually, rotted fruits dry up and shrivel. Early infections may lead to mummified fruit, sometimes hanging on trees until the following season (FIGURE 6). Foliar symptoms (frog-eye leaf spot) may also develop if the fungus has become established in orchards. Black rot is most damaging as a canker disease that causes girdling lesions in scaffold branches. Sporulation from these cankers initiates fruit infections each season.

FIGURE 4. BLACK ROT DEVELOPS AT THE CALYX END OF FRUIT; LESIONS ARE CHARACTERIZED BY ALTERNATING AREAS OF BLACK AND BROWN. NOTE: RAISED BLACK SPECKS ARE PYCNIDIA.

FIGURE 5. LESIONS DARKEN AS DECAY PROGRESSES.

FIGURE 6. ONCE DECAY ENCOMPASSES ENTIRE FRUIT, APPLES BECOME DRIED-UP MUMMIES THAT MAY REMAIN WITHIN THE CANOPY.



White Rot (*Botryosphaeria dothidea*)

White rot, also referred to as *Botryosphaeria* rot or bot rot, first appears as sunken, circular brown or black spots, often with a reddish or dark halo (FIGURE 7). Scattered fungal fruiting structures (pycnidia) may appear on infected surfaces. As decay expands, rotted areas extend into the flesh towards the core in a cylinder shape (FIGURE 8). White rot causes a soft, watery decay that sometimes results in fruit being referred to as a “bag of applesauce” (FIGURE 9). The white rot fungus also causes a canker disease that girdles branches and serves as a source for infection each season. White rot disease is more common in hot climates, including southwestern Kentucky.

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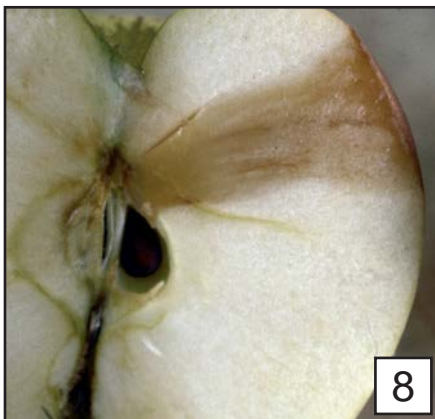


FIGURE 7. INITIAL LESIONS OF WHITE ROT ARE CIRCULAR AND SUNKEN.

FIGURE 8. DECAY EXTENDS INTO THE FLESH IN A CYLINDER-SHAPE

FIGURE 9. APPLES IN ADVANCED STAGES OF WHITE ROT ARE SOFT AND WATERY; FRUIT ARE OFTEN REFERRED TO AS “BAGS OF APPLESAUCE.”

TABLE 1. COMPARISON OF THE CHARACTERISTICS OF THE THREE PRIMARY APPLE FRUIT ROT DISEASES IN KENTUCKY.

Disease	Distinguishing symptoms & signs on fruit	Comparison of infection & symptom development		
		Plant part	Sporulation/ Infection	Symptoms appear
Bitter Rot	Sunken, circular, brown spots with reddish halo; concentric circles of black fungal structures or exuding orange-to-pink spore masses; cone-shaped rot extends to the core.	Fruit	60° to 80°F, but as low as 50°F. Infection near time of petal fall, but possible at bloom if spring weather is warm.	As early as 6 to 8 weeks after petal fall (mid-June), continuing until harvest; most common fruit rot in Kentucky.
Black Rot	Alternating concentric rings of black and brown; black fungal structures; not sunken; often on the calyx end (bottom) of fruit.	Leaf	60° to 80°F	1 to 3 weeks after petal fall.
		Sepals	68° to 75°F	After bloom (early- to mid-season), spreads from sepal to fruit (mid- to late-season).
		Fruit	68° to 75°F Early season infections may occur if spring weather is warm.	4 to 6 wks before harvest
White Rot	Sunken, roughly circular spots early; decay extends to the core; rot becomes soft and watery.	Fruit	80° to 90°F Early season infections occur in Southeastern U.S., but often late-season in Kentucky.	4 to 6 weeks before harvest, especially in hotter regions

OTHER FRUIT DISEASES

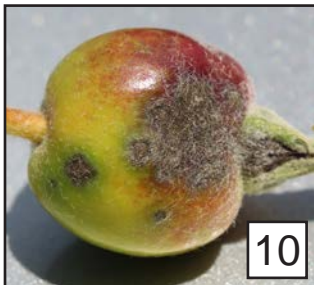


FIGURE 10. INITIALLY, APPLE SCAB LESIONS ARE OLIVE-GREEN TO BROWN WITH A VELVETY APPEARANCE.

FIGURE 11. LESIONS BECOME DARK BROWN TO BLACK WITH A SCABBY SURFACE.



Apple Scab (*Venturia inaequalis*)

Olive-green to brown lesions begin as velvet-like spots with indefinite to feathery margins (FIGURE 10). Older lesions turn dark brown to black, develop a scabby appearance, and frequently become cracked as fruit enlarge (FIGURE 11). If infections occur on young fruit, uneven growth near “scabs” may cause fruit to become severely deformed. Heavily infected fruit may drop prematurely. Pin point scab (rough, black, circular spots) may develop in storage as a result of late season infection.

Powdery Mildew (*Podosphaera leucotricha*)

Early infections result in net-like russetting (cork cells) of fruit surfaces as apples mature (FIGURE 12). Infected fruit may also become distorted and/or dwarfed. Powdery mildew reduces both apple yield and quality.



FIGURE 12. POWDERY MILDEW INFECTIONS CREATE NET-LIKE CORKY AREAS ON FRUIT SURFACES.



Rust (*Gymnosporangium juniperi-virginianae*, *G. clavipes*, *G. globosum*)

Rust lesions begin as raised yellow to orange spots. Symptoms progress to brown, and severely affected fruit may become misshapen (FIGURE 13). Fruit flesh underneath surface lesions dies and becomes brown and spongy, often extending to the core. Infections usually develop on the calyx end of fruit. Typical fungal structures (pycnia and aecia) develop on leaves, but they rarely develop on fruit (FIGURE 14), which may make diagnosis more difficult. Rust diseases are more common and prominent on leaves.

FIGURE 13. RUST BEGINS AS YELLOW SPOTS ON CALYX ENDS OF FRUIT (RIGHT). ADVANCED SYMPTOMS INCLUDE BROWNING OF TISSUE; FRUIT DISTORTION MAY OCCUR (LEFT).

FIGURE 14. RUST FUNGI MAY PRODUCE FRUITING STRUCTURES ON FRUIT.

Sooty Blotch and Flyspeck (*Geastrumia polystigmatis*, *Zygothiala jamaicensis*)

These two separate diseases often occur together on fruit surfaces during summer and autumn (FIGURE 15). Sooty blotch causes black-brown to olive-colored irregular blotches. Fruiting structures (pycnidia) appear in darker spots. Flyspeck symptoms appear as black, shiny dots grouped in clusters; the specks are fungal structures (pseudothecia). Both diseases are superficial and restricted to fruit surfaces. While fruit flesh is not affected, these diseases reduce fruit quality and market value.

FIGURE 15. SOOTY BLOTCH (IRREGULAR BLOTCHES) AND FLY SPECK (TINY DOTS) OFTEN OCCUR TOGETHER; ALTHOUGH SUPERFICIAL, THESE DISEASES RESULT IN REDUCED FRUIT QUALITY.



ADDITIONAL RESOURCES

Disease Management Information

- Backyard Apple Disease, Pest, and Cultural Practices Calendar (PPFS-FR-T-21)
<https://plantpathology.ca.uky.edu/files/ppfs-fr-t-21.pdf>
- Commercial Apple Fungicide Schedule Worksheet (PPFS-FR-T-19)
<https://plantpathology.ca.uky.edu/files/ppfs-fr-t-19.pdf>
- Commercial Fruit Pest Management Guide (ID-232)
<https://plantpathology.ca.uky.edu/files/id-232.pdf>
- Effectiveness of Apple Disease Management Fungicides (PPFS-FR-T-15)
<https://plantpathology.ca.uky.edu/files/ppfs-fr-t-15.pdf>
- Fruit, Orchard, and Vineyard Sanitation (PPFS-GEN-05)
<https://plantpathology.ca.uky.edu/files/ppfs-gen-05.pdf>
- Home Fruit Disease Management: Organic and Sustainable Approaches to Small Scale and Home Fruit Apple & Pear Production (Video)
https://www.youtube.com/watch?v=_8zuFzyC0V0
- Midwest Tree Fruit Pest Management Handbook (ID-93)
<http://www2.ca.uky.edu/agcomm/pubs/id/id93/id93.htm>
- Prediction Models for Plant Diseases of Fruit in Kentucky Counties (PPFS-FR-T-07)
<https://plantpathology.ca.uky.edu/files/ppfs-fr-t-07.pdf>

Disease Information

- Apple Rust Diseases (PPFS-FR-T-05)
<https://plantpathology.ca.uky.edu/files/ppfs-fr-t-05.pdf>
- Apple Scab (PPFS-FR-T-13)
<https://plantpathology.ca.uky.edu/files/ppfs-fr-t-13.pdf>
- Bitter Rot of Apple (PPFS-FR-T-24)
<https://plantpathology.ca.uky.edu/files/ppfs-fr-t-24.pdf>
- Frogeye Leaf Spot, Black Rot, and Canker of Apple (PPFS-FR-T-03)
<https://plantpathology.ca.uky.edu/files/ppfs-fr-t-03.pdf>
- IPM Scouting Guide for Common Problems of Apple in in Kentucky (ID-219)
<http://www2.ca.uky.edu/agcomm/pubs/ID/ID219/ID219.pdf>
- IPM Scouting Guide for Common Problems of Apple in Kentucky (ID-219 mobile website)
<http://applescout.ca.uky.edu/>
- Rust of Apple (Video)
<https://www.youtube.com/watch?v=Y9-uooG3HD4>

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Revised from the original fact sheet, *Apple Fruit Diseases Appearing at Harvest* by John Hartman

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