

Black Rot and Frogeye Leaf Spot of Apple

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Black rot and frogeye leaf spot are phases of a widespread and damaging disease of apple and crabapple. The fruit rot phase is called black rot and on the leaf it is called frogeye leaf spot. The disease can result in losses from (1) a rotting of fruit before harvest and in storage, (2) a weakening of the tree from defoliation, and (3) a blighting and dieback of twigs and limbs caused by girdling cankers. The premature dropping of infected leaves can result in small, poor-quality fruit and reduces crop yield the following year. All apple varieties appear to be equally susceptible to fruit rot. Jonathan and Winesap appear to have the greatest susceptibility to leaf infection.

Symptoms

Fruit

The disease usually starts at the calyx end of the fruit. The fungus usually enters the fruit through wounds caused by insects, hail, growth cracks, or an open calyx tube. At first, a light brown spot forms on the fruit. Usually only one spot occurs per fruit. With time, the spots enlarge and commonly develop a series of brown and black con-

centric bands or rings. The rotted fruit finally turns black. The decayed tissue remains firm to leathery, and holds its original shape until the entire fruit is rotted. The completely decayed fruit finally dries and shrivels into a wrinkled black "mummy," which may remain on the tree a year or longer. Black, pimple-like fruiting bodies (pycnidia) of the causal fungus appear on the surface of rotted fruit. In cold storage, the flesh of black rot-infected fruits remains firm, in contrast to several other apple rots.

Leaves

Starting at petal-fall or somewhat later, small, purple specks appear on infected leaves. These specks enlarge to form spots 1/8 to 1/4 inch in diameter. The round to irregularly lobed spots develop a light brown-to-gray center surrounded by one or more dark-brown concentric rings and a purple margin giving it a "frogeye" appearance. Black pycnidia, like those that appear on rotted fruit, may develop on the upper surface in the centers of the older leaf spots. These pycnidia help to distinguish frogeye leaf spots from similar spots caused by spray injury.



Figure 1. Golden Delicious fruit with black rot on calyx end.



Figure 2. Frogeye leaf spot on apple leaf.

Twigs, Limbs, and Trunks

Small, slightly sunken, reddish-brown areas develop in the bark. These areas slowly enlarge and darken to form cankers. Cankers may continue to expand a little each year, and may extend down the limb for 3 feet or more. These areas remain somewhat sunken, except for the slightly raised and lobed margin.

Cankers may appear as a superficial roughening of the bark; or the bark may be killed and conspicuously cracked, especially at the margins. In recently killed areas, the bark is firmly attached to the wood; but after a year or so, it cracks and falls away and can be easily removed from the wood. Black pimple-like pycnidia and another very similar fungal fruiting structure (perithecium) are usually abundant in older cankers.



Figure 3. Black rot canker on an apple limb.

Causal Organism and Disease Cycle

Black rot and frogeye leaf spot are caused by the fungus, *Botryosphaeria obtusa*. The fungus overwinters in cankers, mummified fruits, and the bark of dead wood. In the spring, the black fungal fruiting bodies (pycnidia and perithecia) release conidia and ascospores, respectively. These two types of spores spread the disease to healthy leaves, fruit, and wood. The heaviest discharge of spores occurs around blossom time, but the production of conidia may continue during wet periods throughout the summer. The conidia can remain viable for at least one year.

Leaf infection usually occurs during the petal-fall period. Conidia become attached to the leaf and may germinate in a film of moisture within 5 or 6 hours. After germination, the fungus penetrates the leaf through natural openings in the under surface or through insect, hail, or other wounds. Spore germination and infection are most rapid at 75 to 80 degrees F.

Fruit infection can occur as early as petal fall; however, symptoms are usually not visible until mid- to late-summer as the apple approaches maturity.

Control

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

1. Sanitation is critical for effective control. 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 critical 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. Cankers generally develop rapidly on winter-injured trees.
3. The use of fungicides combined with good sanitation is beneficial for controlling the fruit rot phase of the disease. Fungicides are not effective for controlling the canker phase of the disease on weakened trees. For the most current fungicide recommendations, commercial growers are referred to Bulletin 506-A2, *Midwest Commercial Tree Fruit Spray Guide*, and backyard growers are referred to Bulletin 780, *Controlling Diseases and Insects in Home Fruit Plantings*. Homeowners are encouraged to emphasize use of the previously described cultural practices in order to reduce or eliminate the need for fungicide use. These bulletins can be obtained from your county Extension educator or the Extension Publications Office, The Ohio State University, 216 Kottman Hall, 2021 Coffey Road, Columbus, OH 43210-1044.

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