



## BLACK ROT OF APPLE

Black rot of fruit, caused by the fungus *Botryosphaeria obtusa*, is a common disease of apple. The fungus also causes a leaf spot called frog-eye leaf spot and branch cankers. In the United States, it is more severe in the Southeast, but it occurs throughout the eastern apple-growing area. *B. obtusa* is pathogenic mainly to apple, pear, and quince. As a secondary invader of dead and weakened tissue, the fungus attacks many woody plants

Disease losses result from (1) the fruit rotting before harvest and in storage, (2) a weakening of the tree from defoliation, and (3) a blighting and dieback of twigs and limbs by girdling cankers. The premature dropping of infected leaves results in small, poor-quality fruit and reduces the crop yield the following year.

### Symptoms

#### FRUIT

Infection of fruit usually starts at blossom end. Sepal infection is the most common form of early-season infection. After petal fall, infections on young fruit begin as reddish flecks, which develop into purple pimples (Figure 1). These lesions do not enlarge rapidly until the fruit begin to mature. As the lesions enlarge, they form a series of concentric bands alternating from black to brown (Figure 2). The rotted fruit finally turns black. The decayed tissue remains firm to somewhat leathery, and it holds its original shape until the entire fruit is rotted. The completely decayed apple finally dries and shrivels into a wrinkled, black mummy (Figure 3). Such fruit commonly does not drop but hangs on the tree for a year or longer.

Black, pimple-like fruiting bodies (pycnidia) of the causal fungus appear on the surface of a rotted fruit (Figure 2). In cold storage, the flesh of fruit infected with black rot remains firm, in contrast to several other apple rots.

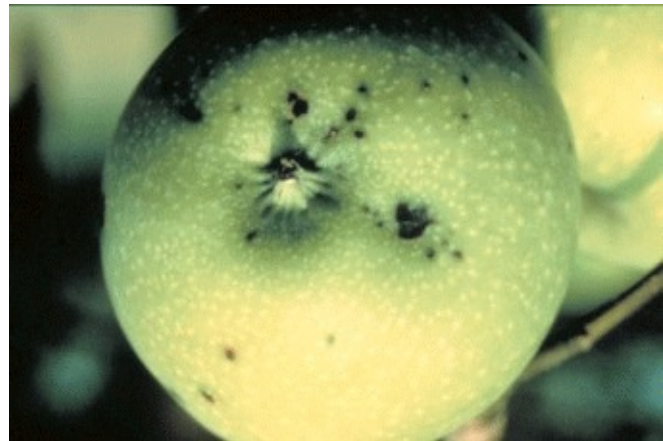


Figure 1. Pimplelike lesions on a young apple fruit.



Figure 2. Black rot lesion on an apple fruit. Note alternating black and brown concentric rings and pycnidia.

For further information concerning diseases of fruit trees, contact **Mohammad Babadoost**, Extension Specialist in Fruit and Vegetable Diseases, Department of Crop Sciences, University of Illinois at Urbana.

## LEAVES

Leaf symptoms usually first appear 1 to 3 weeks after petal fall. Infections begin as small purple flecks that enlarge to about 1/8 to 1/4 inch. The margins of the lesions remain purple and the centers become tan to brown giving the lesions a “frog-eye” appearance (Figures 3 and 4). Black pycnidia, like those that appear on the rotted fruit, may develop on the upper leaf surface in the center of older spots (Figure 4B).

If frog-eye spots are numerous, leaf yellowing and early defoliation may occur, especially on very susceptible varieties such as Jonathan. Frog-eye leaf spot can be serious where the weather is warm, 75° to 80°F (24° to 27°C), and rainy during and immediately following the blossom period.

## TWIGS, LIMBS, AND TRUNK

Small areas that are slightly sunken and reddish-brown develop in the bark of old, stressed, or injured trees. The cankers slowly enlarge and darken. Some cankers remain small, perhaps 1 to 2 inches long. These usually die out during winter. The larger cankers continue to expand a little each year and may extend on the limbs or trunk for a yard or more. These areas remain somewhat sunken, except for the slightly raised and lobed margins.

The canker 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 or can be easily removed from the wood.

The black, pimple-like pycnidia and the very similar perithecia of the sexual stage are usually abundant in older cankers (Figure 5). Infected branches are sometimes weakened enough to break with heavy crop loads, and sometimes branches are girdled and killed.

Sunscauld, limb rubs, pruning, hail (or other injuries), and fire blight cankers are commonly invaded by the black rot fungus. The cankers show the definite, pimple-like pycnidia and perithecia, as well as the somewhat sunken bark characteristic of black rot.



Figure 3. Black rot mummy and apple leaf showing frog-eye leaf spot.

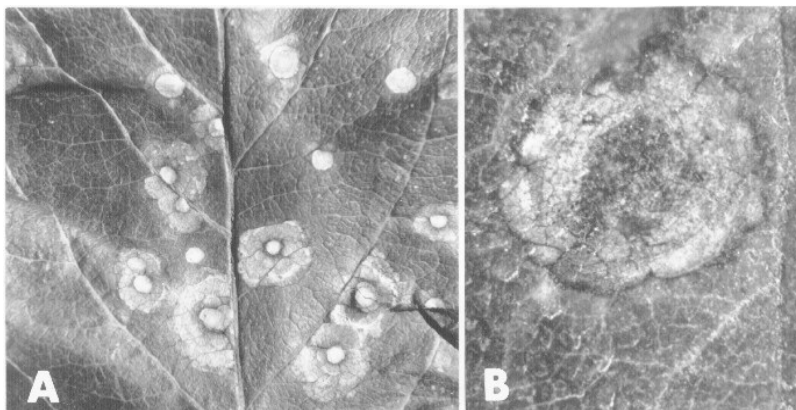
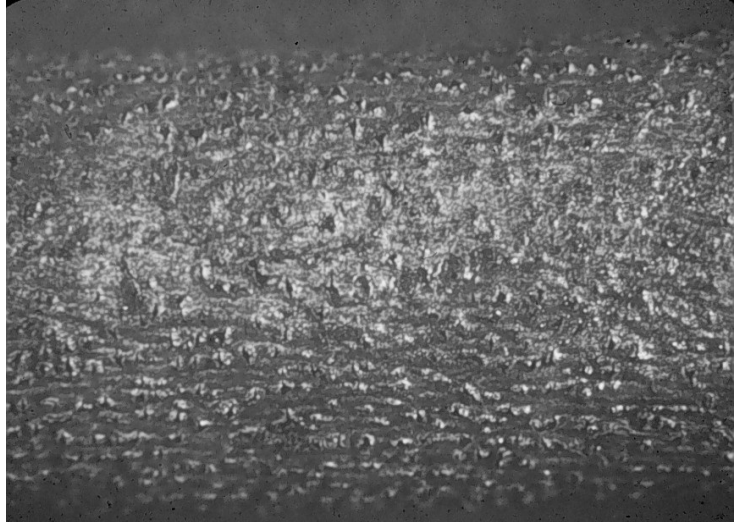


Figure 4. Frog-eye leaf spot on apple leaf. (R) Closeup of single lesion showing zoned appearance. Black specks are pycnidia.

## Disease Cycle

The black-rot fungus overwinters in apple tree cankers, mummified apples, and the bark on dead wood of numerous kinds of woody plants. In the spring, the black pycnidia and perithecia release their respective conidia and ascospores. These spread the disease to healthy leaves, fruit, and wood. The heaviest discharge of conidia may continue during wet periods throughout the summer. Ascospores are generally more common during the spring than in summer. Sepal infection can occur anytime after bud break, and fruit infection can occur anytime during the growing season.

When a pycnidium is wet, a short gelatinous coil containing conidia is pushed out above the bark or fruit surface. The spores are disseminated by wind-blown mist, splashing rain drops, and insects. In the late spring and early summer, cone-shaped areas of spotted leaves are often seen beneath twigs, limbs, and mummified fruit infected with black rot.



*Figure 5. Closeup of black-rot canker on limb, showing pimplelike pycnidia and perithecia.*

Leaf infection usually develops shortly after petal-fall. The conidia become attached and may germinate in a film of moisture within 5 or 6 hours - penetrating through the stomata or through wounds caused by insects, hail, spray injury, and other sources.

The incubation period, from infection to the appearance of external symptoms, is about 2 to 4 days for the frog-eye leaf stage, from 2 to 9 days for bark cankers, and about 2 days for the fruit rot. Fruit infection is not usually apparent until midsummer as the apples approach maturity, and the infection is worst following severe leaf spotting. The blossom end of the fruit is frequently infected first, but symptoms do not develop until the sugar content of the developing fruit begins to rise.

The optimum temperature for leaf infection is 80°F (27°C); at this temperature, 4.5 and 13 hours of leaf wetting are necessary for light and severe infection, respectively. More than 24 hours of wetting are required for infection to occur at 50°F (10°C) or less. The temperature for fruit infection ranges from 68° to 75°F (20° to 24°C); approximately 9 hours of wetting are required at these temperatures for infection to occur.

## Disease Management

The best way to manage black rot of apple is to keep trees in a good state of vigor through annual pruning, watering during summer droughts, and other beneficial cultural practices. Devitalized trees develop more twig, limb, and trunk cankers than vigorous ones. Overall, removing dead woods, mummies, and cankers from the trees is important to help to control the disease.

**Good orchard sanitation is the primary control measure.** To reduce the carryover of the fungus, all mummified fruit and all dead, cankered, or infected twigs and limbs should be **pruned out, removed**

**from the orchard, and destroyed** during the winter. A **single** dead twig, 1/4 inch in diameter, can have 10 or more pycnidia, with each pycnidium producing approximately 1,500 spores. Prunings should **not** be chopped up and left in the orchard, because the black-rot fungus will rapidly colonize the dead bark and will create inoculum in future years. Do **not** leave pruning stubs. These die back and are also a source of black rot and Botryosphaeria rot inoculum. The ends of broken branches should not be left jagged. Either cut them back to a lateral branch or remove the entire branch. Weakened twigs should be pruned to where there is healthy, vigorous wood. Destroy old, weak, and diseased trees. Dead and diseased wood in superficial limb and trunk cankers should be carefully cleaned out. Disinfect the wood surface with liquid household bleach (2 part liquid household bleach to 4 parts of water), then coat the cut with tree-wound dressing.

**Follow a suggested fungicide spray program.** Commercial orchardists should follow the spray schedule outlined in the annual Midwest Fruit Pest Management Guide (<https://ag.purdue.edu/hla/Hort/Documents/ID-465.pdf>). Home fruit growers should follow the recommendation in the “Pest Management for the Home Landscape (C1391-15)” published by the University of Illinois.

**Handle the fruit very carefully while picking, sorting, and packing to avoid bruises and cuts.** All wormy, injured, or infected fruit should be sorted out. The remaining fruit should be refrigerated promptly at 33°F (0-1°C). Black rot progresses very slowly at temperatures below 50°F (10°C).