Black Rot and Frogeye Leaf Spot of Apple

The black rot and frogeye leaf spot fungus, *Botryosphaeria obtusa*, covers a wide geographical range, attacking the fruit, leaves, and bark of apple trees and other pomaceous plants. The fungus is a vigorous saprophyte and may colonize the dead tissue of many other hosts. However, its parasitic activities are confined mainly to pome fruits. Photo by K. Peter.

Fruit rot usually appears at the calyx end of the fruit. It can originate at any wound that penetrates the epidermis, including insect injuries. There is usually one spot per fruit, a characteristic that distinguishes black rot from bitter rot. Photo by K. Peter.

The disease may occur in three forms: a fruit rot, leaf spot, and limb canker on apple trees, and a fruit rot on pear and quince. In northern regions, losses from black rot result principally from the cankering of large limbs and dieback of twigs and branches. Losses from fruit rot and defoliation resulting from leaf spot can be considerable, especially in warm, humid areas of southern and central fruit-growing regions of the eastern United States.

Symptoms

The first signs of black rot are small, purple spots appearing on the upper surfaces of leaves and enlarging into circles 1/8 to ¼ inch in diameter. Leaf margins remain purple, while the centers turn brown, tan, or yellowish brown. After a few weeks, secondary enlargement of leaf spots occurs. Because this is not a uniform expansion, the spots become irregular or lobed in shape, at which time they assume a characteristic “frog eye” appearance: a purple margin with a zone of dark brown surrounding the tan-to-gray center. Small, black pycnidia (pimplelike fruiting bodies of the fungus) may appear in the centers.

Infected areas of branches and limbs are reddish brown and are sunken slightly below the level of surrounding healthy bark. These cankers may expand each year, a few eventually reaching several feet in length. The margins of older cankers are slightly raised and lobed, and the bark within their centers usually turns light-colored, loosens, and scales off raggedly. This characteristic is not confined to black rot cankers, so it is not a good diagnostic symptom. Pycnidia form on dead wood of the cankered areas.

Fruit rot

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Initially, the infected area becomes brown and may not change in color as it increases in size, or it may turn black. As the rotted area increases, often a series of concentric bands form, darker bands of mahogany brown to black alternating with brown bands. The flesh of the decayed area remains firm and leathery. Eventually, the apple completely decays, dries, and shrivels into a mummy. Pycnidia containing spores of the black rot fungus appear on the surface of rotted tissue.
Disease cycle

The fungus overwinters in fruiting bodies (pycnidia and perithecia) on dead bark, dead twigs, and mummified fruit. It can invade almost any dead, woody tissue and is frequently found in tissue killed by fire blight. Early leaf infections often are visible as a cone-shaped area on the tree, with a dead twig or mummified fruit at the apex.

In the spring, black pycnidia and perithecia release conidia and ascospores, respectively. Conidia may continue to be produced during wet periods throughout the summer and may remain viable for long periods. When wet, the pycnidium produces a gelatinous coil containing thousands of spores. Disseminated by splashing rains, wind, and insects these spores can infect leaves, the calyces of blossoms, tiny fruit, and wounds in twigs and limbs. Leaf infection develops during petal fall, at which time conidia attach, germinate in a film of moisture within 5 to 6 hours, and penetrate through stomata or wounds. Infections of fruit and wood may not become visible for several weeks.

Initial fruit infections occur during the bloom period but are not usually apparent until midsummer as the apple approaches maturity. Throughout the growing season, infections occur through wounds. Harvest injuries may become infected and the fruit may decay during or after storage, especially if the fruit was harvested during a wet period. Dead fruit spurs or twigs, particularly those killed by fire blight, pruning wounds, winter injuries, and sun scald, are commonly invaded by the black rot fungus.

Disease management

Timing of chemical treatments and cultural control strategies can affect the level of control achieved for black rot. Captan and fungicides containing a strobilurin (FRAC Group 11 Fungicides) as an active ingredient are effective controlling black rot on fruit. Management programs based on sanitation to reduce inoculum levels in the orchard are the primary means of control.

1. Prune out cankers, dead branches, twigs, etc. which serve as inoculum sources and dispose of dead wood. This should be an important component of both current-season and long-range management.
2. Prune and remove cankers at least 15 inches below the basal end; properly dispose of prunings by burial or burning.
3. Remove all mummified fruit.
4. Control fire blight by pruning out infected wood or controlling insect vectors.

Specific chemical recommendations for home gardeners are in Fruit Production for the Home Gardener, and recommendations for commercial growers are in the Penn State Tree Fruit Production Guide.