A3194

Cottonball disease of cranberry

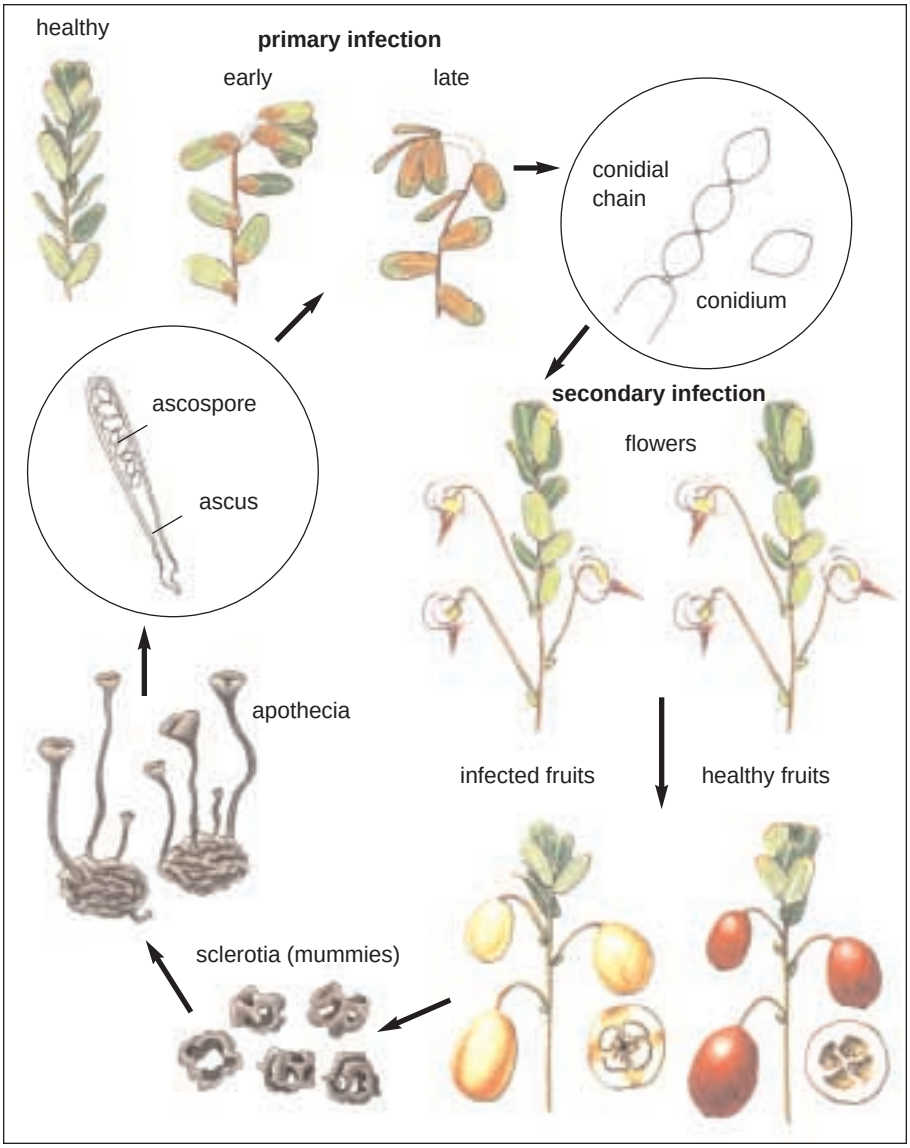
P.S. McMANUS

Cottonball, a disease caused by the fungus *Monilinia oxycocci*, fills berries with a cotton-like fungus and makes them unmarketable. It is an economically important disease on many cranberry marshes in Wisconsin. Typically, 2 to 10% of the fruit in diseased beds is infected; if left unchecked the amount can exceed 40%. Cottonball also occurs in the Pacific Northwest and southeastern Canada, but losses in those areas have generally been minor. For reasons that are not known, the disease has become worse in Wisconsin since the 1970s. During the 1990s, fungicides were applied to about 20% of bearing acreage specifically to control cottonball.

Signs and symptoms

The fungus overwinters in the hard, brown to black, dried-up remains of diseased fruit. These remains are technically termed sclerotia and commonly called mummies (figure 1). The mummies are roughly spherical and about ½ inch in diameter. In the spring, tan or brown mushroom-like structures (about 1 to 2 inches tall) called apothecia grow from the mummies (figure 2). Mummies and apothecia are difficult to spot.

Cottonball disease cycle



When young cranberry shoots become infected, they show "tip blight" symptoms: shriveled shoot tips resemble a shepherd's crook and a tan discoloration spreads from the tip of the shoot down the stem and into leaves (figure 3). To distinguish cottonball tip blight from other shoot diebacks, check the leaves for tan V-shaped or U-shaped lesions centered on the leaf midvein (figure 4). Another indicator is the presence of masses of white, powdery spores (conidia) that appear on diseased shoots just before and during bloom (figures 3 and 5). Cottonball tip blight is often inconspicuous and can be easily overlooked.

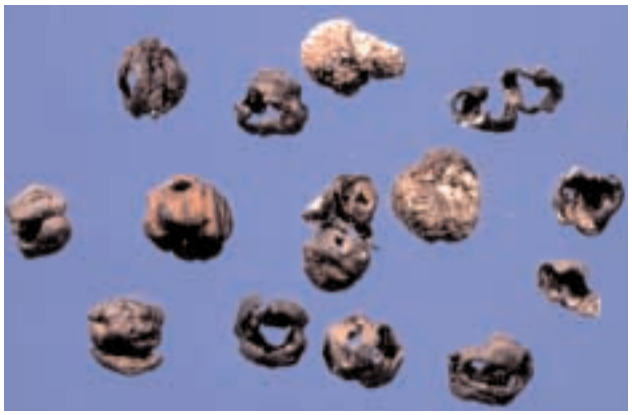


Figure 1. The dried-up remains of infected berries are known as mummies or sclerotia.

Figure 2. Apothecia are the mushroom-shaped structures that grow from mummies in the spring. They eject ascospores that infect new shoots.

Immature diseased berries show no external symptoms, but are filled with the white, cotton-like fungus (figure 6). Healthy berries turn red as they mature; diseased berries may acquire a red blush but are generally yellowish with tan stripes or blotches (figure 7). Diseased fruit are unfit for fresh or processing markets.

Disease cycle

The fungus overwinters in mummies at or near the soil surface. In early spring, wet conditions cause apothecia to germinate from the mummies. These mushroom-like structures eject ascospores—the spores that infect new growth—starting at about budbreak and continuing until just before bloom. Most ascospores are released over a 10- to 14-day period when new shoots are ½ to 1¼ inches long. Infection of shoots (primary infection) probably requires a film of moisture and moderate temperatures, although this has not yet been verified in experiments. The exact sites of fungal penetration on the elongating uprights are not known. About 3 to 4 weeks after primary infection, conidia form on diseased shoots and are carried to flowers by pollinating insects and perhaps by wind. The conidia germinate and grow down into the developing ovary (secondary infection), similar to the way pollen germinates and grows. The fungus fills the fruit seed cavity and eventually grows into the fleshy fruit tissue. By harvest time, mummies develop from 25 to 50% of the diseased fruit; berries that do not have mummies by harvest time decompose by the following spring.

Integrated management

Sanitation and cultural practices

Cottonball-infected fruit and mummies float, and many are removed during harvest. Some growers have found that reflooding beds after harvest is a good way to remove cottonball mummies and other pests. Good drainage is another important tool for limiting spread of this disease. Cottonball tip blight is often most severe in areas that remain wet for prolonged periods, such as along ditches where dense moss is growing and in areas where recently applied sand has remained saturated for several days.

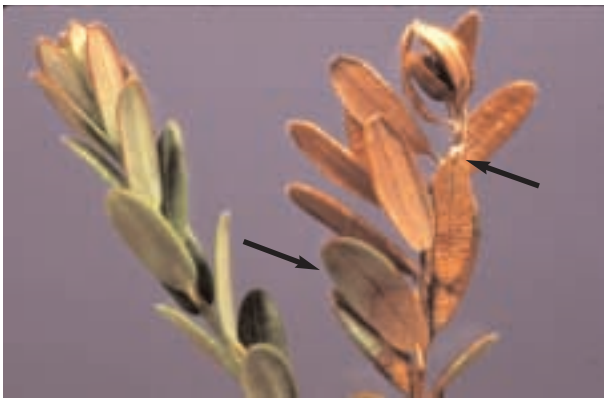


Figure 3. Cottonball tip blight (right). Note the V-shaped lesion on the leaf and powdery growth on the shoot.

Susceptibility of cranberry varieties

Cottonball has been observed in Wisconsin on all the popular varieties, but reports on the relative resistance of these varieties to cottonball have been inconsistent. Under controlled conditions in the greenhouse, flowers of the varieties Ben Lear, Pilgrim, Searles, and Stevens, were equally susceptible to infection. However, in the field, susceptibility to cottonball is complex. It depends on the natural resistance of the variety to both primary and secondary infection, the overlap of bloom and production of conidia on shoots, and environmental factors such as temperature and moisture.

Chemical control and delaying fungicide resistance

Orbit (propiconazole) is the most effective fungicide available for cottonball control. Spray recommendations depend on the previous year's disease pressure.

—Low to moderate disease pressure (fewer than 15% of the berries were infected the previous season): apply Orbit when 10 to 20% of the flowers have opened and again 7 to 10 days later.

—High disease pressure (more than 15% of the berries had cottonball the previous season): apply Orbit when over half the shoots have started to elongate, 7 to 10 days later, and again during bloom as described above.

Experiments have shown that bloom sprays are especially important, and unless disease pressure is high, the shoot elongation sprays appear to be unnecessary. No negative impacts on bees, yield, berry size, or berry color have been noted when Orbit was applied during bloom.

Concerns about fungicide resistance have arisen because Orbit and a related compound have been used extensively to control cottonball for the past several years. Although no evidence of resistance has been found in the field or in the laboratory, the time to implement anti-resistance strategies is before fungicide efficacy is lost. Two approaches are generally recommended to delay the onset of fungicide resistance in plant pathogens: (1) alternate the use of fungicides with different modes of action and (2) reduce the total number of sprays applied per season. Because of the small number of fungicides registered for use on cranberry and their inability to control cottonball, the first option is not currently practical. However, field tests have demonstrated the feasibility of the second option: under low to moderate disease pressure, two sprays during bloom are as effective in reducing cottonball at harvest as two sprays during shoot elongation plus two sprays during bloom.

Figure 4. V-shaped and U-shaped lesions on the midveins of leaves are diagnostic of cottonball disease.

Figure 5. Close-up of powdery spores growing on a diseased shoot.

Figure 6. Infected berries are filled with the cottony white mycelium of the fungus. (Healthy fruit in center.)

Figure 7. In contrast to healthy berries (left), infected berries are typically yellow with tan stripes or blotches, although they may have a red blush.

Recommendations

Research data and the observations of growers and crop consultants are leading to a better understanding of cottonball. Based on this information, the following recommendations should provide cottonball control that will be safe for humans and the environment and also delay the onset of fungicide resistance in populations of *M. oxycocci*.

- Reflood beds after harvest and remove remaining cottonball berries and mummies.
- Consider all varieties susceptible to cottonball. For example, don't expect a newly planted bed of Stevens to remain disease-free if planted next to an infected bed.
- Control moss and avoid having areas of saturated sand in the spring when mummies germinate. Turn off selected sprinkler heads to minimize the period that sand remains wet. Mummies germinate through sand, so you cannot "bury" last year's problem.
- In fields with low disease pressure, skip shoot elongation sprays and spray only during bloom. "Low disease pressure" is a subjective term that will vary among growers. If, based on the previous year's cottonball level, you know you want to spray fungicides but don't think it's bad enough to justify four sprays, then consider it low disease pressure.
- Just before bloom, scout for tip blight. Look especially closely in high-risk areas: along ditches (especially where berries were lifted from the bed during harvest the previous year), and in low-lying wet areas. "Threshold" levels of cottonball tip blight have not been determined, but it is generally hard to find. Therefore, if you easily find tip blight symptoms, bloom sprays would probably be worthwhile.
- Two sprays are permitted during bloom. Be certain that the first one goes on when 10 to 20% of the flowers have opened. The early flowers are the ones most likely to set fruit and therefore are the most important ones to protect.
- To the extent possible, spray according to the developmental stage of each variety, rather than treating early and late varieties at the same time.
- Do not use less than the recommended rate of Orbit. Sterol inhibitor fungicides, including Orbit, generally do not perform well if reduced rates are used. Also, for other plant pathogens, it's been shown that using lower rates of sterol inhibitor fungicides actually promotes the development of fungicide resistance.

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Author: Patricia S. McManus, assistant professor of plant pathology, College of Agricultural and Life Sciences, University of Wisconsin-Madison and University of Wisconsin-Extension, Cooperative Extension. Produced by Cooperative Extension Publishing.

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