CRANBERRY FRUIT ROT PLAYERS IN 2005

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Cranberry fruit rot is caused by a complex of at least 12 and perhaps as many as 15 to 20 different species of fungi in Wisconsin. In 2005 two fungi were especially important: species of *Colletotrichum*, which causes bitter rot, and *Phyllosticta vaccinii*, which causes early rot.

Colletotrichum (bitter rot)

Various species of this fungus have gained importance in Wisconsin in recent years. For example, in a survey of cranberry marshes in central Wisconsin in 1998 through 2000, we rarely encountered it, but since about 2002 it has affected 15 to 40 percent of fruit in some plantings, including Stevens beds. The reasons behind this are not known but may be related to a series of relatively warm winters that allow the pathogen to overwinter at high levels. Bitter rot tends to show up late in the season (mid September or later), but once the rot is detected, the decline in fruit quality is rapid. Beds can look good one week, and have 15% or more rot just a week or so later.

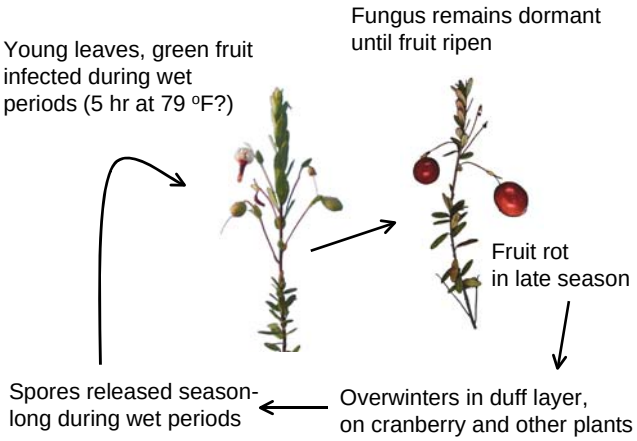

Figure 1. Proposed disease cycle for bitter rot, caused by species of *Colletotrichum.*

Disease cycle for bitter rot. Details of the disease cycle are not well understood, but are proposed in Figure 1 and as follows. The fungus overwinters in the duff layer, and on cranberry vines and other plants. This pathogen is not specific to cranberry, but rather affects many woody plants and weeds. Spores are released starting when shoot growth resumes in the spring and continue to be released season-long during rainy periods. Wind-driven rain and splashing rain spread spores. Young leaves and young, green fruit are most susceptible. Studies have not been done on cranberry, but on apple, species of *Colletotrichum* can infect after five consecutive hours of leaf wetness at 79 ^{o}F. Infection

would take a longer duration of wetness at higher or lower temperatures. Rather than rotting green fruit shortly after infection, the fungus goes dormant or "latent" for several weeks. Then, when fruit begin to ripen, the fungus comes to life again, growing quickly and rotting fruit.

***Phyllosticta vaccinii* (early rot)**

Early rot is a cranberry disease that causes leaf spots, blossom blast, premature leaf drop, and fruit rot. Early rot is caused by the fungus *Phyllosticta vaccinii*. A related fungus, *Phyllosticta elongata*, causes a minor berry speckle symptom and is common in healthy cranberry plants. Early rot is so named because the disease starts rotting fruit relatively early compared to other fungal pathogens (e.g., in August vs. September). By late August, early rot appears on a berry as a soft, watery spot, usually with a distinct margin. The spot is often lighter in color than the healthy tissue surrounding it. Sometimes, but not always, dark concentric rings give the spot a bull's eye appearance.

Historically, early rot has been very important in New Jersey, moderately important in Massachusetts, and rare in Wisconsin. In August and September of 2005, however, early rot was found at four sites on the variety HyRed and in established plantings adjacent to HyRed. It was also detected at one site on vines from an out-of-state breeding program. *P. vaccinii* thrives at temperatures of 84 ^{o}F or greater. The unusually warm summer of 2005 probably favored growth of this fungus and also stressed cranberry plants. Plantings with a sparse canopy or with pockets of poor growth are especially susceptible to early rot, because the temperature within the canopy is high.

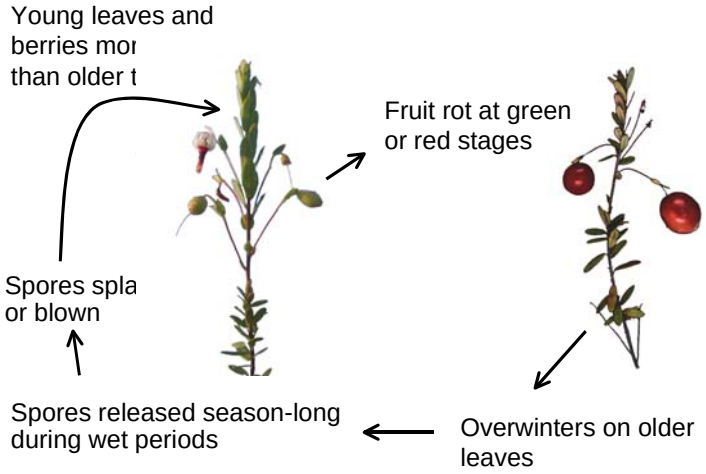

Figure 2. Proposed disease cycle for early rot, caused by *Phyllosticta vaccinii*.

Disease cycle for early rot. Details are not well understood, but a proposed disease cycle is illustrated in Figure 2. *Phyllosticta vaccinii* probably overwinters on living cranberry plants rather than in the duff layer or soil. Spores are released beginning in spring and continuing season-long during wet periods. Wind-driven rain and splashing rain droplets spread spores. Young leaves and berries are more susceptible to infection

than older tissues. Unlike *Colletotrichum*, which undergoes a long latent period, *Phyllosticta vaccinii* starts rotting fruit while they are green and continues until harvest. In addition to cranberry, *Phyllosticta vaccinii* infects blueberry and possibly related plants in the genus *Vaccinium*; however, it is not known to infect weeds common in Wisconsin cranberry beds. Transfer of spores on feet or machinery is possible if vines are wet. However, spread of the disease requires not just movement of spores but also that the plants are susceptible. Therefore, the risk of spreading the disease is probably greatest when there are young, susceptible tissues present. Movement of cranberry vines for propagation can spread the disease among beds on a marsh and over greater distances (e.g., between states).

Control of bitter rot and early rot

Cultural practices

- Since the pathogens that cause bitter rot and early rot overwinter and persist on vines, do not establish plantings with vines from beds with a history of rot problems.
- On hot summer days, vines might benefit from sprinkling to reduce heat stress. It is not known how long vines must remain wet in order for fruit rot pathogens to infect. However, sprinkling for 15- to 20-minute intervals on hot, breezy, sunny days does not provide a long enough period of wetness for most fungi to infect.
- Do not irrigate in the evening, as vines will remain wet for several hours. The prolonged wetness will increase fungal infection.
- Clean vines from beaters and other equipment before moving between beds.
- Wear washable boots if walking in a bed known to have rot problems, and disinfect boots with dilute bleach (1:10 dilution) or other disinfectant before entering other beds.
- Avoid excessive nitrogen fertilization. Nitrogen causes tissues to be succulent and soft, thereby making them more susceptible to infection. Over-fertilization also increases canopy density and causes foliage to stay wet for longer periods.

Chemical control

- Most research on fruit rot control with fungicides has looked at the fruit rot complex rather than individual pathogens such as *Colletotrichum* or *Phyllosticta vaccinii*. Nevertheless, the following practices are effective in the eastern U.S. where fungicides are used every year to manage fruit rot. The available fungicides and relevant comments:

  Bravo: Effective but can be phytotoxic in low spray volume and/or if applied on days when the canopy temperature reaches 90 ^{o}F. Phytotoxicity includes browning of petals and red flecks on fruit. The fruit flecks become almost invisible once the fruit turn red. In some trials Bravo has reduced yields, presumably from burning flowers. Pre-harvest interval of 50 days.

  Mancozeb (e.g., Dithane): Moderately effective; reduces fruit color if applied during bloom or to fruit. Pre-harvest interval of 30 days.

  Abound: Reduced-risk fungicide; inconsistent performance in fruit rot trials. Effective against cottonball, however, and does not appear to be phytotoxic even when applied to flowers. Pre-harvest interval of 3 days.

Copper: Marginally effective at best. Some formulations are accepted by organic certification programs. Exempt from pre-harvest interval.

- Timing of fungicide applications dramatically affects results! Fungicides should be applied during bloom and/or early fruit set stages for best results. The fungi that lead to fruit rot infect when fruit are small and green.
- At a site where early rot is a problem, it might be desirable to protect new, non-bearing vines. If leaf infection is prevented, *Phyllosticta vaccinii* will not be able to produce spores that infect fruit. The only fungicides allowed for application before bloom are some copper compounds (which probably do not provide much benefit) and chlorothalonil (available by 2ee or 24C special labels). Bravo (chlorothalonil), may be applied a maximum of three times per season.