New York State Integrated Pest Management Program
Cornell Cooperative Extension

TREE FRUIT

Brown Rot of Stone and Pome Fruit

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Introduction

Brown rot occurs on all stone fruit worldwide and afflicts blossoms, twigs, and fruit, both pre- and post-harvest. Several closely-related fungal species, collectively known as *Monilinia* spp. cause the disease. In stone fruit, brown rot can lead to complete crop loss if management fails. Although less common on apple, brown rot in the northeastern United States reportedly inflicts losses up to 5% in preharvest fruit in conventionally managed orchards.

Causal Agents

Four species of *Monilinia* can cause brown rot: *M. fructicola, M. fructigena*, *M. polystroma*, and *M. laxa.* In North America, *M. fructicola* and *M. laxa* both have been reported on many stone fruit crops, but only *M. fructicola* has been found on apple. As of 2018, *M. fructigena* (native to Europe) and *M. polystroma* (native to Japan) have not been reported in North America due to quarantine efforts. Differentiation of the four *Monilinia* species is difficult, requiring both observation of the suspected pathogen in the field, in culture, and via DNA analysis.

Symptoms

Fruit rot is the most common symptom of brown rot. The disease initially develops on mature fruit as circular light brown water-soaked spots, often mistaken for wounds. These lesions rapidly expand and darken in color, reducing fruit firmness. Cream-white to buff-colored tufts of fungal mycelia bearing spores may form on the browning flesh (Fig. 1) – sometimes appearing in concentric rings (Fig. 2). As the fungus removes both water and sugar to support growth and spore formation, fruit may mummify post-infection and either remain attached to the tree or fall to the ground. Immature green fruit on the tree may also show rot symptoms during long wetting periods.

Flowers can also be infected during cool wet weather (Fig. 3). In these favorable conditions, all parts of the blossom may rot, and the disease may progress into shoots to form a sunken canker. Blossom and twig blight is particularly common in susceptible varieties of peach, cherry, nectarine and apricot. Highly susceptible varieties may be killed (Fig. 4).

Figure 1. Brown rot on peach fruit showing sporulation at harvest. Photo: K. Cox.

Figure 2. Brown rot of pear fruit with concentric circles of sporulation. Photo: K. Cox.

In fruit post-harvest, brown rot infects when fruit is immature and remains latent until storage. Post-harvest symptoms on stone fruit appear the same as in the orchard. However, in stored apple, typical pre-harvest symptoms may occur (Fig. 5), but 'black apple' symptoms may also develop as the brown-colored rot turns jet black and the fruit shrinks, without visible fungal pustules.

Disease Cycle & Epidemiology (Fig. 6)

Although *Monilinia* spp. can produce apothecia to sexually reproduce, such structures are rare and typically develop on mummified fruit on the orchard floor. Asexual conidia of *Monilinia* spp. are the typical initial sign of brown rot, spreading via wind and rain during the late spring after overwintering in infected stems and mummified fruit that remain attached to the tree. Humid environments promote rapid disease progression. In fruit clusters, infection often spreads to adjacent unaffected fruit as the rot develops (Fig. 7). Wounds on the fruit surface are typically a requirement for infection, caused by growth cracks, bird or insect damage, cracking by rain (for cherry), or inclement weather. Stone and pome fruit with trichomes and firmer flesh are less susceptible to brown rot. Decaying fruit attract vinegar flies (Drosophilids) which may also spread fungal spores to other fruit.

Figure 3. Peach flowers with blossom blight. Photo: K. Cox.

Figure 5. Brown rot on apple lacking sporulation. Photo: K. Cox.

Management

Focus management on sanitation practices that reduce overwintering inoculum: prune out dead wood and blighted twigs and remove mummified fruit from the tree canopy or orchard floor. Should brown rot symptoms appear on apple or pear, contact your local extension office for sampling and pathogen verification.

Cultural Practices

To reduce overwintering inoculum, remove fruit and tissues infected with brown rot from the tree and orchard floor during the summer. When pruning, cut below the sunken cankers and dispose of the infected tissue by burning or burying off site. Also, consider removing any wild Rosaceous trees from your property that may serve as reservoirs for *Monilinia* spp.

Instruct fruit pickers to harvest fruit carefully to prevent wounding, ensure that fruit stems are not left behind on the tree to become infection sites later, and only collect undamaged fruit to minimize inoculum from latent brown rot infections post-harvest.

Figure 4. Apricot tree killed by *Monilinia laxa* blossom and shoot blight. Photo: K. Cox.

Figure 7. Brown rot on tart cherries. Photo: K. Cox.

Fungicides

In stone fruit, several fungicides are available to successfully manage brown rot during the early season. As fruit approach maturity, susceptibility to infection increases and frequent cover applications may be needed to prevent crop loss. In apple, brown rot control is typically achieved through summer cover sprays for other pre-harvest fruit rots. Monitor weather forecasts for rain events coupled with slow drying conditions which can translate into infection events and apply protectants on susceptible fruit beforehand. To prevent fungicide resistance, fungicides should be applied in rotation according to the label directions and the FRAC (Fungicide Resistance Action Committee) grouping. Registered biopesticide products, such as those with active ingredients based on *Bacillus amyloliquefaciens* or *B. subtilis*, may prove effective in rotation with fungicides.

Postharvest, drenches or inline applications of fungicides or disinfectants have proven useful for brown rot control on fruit entering cold storage. Refer to the Cornell Pest Management Guidelines for Commercial Tree Fruit Production for proper fungicides and spray timings.

Resistant Varieties

Several stone fruit cultivars have resistance to *M. fructigena*. These cultivars include: (Peach) Cumberland, Elberta, La Gem, La Premiere, Pullars Cling, Red Bird, Red Gold, and Stark Late Gold; (Sour Cherry) Meteor; (Apricot) Yyul'skii; (Plum) Cacanska Lepotica and Gabrovska Nikitskii.

In apple, several commercial cultivars are reported resistant to *M. fructigena*. These include Cortland, Edward VII, Jonathan, Mac Spur, Melba, Pepin, Red Caiville, Ribston Pippin, Stark Earliest, Vista Bella, and Yellow Newton. The apple cultivars James Grieve and Cox's Orange Pippin are reported to be highly susceptible to brown rot.

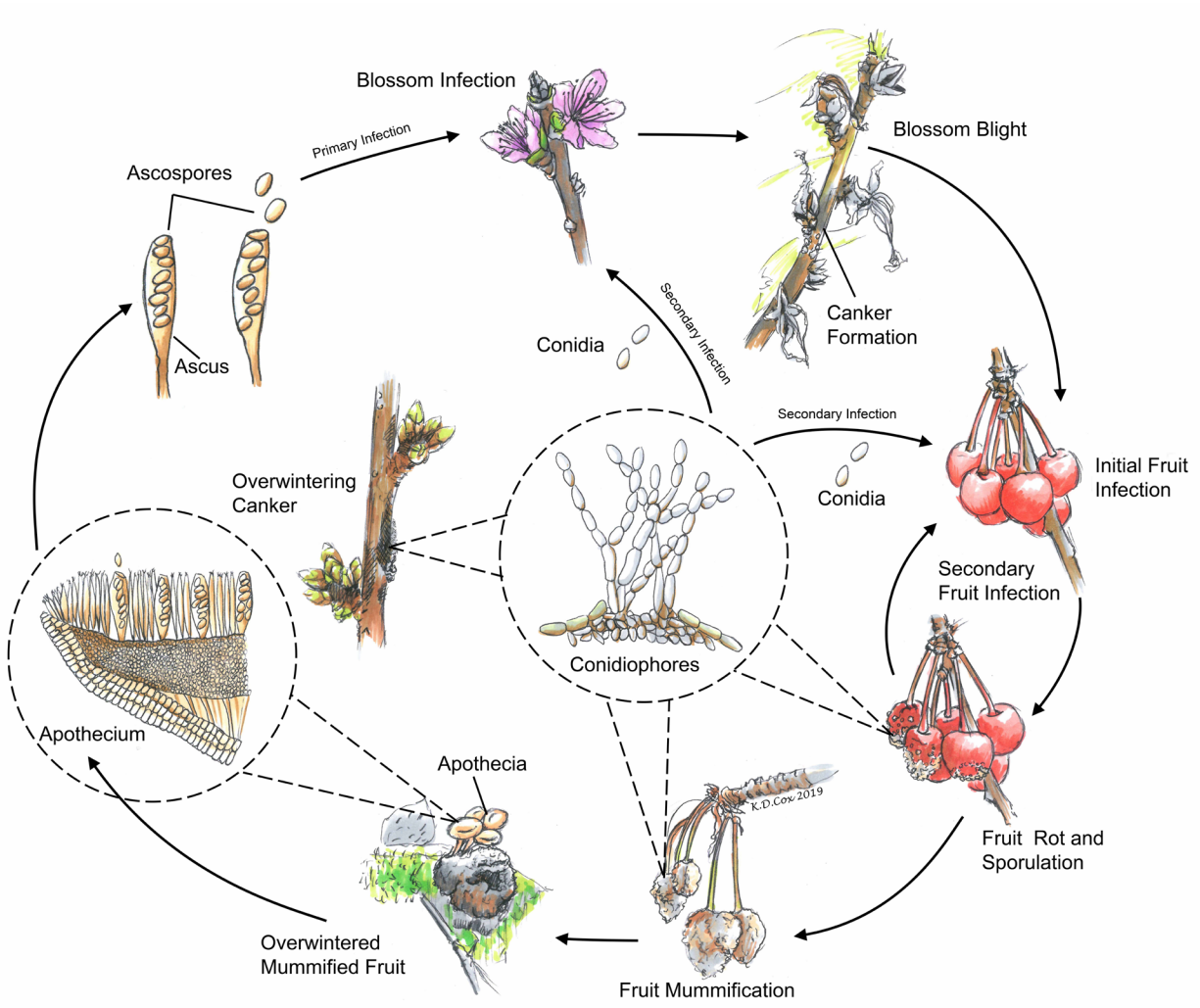

Figure 6. Brown rot disease cycle for *Monilinia* spp. on cherry. Illustration: K. Cox.

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