



Important Apple Diseases in Montana and Recommended Varieties for Resistance

by Nina Zidack, Extension Plant Pathologist; Cheryl Moore-Gough, Extension Horticulturist; and Mary Burrows, Extension Plant Pathologist

Apples are a wonderful addition to the landscape, but there are several common diseases which affect apples and crab apples in Montana. The best control is to plant a resistant variety, and a table of some recommended varieties is included in this publication as well as a color insert to assist with disease identification.

MT200812AG Reviewed 6/10

APPLE AND CRAB APPLE TREES CAN PRODUCE

fairly reliable crop if you pay attention to the cultivars you are purchasing. Purchase your trees locally, whenever possible. If you live in a part of the state that experiences particularly tough winters, select cultivars grafted to a rootstock like 'Antonovka', 'Alnarp 2' or 'Robusta' that imparts additional winter hardiness to the tree. Not all cultivars perform well in all parts of the state. For example, in USDA Zone 3 or 4, select summer or early fall-ripening cultivars, appropriate to your shorter growing season. Most of these will ripen in less than 120 days following bloom. If you're lucky enough to live in Zone 5, you can add the later ripening apples, like the mid-season 'McIntosh' that takes up to 140 days to ripen. Select disease-resistant cultivars whenever possible. The most problematic and prevalent apple disease in Montana is fire blight and you would be foolish to plant an apple or crab apple with no resistance to this disease.

Winter hardiness and ripening period are listed in this guide to assist you in purchasing plants appropriate to your area. Remember that apples and crab apples are considered self-unfruitful; plant two cultivars with similar bloom periods to insure adequate fruit set.

COMMON APPLE DISEASES

In Montana, there are four diseases that home gardeners, nursery and orchard growers commonly see on apples. The most serious disease is fire blight. In highly susceptible varieties, this disease can cause a steady decline and ultimately the death of the tree. Apple scab can be very damaging to the foliage and fruit, but generally does not threaten the overall health of the tree. Cedar-apple rust is a pathogen that affects both apples and junipers. On apples, it causes a leaf spot and can also cause lesions on fruit, reducing fruit quality. Powdery mildew is a very common disease that affects leaves, shoots and fruit.

Fire Blight

Fire blight is the most damaging disease of apple in Montana, and is also a serious problem in pear, cotoneaster and mountain ash. The disease is caused by the plant pathogenic bacteria, *Erwinia amylovora*.

Life cycle and symptoms

The bacteria that cause fire blight overwinter in cankers and become active when the temperature reaches 65°F. Bacteria are spread from plant to plant primarily by rain splash from nearby infected trees and contaminated pruning tools. It can also be spread by insects pollinating flowers, although transmission via pollination is uncommon in Montana. The optimal temperatures for flower infection and growth of the bacteria is 65-85°F. Upon flower infection, the bacteria multiply and begin to travel down the soft tissue into the older tissue of the twigs. During times of prolonged rainfall and high humidity, bacteria can also directly infect young, actively growing twigs, entering the plant tissue through wounds or natural openings such as stomata and lenticels.

Fire blight infections result in a rapid dieback of the shoot tips which give the leaves a burned appearance, hence the name "fire blight" (Figure 1). Infected twigs develop sunken, brown-black cankers (Figure 2). Peeling back the bark in infected parts of the plant will reveal a streaky brown stain. In larger branches, the cankers in the bark are often charcoal black and exhibit excessive peeling. If left unchecked, this disease will cause a steady decline and will ultimately kill infected plants.

Fire blight in Montana

Fire blight is the most serious disease of apple in Montana and is found throughout the state. It is especially damaging during years with sustained rainfall and high humidity throughout the flowering period.

Control of Fire Blight

The primary method for removing fire blight from an affected tree is pruning. Fire blight-infested twigs and branches can be pruned out anytime, as long as the branches are dry and humidity is low. However, it is best to prune out infected tissue while the tree is dormant, after leaf drop or early in the spring before leaves emerge. Removing infected twigs and branches will reduce the likelihood of the bacteria moving to other parts of the tree. It will also reduce the amount of inoculum in the spring which might provide a source for new infections.

To determine if you had fire blight last year, evaluate your tree for the presence of twigs and branches that did not lose their leaves (Figure 1), or have mummified fruit still attached. Perform the pruning operation by cutting the twig or branch at least 8-12 inches below the symptomatic twigs or cankers. After you have pruned out the twig or branch, peel back the bark at the point where you made the cut and look to see if there is any reddish brown streaking or flecking which is a sign of infection. If there is, prune back another 8-12 inches from that point and check again for signs of infection. Take care to prune when the plants are dry and disinfect the pruning tools with a 10 percent bleach solution or rubbing alcohol between cuts. After bud-break and leafing out, monitor the pruning cuts for advancing infections. If new cankers begin to form around old pruning sites, make new cuts 8-12 inches below the previous cuts. Also, scout your plants for new infections which may show up on new growth.

To prevent fire blight from occurring, or to reduce the negative impacts on your landscape, resistant varieties of eating apples are listed in Table 1 on page 4). Susceptibility to fire blight can also be reduced by limiting nitrogen fertilizer. High nitrogen applications lead to excessive succulent growth which is highly susceptible to fire blight. Watersprouts at the base of the tree are also highly susceptible and provide a direct avenue for infections of the trunk, which can be lethal to the tree. Prune out all water sprouts during warm and dry weather, or in the fall when the tree is dormant. There are not effective chemical controls available for fire blight. Antibiotics such as streptomycin can prevent bloom infection only and must be properly timed and applied.

Powdery Mildew

Powdery mildew of apple and crab apple is caused by the fungal pathogen *Podosphaera leucotricha*. It is an important disease worldwide and also occurs on pear and quince. The severity depends on the temperature and humidity in the environment.

Disease life cycle and symptoms

The powdery mildew fungus causes disease on apple buds, flowers, leaves and fruit. The fungus overwinters in the

terminal buds and in the spring, spores germinate and invade the newly emerging leaves and flowers. Infected blossoms turn brown and shrivel. Emerging leaves are often completely covered with a white mat and appear distorted and curled (Figure 3). When conditions are moist, multiple cycles of infection occur. Infections of expanded leaves have round, cottony patches on the surface. Over time, infected leaves become brown and brittle, and are prematurely shed from the tree. Infected fruit has a network of lines which is often referred to as russetting (Figure 4).

Powdery Mildew in Montana

Powdery mildew is commonly found on apple throughout the state, but is usually not damaging. If weather conditions in the spring are mild, bud infections can result in some death of terminals which can weaken the tree.

Control

Cultural Control. Dormant pruning of infected twigs will reduce inoculum for the next growing season, but is marginally effective. It is often not practical to prune due to lack of symptoms to target pruning. There are relatively few cultivars with resistance to powdery mildew (Table 1).

Chemical Control. Bicarbonate products including Kaligreen and Remedy provide organic alternatives to chemical fungicides. Wettable sulfur can also provide control, but sulfur can result in leaf burn. Immunox fungicide is effective and is labeled for home use.

Apple Scab

Another commonly occurring foliar and fruit disease of apple is apple scab, caused by the fungus *Venturia inaequalis*. Unlike the cedar-apple rust pathogen following, this fungus completes its entire life cycle on just one host.

Scab is normally most serious in areas with frequent rain and high relative humidity. Infected trees will experience reduced vigor and subsequent lower yields as well as reduced fruit quality. Excessive foliage loss often occurs in mid-summer, predisposing affected trees to winter injury and other secondary problems.

Disease life cycle and symptoms

The fungus survives the winter on fallen leaves remaining on the soil surface. As warm weather arrives, the fungus becomes active and begins to produce spores on the plant residue. These spores are continually discharged and blown onto newly emerging leaves. In the presence of moisture, the spores germinate and create a new lesion in seven to 14 days. As the temperature rises and the weather dries out, the fungus becomes less active. Fall infections may occur but are of little or no importance in Montana.

Initially, infections are characterized by small, olive green spots with a feathery margin. As the lesions age, they darken and increase in size. In many instances, the lesions are more numerous along the leaf midrib and veins since water

congregates in these areas (Figure 5). Leaf stems may also be infected, which hastens leaf loss.

Fruit infections commonly occur. On infected apples, the fruit appears scabby, cracked and often misshapen (Figure 6). Damage is normally superficial and although unsightly, the fruit is edible.

Apple Scab in Montana

Scab has caused sporadic but serious losses in certain Montana areas. In the protected, wetter intermountain valleys, the commonly grown McIntosh variety has been severely damaged. Less serious infections have been observed in other varieties and in drier areas of Montana.

Newer varieties of crab apples generally have good levels of scab resistance (Table 1). However, individual trees will occasionally experience scab infections in some areas, especially on trees where the previous year's leaf litter is not removed.

Control

Sanitation. In homeowner situations where few trees are involved, scab can effectively be reduced by raking and destroying infected leaves in the fall. This reduces the potential for the pathogen to overwinter. Pruning trees to open the canopy will also reduce the duration of leaf wetting and infection. Avoid sprinkler irrigation which wets the foliage.

Chemical Control. Captan and Immunox fungicides are available to homeowners. Lime sulfur and wettable sulfur products provide organic alternatives. Sulfur products can cause injury to the foliage and fruits and are not as effective as chemical fungicides.

Variety Resistance. When establishing new plantings, the selection of scab resistant varieties offers the easiest method of control (Table 1).

Cedar-Apple Rust

Cedar-apple rust of apple and crab apple is caused by the fungus *Gymnosporangium juniperi-virginianae*. Several species of the genus *Juniperus* – including Eastern red cedar, Rocky Mountain juniper, and horizontal juniper – are alternate hosts for this disease. The rust fungus requires both a *Juniperus* species and an apple or crab apple to complete its lifecycle.

Life cycle and symptoms

The fungus overwinters in brownish globular galls – “cedar apples” – which begin to form on the juniper in late summer. The following spring, the galls grow rapidly and produce orange gelatinous “horns” during moist weather (Figure 7). These horns release spores shortly after they absorb moisture. Spores can be produced over an extended period of repeated wetting and drying. They are forced into the air and can be carried long distances by wind.

Spores that land on an apple leaf will germinate and infect the leaf if conditions are warm and moist. Orange pustules surrounded by a yellow halo form on the upper surfaces of the leaves shortly after bloom (Figure 8). Fruit may also become infected.

One to two months later, orange cuplike structures with pubescent tentacles will develop on the underside of the leaf or on the fruit (Figure 9). Under dry conditions, these structures will release spores to complete the disease cycle on a juniper.

Cedar-apple rust in Montana

In Montana, sporadic outbreaks will occur on susceptible apple and crab apple varieties. Damage will vary with the year, but the most severe injury normally occurs when wet, mild weather occurs in mid-May or June

Closely related fungi with similar lifecycles are often observed on hawthorn and serviceberry. The hawthorn pathogen can cause dramatic yellowing and subsequent leaf loss in most years. The symptoms, similar to those observed on apple and crab apples, begin appearing in mid-July and increase in severity during the remainder of the growing season. Severely infected trees are more prone to invasion by other diseases and insects.

In wild stands of serviceberry, the utility of the fruit is often impaired by this related pathogen. Direct fruit infection, with associated tentacle development, is commonly observed during the harvest season.

Control of Cedar-Apple Rust

Since the fungus requires both hosts to complete its life cycle, removal of nearby apple or juniper plants may break the disease cycle. However, spores can be carried by wind for up to two miles, and if both hosts are valued plants, other means of control are necessary. The best method of control, as with all diseases, is to plant resistant varieties of apple or juniper. Apple varieties resistant to cedar-apple rust are found in Table 1.

Among the alternate hosts, Pfitzer juniper (*Juniperus media pfitzeriana*), Goldtip Pfitzer juniper (*J. pfitzeriana aurea*), Sargent juniper (*J. media sargentii*), Savin juniper (*J. sabina*), and its varieties Von Ehron, Skandia, and Arcadia, Common juniper (*J. communis*) and Meyer juniper (*J. squamata Meyeri*) are resistant to this rust.

Removal and burning of cedar-apple rust galls before the horns form will help control the disease. If chemical control is considered necessary, it is most effective when applied to the apple or related species. In commercial operations, where rust is a recurring problem, fungicides labeled for rust control should be used during the appropriate spray schedule window. The sprays should provide protection during the period in which the spores are being released from the gelatinous galls.

TABLE 1. Apple varieties recommended for Montana according to hardiness, fruit ripening, and resistance to the diseases fire blight, cedar-apple rust, apple scab and powdery mildew.

Apple Variety	Winter Hardiness	Ripening Period	Fire Blight	Cedar Apple Rust	Apple Scab	Powdery Mildew
Anoka	Very	Late summer				
Caravel	Moderate	Summer	Very Res			
Carroll	Extremely	Summer	Resistant	Resistant	Susceptible	
Close	Extremely	Summer	Susceptible			
Crimson Beauty	Extremely	Summer	Resistant			
Duchess	VG to extremely	Summer	Moderate			
Very Early Red Bird	Hardy	Summer	Resistant			
Goodland	Extremely	Fall	Moderate			
Haralson	Extremely	Winter	Very Res			
Hibernal	Extremely	Winter	Resistant			
Lodi	Moderate	Summer	Very Res	Very Res	Susceptible	Resistant
Mandan	Extremely	Fall	Resistant			
McIntosh	Marginal	Fall	Resistant	Very Resistant	Very Res	Susceptible
Melba	Very	Summer	Moderate			
Minjon	Moderate	Late fall	Resistant			
Oriole	Marginal	Summer	Moderate			
Puritan	Moderate	Summer	Resistant	Resistant	Susceptible	Susceptible
Quinte	Marginal	Late summer	Moderate	Susceptible	Susceptible	Susceptible
Red	Extremely	Fall	Resistant			
Red Baron	Marginal	Fall	Moderate			
Red McIntosh	Moderate	Fall	Resistant			
Sweet Sixteen	Very	Summer	Resistant	Resistant	Resistant	
Viking	Very	Summer	Resistant	Resistant	Susceptible	
Wealthy	Very	Fall	Susceptible	Susceptible	Susceptible	Susceptible
Wellington	Very	Summer	Very Res	Resistant	Susceptible	Susceptible
Yellow Transparent	Very	Summer	Very Res		Resistant	
Zestar	Very	Summer				

REFERENCES

- Childers, N.E., J.R. Morris and G.S. Sibbett. 1995. *Modern Fruit Science*. Horticultural publications.
- Gough, R.E.(ed). *Montana Master Gardener Handbook*, Third Edition. 2004. Montana Extension Publication #SR100 Revised.
- Gough, R.E. and C. Moore-Gough. 2007. *The Montana Gardener's Companion*. Globe Pequot.
- Jones, A.L. and Aldwinckle, H.S. 1990. *Compendium of Apple and Pear Diseases*. APS Press, St. Paul, Minnesota.
- <http://plant-disease.ippc.orst.edu/index.cfm>. 2008. *An Online Guide to Plant Disease Control*. Oregon State University, Corvallis, Oregon.
- Brooks and Olmo. 1997. *Register of Fruit & Nut Varieties*. Third edition. ASHS Press.



To order additional publications, please contact your county or reservation MSU Extension office, visit our online catalog at www.msuextension.org/store or e-mail orderpubs@montana.edu

Copyright © 2012 MSU Extension

We encourage the use of this document for nonprofit educational purposes. This document may be reprinted for nonprofit educational purposes if no endorsement of a commercial product, service or company is stated or implied, and if appropriate credit is given to the author and MSU Extension. To use these documents in electronic formats, permission must be sought from the Extension Communications Coordinator, 115 Culbertson Hall, Montana State University, Bozeman MT 59717; E-mail: publications@montana.edu

The U.S. Department of Agriculture (USDA), Montana State University and Montana State University Extension prohibit discrimination in all of their programs and activities on the basis of race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, and marital and family status. Issued in furtherance of cooperative extension work in agriculture and home economics, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Douglas L. Steele, Vice President of External Relations and Director of Extension, Montana State University, Bozeman, MT 59717.

Fire blight



FIGURE 1. Fire blight-affected twig. William Jacobi, Colorado State University, Bugwood.org



FIGURE 2. The dark and sunken bark indicates a fire blight canker on a young branch. William Jacobi, Colorado State University, Bugwood.org

Powdery mildew



FIGURE 3. Powdery mildew-affected apple foliage and buds. William M. Brown Jr., Bugwood.org

FIGURE 4. Russetting symptom on powdery mildew-affected fruit. Clemson University - USDA Cooperative Extension Slide Series, Bugwood.org



Apple scab



FIGURE 5. Apple scab lesions on crab apple leaves and fruit.



FIGURE 6. Apple scab lesions on apple fruit. Clemson University - USDA Cooperative Extension Slide Series, Bugwood.org

Cedar apple rust



FIGURE 7. Gelatinous galls formed on juniper in spring.



FIGURE 8. Cedar-apple rust lesions on the upper surface of apple leaves.



FIGURE 9. Cedar-apple rust lesions on the underside of apple leaves.



MONTANA
STATE UNIVERSITY

EXTENSION

MontGuide