



Common Disease Problems In Saskatoon Orchards

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***Entomosporium* Leaf & Berry Spot**

Symptoms

Symptoms on the leaves are small, angular brown spots. If these spots have expanded and coalesced, they may also have a yellow halo. The leaves eventually turn entirely yellow. Lesions on the leaf petiole result in defoliation. Infected fruit have watery, greyish lesions. Fruit infections are characterized by disfiguration, discoloration, cracking and shrivelling. The stalks of the fruit and fruit cluster may also become infected, causing fruit loss. Figures 6.2 to 6.5 illustrate the various symptoms of *Entomosporium* leaf and berry spot.

Life Cycle

The causal organism is the fungus *Entomosporium mespili* (other latin names include *Fabraea maculata* and *Diplocarpon maculatum*). Other common names for this disease include common or angular leaf and berry spot, or leaf blight. This fungus can also infect hawthorn, mountain ash, apple, pear and possibly cotoneaster. However, it is likely that the strains that infect these plants are different from those that infect the saskatoon.

This is the most serious disease of saskatoons and has been the primary barrier to fruit crop production. It appears to be present every year, but normally only as leaf

spots on succulent, new shoots at the base of the shrub. In years of greater than normal amounts of precipitation and warm temperatures, all foliage and fruit can be infected. The marketability of even lightly-infected fruit is downgraded. The fruit are considered unusable by processors if greater than 6% of the surface area of the fruit is blemished.

Relative humidity and warm temperatures are the primary determinants of the incidence of this disease. Orchards located on drier, more exposed sites are less susceptible. Increased plant and row density appear to result in an increase in the severity of this disease. This fungus can cause severe defoliation of seedlings growing in heavy to full shade; this results in seedling death. The fungus flourishes from early-May through mid-July if the season is moist. It overwinters on fallen leaves and twigs (Figure 6.1).

Control

Preventive measures include thinning seedlings in dense nursery beds, watering at the soil surface, thinning shrubs adequately, and controlling weeds. It was once thought that removing the leaf litter was an important control measure but observations in Alberta have indicated that this measure is not effective in reducing the incidence of the disease.

The fungicides Topas 250E, Kumulus DF and Funginex 190EC have been registered for use against this disease.

Plate 6. *Entomosporium* Leaf & Berry Spot



Figure 6.1: Spore-producing structures of *Entomosporium* leaf and berry spot on fallen leaf from litter; actual size.

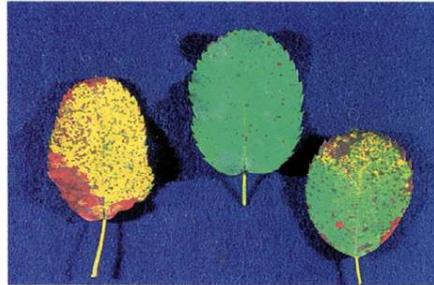


Figure 6.2: Varying densities of *Entomosporium* leaf and berry spot lesions on saskatoon leaves; 3/4 actual size.



Figure 6.3: Lesions of *Entomosporium* leaf and berry spot on green fruit; 3/4 actual size.



Figure 6.4: Lesions of *Entomosporium* leaf and berry spot on ripening fruit; 1 1/4 times actual size.



Figure 6.5: Lesions of *Entomosporium* leaf and berry spot on ripe fruit (indicated by arrow); 1 1/4 times actual size.

Saskatoon-Juniper Rust

Symptoms

Early symptoms include yellowish spots and swellings on leaves and fruit. Mature symptoms include firm, yellow, spiky outgrowths from leaves and fruit. Another species of this rust infects twigs and branches, causing swelling and distortion. This damage may allow subsequent infection by the canker fungi. Infected fruit are unmarketable. Figures 7.1 to 7.5 illustrate the symptoms of saskatoon-juniper rust.

Life Cycle

The life cycle of saskatoon-juniper rust is illustrated in the color graphic - The Life Cycle Of Saskatoon-Juniper Rust. The causal organisms are the rust fungi, *Gymnosporangium nelsonii* and other species. The fungus first appears as globular, woody galls on juniper. Jelly-like, brown horns grow out of these galls following a rain. The horns discharge spores that can infect the saskatoon. The most common species of *Gymnosporangium* fungi infect saskatoon leaves and fruit, and can cause extensive damage. The infected sites on the saskatoon also produce spores which re-infect the juniper.

Control

If possible, orchard sites should not be established near wild stands of juniper. Spores from rust galls on native junipers substantially further than 1 to 2 km from saskatoon orchards may still reach and infect plants. Removal of all native junipers to a distance of 1 km is impractical and ineffective. A variety of factors influence the susceptibility of the saskatoon to infection by rust; heavily-infected junipers do not necessarily mean that nearby saskatoons will be infected. If the number of nearby junipers is small, it may be possible to prune out the woody rust galls that occur on the juniper. Funginex 190 EC is registered for use on saskatoons for control of saskatoon-juniper rust. The use of Nova 40W to control powdery mildew, or Topas 250E to control *Entomosporium* leaf and berry spot, may provide some control of saskatoon-juniper rust coincidentally.

Plate 7. Saskatoon-Juniper Rust



Figure 7.1: Lesions of saskatoon-juniper rust on saskatoon leaves; 1/2 actual size (Photo by L. Harris).



Figure 7.2: Characteristic structures of saskatoon-juniper rust on the undersides of saskatoon leaves; 2/3 actual size (Photo by T. Kabaluk).



Figure 7.3: Developing symptoms of saskatoon-juniper rust on saskatoon fruit; actual size.



Figure 7.4: Mature saskatoon-juniper rust on saskatoon fruit; actual size.

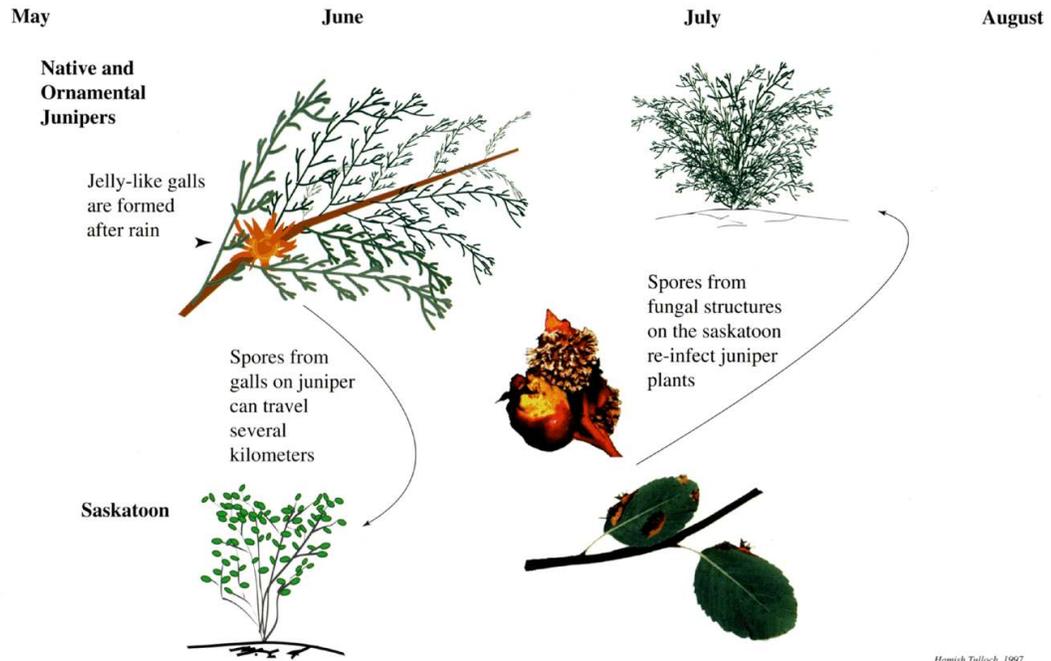


Figure 7.5: Saskatoon-juniper rust at base of fruit cluster; actual size.



Figure 7.6: Spore-producing structure of saskatoon-juniper rust on juniper, the rust's alternate host; 1/3 actual size.

The Life Cycle Of Saskatoon-Juniper Rust



Brown Fruit Rot (Mummyberry)

Symptoms

The symptoms of brown rot include flowers turning brown prematurely, discolored fruit surfaces, brown spots on fruit surfaces, and gray to light brown tufts on the rotted surface. Fruit eventually shrinks and mummifies (Figures 8.1 & 8.2). Those infected fruit that do not drop immediately become mummified, and are the source for re-infection the next season. The mummified fruit may or may not drop off in the fall.

Life Cycle

The causal organism is the fungus *Monilinia amelantheris*. Spores are released from mummified fruit, fallen fruit and leaves at budbreak. Infection occurs during flowering. This fungus infects flowers, young fruit, and sometimes leaves. Infected fruit may drop within three weeks following infection. Humid weather during flowering favors a higher incidence of infection. Insect damage to flowers and fruit also can increase the incidence of this disease.

Control

Prevention includes picking and burning of all mummified fruit, removing fallen fruit, and leaves. Excessive fertilization with nitrogen appears to favour infection by this disease. The use of Funginex 190 EC to control *Entomosporium* leaf and berry spot may help control brown fruit rot coincidentally.

Plate 8. Brown Fruit Rot & *Cytospora* Canker



Figure 8.1: Brown fruit rot; 1 1/2 times actual size (Photo by J. Davidson).



Figure 8.2: Brown fruit rot; 1 1/4 times actual size (Photo by J. Davidson).



Figure 8.3: Cracked and split bark characteristic of *Cytospora* canker.



Figure 8.4: Current season's growth newly infected with *Cytospora* canker (lesion is indicated by the circle).

***Cytospora* Canker (Dieback)**

Symptoms

General symptoms include drying and shrivelling of buds and leaves in the spring, leaves developing fall coloration earlier than normal (referred to as flagging), and bark appearing wrinkled, or having vertical splits and folds (Figure 8.3). Cut surfaces of shoots may be stained black when infected. Some confusion with the symptoms of winter injury or woolly elm aphid infestation is possible.

Specific symptoms vary with age of wood and location on plant. Symptoms on younger growth, especially 1 year old wood, include sunken, discolored or darker areas, which may appear watersoaked; the bark may be wrinkled (Figure 8.4). There is an abrupt transition from dead bark to live bark. Symptoms on older growth include sunken areas where the bark is cracked and broken longitudinally; the outer bark is folded back, revealing rusty-colored inner bark; these symptoms are termed exfoliation. Grey-black, pinhead-sized bumps or pustules may be present on dead branches or stems, or on stems where the disease is well-advanced.

Life Cycle

The primary causal organism is the fungal species *Cytospora leucostoma* (*Leucostoma personii* is a synonym). Similar cankers and diebacks may be found in apples, cotoneaster, mountain ash, poplar, willow, and green ash, although these apparently are genetically distinct strains of *Cytospora*. Less commonly, some cankers and diebacks may be caused by *Stereum*

species (silverleaf), *Nectria cinnabarina* (coral spot), and *Poria* species. The presence of pinhead-sized, orange bumps may indicate infection by coral spot.

The occurrence and severity of canker and dieback are strongly affected by location, weather, and management practices. Canker and dieback are usually seen in older or neglected orchards, but in recent years has been found in newly-established orchards. Exposure to drought, cold, frost, and wind, mechanical injury from harvesting equipment, pruning wounds, rodent damage, poor soil drainage, high levels of salts in the soil, and inadequate levels of nitrogen, potassium or calcium in the soil may predispose the plant to infection by *Cytospora*. Late-summer pruning and late-fall injury may especially predispose the plant to infection because of inadequate wound healing. Canker appears to severely affect young plants, or newly-established orchards, if on exposed, poorly managed sites.

Canker fungi infect buds and shoots through cracks caused by injury and frost. The fungi grow down to the root crown, causing the stem to dieback as they move downwards. The canker fungi sequester calcium which is used to create oxalic acid, a chemical which will kill plant tissue. Plants appear to be able to limit the spread of the disease if only twigs or branches are infected, but not if the main stems or crown are infected. These fungi will infect the entire plant and others unless pruned out; the consequence will be the eventual death of the plant. This disease can be a serious threat to orchards.

Control

Immediate pruning is required to remove all dead and dying shoots. Infected branches or stems must be pruned 25 to 30 cm below the last visible symptoms of infection. Symptoms on older stems may be easier to spot after leaf-fall or before bud break, and therefore pruning can easily be done. If the crown is infected, the entire plant must be removed. All pruned material or rogued plants must be burned.

As preventive measures, plants should be allowed to harden-off properly after harvest. Root suckers greater than one year old should be carefully inspected for canker and perhaps not be transplanted if canker is present elsewhere in the orchard. Orchard location and protection is important. Orchards should not be planted in locations having poor soil or air drainage, must be sheltered from the wind, and groundcover management to trap snow appears helpful. Susceptibility to infection may be associated with low moisture levels within the bark, suggesting that a late-fall watering may be important to prevent dessication of the plant. *Cytospora* cankers of aspen generally grow more quickly when soil nitrogen levels are deficient. Although it's not known if *Cytospora* behaves similarly in saskatoons, growers should ensure that minimum recommended levels of soil nitrogen are present in their orchard.

Complete elimination of this disease likely is not possible.

Powdery Mildew

Symptoms

This disease is common on lower leaves and the leaves of suckers. The primary symptoms include the appearance of a fine powdery white growth on one or both leaf surfaces (Figure 9.1). Infected new leaves may appear distorted, which results in discoloration and the death of the leaves. New shoots can also be infected and these appear stunted.

Life Cycle

The causal organism is the fungus *Podosphaera clandestina*. The fungus can infect both leaves and fruit. This fungus apparently can exacerbate the effects of blackleaf. The fungus is a substantial problem in wetter climates. The saskatoon cultivars Parkhill, Success and Forestburg appear to be more susceptible to infection. Honeywood, Moonlake, Thiessen and Regent appear to be less susceptible.

Control

The fungicide Nova 40W has been registered for use against powdery mildew. Where incidence of the disease is low, infected shoots may be pruned out. Avoid the use of susceptible cultivars.

Plate 9. Powdery Mildew, Fireblight & Blackleaf



Figure 9.1: Powdery mildew on saskatoon leaves and fruit.



Figure 9.2: 'Shepherd's crook' characteristic of fireblight; 1/4 actual size.



Figure 9.3: Blackleaf; note symptomatic downward rolling of leaf edges; 2/3 actual size (Photo by J. Davidson).



Figure 9.4: Blackleaf; note heavy black growth on undersides of leaves; 2/3 actual size (Photo by L. Harris).

Fireblight

Symptoms

Symptoms appear in May through June. Symptoms include the wilting of new shoots in a characteristic crook-shaped manner (Figure 9.2), sudden wilting and browning of blossoms, scorching of foliage, and oozing from cracks in the bark. Infected, young fruit may appear watery or oily, later becoming brown or black.

Life Cycle

The causal organism is *Erwinia amylovora*. Fireblight infects more than 140 species of fruit and ornamental plants, especially those belonging to the Rose family. Saskatoons are less likely to be infected than other fruits such as the apple. Infection occurs during flowering, and is primarily transmitted by bees that are pollinating the flowers, but may also be transmitted by wind, splashing raindrops, other insects, and pruning tools. Succulent, new growth is very susceptible to infection. The symptoms of infection appear in the month subsequent to flowering. Fireblight is most common in years with prolonged, wet spring weather.

Control

It is necessary to prune the infected shoots 25 to 45 cm below the diseased areas as soon as they are observed.

There are no chemicals registered for use against fireblight on the saskatoon. Streptomycin and various copper compounds are registered for use in apples,

pears, mountain ash, hawthorn and other ornamentals.

Blackleaf (Witches' Broom)

Symptoms

The edges of initially infected leaves roll downwards (Figure 9.3) and the underside of the leaves become covered in a grey, felt-like fungal growth. This felt-like growth eventually turns black and the leaves die (Figure 9.4). Infected leaves normally remain on the branches. The fungus also penetrates shoot tips and stimulates many new shoots to develop, thereby causing the characteristic witches' broom. Fruit on infected branches dries up or ripens prematurely.

Life Cycle

The causal organism is the fungus *Apiosporina collinsii*. This disease is non-lethal but debilitating where stem density is high. The disease appears to be especially prevalent in orchards located on exposed sites. Only new wood can be infected; previous years' wood is impervious. The fungus infects new wood below the infected leaves. The fungus overwinters on infected leaves and leaf debris, twigs and branches. Infective spores are released from this material the following spring. Suckers are very susceptible to this fungus. The fungus also can invade the root crown of young plants turning the entire plant into a witches' broom.

Control

All infected seedlings and transplants must be removed and destroyed; on established plants, all infected branches must be pruned 10 to 20 cm below the infected site.

The presence of a protective shelterbelt around the orchard, and adequate snow cover in the winter is considered important to minimizing the incidence of this disease.

Damping-off

Symptoms

Seedlings affected by post-emergent damping-off wilt upon emergence and have rotting stems, especially near the surface of the medium. This disease kills germinating seeds and very young seedlings with less than 2 true leaves.

Life Cycle

The causal organisms include fungal species of the genera *Pythium*, *Rhizoctonia*, *Fusarium* and *Ceratobasidium*. Pre-emergent damping-off affects the sprouting seed and is favored by cold, wet germinating media, and where seedlings are crowded. The fungi survive in soils with high organic matter.

Control

Prevention involves the use of sterilized soils, other potting media, and containers, when germinating seed and

growing seedlings. A 5 minute surface sterilization of the seed, using household bleach (1 part bleach to 9 parts water), prior to placing the seed in the germination medium, can help.

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