

Fire Blight on Fruit Trees and Woody Ornamentals

ANR-542

Fire blight, caused by the bacterium *Erwinia amylovora*, is a common and destructive disease of pear, apple, quince, hawthorn, firethorn, cotoneaster, and mountain ash. Many other members of the rose plant family as well as several stone fruits are also susceptible to this disease (Table 1). The host range of the fire blight pathogen includes nearly 130 plant species in 40 genera. Badly diseased trees and shrubs are usually disfigured and may even be killed by fire blight.

Symptoms

The term fire blight describes the blackened, burned appearance of damaged flowers, twigs, and foliage. Symptoms appear in early spring. Blossoms first become water-soaked, then wilt, and finally turn brown. These



Spur blight on crabapple cv 'Mary Potter'.

symptoms are often referred to as blossom blight. The blossom blight phase of fire blight affects different host plants to different degrees. Fruit may be infected by the bacterium directly through the skin or through the stem. Immature fruit are initially water-soaked, turning brownish-black and becoming mummified as the disease progresses. These mummies often cling to the trees for several months.



Severe fire blight on crabapple cv 'Red Jade'.

Shortly after the blossoms die, leaves on the same spur or shoot turn brown on apple and most other hosts or black on

Table 1. Plant Genera That Include Fire Blight Susceptible Cultivars.

Common Name	Scientific Name	Common Name	Scientific Name
Apple, Crabapple	<i>Malus</i>	Jetbead	<i>Rhodotypos</i>
Apricot, Cherry, Plum	<i>Prunus</i>	Kageneckia	<i>Kageneckia</i>
Avens	<i>Geum</i>	Loquat	<i>Eriobotrya</i>
Brambles	<i>Rubus</i>	Medlar	<i>Mespilus</i>
Chokeberry	<i>Aronia</i>	Mountain Ash	<i>Sorbus</i>
Cinquefoil	<i>Potentilla</i>	Mountain Avens	<i>Dryas</i>
Cliff Rose	<i>Cowania</i>	Ninebark	<i>Physocarpus</i>
Cotoneaster	<i>Cotoneaster</i>	Osteomeles	<i>Osteomeles</i>
Cratnegomespilus	<i>Cratnegomespilus</i>	Pear	<i>Pyrus</i>
Creambush	<i>Holodiscus</i>	Pearlbush	<i>Exocborda</i>
Dichotomanthes	<i>Dichotomanthes</i>	Peraphyllum	<i>Peraphyllum</i>
Docynia	<i>Docynia</i>	Photinia	<i>Photinia</i>
False Spirea	<i>Sorbaria</i>	Quince	<i>Cydonia</i>
Firethorn	<i>Pyracantha</i>	Rose	<i>Rosa</i>
Flowering Quince	<i>Chaenomeles</i>	Serviceberry	<i>Amelanchier</i>
Goatsbeard	<i>Aruncus</i>	Spirea	<i>Spiraea</i>
Hawthorn	<i>Crataegus</i>	Stranvaesia	<i>Stranvaesia</i>
Indian Hawthorn	<i>Rhaphiolepis</i>	Strawberry	<i>Fragaria</i>
Japanese Rose	<i>Kerria</i>	Toyon	<i>Heteromeles</i>

pear. The stems and midribs of diseased leaves often turn black as well. As the twig and leaf blight phase progresses, leaves die, curl downward, and cling to the blighted twigs. Succulent twigs, shoots, and water sprouts are easily infected. The tips of blighted twigs, shoots, and sprouts droop, producing the typical "shepherd's crook." Leaves may be infected through pores as well as wounds.

Cankers form at the base of blighted twigs and spurs. The bark surrounding a developing canker first appears water-soaked, then later sunken and dry. The surface of bark covering the canker is usually smooth and sometimes has a purple color. Reddish-brown streaks can be seen in the sapwood under the discolored, sunken bark. Amber-colored discharge can often be seen near blighted tissues of the plant at any stage of infection.

Characteristics

The fire blight pathogen, *Erwinia amylovora*, is a rod-shaped bacterium that overwinters in tissues around the edge of cankers on large branches and limbs. A gummy, amber-colored discharge oozes from cankers during warm, humid weather. The discharge, which contains bacteria, is dispersed by insects or splashing rain to blossoms, leaves, and shoots (see drawing on next page). Dried bacterial discharge often forms strands which are carried by wind.

Susceptibility to fire blight depends on: (1) cultivar characteristics, (2) maturity of tissue, and (3) weather conditions. Pear flowers are invaded very rapidly through nectaries and pistils, which are ideal sites for growth of the bacteria. Apple flowers are usually invaded through stigmas and anthers.

Soft, succulent shoots are very vulnerable to the disease. Mature apple and pear tissues are much more resistant to infection than young tissues. Cultural practices favoring rapid shoot growth increase the plants' susceptibility to attack. These practices include severe pruning, excessive nitrogen fertilization, and an unbalanced fertility program.

Warm, moist conditions, particularly during flowering, greatly increase incidence of the disease. Blight development can occur at temperatures between 65° and 95°F, but the 75° to 81°F range is most favorable. Temperature extremes will slow development of the disease. In regions with mild winter temperatures, cankers may increase in size during the fall and winter on trees with a southerly exposure. Rain is critical to the spread and development of the disease. Fire blight outbreaks are encouraged by warm, cloudy weather following a rain. A humid environment promotes bacterial growth and spread. Other weather events like frost, high winds, and hail create wounds through which the bacteria can enter the plant.



Typical 'Shepherds Crook' often seen at the end of fire blight-damaged shoots. The brown color of the blighted leaves indicates that this blighted shoot is on apple or crabapple.

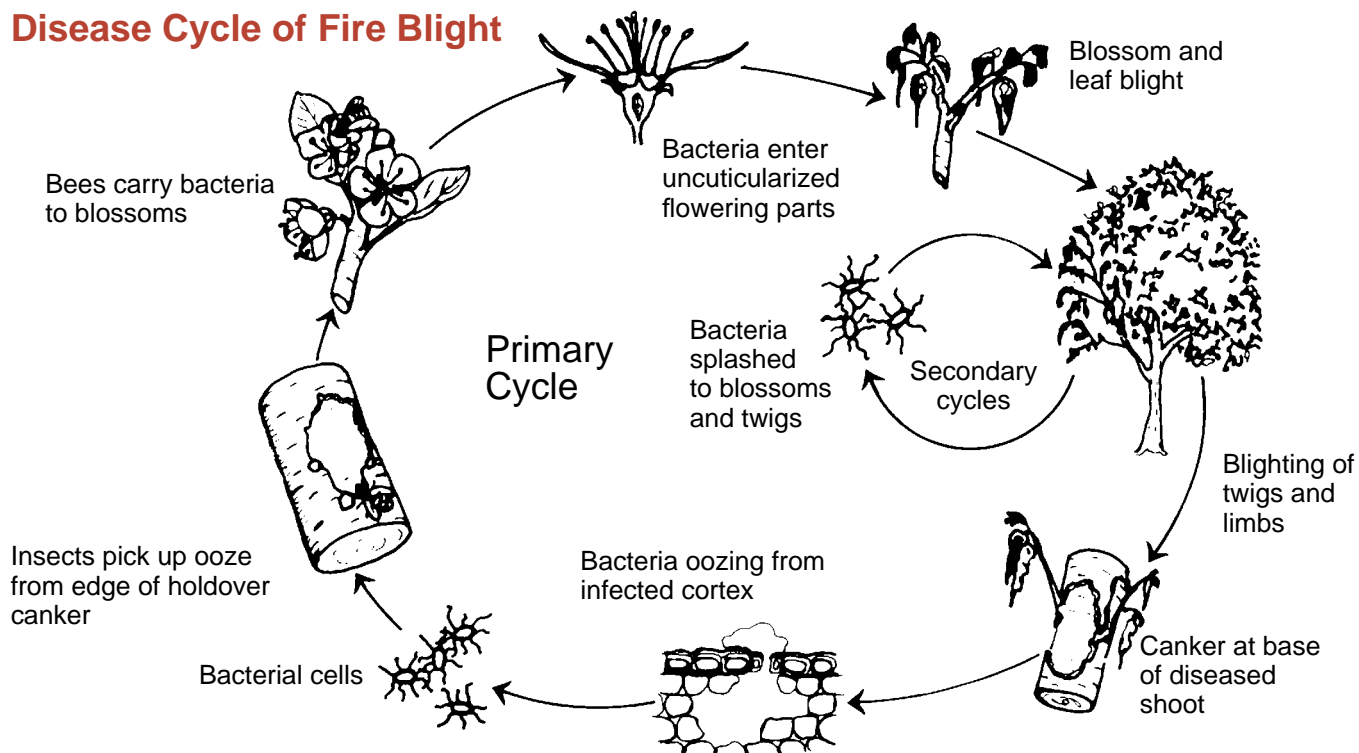
Control

A control program combining resistant varieties, sound cultural practices, sanitation, fertilization, and pesticides is needed to protect plants from fire blight. Cultivation and fertilization practices that produce rank, succulent growth increase the possibility that the disease will develop. Do not cultivate pear and apple orchards late in the season, and do not severely prune susceptible cultivars. Regulate plant growth and apply fertilizers so that *moderate* shoot growth is maintained. Beginning in late winter to early spring and continuing through the growing season, remove all root sprouts and suckers from trees. All diseased tissue (blighted twigs and branches) should be removed as soon as possible to slow the spread of the disease. Prune diseased wood about 12 to 14 inches below visible cankers during the growing season, and 6 to 8 inches below cankers in the fall or winter months. Clean your tools with a solution of isopropyl alcohol or other disinfectant after each cut to avoid spreading the bacteria.

The first chemicals used for the control of fire blight were copper fungicides like copper hydroxide (Kocide 101 at 2 to 4 pounds per 100 gallons of water between silver-tip and green tip on apple and pear) and copper sulfate (Tri-Basic Copper Sulfate at ½ pound per 100 gallons of water on pear only). Recommended spray schedules are listed on the product labels. These compounds provide effective control under light to moderate disease pressure but can cause fruit russetting on some apple and pear varieties. Copper fungicides that are cleared for fire blight control on woody ornamentals may be phytotoxic to crabapple and some other plants.

Copper hydroxide (Kocide 2000 T/N/O at 0.75 pounds per 100 gallons of water or 1.5

Disease Cycle of Fire Blight



teaspoons per gallon) and copper sulfate pentahydrate (Phyton 27 at 20 to 40 fluid ounces per 100 gallons of water) will give some protection from fire blight on woody ornamentals. See the comments for streptomycin sulfate for instructions on optimum application timing for the control of fire blight. Kocide 2000 will damage the foliage of crabapple but is safe to use on Indian hawthorn, loquat, hawthorn, photinia, pyracantha, and flowering pear. Refer to the label of each fungicide for additional directions on product use.

The antibiotic streptomycin (Agrimycin 17) will give better control under higher disease pressure than the copper compounds, and does not cause fruit russeting. When using these products, start spraying as soon as bloom begins because streptomycin is ineffective against fire blight once infection occurs. Protective sprays of Agrimycin 17 at 100 ppm (8 ounces of formulated product per 100 gallons of water or 1 tablespoon per 2½ gallons of water) or Fireblight



The surface of this perennial fire blight canker on the main trunk of pear is cracked and dry. Note the dead branch stub in the center of the canker.

Spray (0.5 teaspoon per gallon of water) are recommended every 4 to 5 days during the bloom period. Begin spraying just before the center flower in the cluster opens and continue applications through petal fall. For best results, make applications in the late afternoon or early evening because streptomycin breaks down in sunlight.

Aphids, leafhoppers, flies, and ants play a major role in spreading the bacteria from cankers to blossoms and new growth in the spring. These insects should be monitored and controlled with insecticides if necessary before bloom occurs. Bees do not feed on bacterial ooze but will spread the disease from infected to noninfected blossoms during pollination. Insecticides used during bloom will kill the bees, but pollination will also be prevented, greatly reducing fruit set.

Many popular trees and shrubs are resistant to fire blight. Establishment of disease-resistant plants is an inexpensive, easy,

and effective means of controlling fire blight without the need for chemical treatments. Some shrubs and small trees resistant to fire blight are listed in Table 2. Refer to Table 3 for reaction of some apple and pear varieties to fire blight.

The reaction of selected crabapple and flowering pear cultivars to fire blight is listed in Table 4. Crabapple cultivars resistant to fire blight, as well as apple scab, powdery mildew, cedar-apple rust, and frog-eye leaf spot are Adams, Candied Apple, Centennial, Centurion, Dolgo, Liset, Sargent, Sugartyme, and Zuni.

Resistant firethorn cultivars include *Pyracantha coccinea* cv. Sensation, *P. koidzumii* cv. Santa Cruz Prostrata, and hybrids San Jose and Shawnee. The firethorn cultivars Apache, Fire Cascade, Mohane, Navaho, Pueblo, Rutgers, Shawnee, and Titon are resistant to both fire blight and scab. Cotoneaster selections resistant to fire blight include *C. apiculatus*, *C. dialisianus*, *C. foveolatus*, *C. franchetti*, *C. integrimus*, *C. nitens*, and *C. zabelli*. Severe outbreaks of fire blight have been noted on *Cotoneaster dammeri* in both production nurseries and landscape plantings.



Note the reddish-brown discoloration of the bark covering this fire blight canker.

Among Indian hawthorn selections, 'Jack Evans' and 'Janice' are highly sensitive to fire blight. Also, significant fire blight damage has been seen on the cultivars 'Olivia' and 'Majestic Beauty'. Most other Indian hawthorn selections, including 'Clara', 'Elenor', 'Tabor', 'Indian Princess', and 'Snow' are highly resistant to fire blight and typically suffer very little damage in landscape plantings.

Table 2. Fire Blight Resistant Members of the Rose Family.

Scientific Name	Common Name
<i>Cercocarpus betuloides</i>	Mountain-mahogany
<i>Exochorda racemosa</i>	common pearl bush
<i>Fragaria chiloensis</i>	beach strawberry
<i>Photinia serrulata</i>	Chinese photinia
<i>Physocarpus capitatus</i>	ninebark
<i>Potentilla fruticosa</i>	bush cinquefoil
<i>Prunus americana</i>	American plum
<i>Prunus cerasus</i>	sour cherry
<i>Prunus dulces</i>	almond
<i>Prunus hortulana</i>	wild-goose plum
<i>Prunus mahaleb</i>	St. Lucie cherry
<i>Rosa californica</i>	California wild rose
<i>Rosa gymnocarpa</i>	wood rose
<i>Spirea prunifolia</i>	bridal wreath

Table 3. Reaction of Various Apple and Pear Varieties to Fire Blight.*

	Moderately Resistant	Moderately Susceptible	Highly Susceptible
Apple	Empire Liberty Priscilla Redspur Red Delicious Topred Yates Arkansas Black	Freedom Golden Delicious Jonafree McIntosh Prima Redfree Stayman Turley Winesap Jonagold	Golden Delicious Granny Smith Jonathan Julyred Lodi Mutsu Paulared Rome Transparent Tydman's Red Fuji Brayburn Gayla Mollies Delicious
Pear	Ayers Keiffer Moonglow Orient	Seckel	Bartlett Bosc Red Bartlett

*This is only a partial list of common varieties. Actual reactions may differ depending on environmental conditions. Contact your local county agent for information on overall quality of a variety before planting.

Table 4. Reaction of Crabapple and Flowering Pear Cultivars to Fire Blight.

	Resistant-Moderately Resistant	Slightly to Moderately Susceptible	Highly Susceptible
Crabapple	M. Baccata 'Jackii' Coral Burst Pink Princess Spring Snow Jewelberry Robinson Dwarf Adams Dwarf Radiant Velvet Pillar Pink Spires Liset (Dwarf) Profusion Bob White David Indian Summer Sargentii (Dwarf) Zumi var. Calocarpa Eleya White Angel Red Splendor Louisa Baskatong Centurion Prariefire Donald Wyman Strawberry Parfait	Red Jewel Red Baron Tea Royalty Hopa Brandywine Winter Gold Candied Apple Selbirk Sugar Tyme Ormiston Roy Red Jade	Klehm's Imperial Bechtel Golden Raindrops Doubleblooms Snowdrift Silver Moon Professor Sprenger Indian Magic Siami Fire Sentinel Purple Prince Mary Potter
Flowering Pear	Bradford	Capital Cleveland Select Earlyred Whitehouse	Aristocrat Autumn Blaze Fauriei Redspire



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Austin Hagan, *Extension Plant Pathologist*, Professor, and **Edward Sikora**, *Extension Plant Pathologist*, Professor, both in Entomology and Plant Pathology at Auburn University, and **William Gazaway**, former *Extension Plant Pathologist*. Originally prepared by **Nancy Kokalis-Burelle**, former Graduate Assistant, Plant Pathology, Auburn University.

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