UTAH PESTS fact sheet
UtahState UNIVERSITY extension

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Fire Blight

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What You Should Know

Fire blight is a bacterial disease of rosaceous plants. Economically, it is most serious on pears and apples. The bacterium that causes fire blight, *Erwinia amylovora*, can be spread by insects, contaminated pruning or grafting tools, infected grafts, and any manner that carries the bacterial pathogen from an infected plant to one that is not, including wind and rain-splash. Pear and apple are most susceptible at flowering, but actively growing shoots can be infected as well. Fire blight can be managed by cultural and chemical means. Carefully pruning to remove infected wood in combination with the use of agricultural antibiotics are the most effective means to manage fire blight. Agricultural antibiotics, typically used by commercial growers to control the pathogen, are available to homeowners, but in certain areas of Utah, the bacteria can be resistant to streptomycin. Vigilant scouting for the disease combined with careful pruning techniques are recommended to manage fire blight in pear and apple trees.

Introduction

Fire blight (Fig. 1) is a serious bacterial disease of pears and apples that was first observed in the late 1700's in the Northeastern United States. It has since been found in all pear and apple-producing areas in the United States, as well as in New Zealand and Europe. *Erwinia amylovora* has the ability to infect many ornamental plants of the rose family, but is particularly important on pear and apple. It not only destroys the current season's crop, but may damage the structure of the tree and reduce subsequent production. Highly susceptible trees may be killed in a single season.

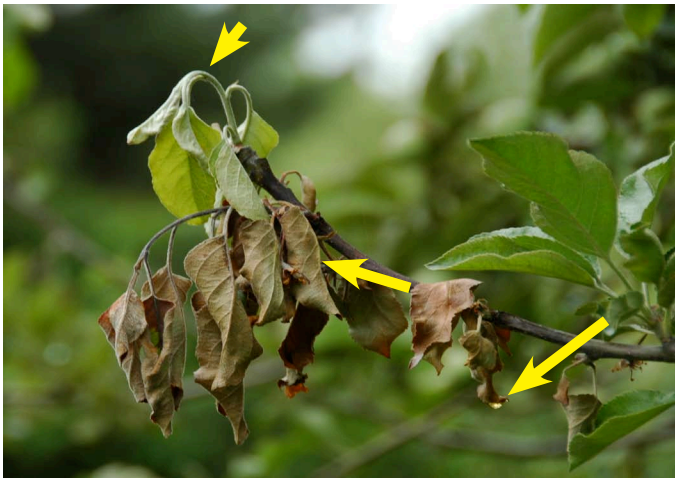

Fig. 1. A shoot on an apple tree exhibiting classic fire blight symptoms. Note the "shepherds crook", scorched leaves, and droplet of bacterial ooze (see arrows, left to right, respectively). Millions of *Erwinia amylovora* bacteria are in the droplet of ooze.

Symptoms

Fire blight symptoms are easily recognized by the scorched appearance of leaves, blossoms, and young terminal shoots. Initial infection causes wilt; infected tissue and tissue outward of infections turns black on pear and brown on apple. Blighted leaves remain attached to the tree through much of the dormant season. Infected ends of shoots (terminals) often exhibit a typical curling on the end, called a "shepherd's crook" (Figs. 1 and 2). Small droplets of bacterial ooze are a diagnostic sign of fire blight. This ooze is amber colored on infected leaves, flowers, and young terminals. Pear trees are generally more susceptible to fire blight than apple trees. Infection of pear flowers or terminals may progress into larger branches and even into the trunk, causing death. Apple infections usually result in death of flower clusters. Fruit of either tree may also become infected, beginning with a brown firm rot that rapidly encompasses the entire fruit. Droplets of ooze are common on infected fruit. Fruit eventually shrivel and may remain attached through the winter. Bacterial cankers form when the infection progresses into woody tissue. Cankers are slightly sunken areas with discoloration of the bark.

Fig. 2. Note the "shephard's crook" symptom at the terminal end of the fire blighted apple shoot. Also note the blossom cluster where the infection likely occurred.

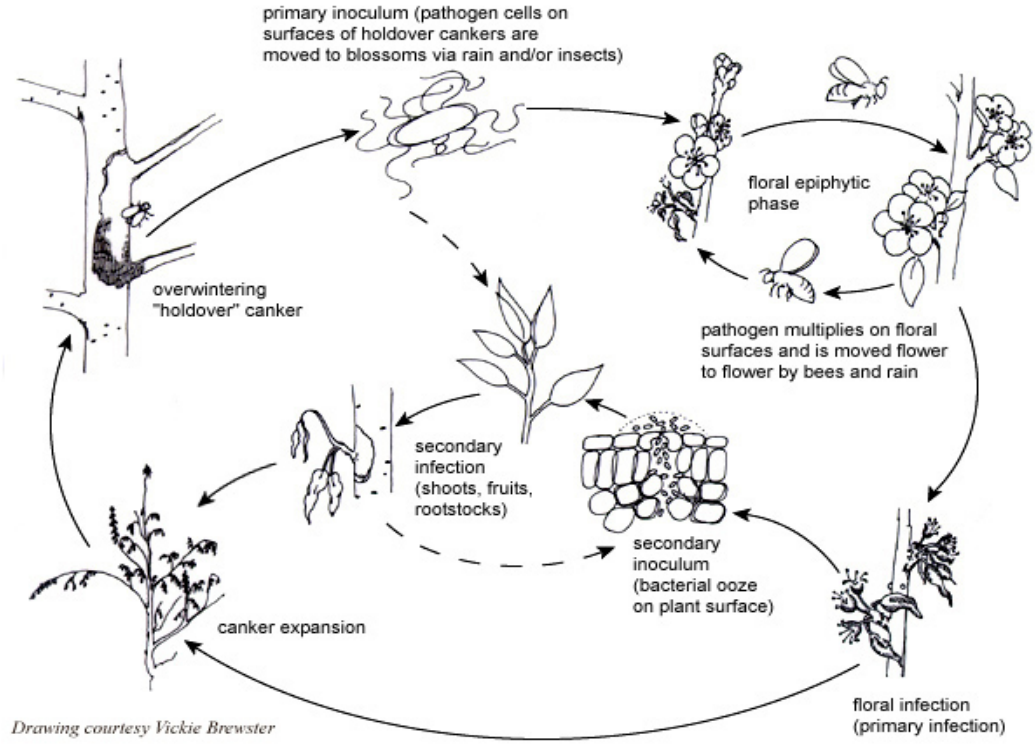

Fig. 4. The disease cycle of fire blight, caused by the bacterial pathogen *Erwinia amylovora,* on apple and pear trees. Reproduced with permission from Johnson, K.B. 2000. Fire blight of apple and pear. The Plant Health Instructor. DOI: 10.1094/PHI-I-2000-0726-01. **Copyright ©, American Phytopathological Society**.

Disease Cycle

The bacteria overwinter within infected tissues at the margins of cankers (see upper left side of depiction in Fig. 4 and lower right in Fig. 5, below). When weather stimulates trees to break dormancy, nutrients and moisture begin moving up from the roots. Bacteria utilize these nutrients and moisture to actively grow. Expanding cankers can eventually girdle the infected branch, killing all growth beyond the canker. Droplets of ooze, called the primary inoculum, are exuded and contain millions of bacteria (Fig. 5). Insects such as flies are attracted to the ooze and transport the bacteria to flowers during later visits. Even if there are no cankers in the orchard, bacteria may still be present. Bees and any other insects that visit flowers can spread bacteria to new infection sites. At flowering, splashing water from rain or irrigation, is the most effective manner that moves bacterial cells from ooze, to flowers and shoots of adjacent trees.

Once in the blossom, the bacteria multiply on the stigma of the flower (Fig. 6, blue arrow). Infection takes

Fig. 5. A fire blight canker on a scafold branch of an apple tree. Bacterial ooze, running from the margin of the canker, can be transmitted by insects such as flies, and rain splash, to the open flower blossoms.

Fig. 6,. The flower cutaway with the blue arrow pointing to a stigma. The red arrow points to the floral cup where bacteria enter the flower.

Fig. 7. An infected fruitlet oozing bacterial inoculum (at tip of arrow).

place when the bacteria are washed from the stigma, by rain or heavy dew, to the floral cup, entering the blossom through natural pores that normally secrete nectar. Blossoms become watersoaked or dark green and can often exude bacterial ooze (Fig. 7). Infected blossoms quickly blacken and die within a few days (Fig. 8). Infection of shoots usually takes place after blossom infection and then only on new succulent leaves and stems. Bacteria enter through natural openings such as stomates (small

Fig. 8. A fire blighted blossom cluster exhibiting complete collapse.

pores for gas exchange) or wounds caused by hail, wind, or sucking-piercing insects. The tree is susceptible to infection until new growth stops. Root sprouts and trunk suckers are frequently infected and allow the disease to easily spread into the trunk or root system and rapidly kill the entire tree. *Erwinia amylovora* can survive in other rosaceous hosts such as pyracantha, hawthorn, cotoneaster, mountain ash, and crabapple that may be growing near the orchard. The bacteria can infect any succulent growth on the plant and may also cause bacterial oozing (secondary inoculum). Bacterial ooze may be exuded from infections as droplets or as cottony strands, which are very fragile and shatter with wind or water movement.

Management

Any practice that promotes excessive succulent growth should be avoided. Trees should be fertilized to promote good health, but overfertilization with nitrogen or applications late in the season often cause excessive new growth that is susceptible to fire blight infection. Remove blighted blossoms and twigs as soon as they are evident. The infected blossoms and twigs should be pruned a minimum of 8 - 12 inches below the obvious infection. Avoid heavy pruning in the early summer because it stimulates succulent growth, which is very susceptible to blight. During the dormant season, remove any cankers or blighted tissue. Also, remove any suckers growing up from the roots or on the trunk. It is advisable to avoid using pruners on small twigs; use hands to break out the blighted twigs. Pruners should be soaked in a 10% solution (1 part bleach:9 parts water) of household bleach, or good surface disinfectant, between cuts when pruning out active fire blight in the summer. Bleach solution is effective but is corrosive to pruning tools. Rinse, dry, and oil the tools several times during the pruning. Pruners need not be sterilized between cuts when pruning during the dormant season. Hosts of fire blight such as pyracantha, hawthorn, cotoneaster, and crabapple growing near the orchard should be eradicated. This will reduce fire blight inoculum in the orchard. Avoid excessive irrigation to reduce humidity in the orchard. If using sprinkler irrigation, do not allow the water to wet the foliage since it will act in the same manner as rain in spreading bacteria. No cultivars are completely resistant to fire blight, but some are less susceptible than others. If fire blight is a common problem in your area, plant less susceptible varieties.

Fire blight bacteria in Utah County have been tested and are documented to be resistant to streptomycin. ***Use of streptomycin, to control fire blight, is not recommended in Utah County. Instead, use compounds containing oxytetracycline.***

Treatments

Dormant Spray

In orchards with a history of severe fire blight, it is advisable to carefully prune out overwintering cankers and spray with a copper-plus-oil mixture at the delayed dormant stage (silver tip to green tip). Copper compounds can be phytotoxic if they are sprayed much past the bud burst stage (1/2 inch green). This spray is thought to reduce the levels of inoculum in the orchard, but may also be effective in reducing insect vectors.

Bordeaux mixture (see formulation below) plus 1 gallon of 60-70 second spray oil. Preparation of Bordeaux Mixture: Dissolve 8-pounds crystalline copper sulfate in 100-gallons of water in the spray tank. After the copper sulfate is dissolved, add 8-pounds hydrated spray lime (350 mesh), either mixed in water or as powder, to the tank. Constant agitation is needed to thoroughly mix the contents of the tank. Finally, add 1-gallon of spray oil.

Copper hydroxide plus oil.

Copper oxychloride sulfate + Basic copper sulphate.

Blossom Sprays[1]

Streptomycin and oxytetracyline, and fixed copper sprays have proven very effective in reducing fire blight provided they are properly applied at correct times. They are preventive sprays only and must be repeated every 4 to 5 days as long as new flowers are opening. A biological control compound (a bioantagonistic bacterial competitor) has recently been licensed for the control of fire blight as well (Bloomtime FD [*Pantoea agglomerans*]).

Agricultural antibiotics available for the treatment of fire blight in pears and apples in Utah include Agri-mycin 17 (streptomycin sulfate **[not recommended for use in Utah County]**) and/or Mycoshield (oxytetracyline-calcium complex).

Fixed Coppers:
Copper oxychloride sulphate (C-O-C-S WDG)
Kocide branded products (20/20, 101, 2000, and 3000, *read labels as some are phytotoxic and may not be labeled for pear, only for apple*).

Timing bactericide applications is critical. A delay of even several hours can reduce the level of control. It is not necessary to spray until mean daily temperature during bloom (average of maximum and minimum temperatures from midnight to midnight) first exceeds 60 ^{o}F in the spring. Use forecasting models such as Maryblyt or Cougarblight to determine when to spray. Sprays should be repeated at 4 to 5 day intervals throughout the bloom period as long as temperatures are above the mean threshold. Applications are most important on young pears and susceptible varieties of apples.

Mention or exclusion of chemical controls of fire blight, in either pear or apple, represents neither endorsement nor criticism of any available products. Always read the label and be familiar with the product's intended uses and limitations. **Never use a chemical pesticide in a manner that is inconsistent with its labeled instructions, it is a violation of federal law.**

[1]Fixed coppers may have a phytotoxic effects causing russetting on fruit. Do not use fixed coppers on d'Anjou pears.

Resistant Cultivars

Fire blight-resistant cultivars of apple include: Red Delicious, Liberty, Prima, Pricilla, Redfree, Spartan, and Sir Prize. There are many moderately-resistant cultivars including Honeycrisp, Duchess, Empire, Golden Delicious, Granny Smith, Jonagold, McIntosh, Mutsu, and Winesap. This is not an exhaustive list as there are many cultivars of apples.

Some less-susceptible cultivars of pear include: Harrow Delight, Harvest Queen, Kieffer, Moonglow, Seckel, LaConte, and Magness.

Diagnosis

To be sure that fire blight is causing the symptoms, samples can be collected and checked for the presence of the pathogen. Contact your local County Extension agents as they often can provide diagnoses quickly and accurately. If confirmation is desired, then the sample may be sent to the diagnostic laboratory. To do this, collect floral or shoot tissues exhibiting symptoms of infection. Plant tissues should be sealed in a plastic bag and sent to: Utah Plant Pest Diagnostic Lab, Department of Biology, 5305 Old Main Hill, Logan, UT 84322. Care should be taken not to expose the bag to excessive heat or cold so that the specimen and pathogen remains alive until the sample is received. General instructions for sample collection and shipment can be found at: http://utahpests.usu.edu/uppdl/htm/forms and directing your browser to the diagnostic laboratory sample submission information.

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