Disease Identification
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TREE FRUIT CROPS

CORNELL COOPERATIVE EXTENSION

IPM Integrated Pest Management

Fire Blight

Erwinia amylovora (Burrill) Winslow

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Fire blight is one of the most destructive diseases of apple and pear trees. Outbreaks are sporadic in most parts of the Northeast, but can cause extensive tree damage when they do occur. Therefore, the necessary intensity of control programs will vary considerably for different plantings and in different years, depending on individual orchard factors and weather conditions.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

Symptoms

Fire blight produces several different types of symptoms, depending on what plant parts are attacked and when. The first symptom to appear, shortly after bloom, is that of blossom blight. In the early stages of infection, blossoms appear water-soaked and gray-green but quickly turn brown or black; generally, the entire cluster becomes blighted and killed (Fig. 1). The most obvious symptom of the disease is the shoot blight phase, which first appears one to several weeks after petal fall. The leaves and stem on young, succulent shoot tips turn brown or black and bend over into a characteristic shape similar to the top of a shepherd's crook or candy cane (Fig. 2). Small droplets of sticky bacterial ooze often can be seen on the surface of these blighted shoots when the weather is warm and humid. Under favorable conditions, shoot blight infections will multiply and continue to expand down the stems, causing the tree to appear scorched by fire (Fig. 3). Shoot blight infections can expand beyond the current season's growth into the older supporting wood, causing dark sunken cankers to form (Fig. 4).

Fruit may appear small, dark, and shriveled if infected when young, or show expanding red, brown, or black lesions when infected later. Infected fruit often exude droplets of sticky bacterial ooze, particularly when the weather is warm and humid (Fig. 5). Entire trees on highly susceptible rootstocks (Mark, M. 9, M. 26) or interstems can wilt and die if this portion becomes infected (Fig. 6; note sunken, girdling canker on the M. 9 interstem piece). The original source of such "rootstock blight" infections is not always obvious.

Disease Cycle and Causal Organism

Fire blight is caused by the bacterium *Erwinia amylovora.* In addition to apple and pear, other susceptible plants include quince, *Pyracantha* (fire thorn), *Cotoneaster,* mountain ash, hawthorn, and raspberry.

Fire blight bacteria overwinter in the bark at the edge of cankers formed during previous growing seasons. As weather becomes warm in the spring, the bacteria multiply, ooze to the surface in sticky droplets (Fig. 7), and are transferred to flowers by insects or rain. Once on the flower stigmas (sticky pollen receptors), the bacteria multiply rapidly when temperatures are greater than 65° F (18.3° C), and are easily moved from flower to flower by bees. Bacteria on the stigmas can build to very high levels during warm bloom periods, but infection does not usually occur unless they are washed by rain to natural openings (nectaries) at the flower base.

Blossoms wilt and die about 1–2 weeks after infection occurs, and the bacteria that ooze from them provide inoculum for secondary spread to young succulent shoots. The bacteria are moved to shoots by insects and rain, and infection occurs through wounds caused by insect feeding, wind-whipping, and hail. Additional bacterial ooze is produced from these new infections sites, providing inoculum for further spread so long as shoots keep growing and wounds are produced. As the season advances, shoots become progressively less susceptible to new infections as their growth slows and stops. Bacterial advancement through woody tissues also slows and cankers are formed, where some bacteria overwinter and renew the disease cycle the following spring.

In addition to producing surface ooze in the spring, overwintering bacteria occasionally move internally from canker margins to nearby shoots, which they infect systemically. Such "canker blight" infections produce a characteristic yellow-orange color in the wilting shoot tips during the early postbloom period (Fig. 8). These infection sites can provide an alternative source of inoculum for initiating summer shoot blight epidemics in years when blossom blight is scarce.

Rootstock infections can occur as a specialized form of shoot blight and canker formation, when succulent rootstock suckers become blighted and infection progresses into the rootstock portion of the trunk. However, most rootstock infections are not associated with suckers, and it appears that many develop when bacteria move systemically from scion infections down into the rootstock. The factors that influence this systemic movement are unknown.

Control

Fire blight is best controlled using an integrated approach that combines (a) horticultural practices designed to minimize tree susceptibility and disease spread; (b) efforts to reduce the amount of inoculum in the orchard; and (c) well-timed sprays of bactericides to protect against infection under specific sets of conditions.

Horticultural practices. The most effective horticultural practice for minimizing fire blight outbreaks is to avoid highly susceptible cultivars and rootstocks. Highly susceptible apple cultivars include Crispin (Mutsu), Fuji, Gala, Idared, Jonathan, Monroe, Paulared, Rhode Island Greening, Rome Beauty, 20-Ounce, and Wayne. Such cultivars on highly susceptible rootstocks (Mark, M.9, M.26) are particularly dangerous combinations, since one bad outbreak can lead to substantial tree death within the orchard. Most popular pear cultivars are highly susceptible to fire blight, although Seckel is somewhat less so.

Shoot blight is most common on young succulent growth; therefore, pruning systems and nitrogen fertilization practices that avoid excessive and prolonged shoot growth are important for limiting shoot blight severity. Advancement of disease into the supporting framework of the tree can be minimized by pruning out blighted shoots as soon as they appear in the early summer . This practice is particularly important on young or dwarf trees, where infected shoots may be only a short distance from the trunk or major scaffold limbs. Cuts should be made at least 8–12 inches (20–30 cm) below the margin of visible infection. Sterilizing pruning shears with alcohol or household bleach between each cut is commonly recommended, although this practice is often impractical and of limited value.

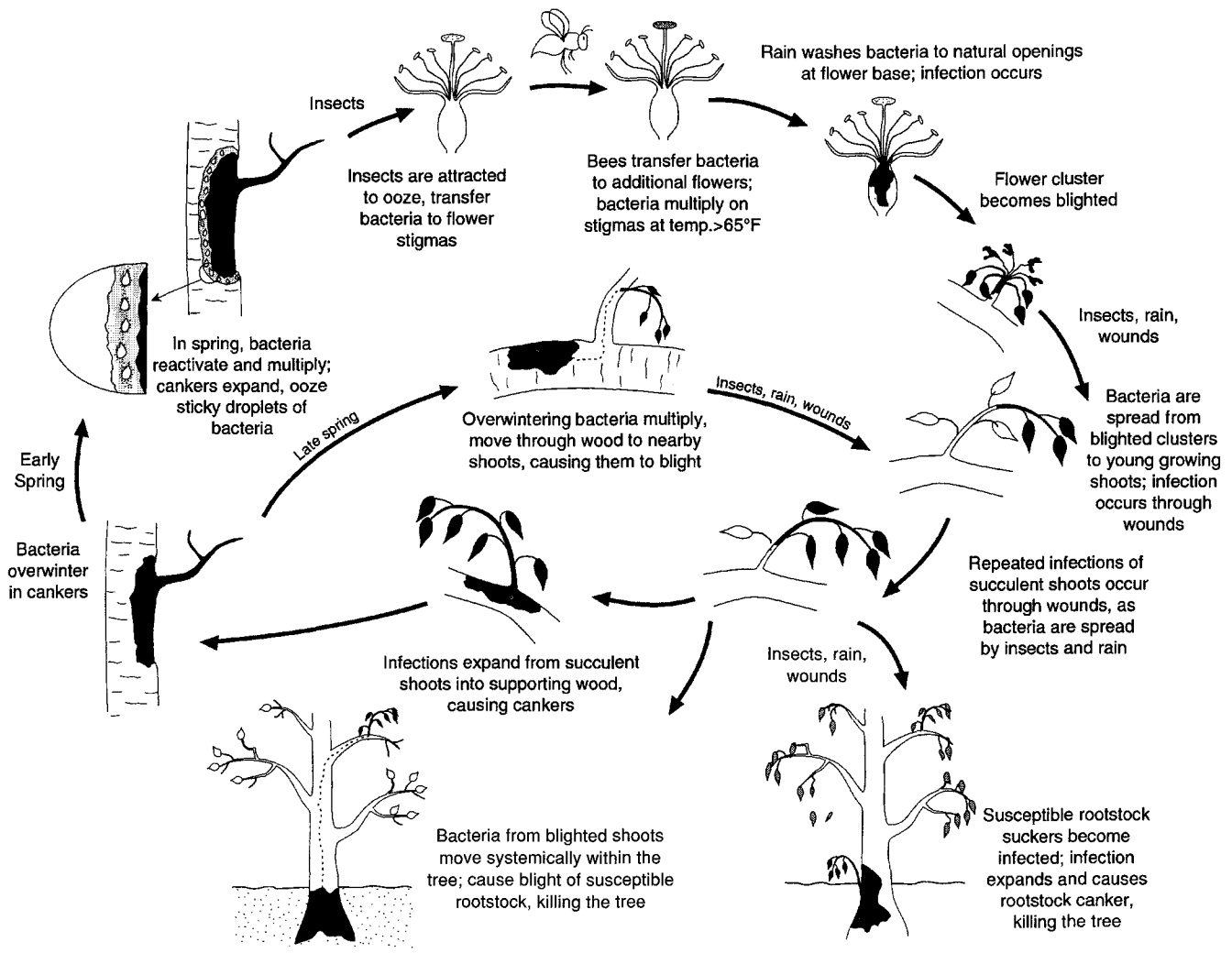
Good control of insects with piercing and sucking mouthparts (aphids, leafhoppers, pear psylla) can be important to slow the spread of shoot blight infections.

Inoculum reduction. Primary inoculum sources should be reduced by pruning out cankered limbs and branches during the dormant season. Application of a copper-containing fungicide/bactericide at or shortly after green tip will further reduce the number of new fire blight bacteria produced from overwintering cankers. In orchards with a history of fire blight, the yellow-orange shoots characteristic of canker blight infections should be scouted for and pruned out 1-2 weeks after petal fall; this is particularly useful when blossom blight is well-controlled and canker blight infections are thus the main source of inoculum for disease spread during the summer. Pruning out new shoot blight infections as they appear can also help limit disease spread, but will be most effective if practiced rigorously during the first few weeks after bloom; pruning will do little to slow disease spread if delayed until a large number of infections are visible.

Bactericide sprays. Most serious fire blight epidemics begin with infection during bloom. Certain antibiotics can effectively protect against blossom infections when applied shortly before or immediately after they occur; various prediction systems have been developed to help determine when such sprays are most important. Most systems are based on the principle that (a) a certain number of heat units, usually in excess of 65°F (18.3°C), must accumulate during bloom before a threshold level of inoculum has been reached; and (b) rain is necessary after this point, to wash the bacteria to their infection sites. Thus, antibiotics should be applied just before (or after) a rain if the inoculum threshold has been reached. Check for current, local recommendations.

Routine use of antibiotics to prevent shoot blight spread during the summer is not effective or recommended. However, applications to protect new wounds immediately following a hail storm can be very beneficial; check current recommendations.

FIRE BLIGHT DISEASE CYCLE



E. Gotham

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