Fire Blight of Apple

Fire blight, caused by the bacterium *Erwinia amylovora*, is a serious bacterial disease of fruit trees. It causes damage and economic losses in apples and related plants such as pear, crab apple, hawthorn and mountain ash. Raspberry and blackberry plants can also be infected by the bacterium, but the strain that infects raspberry and blackberry plants does not infect apple and vice versa. Historically, incidence of fire blight infection has been low in New Brunswick apple orchards. In 2014, there was relatively higher fire blight incidence in apple orchards as a result of a mid-summer hurricane, which damaged apple trees and increased the susceptibility to fire blight.

Symptoms

Fire blight attacks different plant parts and the disease has various names depending on the part of the tree infected. For example, blossom blight (Fig. 1) refers to fire blight infection of flower blossoms. Blossom blight is the first symptom to appear shortly after bloom. Initially, there is a water soaked appearance to the blossoms, followed by wilted (shriveled) blossom clusters and finally, discolouration of the blossoms progressing from dark green to brown or black. Shoot blight (Fig. 2) first appears one to several weeks after petal fall. Disease symptoms continue to advance throughout the spring and summer season on susceptible tissue (leaves and branches).

Fig. 1: Blossom blight symptoms

Fig. 2: Shoot blight symptoms

The young, succulent tissues turn brown or black and the shoot tips curl in a characteristic way referred to as ‘shepherd’s crook’. Under warm and humid conditions the fire blight bacteria multiplies rapidly and small droplets of milky coloured, sticky bacterial ooze start to appear on the surface of blighted shoots (Fig. 3). The bacterial ooze turns brown soon after exposure to the air.

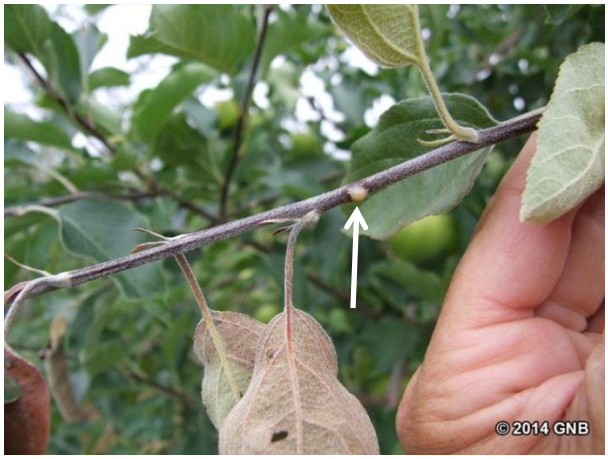

Fig. 3: Shoot blight symptoms (note bacterial ooze) Fig. 4: Canker on infected branch

Usually the most succulent shoot tip and suckers become infected first and wilt from the tip downward.

A sunken canker (Fig 4) is formed when the shoot blight infection progresses into large branches, trunk and the rootstock. These cankers serve as a source of inoculum. The bacteria can internally move from a canker in the tree or can be spread from canker to another healthy tree by insects, rain or wind.

Fruit can also be infected during the growing season (Fig 5). Fruit infection occurs through wounds caused by insect, wind, and rain or hail damage. Similar to shoot blight, small creamy droplets of bacterial ooze are discharged from infected fruits under humid conditions. Infected fruit initially appear small, grey, or water soaked and later the fruit shrivels and turns brown or black and appear mummified.

Root stock blight (Fig. 6) affects susceptible root stocks such as Malling 9 and M.26. The bacteria from infected shoots can move down and spread into the root stock and initiate a canker that often leads to the death of the entire tree.

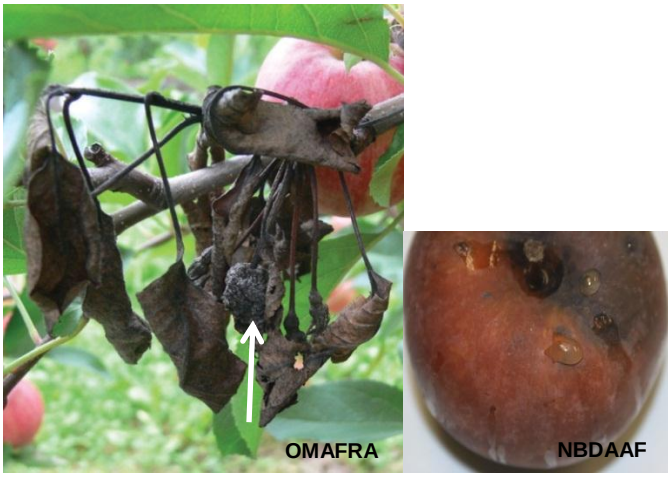

Fig. 5: Fruit blight symptoms

Fig. 6: Root stock blight symptoms

Trauma blight refers to fire blight infection caused when major weather events (late frost, storms accompanied by hail or high winds) cause injury to the plant tissue. Bacterial inoculum present in or near the orchard can enter through the wounds and cause infections. Trauma blight occurred in New Brunswick following the tropical storm hurricane Arthur in July 2014.

Disease Cycle

The bacteria that cause fire blight overwinter at the margins of cankers on limbs or fruit buds that were infected during the previous growing season. Infection and development of fire blight depends on the availability of the pathogen (bacteria), a susceptible host and favourable weather conditions. An extended period of hot (25ºC – 28ºC) and wet weather increases the multiplication rate of bacterium and infection. Development of fire blight occurs at almost the same time as flowering. Insects such as bees, flies and ants are attracted to the ooze and spread the bacteria to other flowers as they visit throughout the orchard. The bacteria can also move directly from oozing canker to healthy flowers when carried by wind or in splashing rain drops. The pathogen rapidly colonizes any open blossoms. The bacterial inoculum moves quickly down into the fruit spur through the vascular system resulting in the death of flowers, leaves and fruit on it, and may kill the whole tree.

Fire blight Management

Fire blight can be managed by integrating various pest management strategies. The management program should include disease monitoring and forecasting, cultural practices, and timely application of disease control products.

- ***Monitoring and disease forecasting***

Fire blight forecasting models, such as MaryBlyt and Cougar Blight, that can predict the risk of fire blight infection, have been developed. These models incorporate various features such as temperature, wetting events (rainfall, fog, dew), history of the orchard (incidence of fire blight in the area) and growth stage of the trees in the orchard. The models predict when sprays are needed to protect blossoms from infection. For instance the MaryBlyt model predicts a blossom infection if the following conditions occur:

1. Open flowers (blossom open with petals intact)
2. Accumulation of 110 degree hours > 18.3ºC from first open bloom
3. A wetting period: as dew, or rain (≥ 0.25 mm) during the current day, or ≥ 2.5 mm rain the previous day, or a spray application
4. A mean daily temperature of ≥15.6ºC

- ***Cultural practices***

If any symptoms of fire blight are present in the orchard during the growing season, remove the infected branch and destroy it as soon as possible. When pruning infected orchards during summer, leave ‘ugly stubs’ for later removal. This pruning is conducted by leaving at least a 13 cm ‘ugly stub’ of the pruned wood on a healthy limb or spur. A small canker may develop but the tree confines the disease on the ugly stub. The ‘ugly stub’ should be marked for easy identification and then pruned during the following winter.

During the winter (dormant period), all twigs, branches and cankers that could be infected with fire blight should be pruned to reduce the inoculum source. Prune at least 30 cm (12 inches) or more

below the point where the symptoms are visible. All pruned material should be removed from the orchard and destroyed.

Sanitation: Remove and burn all infected limbs. Be careful when moving the limbs from orchards to avoid any further spread of the pathogen. Also, bacteria can be transferred from tree to tree through pruning tools. Disinfect pruning tools between cuts with 6% sodium hypochlorite (household bleach) or alcohol solution (70 -75% alcohol solution).

Avoid cultural practices that promote excessive tree growth. Excessive nitrogen fertilization can result in succulent growth which is susceptible to fire blight. Excessive pruning may also encourage succulent growth and suckers which are more susceptible to infection.

Other plants such as crab apple, hawthorn and mountain ash can be infected by fire blight and be a source of inoculum in apple orchards. It is recommended to remove these trees from the orchard area.

Orchards should be closely checked for any symptoms of fire blight, blossom infection, infected spurs and cankers. Remove and dispose any infected blossoms, infected spurs and cankered branches.

- ***Selecting resistant cultivars and root stocks***

There is variability among apple varieties and root stocks with respect to resistance to fire blight. Apple cultivars and rootstocks resistant to fire blight should be considered when establishing new orchards (new plantings) (Table 1).

Table 1. Relative fire blight resistance of apple varieties and root stocks common in New Brunswick

Plant material	Least susceptible	Moderately susceptible	Highly susceptible
Apple cultivar		Ambrosia Cortland Empire Honeycrisp Jersey Mac McIntosh Spartan Sunrise	Gala and Gala-types Ginger Gold Golden Russet Idared Paula Red Wealthy Yellow Transparent
Root stock	M.7 B.9 Cornel-Geneva (CG) series 5	MM.106 MM.111 M.41	M.9 M.26 M.27 Mark Ottawa 3

(Adapted from OMAFRA)

- ***Insect pest control***

Wounds created as a result of insect feeding damage are entry points for fire blight bacteria. Orchards should be monitored for plant-sucking insects such as leaf hoppers, plant bugs and aphids, and insect control products should be applied as required.

- ***Chemical control options***

Copper: copper kills surface bacteria that are accumulated in the infection area and prevents the bacteria from colonizing the leaves and shoot tips to which the copper is applied. Copper should be re-applied at a regular interval because the shoot tips will out-grow the coverage. Copper sprays can cause fruit russeting if applied in summer. Thus, copper should be applied in bearing orchards at least once at bud-break and a second application not later than green tip stage. In non-bearing orchards, copper can also be sprayed one to two times per season.

Antibiotics: If an infection period is reached during bloom, an antibiotic such as streptomycin or kasumin (Kasugamycin) is applied. During a trauma blight event (e.g. hail storm or strong wind storm), streptomycin should be applied within 24 hours. Application timing should always be based on the weather forecast (use of a disease prediction model). In order to reduce development of resistance, streptomycin should not be applied more than three times per season.

Growth regulators: Application of Apogee is recommended to reduce vegetative growth making the trees less susceptible to fire blight. Apogee suppresses shoot blight symptoms by reducing terminal shoot growth. Apogee has no effect on blossom blight so antibiotics are still required if an infection is initiated during bloom. It is recommended to apply Apogee at bloom or petal fall and use repeated low rates as required.

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