BACTERIAL DISEASES ON TREE FRUIT: LEARNING LESSONS FROM 2013

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Overview

- Predisposing factors
- Symptoms
- Disease Cycle
- Management

**Fire blight**
*Erwinia amylovora*

**Bacterial spot**
*Xanthomonas arboricola pv. pruni* (Xap)

**Bacterial canker**
*Pseudomonas syringae pv. syringae*
*Pseudomonas syringae pv. morsprunorum*
Fire Blight

• Predisposing factors favoring the occurrence of fire blight
  Ṣ Rootstock susceptibility
    Mark
    M.9
    M.26

  Ṣ Cultivar susceptibility

  Crispin (Mutsu)    Jonathan    Nittany
  Fuji              Monroe      Rome Beauty
  Gala              Paulared    20 Ounce
  Idared            Rhode Island Greening    York
Fire Blight Symptoms - Blossom

Water-soaked
Gray-green
Quickly turns brown to black
Cluster “blighted” and killed
Bacteria oozes – droplets creamy white, then turns amber-tinted as they age
Fire Blight Symptoms - Shoot

Appears 1 wk to several weeks post petal fall
Leaves/stem on young succulent shoot tips – turn brown/black, characteristic “shepherd’s crook”
Numerous diseased shoots – blighted, “burnt” appearance
Bacterial ooze can be present
Fire Blight Symptoms - Shoot

Overwintering bacteria move from cankers to nearby shoots --infects systemically

***Cankers: alternative bacteria source for initiating summer shoot blight epidemics in years when blossom blight is scarce***

Summer 2013
Fire Blight Symptoms - Rootstock

Rootstock infection may develop when bacteria move systemically from scion infections down into the rootstock.

Symptoms:
- Water soaking
- Purplish-black discoloration, cracking, ooze
- Red to brown streaking in wood under bark
Fire Blight Disease Cycle

Optimum temperatures: 65 °F

Moisture

Insects
Rain

**High bacterial populations influenced by temperature

2013:
Spring: cool, limited blossom infection
Summer: shoot blight (cankers)
Fire Blight Management

Integrated approach

• Resistant Cultivars
  – Not immune = Still need control measures

• Chemical Products

• Horticultural strategies

• Control piercing-sucking insects
  – Aphids, leafhoppers, pear psylla

• Chemical products:
  – Copper: At green tip
  – Streptomycin
    • Monitor weather conditions* (Disease prediction models)
    • Do not use post petal fall (*unless hail event)
    • Does not control summer shoot blight
    • Resistance management
Fire Blight Management

• Horticultural practices
  – Avoid prolonged shoot growth to limit shoot blight
  – Prune out blighted shoots as soon as they appear (~ bloom time)
    ſ 8 -12 inches below margin of visible infection
    ſ Summer blight – wait until tree stops growing (dormant pruning)
  ** burn infected tissue/strikes
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Bacterial Spot

- Predisposing factors favoring the occurrence of bacterial spot
  - Cultivar susceptibility
    - Early bud break and early fruit ripening
  - Sandy and very clay soils
  - ~ 86 °F temperature
  - Relative humidity of 100% over a period of 3 days = appearance of disease

Bacterial Spot Symptoms - Fruit

• Early Season Lesions
  – 3 weeks after petal fall
  – Irregularly shaped
  – Extend deep into fruit

• Late Season Lesions
  – Shallow
  – Skin Cracking
  – Secondary infection: brown rot
Bacterial Spot Symptoms - Fruit

• Peach Scab
  – Circular lesions
  – Dark olive-brown, fuzzy lesions
  – Lesions form pattern
  – No fruit surface pitting
  – No foliar symptoms
Bacterial Spot Symptoms - Leaves

- Most susceptible before full expansion
- Angular lesions
- "Shot-hole" appearance
- Yellowing
- Premature defoliation
- Copper & Captan injury

Chemical injury
Bacterial Spot Symptoms - Twigs

- Cankers
- Bark cracking
- Black Tip

- Lack of vegetative growth
- Overwintering site for bacteria

Ritchie, D.
Bacterial Spot Disease Cycle

**Spring**
- First infect leaves

**Summer**
- Infect leaves and fruit
- Optimum conditions: Warm and wet
- Disease slows down: Hot and dry

**Fall/Winter**
- Overwinter in cankers, infected buds, leaf scars
- Left untreated: bacterial populations “explode”

**Polycyclic disease**

Courtesy A. L. Jones and T. B. Sutton.
Bacterial Spot Management

- Two Main Strategies
  - Resistant Cultivars
    - Not immune = Still need control measures
  - Chemical Products
- Copper
  - Phytotoxic
  - Risk of resistance

- Oxytetracycline
  - Suppresses bacteria
  - Up to 10 applications per season (**disease conditions)
  - Risk of antibiotic resistance
  - Persistent yield loss
  - Label limitations
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Bacterial Canker

- Predisposing factors favoring the occurrence of bacterial canker

Training systems

- Ranked in order of increasing vulnerability to canker infections

Least susceptible: Perpendicular V, Vertical Axis, Marchant, Vogel Slender, Spindle

Most susceptible: Modified Central Leader, Spanish Bush

Source: http://nysipm.cornell.edu/grantspgm/projects/proj09/fruit/carroll5.pdf
Bacterial Canker

- Predisposing factors favoring the occurrence of bacterial canker
  - Cultivar susceptibility
    - Ranked in order of increasing severity of bacterial incidence
      - Sweetheart, Lapins, Tehranivee, Hedelfingen, Regina
  - Rootstock susceptibility
    - Gisela rootstocks highly susceptible

Sources:  
http://nysipm.cornell.edu/grantspgm/projects/proj09/fruit/carroll5.pdf  
Bacterial Canker

- Predisposing factors favoring the occurrence of bacterial canker
  - Sandy and clay soils
  - Nutrient deficiency
  - High ring nematode populations
  - Winter pruning
  - Spring freezes (*May 2013 freeze)

- Bacteria: Ice nucleation proteins & frost injury
  - Proteins allow water to freeze at higher temperatures resulting injury to the plant
  - Bacteria “feed” on the nutrients released by the injured plant tissue
Bacterial Canker Symptoms

**Fruit**
- Sporadic
- Water – soaked lesions
- Chocolate – brown lesions

**Leaves**
- Sporadic
- Necrotic lesions, chlorotic rings
- “Shot hole” appearance
- Lesions occur along leaf margin - curling effect
Bacterial Canker Symptoms
Branches and Trunk

- Facilitated by stress
  - Spring frost
  - Severe winter freezes
  - Water - soaking
  - Blossom infection
  - Pruning wounds
  - Insect injuries

- Limb and tree death
- Cytospora Canker

- Sunken bark
- Amber gummossism
- Girdled branches and trunks

http://commons.wikimedia.org/wiki/File:Bacterial_Canker_-_Gummosis_on_Cherry.JPG  
http://commons.wikimedia.org/wiki/File:Bacterial_Canker_on_Cherry.JPG
Bacterial Canker

Favorable conditions - susceptibility

**Wind and rainstorms move the bacteria

- Mid-April (cool, wet, frost injury):
  - Bacteria overwintering in buds, cankers
  - *P. syringae* populations increase 10 – to 100 – fold during bloom *(blossom infection – blossom blast)*

- Summer:
  - Humid, wet weather: symptoms on leaves and fruit
  - Hot and dry conditions: *P. syringae* populations low

- Autumn rains and cooler temperatures:
  - *P. syringae* detected at high levels prior to and during leaf fall
  - ***Infection at leaf scars can be high***

- Early to mid-winter
  - Bacteria overwinter in cankers, dead buds, healthy buds
  - Exposed to severe temperatures increases chance of infection
Bacterial Canker Management

• Goal: reduce number of bacteria before trees enter susceptible period

• Using Copper*
  – Copper alone: evidence shows limited ability to control
  – Bordeaux mixture PLUS vegetable oil
    • 2.8 qts veg. oil/100 gal
    • (described: http://jerseyfruitagupdates.blogspot.com/2012/09/spray-cherries-for-bacterial-canker.html)
  – Sept, Oct, Nov, and in spring

• Pruning*
  – Avoid large dormant cuts
  – Minimize impact of disease with summer pruning
  – 12 inch rule: distances infection from the main trunk
Bacterial Canker Management

• Remove/Prevent tree stressors
  – Plant in well drained soils
  – Maintain adequate nutrients
  – Weed control: weeds support populations of bacteria
  – Remove wild Prunus
  – Do not interplant new trees with old trees
    • Old trees source of bacteria
Take home messages: Maintain healthy trees!

Fire blight and Bacterial spot
- Resistant rootstocks and cultivars
- Warm, humid temps favor high bacterial populations
- Dormant copper sprays
- Streptomycin – bloom time only, unless hail event (fire blight)
- Oxytetracycline – favorable conditions throughout the season (bacterial spot)
- Fire blight: Prune immediately or wait until tree stops growing

Bacterial canker
- Susceptibility of rootstocks and cultivars
- Spring freezes, cool fall weather promote disease
- Mindful pruning – summer (low bacteria numbers)
- Limited control options
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QUESTIONS?

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