Developing a Management Strategy for Little Cherry Disease

Andrea Bixby-Brosi & Elizabeth Beers: Entomology, Wenatchee, WA
Ken Eastwell: Plant pathology, Prosser, WA
Karina Gallardo: Economic Sciences, Puyallup, WA
Tim Smith: Regional Extension Specialist, Wenatchee, WA
Little Cherry Disease (LCD)

• Symptoms
  ▪ Produce cherries of small size and poor color and flavor
  ▪ Not the same for all cultivars
  ▪ Symptomless trees serve as a reservoir

• Economic losses
  ▪ Unpicked fruit
  ▪ Packing house rejections
  ▪ Tree and orchard removal
Little Cherry Disease history

• In BC Canada (Kootenay Valley)
  • First observed in 1933
  • Quickly spread to more than 30,000 trees within fifteen years, and then more slowly after 1950
  • The last packing line in the Kootenay Valley closed in 1979

• In Washington
  • Since 2010 LCD has become a statewide problem
  • Verified in Chelan, Douglas, Grant, Okanogan, Yakima, and Benton counties
Pathogens associated with LCD

1. Little cherry virus 2 (LChV2)
   - Transmitted by mealybugs (apple & grape)
   - Outbreak in Chelan and Douglas Counties

2. Western X phytoplasma (WX)
   - Transmitted by leafhopper (various species)
   - Surprising resurgence discovered in 2014

3. Little cherry virus 1 (LChV1)
   - Mode of transmission unknown
   - Present at low level throughout WA State
   - Typically found in combination with LChV2 or WX
Managing LCD (slowing the spread)

1. Control mealybug (or leafhopper)
   - No current recommendations for controlling mealybug in WA cherries

2. Identify and rouge infected trees
   - Difficult to ID LCD via visual symptoms
   - Currently molecular analysis is the most reliable diagnostic tool
   - Working to develop a diagnostic kit to simplify the ID process
Difficulty diagnosing infected trees

• **Visual diagnosis**
  - Trees may not show signs, but serve as a reservoir.
  - Degree of disease expression is dependent on cherry variety and weather.
  - Partial recovery in fruit appearance.
  - Confusion of symptoms with those of other pathogens, and certain types of nutrient deficiencies.

• **Molecular diagnosis**
  - Reliable, but expensive. Delays getting results.
  - Growers delay sampling and analysis, increasing the risk of inoculating nearby trees.
A diagnostic kit for detection of LChV2

• WSU Prosser worked with Agdia Inc. to develop the kits.
• May to June of the 2014, samples from symptomatic trees showing little cherry disease symptoms were tested for the presence of LChV2 by Agdia diagnostic kit.
• However, many samples from symptomatic trees did not give positive results in the RT-RPA assay format.
• Trouble shooting ensued......
Diagnostic kit troubleshooting results/conclusions

• Kits lack the sensitivity to reliably detect LChV2 in crude extracts used in RT-RPA method.

• Testing crude sap preparations during the latter part of the growing season provided much more accurate virus detection without the need to purify RNA.
  ▪ presumably due to decreased carbohydrate inhibitors present in crude sap and the increase in concentration of LChV2 in infected tissue.

• A new genetic variant of LChV2 was discovered.

• WX has been found to be an important pathogen associated with LCD in Grant and Chelan counties.
Little Cherry Virus 2 transmission

- Known Vectors

  - **Apple mealybug (AMB)**
    - Univoltine
    - Lifecycle understudied
    - No current control recommendations

  - **Grape mealybug (GMB)** (Mekuria et al. 2013)
    - Multivoltine

  - Egg masses on apple
  - Adults on shoot
  - Adults on cherry
  - Overwintering on apple under grafting tape
  - AMB egg mass
  - Adults

Mealybug control challenges

• Mealybugs notoriously difficult to control with foliar sprays
  ▪ Protected by cottony secretions and location on trees
  ▪ Gradual emergence
  ▪ Difficult to detect visually

Crawlers on the undersides of leaves

Egg masses in crevices
Apple Mealybug Phenology

- Overwintering females
- Overwintering males
- Emerged females
- Emerged males
- Egg masses
- Crawlers

Timeline:
- Jan
- Mar
- May
- Jul
- Sep

Phenological stages:
- Delayed Dormant
- Systemic Petal Fall
- Foliar Crawler
Apple Mealybug Chemical Control

**Foliar Crawler**
- Check
- Actara CE
- Diazinon CE
- Centaur CE
- AdmirePro Foliar CE

**Systemic Petal Fall**
- AdmirePro Drench PF
- Ultor+Oil PF
- Oil DD
- Diazinon+Oil DD
- Lorsban+Oil DD

**Delayed Dormant**
- Live AMB/leaf (seasonal mean)
Mealybug Control in organic systems

• Supreme oil, neem oil (multiple applications)
• Biological control using parasitoids
  ▪ AMB parasitoid – Encyrtid wasp, *Anyagyrus* sp.

Female on top, male on bottom

AMB egg masses with wasp exit holes

Lay eggs in AMB crawlers

Emerge

Mate
Progress for LCD project in 2014

- Diagnostic kit trouble shooting led to improved version
  - Release date unknown
  - WX kit in the works

- WX is more abundant than we previously thought.

- Delayed dormant plus a foliar crawler spray are best option for mealybug control
Plans for 2015

• Address chemical control options for GMB and organic for GMB and AMB
• Disease transmission bioassays
• Continue to troubleshoot the diagnostic kits
• Survey leafhoppers in WA orchards infected with WX
• Sample ‘whole orchards’ to determine disease epidemiology.
Acknowledgements

• Beers Lab Crew
• Eastwell Lab in Prosser
• Washington Sweet Cherry Growers
• Funded by
  ▪ Washington Sweet Cherry Growers
  ▪ Washington Tree Fruit Research Commission
  ▪ Oregon Sweet Cherry Commission
  ▪ California Cherry Board
  ▪ Stemilt Growers
  ▪ Washington Department of Agriculture