Role of insects in fire blight transmission

Larry Gut
Dissemination of fire blight

- Water and wind
- Insects and other arthropods
- Birds, deer
- Humans and mechanical equipment
Merton Waite, U.S. Dept. of Agric.

• First to implicate insects as vectors of fire blight
  Observed that honey bees and wasps carry fire blight bacteria from flower to flower

Literature review by Van der Zwet and Keil (1979) revealed:

- Numerous insects associated with the dissemination of fire blight
- Represented 77 genera
Insect transmission of fire blight occurs mechanically

- Bacteria adhere to various body parts
- No evidence that the bacteria colonize insects internally

Hildebrand et al. 2000
Infection of blossoms with fireblight using insects as vectors (Emmett and Baker, 1971)

- Insects exposed to infected pear slices
- Caged with blossoms
- Assessed blossom infection

![Bar chart showing percent infected flowers for different insects and plant species.](attachment:image.png)

- Honey bee: 57%
- Bumblebees: 58%
- Syrphid flies: 23%
- Other flies: 5%

Apple:
- Infection rates for different insects:
  - Honey bee: 57%
  - Bumblebees: 58%
  - Syrphid flies: 23%
  - Other flies: 5%

Pear:
- Infection rates for different insects:
  - Mining bee: 53%
  - Apple sawfly: 15%
  - Drone fly: 24%
  - Blowfly: 18%
Flower visitors - blossom transmission

- blossom to blossom
- tree to tree
- orchard to orchard
Influence of honey bees on fire blight transmission
(Van Laere et al 1981)

- Conducted in nylon mesh cages
- Test plant – *Cotoneaster salicifolius*
- Some artificially infected with fire blight
- Sprayed with Erwinia suspension (10⁹ bacteria/ml)
- Flower clusters checked for infection every 5 days for 4 weeks

Fire blight infected (2 plants)
Fire blight infected (5 plants)
Honey bee hive
Honey bee hive
Control – no hive
Influence of honey bees on fire blight transmission (Van Laere et al 1981)

- Control (no hive): 0%
- Infected (5 plants): 89%
- Infected (2 plants): 87%
Survival of fire blight bacteria in the hive and in honey

- Reported survival time in honey ranged from 2-11 days
- In other parts of the hive, a few days to a few weeks
- Consensus is that overwintering of fire blight bacteria in the bee colony is very unlikely
Insects that contact or feed on ooze
Occurrence of E. amylovora on Insects in a fire blight orchard (Hilderbrand et al 2000)

- Collected insects in a fire blight infected apple and pear orchard
- Screened for the presence of the bacteria

![Graph showing the number of events for different insect orders.

- Hymenoptera
- Diptera
- Coleoptera
- Homoptera
- Heteroptera
- Lepidoptera
- Plasmopera
- Mecoptera

- Detected on 15 of the 348 insects examined
- Four insect groups

Collected insects and contaminated specimens of various insect orders
Persistence of fire blight bacteria on insects (Hilderbrand et al 2000)

- Lacewings fed fire blight laced food
- Aphids surface contaminated

- Detected for up to 5 days
- Detected for up to 12 days
Survival rates of *E. amylovora* in (a) non-sterile soil or (b) sterile soil (Hildebrand et al 2001)

- Competition for limiting nutrients
- Predation by protozoons
- Growth inhibition originating from toxic derivatives produced by micro-organisms
Survival of *E. amylovora* in the gut of the collembolan, *Folsomia candida* (Hildebrand et al 2001)

- bacteria were fed to the insects
- re-isolated from the feces by plating on selective agar
## Controlling honey bees

Table 1. Reduced-risk, OP-alternative, biopesticide, kairomone and natural products tested organophosphate Azinphosmethyl have been summarized for impact on bees, mite predators such as lady beetles and Syrphid flies, and functional ecology indexes, which indicate overall impact on an orchard ecosystem.

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<th>EPA Class.</th>
<th>Class. Chemical</th>
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Management considerations

• Honeybees and other flower visitors provide essential pollination services and should never be the target of control measures.

• Keeping sap-feeding insects, such as aphids, psyllids, and leafhoppers, in check can reduce the incidence of fire blight infections.

• Best means of managing fire blight are the standard practices of removing infecting plant material, reducing shoot growth and applying bactericides.
Questions!