Other insect concerns in blueberries

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Topics

Blueberry pollinators

Blueberry maggot

Fruitworm caterpillars in blueberries
Blueberry pollinators

Which bees pollinate blueberries?

What are the “best” blueberry pollinators?

Are more bees better?
Which bees pollinate blueberries?

Surveyed 4 sites over 2 years

Shelley Rogers, MS Student
Pollinator community

Apis mellifera

Bombus spp.

Habropoda laboriosa

Xylocopa virginica

Small native bees
   Andrenidae
   Halictidae

Osmia cornifrons
Pollinator community

Apis mellifera

Bombus spp.

Habropoda laboriosa

Xylocopa virginica

Small native bees
   Andrenidae
   Halictidae

Osmia cornifrons

Site 1

Site 2

Site 3

Agapostemon splendens
Andrena spp.
Andrena sp. 1
Andrena sp. 2
Andrena bradleyi
Andrena carlini
Augochlora pura
Augochlorea aurata
Augochlorella gratiosa
Bombus bimaculatus
Bombus impatiens
Ceratina
Colletes
Habropoda laboriosa
Halictus ligatus
Halictus parallelus
Halictus rubicundis
Lasioglossum (Dialictus)
Lasioglossum (Evylaeus)
Lasioglossum (?)
Nomada
Osmia atriventris
Osmia cornifrons
Osmia lignaria
Osmia sandhousea
Scoliidae: Campsomeris
Sphecodes
Other wasps
Xylocopa micans
Measured single visit pollination efficiency

Treatments

- Pollinator Excluded
- Pollinator Visit
- Open Pollinated
Kevin Littlejohn waits for a single visit.
Results
Single visit efficiency is not the whole story

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abundance</td>
<td>number of actively foraging bees in an agroecosystem (Winfree et al. 2008, Tuell et al. 2009)</td>
</tr>
<tr>
<td>Per-visit efficiency</td>
<td>amount of pollination provided by a bee in a single visit to a flower (Inouye et al. 1994, Ne’eman et al. 2010, Artz and Nault 2011)</td>
</tr>
<tr>
<td>Activity patterns</td>
<td>foraging activity that may be dependent on weather (Dogterom 1999, Tuell and Isaacs 2010), seasonal phenology (Cane and Payne 1993), and spatial aspects of bee foraging behavior (Dogterom 1999, Gathmann and Tscharntke 2002, Ratti et al. 2008)</td>
</tr>
<tr>
<td>Visitation rate</td>
<td>number of flowers (or plants) visited over a period of time (Cane and Payne 1988, Ne’eman et al. 2010, Artz and Nault 2011)</td>
</tr>
<tr>
<td>Interspecific influence</td>
<td>interactions between bee groups that may reduce or enhance visitation rates or per-visit efficiency (Maloof and Inouye 2000, Greenleaf and Kremen 2006, Rogers et al. 2013)</td>
</tr>
</tbody>
</table>
Bee species differ in abundance during bloom...

<table>
<thead>
<tr>
<th>Bee group</th>
<th>Floral handling behavior&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Early bloom</th>
<th>Mid bloom</th>
<th>Late bloom</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>East</td>
<td>East</td>
<td>West</td>
</tr>
<tr>
<td>Bees group</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apis mellifera</td>
<td>L</td>
<td>19.9</td>
<td>42.7</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td>R</td>
<td>8.5</td>
<td>29.3</td>
<td>0.0</td>
</tr>
<tr>
<td>Bombus spp.</td>
<td>L</td>
<td>0.1</td>
<td>1.1</td>
<td>11.0</td>
</tr>
<tr>
<td>Habropoda laboriosa</td>
<td>L</td>
<td>11.3</td>
<td>16.6</td>
<td>0.0</td>
</tr>
<tr>
<td>Osmia cornifrons</td>
<td>L</td>
<td>0.0</td>
<td>0.0</td>
<td>101.8</td>
</tr>
<tr>
<td>‘Small native’ bees</td>
<td>L</td>
<td>0.4</td>
<td>2.6</td>
<td>43.8</td>
</tr>
<tr>
<td></td>
<td>R</td>
<td>0.0</td>
<td>1.3</td>
<td>0.4</td>
</tr>
<tr>
<td>Xylocopa virginica</td>
<td>R</td>
<td>0.9</td>
<td>2.4</td>
<td>0.0</td>
</tr>
</tbody>
</table>

<sup>a</sup> Indicates the floral handling behavior of each bee species during different bloom periods.

<sup>b</sup> Sampling periods for each bee group are as follows:
- Early bloom: 8
- Mid bloom: 7
- Late bloom: 5
- East: 8
Bee species differ in abundance during bloom, and based on weather.
Bumble bees are more likely to leave an arena after encountering a honey bee than after encountering another bumble bee.

This is likely a good thing!
<table>
<thead>
<tr>
<th>Bee Type</th>
<th>Abundant?</th>
<th>Efficient?</th>
<th>Activity limits?</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Apis mellifera</em></td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><em>Bombus</em> spp.</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><em>Habropoda laboriosa</em></td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><em>Xylocopa virginica</em></td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Small native bees</td>
<td>Sometimes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Andrenidae</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Halictidae</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Osmia cornifrons</em></td>
<td>No</td>
<td>Yes</td>
<td>Unknown</td>
</tr>
</tbody>
</table>
Are more bees better?

*Bee species diversity positive relates to seed set*

Our estimates suggest that each additional wild bee group contributes 3.66 seeds/berry. Summed over our system, each wild bee group adds ~$1.44 million/year to crop value.
Key blueberry pests

- **Blueberry stem borer**
  - Feeds on stems/branches

- **Thrips**
  - Feeds on leaves

- **Cherry & Cranberry fruitworms**
  - Feeds on fruit or flowers

- **Spotted wing drosophila**
  - Feeds on fruit or flowers

- **Blueberry maggot fly**
  - Feeds on fruit or flowers

- **Sharpnosed leafhopper**
  - Feeds on leaves

**Stages:**
- Dormant
- Prebloom
- Bloom
- Fruit Growth
- Harvest
- Post harvest
Blueberry maggot fly

Directly damages fruit, larvae feed internally

Quarantine concern for shipment to western US & Canada
Blueberry maggot fly

Most treatments in NC are motivated by quarantine restrictions
No formal monitoring program in place
Distinguishing SWD from other larvae present in blueberries

**SWD**
- Pointed on both ends
- Black mouth hooks visible on front
- No legs

**Blueberry maggot**
- Pointed on one end
- Larger when mature
- No legs
Blueberry maggot fly

Monitoring methods

• Yellow sticky (AM) traps baited with external ammonium bicarbonate lures

• DO NOT use prebaited traps, use AM-NB

• Check and change bait weekly

• Hang with fold facing down
Even prior to introduction of SWD, blueberry maggot populations in southeastern NC were extremely low.

1559 acres were monitored weekly in 2011 (1007 trap weeks), and 3 flies were captured.

At one location in western NC, which had never been managed for blueberry maggot, 165 flies were captured in 32 trap weeks.
Management

All materials effective against SWD are effective against blueberry maggot...but not all materials effective against blueberry maggot are effective against SWD
Cherry & Cranberry fruitworms

- Eggs laid in calyx cup on young fruit
- Larvae overwinter in hibernaculae in soil (CBFW) or in pruning stubs/dead leaves (CFW)
- Pupation occurs in spring, and adults emerge around bloom

Figure 13. Webbing (arrow) and premature ripening of fruit caused by feeding larvae.
Cherry & Cranberry fruitworms
Cherry & Cranberry fruitworms

Monitoring

Pheromone baited traps capture adults and should be placed at beginning of bloom

Direct cluster observation to detect damage
Cherry & Cranberry fruitworms

Management

- In locations with adult trap captures, treatments should be timed to egg hatch (~3 days after peak trap capture), typically around petal fall
- Select materials selective for caterpillars (Bt, Intrepid, Confirm, Knack, etc)