Cranberry Fruitworm in BC

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British Columbia Ministry of Agriculture
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Outline

• Life cycle
• Damage
• Monitoring
• Management
• References
Acknowledgements:

**Funding and Support for 2013 Project:**

- Growing Forward 2
- B.C. Blueberry Council
- B.C. Cranberry Marketing Commission
- Cranberry Growers Association
- Cranberry and Blueberry Grower Cooperators
- Ocean Spray Cranberries

**Field and Lab work done by:**

- E.S. Cropconsult staff: Kristine, Carolyn, Heidi, Renee, Marjo, Jason, and seasonal staff
- B.C. Ministry of Agriculture staff: Tracy, Mark, Samuel
Cranberry Fruitworm

*(Acrobasis vaccinii, Lepidoptera: Pyralidae)*

- Internal fruit feeding caterpillar, native to North America.
- Infests blueberry and cranberry in eastern North America.
- Moths detected for the first time in pheromone traps in a few BC cranberry fields in 2011.
Pest Biology:

- **Major Hosts:** cranberry, blueberry.
- Wild and minor crop hosts recorded:
  - Wild vaccinium
  - One generation per year.

4 life stages:

- Eggs
- Larvae
- Pupae
- Moth
Life cycle:

• Moth emerges in summer (June-July) and lays eggs on green fruit (July).
• Larvae hatch and burrow into developing fruit (July-Aug).
• Larvae will infest 3-6 fruit before exiting and searching for an overwintering site (August).
• Over-winters as larvae/pre-pupae in a silken structure in soil.
• Pupates in spring/early summer.
Cranberry Fruitworm Moth

Grey-brown moth with white triangles on wings; hind triangles with two dots each. Medium size moths, 15 mm wingspan.

Note: there are moths that look similar; these tend to occur later, i.e. in August. Sometimes girdler moths will get into fruitworm traps.

Photo: British Columbia Ministry of Agriculture
Cranberry Fruitworm Eggs

- Very small (1mm). Cannot identify without a lens.
- Laid singly or a few overlapping on the fruit calyx of green fruit.

Photos: British Columbia Ministry of Agriculture
Newly hatched larvae in calyx

Empty egg shell

Photo: British Columbia Ministry of Agriculture
Bore hole in stem end from tiny new larvae entering fruit. Unique to this pest.

Photo: British Columbia Ministry of Agriculture
Cranberry fruitworm larvae

- Light green head
- Body is green.
- Grows to ~1 cm

Photo: British Columbia Ministry of Agriculture
Larvae exit holes and frass in cranberry fruit

Looks very different from Fireworm, which mostly feeds on foliage, and sometimes makes large irregular holes in fruits.

Photos: British Columbia Ministry of Agriculture
Damage to cranberry fruit: ‘raisins’

Photo: British Columbia Ministry of Agriculture
Shriveled fruit in field

Photo: Heidi van Dokkumburg, ES Cropconsult Ltd.
Area-wide monitoring in 2013

- 2nd year of a multi-year project

- We expected that cranberry fruitworm moths may fly at a slightly different time in BC compared to eastern growing regions.

- Moth flight timing may fluctuate from year to year, depending on temperature.

- It would be important to know about these differences when planning pest management activities.
Area-wide monitoring in 2013

1. 33 cranberry fields and 27 blueberry fields were trapped with wing traps and commercial cranberry fruitworm pheromone, checked weekly, and number of moths recorded.
   – Traps were placed near row ends, adjacent to mixed natural trees and shrubs.

2. Fruit were collected during ripening and near harvest to look for presence of fruitworm.
Very few moths were caught in traps in blueberry fields (9 total moths in 2012, shown here).

In 2013, only 1 moth was confirmed (June 28) in a blueberry field beside a cranberry field known to have fruitworm (Richmond).
Cranberry fruitworm trap catches in BC Cranberry fields

2012

- First catch, 2 weeks earlier in 2013.
- Peak moth flight: 3 weeks earlier in 2013.
Moth catches in Cranberry 2013

- First moth catch: June 17
- Peak moth catch: July 1
- Slightly more moths caught in 2013.

*Trapping is important to see these annual fluctuations*
Comparing Cranberry Regions

Moths:
• East Delta
• West Delta
• South Richmond
• North Richmond (only 1 moth)

NO Moths:
• Surrey
• Langley
• Pitt Meadows/Maple Ridge
• Chilliwack

Same regions as in 2012
Egg searches once moths are caught:

- In fields with moth catches (8-12 fields/week), 200 random green fruit per field were collected until moth flight ended (June 24-August 8).
- Then, fruit was inspected with a microscope.
- Found eggs: July 1-July 25 in 1-4 fields each week.

We found no eggs and no damage in blueberry fields.
Table Recommended (for all practices) to Determine Necessity of Additional Spraying for Cranberry Fruitworm:

<table>
<thead>
<tr>
<th>Number of Acres</th>
<th>Number of Berries Checked</th>
<th>Number of Viable Eggs Needed to Trigger Spray during profitable berry prices</th>
<th>Number of Viable Eggs Needed to Trigger Spray during very low berry prices (&lt; $0.30 per lb.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5</td>
<td>200-250</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>6 or 7</td>
<td>251-350</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>8 or 9</td>
<td>351-450</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>10 or 11</td>
<td>451-550</td>
<td>4</td>
<td>8</td>
</tr>
</tbody>
</table>

for each additional 2 acres

add 100 berries  
add 1 egg  
double the number determined at left
Cranberry fruitworm eggs, status, & damage.

Compare two years:

**2012:**
- **bore hole**
- **hatched eggs**
- **yellow eggs**

**2013**
- **bore hole**
- **hatched eggs**
- **black head eggs**
- **yellow eggs**

### Number of eggs or damage in collected fruit

- **June 24-27**
- **July 1-4**
- **July 8-11**
- **July 15-18**
- **July 22-25**
- **July 29-Aug 2**
- **Aug 5-8**

### Date collected

- **July 9-12**
- **July 16-18**
- **July 23-25**
- **July 30-31**
- **Aug 6-8**
- **Aug 13**
- **Aug 20**
Cranberry fruitworm eggs, status, & damage.

START of the Egg laying period: 8 days earlier

### 2012:
- **bore hole**
- **hatched eggs**
- **black head eggs**
- **yellow eggs**

### 2013
- **bore hole**
- **hatched eggs**
- **black head eggs**
- **yellow eggs**
Cranberry fruitworm eggs, status, & damage.

Egg laying period: 5 vs 4 weeks
Insecticide management

- Target is the egg and young larvae **before** they bore into the fruit.
- Apply during egg laying, when 1 egg is found in 100 berries checked (per 2 acres);
  - Egg laying appears to begin shortly after moth catches begin.
- Second application 7-10 days after the first.
- Products are available for use in BC. Check with your packer to confirm:
  - Intrepid, Altachor,
  - Suppression ONLY: Success, Entrust (organic)
Timing of sprays

• Note that eastern spray recommendations relate to crop stage (i.e. 50% out of bloom).
• BC sprays will be later relative to bloom,
• Spray dates will vary each year, based on moth flight and egg detections.  
  (as we saw in our two years of monitoring).
• Eggs can be found 1-2 weeks after first moths.
Summary: Green Fruit Assessment

Number of fruit viewed, and fruit with eggs and stage.

<table>
<thead>
<tr>
<th></th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow eggs</td>
<td>28</td>
<td>15</td>
</tr>
<tr>
<td>Black head stage</td>
<td>0</td>
<td>14</td>
</tr>
<tr>
<td>Hatched eggs</td>
<td>51</td>
<td>3</td>
</tr>
<tr>
<td>Bore hole</td>
<td>59</td>
<td>10</td>
</tr>
<tr>
<td>Total fruit viewed</td>
<td>14,443</td>
<td>15,615</td>
</tr>
</tbody>
</table>

Slightly more fruit collected in 2013, similar number of eggs (yellow and blackhead eggs), but fewer hatched eggs and bore holes (indicating larvae activity)…**Possibly due to impact from last years’ sprays?**

Or just annual variation or sampling variation?

Need more than 2 years to determine trends.....
Ripe Fruit Assessment, shortly before harvest

- Sept 5 and Sept 19
- Collect fruit from at least five random 30 cm square areas near the trapping site.

Photos: British Columbia Ministry of Agriculture
% Cranberry fruitworm-damaged cranberry fruit per farm, collected 162-414 fruit on Sept 5, 2013

Acceptable damage: less than 3%

Richmond average: 2.4%
Delta average: 1.3%

Fields:

- Field 1 (damaged fruit)
- Field 2 (damaged fruit)
- Field 3 (damaged fruit)
- Field 4 (damaged fruit)
- Field 5 (damaged fruit)
- Field 6 (damaged fruit)
- Field 7 (damaged fruit)
- Field 8 (damaged fruit)
- Field 9 (damaged fruit)
- Field 10 (damaged fruit)
% Cranberry fruitworm damaged fruit collected
September 19, 2013

- Same ten Delta and Richmond fields on Sept 19 and Sept 5.
- Sampled additional five fields on Sept 19.
- None of these fields in other regions had cranberry fruitworm moth catches, nor did they have any damage.
Other management tools

• **Biological control:** some native parasitoids in eastern North America, but not enough to keep below damage thresholds. Not sure of levels in BC or western regions.
  – We have not confirmed parasitoids in BC.

• **Cultural:** 30 day spring re-flood before end of dormancy (‘late water’); not practiced in all regions.
• **Blueberries:** no damage to fruit reported, no eggs or damage recorded during our trials.

• **In BC, so far, Cranberry Fruitworm seems limited to Cranberries.**

• Will continue monitoring and management project survey in 2014 in both crops.

If it was in blueberry, this is what the damage would look like: lots of frass and webbing.

Photo: B. Cline, North Carolina

Photo: J.A. Payne, USDA/ARS
Next steps

1. Continue outreach and information sharing with growers, consultants, and packers.
2. Continue area wide trapping. Monitor in some new fields and areas if possible, in cranberries and blueberries.
3. Continue to track fruit damage in fields.
4. Refine monitoring and decision making for BC.
More information on Cranberry Fruitworm in cranberries:

University of Maine


Long Beach, Washington State University

- [http://longbeach.wsu.edu/cranberries/documents/cranberryfruitwormwisconsin.pdf](http://longbeach.wsu.edu/cranberries/documents/cranberryfruitwormwisconsin.pdf)

Photos: British Columbia Ministry of Agriculture