Cranberry Fruitworm in B.C.

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British Columbia Ministry of Agriculture
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- Ocean Spray Cranberries
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.
Cranberry Fruitworm Eggs

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

Empty egg shell
Bore hole in stem end from tiny new larvae entering fruit. Unique to this pest.
Cranberry fruitworm larvae

- Light green/brown head
- Body is green.
- Grows to ~1 cm
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.
Damage to cranberry fruit: ‘raisins’
Shriveled fruit in field
Area-wide monitoring in 2014

3rd year of a multi-year project

1. Wing traps and commercial cranberry fruitworm pheromone
   – 97 cranberry fields (32 farms) and
   – 28 blueberry fields (28 farms)
   – checked weekly, and number of moths recorded.
   – traps placed near row ends, beside 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 moths/trap/week in 28 blueberry fields (60 traps), 2014

19 moths total in 60 traps in peak week, July 18: still really low in blueberry fields
# Cranberry fruitworm moths caught in blueberry fields by region, 2014

<table>
<thead>
<tr>
<th>Region</th>
<th># traps</th>
<th>Total # moths caught June 13 to July 11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Richmond</td>
<td>4</td>
<td>25</td>
</tr>
<tr>
<td>Ladner</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>East Delta</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Surrey</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Langley</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Abbotsford</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Matsqui</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>PoCo/ Pitt Meadows</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td><strong>Pitt Meadows/ Maple Ridge</strong></td>
<td><strong>6</strong></td>
<td><strong>1</strong></td>
</tr>
<tr>
<td>Chilliwack/ Rosedale</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td><strong>TOTAL MOTHS CAUGHT</strong></td>
<td></td>
<td><strong>29</strong></td>
</tr>
</tbody>
</table>
# cranberry fruitworm moths caught/ trap/ week in cranberry fields

First moth 2014: June 9, 1 week earlier than 2013.
Peak flight: June 30-July 14.
# moths total per week in **cranberry** (97 traps)

![Graph showing moth population trend over time.](image)

- June 2: 0 moths
- June 9: 0 moths
- June 16: 0 moths
- June 23: 0 moths
- June 30: 0 moths
- July 7: 0 moths
- July 14: 0 moths
- July 21: 0 moths
- July 28: 0 moths
- August 4: 0 moths
- August 11: 0 moths
- August 18: 0 moths
- August 25: 0 moths

**Total Moths**
- 2014: 212 moths
- 2013: 36 moths
- 2012: 36 moths

- 6 times more moths than in blueberry fields.
- Number increases each year.
Total trap catch per trap over the season, cranberry fields (June 2 – August 25, 2014)
Comparing Cranberry Regions: 2012-2013

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

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

Same regions in 2012 and 2013
Comparing Cranberry Regions:

Moths:
• East Delta
• West Delta
• South Richmond
• North Richmond

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

2014: Moths now found in:
Pitt Meadows/Maple Ridge, More in North Richmond
Per cent of cranberry fields per region with moths

2013
2014

% of moth positive fields

Delta
S. Richmond
N. Richmond
Pitt Meadows, Maple Ridge
Langley
Chilliwack
Moth catches Summary:

- First moth catch: can vary from year to year
- Peak moth catch: around July 1
- More moths caught each year.
- Regional differences exist

*Trapping is important to see these annual fluctuations*
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-August).
- Fruit was inspected with a microscope.

We found no eggs and no damage in blueberry fields.
Eggs on fruit 2014

• First eggs found: June 27 in West Delta
• 11 days after first moths were detected in this field.
• Eggs were found: June 27—Aug 4
• Most eggs during week of June 30
• Peak eggs occurred early in moth flight
Moth catches and egg counts per week in cranberry fields

Peaks are close for both eggs and moths
Eggs and damage assessments from 19 moth-positive fields, 2014
• First bore holes (larvae burrowing into fruit): July 7
• Sprays were done from week of June 25 to July 28, most fields 2 applications
• Most larvae were dead July 7-28.
• After July 28, most larvae were live (no more sprays after July 28)

*Is a third spray needed?*
Sprayed cranberry fields with live or dead larvae

- Percentage of positive fields sprayed
- Percentage of berries containing dead larvae
- Percentage of berries containing live larvae

Week of June 23: 10
Week of June 30: 70
Week of July 7: 10
Week of July 14: 30
Week of July 21: 0
Week of July 28: 10
Week of August 4: 0
Week of August 11: 0

% of berries with larvae

% of fields sprayed
Fruit damage: September 2014

• 40% of fields (with moths) checked had fruit damage (8/20 fields)
• Variable damage level detected: 1/400 fruit to 1/10 fruit (0.21 – 11 %)
• 3 fields out of 20 (15%) had significant (6-11%) damaged fruit. Similar to 2013.
• >22 moths over the season (June-August) were caught in each of the ‘high’ fields.
• No fields with only 1 moth had damage.
• No damage seen in fruit-sampled fields with no moth catches
<table>
<thead>
<tr>
<th>Field #</th>
<th>Field</th>
<th>Total Trap catches</th>
<th>Total eggs</th>
<th>% of berry damage (Week of September 5)</th>
<th>% of berry damage (Week of September 19)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>W. Delta 1-4</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>W. Delta 1-5</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0.27</td>
</tr>
<tr>
<td>4</td>
<td>W. Delta 2-3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>1.38</td>
</tr>
<tr>
<td>6</td>
<td>W. Delta 3-2</td>
<td>38</td>
<td>--</td>
<td>1.34</td>
<td>0.35</td>
</tr>
<tr>
<td>7</td>
<td>W. Delta 3-4</td>
<td>22</td>
<td>3</td>
<td>3.33</td>
<td>5.71</td>
</tr>
<tr>
<td>5</td>
<td>E. Delta 1-4</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>E. Delta 2-2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0.2</td>
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<tr>
<td>8</td>
<td>N. Richmond 6-2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>N. Richmond 4-3</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>N. Richmond 2-1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>11</td>
<td>N. Richmond 5-2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>12</td>
<td>N. Richmond 1-4</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>13</td>
<td>S. Richmond 4-2</td>
<td>27</td>
<td>3</td>
<td>3</td>
<td>3.5</td>
</tr>
<tr>
<td>14</td>
<td>S. Richmond 2</td>
<td>51</td>
<td>20</td>
<td>10.73</td>
<td>6.71</td>
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<tr>
<td>15</td>
<td>S. Richmond 5-3</td>
<td>20</td>
<td>13</td>
<td>0</td>
<td>0</td>
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<tr>
<td>16</td>
<td>N. Richmond 8-1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
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<tr>
<td>17</td>
<td>S. Richmond 3-1</td>
<td>56</td>
<td>9</td>
<td>7.8</td>
<td>1.65</td>
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<tr>
<td>18</td>
<td>S. Richmond 1-1</td>
<td>29</td>
<td>4</td>
<td>1.17</td>
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<tr>
<td>19</td>
<td>PMMR 1-3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>20</td>
<td>PMMR 2-2</td>
<td>5</td>
<td>1</td>
<td>0.21</td>
<td>0</td>
</tr>
</tbody>
</table>
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 begins within a few days after moth catches begin.

• Second application about 10 days after the first.
  – *Third spray needed?*

• Products are available for use in B.C. Check with your packer to confirm acceptability:
  – Intrepid, Altachor,
  – Suppression ONLY: Success, Entrust (organic)
  – Delegate (for other caterpillars species).
A Reference for # of fruit to collect:

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>
<tr>
<td>for each additional 2 acres</td>
<td>add 100 berries</td>
<td>add 1 egg</td>
<td>double the number determined at left</td>
</tr>
</tbody>
</table>
Timing of sprays

• Eastern spray recommendations relate to crop stage (i.e. 50% out of bloom).

However,

• B.C. sprays do not need to occur until post bloom

• Spray dates may vary each year, based on moth flight and egg detections
  – (which is driven by temperature)
Degree days, predictive model

- MSU model seems to be accurate for Richmond, 2014, but may not be for all regions or all years. More years of comparisons needs to be made.

- In new regions where the pest is only detected at low levels, the model may not be very accurate, i.e. Pitt Meadows.
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.
• For blueberries, there was no damage to fruit reported and 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 2015 in both crops.

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

B. Cline, North Carolina

J.A. Payne, USDA/ARS
More information on Cranberry Fruitworm in cranberries:

University of Maine:  
http://umaine.edu/cranberries/grower-services/insects/cranberry-fruitworm/

Long Beach, Washington State University:  
http://longbeach.wsu.edu/cranberries/documents/cranberryfruitwormwisconsin.pdf

Michigan State University model:

http://msue.anr.msu.edu/news/using_msus_cranberry_fruitworm_degree_day_model

Reminder: Timing for pest life stages is a bit later in BC than in eastern cranberry growing regions.
Next steps

1. Continue outreach and information sharing with growers, consultants, and packers.
2. 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 in future years, as we gain experience and generate data.