Anarsia lineatella

Peach Twig Borer
Twig Borer Life Cycle
Typical Fruit Damage
2003 Peach Twig Borer Flight Pattern

Nightly Moths Trap-catch/Date

Date


0 3 6 9 12 15 18
Trapping Results: 2003

- Total PTB: **4,863**
- Average per trap: **413**
  - Duration: April-October
- Ave. per block: **608**
  - Boxelder County: 1,976
  - Utah County: 131

<table>
<thead>
<tr>
<th>Site</th>
<th>Total PTB</th>
<th>Per-Trap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perry</td>
<td>3388</td>
<td>1694</td>
</tr>
<tr>
<td>Willard</td>
<td>564</td>
<td>282</td>
</tr>
<tr>
<td>Kaysville</td>
<td>256</td>
<td>128</td>
</tr>
<tr>
<td>Payson</td>
<td>19</td>
<td>9.5</td>
</tr>
<tr>
<td>Santaquin</td>
<td>60</td>
<td>30</td>
</tr>
<tr>
<td>N. Santaquin</td>
<td>91</td>
<td>91</td>
</tr>
<tr>
<td>Genola</td>
<td>83</td>
<td>41.5</td>
</tr>
<tr>
<td>Lincoln Pt.</td>
<td>402</td>
<td>201</td>
</tr>
<tr>
<td><strong>Overall:</strong></td>
<td><strong>4863</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Average:</strong></td>
<td><strong>608</strong></td>
<td><strong>413</strong></td>
</tr>
</tbody>
</table>
Peach Harvest Damage (%)

- PTB
- Thrips
- Cat-facing bugs
- Various Leps

Bar chart showing damage percentages for different locations:
- Payson
- Lincoln Pt.
- Perry
- Willard
- Kaysville
- Santaquin
- Genola
## 2003 Shoot Strike Counts

<table>
<thead>
<tr>
<th>Orchard Site</th>
<th>Mean Strikes/tree</th>
<th>Harvest Damage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Payson Peaches</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Lincoln Pt. Nectarines</td>
<td>0.06</td>
<td>0.50</td>
</tr>
<tr>
<td>Perry Peaches</td>
<td>2.30</td>
<td>26.80</td>
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<tr>
<td>Willard Peaches</td>
<td>0.01</td>
<td>0.00</td>
</tr>
<tr>
<td>Kaysville Peaches</td>
<td>0.04</td>
<td>0.12</td>
</tr>
<tr>
<td>Santaquin Peaches</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Genola Peaches</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>
Key Elements for Management

- Overwinters as a larva in hibernacula
- 3-4 generations/year
- First generation targets succulent shoots.
- 2nd and 3rd generations target fruit.
Degree-Days (DDs) for Each Stage

- Total required for a generation: 1,092.6 DDs
  - Pre-ovipositing Adult: 50.4
  - Ovipositing Adult: 124.2
  - Egg: 165.6
  - Larva: 464.4
  - Pupa: 288.0
Translate DDs into Biology

- PTB larvae require **3-5** shoots to complete their development.
- **Residence time per shoot:**
  - 464 DDs / # shoots
  - between 155 and 93 DDs per shoot.
- **Assuming warm temperatures (~22 DDs per day), the residence time is:**
  - 4-7 days per shoot
  - larva will likely be “re-surfacing” every 4-7 days.
2003 PTB Flight and DD Accumulations

![Graph showing degree-day totals and moths per night over dates from May to October. The graph indicates a spike in moths in June, followed by a decline before increasing again in August and September.](image-url)
Egg-hatch Relative to Date
(based on DD model projections)
Strategies for 2004

- Accurate trapping is key to precision in management.

- Average DDs for first moth emergence in 2003:
  - $367 \pm 53$ DDs
  - get traps out ~ 250 DDs to ensure reliable biofix.

- 340-640 is likely peak egg-hatch window for 1st generation.

- First generation sprays may need to be initiated at 300-400 DD.
On the Horizon in 2004

• As more and more orchards are abandoned or neglected, beware of:
  – Greater Peachtree Borer
  – Giant CA Prionus Beetle
  – Shothole Borers

• For more information on tree borers, see recent talks by Dr. Alston at: [www.extension.usu.edu/SlideShowIndex.htm](http://www.extension.usu.edu/SlideShowIndex.htm)
Tree Borer Management
(courtesy Diane Alston, March 3rd, 2004)

- Timing is critical (northern Utah)
  - Ash/Lilac borer – May 1- late June
  - Bronze birch borer – late May – June
  - Aspen borer – May-July
  - Peachtree (Crown) borer – late June – August
  - Locust borer – August – Sept.
  - Shothole borer – June and late Sept.
  - Insecticides: carbaryl, endosulfan, pyrethroids (permethrin, bifenthrin)
Considerations for Codling Moth Management

Shawn A. Steffan
Dept. Of Biology
Utah State University

February 20th, 2004
General Pattern of Codling Moth Flight and Egg-hatch, Relative to Degree-Days
Codling Moth Degree-Days

- Degree-days give us an indirect measurement of an arthropod’s development.

- **How are DDs calculated?**
  - Time spent within a specific temperature range.
  - For codling moth, the upper threshold is: 88; the lower is: 50.

![Diagram of temperature over time with shaded area representing degree-days](image-url)
Important Stages in a Codling Moth’s Life

- Pre-ovip. Flight: 58 DDs
- Eggs: 158 DDs
- Larval Feeding: 471 DDs
- Pupae: 431 DDs
- Total for Generation: 1,118 DDs
D-D Accumulations at Each Generation’s Egg-hatch:

- 220 DDs (1st egg-hatch)
- 1,120 DDs (2nd egg-hatch)
- 2,160 DDs (3rd egg-hatch)
For the past 3 years the model has accurately predicted codling moth development (flight, oviposition, and egg hatch) in Wenatchee in unsprayed orchards.

**2002 actual activity and model predictions - 1st generation**

![Moth capture graph](image1)

![Egg hatch graph](image2)

Courtesy Dr. Jay Brunner, WSU, Wenatchee
Case Studies from ’03 Season

✓ **Case 1:** *No mating disruption; high CM pop;* poorly timed apps; over-reliance on a single material; insecticide resistance documented.

✓ **Case 2:** *No mating disruption; moderate CM pop;* well-timed apps; use of IGR and conventional materials.

✓ **Case 3:** *Mating disruption; moderate CM pop;* many applications; use of various materials.

✓ **Case 4:** *Mating disruption (applied 1 week late); high CM pop;* well-timed applications; various materials.
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✓ **Case 4:** *Mating disruption (applied 1 week late); high CM pop;* well-timed applications; various materials.
Case 1: Codling Moth Flight and Degree-Day Accumulation for Apples in Perry (Boxelder Co.)

- 1st generation egg-hatch begins (220 D-Ds).
- 2nd flight begins (860-900 D-Ds).
- 2nd gen egg-hatch begins (1,120 D-Ds).
- 3rd flight begins (1,920 D-Ds).
- 3rd gen egg-hatch begins (2,160 D-Ds).

Sample Date:
- 21-Apr
- 1-May
- 12-May
- 24-May
- 3-Jun
- 16-Jun
- 30-Jun
- 16-Jul
- 30-Jul
- 12-Aug
- 28-Aug
- 8-Sep
- 24-Sep
- 8-Oct

Moths/trap-day
- 0
- 5
- 10
- 15
- 20
- 25
- 30
- 35

D-D Accumulation
- 0
- 500
- 1000
- 1500
- 2000
- 2500
- 3000
- 3500
- 4000

Biofix
Case 2: Codling Moth Flight and Degree-Day Accumulation for Apples in Kaysville (Davis Co.)

- 1st gen egg-hatch (220 D-Ds).
- 2nd flight begins (860-900 D-Ds).
- 2nd gen egg-hatch begins (1,120 D-Ds).
- 3rd flight begins (1,920 D-Ds).
- 3rd gen egg-hatch begins (2,160 D-Ds).

**Moths/trap-day**

**D-D Accumulation**
Case 3: Codling Moth Flight and Degree-Day Accumulation for Apples in Genola (Utah Co.)

<table>
<thead>
<tr>
<th>Sample Date</th>
<th>Moths/trap-day</th>
<th>D-D Accumulation</th>
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<tbody>
<tr>
<td>4/15/2003</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4/29/2003</td>
<td>0.8</td>
<td>500</td>
</tr>
<tr>
<td>5/13/2003</td>
<td>1.6</td>
<td>1000</td>
</tr>
<tr>
<td>5/29/2003</td>
<td>2</td>
<td>1500</td>
</tr>
<tr>
<td>6/10/2003</td>
<td>2.4</td>
<td>2000</td>
</tr>
<tr>
<td>6/29/2003</td>
<td>3.2</td>
<td>2500</td>
</tr>
<tr>
<td>7/7/2003</td>
<td>4</td>
<td>3000</td>
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<td>7/22/2003</td>
<td>4/1/2003</td>
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<td>8/21/2003</td>
<td>9/3/2003</td>
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<td>10/1/2003</td>
<td>9/6/2003</td>
<td>5500</td>
</tr>
<tr>
<td>10/16/2003</td>
<td>10/30/2003</td>
<td>6000</td>
</tr>
</tbody>
</table>

**1st generation egg-hatch (220 D-Ds).**

**2nd flight begins (860-900 D-Ds).**

**3rd flight begins (1,920 D-Ds).**

**2nd gen egg-hatch begins (1,120 D-Ds).**

**3rd gen egg-hatch begins (2,160 D-Ds).**
Case 4: Codling Moth Flight and Degree-Day Accumulation for Apples in Lincoln Point (Utah Co.)

- **1st generation egg-hatch** begins (220 D-Ds).
- **2nd flight** begins (860-900 D-Ds).
- **2nd gen egg-hatch begins** (1,120 D-Ds).
- **3rd flight begins** (1,920 D-Ds).
- **3rd gen egg-hatch begins** (2,160 D-Ds).

Moths/trap-day

D-D Accumulation

Sample Date

Sample Dates:
- 4/15/2003
- 4/29/2003
- 5/13/2003
- 5/29/2003
- 6/10/2003
- 6/23/2003
- 7/7/2003
- 7/22/2003
- 8/5/2003
- 8/21/2003
- 9/3/2003
- 9/17/2003
- 9/16/2003
- 10/1/2003
- 10/16/2003
CM Damage Estimates

✓ **Case 1 (Perry):** Not harvested due to CM damage (83% worm entry).

✓ **Case 2 (Kaysville):** Moderate CM damage (1.3% worm entry).

✓ **Case 3 (Genola):** Very low CM damage.

✓ **Case 4 (Lincoln Pt.):** High CM damage (approx. 20% worm entry).
Improve the Odds

- Time the cover sprays based on known biological events (run traps).
- **Achieve better coverage** by using higher gallonages and verifying uniformity within the canopy.
- **Sanitation** (remove infested apples from orchard).
- **Rotate insecticide classes** (implications for spray timing).
- **Use Pheromone mating disruption** to reduce the egg load.
Mating Disruption Works

• Here’s how:
  – It *delays the mating* of females.
  – Late mating means fewer eggs deposited.
  – The dispensers work **24-7** for months.

• Some of the nuts-n-bolts:
  – **Dispensers** (ties, tubes, ropes, membranes, puffers, etc.)
  – Applied relative to CM phenology, biofix.
  – Function is independent of sprays, tree growth.
A Key Point in CM Development

• 1\textsuperscript{st} Generation Egg-Hatch.
  – The success/failure of 1\textsuperscript{st} gen. larvae set the stage for the remainder of the season.
Broad-Strokes Strategy for CM Management

- Set traps in early spring (around bud break).
- At first biofix, hang mating disruption dispensers asap.
- Keep track of accumulated DDs using IPM Advisory or your own weather monitoring system.
- Make treatments based on DD accumulations (time sprays for egg-hatch periods).
- Continue to monitor traps and fruit.
Good Resources

- www.extension.usu.edu/ipm
- www.extension.usu.edu/insectpath
- www.ipm.ucdavis.edu/default.html

- Common Sense Pest Control (Olkowski et al)
- USU Home Orchard Pest Management Guide
- Pests of the Garden and Small Farm


- Box Elder County Home Orchard Hotline
  435-734-9958 ext-298