Spotted Wing Drosophila:
A Threat to Berries and Stone Fruit

Juliet Carroll
NYS IPM Program
Spotted Wing Drosophila

- Found in NY in 2011
- Now well established
- “Arrives” in June/July
- Soft-skinned fruit ripening in mid summer through fall are susceptible
- Late season fruit are at high risk of infestation

1. Understand which fruits are at risk
2. Learn how to recognize damage and the insect
3. Access SWD monitoring and information resources
Impacts of spotted wing drosophila

- Customer complaints
- 30% loss in blueberry
- Raspberry plantings abandoned
- Sanitation labor-intensive
- Insecticide sprays
  - Calendar spray schedules
  - Only affect the adults
- Economic impact in US estimated at $1 billion, $7M in NY

S. Gwise, CCE Jefferson County
Potential for harm to vulnerable fruit crops in NY due to spotted wing drosophila, an invasive fruit fly.

<table>
<thead>
<tr>
<th>Fruit Crop</th>
<th>Year</th>
<th>Acreage</th>
<th>Value of Production (M)</th>
<th>Projected Loss</th>
<th>Loss in Value (M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raspberry</td>
<td>2010*</td>
<td>500</td>
<td>$3.746</td>
<td>80%</td>
<td>$2.997</td>
</tr>
<tr>
<td>Blueberry</td>
<td>2010</td>
<td>900</td>
<td>$4.521</td>
<td>30%</td>
<td>$1.356</td>
</tr>
<tr>
<td>Strawberry</td>
<td>2010</td>
<td>1,400</td>
<td>$6.895</td>
<td>10%</td>
<td>$0.690</td>
</tr>
<tr>
<td>Peach</td>
<td>2010</td>
<td>1,600</td>
<td>$7.023</td>
<td>10%</td>
<td>$0.702</td>
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<tr>
<td>Sweet cherry</td>
<td>2010</td>
<td>700</td>
<td>$2.255</td>
<td>2%</td>
<td>$0.045</td>
</tr>
<tr>
<td>Tart cherry</td>
<td>2010</td>
<td>1,500</td>
<td>$1.360</td>
<td>2%</td>
<td>$0.027</td>
</tr>
<tr>
<td>Grape</td>
<td>2010</td>
<td>37,000</td>
<td>$68.404</td>
<td>2%</td>
<td>$1.368</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>43,600</td>
<td><strong>$94.204</strong></td>
<td>~8%</td>
<td><strong>$7.185</strong></td>
</tr>
</tbody>
</table>

* No data for raspberry in NY collected after 2010.
Source – NY, NASS, Fruit Statistics. 2011. (Data is not collected for plum or apricot.)

Vulnerable fruit crops have a combined farm gate value of 94 million dollars in NY. Current research results from Cornell University agricultural scientists project that New York’s fruit farmers could lose up to $7 million dollars in farm gate value from spotted wing drosophila, without any control measures.

12/20/2012 Carroll, Heidenreich, Loeb
Optimum 77° F
Maximum 91° F
Minimum 28° F

8 days from egg to adult in warm weather

Adults live ~1 month

Females lay >300 eggs, ...into intact fruit

Limited by high heat in summer and by winter cold

B. Gerdeman, Washington State Univ.

**SWD develops winter morphs and may have a reproductive diapause in spring.**
Cultivated Fruit Hosts

- Highly susceptible
  - Raspberries
  - Blueberries
  - Blackberries
  - Strawberries
  - Elderberries

- Susceptible
  - Sweet cherries
  - Tart cherries
  - Plums
  - Peaches
  - Grapes

Photos: F. Zaman

Oviposition in grape
SWD in raspberry & blackberry

Monitor for SWD and symptoms

Fruit is highly susceptible

**Summer raspberry** -
Insecticides may not be required until the end of harvest

**Fall raspberry** - Insecticide protection almost certainly required

Sanitation/destruction of dropped and over ripe fruit

Refrigerate fruit after harvest (35 F)

More info, www.fruit.cornell.edu/spottedwing
SWD in blueberry

Monitor for SWD and symptoms

Fruit is highly susceptible

**Early-season varieties** -
Insecticides may not be required until the end of harvest

**Late season varieties** -
Insecticide protection may be required

Sanitation/destruction of dropped and over ripe fruit

Refrigerate fruit after harvest (35 F)

More info, www.fruit.cornell.edu/spottedwing
SWD in grape

Monitor for SWD and symptoms

Thin-skinned fruit is susceptible

Insecticides may not be required

Associated with sour rot

**Table grapes** - Refrigerate fruit after harvest (35 F)

More info, [www.fruit.cornell.edu/spottedwing](http://www.fruit.cornell.edu/spottedwing)
SWD in stone fruit

• SWD can infest plums, peaches, nectarines, tart cherry, sweet cherry
• Damage is dependent on when SWD “arrives”
• Damage depends on harvest dates
• Does SWD arrival occur before harvest?
• Does SWD arrival occur after harvest?

Sweet cherry with symptoms of SWD infestation and pupa on fruit surface.

More info, www.fruit.cornell.edu/spottedwing
In 2 of 14 orchards, SWD was caught in traps before harvest was complete, both were sweet cherry orchards.

In 3 of 14 orchards, SWD was reared from sampled fruit before harvest was completed, one tart cherry and two sweet cherry orchards.
Recognizing SWD damage

Early mold, wrinkling, softening at 2-3 days
Soft spots and collapse of berry
Small larval breathing holes – sometimes with tubes
Berry sap leaking
Scarring of tissue
Larvae emerging
Pupae in or outside of berries
Fruit ‘dissolve’ downward and dry up, leaking juice onto leaves and fruit below
Egg-laying sites

In peach, egg breathing tubes

In blackberry, egg breathing tubes and egg visible under fruit skin

In plum, egg breathing tubes, larval breathing hole, larva breathing

Fruitlet stigma

Photo: J. Carroll

J. Carroll, Cornell Univ.
Recognizing SWD egg laying

Look for pits in fruit surface that leak tiny dew drops of juice.

Look for the egg breathing tubes.

Use a 30x hand lens, also available with LED light for better viewing.

Put intact fruit samples on a white paper towel and look for leaks and drops of juice.
Larvae in fruit

J. Carroll, Cornell Univ.

SWD larva in pokeweed

D. Polk, Rutgers Univ.

SWD larvae in harvested fall raspberry

S. Gwise, CCE Jefferson County

SWD larvae in blueberry, salt test
Salt floatation test

Start as fruit begins coloring.
Sample 50-100 ripest suspect fruit.
Place in a shallow pan or zip-lock bag.
Pour salt solution (1 Tbsp salt in 1 cup water =1 cup/gal) over fruit.
Gently crush fruit to break skin to release larvae.
Wait 15-60 minutes.
Look for mature larvae (2-4 mm long).
Eggs and smallest larvae difficult to see.

R. Isaacs, Michigan State Univ.
J. Carroll, Cornell Univ.
H. Burrack, NC State Univ.

SWD larvae

R. Isaacs, Michigan State Univ.
J. Carroll, Cornell Univ.
H. Burrack, NC State Univ.
Recognizing the insect

Dark spot on each wing.

No dark spots on wings.

Saw-like serrations on ovipositor.

The males can be identified without a microscope because of the distinctive spot on each wing.

Two dark comb-like structures on each foreleg.
SWD females

Photo: Faruque Zaman

J. Carroll, Cornell Univ.

Serrated ovipositor

Photo: S. Schloemann, UMass

Photo: J. Carroll
SWD males

F. Zaman, Cornell Univ.
NY SWD Monitoring Network

- A coordinated approach to collect and deliver SWD information to fruit growers.
- Approximately 50 sites in 15 counties each year.
- **Map** - SWD trap catch reported to a NY map at [www.eddmaps.org/swd/](http://www.eddmaps.org/swd/).
- **Blog** - SWD first reports posted on the SWD blog at [blogs.cornell.edu/swd1/](http://blogs.cornell.edu/swd1/).

More info, [www.fruit.cornell.edu/spottedwing](http://www.fruit.cornell.edu/spottedwing)
SWD Distribution Map

SWD Trap Network
2015 Results

white Counties - no traps

Legend
- January
- February
- March
- April
- May
- June
- July
- August
- September
- October
- November
- December
- Not Found

More info, www.fruit.cornell.edu/spottedwing
## First trap catch dates

<table>
<thead>
<tr>
<th>County</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monroe</td>
<td>July 16 (woods)</td>
<td>Aug 19 (RB)</td>
<td>July 21 (RB)</td>
<td>July 27 (RB)</td>
</tr>
<tr>
<td>Niagara</td>
<td>-</td>
<td>July 30 (SB)</td>
<td>July 15 (RB/BB)</td>
<td>July 15 (RB)</td>
</tr>
<tr>
<td>Onondaga</td>
<td>-</td>
<td>July 25 (RB)</td>
<td>July 8 (RB)*</td>
<td>July 23 (BB)</td>
</tr>
<tr>
<td>Orleans</td>
<td>July 16 (PCH)</td>
<td>July 30 (SwC)</td>
<td>July 22 (RB/BB)</td>
<td>July 20 (RB)</td>
</tr>
<tr>
<td>Wayne</td>
<td>Aug 6 (B)</td>
<td>July 22 (DN SB)</td>
<td>July 25 (RB)</td>
<td>June 24 (RB)</td>
</tr>
<tr>
<td>Statewide</td>
<td>?</td>
<td>Early (mild)</td>
<td>Late (severe)</td>
<td>Avg (Feb cold)</td>
</tr>
<tr>
<td>Yates</td>
<td>July 6 (CH)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ontario</td>
<td></td>
<td>June 11 (woods)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cayuga</td>
<td></td>
<td></td>
<td>July 8 (RB)*</td>
<td></td>
</tr>
<tr>
<td>Orange</td>
<td></td>
<td></td>
<td></td>
<td>June 22 (RB)</td>
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</tbody>
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More info, [www.fruit.cornell.edu/spottedwing](http://www.fruit.cornell.edu/spottedwing)
Spotted Wing Drosophila blog
blogs.cornell.edu/swd1/

Subscribers get email alerts with a link to the blog post.
Subscribe today – sign up sheet: name & email

Rensselaer County – first find

Two female SWD were caught in traps set in Rensselaer County the week ending July 22, 2014. One trap is in an Amelanchier hedgerow and the other is in blueberries. Traps are being monitored by Cara Henderson Fraver in Laura McDermott’s program, Cornell Cooperative Extension, Eastern NY Horticulture Program. First SWD trap catch reports are coming in from many sites across NY this week. (GDD 1257; day length 14:44)

More info, www.fruit.cornell.edu/spottedwing
How do the map and blog help?

- **Decide if your crop is at risk**
  - consider SWD numbers, fruit maturity & market.

- **Is an insecticide application warranted?**
  - when at-risk fruit will be present, yes.
  - if harvest is nearing completion, maybe not.

- **Provides warning of potential infestation**
  - sample fruit for larvae, look for symptoms.

- **Inform customers SWD is in area**
  - make sure they know to refrigerate fruit.
Trapping SWD? – need ID

Cornell specialists in WNY able to help with ID:

Liz Tee, Lake Ontario Fruit Program
Art Agnello
ama4@cornell.edu
(315) 787-2341
mail to: Department of Entomology, Barton Lab
630 W. North St.
Geneva, NY 14456

Julie Carroll
jec3@cornell.edu
315-787-2430
mail to: New York State IPM Program
630 W. North St.
Geneva, NY 14456

Express mail
Plastic vial in alcohol
Alcohol prep swab
Prevent crushing
Your information
Crop
Date collected
Name, contact info
Management Tactics

- Insecticides applied weekly when at-risk fruit ripen, rotate ai’s
  - Spinosads (Delegate, Entrust)
  - Pyrethroids (Asana, Brigade, Mustang Max, Danitol)
  - Organophosphates (Imidan, Malathion)
  - New active ingredients (Exirel)
- Good sanitation and removal of infested fruit if possible
- Refrigeration post harvest (33 to 38°F)
- Judicious pruning
- Netting, <0.98mm, 80 gram
- Monitoring SWD, sampling fruit
- Biological control

It’s September 3rd and fruit flies congregate on a damaged strawberry.
Questions?