Effects of novel insecticides on spotted wing drosophila (*Drosophila suzukii*)

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Outline

• Background
  – Spotted wing drosophila
  – Chemical management

• Research

• Conclusion
Spotted wing drosophila
(Drosophila suzukii; SWD)
<table>
<thead>
<tr>
<th>Cultivated</th>
<th>Wild</th>
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<tbody>
<tr>
<td>Apricot</td>
<td>Aucuba</td>
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<tr>
<td>Blackberry</td>
<td>Akamono</td>
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<td>Blueberry</td>
<td>Ash</td>
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<td>Cherry</td>
<td>Barberry</td>
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<td>Cranberry</td>
<td>Bayberry</td>
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<td>Currant</td>
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<td>Elderberry</td>
<td>Blackthorn</td>
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<td></td>
<td>Buckthorn</td>
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<td>Cherry</td>
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<td>Cotoneaster</td>
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<td><em>Ribes</em></td>
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<td>Dewberry</td>
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<td>Dogwood</td>
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<td>Fig</td>
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<td>Hawthorn</td>
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<td>Herb-paris</td>
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<td>Honeysuckle</td>
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<td>Huckleberry</td>
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<td>Minnesota Invasive Terrestrial Plants &amp; Pests Center</td>
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Morphology

*D. melanogaster*
- Female
  - Brown bodies
  - Smooth ovipositor

*D. suzukii*
- Male
  - Spotted wing
- Female
  - Large, red eyes
  - Serrated ovipositor

Matusmura, 1931; Liburd & Iglesias, 2013; Atallah et al. 2014

Photo Credits: Shutterstock, Michigan State University Extension
Oviposition

Photo Credit: Joel Atallah, UC Davis
Life cycle

- **Egg** (350+ per adult!)
- **Larvae**
- **Pupae**
- **Adult**

Egg to adult: 10.8 days

Adults up to 59 days

Kanzawa, 1939
SWD Summary

- Recently established
- Modified ovipositor
- Wide host range
- Rapid generation time
Chemical Control

- Maximum residue limits
- Re-entry intervals
- Cost – especially for organic sprays
- Detrimental to beneficial insects
- Insecticide resistance
- Concerns about the environment and human health
Bioinsecticides

• Naturally occurring substances
Feeding Stimulants

• Entice the pest to ingest more of the chemical
Questions

- Which products work against SWD?
- Are there ways to increase efficacy?
Laboratory bioassays

• Objective
  – Determine the lethal and sub-lethal effects of novel insecticides

• Methods
  – Maintain a *D. suzukii* colony
  – Apply insecticides to raspberry fruit
  – Introduce flies to treated raspberry fruit
  – Record mortality, eggs, larvae, pupae, and adults
D. suzukii colony
<table>
<thead>
<tr>
<th>Trade name</th>
<th>Chemical name</th>
<th>Class</th>
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<tbody>
<tr>
<td>LI700®</td>
<td>Soyal phospholipids + propionic acid</td>
<td>Adjuvant</td>
</tr>
<tr>
<td>Spear™</td>
<td>GS-omega/kappa-Hxtx-Hv1a</td>
<td>Conventional</td>
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<tr>
<td>Rimon®</td>
<td>Novaluron</td>
<td>Conventional</td>
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<tr>
<td>Mustang Maxx™ 0.8 EC</td>
<td>Zeta-cypermethrin</td>
<td>Conventional</td>
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<tr>
<td>Erythritol</td>
<td>Erythritol</td>
<td>Feeding stimulant</td>
</tr>
<tr>
<td>Azera®</td>
<td>Azadirachtin and pyrethrin</td>
<td>Organic</td>
</tr>
<tr>
<td>Grandevo®</td>
<td><em>Chromobacterium subtsugae</em></td>
<td>Organic</td>
</tr>
<tr>
<td>Pyganic®</td>
<td>Pyrethrin</td>
<td>Organic</td>
</tr>
<tr>
<td>Entrust® SC</td>
<td>Spinosad</td>
<td>Organic</td>
</tr>
<tr>
<td>Oroboost®</td>
<td>Alcohol ethoxylate</td>
<td>Surfactant</td>
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<tr>
<td>Silwet® L-77</td>
<td>Trisiloxane ethoxylate</td>
<td>Surfactant</td>
</tr>
<tr>
<td>Jet-Ag®</td>
<td>Hydrogen peroxide + peroxyacetic acid</td>
<td>Sterilant</td>
</tr>
</tbody>
</table>
Materials & Methods
Mortality

- Entrust® SC + Erythritol
- Mustang Maxx™
- Entrust® SC
- Spear™ + Erythritol
- Spear™ + Silwet 77®
- Spear™ + LI700®
- Grandevo® + Erythritol
Oviposition

- Mustang Maxx™
- Spear™ + Silwet 77®
Incubation: 1 week

Control without flies

Control with flies
Larvae

- Mustang Maxx™
- Entrust® SC + Erythritol
- Entrust® SC
- Spear™ + Silwet 77®
- Grandevo® + Erythritol
- Spear™ 10 ppt
Pupae

- Mustang Maxx™
- Entrust ® SC + Erythritol
- Entrust ® SC
- Grandevo® + Erythritol
- Azera® + Erythritol
Incubation: 2 weeks

Control without flies  Control with flies
Adults

- Mustang Maxx™
- Entrust® SC + Erythritol
- Entrust® SC
- Pyganic®
- Azera® + Erythritol
Feeding Stimulants

- Improved efficacy
  - Grandevo®
  - Spear™
  - Jet Ag®
  - Entrust® SC

- Decreased efficacy
  - Rimon®
  - Azera®
Bioassay Summary

- Mustang Maxx™ and Entrust ® SC are still the most effective products
- Few products decreased oviposition
- Efficacy varied by life stage
- Feeding stimulants improved some products
Next Steps

• Testing these products in the field
• In combination with cultural controls
  – High tunnels
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Bill Hutchison, Eric Burkness, Anh Tran, Dominique Ebbenga

Photo credit: Thanwalee (JiJY) Sooksa-nguan
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