Development of Attract-and-Kill for the Invasive Spotted Wing Drosophila

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Attract-and-Kill

- Attractive cues
  - Visual
  - Chemical
- Insecticide kills pest
- Reduce injury
- Reduce non-target affects
Apple Maggot Fly Attract-and-Kill System
Attracticidal Spheres

- Visual Stimulus
- Olfactory Stimulus
- Deployment Strategy
- Capture Mechanism
Perimeter-Based Attract and Kill System for Apple Maggot

Wright et al. 2012
# Field Performance in Commercial Orchards

No. Insecticide Sprays
Control = 3.0 per season
Sphere = 0.3 per season

Morrison et al. 2016

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Total fruit sampled</th>
<th>No. of damaged fruit</th>
<th>% Damaged fruit</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td></td>
<td></td>
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<tr>
<td>Red sphere</td>
<td>997</td>
<td>29</td>
<td>2.91%</td>
<td>a</td>
</tr>
<tr>
<td>Grower control</td>
<td>1,023</td>
<td>30</td>
<td>2.93%</td>
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<td>2011</td>
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<tr>
<td>Red sphere</td>
<td>751</td>
<td>25</td>
<td>3.33%</td>
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<tr>
<td>Grower control</td>
<td>961</td>
<td>17</td>
<td>1.77%</td>
<td>a</td>
</tr>
</tbody>
</table>
Can we develop an attract-and-kill system for SWD?
Visual Stimuli

Color

Shape

Size

Rice et al. 2016 Environ Ent
Do Attracticidal Spheres Kill SWD?

- Examined 10 toxicants
- Evaluated a minimum 20 males and 20 females/insecticide/rate.

- Released at sphere equator and allowed to forage freely for 5 min. Measured foraging time.

- Evaluated toxic effects at 0, 24 and 48 h after exposure
High Mortality after 24 Hours

Rice et al. In press
Where do SWD Choose To Forage Within a Host Plant?

- Clean, ripe berries for oviposition
- Tangletrap-coated ripe berries for alightment
Within-Plant Foraging Semi-Field Bioassay
Influence of Berry Height

Mean No. SWD ± SE Per Berry Heights

Low (a) > Middle Low (b) > Middle High (c) > High (c)

Rice et al. submitted
Where do SWD Choose To Forage Within a Host Plant?

Oviposition

Mean No. SWD ± SE Per Berry

- Low
- Middle Low
- Middle High
- High

Rice et al. submitted
1.8% Non-fliers

2.3% Recaptured
SWD Prefer Low Fruit

X² = 4.03
p = 0.044

Rice et al. submitted
Strong Edge Effect

Rice et al. submitted

$X^2 = 17.7$
$p < 0.0005$
SWD Prefer Low Fruit
Low Pest Pressure

Mean No. Spotted Wing Drosophila Captured Per Sticky Berry

Rice et al. submitted
Strong Edge Effect
Low Pest Pressure

Large Scale Commercial Farms?

Mean No. Spotted Wing Drosophila Captured Per Sticky Berry

Exterior Interior Center

\( p < 0.04 \)

Rice et al. submitted
High SWD Populations Yield Different Pattern

![Graph showing the mean number of Spotted Wing Drosophila captured per sticky berry at different heights.]

- $\chi^2 = 5.58$
- $p = 0.018$

Rice et al. submitted
Reduced Edge Effect Under High SWD Populations

Rice et al. submitted
Wild SWD Oviposition Preference

- Sterile field
- Collect ripe fruit
  - Height
  - # Fruit
  - Location
- Emerging SWD adults
- 4 collection dates
  - 5,219 fruit collected
High Fruit Preferred

Fruit density increases with plant height
Field Experiment

- Potted raspberries with ripe fruit placed in field.

- Four experimental treatments evaluated for SWD management.
  1) weekly sprays (Brigade, Entrust or Danitol)
  2) 1% Delegate attracticidal spheres at a rate of 1/plant
  3) sprays + spheres
  4) Control

- Monitored SWD populations with traps baited with yeast/sugar.

- Harvested ripe berries and evaluated infestation rates.
Attracticidal Spheres Reduce Damage

Rice et al. In press
6 Week Exposure UV and Rain
Conclusions

• SWD prefer low hanging fruit
  – Dependent on size of population
  – Dependent on fruit density

• Edge effect-initial colonization
  – Early season border sprays

• Behavioral attract-and-kill