Black Scale Control Programs and Carbaryl Alternatives

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Black Scale Biology and Background
Hemiptera: Coccidae: *Saissetia oleae*

**Geography**
- Origin = South Africa
- Globally distributed today

**History**
- Introduced to CA in late 1800s
- Major pest – olive, citrus, ornamentals
- Minor pest – many other crop and non-crop species
Crop Damage

- Pierce-suck feeding
- Honeydew = substrate for sooty mold
- Impacts on vigor, productivity and bloom
Identification
• Distinctive “H” shape on later stages
Black Scale Biology and Background

Life-Stages and Identification

- Rubber stage
- Adults/Eggs
- 2nd/3rd stage
- Crawlers / 1st stage
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Seasonal Ecology

Typically 1-2 generations/year

(2 @ Coastal, 1 @ Interior)
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Natural Enemies and Biological Control

Importation of Natural Enemies

• Extensive attempts in olives/citrus
• 1890s = recent success with cottony cushion-scale
• Could this be repeated for olive scale?
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Natural Enemies and Biological Control

Limited Success

• Many importations
  • 40+ parasitoids
  • 10+ predators

• Poor performance due to...
  • Misidentification of scale and natural enemies
  • Improper/inadequate evaluation before release
  • Release into wrong conditions

• Efforts oscillate between chemical and biological
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Natural Enemies and Biological Control

Metaphycus helvolus
Attacks early instars

Metaphycus lounsburyi
Attacks late instars

Scutellista caerulea
Attacks adults
Larva consume eggs
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Natural Enemies and Biological Control
Ant Interference

Photo: Kent Daane
Black Scale Management
Cultural Controls
Effect of Canopy Microclimate Temperature
Black Scale Management

Cultural Controls

Closed vs. Open Canopies

CLOSED CANOPY
Black Scale Management

Cultural Controls

Closed vs. Open Canopies

OPEN CANOPY
Black Scale Management
Super High Density Systems
Closed Canopies = More Black Scale?
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Chemical Controls

History of Chemical Use

• All of the “bad stuff” 1910s-1980s
  • Hydrocyanic acid gas
  • DDT
  • Calcium cyanide
  • Parathion, Malathion
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Chemical Controls

Modern Chemical Controls

• UC IPM Recommends
  • Postbloom/Summer (May-Aug.)
    • Oil
    • Pyriproxyfen (IGR)
    • Oil + carbaryl
  • Postharvest (Oct./Nov.)
    • Oil
    • Oil + methidathion
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Chemical Controls

Modern Chemical Controls

• What Actually Goes On
  • August = Oil + carbaryl (sometimes IGR)
  • November = Oil (sometimes methidathion, but not after 2011)
  • ~30% acreage annually
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Chemical Controls

Current Status of Carbaryl

- **2003 – EPA Registration Review**
  - Aggregate risk data, restrict some uses

- **2014 – Cal-DPR “Risk Characterization”**
  - Olive is a “top 5” user (tomato + citrus ~40%)

- **2016 – Cal-DPR “Critical Uses”**
  - Olive = not a critical use

Though not meeting this document’s definition of “critical”, the following carbaryl uses are valued by industry or CDFA quarantine officials and should be carefully considered when selecting among mitigation options:

- **Citrus production**: no critical uses per se, though carbaryl is a valuable tool for late-season control of red scale, for helping prevent resistance, and for control of multiple insect species with a single application, and is one of several pesticides effective against Asian citrus psyllid (liquid formulations); and

- **Olive production**: no critical uses per se, though carbaryl is a useful rotation insecticide for scale control to help prevent resistance (liquid formulations).
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Market Summary

Production
• 56,000 acres (99% of US production)
  • ~40k oil
  • ~16k table

Exports
• 40% of crop exported ($40 million)
  • Canada – 37%
  • Mexico – 14%
  • EU – 10%
  • Japan – 7%
  • Taiwan – 5%
  • All others – 27%
# Black Scale Management
## Market Summary

### MRLs of Key AIs

<table>
<thead>
<tr>
<th>Country</th>
<th>Carbaryl</th>
<th>Buprofezin</th>
<th>Pyriproxyfen</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>10 / -</td>
<td>3.5 / 4.8</td>
<td>1 / 2</td>
</tr>
<tr>
<td>Canada (37%)</td>
<td>10 / -</td>
<td>5 / -</td>
<td>1.5 / 2</td>
</tr>
<tr>
<td>Mexico (14%)</td>
<td>10 / -</td>
<td>3.5 / 4.8</td>
<td>1 / 2</td>
</tr>
<tr>
<td>EU (10%)</td>
<td>0.01 / 0.02</td>
<td>5 / 5</td>
<td>0.05 / 0.05</td>
</tr>
<tr>
<td>Japan (7%)</td>
<td>30 / 25</td>
<td>5 / -</td>
<td>1 / -</td>
</tr>
<tr>
<td>Taiwan (5%)</td>
<td>0.5 / -</td>
<td>1 / -</td>
<td>0.01 / -</td>
</tr>
</tbody>
</table>
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Alternative AIs?

**Carbaryl**
- Domestic scrutiny
- MRL restrictions in some export markets (EU, Taiwan)

**Alternatives**
- Insect growth regulators
  - Pyriproxyfen
  - Buprofezin
- Systemics
  - Neonicotinoids
    - Imidacloprid
    - Acetamiprid
  - Spirotetramat
- Other
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Alternative AIs?

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Alternatives
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    - Acetamiprid
  - Spriotetramat
- Other
  - Some of these promoted in other markets
  - Limited use and efficacy data for olive scale in CA
  - Moreover specifically for high-density plantings
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Summary and Conclusions

Black Scale Management

• Long history in California

• Biological control
  • Complicated by ecological considerations

• Cultural control
  • Open canopy is key

• Chemical control
  • Oils, carbaryl, IGRs
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Summary and Conclusions

CA Olive Industry Today

• High-density plantings
  • Changes to canopy structure

• Chemical regulations / MRLs
  • Possible restrictions

• Potential Research Opportunity
  • Black scale development in hedge-style plantings
  • Spray coverage, timing, AIs etc.
  • Natural enemy impacts
THANK YOU!

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