Newer Insecticides and Biologicals against Invasive Pests

Crop Production Services Nursery Seminar
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Arnold H. Hara
University of Hawaii at Manoa
College of Tropical Agriculture & Human Resources
875 Komohana St. Hilo, Hawaii
E-mail: arnold@hawaii.edu
Phone: 808 981-5199
Website: http://www.ctahr.hawaii.edu/haraa/index.asp
What will this presentation cover?

PESTS:
western flower & melon thrips, anthurium thrips & whitefly, foliar & root mealybugs, aphids, little fire ant, hisbiscus snow scale, slugs.

*Insecticides:
  Acelepryn (chlorantraniliprole)
  Aria (flonicamid)
  Hachi Hachi (tolfenpyrad)
  Kontos (spirotetramat)
  Merit, Safari, Optigard, TriStar, Arena (neonicotinoids)
  Overture (pyridalyl)
  Pylon (chlorfenapyr)

*Ant Baits: Probait, Maxforce Complete (hydramethylnon), Extinguish Plus hydramethylnon plus methoprene)

*Slug Baits: Deadline, Metarex (metaldehyde)

*Biologicals (Beauvaria, Paecilomyces, Steinernema, Bacillus)
*Western Flower Thrips, Glasshouse Strain (GH) damage to dendrobium blossoms.
*Resistant to insecticides including Avid and Conserve.

About 1/16 an inch long
Life Cycle of Thrips (7 to 14 days)

Eggs inserted in plant tissue. 150-300 eggs per female.

Adults are characterized by wings fringed with hair-like setae. Life span = 30 to 45 days.

Adapted from UC Pest Management Guidelines, THRIPS Home & Landscape (Published: 5/01)
<table>
<thead>
<tr>
<th>Products</th>
<th>Group</th>
<th>Mode of Action</th>
<th>Insects and Pests</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hachi Hachi</strong> (Sepro)</td>
<td>21A</td>
<td>Inhibits energy metabolism</td>
<td>Also aphids, scale insects, whiteflies</td>
</tr>
<tr>
<td><strong>Pylon</strong> (BASF)</td>
<td>13</td>
<td>Disrupts proton gradient.</td>
<td>Also mites, foliar nematodes</td>
</tr>
<tr>
<td><strong>Overture</strong> (Valent)</td>
<td>Unknown MoA; in a unique group.</td>
<td>Also caterpillars</td>
<td></td>
</tr>
<tr>
<td><strong>Aria</strong> (FMC)</td>
<td>9C</td>
<td>Stops insect feeding.</td>
<td>Also aphids, whiteflies, mealybugs,</td>
</tr>
<tr>
<td><strong>Mesurol</strong> (Gowan)</td>
<td>1A (carbamate)</td>
<td>Nerve poison</td>
<td>Also snails and slugs</td>
</tr>
<tr>
<td><strong>Avid</strong> (Syngenta)</td>
<td>6</td>
<td>WFT-G resistance</td>
<td>Also mites, nematodes</td>
</tr>
<tr>
<td><strong>Conserve</strong> (Dow)</td>
<td>5</td>
<td>WFT-G resistance</td>
<td>Also caterpillars, leafminers</td>
</tr>
</tbody>
</table>
Thrips on Dendrobium Flowers

<table>
<thead>
<tr>
<th></th>
<th>Total Adults</th>
<th>Total Larvae</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd Hachi Hachi, no drench</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td>3rd Hachi Hachi, no drench</td>
<td>14</td>
<td>43</td>
</tr>
<tr>
<td>1st Pylon spray + Duraguard drench</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td>2nd Aria + Malathion Drench</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>2nd Overture + Malathion Drench</td>
<td>1</td>
<td>8</td>
</tr>
</tbody>
</table>
The Berlese Funnel

Materials:
Automotive Funnel (Napa)
¼” galvanized hardware cloth
4-ounce glass jar (baby food jar)
Alcohol or detergent water
10-inch brooder lamp (Ace)
40 watt bulb
½ “pvc pipe and fittings
Melon Thrips, *Thrips palmi* on Lavender Lady Anthuriums

Flower Marketability

1 severe to 10 no visible damage

<table>
<thead>
<tr>
<th>Rating Scale</th>
<th>Pretrt</th>
<th>1 App.</th>
<th>2 App.</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td></td>
<td>A*</td>
<td>A*</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
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<td></td>
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<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
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<td>4</td>
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<td>3</td>
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<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>B</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pylon at 10 fl oz/100 gal (app 7 days apart)
Spirotetramat
Tetronic/Tetramic Acid

*Movento or Kontos (spirotetramat) moves up and down within the plant to provide excellent pest control in dense crop canopies and on plant roots.
*High level of residual efficacy and protection of new plant growth.
*Minimal risk to natural predators when used as directed, making it an ideal addition to Integrated Pest Management (IPM) programs.

Key Pests:
- Aphids
- Mealybugs
- Whiteflies
- Scales
- Spider mites
- Psyllids/Psylla

Crop Use
- Vegetables
- Fruits
- Nuts

IRAC Class
- 23

Ornamental use:
- Greenhouse
- Field grown ornamentals
- Outdoor ornamentals
Efficacy of Spirotetramat (Kontos) against aphids, foliar mealybugs, thrips and whiteflies

Severe – whitefly on >50% of sheath surface area

Severe thrips damage

ants, mealybugs, and banana aphids on stem and between bracts of red ginger
Kontos (spirotetramat)

Drench: 0.4 fl oz/ft plant height
(1 application to root zone area)
Low Foliar: 1.7 fl oz/100 gallons
High Foliar: 3.4 fl oz/100 gallons
(2 applications, 4 weeks apart)

*Drench application was most effective.
*Reduction in ants due to fewer honeydew
producing aphids and mealybugs.
*Drench application lasted for >14 weeks.
Anthurium Whiteflies

- Drench and foliar applications were effective from 3 to 17 weeks. (P<0.05).
- Drench application was most persistent providing whitefly control for >17 weeks.

Anthurium Thrips

- Kontos was not effective against anthurium thrips.

RATES:
Drench: 0.2 fl oz/ft plant height
Foliar: 3.4 fl oz/100 gallons
Efficacy of Acelepryn, Aria and Safari against the root mealybug, *Rhizoeus hibisci* infesting Rhapis palms.

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>IRAC Class</th>
<th>Mode of Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aria (flonicamid)</td>
<td>9B</td>
<td>Feeding blocker/nerve action</td>
</tr>
<tr>
<td>Safari (dinotefuran)</td>
<td>4A</td>
<td>Nerve action</td>
</tr>
<tr>
<td>Kontos (spirotetramat)</td>
<td>23</td>
<td>Inhibitor of lipid synthesis; Growth regulator disrupter</td>
</tr>
<tr>
<td>Acelepryn (chlorantraniliprole)</td>
<td>28</td>
<td>Nerve and muscle action Ryanodine receptor</td>
</tr>
</tbody>
</table>
Efficacy Study:
Managing Root Mealybug on *Rhapis Robusta*

![Bar Chart](chart.png)

- **Control**
- **Acelepryn 0.8 fl oz per 100 gal**
- **Kontos Foliar 3.4 fl oz per 100 gal**
- **Aria 50SG 120 g per 100 gal**
- **Kontos Drench 3.4 fl oz per 100 gal**
- **Safari 6 g per ft plant height**

**Treatment**
- Acelepryn (chlorantraniliprole Group 28) 0.8 fl oz/100 gallons (drench)
- Aria (flonicamid Group 9C) 2 oz/100 gallons (drench)
- Kontos (spirotetramat Group 24) 3.4 fl oz/100 gallons (foliar & drench)
- Safari (dinotefuran Group 4) 0.2 oz/ft plant height (drench)
Orthene TTO 97 (acephate)

A16901B (Acelepryn cyantraniliprole + Flagship thiamexthoxam)

Safari 20SG (dinotefuran)

MBI 203 (Chromobacterium subtsugae)

MBI 205 (Eucalyptus camaldulensis extract)

Kontos (spirotetramat)
MBI 205 Background

- *Eucalyptus camaldulensis*
  - “Red River Gum”
  - Native to Australia waterways
  - Used as firewood, fence posts
- Developed by The Energy and Research Institute (TERI) in India
  - Formulation based on plant extracts
  - Initial interest was for control of *Helicoverpa armigera* on chickpea and cotton
  - Not a Eucalyptus oil product; contains novel extract, patent pending (PCT filed)

Broad-spectrum insecticidal activity found by MBI
MBI has commercial rights for Americas and ROFR for Europe

Tim Johnson
Global Product Development Director
14 Baldtop Heights Danville, PA 17821
Mobile: 570-441-8775 Email: tjohnson@marronebio.com
New Microbial Insecticide (MBI 203)

- Licensed from USDA-ARS. Discovered by Dr. Phyllis Martin

- New species of *Chromobacterium (subtsugae)* (Strain PRAA4-1T). Patent issued. Isolated from forest soil in U.S.

- Active by ingestion of cellular contents and contact (potent anti-feeding activity). Death in 2-5 days for chewing insects and 4-7 days for sucking insects. Toxic to multiple orders of insects.

- Activity is from compounds produced by the bacterium.

- Do not need living microbe for activity – MBI-203 is not a live product.
Biological or Microbial Insecticide

Bacteria - *Bacillus thuringiensis* – caterpillars
- *B.t. israelensis* – mosquitoes, fungus gnats

Fungi - *Paecilomyces fumosoroseus* – whiteflies,
- Preferal aphids, thrips, mealybugs
  Humidity is 80% or higher for 8 - 10 hours
  Temp is between 68° and 82° F

- *Beauvaria bassiana* – whiteflies, thrips, aphids

BotaniGard coffee berry borer
  High humidity and free water enhance activity.
  Sunlight kills fungal spores.

Nematodes - *Steinernema carpocapsae* – banana moth,
- Nematac borers (weevil), soil-
  High humidity required.
**Little Fire Ant Control**

*Maxforce Complete, Probait/Amdro (hydramethylnon) & Extinguish Plus (hydramethylnon+methoprene, insect growth regulator) are most effective.*

*Esteem (pyriproxyfen, IGR) is labeled for tropical fruit crops.*

*Aerial colonies in trees are difficult to control (bait must be in trees)*

*Tango (methoprene) mixed with vegetable oil and Xanthan gum (emulsifier and thickener) can be applied in trees (Vanderwoude).*

*Talstar granular and liquid effective as a residual contact/barrier treatment.*

*Termidor (fipronil, PCO only) for building perimeter is effective.

**Untreated**

**Extinguish Plus**

(0.365% hydramethylnon & 0.25% S-methoprene)

Nest Activity 7 WAT
Attractiveness of peanut butter, Probait, Extinguish Plus & Professional to LFA

- Peanut butter
- Probait 0.73% hydramethylnon
- Extinguish Plus 0.36% hydramethylnon + 0.25% methoprene
- Extinguish Professional 0.50% methoprene
Active Ingredients:
1.00% Hydramethylnon, similar AI to Amdro & Probait
Mode of Action: Disrupts energy metabolism.

Maxforce Complete granules contain a bait matrix combining sugars, proteins (including silk worm pupae), fats and oils, which accommodate insects' changing nutritional needs.

Ants (Acrobat, Argentine, Big Headed, Carpenter, Cornfield, Field, imported and native Fire, Ghost, Harvester, Odorous House, Pavement, Pharaoh, Thief)

Maxforce® Complete Brand Granular Insect Bait is a ready-to-use product for use indoors and outdoors and around buildings, on lawn, and other non-crop areas: (including school yards, playgrounds, golf courses, and ornamental nurseries).
1 Hour after placement

Little Fire Ant

Control (Peanut Butter)  Maxforce Complete  Probait

2 Hours after placement

Control (Peanut Butter)  Maxforce Complete  Probait
TriStar and Optigard Against the Coconut Mealybug, *Nipaecoccus nipae*

TriStar = acetamiprid

Optigard = thiamethoxam

(Now for sale in Hawaii, landscape use)
TriStar is registered for foliar use only and the most UV stable of all neonicotinoids.
Relative Water Solubility of Neonicotinoids:

Water Solubility (Active Ingredient)

<table>
<thead>
<tr>
<th>Compound</th>
<th>Water Solubility (Milligrams A.I./liter)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clothianidin</td>
<td>327</td>
</tr>
<tr>
<td>Imidacloprid</td>
<td>500</td>
</tr>
<tr>
<td>Acetamiprid</td>
<td>2950</td>
</tr>
<tr>
<td>Thiamethoxam</td>
<td>4100</td>
</tr>
<tr>
<td>Dinofururan</td>
<td>39830</td>
</tr>
</tbody>
</table>

Information sources:
Clothianidin (Celero), Acetamiprid (Tristar), Dinofururan (Safari) – EPA Pesticide Fact Sheet
Imidacloprid (Marathon), Hiamethoxam (Flagship) – MSDS for Products

Slide information courtesy J. Chamberlin
Application of Merit as a “Tablet”

*Insert the “pill” in the pot media and solve your pest problem.

- >20 weeks of whitefly control
- >12 weeks of thrips control
Efficacy of Neonicotinoids against Melon Aphids and Papaya Mealybug on Native *Hibiscus* sp.

Melon Aphid, *Aphis gossypii*

Papaya Mealybug, *Paracoccus marginatus*
Efficacy of Neonicotinoids against Melon Aphids and Papaya Mealybug on Native *Hibiscus* sp.
Melon Aphids and Papaya Mealybug on Native *Hibiscus* sp
# Level of aphid infestation on hibiscus plants before and after treatment

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Pretreatment</th>
<th>2 WAT</th>
<th>4 WAT</th>
<th>7 WAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>H</td>
<td>H</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Safari 2G</td>
<td>H</td>
<td>M</td>
<td>M</td>
<td>L</td>
</tr>
<tr>
<td>CoreTect NPK Tablets</td>
<td>H</td>
<td>M</td>
<td>L</td>
<td>S</td>
</tr>
<tr>
<td>Merit 2.5G</td>
<td>H</td>
<td>L</td>
<td>L</td>
<td>S</td>
</tr>
</tbody>
</table>

H = Heavy infestation, aphids present on 70% or more of plant surface area  
M = Moderate infestation, aphids were present on 30-60% of plant surface area  
L = Light infestation, aphids were present on at least 20% of plant surface area  
S = no or slight infestation, aphids were either not present or were present on less than 5% of plant surface area

# Level of mealybug infestation on hibiscus plants before and after treatment

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Pretreatment</th>
<th>2 WAT</th>
<th>4 WAT</th>
<th>7 WAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Safari 2G</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>CoreTect NPK Tablets</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Merit 2.5G</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

Y = mealybugs present  
N = mealybugs not present
Hibiscus Snow Scale, *Pinnaspis strachani*

*Aka Lesser snow scale was a major cause of shipment rejection in California on foliage plants.*

*An armored scale with elongated male preadult.*

*About one month to complete life cycle.*

Preadult or pupa encased in armor produced by their previous body shell and secretions.
Feeding Damage on Upper Leaf Surface

Scale Infestation on Lower Leaf Surface
Untreated control cuttings dipped in water and Liberate, a non-ionic surfactant.
Kontos and Safari Dips Against Hibiscus Snow Scale

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Number of Pots with live Snow Scales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>10</td>
</tr>
<tr>
<td>Kontos 1.7 TBS/25 gal</td>
<td>6</td>
</tr>
<tr>
<td>Safari 8 TBS/25 gal</td>
<td>10</td>
</tr>
</tbody>
</table>

(Liberate (3 TBSP) was added to both treatments)
Foliar Kontos, Safari and Distance (IGR) and Safari Granular Applications 6 weeks after potting
Foliar Applied Kontos, Distance and Safari and Safari Granules Against Hibiscus Snow Scale (6 Weeks After Treatment)

- Control
- Kontos 1 tsp/5 gal
- Safari 20SG 5 tsp/5 gal
- Safari 2G 1 tsp/8" D pot
- Distance 3.6 tsp/5 gal

Number of Pots with live insects 6 WAT

Treatment – 2 foliar applications, 14 D apart
(Liberate (3 TBSP) was added to all treatments)
Bags of Fresh Slug and Snail Baits

Metarex

Deadline
Weather Data During Aging Process

- During the “aging process” baits were exposed to natural rainfall under shade house conditions.

- 7 Weathered days (WD) baits received 3.9” of rainfall.

- 14 WD baits received 5.2” of rainfall.

- 21 WD baits received 13” of rainfall.

- The average temperature was 76°F with an average high of 82°F and an average low of 69°F.
% Mortality Cuban Slug

Aged Bait Treatments
(Rate: 40 lb/Ac)
7 Day Weathered Slug and Snail Baits

Metarex

Deadline
Summary

*Avoiding the use of broad-spectrum insecticides, such as OP’s, carbamates and pyrethroids, will conserve natural enemies.

*Use more selective insecticides and application methods, such as drench application of neonicotinoids (Merit, Discus, Marathon, Safari, Optigard), tetronic acid (Kontos), Aria, Pylon, Overture, insect growth regulators (Distance, Talus), biological insecticides (Preferal, BotaniGard, Bt) to avoid negative effects on natural enemies.

*When applying insecticides/miticides, always focus on resistance management.
  - When labels permit, make 2 or 3 applications of a product in sequence, then rotate to products with different modes of action or group.
  - Monitor pest numbers to determine re-application.
  - Avoid tank-mixes of insecticides.
THANK YOU!

For technical assistance:

Ruth Niino-DuPonte
Susan Cabral
Kris Aoki
Jorden Zarders

08 Feb 14
“lobate lac scale”
*Paratachardina pseudolobata*
(Hemiptera: Kerriidae)

Native home: unknown, but thought to be Asia or the Pacific Ocean region.

First collected in Hawaii: October 11, 2012
Hawaii distribution: Oahu only (Moanalua)
Recorded hosts in Hawaii: weeping banyan (*Ficus benjamina*), red hibiscus, mango.

Recorded hosts in Florida: >300 plant species

World distribution: Bahamas, Christmas Island, and Cuba.
**Banyan Stem-Galling Wasp, a New Insect in Hawaii**

**Hawaii Department of Agriculture (HDOA), Plant Pest Control Branch - August 28, 2012**

**Insect species**: Undetermined at this time. Specimens being sent to insect specialists for identification. Belongs to the family Agaonidae (fig wasps).

**Description**: A black wasp, about 1/16th inch or (2mm) in length (Fig. 3).

**First found in Hawaii**: July 13, 2012 (samples of infested stems submitted to HDOA by an arborist from the East-West Center, University of Hawaii).

**Host**: Chinese banyan, *Ficus microcarpa*, family Moraceae (Fig. 1). Tree is native from Ceylon to India, southern China, Ryukyu Islands, Australia, and New Caledonia.

**Island Distribution**: Oahu (widespread), Hawaii Island (Hilo), and Maui (Kahului, Wailuku).

**Biology**: The female wasp lays its egg in the young stems. The wasp larva hatches and feeds within the tissue (Fig. 4). As the larva develops, the stem becomes swollen and forms a gall. The larva pupates and the wasp adult eventually emerges (Fig. 5), leaving a distinctive exit hole in the woody tissue (Fig. 2).

**Damage**: Some leaf drop and dieback of stems, causing canopy to thin out, although our surveys indicate varying degrees of infestation and damage.

![Figure 3. Stem-galling wasp (1/16th inch)](image)

![Figure 4. Wasp larva in gall (1/16th inch)](image)


2. Galls in green stem tissue (left side in each picture) and old galls in woody tissue with wasp exit holes (right side).

3. Adult wasps in dissected stem galls.
*40 inch diameter breast height.
*Injected with 90 g of AceJet (acephate 97.4%) in 400 ml water.
*3/8 inch drill bit w/ fast drilling
*Bicycle pumped to 50 psi.
*Better uptake during mornings with cooler temperatures.
*Acephate has quicker knock-down compared with imidacloprid.