Common Pests: “Green” Solutions

HENA Horticultural Conference
Hapuna Beach Prince Resort
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http://www.dracaena.com/
http://www.evergrowing.com/
Topics to be Covered

* Survey of interior plants at resorts
* Major pests of interior plants
* Control Strategies – Preventative vs Remedial
* Green Solutions
  - Cultural Control = sanitation
  - Physical = pressure wash and heat treatment
  - Bio Control = natural enemies, microbes
  - Natural/Softer Products = boric acid, diatomaceous earth, kaolin clay, neem, pyrethrins, oils, soaps
* Conclusions
SURVEY FOR PESTS OF INTERIOR PLANTS

* Visited 5 major resort hotels in West Hawaii in one day (September 14, 1995).

* Observed interior plants for insects.
Hilton Waikoloa Ponytail palm, Beaucarnea recurvata
Ponytail Palm heavily infested with mealybugs
Hapuna Prince
Hapuna Prince Armored Scales
Ritz Carlton Ixora with whiteflies.
Royal Waikoloan
Royal Waikoloan Spider mites on Beach Naupaka
## Survey for Pests of Interior Plantscape

<table>
<thead>
<tr>
<th></th>
<th>Mealybugs</th>
<th>Armored Scales</th>
<th>Whiteflies</th>
<th>Soft Scales</th>
<th>Spider Mites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hotel 1</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Hotel 2</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Hotel 3</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Hotel 4</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Hotel 5</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

*Observed on September 14, 1995*
Pests of Interior Plantscape

- Mealybugs
- Armored Scales
- Whiteflies
- Soft Scales
Kahului Airport Lobby  
June 02, 2011  

Interior landscape plants infested with mealybugs [probably longtailed mealybug,, infesting interior green ti leaf plants.]
Strategies for Interior Pest Management

- **Preventative**
  Before installing plants.
  Plants not infested.

- **Remedial**
  After installing plants
  Plants infested.
Remedial “Green” Controls

*Cultural Control* – Early detection and removal of infested plant or parts

*Physical Control* – pressure wash, hot water

*Biological Control* – release of parasitic wasps, predators, pathogens (fungus, bacterium, virus, nematodes)

*Natural/Softer Products* – boric acid, diatomaceous earth, kaolin clay, neem, pyrethrins, soaps, oils
All insects have a hard, waxy, oily exoskeleton (outside skeleton).
Physical Control
Pressure washing
HOT WATER TREATMENTS: NON-CHEMICAL CONTROL OF INVASIVE PESTS

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University of Hawai‘i at Mānoa, College of Tropical Agriculture and Human Resources, Beaumont Agric. Research Center, Hilo, HI

HEAT TREATMENT TO KILL PESTS
(lowest temperature, shortest duration to achieve 100% mortality)

<table>
<thead>
<tr>
<th>Pest Type</th>
<th>Temperature/Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burrowing nematode</td>
<td>122°F/5 min</td>
</tr>
<tr>
<td>Root mealybugs</td>
<td>120°F/15 min</td>
</tr>
<tr>
<td>Nettle caterpillar (larva)</td>
<td>117°F/7 min</td>
</tr>
<tr>
<td>Green scale mealybug</td>
<td>113°F/12 min</td>
</tr>
<tr>
<td>Spiraling whitefly</td>
<td>110°F/10 min</td>
</tr>
<tr>
<td>Foil nematode</td>
<td>109°F/10 min</td>
</tr>
<tr>
<td>Cockerel scale mealybug</td>
<td>109°F/12 min</td>
</tr>
<tr>
<td>Pink hibiscus mealybug</td>
<td>109°F/12 min</td>
</tr>
<tr>
<td>Gardenia</td>
<td>122°F/6 min</td>
</tr>
<tr>
<td>Ginger, edible</td>
<td>122°F/6 min</td>
</tr>
<tr>
<td>Plumeria</td>
<td>122°F/6 min</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>122°F/6 min</td>
</tr>
<tr>
<td>Dracaena:</td>
<td>122°F/6 min</td>
</tr>
<tr>
<td>cutbacks: 'Massangeana', 'Jumbo', 'Warneckii', money tree tip cuttings: 'Janet Craig', 'L'</td>
<td></td>
</tr>
<tr>
<td>Diplodia</td>
<td>122°F/6 min</td>
</tr>
<tr>
<td>Bird-of-paradise buds, foliage</td>
<td></td>
</tr>
<tr>
<td>Calathea foliage</td>
<td>120°F/10 min</td>
</tr>
<tr>
<td>Red ginger</td>
<td>120°F/10 min</td>
</tr>
<tr>
<td>Heliconia flowers (16 cv, var.)</td>
<td></td>
</tr>
<tr>
<td>Palm foliage</td>
<td>120°F/10 min</td>
</tr>
<tr>
<td>Papyrus foliage</td>
<td>120°F/10 min</td>
</tr>
<tr>
<td>Ti leaves</td>
<td>120°F/10 min</td>
</tr>
<tr>
<td>Whaleback foliage</td>
<td>120°F/10 min</td>
</tr>
</tbody>
</table>

PLANT TOLERANCE TO HEAT
(highest temperature, longest duration tolerated)

<table>
<thead>
<tr>
<th>Plant Type</th>
<th>Temperature/Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthurium ‘gobo’ (propagative material)</td>
<td>122°F/10 min</td>
</tr>
</tbody>
</table>
Hot Water Controls Spider Mites
>120 F for 10 min

**Ti leaves**

**Sexy pink heliconia**

PREVENTS ABSCISSION

7 days after hot water treatment
Portable Hot Water Sprayer

Spraying hot water 115 F at nozzle against coqui frogs & other quarantine pests.
Water at 115 F at Nozzle tip.

Green Solution!
Hot Water Drench for Reniform Nematode 122 °F for 10 min
Root-Infesting Quarantine Pests Are Controlled By Hot Water

with continuous drenching of potted plants at 122 °F for 10 min

Root mealybug

Burrowing nematode

Infested

Healthy

Root Knot Nematode

Ensign scale insect

Snail
Hot water and IBA Treatments on Dracaena Bush Tip Cuttings

- Untreated
- Hot Water Dip
- Untreated
- Hot Water + IBA Dip
- Untreated
- IBA Spray
- Untreated
- IBA Dip

Hot water is not detrimental to root growth; treat cuttings from field stock infested with thrips, banana moth, mealybugs, scales, etc. before propagating them in your nursery.
Treating Propagative Materials with Hot Water & Rooting Hormone

(49º C for 10 min + 0.8% indole butyric acid (IBA) rooting powder)

<table>
<thead>
<tr>
<th>Plant</th>
<th>Hot water + IBA</th>
<th>IBA only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Massangeana</td>
<td>8.3</td>
<td>3.3</td>
</tr>
<tr>
<td>Gardenia</td>
<td>118.3</td>
<td>15.6</td>
</tr>
<tr>
<td>Plumeria</td>
<td>12.4</td>
<td>3.2</td>
</tr>
<tr>
<td>‘Janet Craig’</td>
<td>2.2</td>
<td>1.1</td>
</tr>
</tbody>
</table>

Hot water @ 49º C + IBA

IBA only

Gardenia
Hawaii's government has been practicing classical biological control by purposely introducing and releasing natural enemies, for over a 100 yrs. Early attempts to control pests (rats & armyworms) through the introduction of animals (mongoose & mynah bird) into Hawaii were made by private citizens in 1865.

In 1890, 25 years later, procedures of biological control were regulated and supported by the Hawaiian government.

Of the 243 natural enemies purposely introduced (1890-1985), 86.4% have been recorded to prey on or attack about 200 pest species.

No purposely introduced species, approved for release in the past 35 years, has attacked any native or other desirable species.
Plumeria at Keahole Ag Park (09/2010)

Immature Lady Beetle

No natural enemies present

Adult Lady Beetle
Biological Control of Mealybugs

Mealybug destroyer

Immature ladybeetles
Parasite for Aphids
Parasite for whiteflies
Ladybeetle for mealybugs
Nematodes for Root weevils
Predatory Mite

*Importation and sale in Hawaii require Hawaii Dept. of Ag permit and approval because of possible contamination of the host pest, or hyperparasites.

*Most of these parasitic wasps & predators already occur naturally in HI.

*Capture these biocontrol agents that naturally occurs in HI and release into interiorscapes without natural enemies of pests.
**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-dwelling insects.
Oils

* Horticultural oils (petroleum, vegetable & essential) are effective in controlling insects by suffocation.
* Safe to the environment and nontarget organisms.
* No development of resistance.
* Major disadvantage like soap is plant injury.
* Essential plant oils include cedar, lavender, citrus (citronella, lemon, orange) peppermint, eucalyptus, etc.
* Neem oil works as an oil only as the oil fraction from the neem seed is free of the insect growth regulator & repellent, azaditrachtin (Azatin).
* Limonene, refined from citrus oil is thought to be a nerve poison causing excessive motor nerve activity.
Horticultural Oils against Spider Mites

“For spider mites, a low rate of horticultural oil, 0.5%, can be exceptionally effective and is compatible with predaceous mites. Nurseries that adopted the use of low dosage oil for managing mites, while at the same time avoiding use of acephate or pyrethroids, essentially saw their spider mite problems disappear.”

Richard Cowles, Entomologist
The Connecticut Agricultural Experiment Station
July 20, 2013
Insecticidal Soaps and Detergents

* Soaps and detergents destroy the oily & waxy exoskeleton of insects.
* Broad-spectrum against most insects, causing them to drown in water.
* Major disadvantage is injury to plant tissue, especially at rates higher than 1-2%.
* Do not apply under hot conditions (>90 °F).
* Soaps and detergents act strictly as contact insecticides, with no residual effect. To be effective, sprays must be applied directly to and thoroughly cover the insect.
* Certain brands of hand soaps and liquid dishwashing detergents can be effective for this purpose.
* Dry (powder) dish soaps and all clothes-washing detergents are too harsh to be used on plants. (W. S. Cranshaw, Colorado State)
Boric Acid is a weak acid of boron used for control of cockroaches, ants and other insects by acting as a stomach poison, and the dry power is abrasive to the insect’s exoskeleton?

Diatomaceous Earth is a soft, silica rock crumbled into a powder and used as an insecticide, due to its abrasive and absorptive properties. The fine powder absorbs oils from insects' exoskeleton, causing them to dehydrate.

Kaolin Clay is a clay mineral used in organic farming, as a spray applied to crops to deter insect damage, and in the case of apples, to prevent sun scald. Commercial product: Surround WP
Kaolin Clay Crop Protectant

White residue may be washed or brushed off prior to sale or installation in interior landscapes (Preventative)
Natural Pyrethrin Insecticide

*Pyrethrins are produced from seeds of chrysanthemum.

*Pyrethrin is a repellent and a nerve poison to insects & coqui frog.

*Non-persistent in the environment and biodegradable.

*One of the safest insecticides - pyrethrins are degraded by stomach acids in mammals.

*Non-phytotoxic, unlike citric acid.
Pyrethrins + Hydrated Lime Strategy

Developed by HDOA

Paralyzed but not dead, may recover.

Dead – no recovery
Conclusions

*Green solutions are effective options for interior plants including natural enemies, hot water, oils, soaps, pyrethrins.

*New green products are being produced by major agrochemical companies, including natural enemies and microbial control products.

*All new insecticides developed by agrochemical companies will be considered reduced-risk with a movement to organically acceptable or green pest control products.
A BIG THANK YOU!

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