Newer Insecticides and Biologicals against Invasive Pests

Crop Production Services Nursery Seminar
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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*)

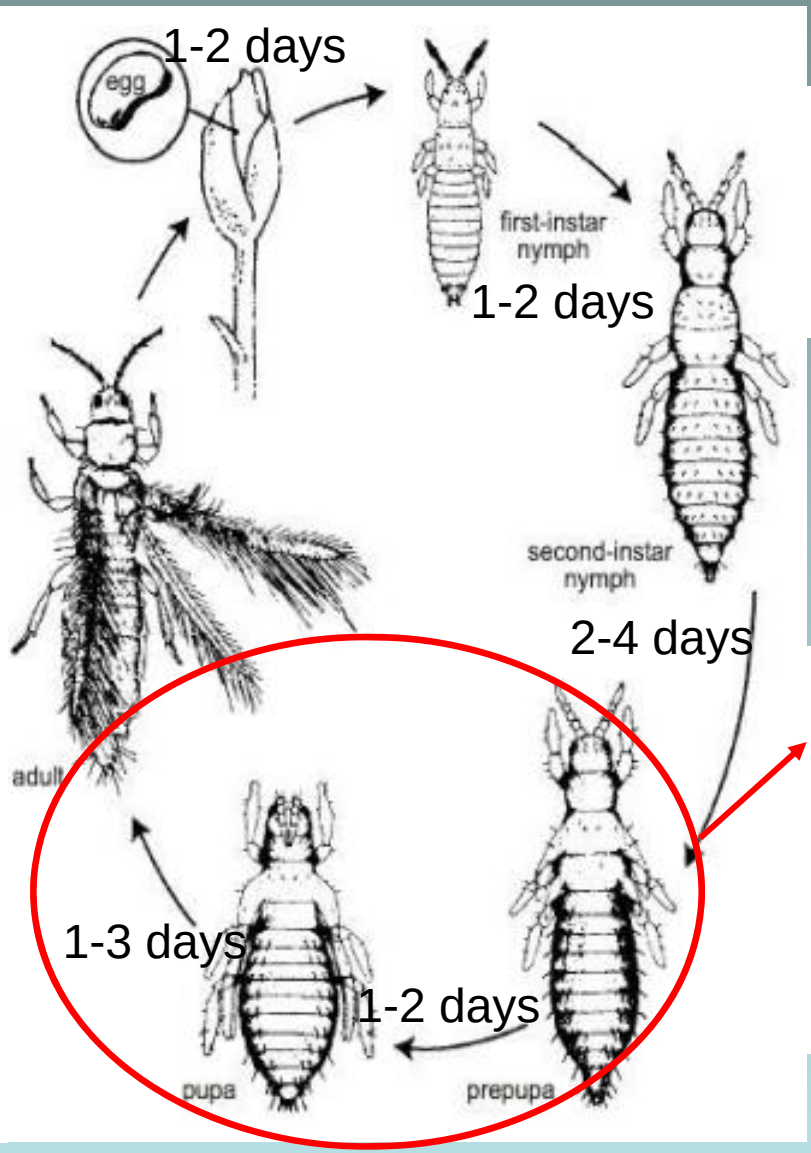
*Western Flower Thrips, Glasshouse Strain (GH) damage to dendrobium blossoms.

*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



Adult and nymphs occur on flowers or foliage.

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

Prepupa and pupa occur in the media below the plant.

Adapted from UC Pest Management Guidelines, THRIPS **Home & Landscape** (Published: 5/01)

Products Against Western Flower & Melon Thrips

Hachi Hachi (Sepro) - Group 21A inhibits energy metabolism
GH also aphids, scale insects, whiteflies

Pylon (BASF) - Group 13 disrupts proton gradient.
GH also mites, foliar nematodes

Overture (Valent) - Unknown MoA; in a unique group.
GH also caterpillars

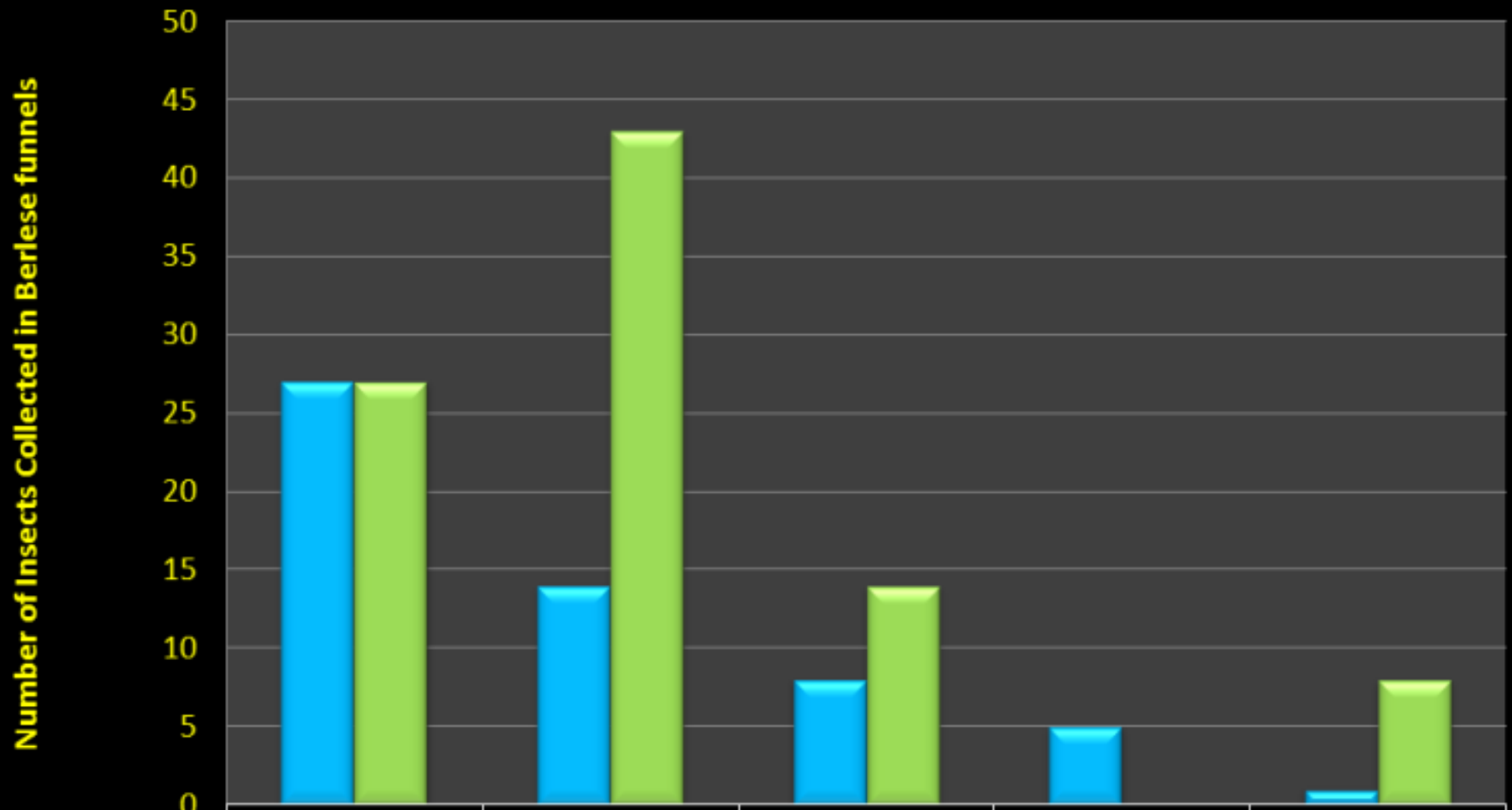
Aria (FMC) - Group 9C stops insect feeding.
GH, N, L also aphids, whiteflies, mealybugs,

Mesurol (Gowan) - Group 1A (carbamate) nerve poison
GH, N, L (RUP) also snails and slugs

Avid (Syngenta) - Group 6 WFT-G resistance
GH, N, L also mites, nematodes

Conserve (Dow) - Group 5 WFT-G resistance
GH, N, L also caterpillars, leafminers

Thrips on Dendrobium Flowers



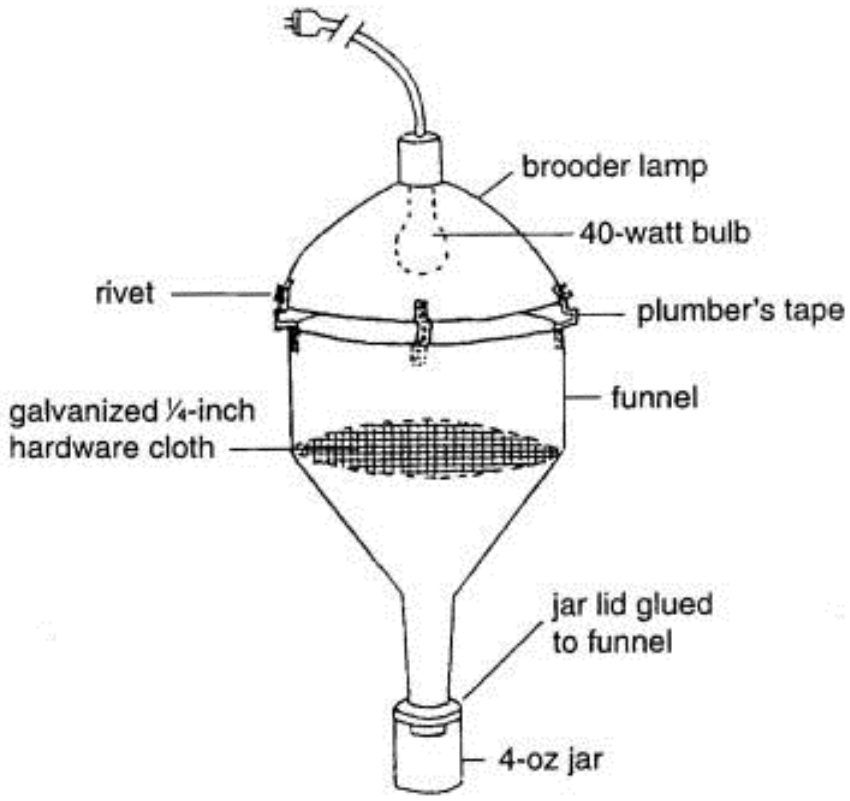
	2nd Hachi Hachi, no drench	3rd Hachi Hachi, no drench	1st Pylon spray + Duraguard drench	2nd Aria + Malathion Drench	2nd Overture +Malathion Drench
Total Adults	27	14	8	5	1
Total larvae	27	43	14	0	8

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

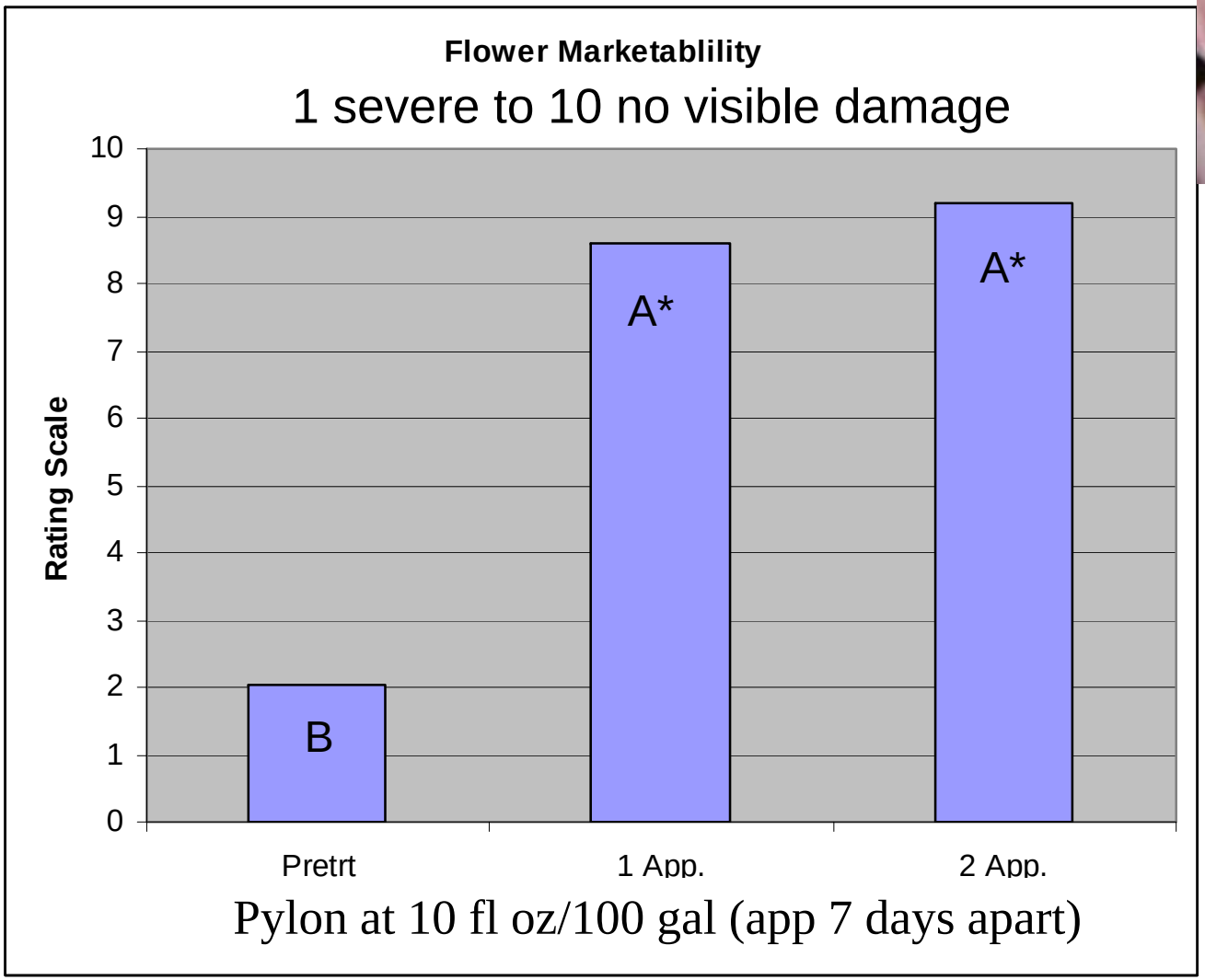
The Berlese Funnel, A Tool for Monitoring Thrips on Orchids

CTAHR Insect Pests IP-3 10/98



The modified Berlese funnel

Melon Thrips, *Thrips palmi* on Lavender Lady Anthuriums



Spirotetramat
Tetronic/Tetramic Acid

MOVENTO

Crop Use
Vegetables
Fruits
Nuts

IRAC Class 23

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

Ornamental use:
Greenhouse
Field grown ornamentals
Outdoor ornamentals

*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.

Efficacy of Spirotetramat (Kontos) against aphids, foliar mealybugs, thrips and whiteflies

Severe thrips damage

ants, mealybugs, and banana aphids on stem and between bracts of red ginger

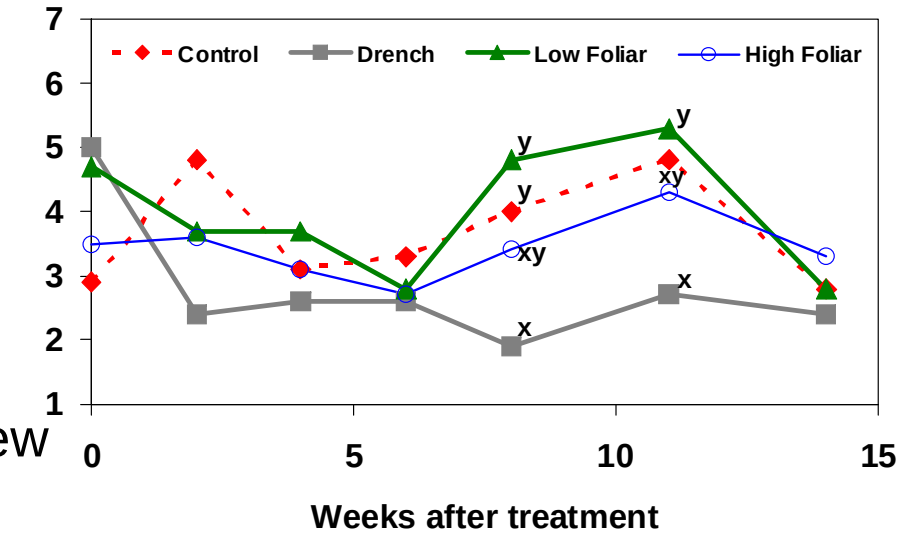
Severe – whitefly on >50% of sheath surface area

Kontos (spirotetramat)

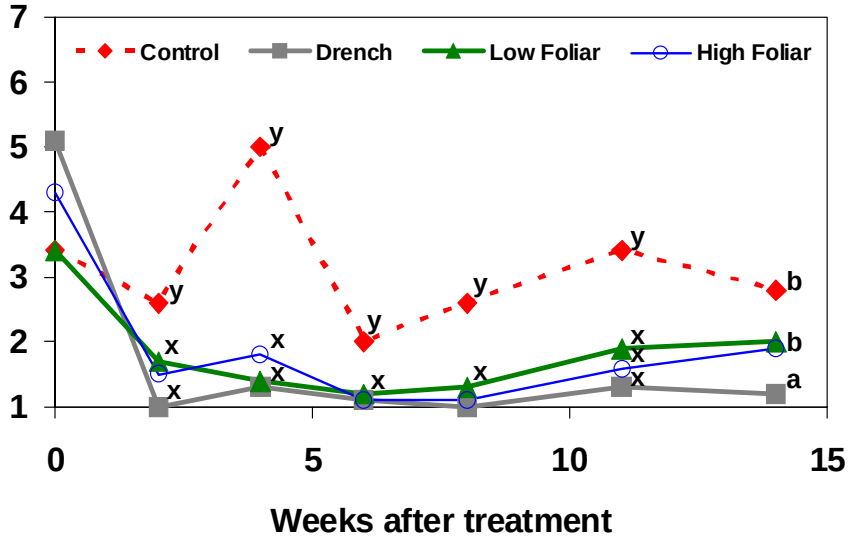
Drench: 0.4 fl oz/ft plant height
(1 application to root zone area)
Low Foliar: 1.7 fl oz/100 gallons
High Foliar: 3.4 fl oz/100 gallons
(2 applications, 4 weeks apart)

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

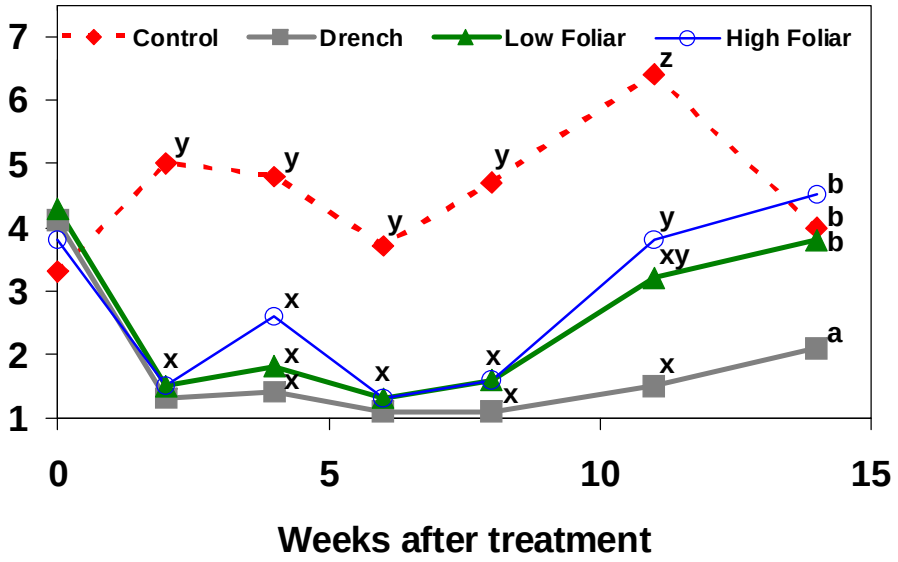
Level of ant infestation



Level of mealybug infestation

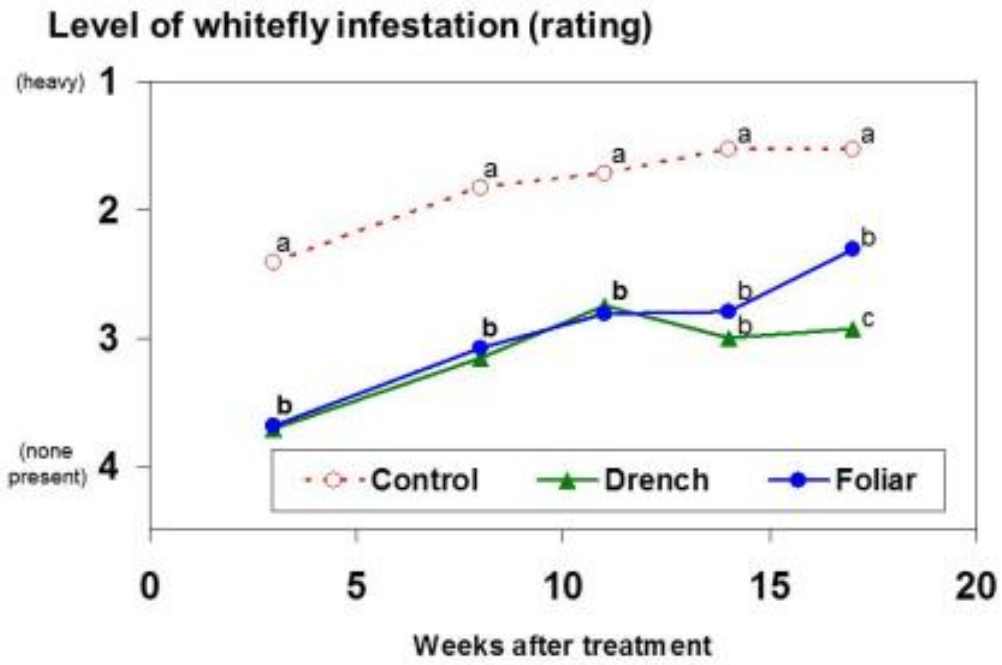


Level of banana aphid infestation



Anthurium Whiteflies

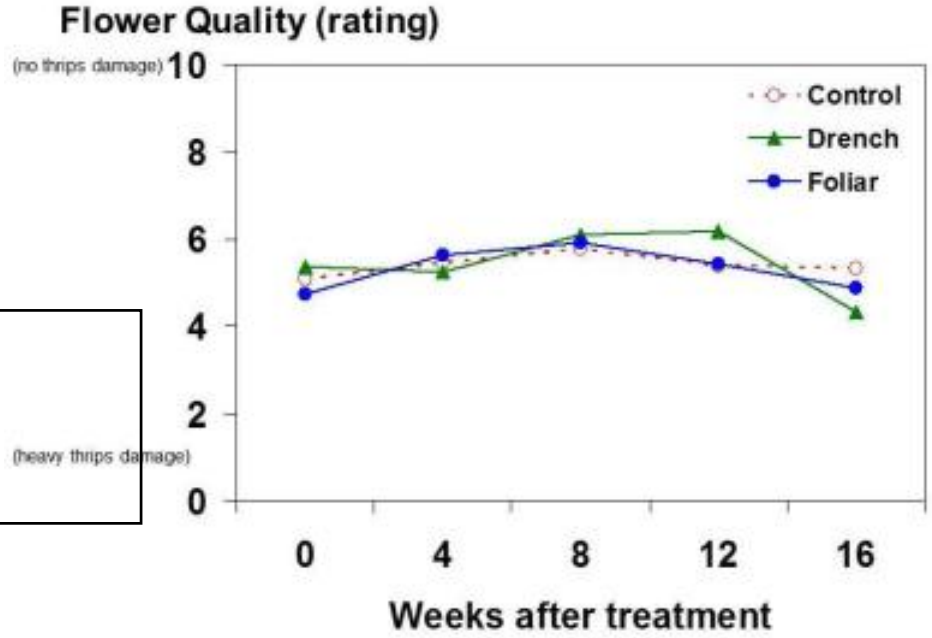
- Drench and foliar applications were effective from 3 to 17 weeks. ($P<0.05$).
- Drench application was most persistent providing whitefly control for >17 weeks.



Anthurium Thrips

- Kontos was not effective against anthurium thrips.

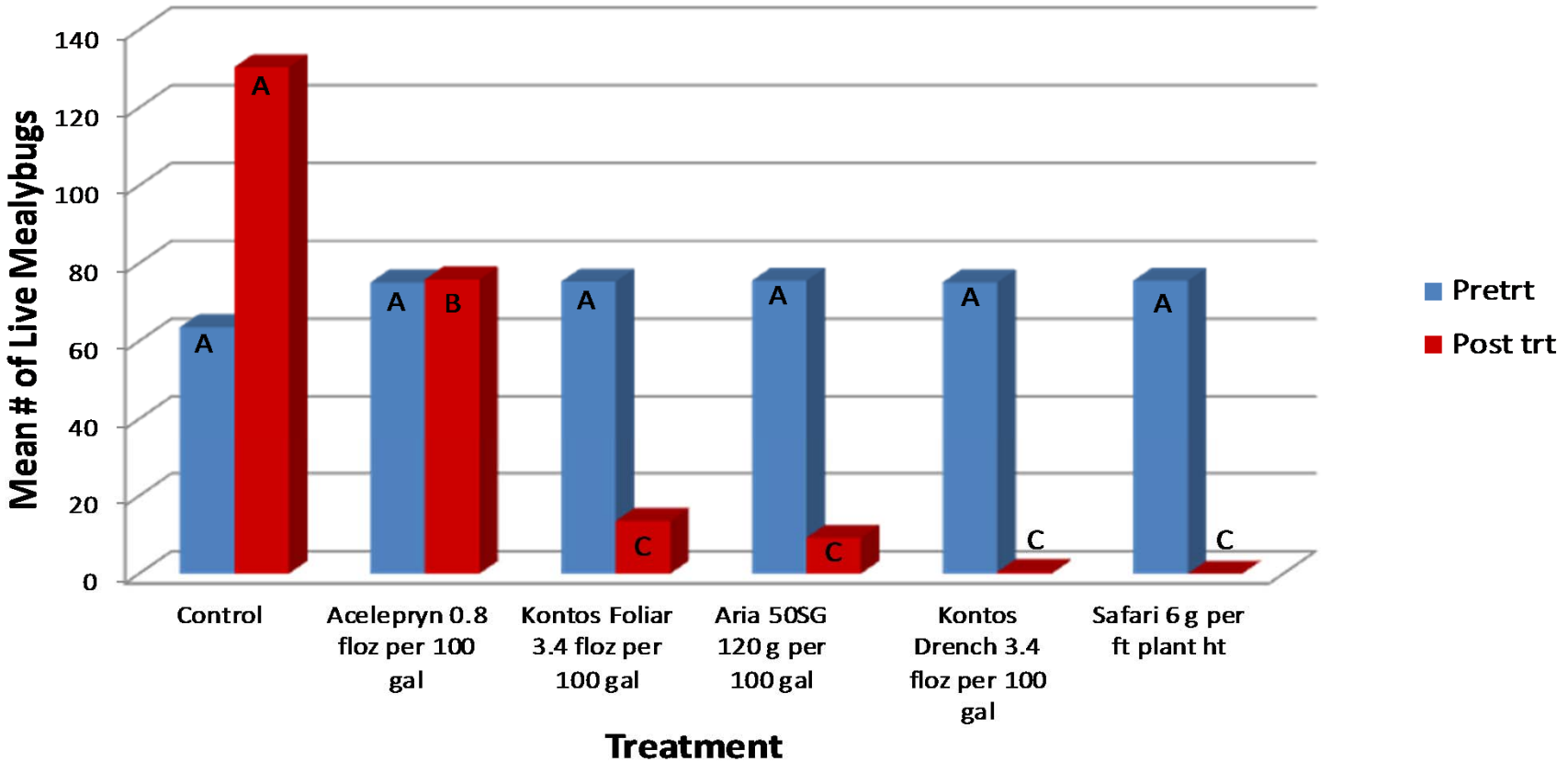
RATES:
Drench: 0.2 fl oz/ft plant height
Foliar: 3.4 fl oz/100 gallons



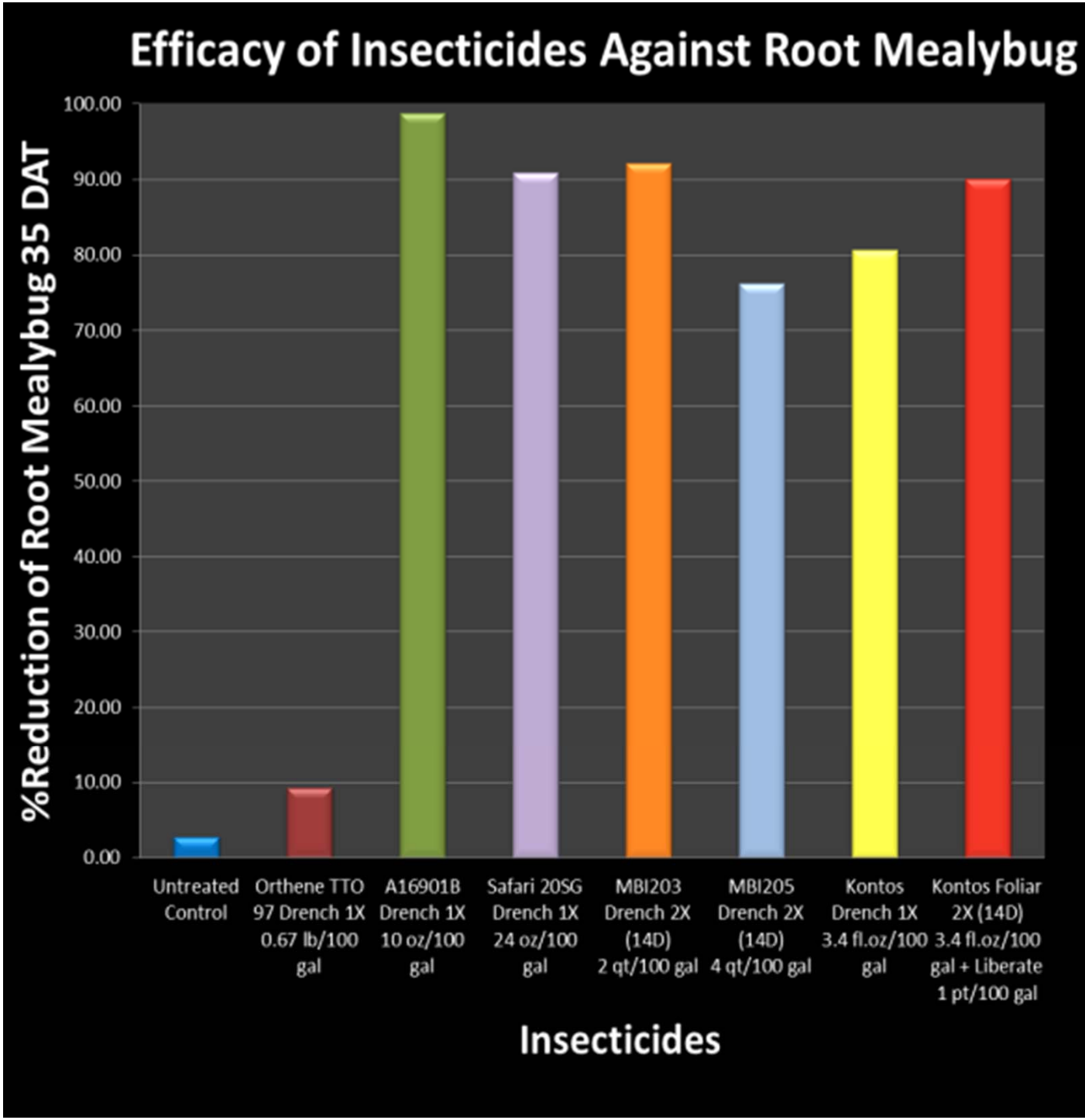
Efficacy of Acelepryn, Aria and Safari against the root mealybug, *Rhizoecus hibisci* infesting Rhapis palms.

Insecticide	IRAC Class	Mode of Action
Aria (flonicamid)	9B	Feeding blocker/nerve action
Safari (dinotefuran)	4A	Nerve action
Kontos (spirotetramat)	23	Inhibitor of lipid synthesis; Growth regulator disrupter
Acelepryn (chlorantraniliprole)	28	Nerve and muscle action Ryanodine receptor

Efficacy Study:
Managing Root Mealybug on *Rhapis Robusta*



Acelepryn (chlorantraniliprole Group 28) 0.8 fl oz/100 gallons (drench)
Aria (flonicamid Group 9C)4. 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

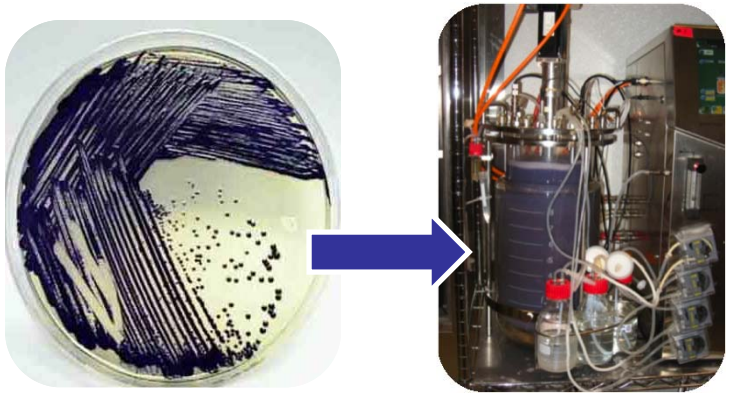
MBI has commercial rights for Americas and ROFR for Europe

Marrone® Bio Innovations

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.
- <u>Do not need living microbe for activity – MBI-203 is not a live product.</u>



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 humidiy required. dwelling insects.

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).

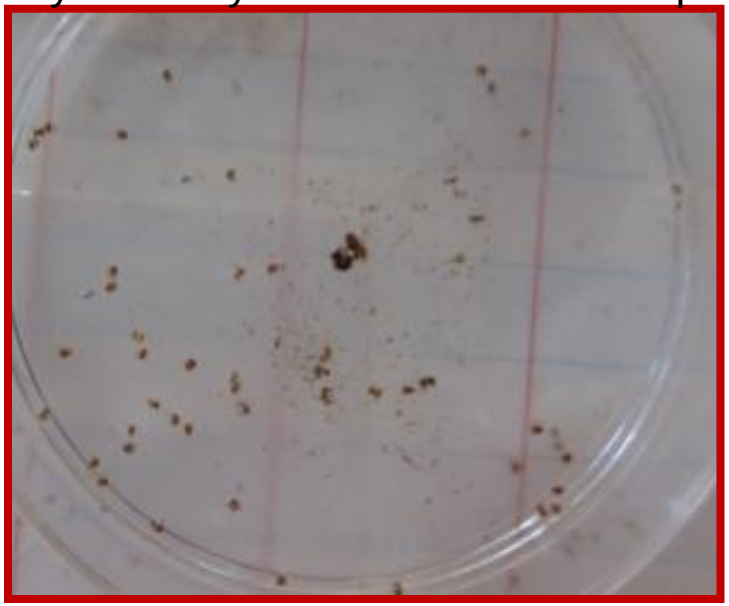
*Talstar granular and liquid effective as a residual contact/barrier treatment.

*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).

Little Fire Ant

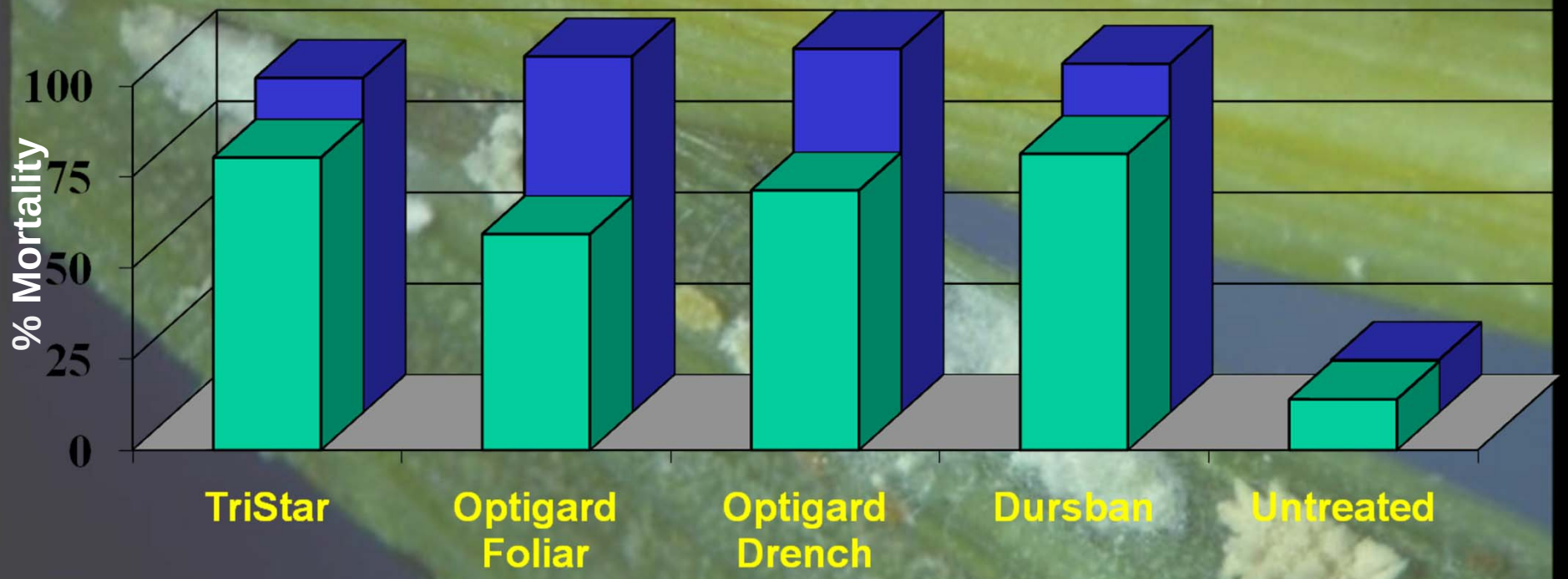
1 Hour after placement

Control (Peanut Butter) | Maxforce Complete | Probait

2 Hours after placement

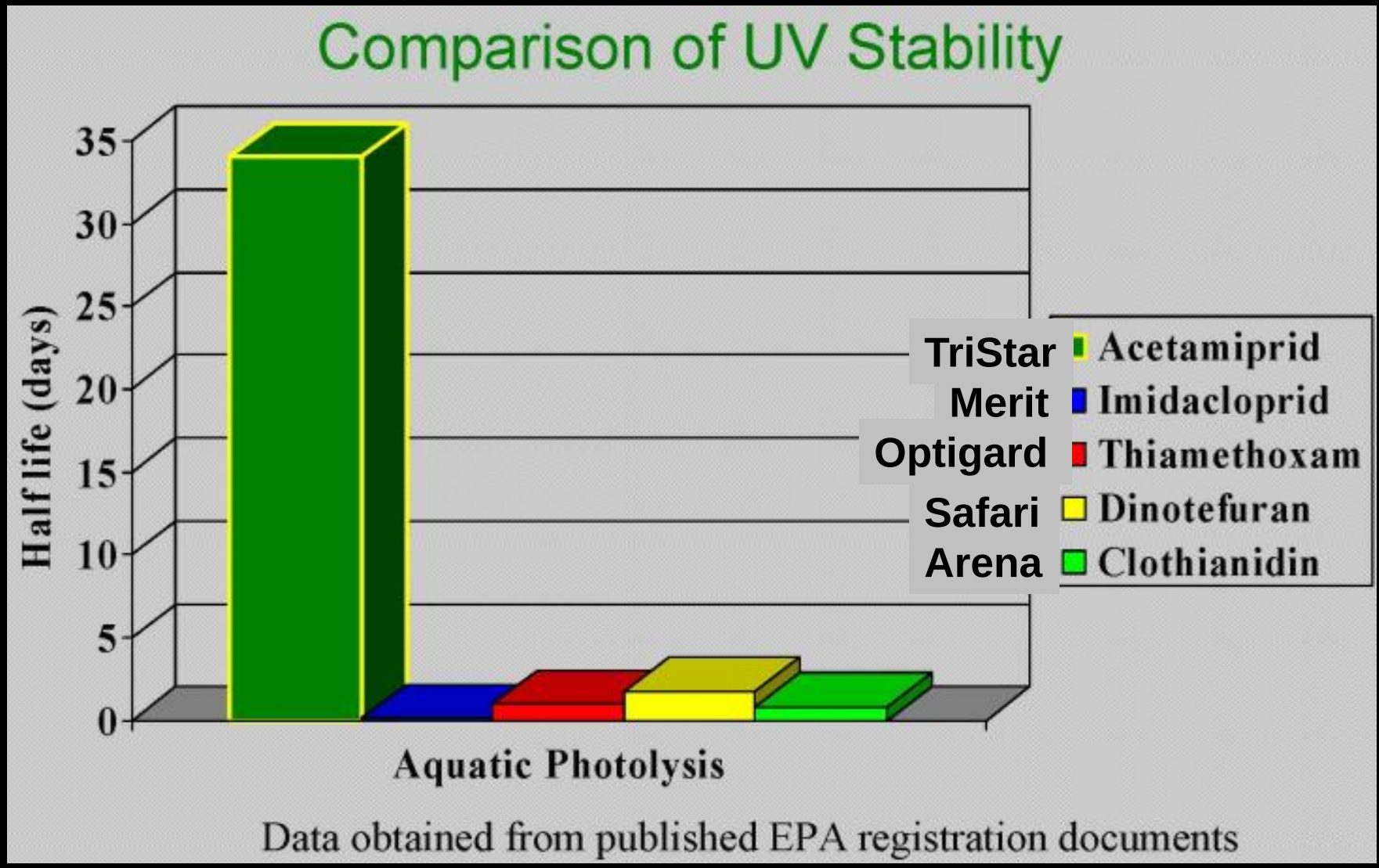
Control (Peanut Butter) | Maxforce Complete | Probait

TriStar and Optigard Against the Coconut Mealybug, *Nipaecoccus nipae*



TriStar = acetamiprid

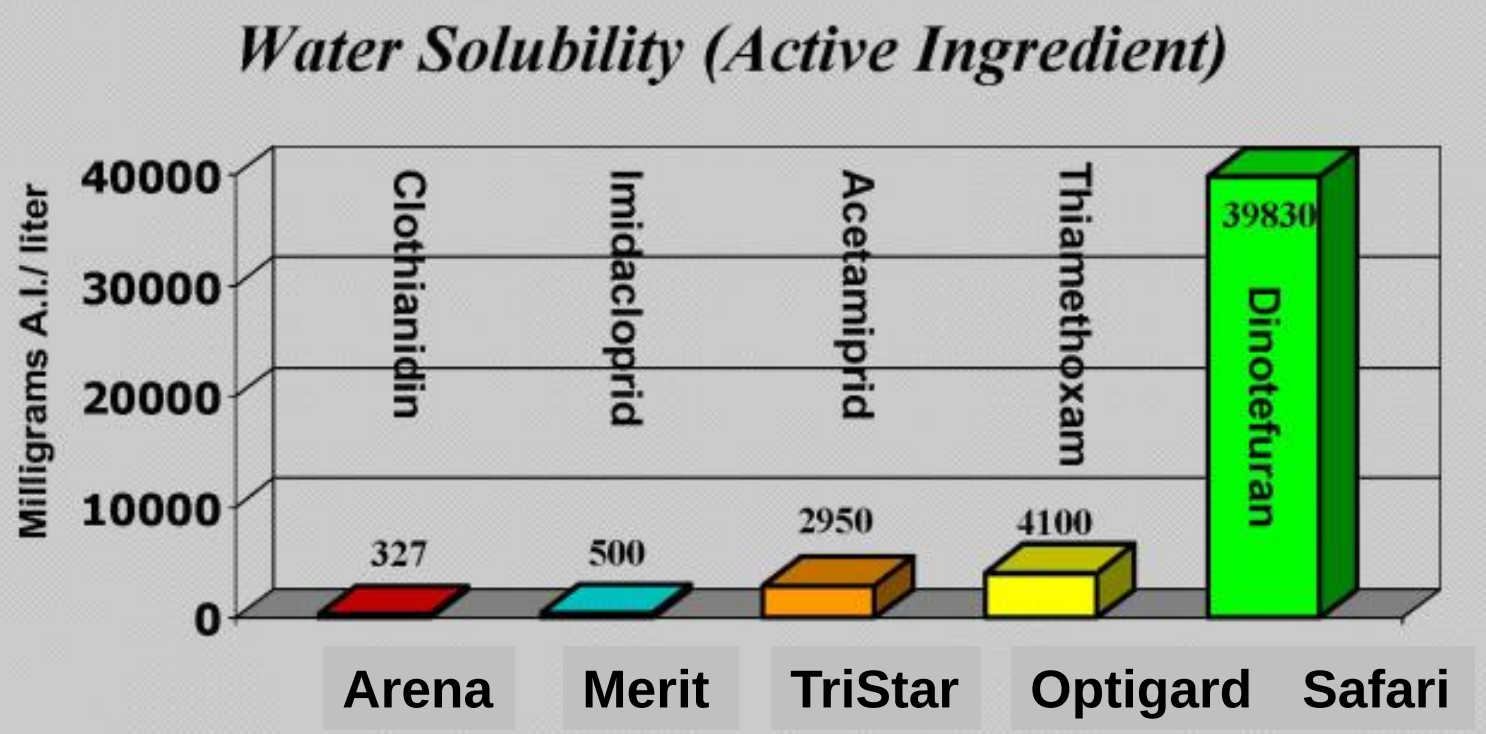
Optigard = thiamethoxam
(Now for sale in Hawaii, landscape use)



TriStar is registered for foliar use only and the most uv stable of all neonicotinoids.

Slide Credit: R. Fletcher

Relative Water Solubility of Neonicotinoids:



Information sources
Clothianidin (Celero), Acetamiprid (Tristar), Dinotefuran (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.


Placing Tablet 2” Below Media Surface

* >20 weeks of whitefly control
* >12 weeks of thrips control


Thrips


Whitefly

Efficacy of Neonicotinoids against Melon Aphids and Papaya Mealybug on Native *Hibiscus* sp.

Native *Hibiscus* sp

Melon Aphid, *Aphis gossypii*
Papaya Mealybug, *Paracoccus marginatus*

Efficacy of Neonicotinoids against Melon Aphids and Papaya Mealybug on Native *Hibiscus* sp.

Control
Pretreatment

Control
7 WAT

Merit 2.5G
Pretreatment

Merit 2.5G
7 WAT

Melon Aphids and Papaya Mealybug on Native *Hibiscus* sp

CoreTect Pretreatment

CoreTect 7 WAT

Safari 2G Pretreatment

Safari 2G 7 WAT

Level of aphid infestation on hibiscus plants before and after treatment

Treatment	Pretreatment	2 WAT	4 WAT	7 WAT
Control	**H**	**H**	**M**	**M**
Safari 2G	**H**	**M**	**M**	**L**
CoreTect NPK Tablets	**H**	**M**	**L**	**S**
Merit 2.5G	**H**	**L**	**L**	**S**

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

Treatment	Pretreatment	2 WAT	4 WAT	7 WAT
Control	**Y**	**Y**	**Y**	**Y**
Safari 2G	**Y**	**N**	**N**	**N**
CoreTect NPK Tablets	**Y**	**Y**	**Y**	**Y**
Merit 2.5G	**Y**	**Y**	**N**	**N**

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.

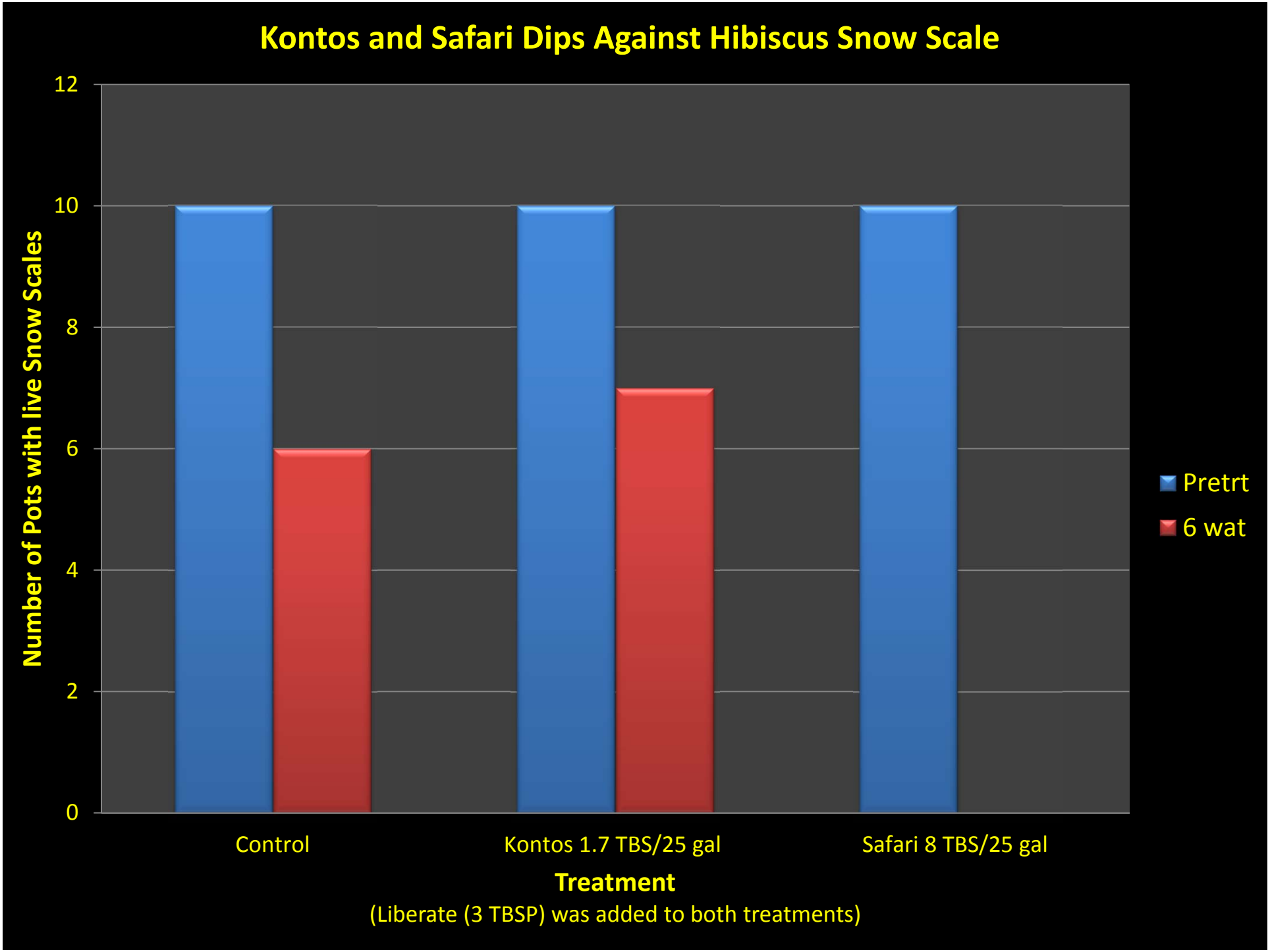
*About one month to complete life cycle.

Preadult or pupa encased in armor produced by their previous body shell and secretions.

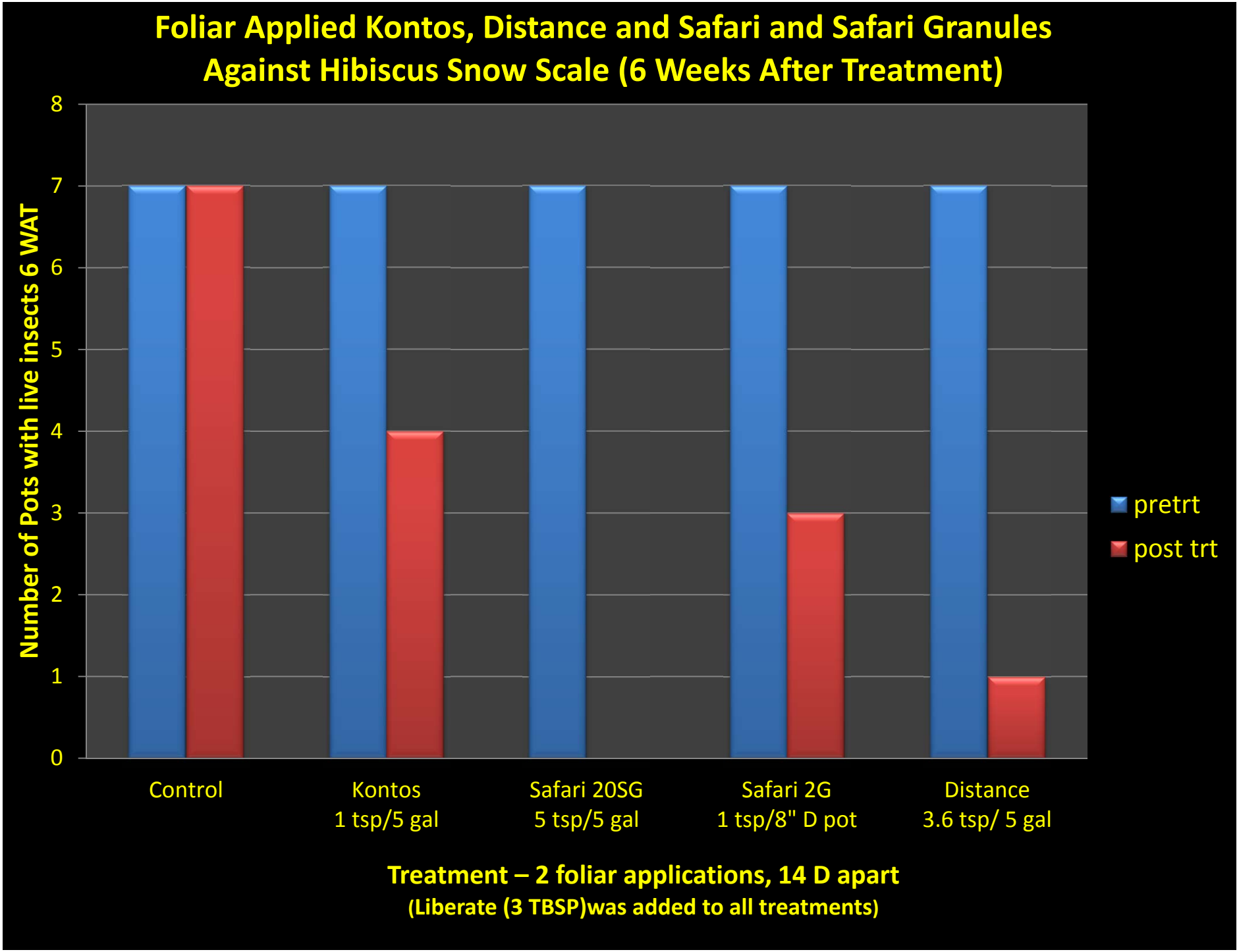
Feeding Damage on
Upper Leaf Surface

Scale Infestation on
Lower Leaf Surface

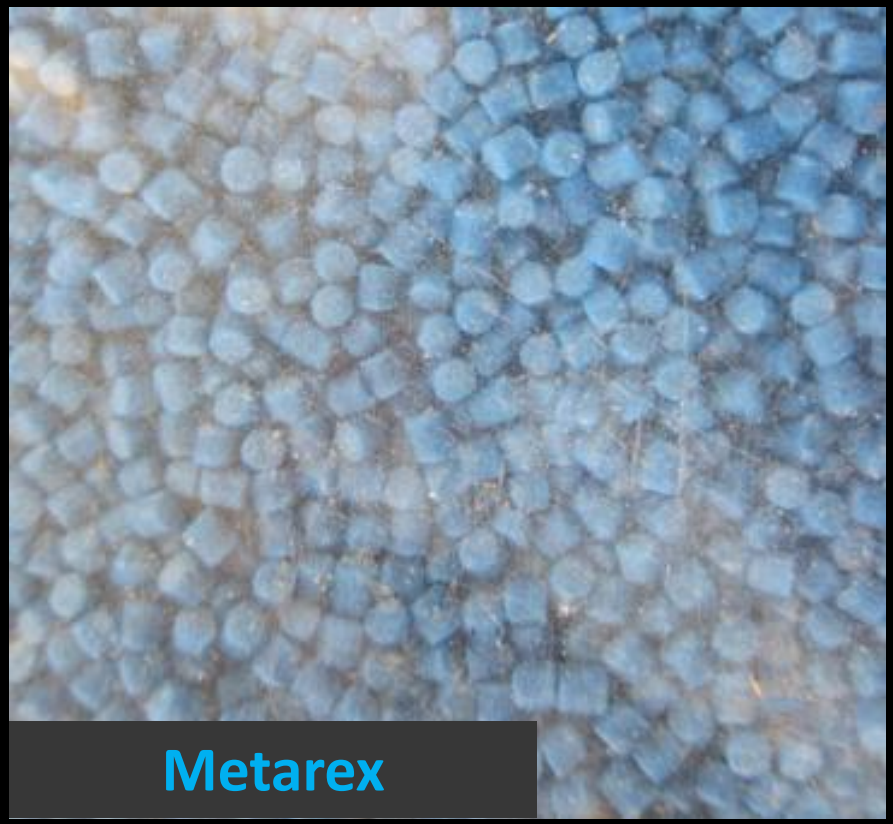
Untreated control cuttings dipped in water and Liberate, a non-ionic surfactant.


Kontos and Safari Dips Against Hibiscus Snow Scale
Number of Pots with live Snow Scales
12
10
8
6
4
2
0
Control
Kontos 1.7 TBS/25 gal
Safari 8 TBS/25 gal
Treatment
(Liberate (3 TBSP) was added to both treatments)
Pretrt
6 wat

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)
Number of Pots with live insects 6 WAT
0
1
2
3
4
5
6
7
8
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
pretrt
post trt
Treatment – 2 foliar applications, 14 D apart
(Liberate (3 TBSP)was added to all treatments)

Bags of Fresh Slug and Snail Baits

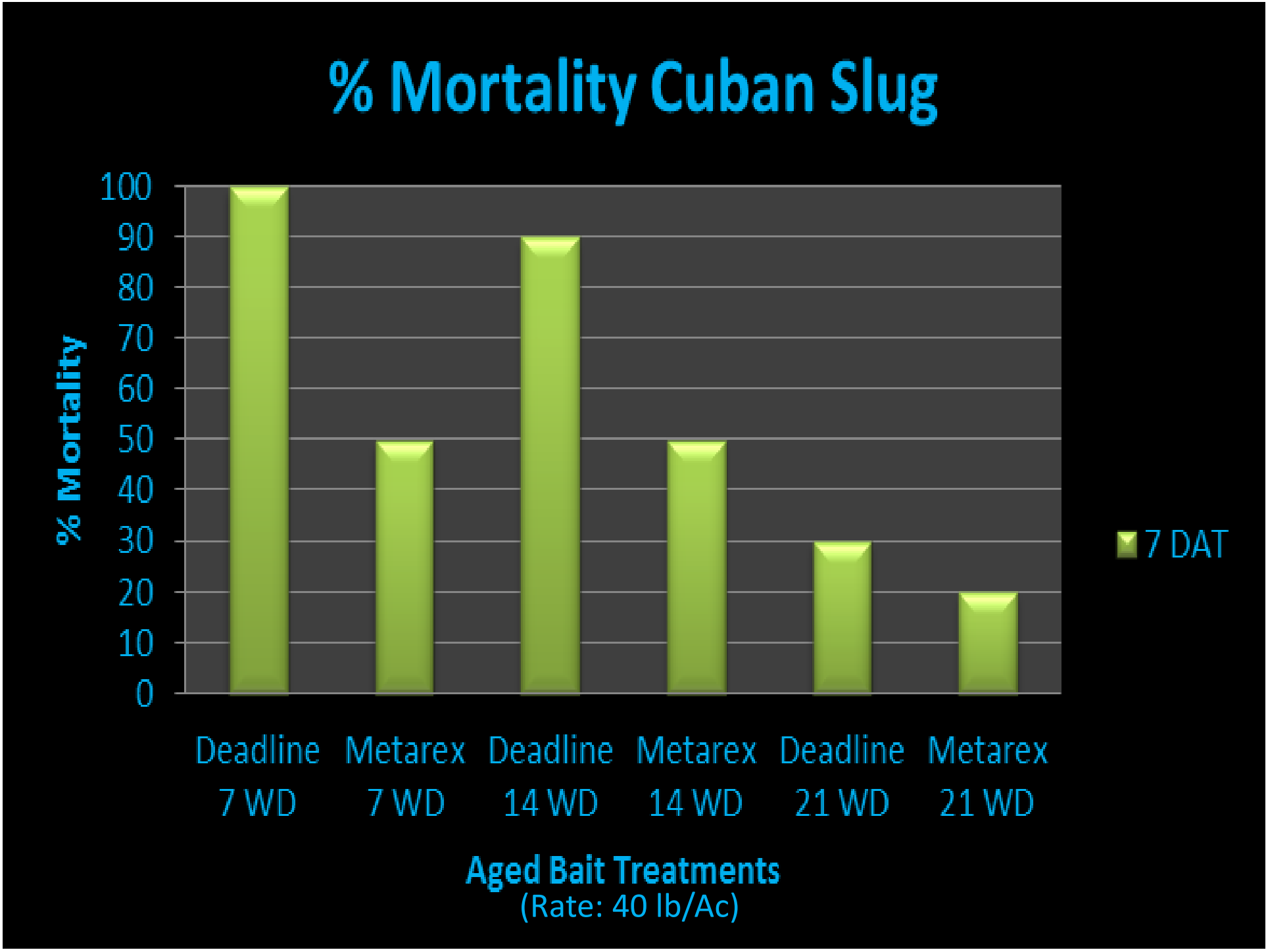


Metarex

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
% Mortality
100
90
80
70
60
50
40
30
20
10
0
Deadline 7 WD
Metarex 7 WD
Deadline 14 WD
Metarex 14 WD
Deadline 21 WD
Metarex 21 WD
7 DAT
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 techinical assistance:
Ruth Niino-DuPonte
Susan Cabral
Kris Aoki
Jorden Zarders
08 Feb 14

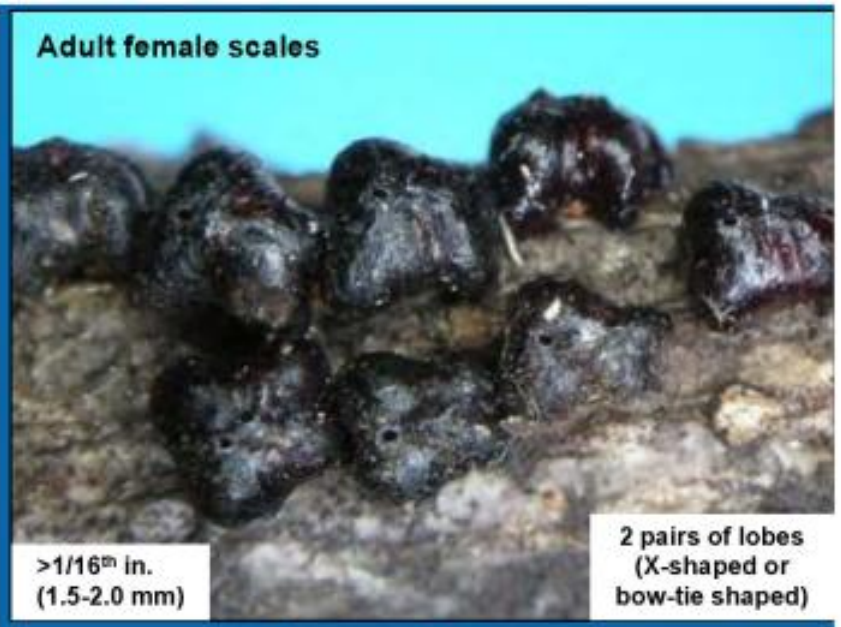
"lobate lac scale"
Paratachardina pseudolobata
(Hemiptera: Kerriidae)

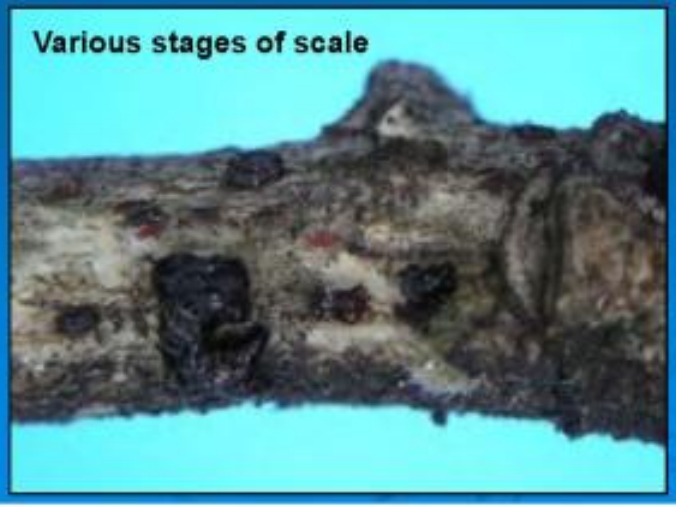
Native home: unknown, but thought to be Asia or the Pacific Ocean region.

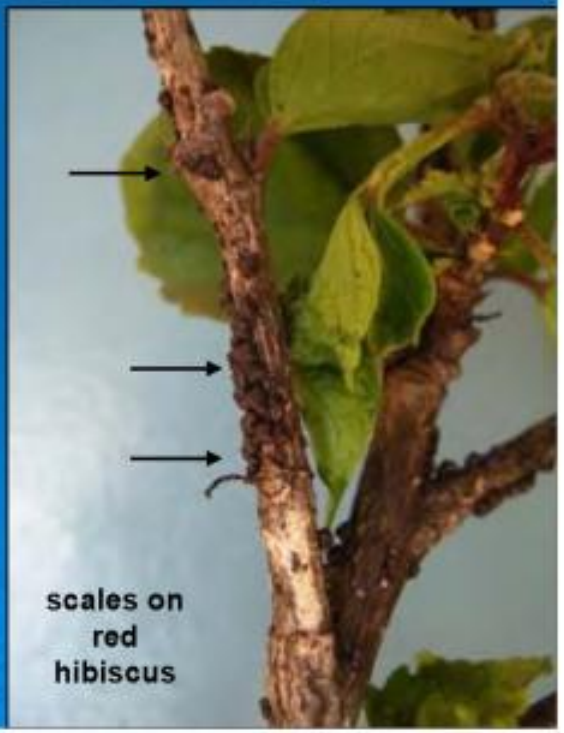
First collected in Hawaii: October 11, 2012
Hawaii distribution: Oahu only (Moanalua)
Recorded hosts in Hawaii: weeping banyan (*Ficus benjamina*), red hibiscus, mango.

U.S. distribution: Florida (1999)
Recorded hosts in Florida: >300 plant species

World distribution: Bahamas, Christmas Island, and Cuba.







Darcy Oishi
Walter Nagamine
Hawaii Dept. of Agriculture
Plant Pest Control Branch


Moanalua
Gardens
Ficus
benjamina


W. Nagamine, HDOA

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, Waihuku).

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.

1. Chinese banyan, Ficus microcarpa.

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

Figure 3. Stem-galling wasp (1/16th inch)

4. Wasp larva in gall (1/16th inch)

5. Adult wasps in dissected stem galls.

Injected with Ace-Jet using Tree I.V. (09/12/12)

*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.