Newer, Safer Insecticides for Use in the Landscape

LICH Green Industry Conference
October 25, 2012

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PESTS: What will this presentation cover?

Caterpillars (monkeypod, bougainvillea), thrips (anthurium, myoporum & chilli thrips), ants (little fire ant), mealybugs (coconut, papaya), aphids, armored scale, stem gall, lac scale and whitefly (anthurium, spiraling, ficus).

*Insecticides:

- Organophosphate (Acejet = acephate)
- Pyrethroid (Talstar)
- Neonicotinoids (Merit, Safari, Optgard, TriStar, Arena)
- Tetronic Acid (Kontos = spirotetramat)
- Avermectins (Avid = abamectin)
- Spinosyns (Conserve = spinosad)
- Insect Growth Regulator (Distance = pyriproxyfen)

*Ant Baits: Talus = buprofezin)

- Probait (hydramethylnon)
- Extinguish Professional (methoprene)
- Extinguish Plus (hydramethylnon plus methoprene)
- Maxforce Complete (hydramethylnon)

Monkeypod Caterpillars

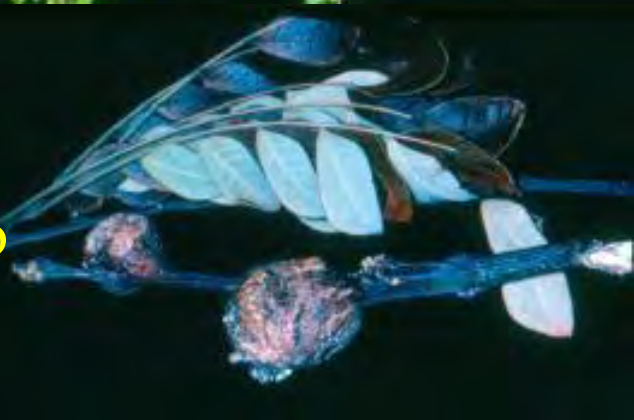
Monkeypod-
Kiawe caterpillar
Melipotis

Monkeypod moth
Polydesma

Black Witch, *Ascalapha odorata*

Monkeypod caterpillars

*In the 1970's defoliated monkeypods.
*Eggs laid in crevices of the bark.
*At dusk, caterpillars migrate up the tree to feed in the canopy at night.
*At dawn, caterpillars migrate down the tree and hide during the day in cracks and crevices in the bark or down into the soil.
*Caterpillars pupate in the bark.
*Egg to adult in 50 to 60 days.
*Continued nightly eating of the sprouting leaves caused swellings or "galling" of the monkeypod. (Insects of Hawaii 7: 395, 1958)
*Control by spraying tree trunk not canopy with insecticides or treat burlap or carpet attached to tree trunk that provides hiding habitat for caterpillars between bark and carpet/burlap.



COUNTY OF LOS ANGELES
DEPARTMENT OF AGRICULTURAL COMMISSIONER/WEIGHTS AND MEASURES

Bougainvillea Looper *(Disclisioprocta stellata)*

Other common name: Somber Carpet Moth
Distribution: Neotropical species introduced into many parts of the world. In the Western hemisphere: from Canada to Brazil. Found also in Africa and islands of the Indian Ocean. In the U.S.: southeastern states, HI and CA.
Hosts: Recorded on *Bougainvillea, Amaranthus, Boerhaavia, Mirabilis,* and *Pisonia.*
Damage: Larvae feed on foliage, producing deep notching cuts or consuming the entire leaf except the larger veins. During heavy infestations larvae may defoliate and kill younger plants.
Field ID: Adults with 25-33 mm wingspan. Wings mainly dark brown with black and tan wavy bands. Nocturnal moths.
Larvae (full grown) about 25-30 mm long. Locomotion with a characteristic looping gait. Young larvae are greenish with some rusty brown; later instars are more rusty brown.
Pupae around 11-13 mm long, mostly dark brown. Terminal segment armed with a pair of hooks.

November, 2007

In Hawaii since 1993

Feeding damage on Bougainvillea

Bt (Dipel) sprayed in late afternoon should be effective.

Myoporum thrips
Klambothrips myopori

*First reported in March 2009 at Waikoloa Village.
*First observed in 2008 by landscapers.
*First described in CA in 2007.
*Specific to *Myoporum* spp. or naio, false sandlewood

Control of Myoporum Thrips, *Klambothrips myopori*

Based on trials in California and Hawaii

*The minute pirate bug, *Orius* sp., a thrips predator, has controlled the myporum thrips in CA and will also impact thrips in HI.

*Avoid broad-spectrum insecticides that will impact these predators.

*Avid did not reduce thrips numbers as much as Conserve or Merit.

*Talstar works well as a preventative treatment according to landscapers, but will negatively impact the pirate bugs.

*Suggested treatments are Safari drench and Conserve foliar application.

Myoporum Thrips Infestation at Maunalani “Kamilo”

← Before Talstar application

Ca. 3 weeks after Talstar application →

Chilli thrips, *Scirtothrips dorsalis* attacking Naio Papa

*High population of chilli thrips observed on naio papa, Maunalani Point causing bronzing, stunting, thickening, and deformed, curled leaves, but not galling (04/16/09).

*Previously, plants were infested with the galling myoporum thrips.

Chilli thrips, *Scirtothrips dorsalis,* is a polyphagous species with more than 100 recorded hosts from about 40 different families, including peppers, and roses.

*On Oahu since 1987 reported on African daisy, cucumber, joyweed, false heather.

*Also a pest in Florida and Texas.

*Southeast Asia or India origin.

*USDA-APHIS intercepted this thrips 89 times since 1984 on imported cut flowers, fruits and vegetables.

Chlorfenapyr (Pylon, GH) was the most effective in reducing the densities of *S. dorsalis* adults and larvae followed by spinosad (Conserve) and imidacloprid (Merit, Marathon). The performance of other insecticides in controlling *S. dorsalis* populations was inconsistent (Seal et al. 2006).

Bronzing Scirtothrips sp. vs Galling Myoporum Thrips

Sooty Mold

Sooty mold is caused by a sweet substance called honeydew excreted by aphids, mealybugs, soft scales and whiteflies. Plants with sooty mold indicates severe infestations of one of the above insects.

Ecological Control Strategies

Ant Control

Ants feed on sweet honeydew excreted by aphids, mealybugs and soft scales. Ants nurture these pests by protecting them from predators and "cleaning house". Controlling ants will reduce these pests.

Little fire ant (LFA) or Electric Ant

Chopstick w/peanut butter is very attracting to LFA

*First discovered on the Big Island in 1999.
*Stings and tends to honeydew-producing insects.
*Nest in trees (coconut, fruit trees) with no connection to ground.
*An inter-island, inter-state & global quarantine pest.
*Eventually will spread throughout the Hawaiian Islands.

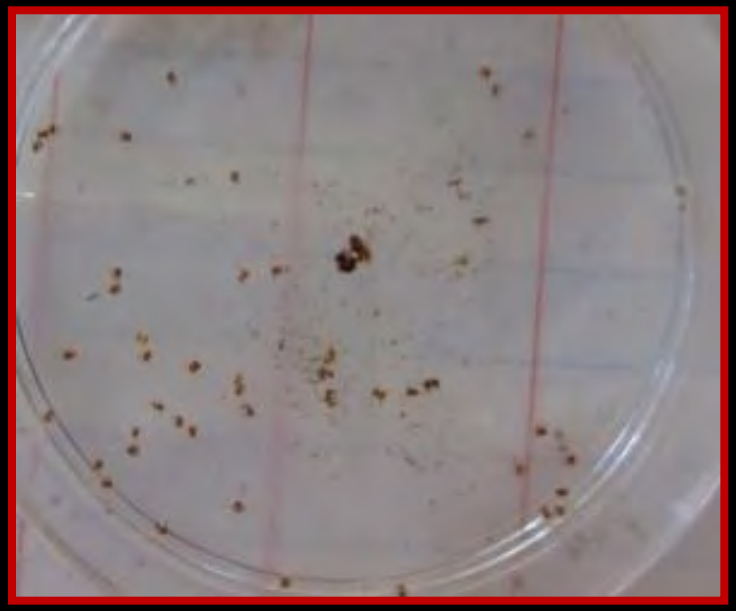
Little Fire Ant Control

*Extinguish Plus and Probait/Amdro (hydramethylnon) are most effective.
*Esteem (pyriproxyfen) 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 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
Infestation at UH-Hilo Instructional Farm

1 Hour after placement

Control (Peanut Butter) | Maxforce Complete | Probait

2 Hours after placement

Control (Peanut Butter) | Maxforce Complete | Probait

NEONICOTINOID INSECTICIDES

Acetamiprid

Arena®
INSECTICIDE

Clothianidin

Dinotefuran

imidacloprid

imidacloprid

imidacloprid

ADMIRE®
PRO
Systemic
Protectant

imidacloprid

*__Neonicotinoids__ act on the nervous system of insects with very low toxicity to mammals and minimal environmental impact and therefore, considered a reduced-risk pesticide.

*Neonicotinoids are among the most widely used insecticides worldwide.

*The mode of action of neonicotinoids is similar to the natural insecticide nicotine, In insects, neonicotinoids cause paralysis which leads to death, often within a few hours.

*They bind at a specific site, the nicotiniic receptor, and there are no records of cross-resistance to the carbamate, organophosphate, or synthetic pyrethroid insecticides, thus making them important for management of insecticide resistance

Neonicotinoid Insecticides

Spectrum of Insect Control

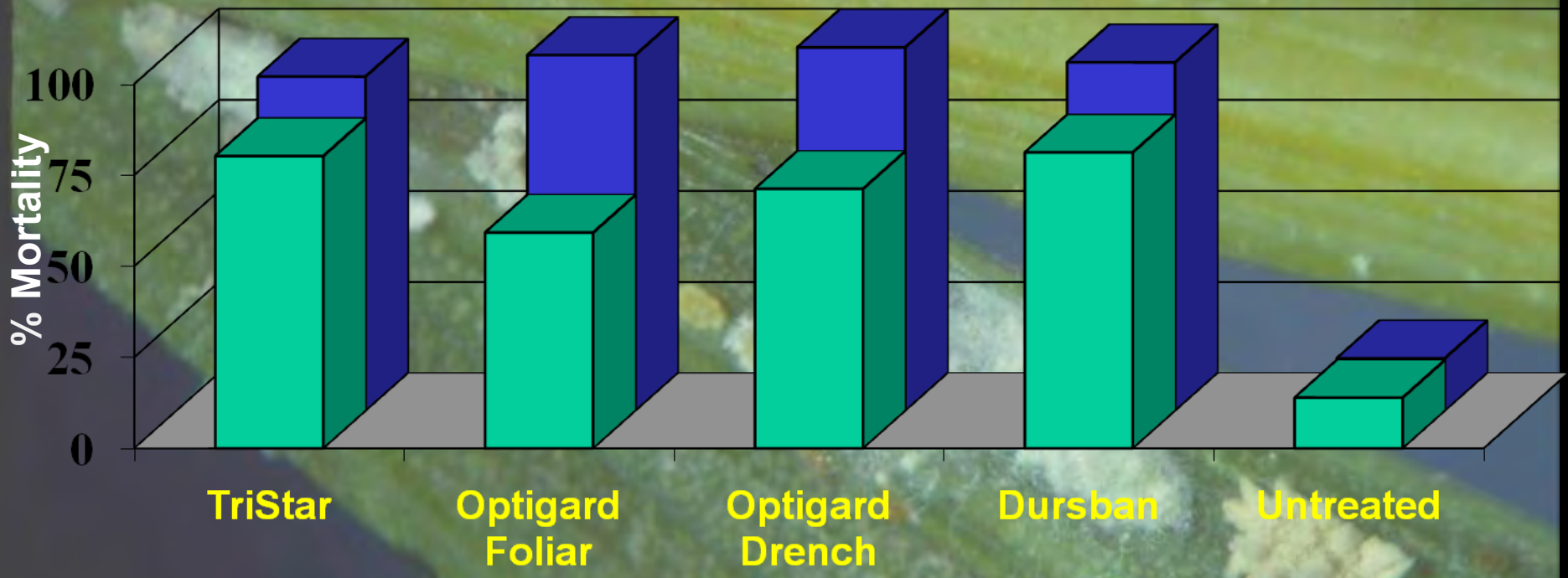
Sucking insects

- Aphids
- Lace Bugs
- Leafhoppers
- Mealybugs
- Plant Bugs/Hoppers
- Psyllids
- Scale Insects
- Spittlebugs
- Thrips
- Whiteflies

Chewing insects

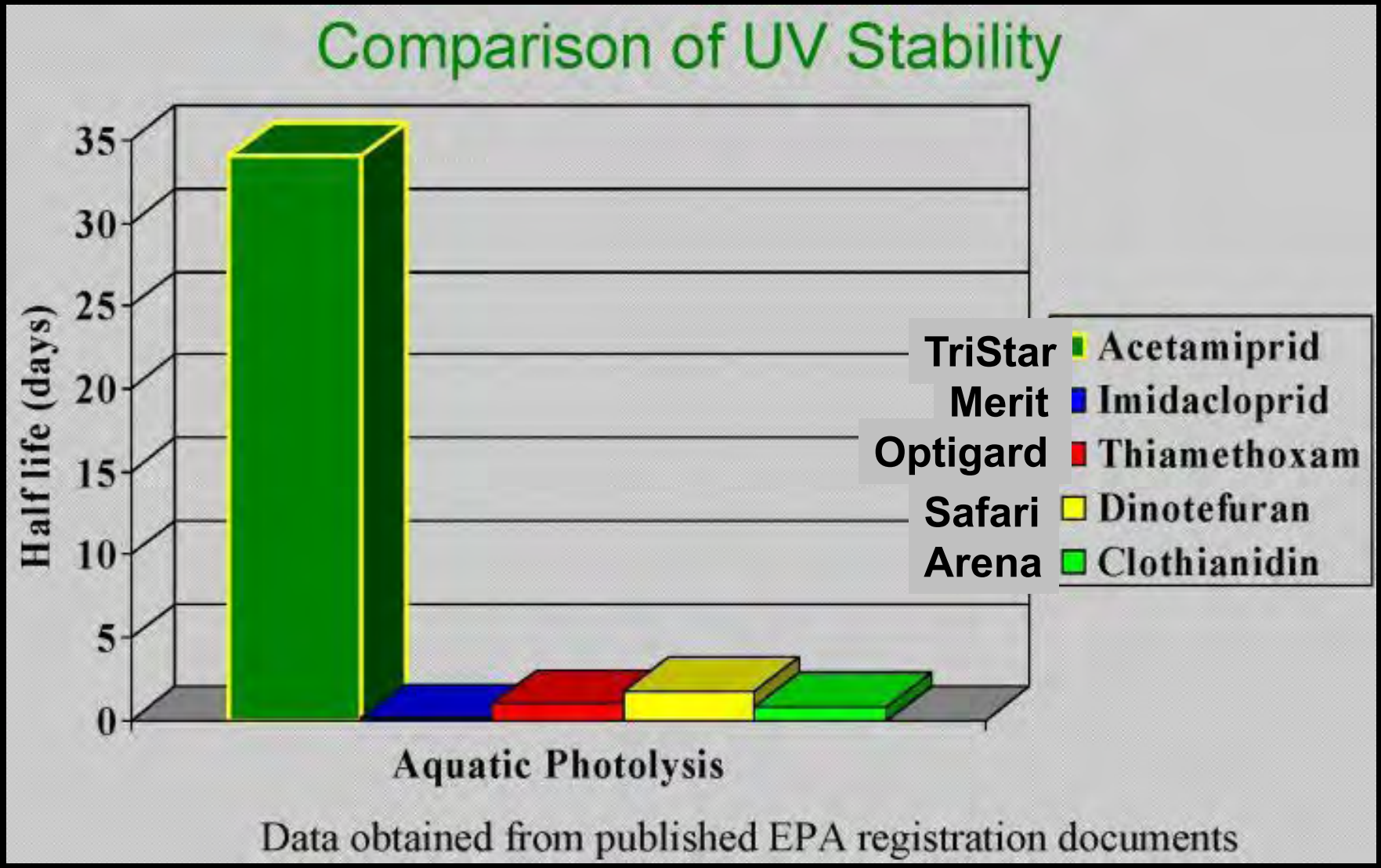
- Beetles
- Borers
- Mole Crickets
- Gall Wasps
- Grubs
- Leafminers
- Termites
- Weevils

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



TriStar = acetamiprid

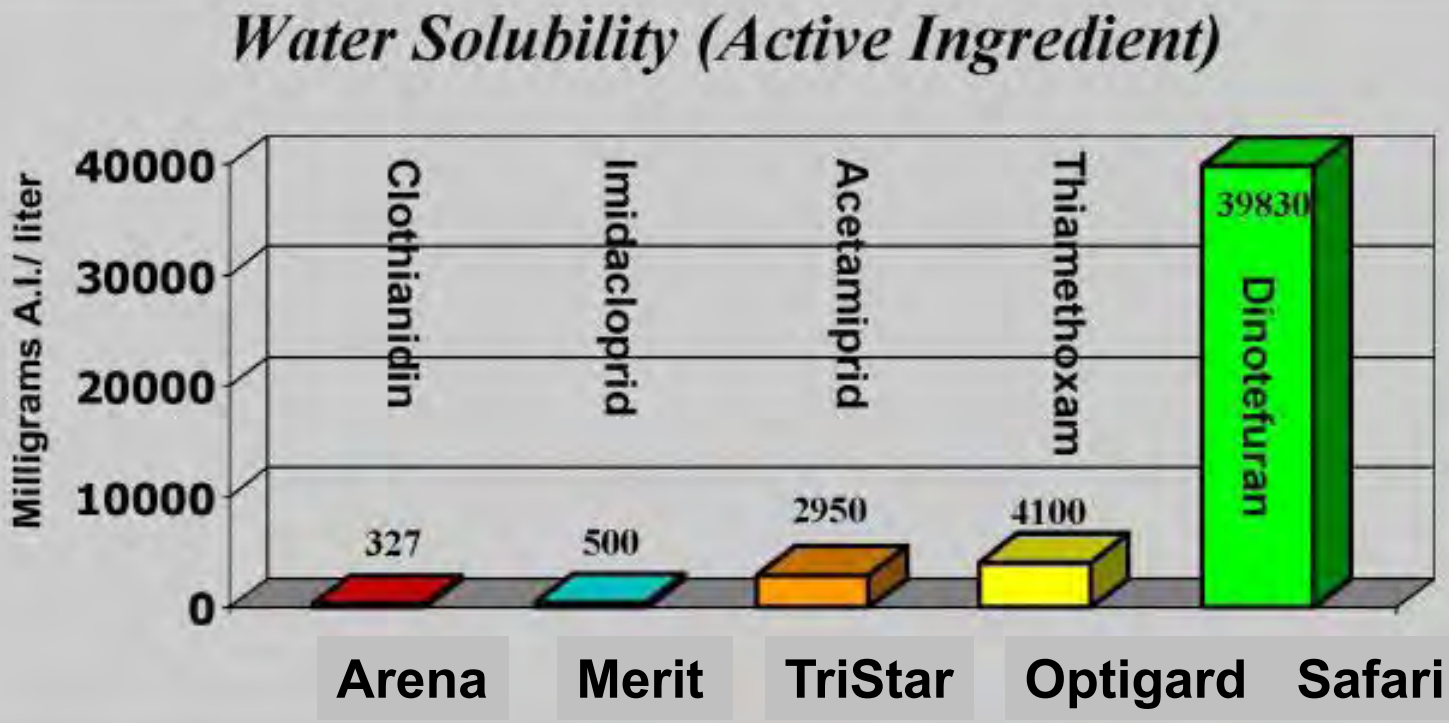
Optigard = thiamethoxam
(Now for sale in Hawaii)



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

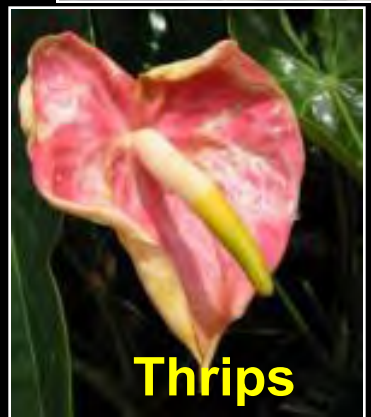
Slide information courtesy J. Chamberlin

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



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 onless 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

Insecticide Toxicity to Natural Enemies

Common name (trade name)	Class	Selectivity (affected groups)	Predator Mites	General Predators	Parasites	Duration of impact to natural enemies
carbaryl (Sevin)	carbamate	Broad (insects, mites)	Moderate/ High	High	High	Long
chlorpyrifos (Dursban)	OP	Broad (insects, Mites)	Moderate	High	High	Moderate
fenpropathrin (Tame similar to Talstar)	Pyrethroid	Broad (insects, Mites)	High	High	High	Moderate Long for Talstar
Imidacloprid (Merit as a drench)	Neonico-tinoid	Narrow (sucking, insects)	-	Low	Low	-
Imidacloprid (Merit as a foliar)	Neonico-tinoid	Narrow (sucking, insects)	-	Moderate	High	Short to moderate
Insecticidal Soap (M-Pede)	soap	Broad (insects, Mites)	Moderate	Moderate	Moderate	Short to none

http://www.ipm.ucdavis.edu/PMG/r302900111.html

*Drench application must be applied to the feeder roots with adequate soil moisture.

* Subsequently, the tree must be irrigated to assure uptake.

*Liquid fertilizer added to insecitcide may assist uptake.

*Competition by groundcovers or turf contributes to effective uptake.

Bark Application of Safari to King Protea for mealybugs at 18 oz/ gallon

Bark application of Safari to Telopea sp. for armored scales, *Pseudaulacaspis* sp.

Trunk spray was not effective
More trials needed

Spirotetramat
Tetronic/Tetramic Acid

MOVENTO

Crop Use
Vegetables
Fruits
Nuts

IRAC Class 23

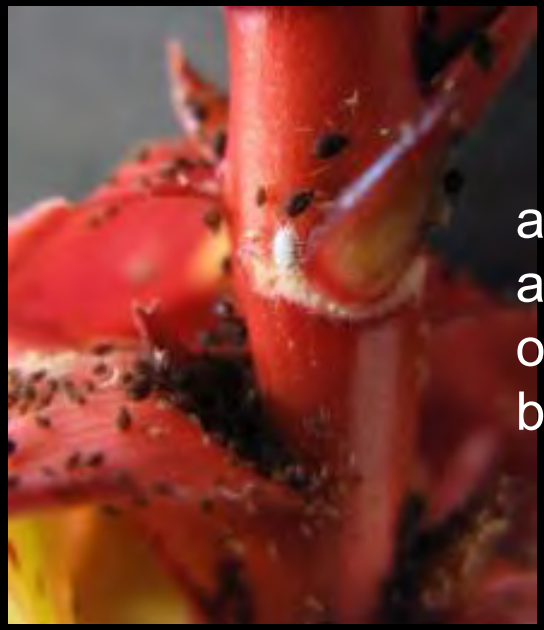
Key Pests:
Aphids
Mealybugs
Whiteflies
Scales
Spider mites
Psyllids/Psylla

Ornamental use:
Greenhouse
Field grown ornamentals
Outdoor ornamentals

*Movento or Kontos (spirotetramat) moves up and down within the plant to provides 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

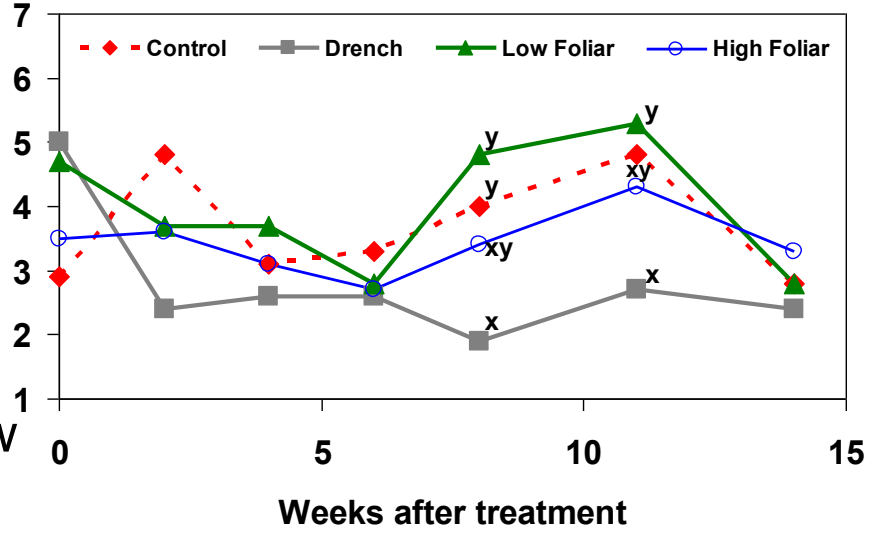
Severe – whitefly on >50% of sheath surface area

Kontos (spirotetramat)

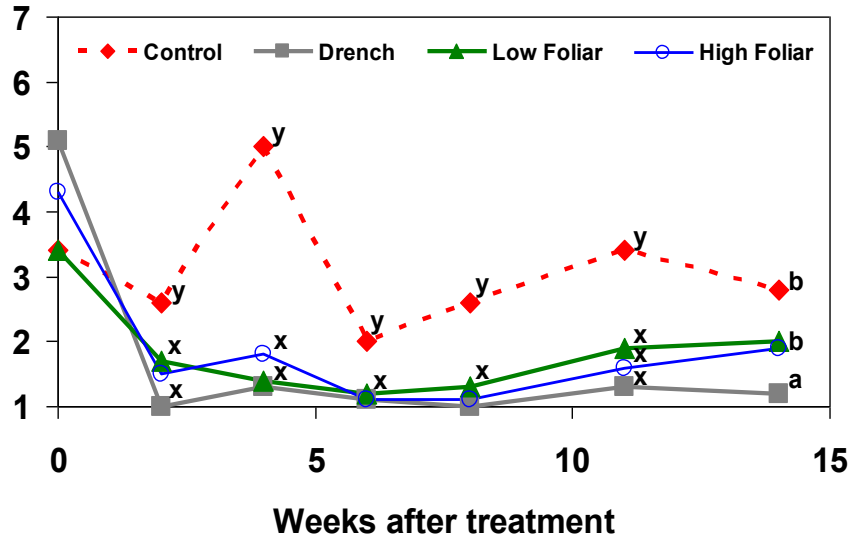
Drench: 0.4 fl oz/ft plant height
(1 application to root zone area)
Low Foliar: 1.7 fl oz/100 gallons
High Foliar: 3.4 fl oz/100 gallons
(2 applications, 4 weeks apart)

*Drench application was most effective.
*Reduction in ants due to fewer honeydew producing aphids and mealybugs.
*Drench application lasted for >14 weeks.
*Effective against anthurium whitefly but not thrips.

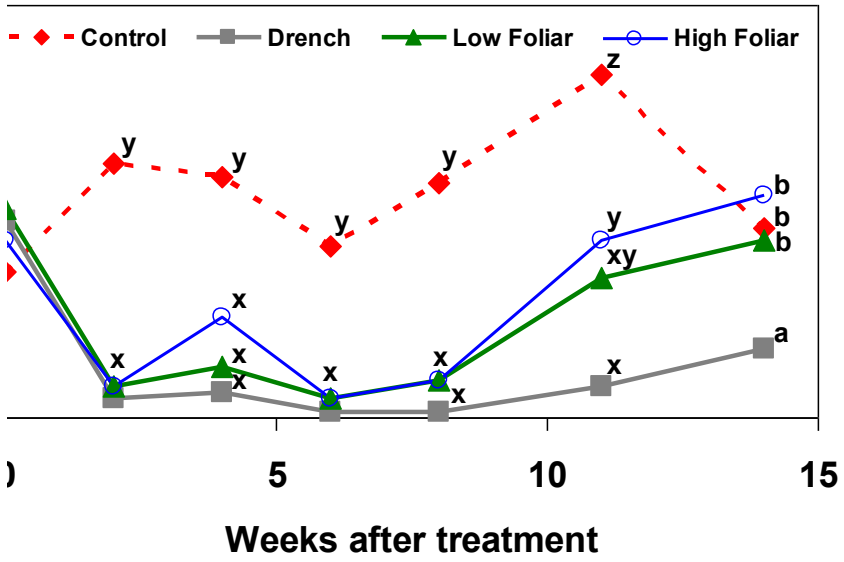
Level of ant infestation



Level of mealybug infestation



of banana aphid infestation



Types of Insect Growth Regulators

1. ***Juvenile hormone (JH) mimics***
   - Enstar (kinoprene)
   - Distance (pyriproxyfen)
   - Precision (fenoxycarb)?
2. ***Ecdysone inhibitors***
   - Azadirachtin = Aza-Direct, Azatin and Ornazin
3. ***Chitin synthesis inhibitors***
   - Citation (cyromazine)
   - Adept (diflubenzuron)
   - Pedestal (novaluron)
   - Talus (buprofezin)

Buprofezin

Insect growth regulator
Talus = ornamentals, Sepro
Applaud = food crops, Nichino

*Inhibits chitin synthesis which interrupts molting, suppresses oviposition & reduces egg viability.
*High level of activity against most homopteran insect pests including whiteflies, mealybugs, soft scales, armored scales, leafhoppers and planthoppers.
*Vapor activity allows buprofezin to reach the undersides of leaves and new growth.

Whiteflies	Mealybugs	Soft Scales	Armored Scales
Silverleaf	Longtailed	Black	Coconut
Greenhouse	Citrus	Brown	Cockerell
Sweet potato	Mexican	Hemispherical	Fern
Ash	Obscure	Wax	Boisduval
	Comstock	Tessellated	White peach
			Cycad

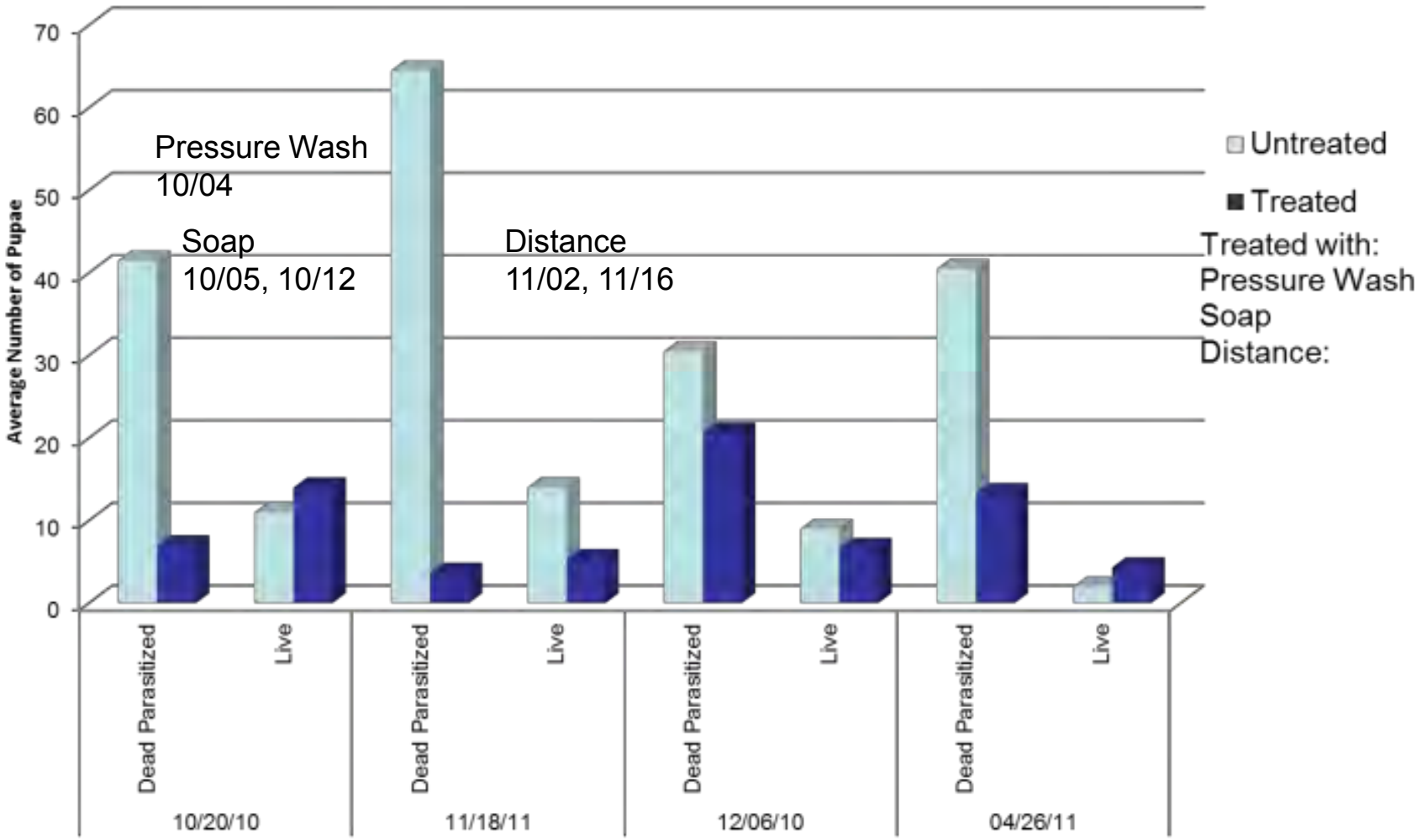
Pests of Ornamentals in Hawaii

Distance (Juvenile Hormone mimic) is effective against whiteflies

Untreated — 27 Days After Treatment — Treated

Also effective against fungus gnats and armored scales

Whitefly 4th Instar Pupae on Plumeria at Islands at Mauna Lani



Dead or Parasitized and live Pupae from Oct 2010 to Apr 2011

***Overall, untreated had more dead and parastized pupae and was as effective as treated.**

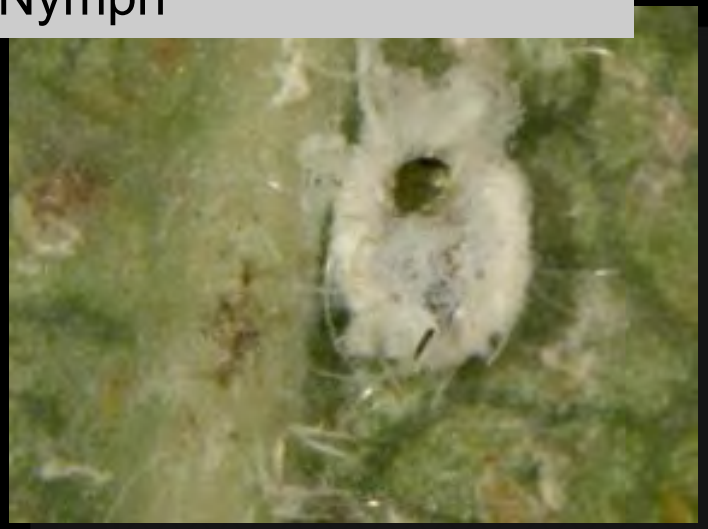
***Wash, Soap and Distance lowered live pupae on 11/18 to 12/05.**

Spiraling Whitefly in West Hawaii

Parasitic wasp, very effective against spiraling whitefly in windy, coastal areas in Hawaii . (Kumashiro HDOA)

Parasitized Whitefly Nymph

Pupae with round exit holes



Parasitoid Emergence Hole

Eulophid parasitic wasp, *Aleuroctonus vittatus*

New Armored Scale on Palms and Ornamental Plants in Hawaii

Fiorinia phantasma (Hemiptera: Diaspididae)

*First discovered in Hawaii in Dec 2004 on Japanese privet on Oahu; previously, only reported from Philippines.

*Also found on various palms, including coconut palms and traveler's palm, kamani, *Ficus benjamina, Cassia* sp., naio (myoporum), pandanus, heliconia, mock orange, Madagascar olive.

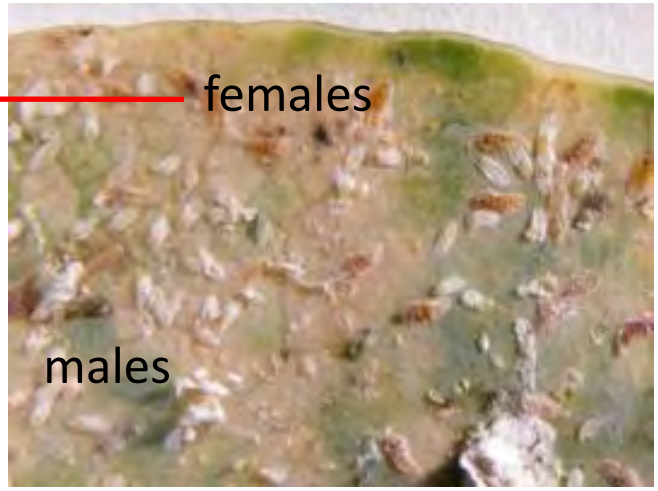
*Reported as a serious pest on areca palms in the landscape in Wailea/Kihei, Maui (Sept 2011).

Damage on upper leaf surface of areca

*Natural enemies not identified yet. Scale insect is totally encased in in their cast skin "shell" providing protection.

*Horticultural oils should be effective against crawler stages. Systemic insecticides (e.g. Safari) and insect growth regulars (e.g., Distance) are effective (G. Webb 10/12).. Parasitoids recovered (HDOA).

Female – yellow w/red stripes



Infestation on lower leaf surface

Janis Garcia, HDOA
Arnold Hara, UH-CTAHR
October 2011

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, Waihiku).

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.

Injection Systems Evaluated


Sidewinder Tree Injector


Mauget Tree Injectors

Paratachardina pseudolobata
lobate lac scale

- Adult females are x-shaped, dark red-brown, and ~ 1/16th inch in length and width and height.

- To the untrained eye, scales can blend in with the bark of the plant and be difficult to spot.

- Immature scales are bright red, flat, oval, and around 1/64th inch long.

- Over 300 recorded hosts in over 50 plant families were recorded in Florida.

- Prefer woody stems. Usually not found on stems more than ¼ inch in diameter.

- On Oahu, it has been found on various ficus and hibiscus species, mango, Tahitian gardenia, and golden rain tree

Adult females on hibiscus branch. Inset: immature scale (magnified)

- In the continental U.S., it is only known to occur in Florida. Also found in Puerto Rico, Cuba, The Bahamas, and Christmas Island (Australia).

-First found on Oahu in October 2012 in the Moanalua area. Likely to be found island-wide. Not yet found on other islands.

Infested hibiscus stem showing scales and black sooty mold starting to build up (a good indicator of an infestation)

- These insects produce copious amounts of honeydew , which can lead to thick layers of sooty mold covering branches and foliage.

Badly infested *Ficus benjamina* tree showing dieback of large branches and defoliation

<u>If you suspect that you have the lobate lac scale, please call:</u>

Maui: 873-3949
Kauai : 274-3072
Big Island Hilo: 974-4146
Kona: 323-7579
Oahu: 973-9525

PLANT PEST CONTROL BRANCH, Division of Plant Industry, Hawaii Department of Agriculture
1428 South King Street, Honolulu, HI 96814. Phone (808) 973-9525, FAX (808) 973-9533
Email: hdoa.ppc@hawaii.gov Web: http://hawaii.gov/hdoa/pi/ppc/

*One drench application of Merit 75 WP (imidacloprid) to large Indian Laurel Tree, *Ficus retusa,* eradicated lobate lac scale for over a year (523 days).

*Foliar applications of imidacloprid and bifenthrin (Talstar) were also highly effective against crawler and adult stages of lobate lac scale.

(Research in Florida by Howard & Steinberg 2005)

Hawaii Dept. of Agriculture
Plant Pest Control Branch

Walter Nagamine, Darcy Oishi, Bernarr Kumashiro, Janis Garcia

COUNTY OF LOS ANGELES
DEPARTMENT OF AGRICULTURAL COMMISSIONER/WEIGHTS AND MEASURES

Ficus Whitefly *(Singhiella simplex)*

Other common names: Fig whitefly.
Distribution: Native to southeastern Asia (Myanmar, China and India). Introduced into the U.S.: Florida (2007) and California (2012).
Hosts and damage: Attacks various *Ficus* species (*F. aurea, F. altissima, F. bengalensis, F. benjamina, F. lyrata, F. microcarpa,* and *F. macilellandii*). Was also observed on *Rhododendron (Azalea) indica.* Feeding may cause yellowing of leaves, defoliation and branch dieback. High populations are able to stunt the growth of young trees.
Field ID: Adults (about 1.4-1.6 mm) have white wings with faint grayish-brown markings. Eyes dark red. Fly readily when disturbed.
Nymphs have light green to tan, often semitransparent, oval bodies which may blend with the surrounding leaf surface. Pupae with red eyes. Immature stages can be found on both lower and upper surfaces of leaves.
Eggs: Yellow to light brown color, elongate. Deposited mostly along the midvein on the underside of the leaves.

Adult whiteflies

Eggs

Third instar nymph

Healthy (left) and parasitized (right) puparia

Infested Ficus tree

Adult and immature whiteflies on affected leaves

Prepared by Dr. Gevork Arakelian, Senior Biologist, Los Angeles County Department of Agricultural Commissioner/Weights & Measures
October, 2012

The Reality

*Many more new invasive species will arrive in Hawaii.

*Once a new species is discovered in Hawaii, eradication is almost impossible.

*Exclusion and very early detection are the only effective strategies to prevent the invasion of pest species.

*Use of pesticides will increase in Hawaii because of newly established invasive species until these pests are effectively controlled by natural enemies already here in Hawaii or purposely imported from its native home.

Conclusion

Comments from Insect Taxonomist, Bernarr Kumashiro, HDOA

"Plumeria is probably the most favorite host of Spiraling Whitlefly (SWF)."

"Plumeria is also a favorite host of papaya mealybug, many other mealybugs, scales, whiteflies, and aphids which love to feed on plumeria."

"We should encourage resort landscapers to choose other plants, since planting plumeria (and Ficus & Hibiscus) is just asking for trouble."


THANK YOU!
08 Feb 14