Sending Pest-Free Products to California

Oahu Urban Garden Center
Pearl City, Hawaii
April 24, 2013

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Topics to Be Covered

- USDA, California and Hawaii Quarantine Regulations
  Recent Rejections of Hawaiian Shipments
- Basic Entomology (development and mouthparts)
- Major Quarantine Pests and Control Strategies
  - Armored Scales -Soft Scales
  - Ants -Mealybugs
  - Aphids
- Systems Approach to Assure Pest-Free Shipments
- Field Control Tactics
- Postharvest Disinfestation Treatments

Regulation of Imports & Export of Agricultural Products in Hawaii

Exports from Hawaii

Hawaii Department of Agriculture (HDOA) regulates the export of nursery products (propagative plants) to the mainland U.S.

U.S. Department of Agriculture (USDA) regulates the export of cut-flowers, foliage and fruits from Hawaii to the mainland U.S. and plant products to foreign countries.

Imports to Hawaii

HDOA regulates all imports from the U.S. Mainland. Agricultural items brought into the Hawaii by passengers and importers must declare all agricultural items and may be subject to inspection, including baggage, cargo and mail.

The **U.S. Customs and Border Protection Agency** and **USDA** regulate the introduction of plant products, from **foreign countries** into Hawaii. Sometimes, the State may have additional restrictions on the same commodity. These commodities must be inspected by both agencies to insure all the requirements are met. (e.g., orchids)..

Interisland Movement of Agricultural Products is Regulated by HDOA

California Department of Food and Agriculture

Sacramento, CA

Division of Plant Health and Pest Prevention Services

Interior Pest Exclusion Program

High Risk Pest Exclusion Reports

- Foreign Plant Shipments
- Hawaii
- Florida
- Incoming Nursery Stock 008s
- Weekly 008 Reports **NEW**
- Monthly High Risk Interception Reports
- Monthly Nematodes Sample Results
- Parcel Facility Locations
- Suspended Out of State Shippers
- Weekly A and Q Report

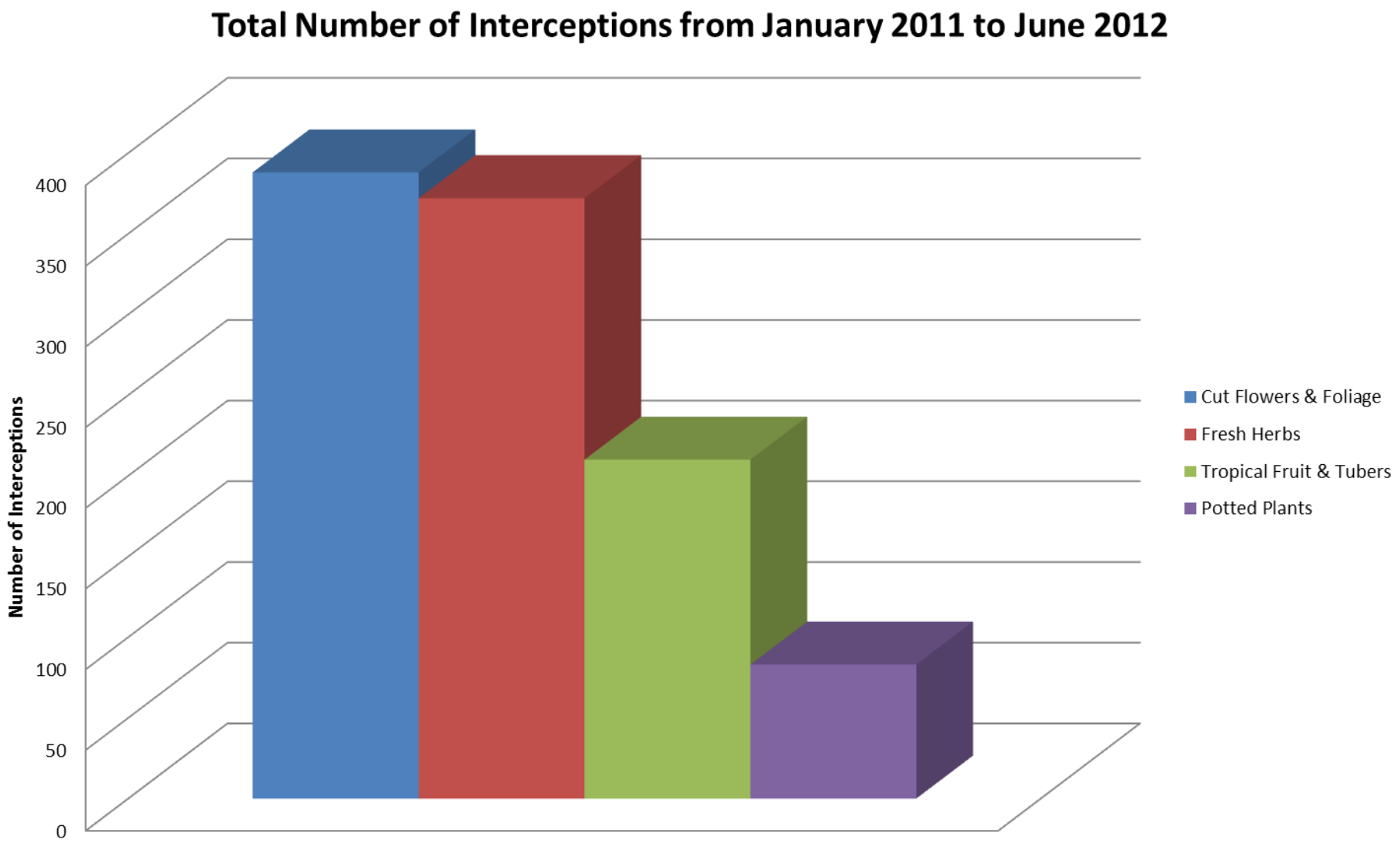
CDFA is watching us like a hawk

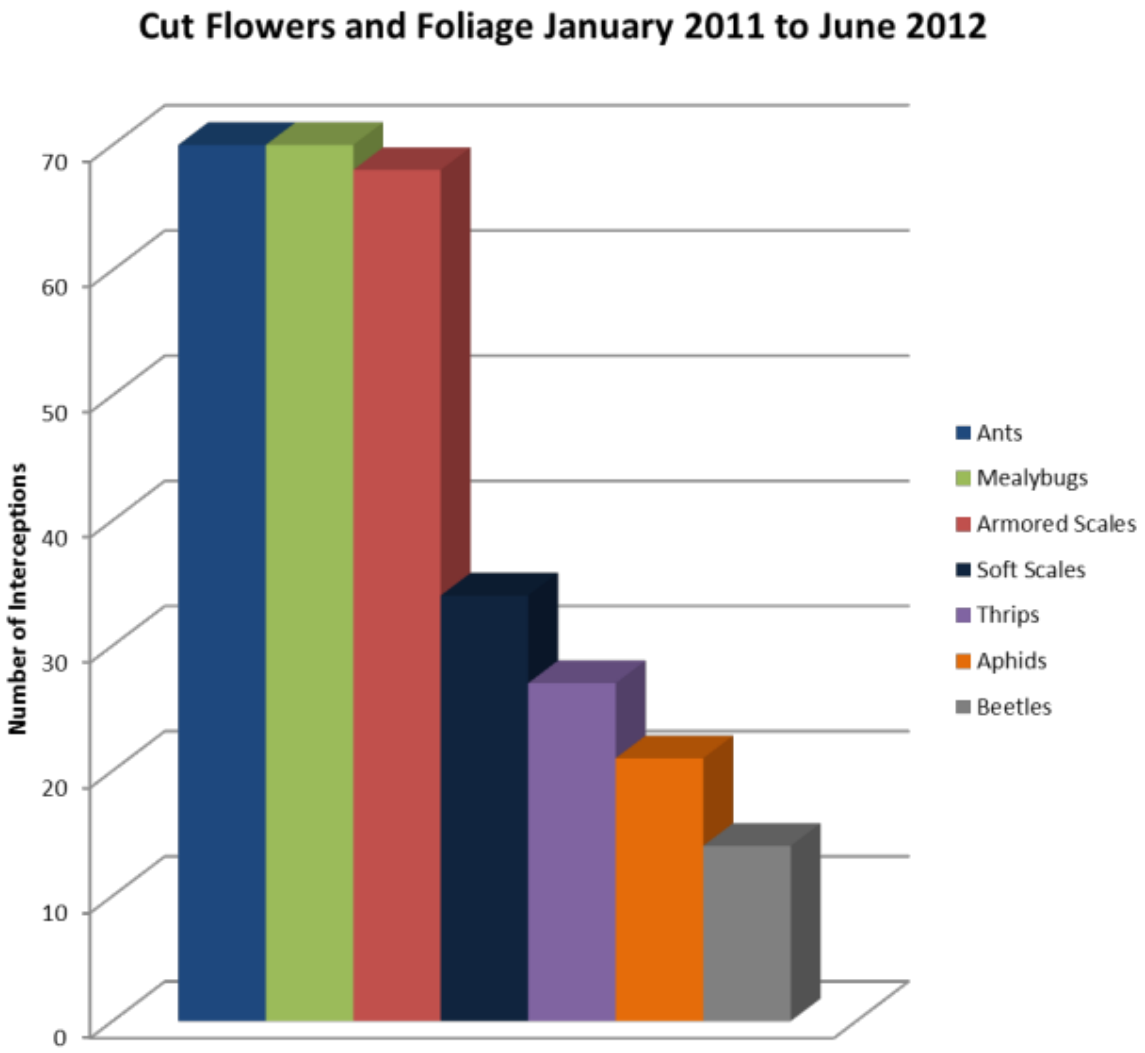
Hawaii Reports

A, B, Q Weekly Reports (Hawaii Origin Nursery Stock)

Approved Nursery Stock Shippers (QC 650)

Weekly A & Q Interceptions on Cut Flowers, Fruits & Vegetables


Total Number of Interceptions from January 2011 to June 2012
Number of Interceptions
400
350
300
250
200
150
100
50
0
Cut Flowers & Foliage
Fresh Herbs
Tropical Fruit & Tubers
Potted Plants



Most Prevalent Species:

Ants:

- *Ochetellus glaber*
- *Pheidole megacephala*
- *Technomyrmex albipes*

Mealybugs:

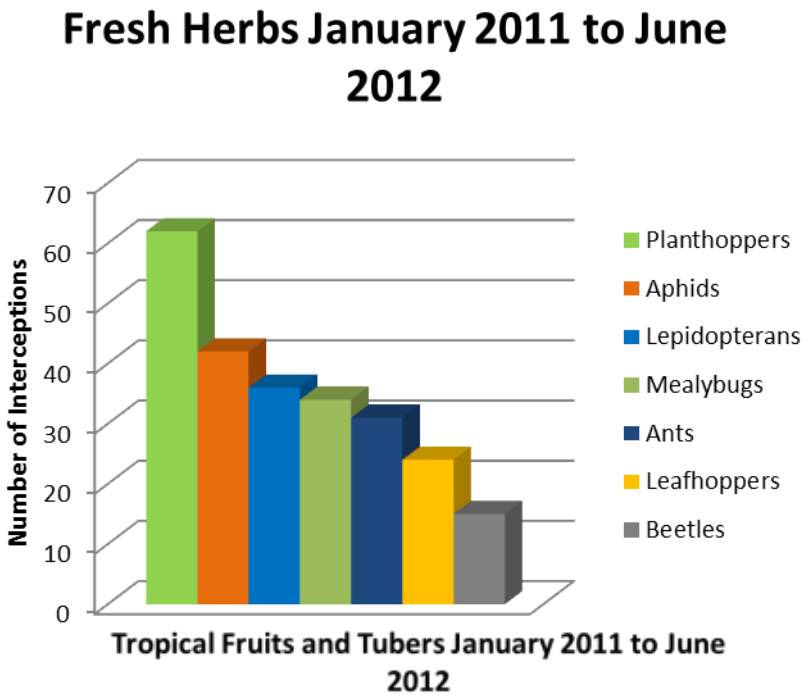
- *Nipaecoccus nipae*
- *Planococcus citri*
- *Pseudococcus longispinus*

Armored Scales:

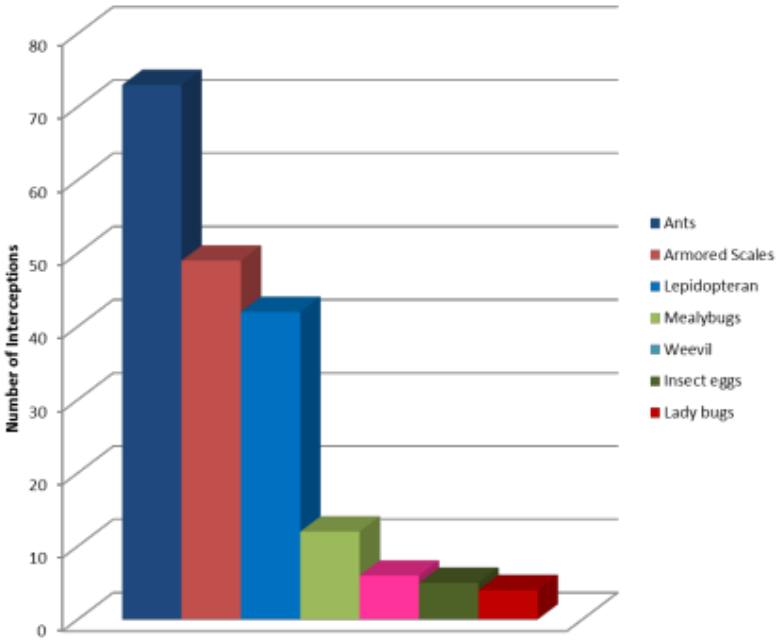
- *Abgrallaspis cyanophylli*
- *Pinnaspis buxi*
- *Pseudaulacaspis cockerelli*

Soft Scales:

- *Ceroplastes rubens*
- *Saissetia coffeae*
- *Parasaissetia nigra*



Most Prevalent Species:
Planthoppers:
Auchenorrgncha sp.
Kallitaxila granulata
Tarophagus colocasiae
Aphids:
Aphis gossypii
Aulacorthum solani
Pentalonia nigronervosa
Lepidopterans:
Noctuidae
Pyralis sp.
Tortricidae
Mealybugs:
Phenacoccus madeirensis
Planococcus citri
Pseudococcus jackbeardsleyi



Most Prevalent Species:
Ants:
Pheidole megacephala
Technomyrmex albipes
Wasmannia auropunctata
Armored Scales:
Aonidiella comperei
Diaspis bromelide
Pseudaulacaspis pentagona
Lepidopteran:
Cosmopterigidae
Lepidoptera
Pyroderces badia
Mealybugs:
Dysmicoccus brevipes
Pseudococcus jackbeardsleyi
Pseudococcus longispinus

FedEx Distribution Center Near San Francisco Airport, San Mateo County

Roses from South America considered low risk

Flowers from HI considered high risk


Hand lens

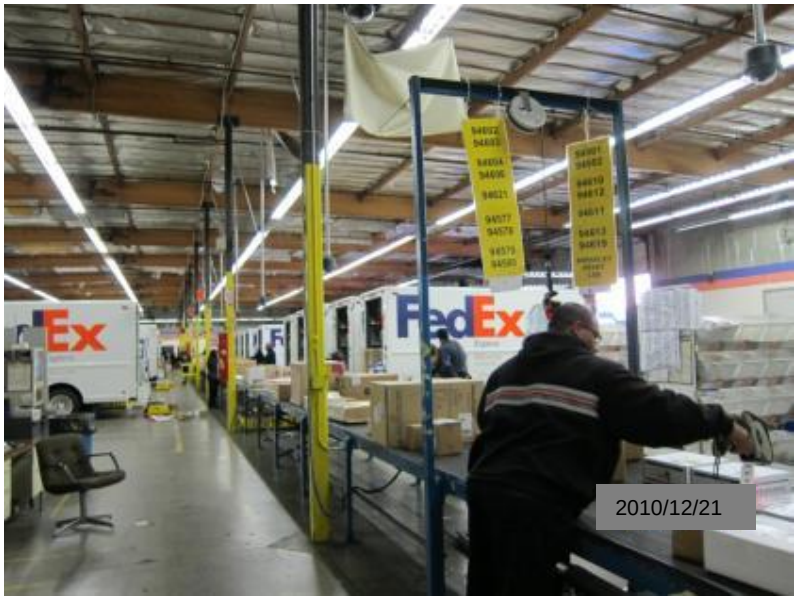

20/15 vision


snail


Fungal spore mass
Sphaerobolus stellatus
cannonball fungus.

Inspection at FEDEX Distribution Center in Oakland

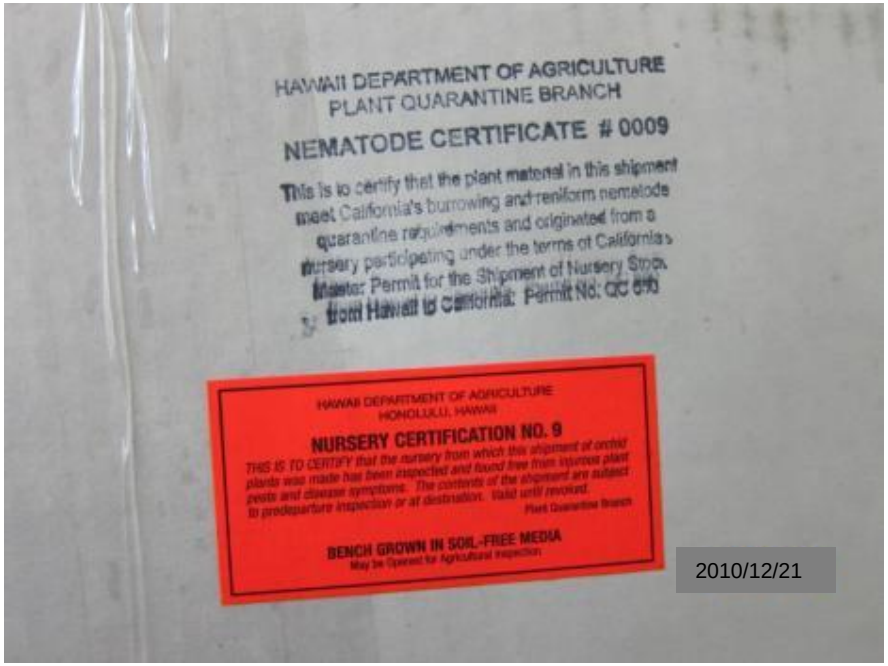
With Ken Peek, Senior Agricultural Biologist, **December 21, 2010**




2010/12/21


2010/12/21


HILO
2010/12/21


HAWAII DEPARTMENT OF AGRICULTURE
PLANT QUARANTINE BRANCH
NEMATODE CERTIFICATE # 0009
NURSERY CERTIFICATION NO. 9
BENCH GROWN IN SOIL-FREE MEDIA
2010/12/21

Summary of package holding requirements for Agriculture

•Packages containing unprocessed agricultural commodities must be held for inspection, including California origin packages, unless they bear:

•A green and white "Passed California Agriculture" sticker

or,

•A certificate or permit with the following text:

"THIS SHIPMENT NEED NOT BE HELD FOR INSPECTION IN CALIFORNIA"

**********If this text does not appear, the box must be held for inspection**********

Examples of Certificates:

CALIFORNIA
APPROVAL FOR RELEASE
OF INTRASTATE SHIPMENTS
NO.:_____

This shipment has passed quarantine inspection upon entry into California or at the shipping origin within California and meets all California quarantine requirements.

THIS SHIPMENT NEED NOT BE HELD
FOR INSPECTION IN CALIFORNIA

Issued by:_____
and California Department of Food and Agriculture
1220 N Street, Sacramento, CA 95814

CALIFORNIA/.....
ORIGIN INSPECTION CERTIFICATE
FOR INTERSTATE SHIPMENTS
NO.:_____

This plant material or nursery or premises from which this shipment was made has been inspected and found free from especially injurious plant pests and disease symptoms.

THIS SHIPMENT NEED NOT BE HELD
FOR INSPECTION IN CALIFORNIA

Issued by:_____
and California Department of Food and Agriculture
1220 N Street, Sacramento, CA 95814

CALIFORNIA NURSERY STOCK
CERTIFICATE FOR
INTERSTATE AND INTRASTATE SHIPMENTS
NO.:_____

This plant material or nursery or premises from which this shipment was made has been inspected and found free from especially injurious plant pests and disease symptoms.

THIS SHIPMENT
FOR INSPECT

Issued by:_____
and California Department of Food and Agriculture
1220 N Street, Sacramento, CA 95814

2010/12/23

Basil rejected at San Francisco Airport

USDA-APHIS-PPQ “Released” Stamp
Shipments of cut flowers and vegetables from firms or individuals not under Compliance Agreement are inspected prior to shipment by federal inspectors to determine compliance with federal quarantines.

Basil Inspection at Air Cargo Facility at San Francisco Airport March 2013

Beating basil on table

San Diego County Ag Inspectors

Presentation to inspectors re:
Hawaiian
potted foliage plants
Pest management
to assure pest-free shipments to California.

March 2013

cdfa CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE
Karen Ross, Secretary

DATE: July 24, 2012

TO: All County Agricultural Commissioners

FROM: Plant Health and Pest Prevention Services

SUBJECT: **A and Q Pest Report No. 28-2012**
Weekly A and Q Report: For the week of July 5-11, 2012

Attached is the report for all A and Q pests intercepted or detected in California from July 5-11, 2012. Pests are identified by the California Department of Food and Agriculture's Plant Pest Diagnostics Laboratory.

Fresno Dog Team Interception **PDR: 1626935**

On Thursday, July 5, 2012, Fresno dog team handler Stephanie LeBarron, dog Chelsea, and Inspector Aide Matthew Douglas were inspecting packages at FedEx in Fresno. Chelsea alerted on a package sent from Allegiant Air in Las Vegas, Nevada. Upon opening, the team discovered ti leaf garland with egg masses on the leaves.

On June 30, 2012, Allegiant Air began flying from Fresno to Hawaii. The first return flight from Hawaii to Fresno was scheduled for July 6, 2012. Phone conversations with Allegiant Air determined that the garland had originated in Hawaii and was being sent to Fresno Air terminal for good luck on the inaugural Hawaiian flight into Fresno. A sample submitted to the lab came back with a determination of live Q-rated *Orchamoplatus mammaeferus* (croton whitefly) pupae. The ti leaf garland was double bagged and destroyed.

Fresno Dog Team pictured with infested ti leaves from Hawaii

Rejection of maile (maire) imported from Cook Islands to Hawaii

What is an Insect?

3 body regions

3 pairs of jointed legs

1 pair antennae or feelers

1 or 2 pairs of wings

*Hard exoskeleton requiring molting for growth.
*Open circulatory system (no blood vessels).
*Highly adaptable to the environment (land, water, air).
*Accounts for 90% of known animals w/ 10+ million species.

Two Major Types of Insect Development

I. Complete Metamorphosis

II. Gradual Metamorphosis

Complete Metamorphosis

Inside green onion

Beet armyworm

Major Cause of Shipment Rejection

Green Garden Looper

Complete Metamorphosis

Chewing mouthparts (caterpillars)

Younger instars

Older instar

Pupa in silken cocoon

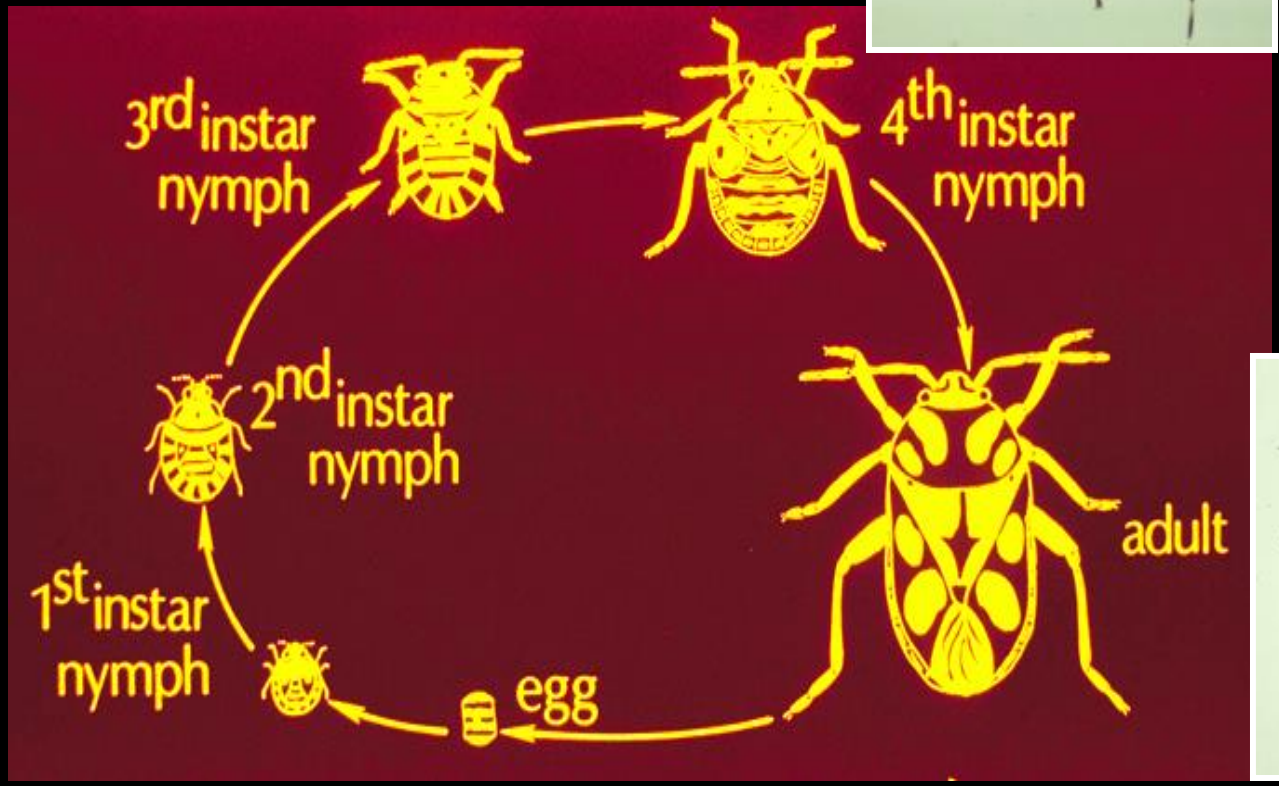
Adult

Insects with Complete Metamorphosis

- Butterflies, Moths
- Flies
- Bees and Wasps
- Beetles

Gradual Metamorphosis

Stink bug

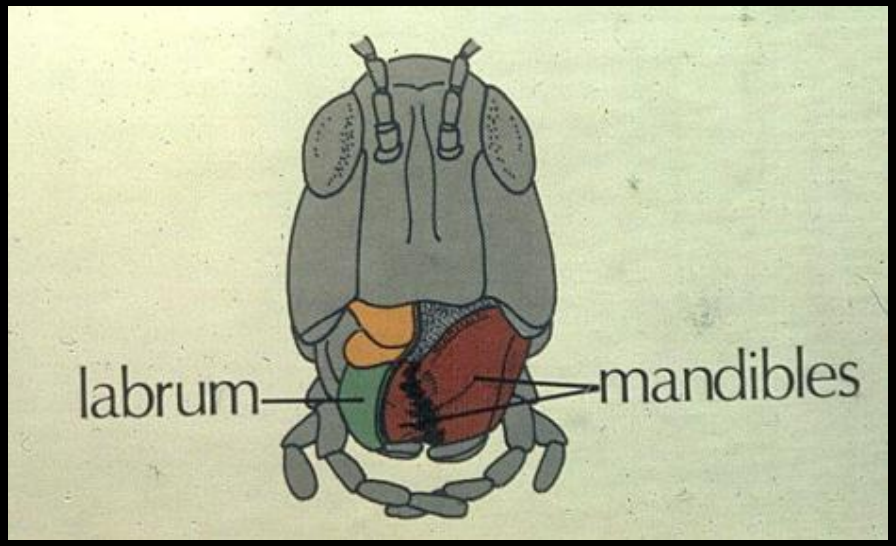


Insects with Gradual Metamorphosis

- Cockroaches, Grasshoppers, Crickets
- True Bugs (lacebugs, stinkbugs)
- Aphids, Mealybugs, Scales, Whiteflies

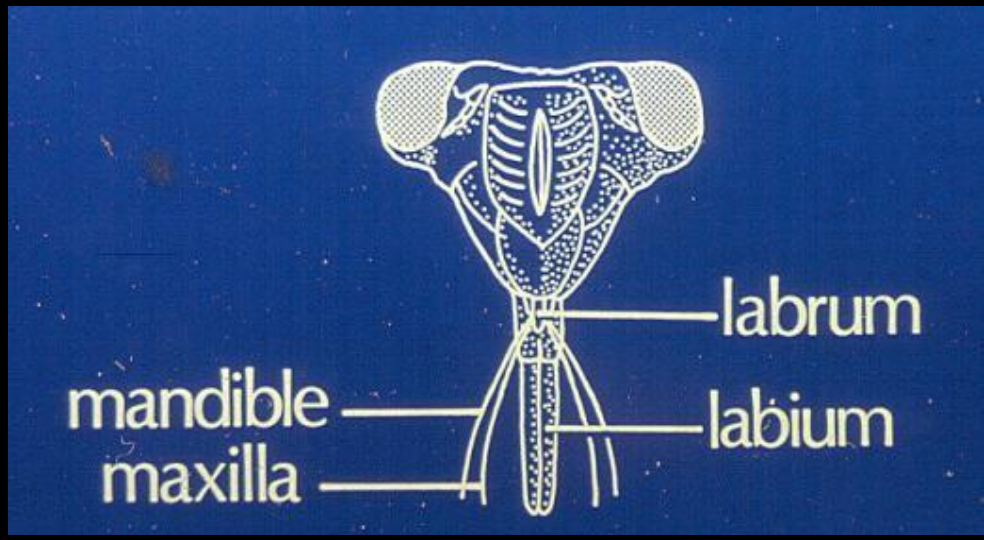
Two Major Types of Mouthparts

Chewing Mouthparts



Mandibles are like teeth for chewing.

Sucking Mouthparts



Mouthparts modified to function like an hypodermic needle for sucking plant juices or blood.

Examples of Insects with Chewing Mouthparts

Leaf-cutting Bee
(*Megachile* sp.)

http://www.honolulurosesociety.org/pests.html

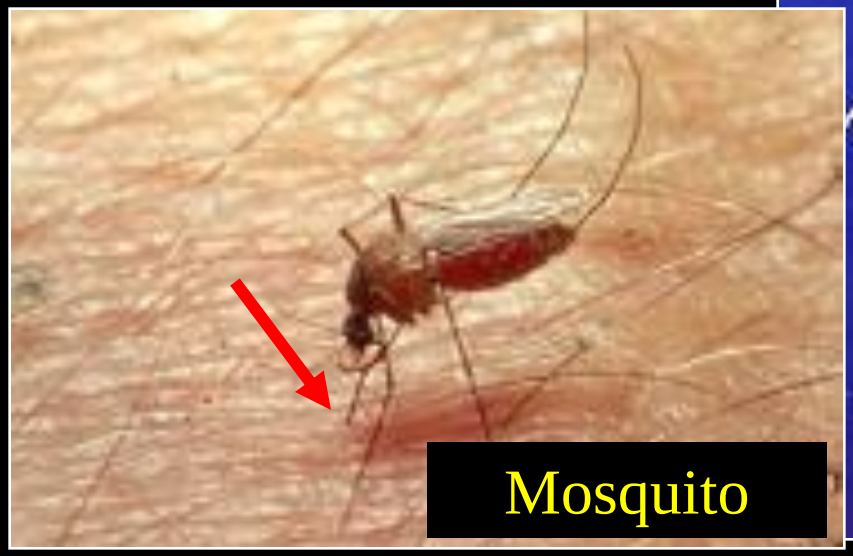
Chinese Rose Beetle

Walking stick

Katydid

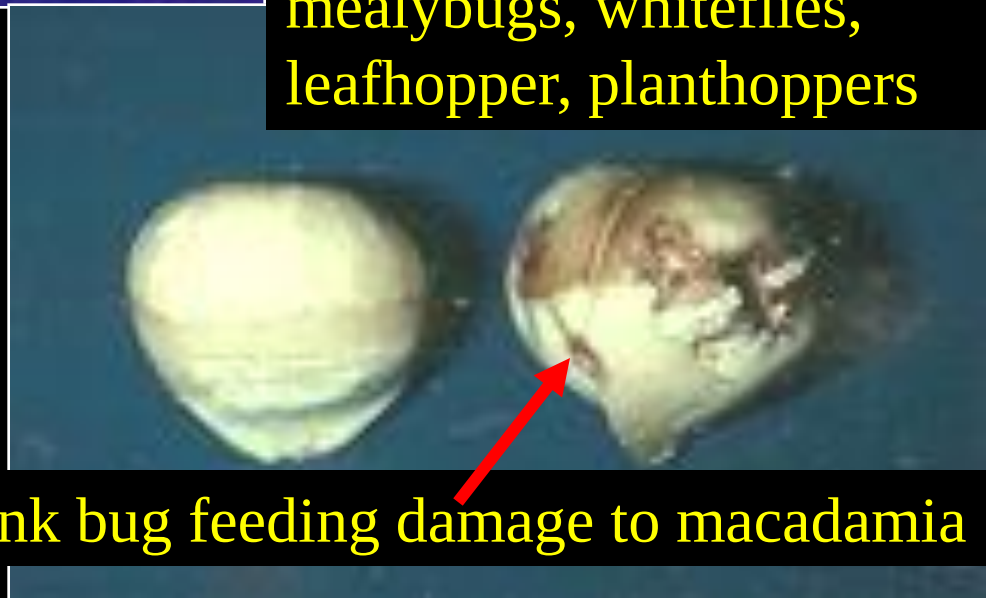
Fuller Rose Beetle

Examples of Insects with Sucking Mouthparts


Mosquito


Aphids, also scale insects, mealybugs, whiteflies, leafhopper, planthoppers


Stinkbug

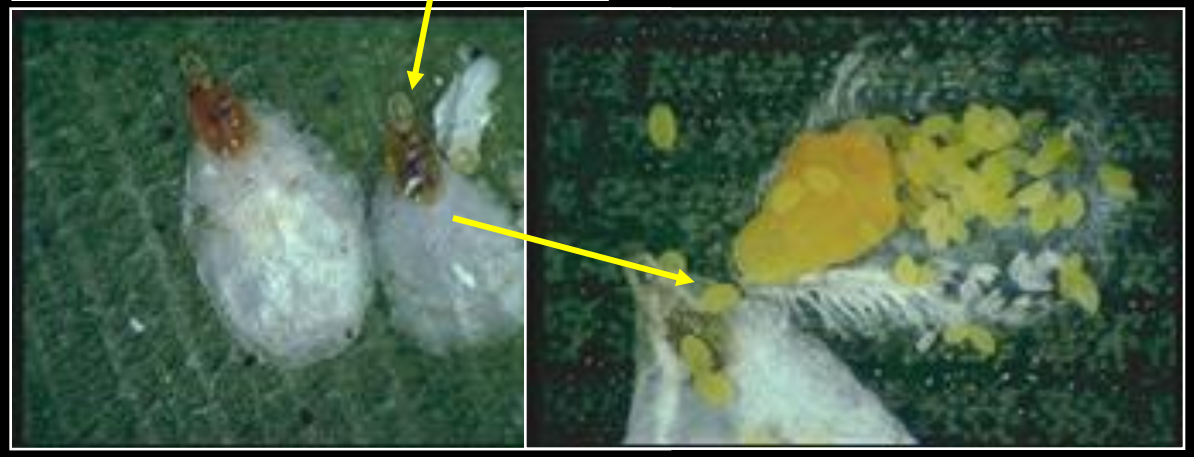

Stink bug feeding damage to macadamia

Major Cause of Shipment Rejections

Scale Insects

Armored

Example:
Cockerell
or Magnolia
White Scale



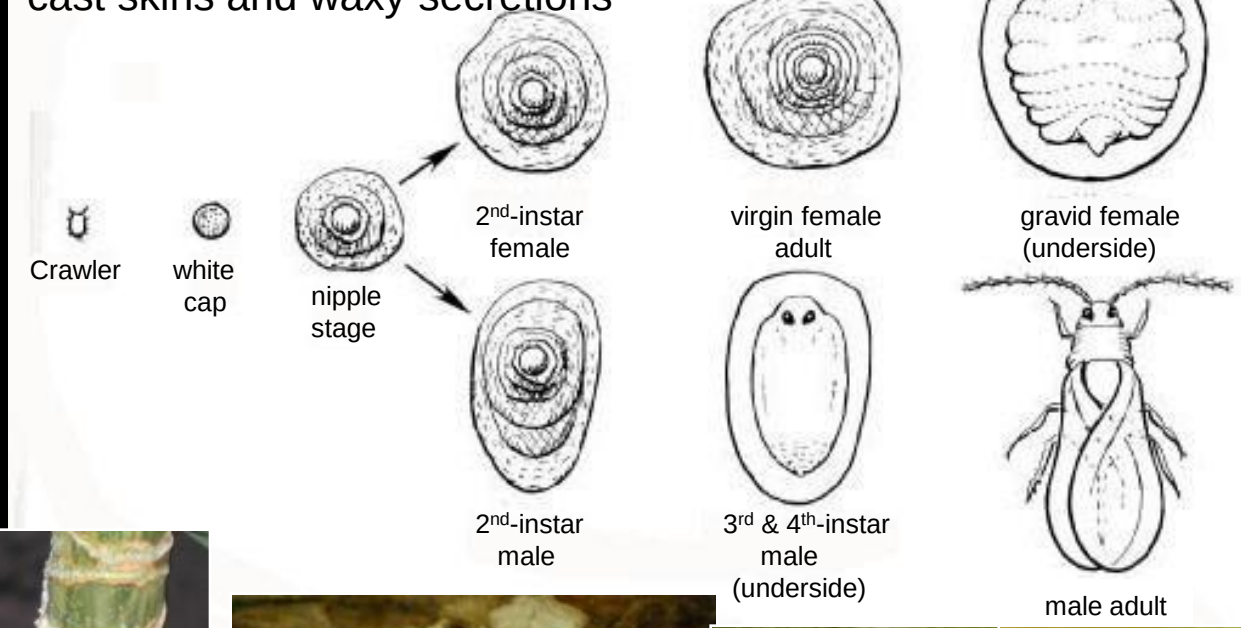
Soft

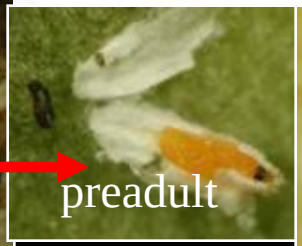
Example: Green scale

Development of Armored Scales

Crawler to adult is about one month

Armored covering formed by cast skins and waxy secretions





Armored Scales Causing Rejections

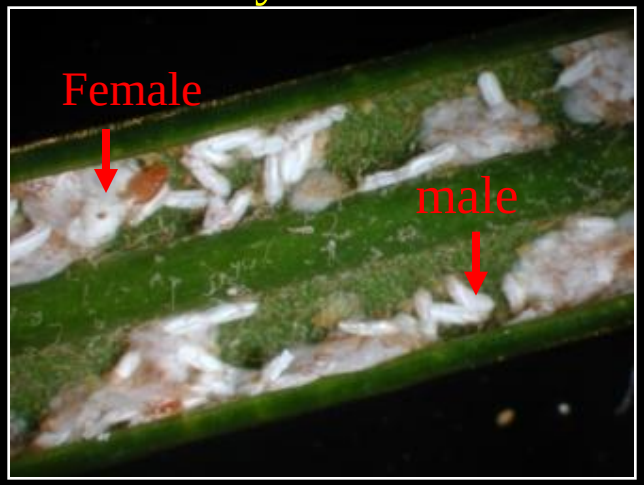
Coconut Scale

Ti Scale

Black Thread Scale

Saprophytic fungus,
Sphaerobolus stellatus

Cycad Scale



Mining Scale

Major Cause of Shipment Rejections

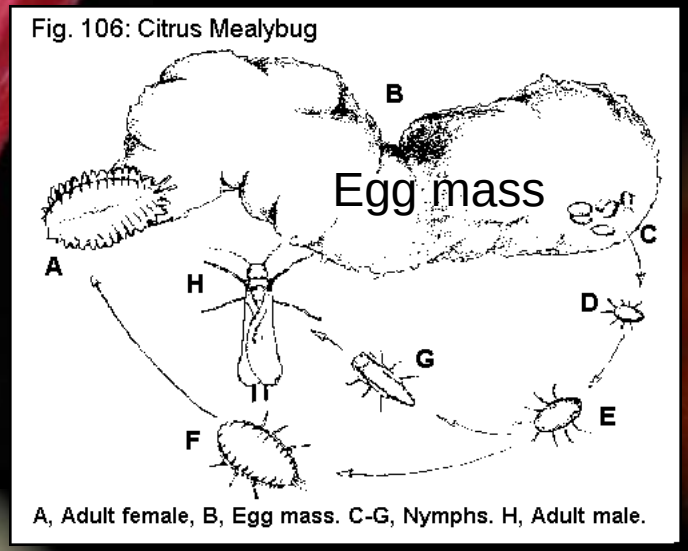
Mealybugs

Foliar

Root

Mealybugs Causing Rejections

Citrus Mealybug



Eggs per adult = 200-400

Egg to egg-laying adult = 20-44 days

Female adult life span = 90 days

Coconut Mealybug

Male cocoon

Female

Aphids

Incomplete Metamorphosis
Sucking mouthparts

Cornicles: Emits defensive fluids

Orchid aphids

Banana aphids

Oleander Aphid

Aphid damage to day lily

Sooty Mold

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

Ants Increase Aphid, Mealybug, Soft Scale, and Whitefly Infestations

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

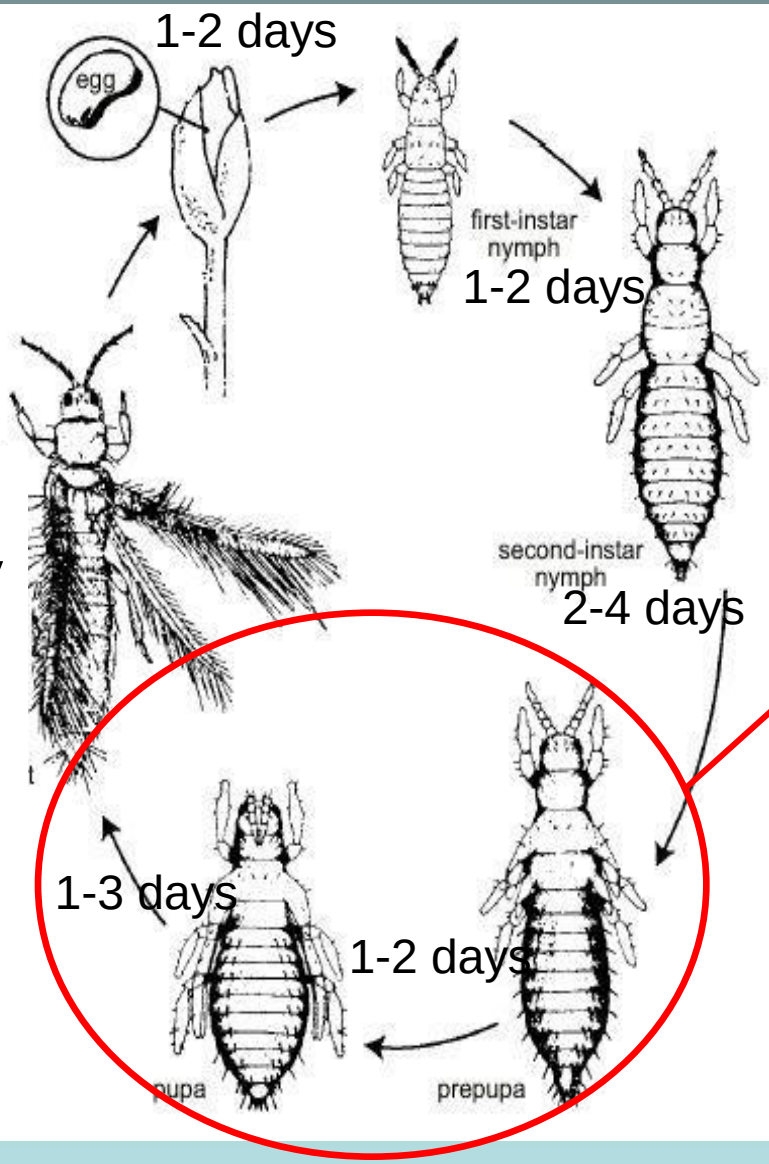
*Western Flower Thrips - Glasshouse (GH) strain's damage to dendrobium blossoms.

*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



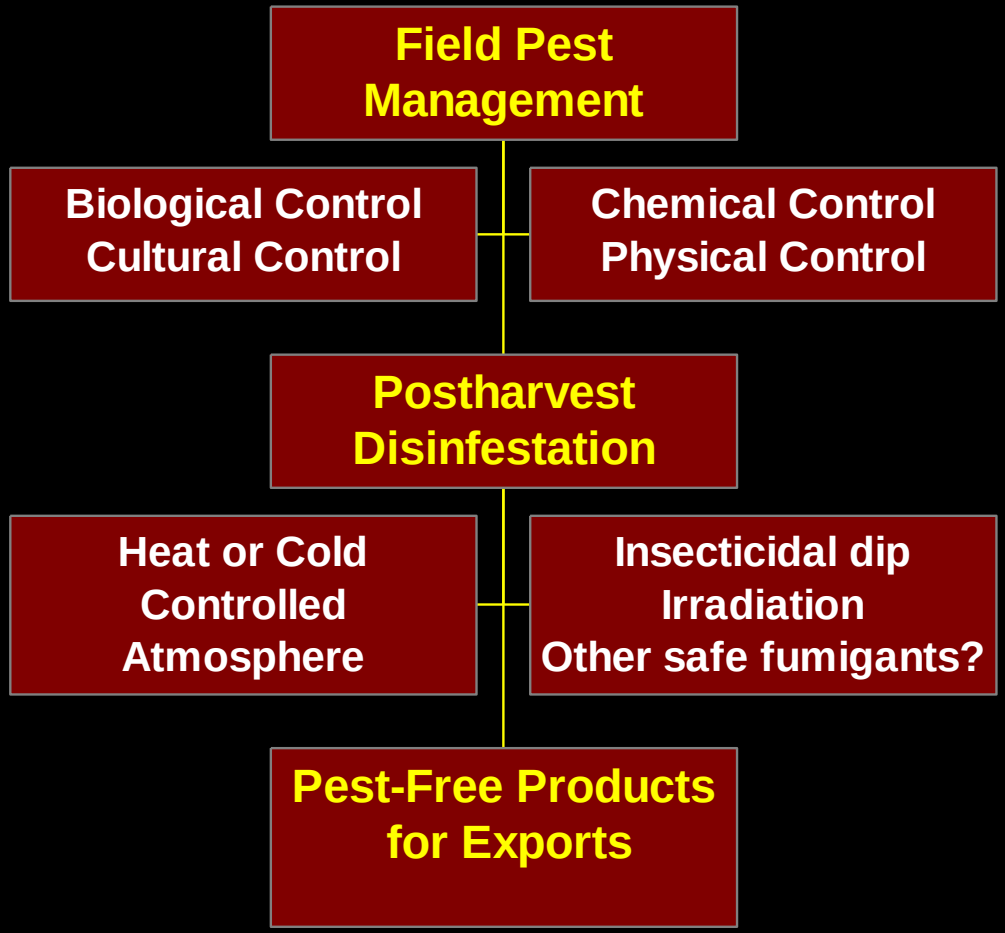
Adult and nymphs occur on flowers or foliage.

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)

System Approach to Quarantine Security



Field Control Tactics

- **Cultural Control** - Sanitation by removal of plant parts or plant. Grow healthy plants. Stressed plants are more susceptible to pests.
- **Physical Control** - temperature, water.
- **Mechanical Control** - fly swatter, screening
- **Biological Control** - use of parasites, predators, or pathogens (fungus, bacteria, virus, nematode).
- **Biorational Control** - soaps, oil, insect growth regulators, softer/natural insecticides-neem, pyrethrins, rotenone.
- **Chemical Control** - Malathion, Diazinon, Dursban (OP) and Sevin (carbamate)

Reduced-Risk Insecticides: Insect Growth Regulators-Talus, Distance; systemic neonicotinoids-Marathon, Safari

Break!

Evolution of Insecticides

1940-50's

Chlorinated hydrocarbons

DDT, Chlordane, Dieldrin, Mirex

1960-70's

Organophosphates & Carbamates

Dimethoate, Diazinon, Dursban, Orthene

1980-90's

Pyrethroids (synthetic)

Mavrik, Tame, Tempo, Decathlon, Talstar

1990-2000's

Reduced-Risk Insecticides

Naturalytes

Conserve, Avid, Ultiflora, Neem, Bt

Insect Growth Regulators

Distance, Enstar, Talus

Neonicotinoids

Merit, Marathon, Safari, TriStar

NEONICOTINOID INSECTICIDES

Foliar

Acetamiprid

Arena®
INSECTICIDE
grubs

Clothianidin

More Water Soluble
Effective against armored scales

Dinotefuran

Landscape

imidacloprid

Nursery

imidacloprid

Termite

imidacloprid

ADMIRE® PRO
Systemic Protectant

Fruits & Vegetables

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

Systemic Insect Control

Insecticide is taken up via roots

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

Imidacloprid against Red Ginger Pests

FIELD TREATMENT	WEEKS OF EFFECTIVE CONTROL (>95%): MEALYBUGS	BANANA APHIDS
IMIDACLOPRID (1 APPL.)	17	53
DURSBAN (3 APPL.)	3	4

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

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

*Subsequently must be irrigated to assure uptake.

*Liquid fertilizer added to insecticide may assist uptake.

*Competition by groundcovers or turf contributes to effective uptake.

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

Kontos was not effective

*Ants, mealybugs, & banana aphids on stem and between bracts of red ginger

*Kontos drench application was most effective, lasting up to >14 wks.

Severe whitefly infestation

>50% of sheath surface area

Kontos was effecitve

Control of Scale Insects

Insecticide	Armored/Hard	Soft
Oils, horticultural	Effective	Effective
Pyrethroids: Talstar/Decathlon	Not effective	Effective
Neonicotinoids: Merit/Marathon TriStar Safari	Not effective Not effective Effective	Effective Effective Effective
Insect Growth Regulators (IGRs): Distance	Effective	Not effective
Talus	Effective	Effective

Distance® Insect Growth Regulator
Esteem, Knack (JH mimic)

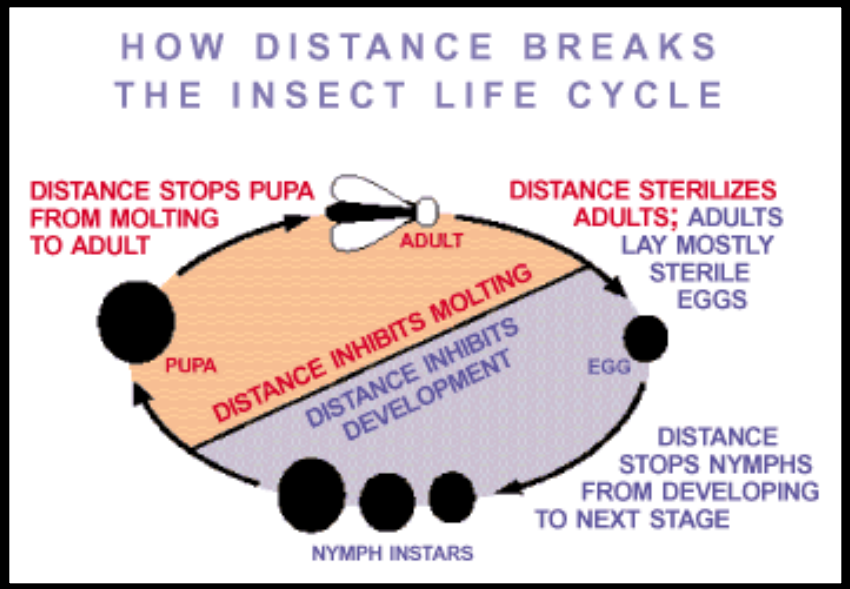
*Good control of whiteflies and armored scales.

*Also controls fungus gnats, shore flies; suppresses aphids and mealybugs.

*Directly inhibits egg and larval development and adult reproduction.

*Exhibits translaminar movement in plant leaves, providing insect control on the underside of leaves as well as the top.

Highly effective against armored scales
8-12 oz/100 gal
2nd application in 14-28 days
No more than 4 X per year



Distance (pyriproxyfen) against Spiraling Whitefly, *Aleurodicus dispersus* 27 Days After Treatment

Untreated

Treated

8 oz/100 gallons = 0.4 oz/5 gallons; $230.00/quart
$2.88 per 5 gallons of finished spray

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

Insecticide Toxicity to Natural Enemies

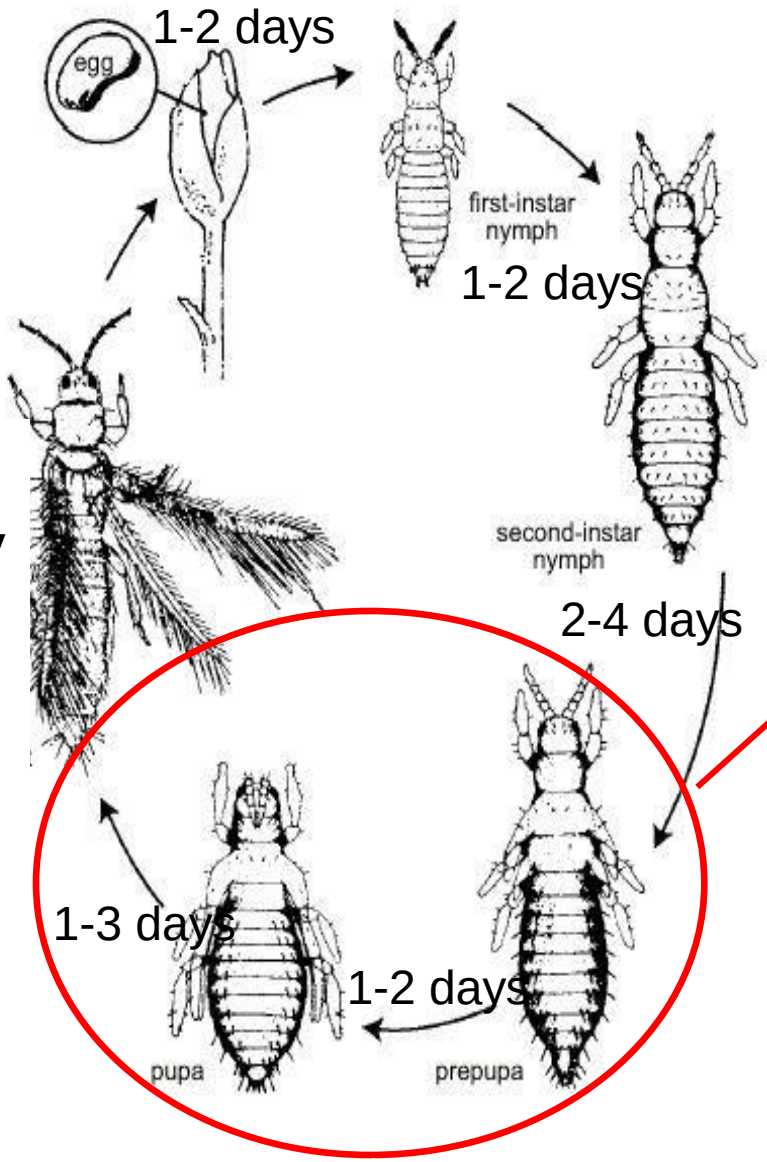
Common name (trade name)	Class	Selectivity (affected groups)	Predator Mites	General Predators	Parasites	Duration of impact to natural enemies
carbaryl (Sevin)	carbamate	Broad (insects, mites)	Moderate/ High	High	High	Long
chlorpyrifos (Dursban)	OP	Broad (insects, Mites)	Moderate	High	High	Moderate
fenpropathrin (Tame) similar To (Talstar)	Pyrethroid	Broad (insects, Mites)	High	High	High	Moderate Long for Talstar
Imidacloprid (Merit as a Drench or trunk spray)	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

Thrips Control (Target prepupa & pupa)

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

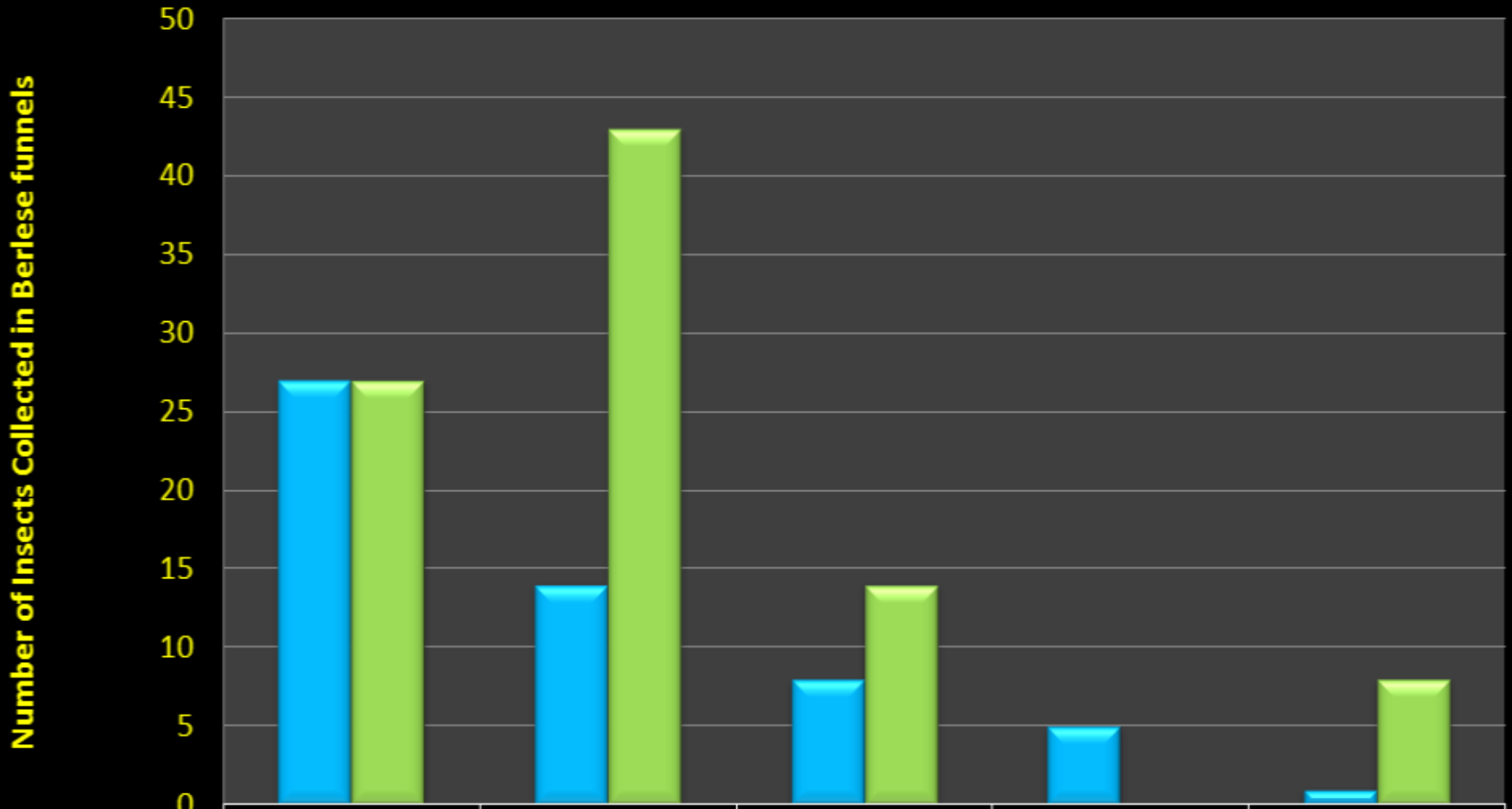
Adults are characterized by wings fringed with hair-like setae.
Life span =
30 to 45 days



Adult and nymphs occur on flowers or foliage.

Prepupa and pupa occur in the media below the plant.

Thrips on Dendrobium Flowers (Weekly sprays)



	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

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 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

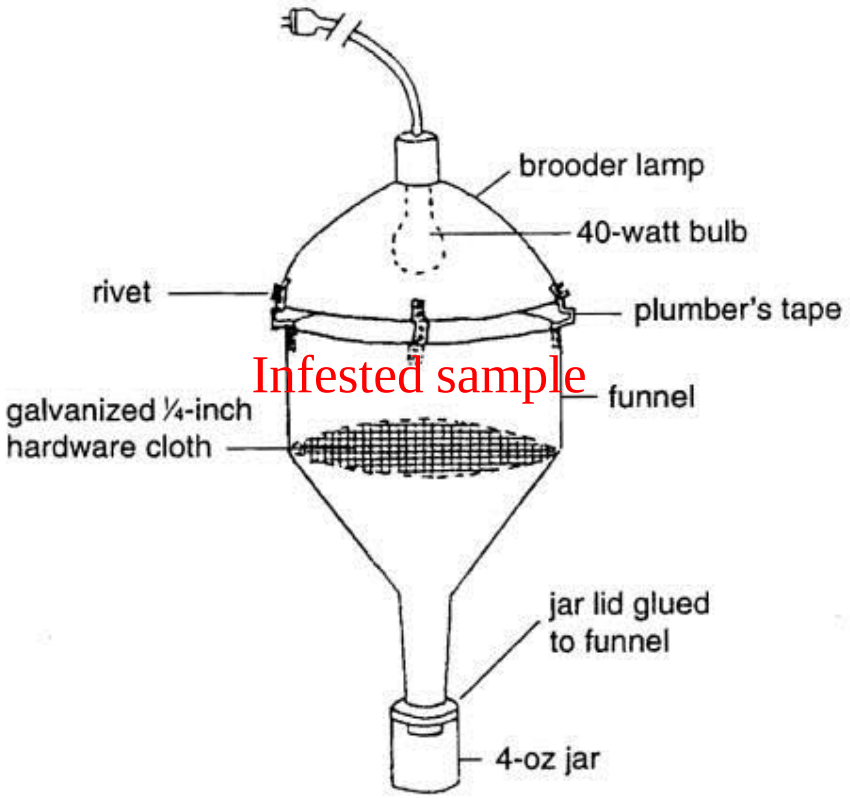
Conserve (Dow) - Group 5 WFT-G resistance
GH, N, L also caterpillars, leafminers

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 flowers and foliage.

CTAHR Insect Pests IP-3 10/98



The modified Berlese funnel

White-footed Ant

Bigheaded Ant

Little Fire Ant

*Bigheaded and LFA are effectively controlled with commercially available red imported fire ant bait insecticides.

*White-footed ant is very difficult to control because food or bait toxicants ingested by foraging workers is not regurgitated, nor is it shared with others.

*Sugary liquid bait insecticides with boric acid (Terro) have shown to be effective by killing white-footed ant workers, who feed sterile eggs to the brood and nestmates. Brood and nestmates die by starvation.

*A highly effective insecticide, fipronil, is slow-acting and eliminates ant nests, but is not registered for use on ornamentals; registered for use only against termites.

*Pyrethroids such as Talstar or the organophosphate, Dursban, can be effective as a barrier treatment to prevent worker ants from foraging on plants while nurturing honeydew-producing insects.

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

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.

Posthavest Disinfestation Treatments for Export Ornamentals & Vegetables

- Washes, Chemical Dips & Mechanical Shakes
- Fogs and Aerosols
- Heat Treatment
- Irradiation
- Systems Approach

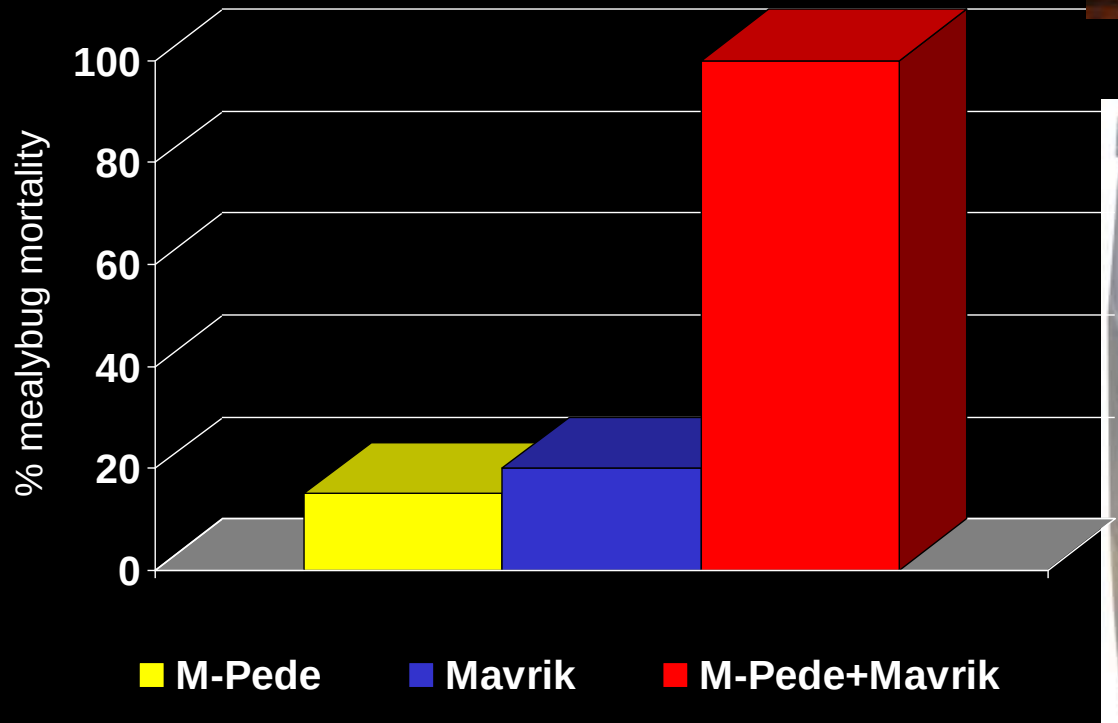
Washes and Wipes

Chemical Dips

*Mavrik is labeled for use as a dip for flower and foliage cuttings.

*Broad-spectrum pyrethroid effective against aphids, leafhoppers, mites, thrips, whiteflies.

*In tank-mix with insecticidal soap (M-Pede), effectiveness against mealybugs is significantly increased.



+

Fogs and Aerosols

*Aerosols are small droplets <10 µm diam.

*Fogging is achieved by vaporizing insecticide with heat.

Aerosols applied to pincushion protea for thrips control.

Thermal Fogger

Postharvest Treatments Against Thrips in Protea

Treatment	AI	No. thrips per flower
Mavrik Aquaflow	0.09 g/l	0c
Raid Aerosol	0.016 g/s	1.2b
Resmethrin fog	20 ml/m^3	9.8a
Water dip		25.7a
Fog control		17.1a
No treatment		17.1a

Mechanical Control

Beat & shake before shipping

Insects more apt to fall off if refrigerated (not clinging onto plant host).

HOT WATER TREATMENTS: NON-CHEMICAL CONTROL OF INVASIVE PESTS

A.HARA, C. JACOBSEN, E. OUCHI, S. MARR, and R. NIINO-DuPONTE
University of Hawai'i at Mānoa, College of Tropical Agriculture and Human Resources, Beaumont Agric. Research Center, Hilo, HI

All photos by UH CTAHR unless otherwise noted.

HEAT TREATMENT TO KILL PESTS

(lowest temperature, shortest duration to achieve 100% mortality)

°F / °C: 122 / 50 — 120 / 49 — 117 / 47 — 113 / 45 — 109 / 43

122

Roger Lopez-Chaves

Burrowing nematode **15 min**


Root mealybugs **15 min**

120


Julie Coughlin
Taro root aphid **5.5 min**

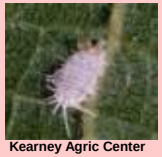

Cockerel scale **6 min**

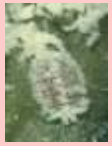

Green scale **7 min**


Spiraling whitefly **10 min**


Nettle caterpillar (pupa) **7 min** (eggs) **10 min**


BioPlant
Long-tailed mealybug **12 min**


Kearney Agric Center
Obscure mealybug **12 min**

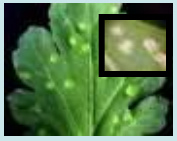

Pink hibiscus mealybug **12 min**

117


Missouri Botanical Garden
Foliar nematode **10 min**


Nettle caterpillar (larva) **12 min**

113



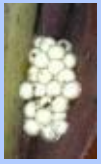
W Nagamine

Can Food Ins Agency
Chrysanthemum white rust **5 min**
Little fire ant adults **10 min**
Snails adults **15 min**

103


Coqui Frog
adults **5 min**

109


eggs **5 min**

PLANT TOLERANCE TO HEAT

(highest temperature, longest duration tolerated)

122


Anthurium 'gobo' (propagative material) **10 min**

120

POTTED PLANTS

6 min: Rhapis palm
10 min: Dracaena 'Massangeana', 'Compacta', Bromeliad 'Tillandsia'
10 min w/ hot water conditioning at 102 °F (39 °C): Palms: Parlor, Bamboo, Phoenix, Fishtail; Dracaena: 'Janet Craig' and 'L'

PROPAGATIVE MATERIAL

- Gardenia
- Ginger, edible
- Plumeria
- Sugarcane
- Dracaena: cutbacks: 'Massangeana', 'Jumbo', 'Warneckii', money tree tip cuttings: 'Janet Craig', 'L'

10 min

CUT FLOWERS & FOLIAGE

- Bird-of-paradise buds, foliage
- Calathea foliage
- Red ginger
- Heliconia flowers (16 cv, var.)
- Palm foliage
- Papyrus foliage
- Ti leaves
- Whaleback foliage

10 min

117

Orchid Oncidium Sharry Baby 'Sweet Fragrance'
Orchid Vuylstekeara Michelle Rehfield 'Pacific Blue Skies'
5 min

Chrysanthemum 'Cupertino' 'Manhattan'
10 min

Bromeliad Vriesea
- 'Flammea'
- *V. cocorvadensis*
- 'Purple cockatoo' (right)

10 min

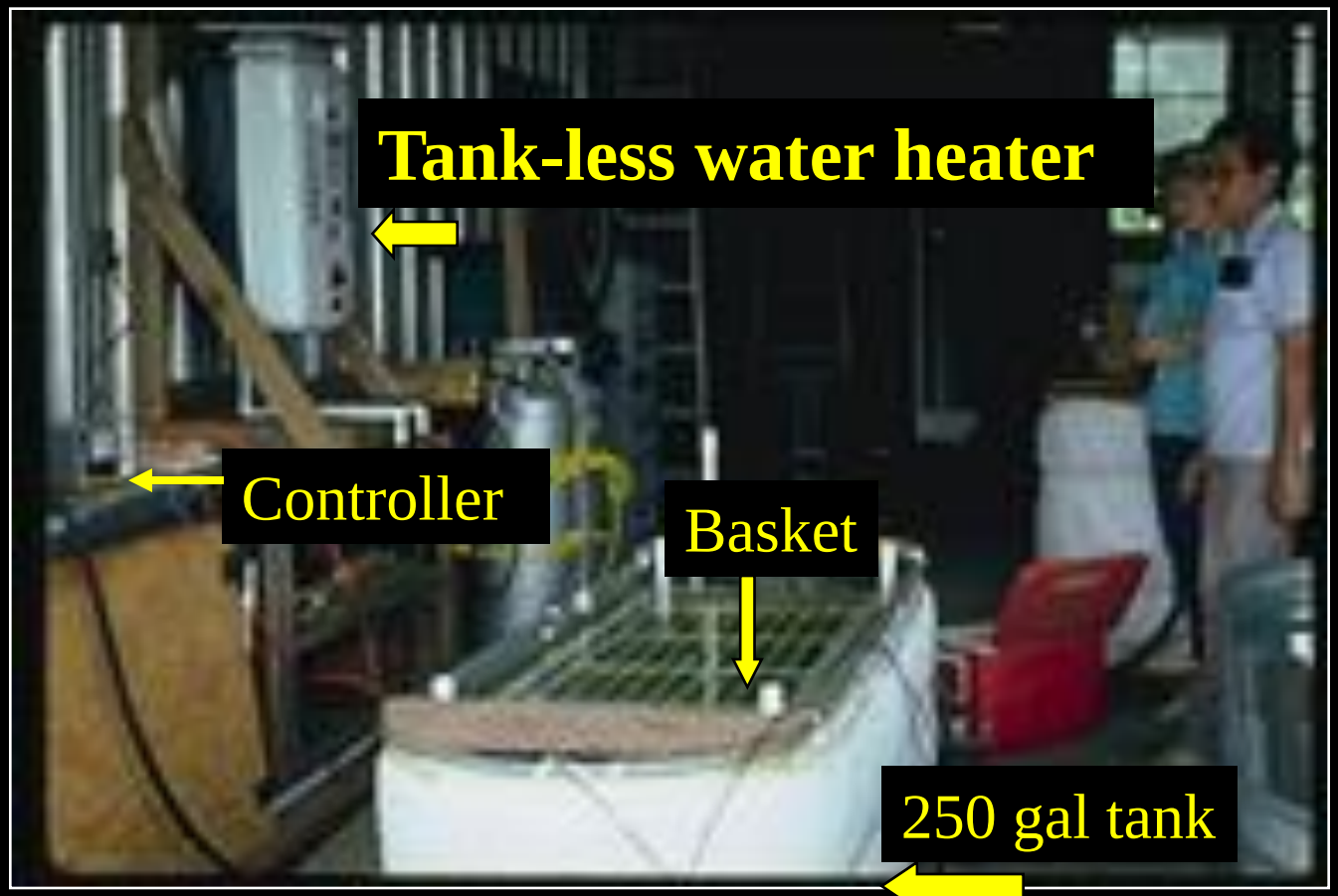
113

Bromeliads Guzmania 'Fiesta', 'Marjam'. 'Puna Gold' **5 min**
Ornamentals Canna lily, Dieffenbachia, Dracaena 'Tricolor coloramma', Easter lily, Philodendron, Salvia
Landscape Bougainvillia, Croton, Kupukupu fern, Lantana, Laua`e fern, Liriope var., Plumbago, Podocarpus, Ti 'Kaua'i', Zoysia grass
Orchids Dendrobium 'Din Daeng Blue', Beallara Peggy Ruth Carpenter 'Jem', Epicat Hilo Delight 'Starlight'

103

Ornamentals Spathiphyllum **15 min**

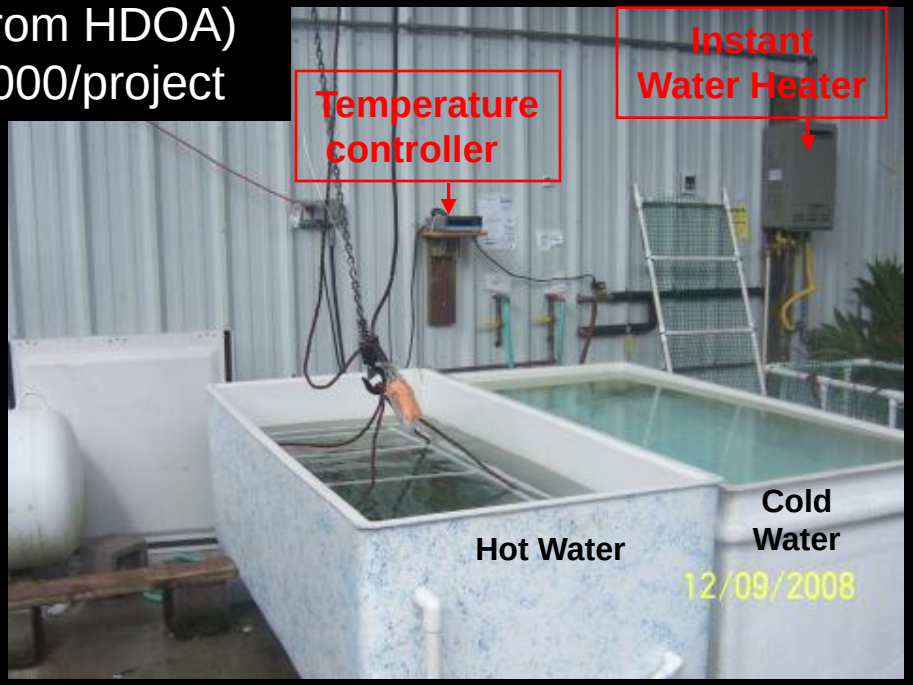
Hot-Water Dip Tank

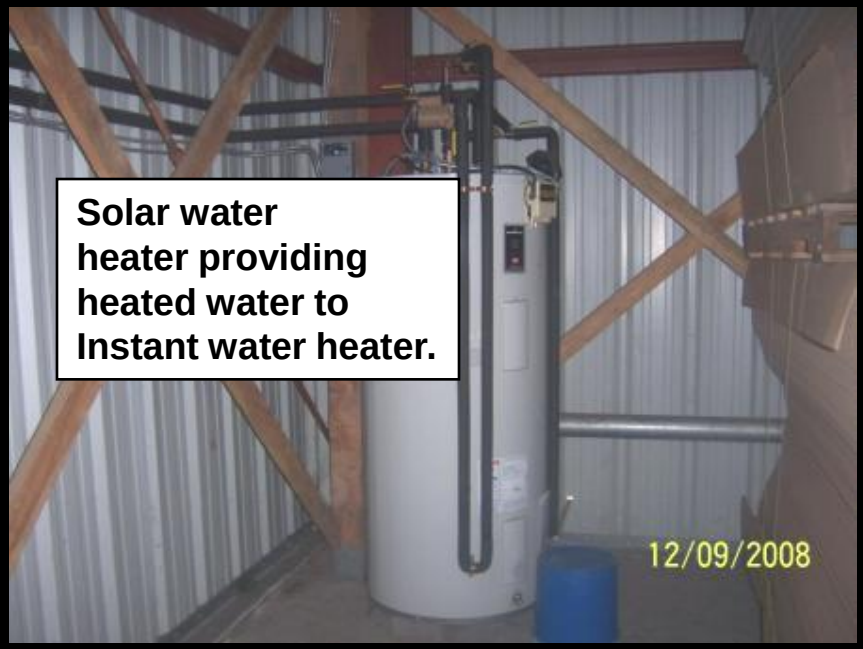


Basket loaded w/ red ginger

Cut Flower Shipping Co w/ Hot water Treatment 12/09/08

(County Cost Sharing Program, $125,000 from HDOA)
25% of all qualified cost not to exceed $10,000/project





Hot Water Treament Recognized as Effective by CDFA

Notifies inspector that insects may appear live; hot water preserves soft bodied insects

NOTICE OF TREATMENT

PRODUCTS DIPPED IN HOT WATER

- ☐ Ginger Pink
- ☐ Ginger Red
- ☐ Bird of Paradise
- ☐ Bird Leaves

Palm Leaves:

- ☐ Areca
- ☐ Phoenix
- ☐ Queen Sago
- ☐ Rhapis
- ☐ Ti Leaves

The shipper performed this treatment without official regulatory supervision at origin. Insects killed by this treatment may appear "fresh" or "alive." DO NOT REJECT FOR INSECTS UNLESS IT IS DETERMINED THEY ARE ACTUALLY ALIVE THROUGH AN APPROVED MANNER. IF NECESSARY, CONTACT CDFA'S Pest Exclusion Branch for further information.

FLORAL RESOURCES, INC. HAWAII
175 E. KAWAILANI ST
HILO, HAWAII 96720
PH: (808) 959-5851/FAX: (808) 959-2077

Hot Shower Chamber

For commercial use by export plant nurseries

Refrigerated freight container modified to hot shower chamber delivering 43 - 49^{o} C water at 70 gpm through 110 full conejet nozzles.

Shower chamber

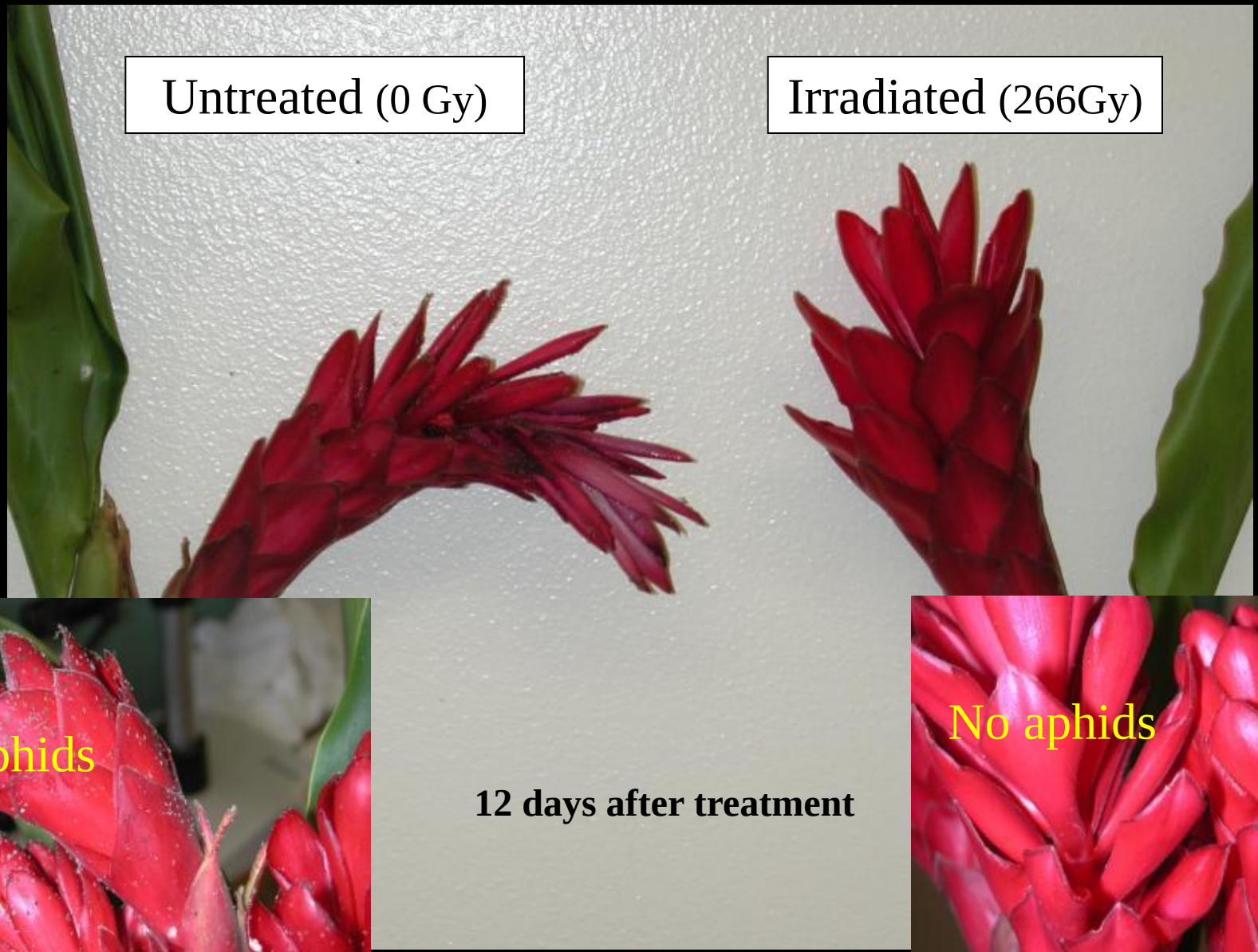
80 plants in one load

Dead frogs, geckos, Slugs at 113 F for 5 min

Summary of Heat Treatments for Pests of Quarantine Significance

- Hot-Water treatment for 10 to 15 min. @ 49^{o} C (120^{o} F) disinfests flowers, potted plants, cuttings, and media of many pests of quarantine significance, including ants, frogs, mealybugs, nematodes, snails and scales.
- Hot-Water treatment of tropical cuttings are not detrimental to rooting and can be used to disinfest cuttings of insect and nematode pests before planting.
- Hot-Air at 40^{o} C (104^{o} F) conditions flowers to tolerate hot water.
- Hot-Air at 44^{o} C (112^{o} F) controls thrips & other insects.

Irradiation as a Quarantine Treatment



Untreated (0 Gy)

Irradiated (266 Gy)

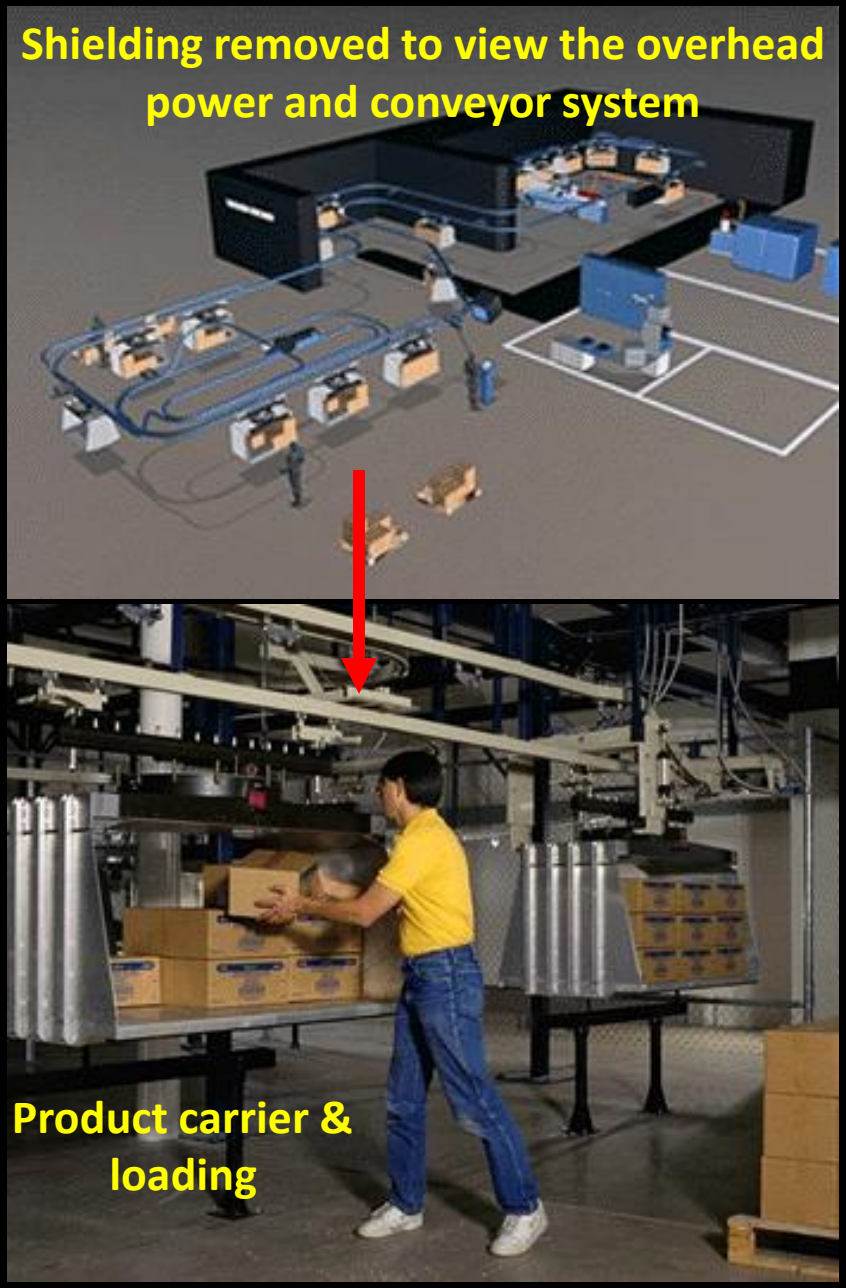
5 days after treatment

Major Sources of Irradiation

Source	Concerns/Benefits
➢ Gamma ray (Cobalt 60) (Cesium 137)	Consumer acceptance Environmental risks (nuclear?) Multi-directional Economical
➢ Electron beam (beta particle)	Poor penetration (few centimeters)
➢ X-ray (bremsstrahlung)	Unidirectional Costly Penetrates pallet loads

SureBeam X-Ray Electronic Pasteurization

- SureBeam Corp. generates X-rays by directing the electron beam to a metal target (tungsten) that converts the beam to X-rays.
- An $8 million facility in Hilo, HI treats papayas and other tropical fruits, curry leaves, sweet potato for quarantine pests at 400 Gy.
- New cobalt facility in Kunia (Lyle Wong).



Foods Approved by FDA for Irradiation Treatment

Commodity	Date Approved		Dosage (Gy)
• Wheat and wheat powder	1963		500
• White potatoes	1965		150
• Spices	1983		30,000
• Dry enzyme preparations	1985		10,000
• Pork	1985		1,000
• Dry aromatic vegetable	1986		30,000
• Fresh fruits	1986		1,000
• Poultry	1990		3,000
• Meat	1997	(fresh)	4,500
		(frozen)	7,000

Which ornamentals & food crops will be disinfested by irradiation without reducing product quality?

- Cut flowers
  - Temperate
    - Alstroemeria, carnation, chrysanthemum (sugar preservative required), rose, gerbera, gladiolus, gypsophila
    - (Sensitive: Lilies, iris)
  - Tropicals:
    - Dendrobium and oncidium orchids, ginger flowers, ti-leaves,
    - (Sensitive: anthuriums, heliconia, bird of paradise, protea)

- Most vegetables (curry leaves), corms (sweet potato) and fruits (papayas, rambutan, longan, lychee)

- Potted Plants
  - -Preliminary tests demonstrate that potted plants (gardenia) are killed by irradiation. Live shoots/terminals are killed.

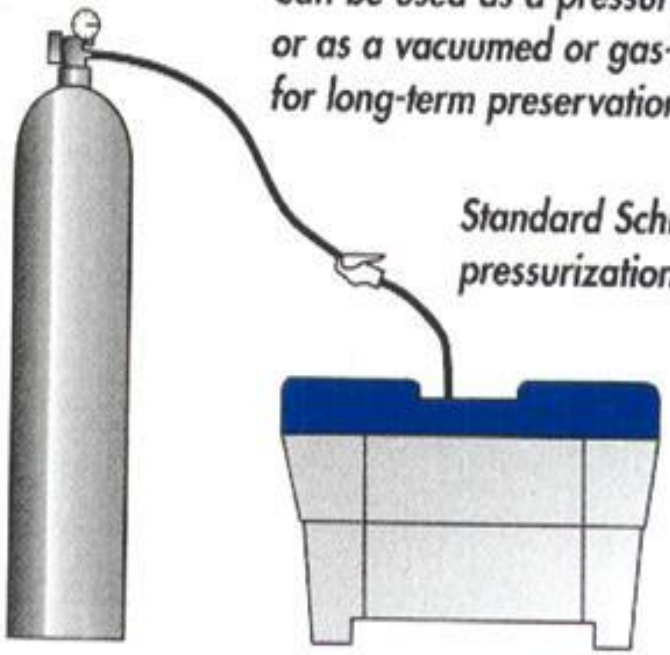
Controlled Atmosphere

(high CO_2, low O_2)

- Controlled atmosphere (*CA*) is the removal or addition of gases resulting in atmospheric composition that is different from air.
- The use of low oxygen (0_2) and/or high carbon dixoide (CO_2) levels may be used to control insects and maintain product quality.
- Generally, high levels of CO_2 are more effective against insects than low O_2.
- Insecticidal atmosphere of high CO_2 (>30%) levels can be damaging to products such as orchids.
- Increase in temperature reduces time needed for insect kill in *CA*.
- 100% mortality of thrips is achieved at 1.5% O_2 for 48 hours with less damage to orchids than high CO_2 .

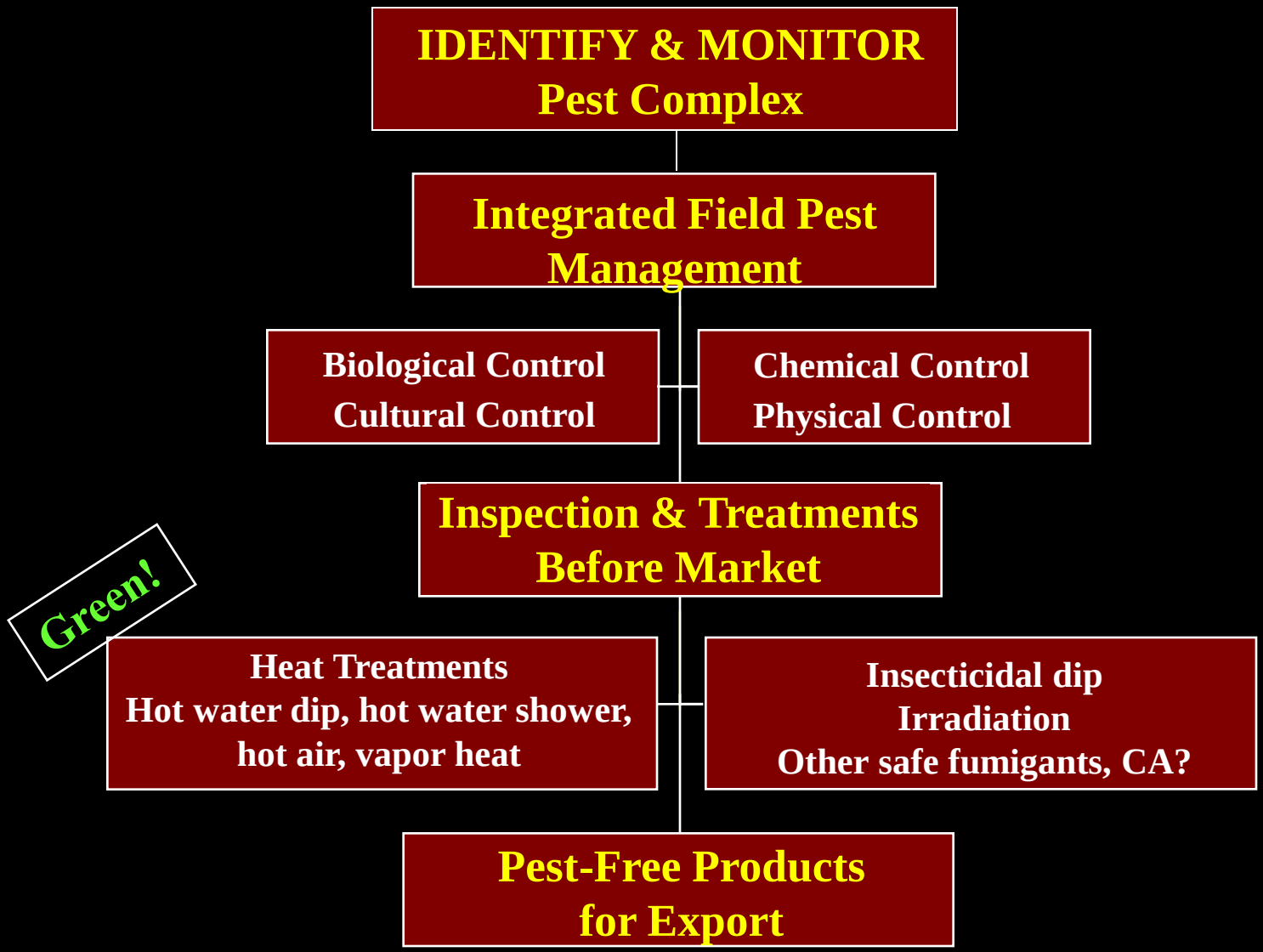
Controlled Atmosphere Container

Possibly adaptable to shipping flowers under low oxygen or high CO_2 to control insects.



Overall Control Strategy

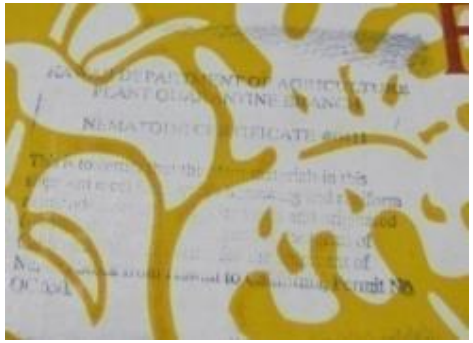
The Systems Approach



FedEx Distribution Center Near San Francisco Airport in San Mateo County

Summary

*CA considers Hawaii high-risk for quarantine pests, similar to Florida.
*USDA, Limited Permit Stamps, State Certifications on boxes does not prevent inspections.
*Only boxes with origin inspection stickers are not inspected as frequently.
*Replace rubber stamp permits and certificates with stickers.
*Invite personnel from CDFA to discuss origin inspection programs for cut flowers, produce and potted plants.
*Public outreach program on shipping clean fresh flowers and foliage to California is needed in HI.




CALIFORNIA/.....
ORIGIN INSPECTION CERTIFICATE
FOR INTERSTATE SHIPMENTS
NO.:_____

This plant material or nursery or premises from which this shipment was made has been inspected and found free from especially injurious plant pests and disease symptoms.

THIS SHIPMENT NEED NOT BE HELD FOR INSPECTION IN CALIFORNIA

Issued by:_____
and California Department of Food and Agriculture
1220 N Street, Sacramento, CA 95814


A BIG THANK YOU!
For assistance:
Kris Aoki
Peter Ballerini
Brian Bushe
Susan Cabral
Pat Conant
Stacey Chun
Christopher Jacobsen
Ruth Niino-DuPonte
Johnny Gordines
Reggie Hasegawa
Clyde Hirayama
Andrew Kawabata
Charlie Nelson
Ken Ogawa
Kyle Onuma
Erik Ouchi
Kelvin Sewake
Marcel Tsang
08 Feb 14