

Identifying and Controlling Insects in the High-Tunnels

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Thrips

Western Flower Thrips

Greenhouse Thrips

Cuban Laurel Thrips

Whitefly sampling

- Yellow sticky cards
 - 1000 sq ft
 - Check them often: at least once per week

Poinsettia thrips

Image by Laurence Mound, ANIC, CSIRO

Western flower thrips

Frankliniella occidentalis, western flower thrips adult

Photo by Nardia Accetta
The Ohio State University, OARDC
2008

Thrips on flowers

UC Statewide IPM Project
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IPM for Thrips



- Sanitation
 - Monitoring incoming plant shipments
 - Monitor plants surrounding facility
 - Remove infested plants
- Biological control
 - *Amblyseius cucumeris*, rate 3-25 / sq ft, 1000/sachett = \$20
 - *Amblyseius swirskii*, rate 3-15 / sq ft
 - *Orius insidiosus*

Biopesticides + BC



- Insect killing fungus
- Tank-mixes well (probable synergism) with nematodes
- Many species including *Beauveria bassiana* and *Paecilomyces fumosoroseus*

Botanigard = <http://www.bioworksbiocontrol.com/>

No Fly = <http://naturalindustries.com/> ; MGS Horticultural Inc.

IPM for Thrips: Some Insecticides Available for Rotations

Effect	Trade Name (each row is a mode of action)	Impact on Biologicals
VG	Conserve (spinosad)	Harmless
VG	Pylon (chlorfenapyr)	Slightly toxic
G	Overture (pyridalyl)	
G	Mesuro (methiocarb)	Harmful
	Hachi-Hachi (tolfenpyrad)	
G	Avid (abamectin)	Moderately toxic
	Pedestal (novaluron)	Harmless to adults
	Botanigard (<i>Beauveria bassiana</i>)	

Nematodes = *Steinernema*

Nemasys = <http://www.beckerunderwood.com/>



Example, Whitmire Micro-Gen, MOA 13

PYLON TR PYLON TR
total release insecticide / Insecticida de liberación total

One 2 oz can treats up to 3,000 sq ft (50,000 sq ft) (40' x 120' x 10' ceiling)
KILLS FUNGUS GNAW ADULTS, NITES & THIRPS

• For use only on Ornamental Crops and Fruiting Vegetables Grown in Commercial Greenhouses.
• May be used on Bedding Plants, Cut Flowers, Flowering Hanging Baskets, Foliage, Fruiting Vegetables, Potted Flowering Plants and Ornamentals.

ACTIVE INGREDIENT: Chlorfengypir 4.0%
OTHER INGREDIENTS: 96.0%
TOTAL: 100.0%

EPA Reg. No. 499-544
KEEP OUT OF REACH OF CHILDREN
WARNING

IF YOU DO NOT UNDERSTAND THE LABEL, ASK SOMEONE TO EXPLAIN IT TO YOU IN DETAIL.

FIRST AID
IF IN EYES: Hold eyes open and irrigate gently with water for 15-20 min. Remove contact lenses, if present, after the first 5 min. Then continue rinsing eyes. Call a poison control center or doctor for treatment advice.

PRIMEROS AUXILIOS
SI ENTRA EN CONTACTO CON LOS OJOS: Manténgalos abiertos y enjuágalos bien y abundantemente con agua durante 15-20 min. Sálvate los lentes de contacto, si los lleva, después de los primeros 5 min. Después continúe enjuagando los ojos. Llame a un centro de control de toxicología local o a un médico para pedir ayuda del tratamiento.

Amblyseius swirskii



Biobest = <http://www.biobest.be/>

Aphids (Hemiptera:Aphididae)



Myzus persicae, green peach aphid: L = adult, R = nymph



Aphis gossypii, cotton aphid



Use of imidacloprid as drench or spray vs the green peach aphid

Green peach aphid =
M. persicae

Zinnia elegans



Neonicotinoids

MOA	Trade Name	
4A	Marathon (imidacloprid),	
	Flagship (thiametoxam),	
	Tristar (acetamiprid),	
	Safari (dinotefuran)	
	Celero (clothianidin)	

IPM for Aphids



- Examples
 - Green peach = *Myzus persicae*
 - Melon = *Aphis gossypii*
- Biological control
 - *Aphidoletes aphidimyza*,
 - *Aphidius colemani*,

IPM for Aphids: Some Insecticides Available for Rotations

Effect	Trade Name (each row is a mode of action)	Impact on Biologicals
E	Endeavor (pymetrozine)	Harmless to larvae
E	Marathon (imidacloprid), Flagship (thiametoxam), Tristar (acetamiprid), Safari (dinotefuran)	Toxic as spray, non-toxic as drench
	Kontos (spirotetramat)	
	Aria (flonicamid)	
	Ultra fine oil	Harmless
	Orthene (acephate)	Harmful
	Insecticidal Soap, M-Pede	
	Azatin XL (azadirachtin)	Harmless

IPM for Aphids: Some Insecticides Available for Rotations

Effect	Trade Name (each row is a mode of action)	Impact on Biologicals
E	Xxpire (spinetoram + sulfoxaflor)	Harmless?
E	Mainspring (cyantraniliprole)	Harmless?

Mite Damage



Mites (two spotted spider mite)



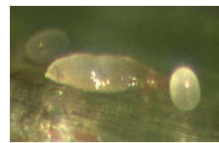
Broad mites



Mite damage



IPM for Mites



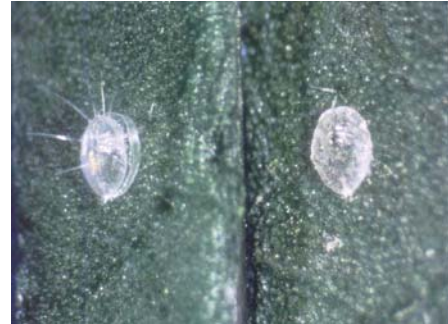
- **Examples**
 - Two spotted spider mite = *Tetranychus urticae*
 - Cyclamen mite = *Phytonemus pallidus*
 - Broad mite = *Polyphagotarsonemus latus*
- **Biological control**
 - *Phytoseiulus persimilis*,
 - *Amblyseius cucumeris*,

IPM for Mites: Miticides

Effect	Trade Name (each row is a mode of action)	Impact on Biologicals
E	Floramite (bifenazate)	
E	Pylon (chlorfenapyr) (vs Broad, Cyclamen)	Harmful
E	Avid (abamectin) (vs Broad, Cyclamen)	Harmful
E	TetraSan (etoxazole), Hexygon (hexythiazox), Ovation (clofentezine)	Harmful
E	Sanmite (pyridaben) (vs Broad), Akari (fenpyroximate)	Harmful
VG	Shuttle (acequinocyl)	
E	Sultan (cyflumetofen)	
	Insecticidal Soap, M-Pede	Harmful
E	Judo (spiromesifen) (vs Broad and Cyclamen), Kontos (spirotetramat)	

Whitefly Identification

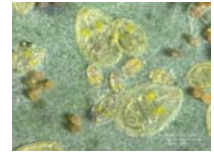
Greenhouse *Trialeurodes vaporariorum* Silver leaf *Bemisia tabaci*



New insecticides, miticides

- BASF
- Sultan (2014)
 - Cyflumetofen
 - New mode of action?
 - Miticide, very effective against two spotted spider mites, including eggs?

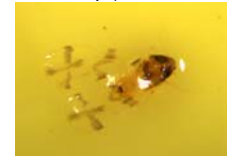
White Flies (Hemiptera: Aleyrodidae)



Bemisia tabaci, silver leaf whitefly: L = adult, R = nymphs



Trialeurodes vaporariorum, glasshouse whitefly nymphs



Trialeurodes abutilonia, banded wing whitefly adult

Whiteflies

Banded wing Greenhouse Silver leaf



(From Flint 1995)

Whitefly damage



Parasitized Nymphs

Encarsia



Eretmocerus



Mealy bugs (Hemiptera: Pseudococcidae)



Planococcus citri, citrus mealy bug: L = female R = male

Whitefly control (draft)

Table F. Plants or Harvested Cuttings are 2 – 3 Days before Shipping

Make foliar applications 2 - 3 days before shipping finished plants or rooted cuttings or before each cutting harvest when shipping unrooted cuttings. **To reduce resistance development:** avoid applications of modes of action used in the previous growth stage (Table E for finished plants or stock, and Table B for rooted cuttings).

Suggested Products for Harvested Cuttings	IRAC Class	B-Biotype	Q-Biotype
Avid (abamectin)	6	Yes	Yes
Flagship (thiamethoxam)	4	Yes	Yes
Judo (spiromesifen) – targeting nymphs at this plant stage for unrooted cuttings or cultivars tested for crop safety	23	Yes	Yes
Mainspring	28	Yes	Yes
PFR-97	n/a	Yes	Yes
Safari (dinotefuran)	4	Yes	Yes
Sanmite (pyridaben)	21	Yes	Yes
TriStar (acetamiprid) – targeting adults at this plant stage	4	Yes	Yes
XXpire	4C + 5	Yes	?

<http://www.mrec.ifas.ufl.edu/LSO/bemisia/bemisia.htm>

Mealybugs

- Longtailed mealybug, *Pseudococcus longispinus*
- Madeira mealybug, *Phenacoccus madeirensis*



Pictures from: Lance S. Osborne, University of Florida

Citrus Mealybug



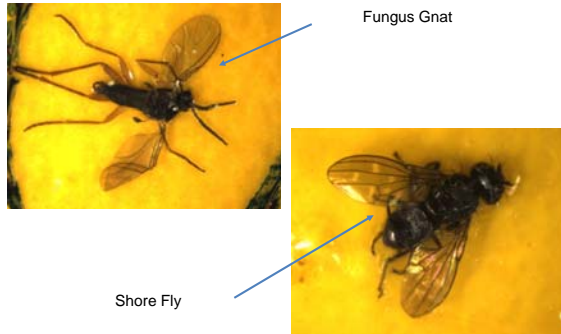
OSU: Ivan Galvan, Travis Appiah

IPM for Mealybugs: Insecticides

Effect	Trade Name (each row is a mode of action)	Impact on Biologicals
E, VG	Safari (dinotefuran), Flagship (thiamethoxam), Tristar (acetamiprid), Marathon (imidacloprid), clothianidin	Harmful as spray
VG	Distance (pyriproxyfen)	Harmless
E	Talus (buprofezin)	Harmless
E	Kontos (spirotetramat)	?
VG,G	Insecticidal Soap, M-Pede (potassium salts of fatty acids) Herbal aphid control (thyme, mint oil), GSHGIS (canola oil, pyrethrins)	Harmful
VG	Talstar (bifenthrin)	Harmful

Cloyd AMT 2005, G25; Ludwig AMT 2006, G14, G15; Canas AMT 2007, G42.

Fungus Gnat and Shore Flies



IPM for Fungus Gnats and Shore Flies

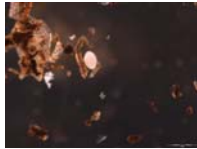


- Pathogens
 - *Steinernema feltiae* (46 K / sq ft)
 - Also used against western flower thrips
 - Affected by high temperatures
 - *Steinernema carpocapseae*

Fungus Gnat (Diptera: Sciaridae)



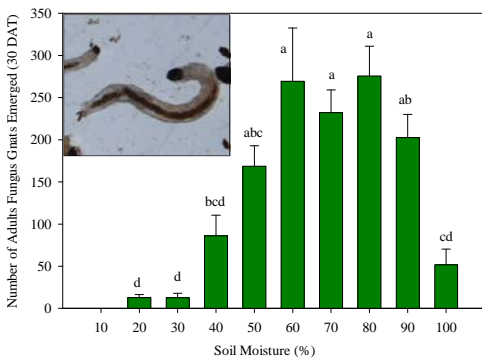
Bradysia impatiens, fungus gnat: L = adult, R = larva, Down = egg



IPM for FG and Shore Flies: Some Insecticides Available for Rotations

E	Trade Name (each row is a mode of action)	Impact on Biological Control Agents
VG	Nemasys	
VG	Citation (cyromazine)	Slightly toxic
VG	Distance (pyriproxyfen)	Slightly toxic
	Enstar II (s-kinoprene)	
	Adept (diflubenzuron)	
G	Marathon (imidacloprid), Safari (dinotefuran)	Toxic as spray, non-toxic as drench
	Azatin (azadirachtin) XL	Slightly toxic

Fungus Gnats = Soil Moisture



Thanks!

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