Beneficial Insects

Treasure Coast Chapter Rare Fruit Club

Photo: UF Schall

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PALM BEACH COUNTY FLORIDA

A Little Review from Last Time

Photo: UF Office of Sustainability

Insects with Piercing/Sucking Mouthparts

Photos by Glenn, UF

Insects with Chewing Mouthparts

http://edis.ifas.ufl.edu/pdffiles/HS/HS17700.pdf

HS929

UF UNIVERSITY of FLORIDA
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Pesticides Registered for Tropical Fruit Crops in Florida[1]

Jonathan H. Crane and Mark A. Mossler[2]

Introduction

Please note, this list may not cite all chemical and common names of pesticides legally registered at the present time. This list does not constitute endorsement of any pesticide chemical named; these

Types of Beneficials Mites, Insects, Diseases & Nematodes

- Predators
- Parasitoids
- Insect Diseases
- Beneficial Nematodes
- Developing refugia in your yard
- Products that are softer on beneficials

Some Key Points

- Many beneficials already in environment
- Some can be purchased
- Beneficials work best when you do not have to control a huge pest population
  - Predators better than parasitoids in responding to large pest populations
- Some beneficials “generalists,” by many very specific to pest – especially parasitoids

Some Key Points

- Probably best strategy for you is develop refugia & use products and techniques that are less damaging to beneficials
- Lots & lots of activity occurring below noticeable levels
- Do not want to confuse “good” with “bad” insects – especially when they show up to attack pests that are actually causing the plant decline

Minute Pirate Bug (*Orius*)

Photo: John Ruberson, University of Georgia, Bugwood.org

Orius feeding on insect egg

Minute Pirate Bug (*Orius*)

Photo: John Ruberson, University of Georgia, Bugwood.org

- Good for small insects, especially thrips
- Can be up purchased commercially
- Sunflowers (even Mexican sunflower) provides refuge for non pest thrips & therefore Orius

Photo: Edward Sikora, Auburn University, Bugwood.org

Minute Pirate Bug (*Orius*)

Life History: One generation takes 20 days to complete, multiple generations per year.

Prey: Spider mites, insect eggs, aphids, thrips, scales, caterpillars.

Minute Pirate Bug (*Orius*)

Orius insidiosus **nymph**

Minute pirate bug feeding on thrips

Photos: UF Santana

Big-Eyed Bugs – *Geocoris Spp.*

Photo: UF Lyle Buss

Photos: UF Santana

Prey: Insect eggs, aphids, mealybugs, spider mites, leafhoppers, plant bugs, whiteflies, caterpillars, and beetle larvae.

Predaceous Stink Bugs

Life History: Most feed on plants, but some are predaceous. Many discharge a distasteful smell when handled.

Photos: UF Santana

Prey: Caterpillars and beetles

Difference Between Predatory and Pest Stink Bugs

Assassin Bugs

Life History: Assassin bugs feed by piercing prey with their beaks to suck out juices.

Prey: Caterpillars, small flying insects, aphids, and leafhoppers.

Wheel bug (*Arilus cristatus*)

Photos: UF Santana

Green Lacewings

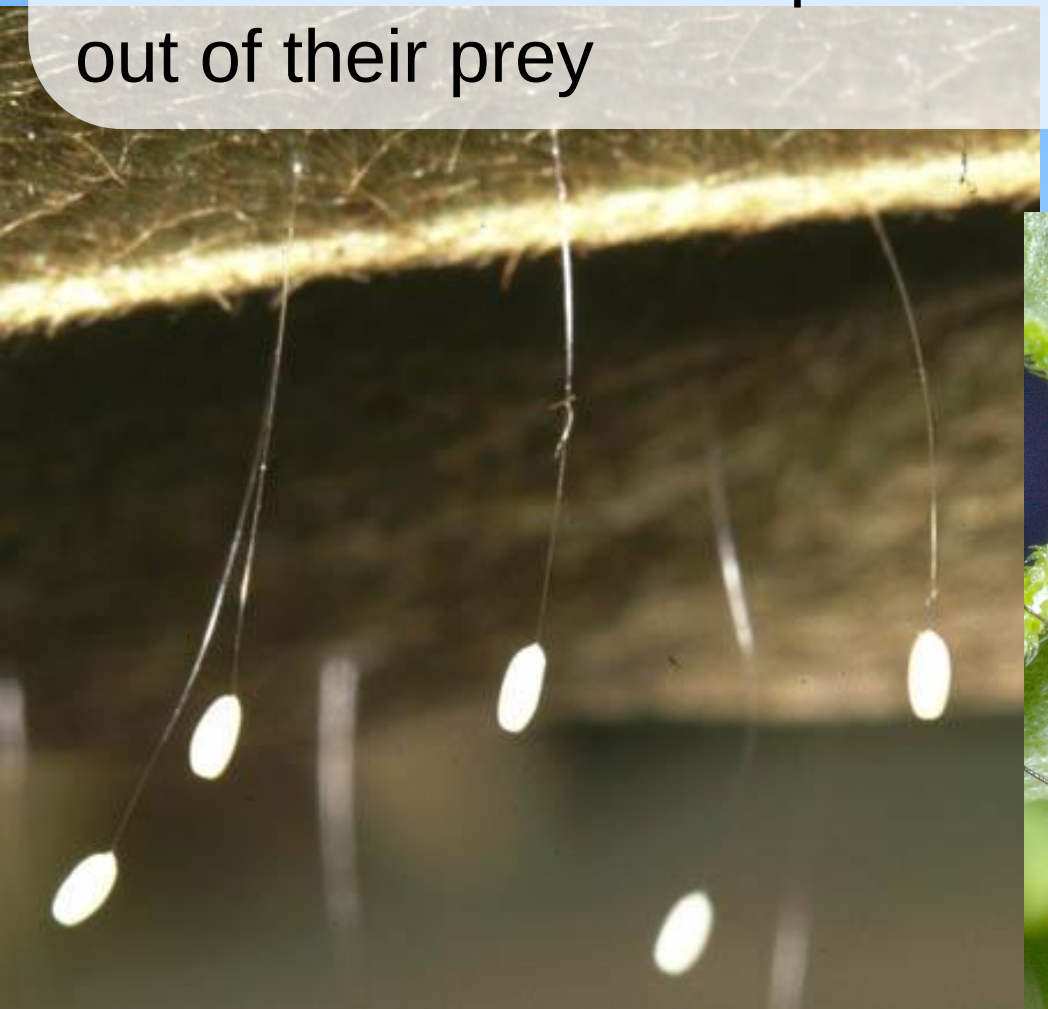
Life History: Oval, white eggs laid singly on stalks 1/3 inch long. Small gray larvae spin cocoons and pupate on undersides of leaves. One to ten generations per year.

Prey: Larvae feed on aphids and other small insects. Adults feed on honeydew and pollen.

Green Lacewings – Mostly Feed On Aphids & Soft Bodied Insects

Green Lacewings

Eggs are laid singly on silken stalks
Larvae flattened and tapered, alligator like, with long, curved mandibles for puncturing and sucking fluid out of their prey



Green Lacewings

John Davidson

John Davidson

John Davidson

Clockwise from top left: eggs, larva, cocoons, adult

Lady Beetles & Mealybug Destroyers - Many

In Order **Coleoptera** and mostly **Coccinellidae** Family

Pink Lady Beetle - (*Coleomegilla maculata*

Life History: Both larvae and adults are predaceous.

Prey: Aphids, scale insects, mealybugs, whiteflies, spider mites, insect eggs.

A Florida native lady beetle

Convergent Lady Beetle

Life History: Native and common in the Midwest; larvae and adults are both predaceous.

Prey: Aphids.

Twice-Stabbed Lady Beetle

Photo: http://www.uoguelph.ca/~samarsha/lady-beetles.htm

Life History: Spiny larvae pupate in last larval skin.

Prey: Armored or soft scales (depending on species).

Top: adult
Bottom: larva

More Lady Beetles

Mealybug destroyer (*Cryptolaemus montrouzieri*) adults feeding on mealybug egg mass (left)

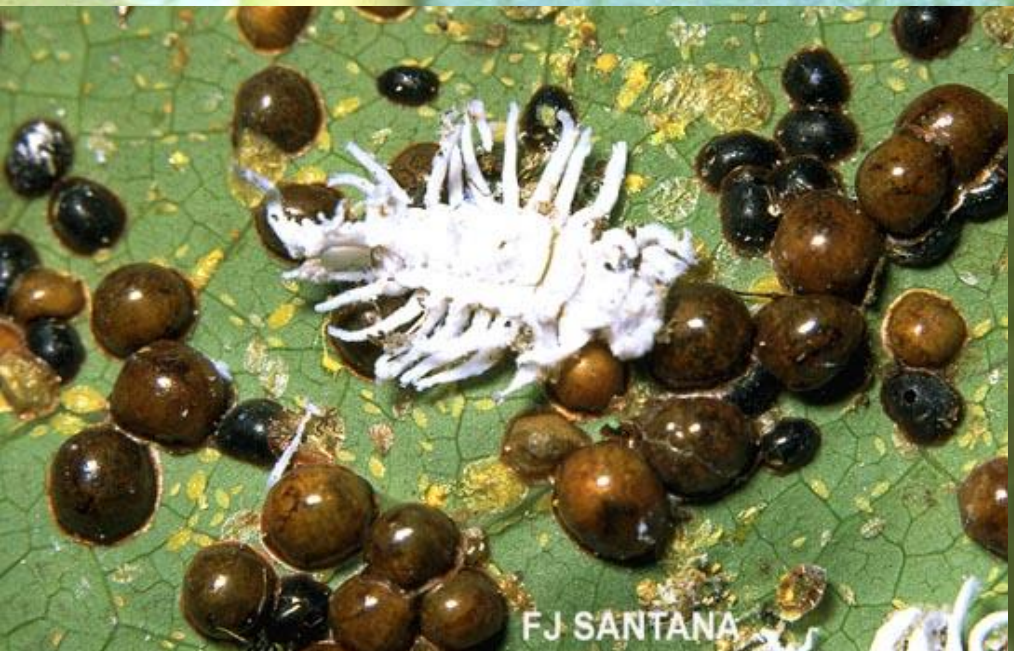
Twospotted lady beetle (*Adalia bipunctata*) adult and pupa with shed pupal skins (right)

Photos Whitney Cranshaw

Lady Beetles At Work Eating Aphids

Common Australian Lady Beetle Eating an Aphid

Lady Beetle Larvae Have Many Shapes and Forms



Robber Flies

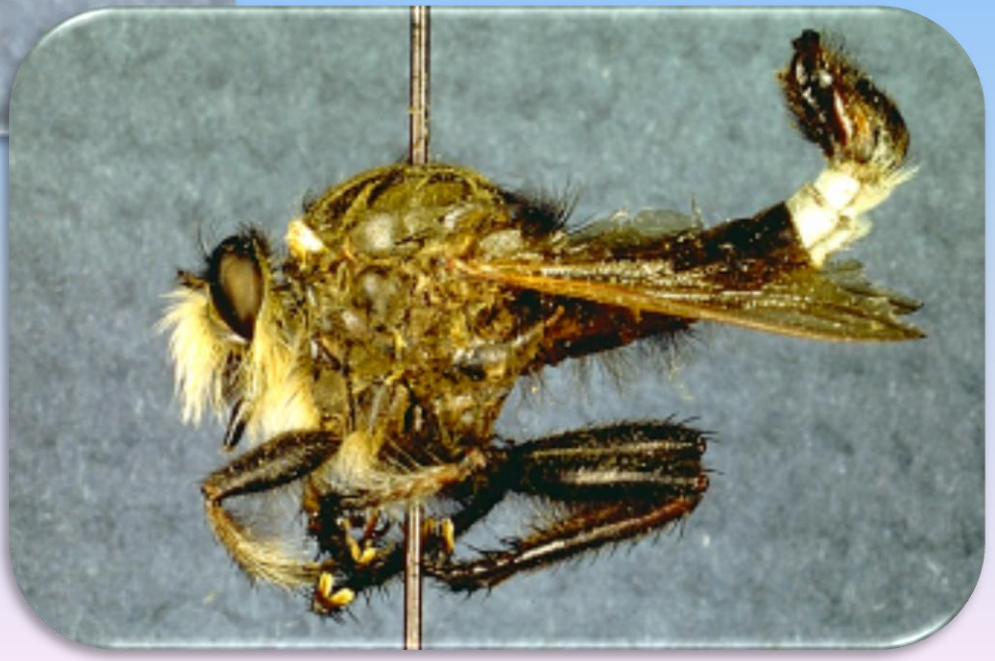
Life History: Larvae live in soil and decaying wood; adults are fast fliers.

Photo: Whitney Cranshaw

Prey: Butterflies, wasps, bees, dragonflies, grasshoppers, beetles, and other flies. Larvae feed on soft-bodied insects such as grasshopper eggs, white grubs, and other insect larvae.

Robber Flies

Adult female



Adult male

Photos: UF Santana

Syrphid or Hover Flies

Life History: Adults feed on nectar and pollen. Larvae are predaceous. One generation every 2 to 4 weeks.

Prey: Larvae feed on aphids, scales, and other insects.

Syrphid or Hover Flies

Clockwise from right: Syrphid egg, larva, and larva on branch

Photo: Whitney Cranshaw

Photos: David Laughlin

Beneficial Insects & Mites

Syrphid Fly Larva

Photos: UF Santana

Tachinid Flies

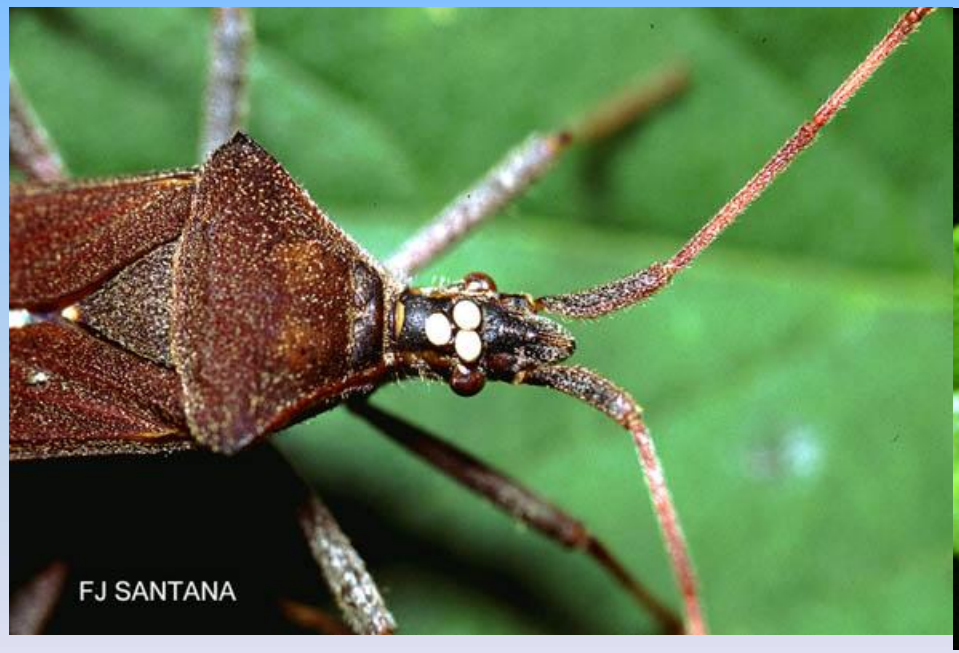
Photo: John Davidson

Life History: Adults deposit eggs on plants or hosts. Larvae Develop inside hosts and pupate in 4 to 14 days. One or more generations per year.

Prey: Caterpillars, adult and larval beetles, sawfly larvae, true bugs, grasshoppers, and others.

Tachinid Flies
The Most Important Family of Flies Providing Biological Control of Pests

Leaf-footed Bug With Eggs Deposited By Tachinid Fly On Its Head



ANT DECAPITATING PHORID FLIES Introduced by USDA, Gainesville, FL, to Reduce the Problem of Fire Ants

Phorid fly life history – causes fire ant head to drop off

6 Spotted Predatory Thrips

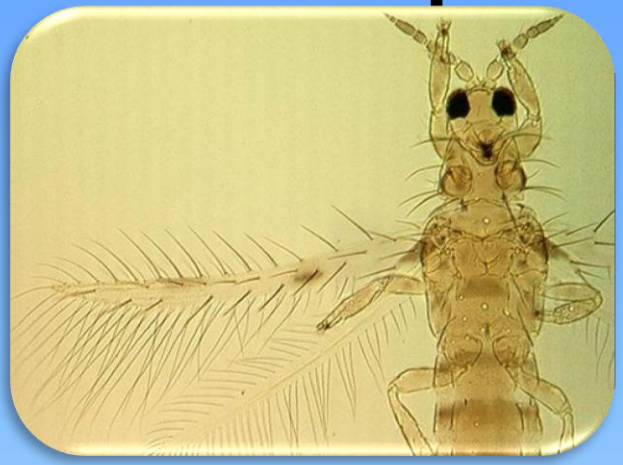


Photo: UF Funderburk

Life History: Sexual or asexual reproduction.
Nymphs resemble adults in size and color.
Several generations per year.
Prey: Pest thrips, aphids, mites, whiteflies, and other soft-bodied insects.

Identified by the six pairs of extraordinarily long setae (bristles) on the prothorax

A Large Predatory Ground Beetle That Lives In Turf (Eats Mole Crickets And Caterpillars)

Pasimachus sublaevis

Ground Beetles

Life History: Nocturnal, in or on soil, some live up to four years.

Prey: Caterpillars, soil and tree insects, earthworms.

Photos:Vera Krischik

Top: *Harpalus* sp.
Bottom: *Calosoma* sp.

Rove Beetles

Life History: Nocturnal predators.

Prey: Soil-dwelling insects.

Predatory Mites

Several Types

Prey: Two-spotted spider mites, sometimes thrips and whitefly, and other small arthropods.

Swirskii Mite - *Amblyseius swirski*

Pho

Persimilis - *Phytoseiulus persimilis*

Californicus - *Neoseiulus californicus*

Photo: Clemson University

Many Wasps
Here Aphelinid Wasps

Life History: Solitary, lay eggs in or outside hosts. Females usually reproduce parthenogenetically, males are rare.

Photo: John Davidson

***Encarsia formosa* adult**

Prey: Aphids, mealybugs, psyllids, scales, and whiteflies.

Braconid Wasps

Life History: Life cycle is 10–14 days. Larvae are internal parasitoids; many pupate outside hosts.

Photo: John Davidson

Prey: Aphids, larvae of beetles, flies, sawflies, and caterpillars; tomato hornworm, imported cabbageworm.

Braconid Wasps

***Cotesia congregata* cocoons on tomato hornworm**

Aphid mummies with braconid emergence holes

Photos: UF Santana

Ichneumonid Wasps

Life History: Larvae are internal or external parasitoids.

Photo: Whitney Cranshaw

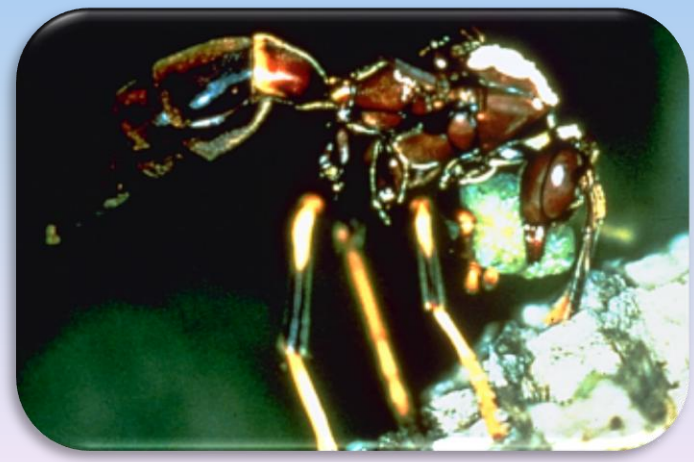
Prey species: Larvae and pupae of beetles, wasps, and caterpillars; armyworms, cabbage looper, fall webworm, oakworms, tent caterpillars, tussock moths, European corn borer.

Vespid Wasps

Life History: Many have annual colonies with queens, workers, and males.

Yellowjacket with caterpillar

Photos: UF Santana



Prey: Caterpillars and other insects. May bother people at picnics.

Paper wasp (*Polistes* species)

Parasitized Scale Insects


yellow jacket
FJ SANTANA


paper wasp


paper wasp


paper wasp nest
FJ SANTANA

Mud Dauber Wasps: Prey on spiders

Potter Wasps

Photos: UF Santana

Build mud nest in the shape of narrow-mouthed pots

Stock the pots with several caterpillars

Spiders

Photo: Ronald F. Billings Texas Forest Service www.forestryimages.org

Life History: Generalist predators. Most make webs and have poor eyesight.

Prey: Other small arthropods.

Left: Yellow garden spider (*Argiope aurantia*) (Araneidae)

WOLF SPIDERS

Many Species

Bite not dangerous to humans

Earwigs

Most are beneficial predators that feed on other insects

¼ to 1inch long

Flattened bodies

Active at night

Forceps-like cerci at the end of the body to capture prey and defend themselves

Ants

Colonies with queens, workers, and drones (males).

Photo: Jim Occi, BugPics, www.insectimages.org

Workers with eggs

Ants

Photo: Clemson University, USDA Cooperative Extension Slide Series, www.forestryimages.org

Above: Carpenter ant (*Camponotus* sp.)
Right: Red imported fire ants (*Solenopsis invicta*) with cerambycid larvae

Photo: Herbert A. "Joe" Pase III, Texas Forest Service, www.insectimages.org

Centipedes

Life History: Nocturnal; in gardens and houses.

Prey: Small arthropods.

Tree of Life
http://tolweb.org/tree/phylogeny.html

Tree of Life
http://tolweb.org/tree/phylogeny.html

Left: *Lithobius forficatu*
Above: House centipede (*Scutigera coleoptrata*)

Nematodes

What are nematodes?

- Unsegmented roundworms
- Aquatic
- Small

“Good”-vs.-“Bad” nematodes

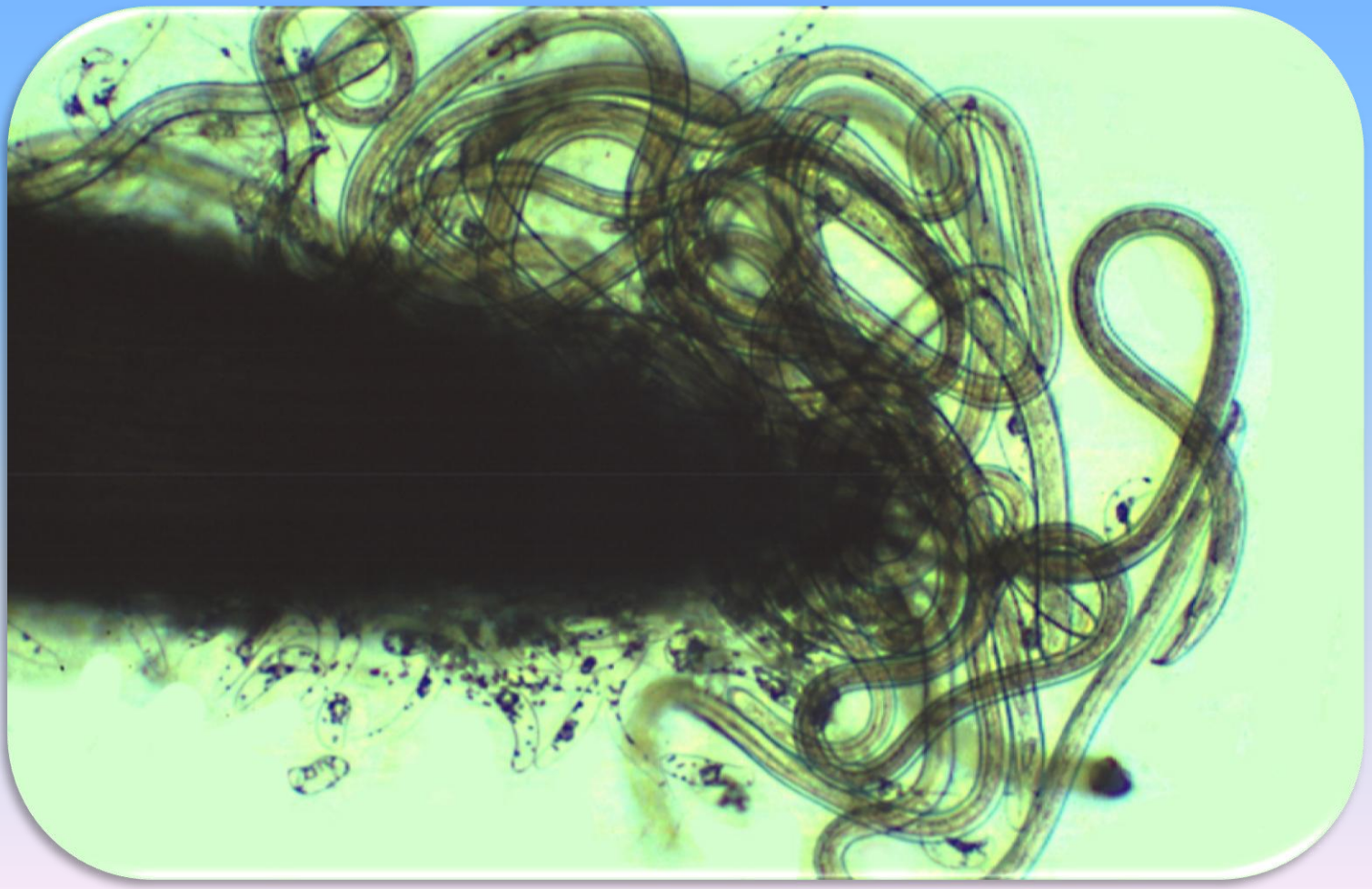
- Bacterial feeders
- Fungal feeders
- Predators

“Good guys”

- Animal-parasites
- Plant-parasites

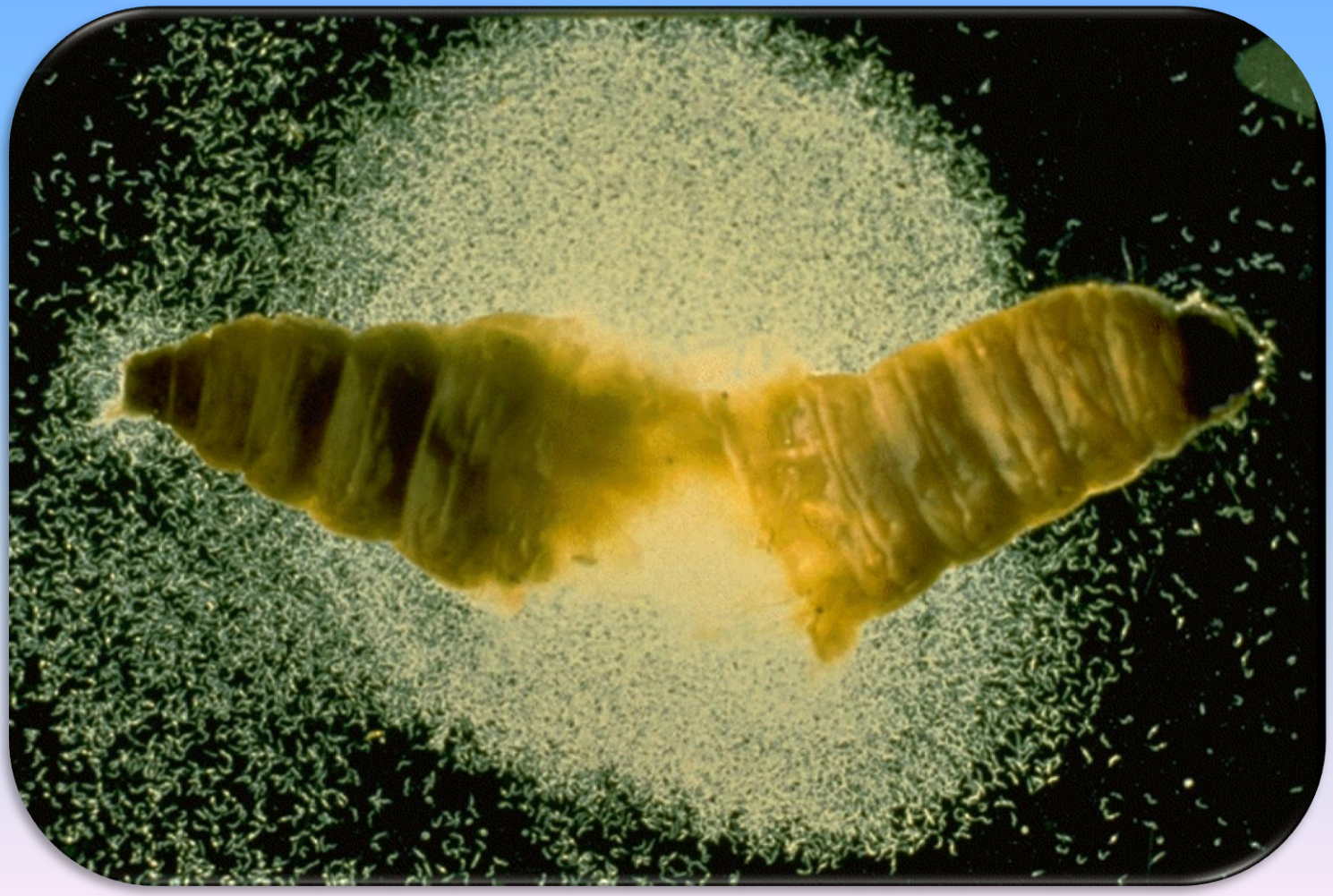
“Bad guys”

Plant-parasites



Photos: UF William Crow

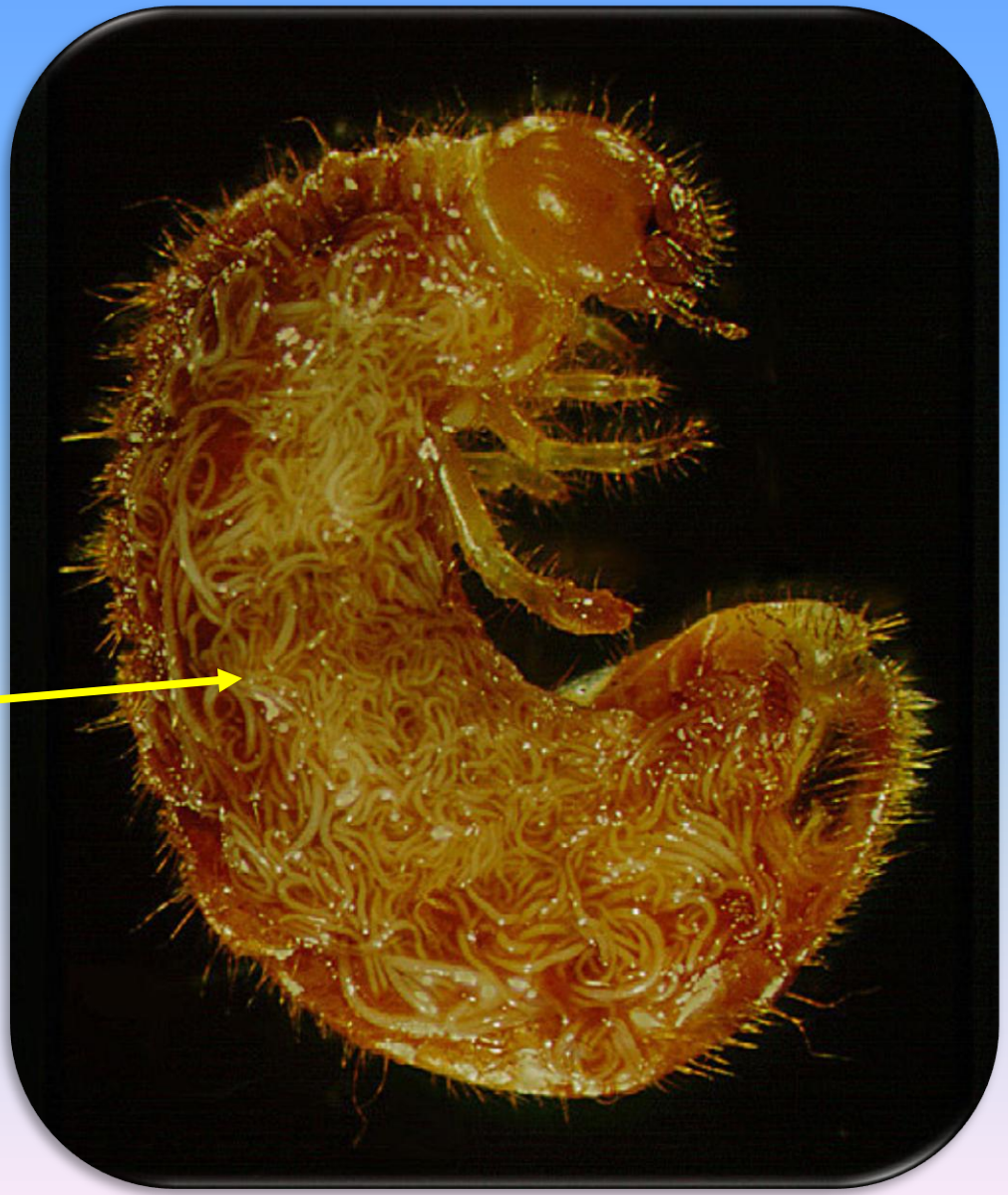
Entomopathogenic nematodes



Photos: UF William Crow

Entomopathogenic nematodes inside a grub

Nematodes



Photos: UF William Crow

Bacteria kill insect, nematodes eat bacteria

Photos: UF William Crow

Bacteria

- ***Steinernema* spp.**
  - ***Xenorhabdus***
  - **Tan to dark gray**

Photos: UF William Crow

- ***Heterorhabditis* spp.**
  - ***Photorhabdus***
  - **Red, orange, purple, brown**
  - **Glow**

Nematodes exiting an insect body cavity

Photos: UF William Crow

Some good nematode / insect combinations

- ***S. carpocapsae*** **– caterpillars, borers, cutworms, armyworms, billbugs**
- ***S. feltiae*** **– mushroom flies, crane flies, fungus gnats**
- ***S. riobrave*** **– mole crickets, citrus root weevils, corn earworms, pink bollworms**
- ***S. scapterisci*** **– mole crickets**
- ***H. bacteriophora*** **– root weevils, white grubs, billbugs, borers**
- ***H. megidis*** **– root weevils**

Keys to effective use – storage and handling

- Shelf life - generally 1 month (check for viability)
  - Store in refrigerator (not freezer) near 39^{O} F
- Avoid heat, sunlight
  - Apply at dusk or early morning
  - Keep in AC if possible

Keys to effective use

- Apply in the evening
- Use lots of water

Death by nematode

Photos: UF William Crow

Developing Refugia

Beneficial Attracting Plants - Refugia – Do They Work?

Seven spotted lady beetle, Photo: **Jerry A. Payne, USDA Agricultural Research Service, Bugwood.org**

<u>Soft Insects</u>
(Lady Beetle)

- **Dill**
- **Sunflower**
- **Cosmos**

Beneficial Attracting Plants – Refugia – These Worked – Extra Floral Nectaries, Trichomes & Pollen

Photos: M. Doğramacı

Photo: UF Russ Mizell, PhD

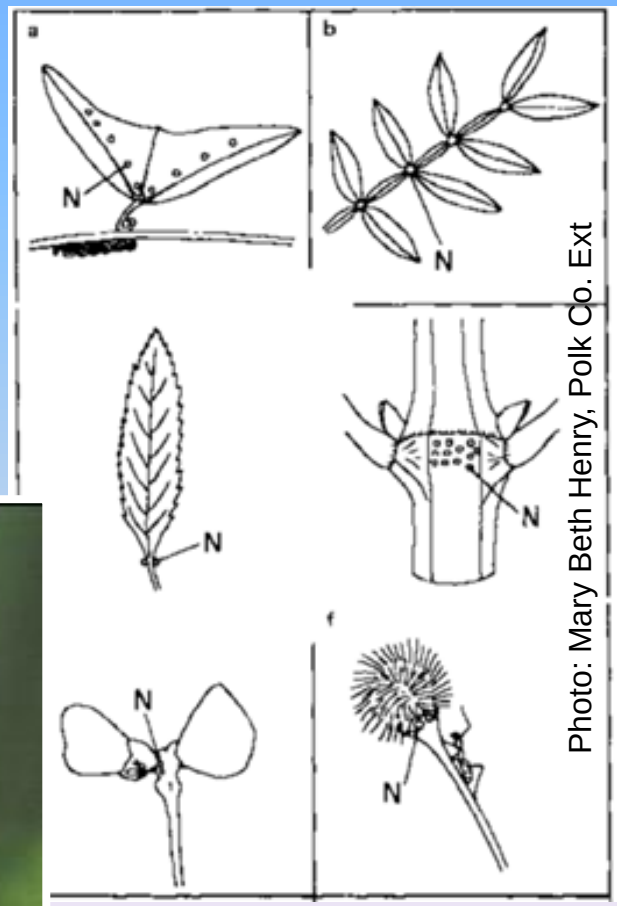


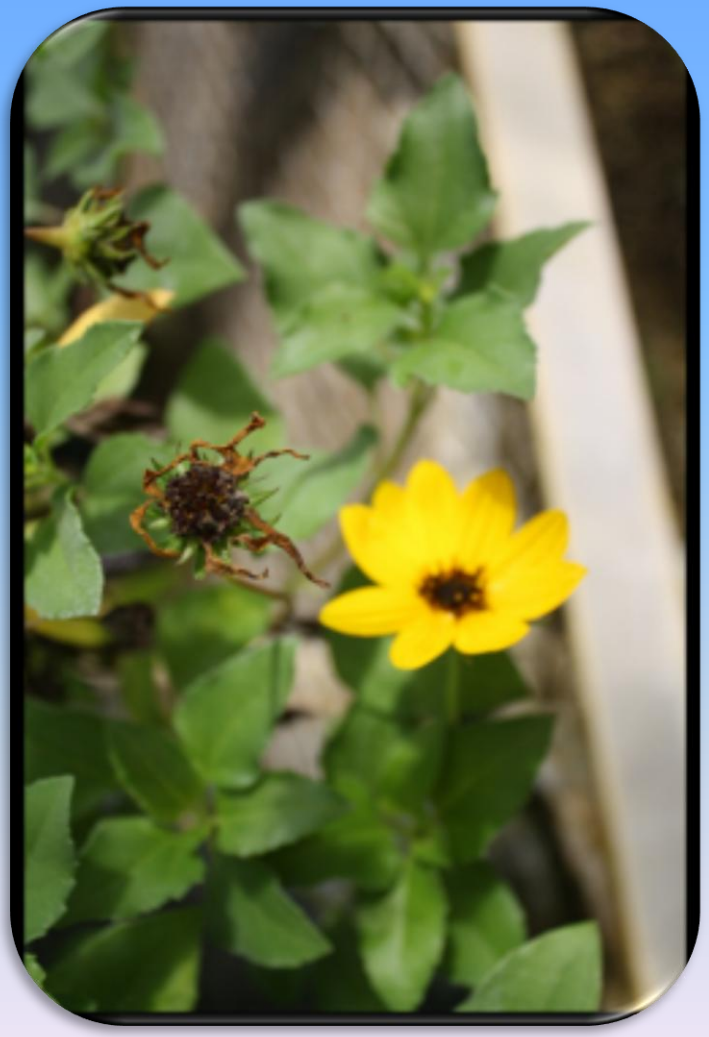
Photo: Mary Beth Henry, Polk Co. Ext

Explosive Ember & Red Missile Ornamental Pepper

Photo: ParkSeed.com

Photo: PanamSeed.com

Snow Princess TM Alyssum & Beach Sunflower



Photos: Mary Beth Henry, Polk Co. Ext

Beneficial Attracting Plants

<u>Caterpillar</u>
(Parasitic Wasps)

- **Beach Sunflower**
- **Gaillardia**
- **Spearmint**
- **Parsley**
- **Coreopsis**
- **Basil**

Beneficial Attracting Plants

Blue Porterweed, Photo: Joy Viola, Northeastern University, Bugwood.org

<u>White Grub</u>
(Parasitoids)

- **Mints**
- **Blue Porter Weed**

Flowers That Attract Beneficial Insects

- Anise hyssop (Agastche foeniculum
- Coriander (Coriandrum sativum)
- Coreopsis (annuals and perennials)
- Cosmos (annuals and perennials)
- Fennel, Dill (Foeniculum vulgare)
- Golden marguerite (Anthemis tinctoria)*
- Lavender
- Sweet alyssum
- Yarrow (Achillea millefolium)
- *Attracted all beneficial insect groups

Insecticides and Beneficials

- Even water will cause some damage
- Avoid organo phosphates (malathion, orthene), pyrethroids (bifenthrin, etc.) and Sevin
- Spray when beneficials are not active
- Short Lasting
- Targeted

Biorational Pesticides

- Home Remedies
  - Hot pepper, beer, egg shells, milk, baking soda, vegetable oil, dish soap
- Insecticidal soaps
- Horticultural oils

Biorational Pesticides

- Microbials (*Bacillus thuringiensis* **Bt)**
- Insect growth regulators (IGRs)

- Interesting behavioral “fever” response in some infected insects
- Lots of research and development, some public concern
- Some use, especially in baits
- Infected insects change color

Fungi

- *Metarhizium anisopliae* is registered in the U.S. for control of household cockroaches

- *Beauveria bassiana* for control of various insects (Mycotrol)

- **Sensitive to desiccation and UV light**
- **Need high humidity to germinate**
- **Do not need to be ingested. Spray directly on the pest**
- **Can kill insects in various life cycle stages**

- Takes several days to kill the insect
- Becoming commercially available to homeowners

- Many are naturally occurring in Florida and others species can become established

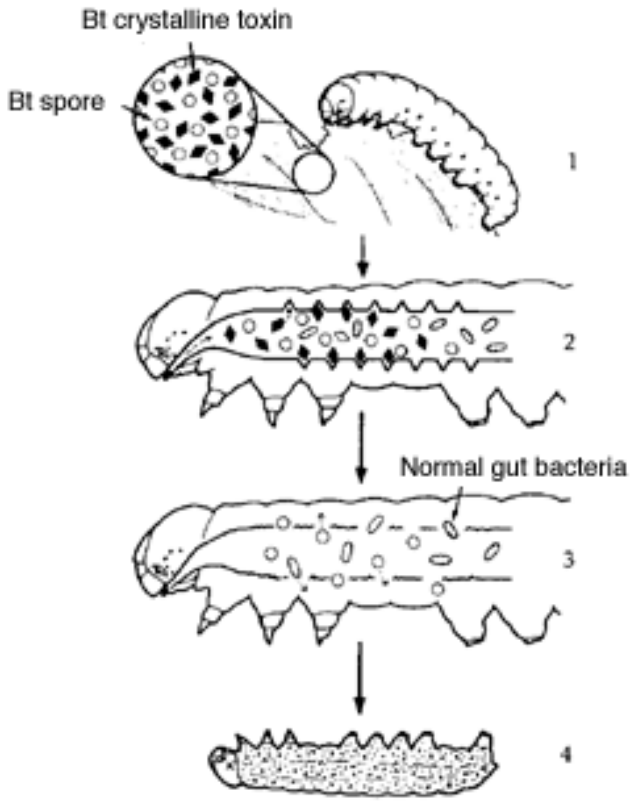
Bacteria

Bacillus thuringiensis specificity
var. *kurstaki* - caterpillars
var. *israelensis* - mosquito, black fly, and fungus gnat larvae

European corn borer larvae infected with *Bacillus thuringiensis*.
Courtesy Nova Nordisk Entotech, In

Best known are toxins produced by *Bacillus thuringiensis* (Bt)

Action of *Bacillus thuringiensis* var. *kurstaki* on caterpillars



1) Caterpillar consumes foliage treated with Bt (spores and crystalline toxin).
2) Within minutes, the toxin binds to specific receptors in the gut wall, and the caterpillar stops feeding.
3) Within hours, the gut wall breaks down, allowing spores and normal gut bacteria to enter the body cavity; the toxin dissolves.
4) In 1-2 days, the caterpillar dies from septicemia as spores and gut bacteria proliferate in its blood.

Bt (Bacillus thuringiensis)

- Multiple sprains lessen the risk of resistance
- apply in the evening or cloudy days (UV light deactivates it quickly)
- caterpillars die 2-3 days later but stop feeding some after ingestion
- spray on foliage including undersides, pest has to ingest the bacteria
- more effective on younger immature insects

- Has to be reapplied if needed (does not become established)
- Active for only a few days
- Commercially sold as Dipel, Thuricide, Caterpillar Killer, etc.
- Easily bought at most garden centers

Sources of Beneficials

Vendors of Beneficial Organisms in North America (UK Pub)

http://www.ca.uky.edu/entomology/entfacts/entfactpdf/ef125.pdf

Biobest http://www.biobest.be/home

Koppert Biological Systems

http://www.koppert.com

Featured Creatures Web Site for Biology Information

- Web Address
  http://entomology.ifas.ufl.edu/creatures

More Resources

Solutions for Your Life (EDIS)

- http://solutionsforyourlife.com

Extension Soil Testing Lab

Plant and Soil Nutrients

- http://soilslab.ifas.ufl.edu/ESTL%20Tests.asp

Nematode Assay

- http://edis.ifas.ufl.edu/SR011

Florida Extension Plant Disease Clinic

- http://plantpath.ifas.ufl.edu/pdc/default.htm

Insect Identification Service

- http://edis.ifas.ufl.edu/SR010

Thanks To For Information, Pictures and Slides!

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- Catharine Mannion, PhD, UF Tropical Research and Education Center
- Norm Leppla, UF Entomology and Nematology Department
- William Crow, PhD, UF Entomology and Nematology Department

Beneficial Insects

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Palm Beach County

COOP. E X T E N S I O N SERVICE

Additional Information Chemical Pesticides

- Insecticides
- Miticides
- Fungicides
- Bactericides
- Herbicides

Some Chemical AI's for Homeowner Use

- Acephate
- Bt - *Bacillus thuringiensis*
- Bifenthrin
- Boric Acid
- Carbaryl
- Cyfluthrin
- Cyhalothrin
- Cyhalothrin
- Deltamethrin
- Diatomaceous Earth
- Disulfoton
- Dimethioate
- Eugenol (Clove Oil)
- Esfenvalerate
- Fenoxycarb
- Hydramethylnon
- Insecticidal oils
- Imidacloprid
- Imiprothrin
- Malathion
- Metaldehyde
- Neem Oil
- Permethrin
- Pyrethrin
- Resmethrin
- Soaps
- Spinosad
- Sulfur
- Tetramethrin
- Tralomethrin
- Trichlorfon

Management

Product	Active Ingredient	For
Sevin	Carbaryl	Citrus
Spectracide Triazicide Insect Killer	Gamma-Cyhalothrin	Citrus
Bayer Advanced: Fruit, Citrus, and Vegetable Insect Control (Pre-Harvest Interval Varies)	Imidacloprid	Atemoya, Avocado, Banana, Barbados Cherry, Black Sapote, Canistel, Citrus, Custard Apple, Feijoa, Grape, Guava, Jaboticaba, Longan, Lychee, Mamey Sapote, Mango, Papaya, Passion Fruit, Peach, Persimmon, Plantain, Plum, Pomegranate, Rambutan, Raspberry, Sapodilla, Soursop, Spanish Lime, Star Apple, Star Fruit, Sugar Apple, Wax Jambu
Ortho Max Malathion (Pre Harvest Interval Varies)	Malathion	Avocado, Citrus, Mango, Peach,
Green Light Neem	Neem	Avocado, Banana, Citrus, Coconut, Date, Fig, Grape, Guava, Loquat, Mango, Nectarine, Papaya, Passion Fruit, Peach, Persimmon, Pineapple, Plantain, Pomegranate, Raspberry,

More Management

Product	Active Ingredient	For
Protech: Sniper Yard & Garden	Permethrin	Fruits, Nuts
Ultra-Pure Oil	Petroleum Oil	Avocado, Banana, Citrus, Coffee, Fig, Grape, Mango, Nectarine, Papaya, Peach, Pineapple, Plantain, Plum
EcoSmart: Organic Garden Insect Killer	Herb Oils	Fruit Trees
Green Light Lawn and Garden Spray with Spinosad 2 (thrips only) (Pre Harvest Interval Varies)	Spinosad	Avocado, Citrus, Custard Apple, Grape, Guava, Longan, Lychee, Mango, Papaya, Passion Fruit, Rambutan, Raspberry, Sapodilla, Sapote, Star Apple, Star Fruit, Wax Jambu

Management

Product	Active Ingredient	For
Spectracide Triazicide Insect Killer	Gamma-Cyhalothrin	Fruits, Nuts
Bayer Advanced: Fruit, Citrus, and Vegetable Insect Control	Imidacloprid	Avocado, Banana, Barbados Cherry, Black Sapote, Canistel, Carrot, Citrus, Custard Apple, Feijoa, Grape, Guava, Jaboticaba, Longan, Lychee, Mamey Sapote, Mango, Papaya, Passion Fruit, Peach, Persimmon, Plantain, Plum, Pomegranate, Pulasan, Rambutan, Raspberry, Sapodilla, Soursop, Spanish Lime, Star Apple, Star Fruit, Sugar Apple, Wax Jambu
Natural Guard Spinosad	Spinosad	Avocado, Cashew, Citrus, Collards, Corn, Custard Apple, Grape, Mango, Nectarine, Papaya, Passion Fruit, Peach, Raspberry, S tar Apple, Star Fruit

Beetle/Weevil Management

Product	Active Ingredient	For
Spectracide Triazicide Insect Killer	Gamma-Cyhalothrin	Fruit, Nuts
Bayer Advanced: Fruit, Citrus, and Vegetable Insect Control	Imidacloprid	Many as before
Ortho Max Malathion	Malathion	Avocado, Citrus, Grape, Mango, Peach
Southern Ag: Triple Action Neem Oil	Neem	Fruit, Nuts
Ferti-Lome: Triple action plus	Pyrethrum and Neem	Fruit, Nuts
Natural Guard Spinosad	Spinosad	Avocado, Cashew, Citrus, Custard Apple, Mango, Nectarine, Papaya, Passion Fruit, Peach, Raspberry, S tar Apple, Star Fruit

Management

Product	Active Ingredient	For
Ultra-Pure Oil	Petroleum Oil	Avocado, Banana, Citrus, Coffee, Fig, Grape, Mango, Nectarine, Papaya, Peach, Pineapple, Plantain
EcoSmart: Organic Garden Insect Killer	Rosemary Oil, Peppermint Oil, Thyme Oil, Clove Oil, Mineral Oil, Octadecenoic Acid Potassium Salt	Fruit, Nuts
Sulfur	Sulfur	All

Veggie Garden Products Found at Lowes & Home Depot
February 2011

Brand Name	Active Ingredient
Bayer Fruit, Citrus and Vegetable	Imidacloprid
Bayer Vegetable and Garden Insect Spray	Cyfluthrin
Bayer Advanced Complete Insect Dust	Permethrin
Bayer Natria	Sulfur
Bonide Garden Dust	Sulfur
Insecticidal Soap	Insecticidal Soap
Malathion	Malathion

Veggie Garden Products Found at Lowes & Home Depot

February 2011

Brand Name	Active Ingredient
Ortho Max Flower Fruit and Vegetable Insect Killer	Acetamiprid
Ortho Max Lawn and Garden Insect Killer	Bifenthrin
Sevin Dust	Carbaryl
Southern Ag Malathion Oil	Malathion & Insecticidal oil
Southern Ag Neem Oil	Neem
Southern Ag Thuricide	Bt
Volck Oil Spray	