Facilitating biological control of insect pests on ornamental crops

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Where do you work?

1. California
2. Oahu
3. Kauai
4. Maui
5. Molokai/Lanai
6. Big Island
7. American Pacific Islands
8. Other
How many of you grow (as your primary commodity)....

1. Ornamental crops
2. Greenhouse vegetables or fruits
3. Outdoor vegetables
4. Fruit trees
5. Bees
6. A different commodity
7. I am an educator/extension agent
8. I am an administrator/regulator
9. I am a researcher
10. My job is not listed above
Nursery, greenhouse, floriculture, and sod: products in Hawaii: 1628 farms, $119 million in 2007

Vegetables, melons, potatoes, and sweet potatoes: 866 farms, $61 million in 2007

Major ornamental commodities:
- orchids (cut and potted)
- anthuriums (cut and potted)
- Dracaena
- potted palms
Common pests on nursery plants:

- Thrips
- Aphids
- Whiteflies
- Scales
- Mealybugs
- Mites
- Caterpillars
- Nematodes
- Slugs
- Snails
1. Thrips
2. Aphids
3. Scales
4. Mealybugs
5. Mites
6. Beetles
7. Stinging wasps
8. Fruit flies
9. Caterpillars
10. I like insect pests
Pest management strategies will depend on:

- Market and market destination
- Tolerance of commodity for pest
- Attitude of grower
- Which techniques work for the major pest(s)
Introduction of exotic natural enemies (classical biological control) (e.g. gall wasp parasite for Erythrina)

Mass-production and release of natural enemies

Conservation/augmentation of existing natural enemies

Use of microbial pesticides (Beauveria bassiana, Steinernema carpocapsae)

Planting resistant cultivars
Pests are the exception. The majority of insect species which feed on the host plant are rare. These species might be rare because good habitat is limited, or because natural enemies reduce the pest in a density dependent fashion.
Pest populations typically go up and down due to:

*Weather, Natural enemies, Dispersal, Pesticides, and Changes in plants*
Biological control is sometimes so effective that it is difficult to observe directly (particularly for wasp parasites and pathogens).

Over-use of insecticides will help you find out if a pesticide resistant pest is under biological control.

If un-sprayed plants have fewer pests, this is also evidence of biological control.
Insecticides/miticides hard on beneficials (broad-spectrum pesticides)

- Organophosphates (acephate, diazinon, dimethoate, chlorpyrifos, malathion)
- Organocarbamates (carbaryl, bendiocarb)
- Many pyrethroids (e.g. Decathlon, Topside, Bifenthrin)
Insecticides/miticides easy on beneficials

- Pesticides with little residual effect (soaps, oils)
- Pesticides that affect some types of insects/mites more than others (Conserve, Avid, and microbials such as BotaniGard and Bacillus thuringiensis (Bt))
- Insect growth regulators (neem, Distance, Enstar, Talus)
- Systemic insecticides active via plant uptake (Merit, Marathon, Safari, TriStar)
Which of these insects are ladybugs?

1. A
2. B
3. A and C
4. A, B, C and D
Cryptolaemus montrouzieri and Harmonia axyridis
Scale insects are frequently controlled by parasitic wasps and insect pathogens. Aphids and mealybugs are frequently controlled by parasitic wasps and coccinellid beetles. Whiteflies are frequently controlled by parasitic wasps.
Green scale (*Coccus viridis*) with *Verticillium* fungus (right side)
Mealybugs on gardenia and emergence holes of parasitic wasp species (bottom middle, bottom right)
Banana moth in Dracaena stem

Pest of *Dracaena*, Coffee, Palms, and others
Use Bt (*Bacillus thuringiensis*) or insect-eating nematodes
Mass-produced by Becker Underwood (product name: Millenium) Nematodes are mixed with water, sprayed on crops. Commonly used to control caterpillar pests. Juveniles burst from dead insect and seek out new hosts.

Entomopathogenic Nematode: Steinernema carpocapsae

0.25 Billion Nematodes (in 3x5” bento container)
Some Common thrips on orchids in Hawaii

Thrips palmi

Western flower thrips

Vanilla thrips

Western flower thrips
- Quarantine pests
- Cause scarring, twisting, loss of blossoms

Thrips palmi
Natural Enemies of Thrips

In vegetable “glasshouses,” most important 3 biocontrols:

- Spores of insect-killing fungi (*Beauveria bassiana* or Botanigard)
- Mites that predate on thrips nymphs
- Minute pirate bugs
Beauveria bassiana (BotaniGard, Mycotrol) on coffee berry borer
Minute Pirate Bugs (Orius spp.) in Hawaii

- *Orius* are occasionally seen in orchids in East Hawaii island where thrips problems are frequent. Most growers would mistake them for thrips.
- A ratio of 20 thrips to 1 *Orius* leads to control of thrips
Macaranga tanarius
Blush Macaranga or Parosol Leaf Tree

Photo - Starr
Macaranga tanarius trees along roadside in Keaau, HI
Dioecious trees blooming year round in Hawaii

Panicles of male flowers & Female flowers and seed pods
Prey, Predators & Pollinators

- Thrips on the Big Island: *Dolichothrips nesius* (Stannard)

- Big Island Anthocorids: *Orius persequens* (White) *Montandoniola confusa* (Streite & Matocq)
Orius (minute pirate bugs) are the main pollinators of Macaranga tanarius. Plants provide a nectar and a breeding site for minute pirate bugs.

A new pollination system: brood-site pollination by flower bugs in Macaranga (Euphorbiaceae) by Chikako Ishida, Masumi Kono and Shoko Sakai 2008 Annals of Botany
Dendrobium orchid sprays were infested with 400-500 Western Flower Thrips larvae, *Frankliniella occidentalis*.

- **Experiment 1:** 1, 5, 10 meters from *Macaranga tanarius* panicles which had an average of 50 Orius per 30 centimeters.
- **Experiment 1:** 1, 5 and 10 meters.
Dioecious trees blooming year round in Hawaii

Panicles of male flowers

Female flowers & seed pods
Questions?