



Biological and Cultural Pest Controls in the Debra Ann November Research Greenhouse

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No Chemicals Used in Food Production

Once food production commenced in the greenhouse, the use of chemical pesticides to control insect and disease problems in the greenhouse ceased

Only biological, cultural, mechanical and non-chemical applications and practices are employed



<http://www.pesticidefreezone.org/>

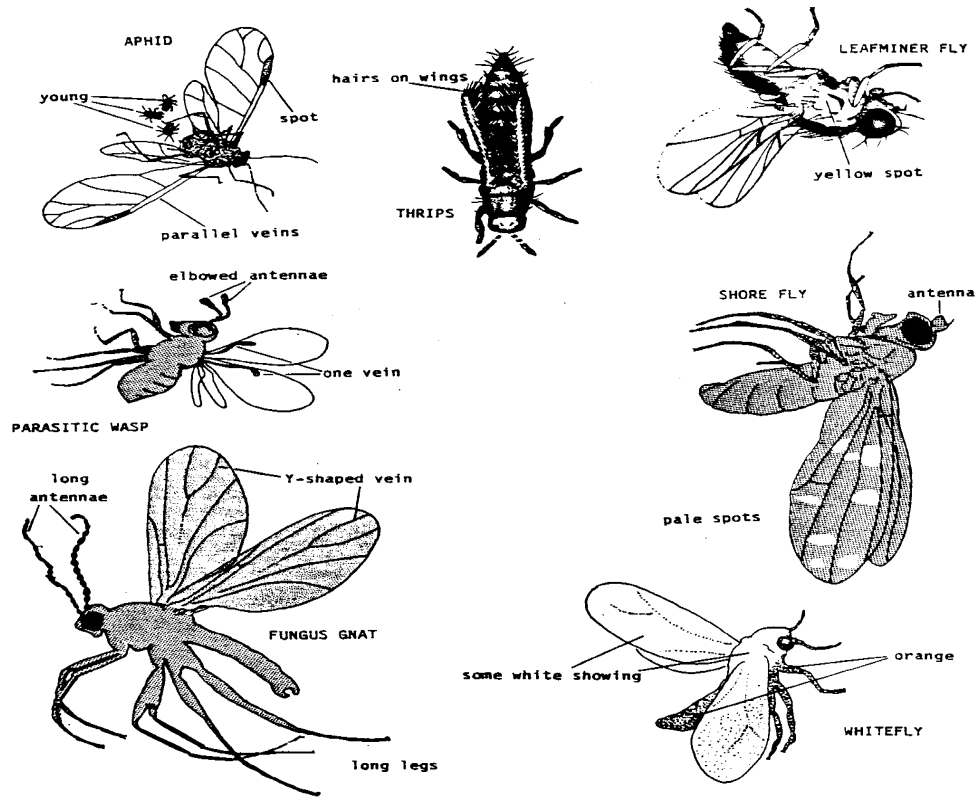
Common Greenhouse Pests at the Debra Ann November Research Greenhouse

Aphids (1351 recognized spp. with 224 genera all in the family Aphididae)

Whiteflies (*Trialeurodes vaporariorum*)

Fungus Gnats (*Bradysia coprophila*, family Sciaridae and Mycetophilidae)

Greenhouse Pests



<http://ag.udel.edu/enwc/faculty/dmcaron/Apiology/Greenhouse%20IPM.htm>

Pest: Aphids

Can be monophagous or diphagous

Feed on the sap of phloem



Each female can literally produce billions of offspring in one lifetime (20-40 days), they are born pregnant (parthenogenic).

Can produce winged and non-winged individuals depending on need to migrate

Pest: Whiteflies



Feed on plant phloem

Reproduce within 24 hours of emergence into adult stage

Can be a vector of plant disease as they fly between and among plants

Resistant to many chemical pesticides

Pest: Fungus Gnats

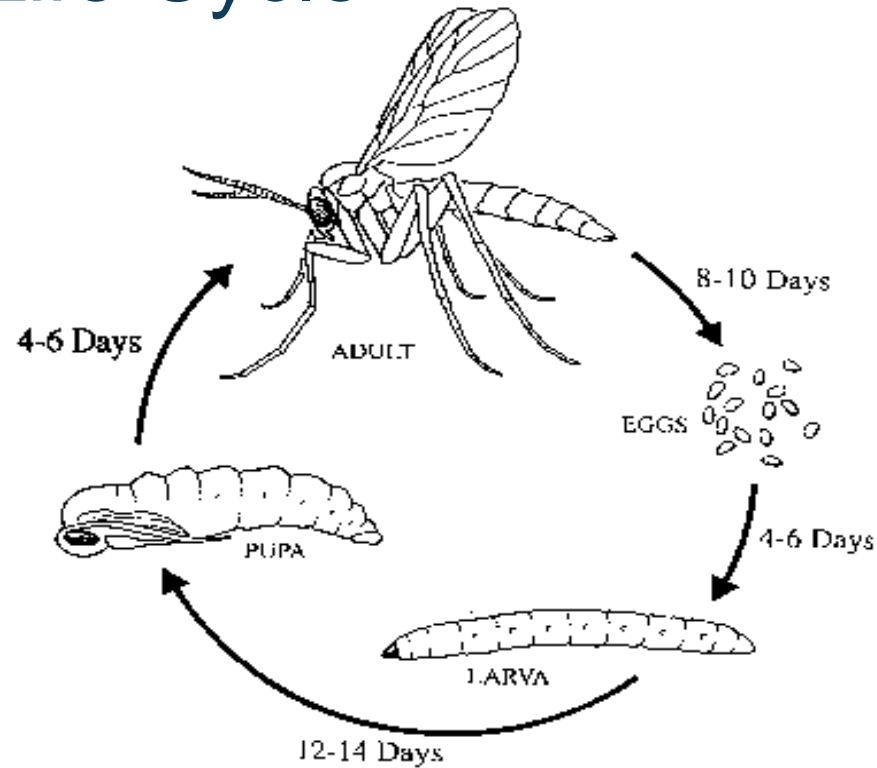
Larvae feed on fungus in soil and plant roots

Larvae cause plant stress

Adults are vectors for plant disease

Rapidly reproduce, laying 100-300 mostly female eggs during their ten day adult life cycle

Fungus Gnat Life Cycle



http://www.umass.edu/umext/floriculture/fact_sheets/pest_management/fungnat.html

Bio-Controls

Predators- consume either eggs, larvae, pupae or adults of insect pests

Parasitoids- insect pests serve as host for parasitoid species, forfeiting their life in the process



Predators

Lady Bugs (*Hippodamia convergens*)

Delphastus (*Delphastus catalinae*)

Hypoaspis (*Hypoaspis miles*)

Nematodes (*Steinernema feltiae*)

Lacewings (*Chrysoperia carnea*)



Predator: Ladybugs

Feed on aphids, whiteflies, mites, weevils, adelgids, other beetle larvae

Larvae consume 50-60 aphids per day

Will consume up to 5,000 aphids on a lifetime

The most common of all beneficial insects

Lady Bugs on Bamboo Stake



Predator: *Delphastus*

Predatory beetle



Both larvae and adult will feed on all stages of whitefly or spidermites

1 month lifespan

Females lay 3-4 eggs per day

Predator: *Hypoaspis*

Predatory mite



Feeds on larvae of fungus gnat in the soil and will feed on thrips in the absence of fungus gnats

Lifecycle is approximately 18 days

Consumes 1-5 larvae per day

http://picasaweb.google.com/lh/photo/yB_MqAMCE-B8JtfBn475OA

Predator: Nematodes



http://soils.usda.gov/sqi/concepts/soil_biology/nematodes.html

Microscopic non-segmented worms

Both a predator and parasite as they enter their prey through body openings and feed from within

Lay offspring (up to 200,000) in prey which in turn feeds on prey

Can live for over six months; good long term control

Predator: Lacewings



<http://ag.arizona.edu/maricopa/garden/html/t-tips/bugs/lacewing.htm>

Larvae feed on aphids, mealybugs, spider mites, leafhopper nymphs, caterpillar eggs, scales, thrips, and whiteflies

Adults are omnivores

Performance is variable as they can be cannibalistic

Jar of Aphidoletes



Parasitoids: Aphidoletes



Adults insert eggs into adult aphids

Larvae feeds inside and hatches from aphid “mummy”

Larvae can consume up to 65 aphids/day

Will kill more aphids than can consume when the populations are high

Parasitoids: *Encarsia*

Parasitic wasp



Adult females lay eggs in whitefly nymphs with their ovipositor and consume the exuding blood

Each *Encarsia* can lay up to 200 eggs

Lifecycle about 28 days

Mechanical and Cultural Controls

Monitoring Cards

Insects attracted to the color yellow (white and blue as well)

Used to detect levels and variety of pest pressure in an area

Serves as a control measure as well since insects die once they have landed on card and can't escape



Leaf Blower/Vacuum

Used for floor sanitation in greenhouse for insects making a home down low

Used to extract mostly flying insects from infested plants

Effectiveness varies depending on pest species



Temperature Variations

Each room in greenhouse can be set to different temperatures. Crops that can tolerate lower temperatures are expected to in order to keep insect populations in check

Pots and containers that have had insects in them are placed out in the cold to kill any lingering eggs

Crops that can tolerate colder temperatures (greens) are placed outside on cool nights in late spring to control pest populations

Getting Rid of Infested Plants

If a plant or plants has a high pest population and other bio-controls have failed, it is added to the compost pile

This can reduce overall yields, but is preferable to widespread outbreak



Tolerating Low Levels of Pests

Part of an IPM (integrated pest management) strategy is to tolerate the inevitable presence of some pest species.

A “Zero-Tolerance” approach is unrealistic and can only be achieved with heavy chemical pesticide use, which pests eventually build up a tolerance to

Spray Applications

Spraying is still necessary at times, but only with OMRI (Organic Materials Review Institute) approved and organic applications



http://www.sapiensman.com/tools_and_equipment/equipment_store75.php

Plant Derived Solutions

Neem Oil- this is both an insecticide and fungicide that can be used on a wide range of edible crops and is derived from the seeds of the Neem Tree of India



Pyrethrins (NOT Pyrethroids)-this is a plant derived insecticide from the chrysanthemum that has effectively been used in greenhouse pest control for decades



Sucra Shield



Sucra-Shield- a sugar based solution that kills insects by smothering them

<http://www.4hydro.com/growroom/sucraShield.asp>

Mycotrol



Mycotrol- a fungus that the pest species ingest and kills them, but is harmless to plant species and humans

<http://www.organicgardeningpractices.com/lacebugs.php>

Results

After one year of observation, best results at the Debra Ann November Research Greenhouse, are obtained by a combination of:

- Ladybugs
- Nematodes
- Aphidoletes
- Mycotrol

Sources

<http://www.ipmlabs.com/>

<http://www.buglogical.com/>

<http://www.koppert.com/>

Contact Information

For more information about bio-controls in the greenhouse or the Farm Food Program, visit :

<http://studentaffairs.case.edu/farm/food/>

Or e-mail Chris Bond at cjb88@case.edu