

5 Ways to Create Continuous Biocontrol in Greenhouses



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Today's topics

- ▶ Biological control basics
- ▶ Continuous presence of beneficials
- ▶ Banker Plants
- ▶ Habitat Plants
- ▶ Pollen supplementation
- ▶ Ephestia egg supplementation
- ▶ Breeding Sachets
- ▶ Spider mite banker plant research supported by SARE grant.

What are biocontrol agents (BCAs) ?
Natural Enemies of pests manipulated by humans

Microbials	<ul style="list-style-type: none"> • Bacteria • Fungi • Viruses • Microsporidians
Beneficial Nematodes	<ul style="list-style-type: none"> • AKA Entomopathogenic Nematodes (EPNs) • AKA Insect Parasitic Nematodes (IPNs)
Beneficial Insects and Mites	<ul style="list-style-type: none"> • Parasites • Predators

Fundamentals of Successful Biocontrol

- ▶ Keep pest numbers low from the beginning. Biocontrol is preventative
- ▶ Right BCA's for the pest identified
- ▶ Be sure that the biocontrols are constantly exerting pressure on the pest
- ▶ Compatible chemicals

Somewhat compatible pesticide list

Azatin (this is an Azadirachtin)
MoltX (this is an Azadirachtin)
Botanigard
Endeavor/Fulfill
Pyrethrum (Pyreth-it, Pyganic)
Pyganic (organic pyrethrum)
Floramite
Suffoil X (Mineral oil, organic)
Kontos (systemic)
Mainspring (systemic)
Avid
Conserve

Repeated applications

- ▶ One way to assure constant presence of BCAs
- ▶ Apply fresh BCAs weekly or every other week

What kinds of beneficials are released continuously?

- ▶ Nematodes, weekly for thrips
- ▶ Cucumeris, weekly or biweekly for thrips
- ▶ Predatory mites for spider mites biweekly or monthly
- ▶ Aphid parasites and aphid midges weekly or biweekly

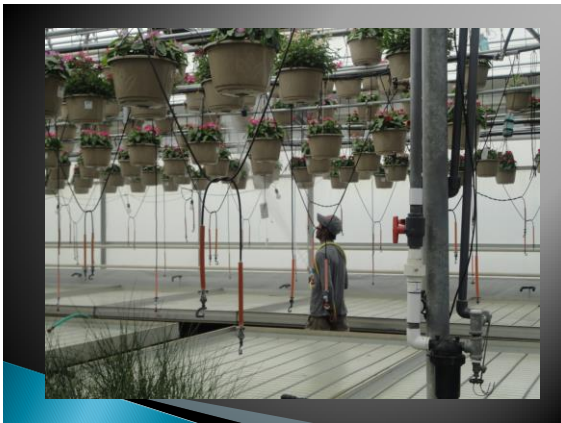
Thrips control with nematodes new and unexpected, not scientifically proven but there are 7+ years of success

Roger McGaughey
Michaels Greenhouse
2009



250 million beneficial nematodes (*S. feltiae*) per 1.5 A weekly for thrips control along with wetting agent, Capsil

Sprayed in high humidity, (evenings, rainy days) so the nematodes are not inactivated by drying



Mechanized application techniques

- ▶ Modified leafblower makes application of predatory mites for Spider mite and Thrips control in just minutes

Modified Leafblower for regular application of Cucumeris for thrips



Why Time Treatment for the First Generation?

Pest	Reproduction	Time Period
Aphids	3-6 live young	daily
Fungus Gnats	100-300 eggs	7-10 days
Spider Mites	90-200 eggs	8-12 days
Thrips	25-200 eggs	10-21 days
Whitefly	8-400 eggs	9-40 days

Timing is IMPORTANT

Ten-fold increase per generation			Number of Survivors	
Time	Generation	Number	30% kill (70% survivors)	80% kill (20% survivors)
3 wks	1 st	1000	700	200
6 wks	2 nd	5000	3500	1000
9 wks	3 rd	25000	17,500	5000
12	4 th	125,000	87,500	25,000

Aphid Population Growth With No Natural Enemies or Pesticides and a 3-day doubling time

Day #	0	3	6	9
# Aphids	100	200	400	800

Aphid Population Growth With No Natural Enemies or Pesticides and a 3-day doubling time

Day #	12	15	18	21
# Aphids	1,600	3,200	6,400	12,800

Aphid Population Growth With No Natural Enemies or Pesticides and a 4-day doubling time

Day #	0	4	8	12
# Aphids	100	200	400	800

Aphid Population Growth With No Natural Enemies or Pesticides and a 4-day doubling time

Day #	16	20	24	28
# Aphids	1,600	3,200	6,400	12,800

The Exceptions: easy establishers

- ▶ Stratiolys (old name Hypoaspis) soil dweller predator mite which finds all it needs in the substrate after a single release
- ▶ Dalotia (old name Atheta) soil dweller same as the Stratiolys

Dalotia = Atheta (a rove beetle)...
very short elytra (wing covers)

Nematode drench to new flats for fungus gnat control. Dr. John Sanderson's study shows that these nematodes persist for many weeks.



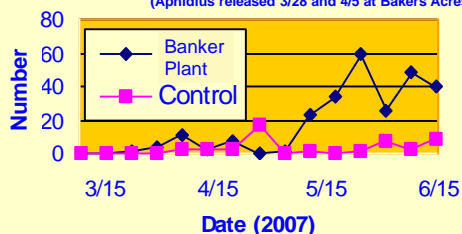
Aphid Banker Plant

Cereal aphid plus
Aphidius colemani or
Aphidoletes



Number of Aphid Parasites on Sticky Cards by Week

(Aphidius released 3/28 and 4/5 at Bakers Acres)



Habitat: ornamental peppers

- ▶ Pepper flowers are a favorite habitat of Orius
- ▶ The # of Orius is directly related to the # of pepper flowers
- ▶ The flowers offer pollen and small "rooms" to keep the Orius nymphs away from each other

Any ornamental pepper but
black pearls are not flowers!



Purple Flash works particularly well

- ▶ Faster flowering
- ▶ Long bloom period

Sweet alyssum
another favorite of Orius



Habitat baskets at Baker's Acres
2005



Photo by Joe Ogruzek

Photo by Betsy Lamb

Flower habitats set up for Orius



Outdoor habitat for beneficials includes
flowers for Orius and barley aphid banker
plant



Dicyphus hesperus / mullein

- ▶ Mirid bug on first year mullein plants



Generalist predator used for whitefly control in vegetables.

“New” predator foods

- ▶ Cattail pollen to support predatory mites
- ▶ Ephestia eggs for Orius and Dicyphus

Cattail Pollen

- ▶ Supports Swirskii
- ▶ Resistant to Botrytis
- ▶ Spread very thinly to avoid feeding thrips
- ▶ 500 g per ha (5 g / 1000 sq ft)

Ephestia Eggs

- ▶ Grain moth eggs
- ▶ Tiny eggs, about the size of pollen
- ▶ Adds a little meat to the plant diet on habitat plants
- ▶ Add some every week or 2

Breeding units

- ▶ Self-contained
- ▶ Cucumeris for thrips and broad mite
- ▶ Swirskii for whitefly & thrips & broad mite

Predator
Cucumeris



Prey
Grain Mite



Sachets or slow release bags Minisachets for hanging baskets.



Banks grass mite on corn to support spider mite predators

- ▶ 2016 SARE grant
- ▶ A method demonstrated by Dr. Lance Osborne in Apopka FL
- ▶ Attempted to address a need in tomatoes to have the predatory midge *Feltiella* establish early before spider mites start to do damage in the tomatoes.



Lance Osborne

Organic CSA near Burlington VT



Andy Jones and Jill Rotondo, BP experimenters beside nursery area



Assessing the Banks grass mite #'s



Tomato greenhouse



Searching for Feltiella on banker plants in tomato greenhouse



Spider mite predator beetles & immatures common on BP system



Numerous Feltiella larvae on bean trap plants



Experimental outcome

- ▶ Feltiella colonized the corn briefly but appeared to prefer the beans and tomatoes
- ▶ Sandy Menasha alerted us that the Banks grass mite also attacked the beans (broad leaved plants)
- ▶ The best corn (at Nathan Ludlow's) had roots going into the ground under the pot. The corn tassled and fruited. All the over-crowded corn simply died.

For Success:

- ▶ Select the right BCA for the pest and habitat
- ▶ Release early, when the pest first gets started
- ▶ Create continuous presence
- ▶ Avoid pesticides harmful to BCAs

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Thank you!

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