Beneficial Insectary

Reinforcing IPM Strategies with Biological Control

MNLA Winter Forum

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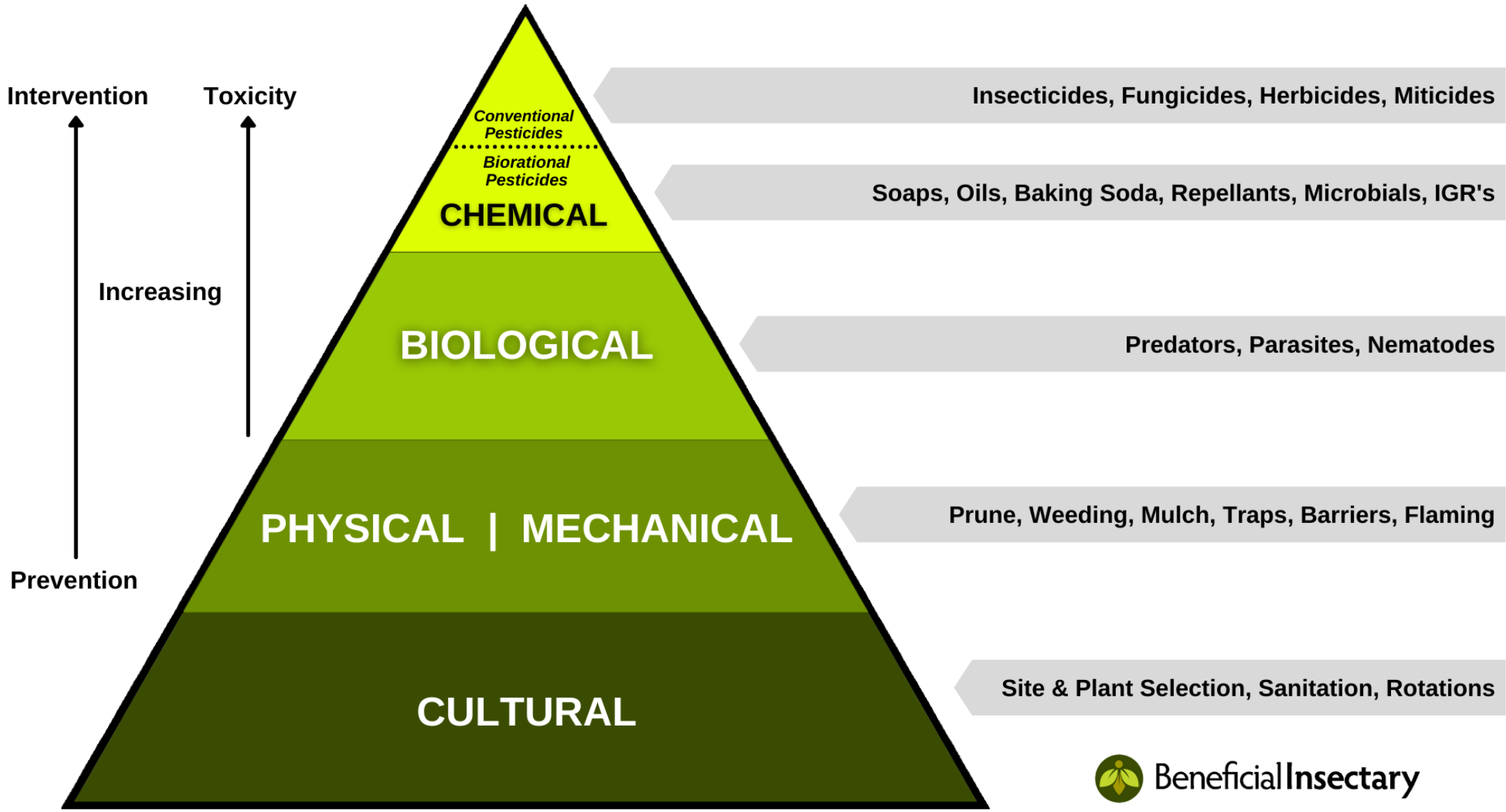
- Greg Bryant
- Technical Lead
- Beneficial Insectary
- Greg@insectary.com



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Key Points

- Biocontrol Basics and Why Starting Early is Critical
- Using the Right Biocontrol Agent (BCA) and Application Method
- Banker Plants – not *critical* to a successful program, but they can be very helpful
- Insectary Plants and Trap Crops
- Other IPM Tips

Why Use Biocontrol?

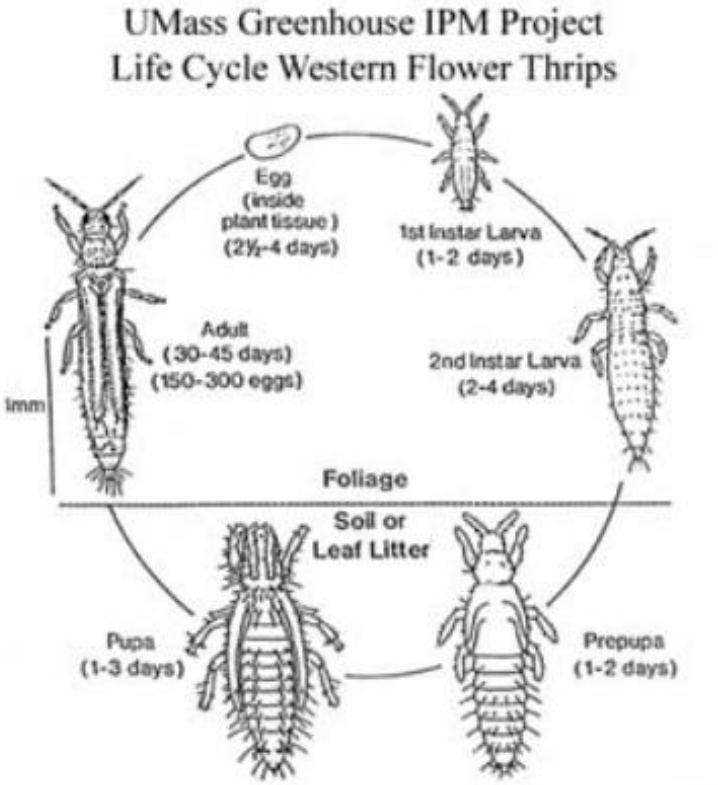
- Safer for people (employees and customers)
- Better for the environment
- Better for your plants
- No REIs or PHIs
- Marketing – retail customers love it
- No resistance to being eaten

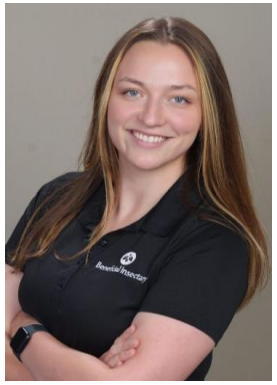
Try Before You **Buy** All The Way Into **Biocontrol**?

Best to use a full biocontrol program in just certain areas of the greenhouse or, even better, in a separate GH altogether

More Than Just See Bug, Spray Bug

- Be proactive, not reactive
- Proper pest ID is important
- Be aware of BCA environmental condition requirements
- Learn pest life-cycles and target each one you can
- **Find good technical support**





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Importance of Identifying Pests

- Thrips biocontrol agents (BCAs) don't work for every species
- Aphid parasitoid wasps are species specific
- *Phytoseius persimilis* doesn't work well against any spider mite species besides two-spotted spider mites
- *Eretmocerus* are better at controlling *Bemisia* whitefly than *Encarsia*

Start Clean By Dipping Young Plants

- Mix of Principle, Rootshield +, and Nematodes
- Low concentration of oils

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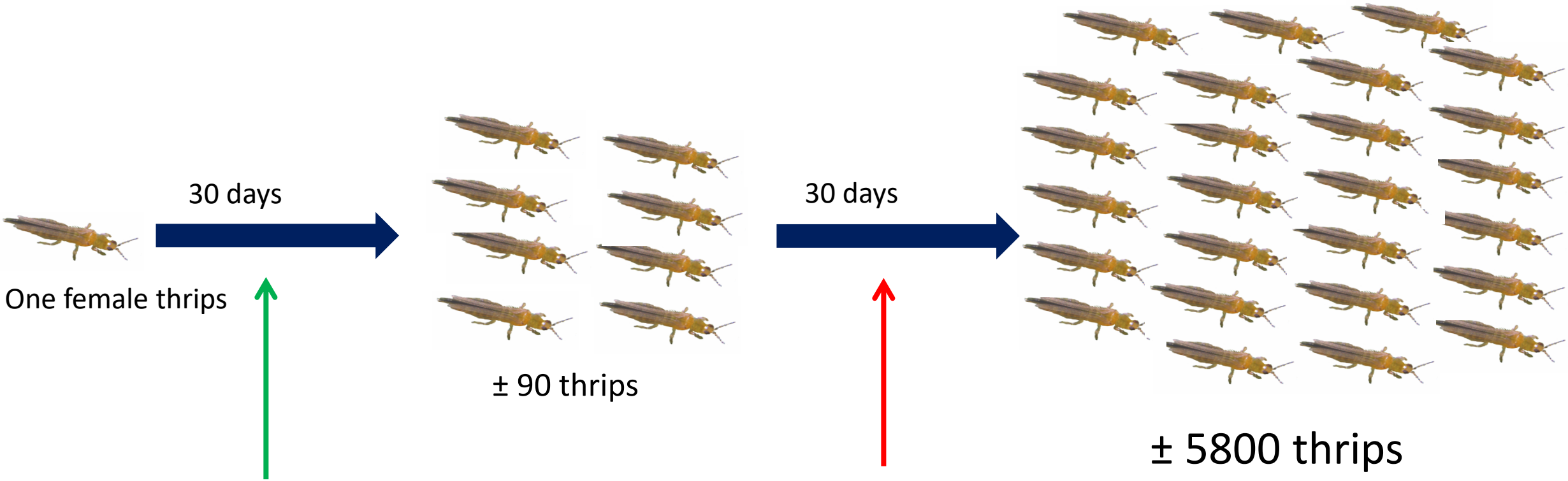
Development of Thrips in 60 Days (at 68°F) in Cucumbers



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Thrips Development and Pollen

- Thrips egg laying capacity **without pollen**: One female thrips will lay **4 to 5 eggs** every day
- Thrips egg laying capacity **with high quality pollen**: **15 eggs** per female per day
- Adult thrips live up to **60 days**
- **900 eggs**!

Temperature Affects on Thrips Life-cycle

	Egg (In leaf tissue)	Larva 1 & 2 (on plant → exposed)	Pupa (in soil)	Adult (on plant → exposed)
68F	6 days	3 + 3 days	6 days	up to 60 days
86F	3 days	1.5 + 1.5 days	3 days	20 - 40 days

Aphids

- Very explosive populations
- **All** aphids are **female** in greenhouses, and most are **born pregnant**
- Almost impossible to ‘repair’ an out of hand situation with BCA’s, especially in ornamentals

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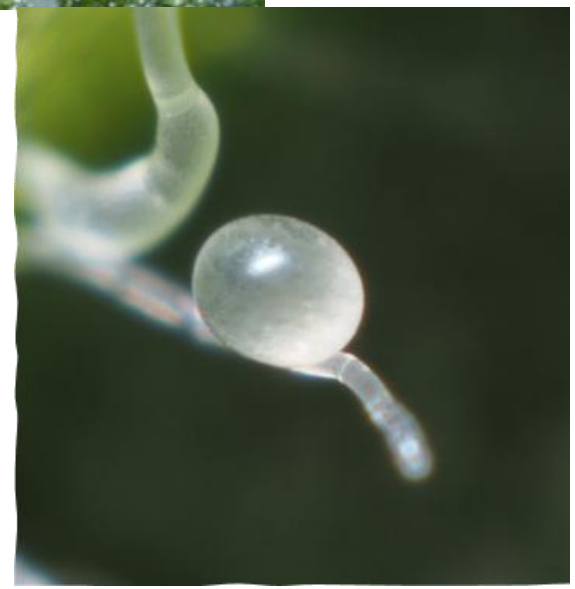
Predatory Mites - *Amblyseius* or *Neoseiulus* spp.

- Foundation and first line of defense for many biocontrol programs
- Impossible to ID in the field
- Generalists but each species has preferred prey
- Thrips, broad mites, whiteflies, spider mites can all be on the menu
- Eggs often found on ends of trichomes
- All mites are wingless – distribution is **critical**



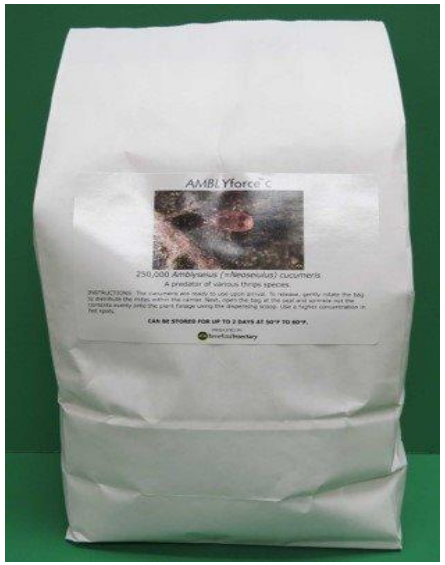
Application Methods

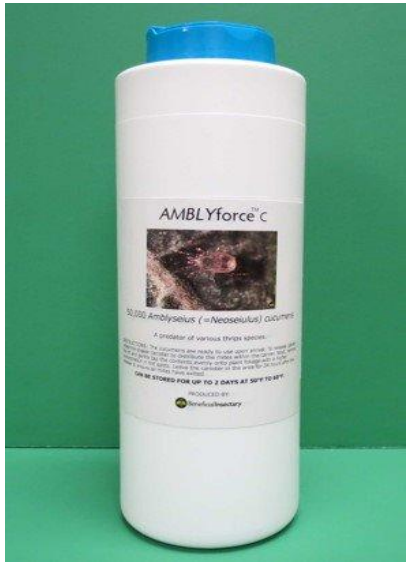
Bulk Formulations

- Carrier – bran, bran/vermiculite, vermiculite. Breeder material is **always** bran

Sachets

- Breeding system that results in consistent production of mites in the crop





Bulk Formulations

Breeder piles

- Bran carrier – lots of bran “feeder” mites
- Shorter longevity compared to sachets
- Can be more cost effective for smaller pot sizes/plugs
- Not used very often anymore

Bulk Formulations

Broadcasting

- Use mostly or 100% vermiculite formulation
- No need for bran mites
  - Less bran = fewer pray mites
- Predatory mites do not establish in crops without pollen or prey
- Need weekly or bi-weekly applications to get population high enough to be effective

Sachets

- Best method when applicable
- Water-resistant paper
- 4-6 weeks of reproduction and release of mites
- More mites over time vs Broadcasting or Breeder Piles

Sachets

What's Inside?

- Bran
- Food for bran mites
- Bran Mites
- Predatory Mites

Humidity is vital for longevity of the sachet

How To Tell Prey From Predator

Bran mite vs *Amblyseius*/*Neoseiulus* spp.

Predatory Mites for Thrips

Amblyseius cucumeris

- Preferred prey items are **thrips** and **broad mites**
- Feeds on L1 thrips only
- Most active from 58-86°F

Amblyseius swirskii

- Preference for **thrips** and **broad mites** plus **whiteflies**
- Capable of feeding on L2 thrips
- Active from 68-105°F, prefers warm/hot

Soil Predators for Thrips Pupae & Fly Larvae

Dalotia coriaria

- Soil-dwelling rove beetle
- Eats thrips pupae and shore fly/fungus gnat larvae
- Adults fly and will search the greenhouses for pests
- Breed your own!

Stratiolaelaps scimitus

- Soil-dwelling predatory mite
- Eats thrips pupae and fungus gnat larvae
- Doesn't fly, but they have strength in numbers
- Can be mixed with *Dalotia* just prior to introduction

Apply ASAP to the soil of young plants or to all new gutters/rafts in hydroponic greenhouses

Soil Predators for Thrips Pupae & Fly Larvae

Nematodes

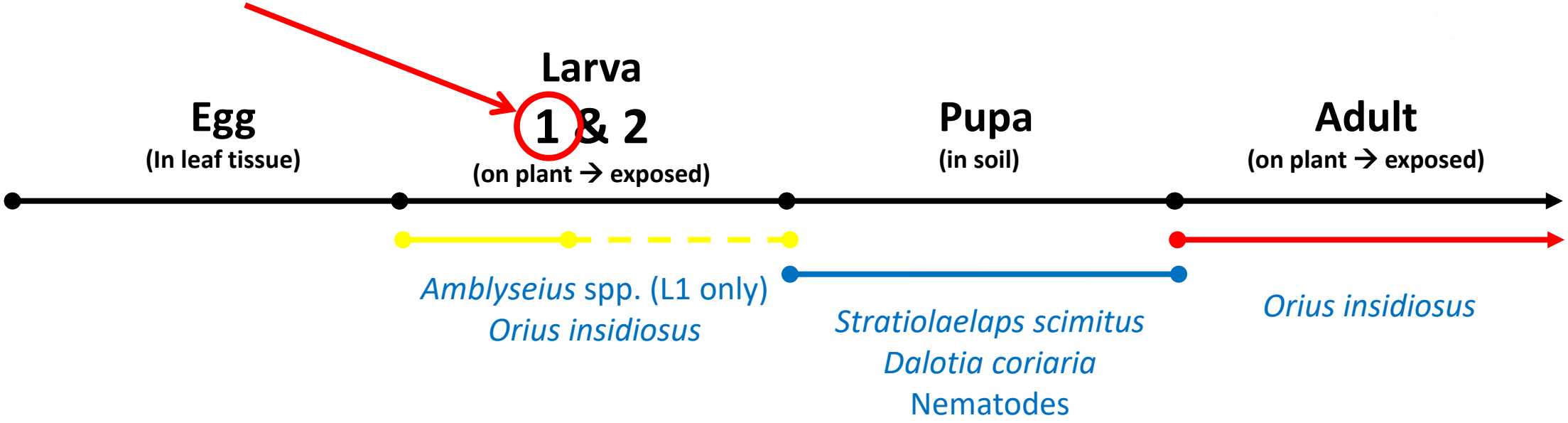
- *Steinernema feltiae*
  - Lives 1-2” below surface
  - Optimal temps 10-26°C (50-78°F)
  - Fungus gnats and thrips

- *S. carpocapsae*
  - Lives on surface
  - Optimal temps 14-29°C (57-84°F)
  - Shore flies and thrips

Orius insidiosus aka Pirate Bugs

- Eats **larval** and **adult thrips**
- Can **kill** up to **80 thrips per day**!
- Also feeds on other small pest like spider mites, moth eggs, etc
- Will feed and establish on **pollen**
- Diapause sensitive → less active at low light levels (under ~12h)

Thrips life cycle and BCA target



Aphid Solutions – Parasitoid Wasps

Aphidius colemani

- **Only** effective against **smaller** aphids (green peach, melon/cotton aphids)
- Will establish on banker plants (bird cherry oat aphids)

Aphidius ervi

- **Only** effective against **larger** aphids (foxglove, potato aphids)
- Will not establish on banker plants (species of aphid used is incompatible)

Know Your Aphids!
Smaller Species

Green Peach Aphid

Cornicles same color as body but tips are black, tubercles convergent

Melon/Cotton Aphid

Always have solid black cornicles

Photo credits:
Influentialpoints.com

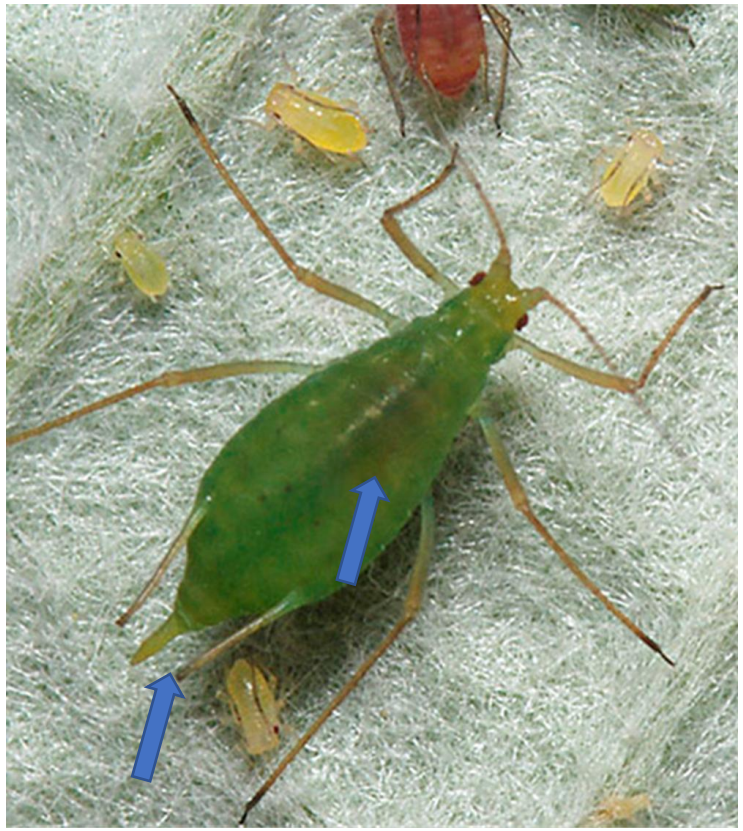
Know Your Aphids!
Larger Species

Foxglove Aphid

Dark spots on body right at cornicles

Potato Aphid

Shaped differently – long legs, cornicles, antennae, cauda, and often has dark stripe



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Aphid Solutions – Predators

Lacewings – *Chrysoperla rufilabris*

- Most aphid species are eaten
- Extremely **aggressive** and always **hungry**
- Also feeds on other small arthropod pests
- **Eggs** or **adults** used for **prevention**
- **Larvae** used for aphid **hotspots**
- Cannibalistic

Aphidius colemani & A. ervi Aphid Parasitoid Wasps	*Chrysoperla rufilabris* Green Lacewings
• Highly mobile and great scouts • Specific to aphid species • Multiple generations • Each female wasps parasitizes dozens/hundreds of aphids • 7-10 days before aphids mummify • Preventative releases or increase rate for hotspots	• Limited mobility within the crop • Multiple species eaten • Usually little to no reproduction • Each larva eats dozens/hundreds of aphids throughout lifespan • Kills/eats aphids right away • Excellent tool for cleaning up small to medium sized outbreaks

IPM Strategies for Aphids in Baskets

- Drenching HBs for aphids, especially calibrachoa
- Mainspring and Kontos rotation

Might Need to Spray?
Don’t Give Up on Biocontrol Too Quickly

Be Aware Of The **Tipping Point**, where BCAs are going to overtake the pest, based on scouting

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Example

- 2018, unusually hot in Massachusetts, a week over 100°F
- Aphid population rapidly increased on ornamental peppers (too hot for BCAs)

One Week Later

- **Half** of aphids mummified
- **Lots** of other **BCAs**
- **The tipping point had been reached**
- Still **lots** of live aphids
- Grower trusted the process and waited to spray to give the BCAs more time to work

Another Week Later Almost All Aphids Were Mummies

Remember, around **half** of the aphids were already **mummified** when I first got there – that was past the **tipping point**!

Banker Plants

- Keeps high populations of biocontrol agents (BCAs) in crop area
- Cereal grains for aphid bankers
- Purple flash pepper and *Alyssum* banker plants for *Orius*
- *Mullein* for *Dicyphus*

Aphid Banker Plants

- Uses grasses (typically cereal grains) with bird cherry oat aphids (BCOA - *Rhopalosiphum padi*)
- BCOAs can only survive and reproduce on monocots
- *Aphidius colemani* will use BCOAs as a host and build up their numbers before you ever see a pest aphid
- Not a panacea because *A. colemani* is host-specific

Added Benefits…
Attract more natural predators

Pepper and Alyssum Banker Plants for Orius

- Orius feed on pollen and reproduce on the banker plants
- Peppers alone will work but combination with Alyssum is best
- Very helpful for thrips biocontrol programs

Orius banker plants

- Can also be used outdoors
- Establish in greenhouse first then transplant
- Might need supplemental introductions afterwards

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Insectary plants

- Attractive to natural enemies in the environment
- Focus mainly on native plants
- If it attracts pollinators, it’s likely going to attract beneficials

Insectary Plants

- Carrot and Aster families
- Culinary herbs – dill and cilantro
- Sweet Alyssum
- Clover

More examples and information

- Grow Native Massachusetts
- Mass Audubon
- UMass
- Xerces Society

Indicator Plants

Marigolds for Thrips

- Can be used for early detection of WFT
- More attractive than many other ornamentals
- Use predatory mites and soil predators
- Be sure to monitor closely

Indicator Plants

Bean Plants for Spider Mites

- More attractive than many veggie crops and ornamentals
  - There are exceptions like Thunbergia
- Damage often shows more quickly than on other crops
- Spider mites don’t move on until the plant quality declines
- Can make bean plants into banker plants for predatory mites or get rid of it once it’s infested

Indicator Plants

Eggplant for Whiteflies

- More attractive than gerberas or a lot of other ornamentals
- Research mixed on poinsettias

Trap Crops

- Japanese beetles
  - Soybeans, zinnias, or white roses
- Harlequin bugs
  - Radishes, turnips, or mustard
- *Lygus*
  - Sunflowers

Scouting

- Scout at least once a week
- Pay close attention to doorways and other entrances that pests could use
- Greenhouses under 4000 sqft treated as one unit
- Larger should be split into 2000 – 3000 sqft divisions
- 5 – 10 minutes and at least 20 plants per 1000 sqft

Scouting

- Spend 2/3 of your time on highly susceptible crops or problem areas and 1/3 on other ‘random’ plants
- Also note **biocontrol agents**
- Flag Infested Plants
- **Build a regular scouting program and stick with it**


2-1


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BUG-SCAN

Monitoring Methods

- Double-sided tape for scale crawlers
- Target them with BCAs or pesticides

Recap

- Start early with biocontrol – have a plan going into the season
- Find good technical help and ask questions
- Use the right BCA and application methods
- Consider using banker plants to sustain BCAs long-term
- Utilize insectary plants or trap crops
- Scout not only for pests but also BCAs

Thank you!

Discussion and Questions?

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