Habitat Plants to Attract Natural Enemies into High Tunnel Crops

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Entomology Research Laboratory

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About Us & Topic Outline

Entomology Research Laboratory

- Small team of senior scientists, technicians & several graduate students
- Research primarily focused on biological control of greenhouse ornamental & high tunnel pests
- Devise practical solutions to grower's real-world pest problems

The Entomology Research Laboratory

Presentation Topics

- ✓ Habitat Plants & Their Benefits
- ✓ Current High Tunnel Research
- ✓ Review Common Natural Enemies

What Are Habitat Plants?

Habitat Harbors Happiness

To thrive natural enemies need:

- Adequate food with protein & sugars (pests/pollen/nectar)
- Shelter & proper climate
- Reproduction sites

Habitat Plant Systems can provide the above to wild &/or released natural enemies

- Successional perennials
- Annuals with long bloom times

Habitat Plants

Suitable for many types of production, natural & landscaped settings

Greenhouse ornamentals & high tunnel crops

Outdoor nursery mum plantings

Habitat rows in nursery & vegetable production

Just Because it Flowers Doesn't Make it a Good Habitat Plant

Attractive to natural enemies

Provide food all season long

- Abundant flowers with proper size, structure, pollen or nectar
- Enough pests/prey maintained at non-damaging levels to crops

Tolerate wide range of growing conditions (hot or cold & dry)

Cheap, easy to produce & low maintenance

Not invasive or aggressive

Another Tool in the Pest Management Toolbox

Not the silver bullet of pest management

Need to be worked into a management program

Routine Scouting essential (crops & habitat plants)

Know Friend vs Foe & their life cycles

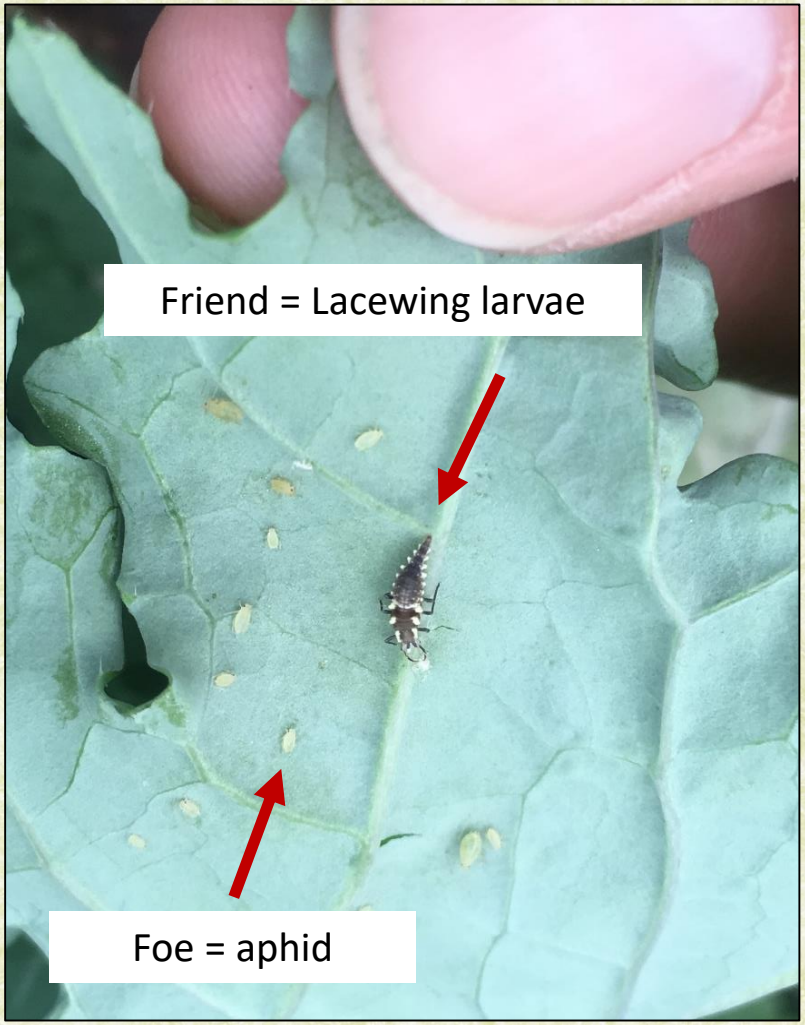
- What do they look like at each stage?

Properly trained staff

- Each person handling plants should be familiar with key pests & natural enemies

Expect the unexpected

- Set action thresholds & backup plans



How Have We Been Using Habitat Plants In High Tunnels?

The Problem Is Aphids

Reduce yield, quality & revenue of a wide range tunnel crops

Increase rapidly if undetected & in the absence of natural enemies

Limited insecticides for organic growers

Purchasing & shipping natural enemies is expensive

Growers need simple, cost-effective way to support natural enemy establishment

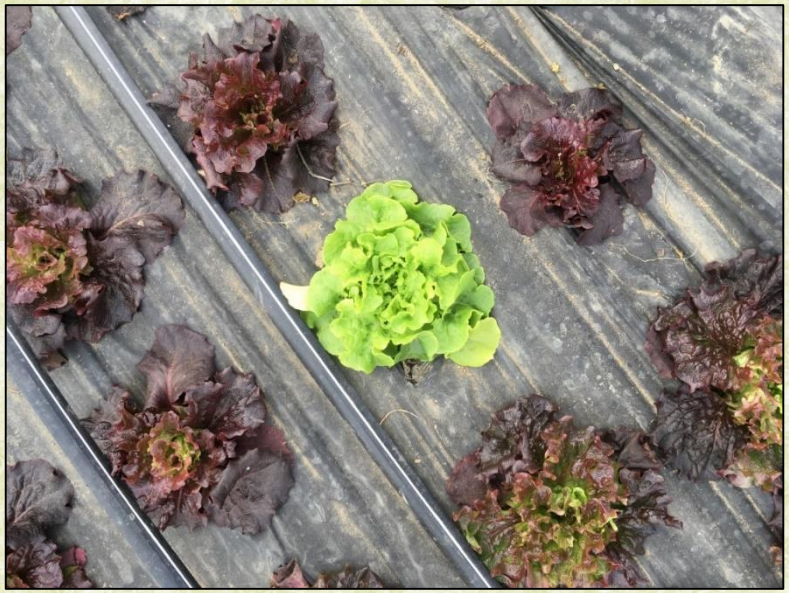
The #1 Pest

Plaguing Northeastern High Tunnel Growers

Research Plan

Goal: Develop effective IPM tactics for high tunnel vegetable production suitable for the Northeast and Mid-Atlantic regions.

Objective: Evaluate habitat plants to manage aphids grown in leafy greens and tomatoes in high tunnels.



Hypothesis: Including habitat plant systems within high tunnels will attract wild &/or released natural enemies from around the high tunnels to enhance aphid management.

Habitats for High Tunnels

3 years across several Northeastern States

Conducted routine scouting of crops & habitat plants for aphids & their natural enemies

Selected tunnels in year-round production with limited fallow periods

- Summer – tomato, pepper, etc.
- Winter – greens

Sampled tunnels with vs without habitat plants

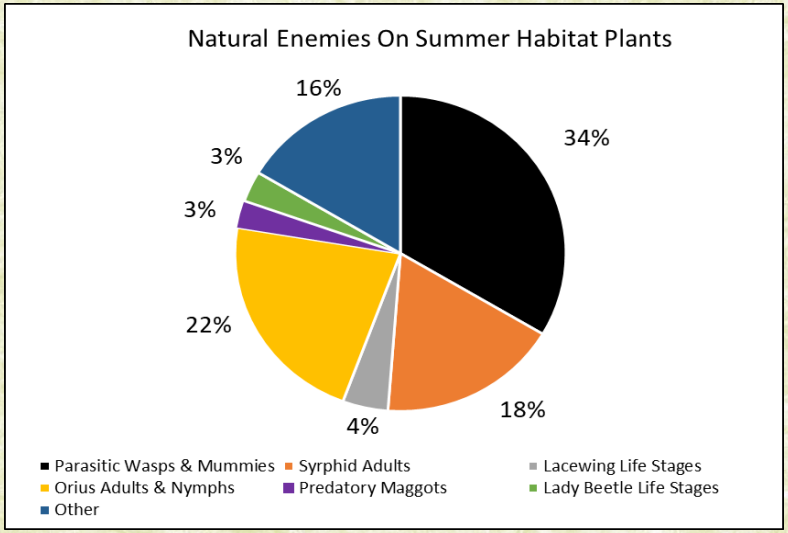
- Summer - borage, marigold, bush green bean, alyssum & dill
- Winter- marigold, bush green bean, alyssum, calendula & viola
- Rate = 1/1000 sqft

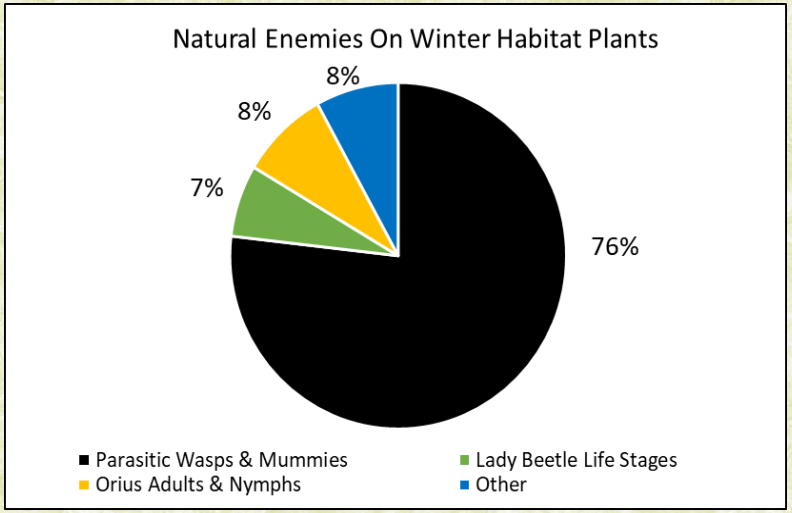
Summer

Winter

Results

Natural Enemies Attracted to Habitat Plantings





Over 2,160 aphid natural enemy individuals encountered on summer habitat plantings averaging 3.75 per habitat planting over the experiment duration

Over 400 in winter averaging 5.73 per planting

Primarily parasitic wasps & mummies, *Orius* & Syrphid adults

Lady beetles, lacewings & predatory maggots also observed

Others: spiders, assassin & damsel bugs & soldier beetles

How About Those Natural Enemies?!

Parasitic Wasps & Mummies

Ichneumonids

Aphelinidae (Aphelinids) *Aphelinus* species

Chalcids

larva-pupa 'mummies'

Aphid specialists

Predatory mostly in larval stages

Tiny adults lay eggs in or under aphids & larvae develop inside 'mummies', killing host

Adults feed on nectar, pollen & honeydew (aphid poo), some species host feed

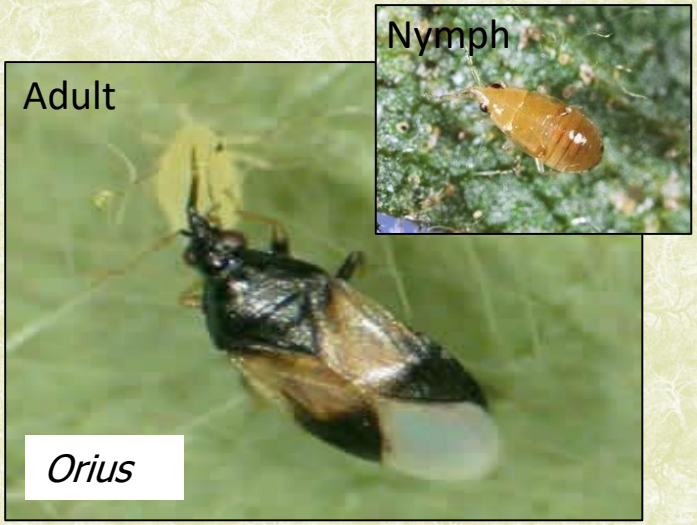
Many commercially available

Praon mummy

Braconidae (Braconids) *Aphidius* & *Praon* species

Predatory Bugs

Pirate Bugs



Generalist predators

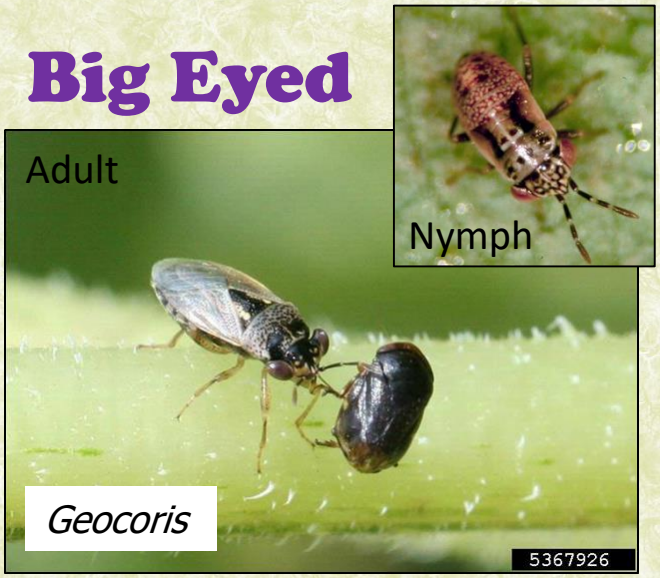
Predatory as adults & nymphs

Piercing prey with mouthparts, many inject paralyzing toxins then suck dry

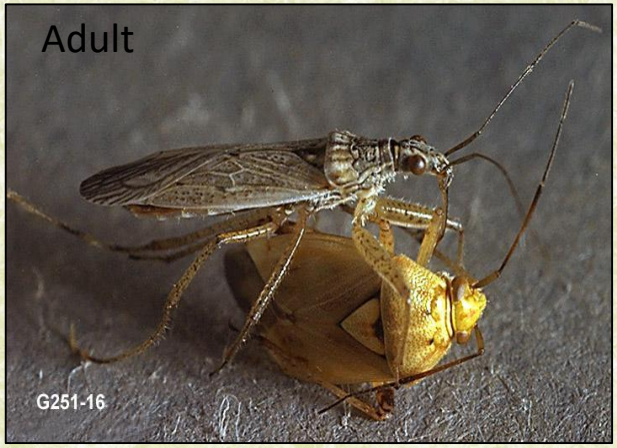
Many nymph stages (immatures) resemble adults

Orius & leaf hopper assassin bugs commercially available

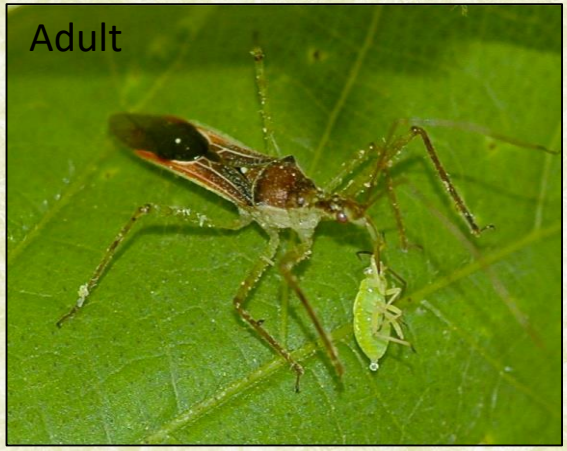
Big Eyed



Damsel



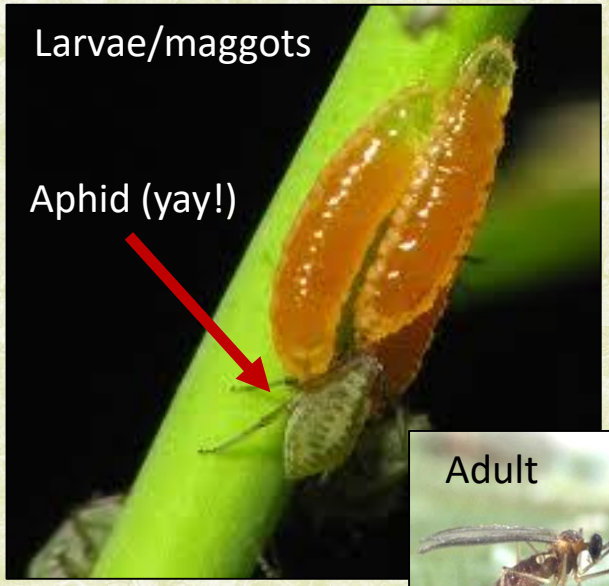
Assassin



Flies & Predatory Maggots

Adults of both feed on honeydew & nectar, larvae are predatory

Aphidoletes



Aphid specialists

Adults are mosquito looking midges

Larvae orange

Commercially available

Syrphid spp. - Hover/Flower Flies

Generalists

Adults resemble bees (highly diverse)

Larvae colors variable

Not commercially available

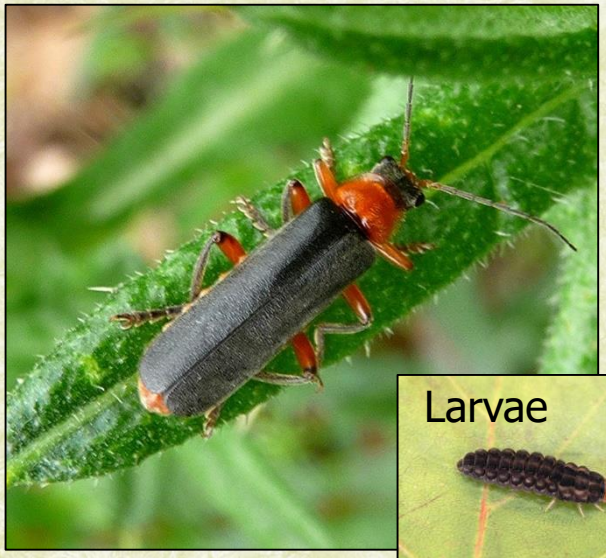
Adults

Larvae/Maggots

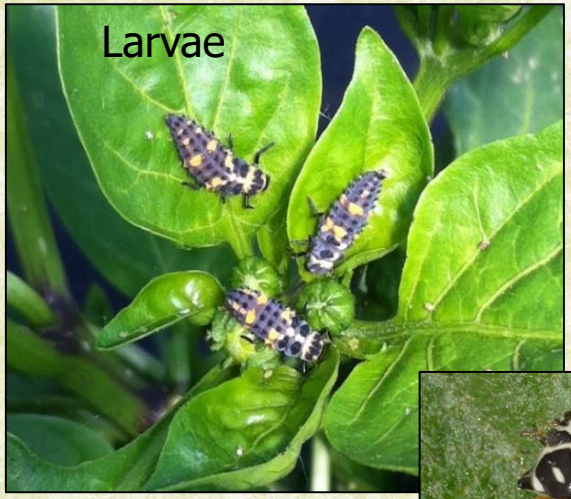
Predatory Beetles

Soldier

Adults



Lady



Adults

Predatory as adults & larvae

Adults also feed on nectar & pollen

Lady commercially available *Hippodamia convergens* wild caught & native & *Adalia bipunctata* insectary raised & native

Green Lacewings

Adult

Larvae

Adults consume pollen & nectars

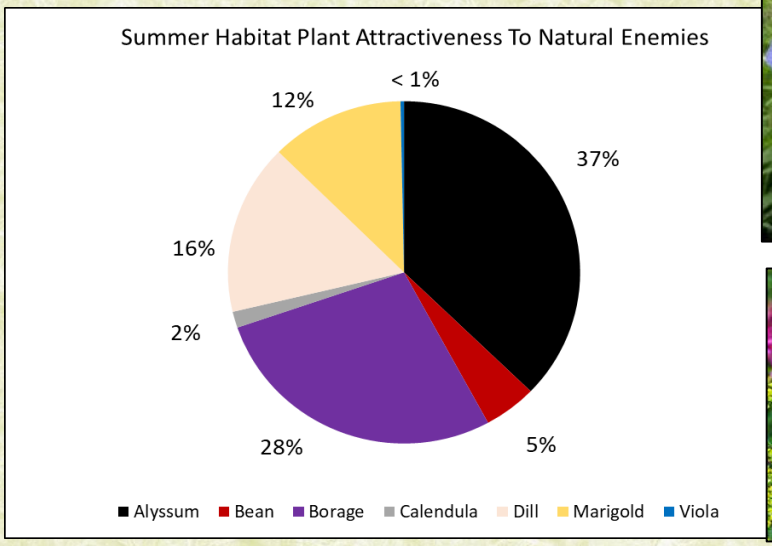
Larvae predatory

Also Commercially available

Stalked eggs

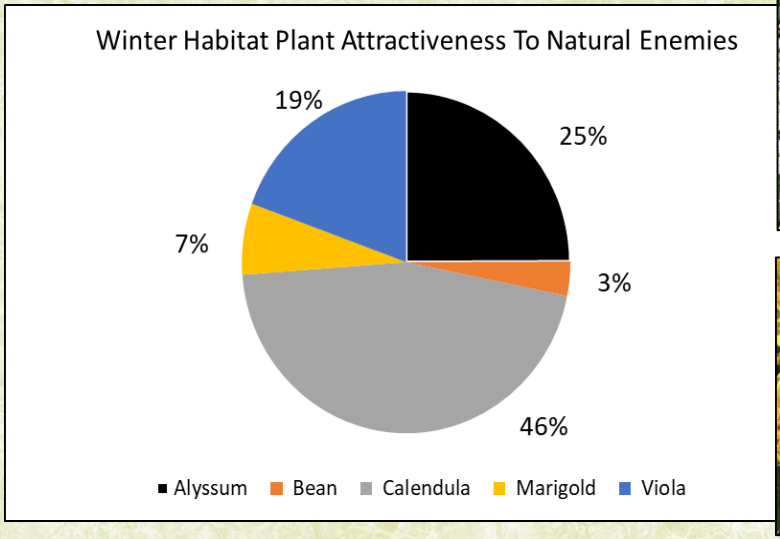
Results

Habitat Plant Attractiveness to Natural Enemies



Summer

Alyssum, Borage, Dill most attractive averaging 1.13 natural enemies per plant type over the experiment duration

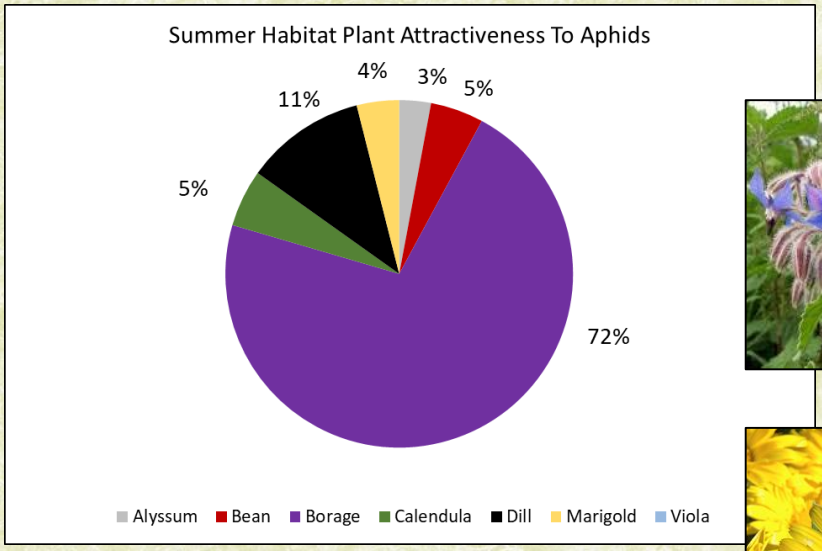


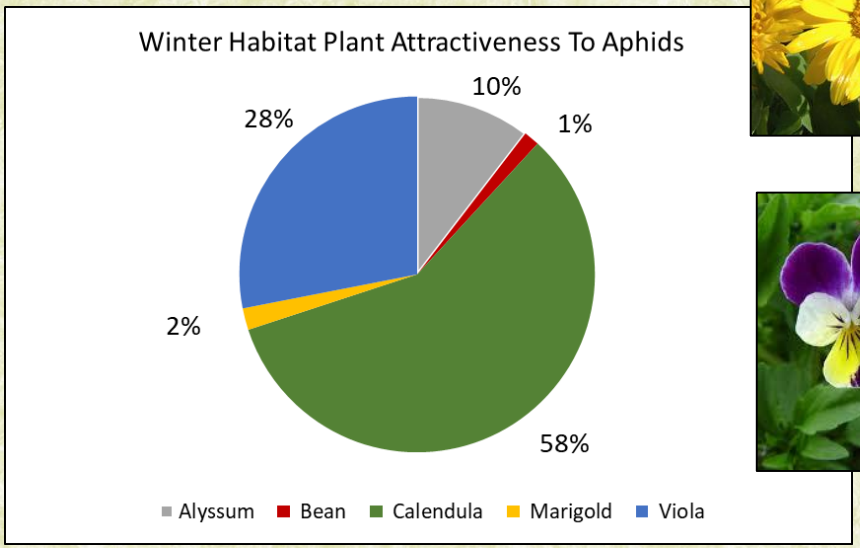
Winter

Calendula & Alyssum most attractive averaging 0.45 natural enemies per plant type

Results

Habitat Plant Attractiveness to Aphids





Summer

An average of 3.66 aphids per habitat planting were observed over the experiment duration

72% of aphids observed were attracted to Borage

Winter

An average of 18.07 aphids per habitat planting.

58% of the aphids observed on Calendula & 28% on Viola

Commonly Observed Aphids

Foxglove, *Aulacorthum solani*

Back Bean, *Aphis fabae*

Ornate, *Myzus ornatus*

Potato, *Macrosiphum euphorbiae*

Melon, *Aphis gossypii*

Carrot-willow Aphid, *Cavariella aegopodii* (on dill)

Green Peach, *Myzus persicae*

The Species of Aphid Matters!

Some natural enemies, such as parasitic wasps, are host aphid specific.

For example:

- Green peach aphid commonly infests greens & peppers. *Aphidius colemani* prefers to parasitize GPA.
- Potato aphid commonly infests tomatoes. *Aphidius ervi* prefers to parasitize PA.

Know what your purchasing!

Consult natural enemy supplier or local university extension agent for id assistance when in doubt.

Results

Natural Enemies on Habitat Plant Type

Nat. Enemy	Season	Alyssum	Borage	Dill	Marigold	Calendula
Parasitic wasps & mummies	S	29%	40%			
	W	20%				57%
Predatory bug (Orius)	S	56%			26%	
	W	59%			35%	
Syrphid fly adults	S	41%		34%		
	W					

Data shown for top 2 plant types & if proportion greater than 20%

Attracted to floral resources &/or aphids

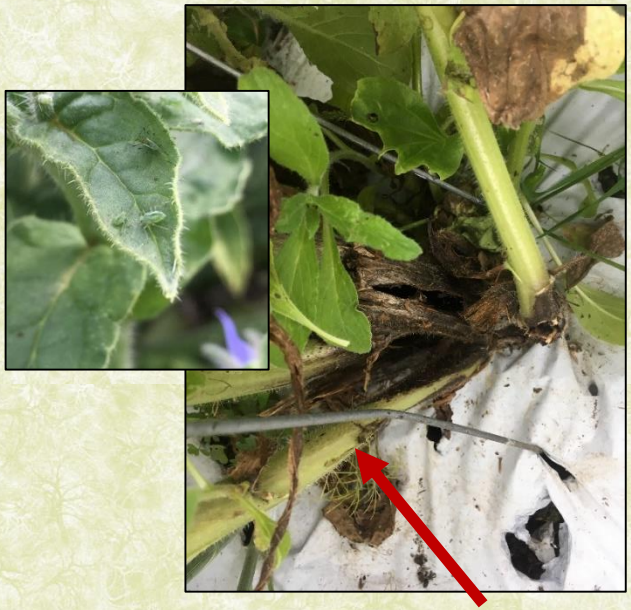
Parasitic wasps & mummies were present all year

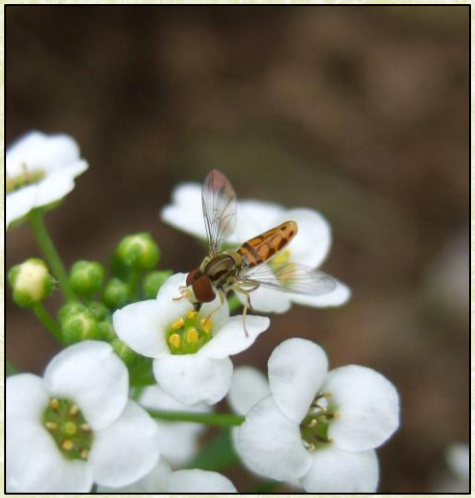
Orius presence highest in late summer - early fall

Syrphids present spring – fall, highest in summer, very few in late fall - winter

General Remarks on Habitats

Borage high maintenance, over bearing, readily volunteered, prone to stem rot & attractive to aphids

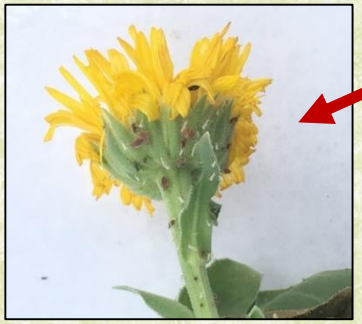




Alyssum has great potential as a year-round habitat plant

- Easy to produce & low maintenance
- Tolerant to wide temperature ranges
- Prolific blooms all season

Possible indicator plants for aphids???



Calendula very attractive to aphids, took long time to flower if at all

Marigolds have potential in summer & early fall

Take Home Messages

Habitat plants:

- Contribute valuable resources to natural enemies both wild &/or released
- Serve as valuable scouting tool warning of potential aphid outbreaks & for monitoring of natural enemy establishment & effectiveness

Tips getting started:

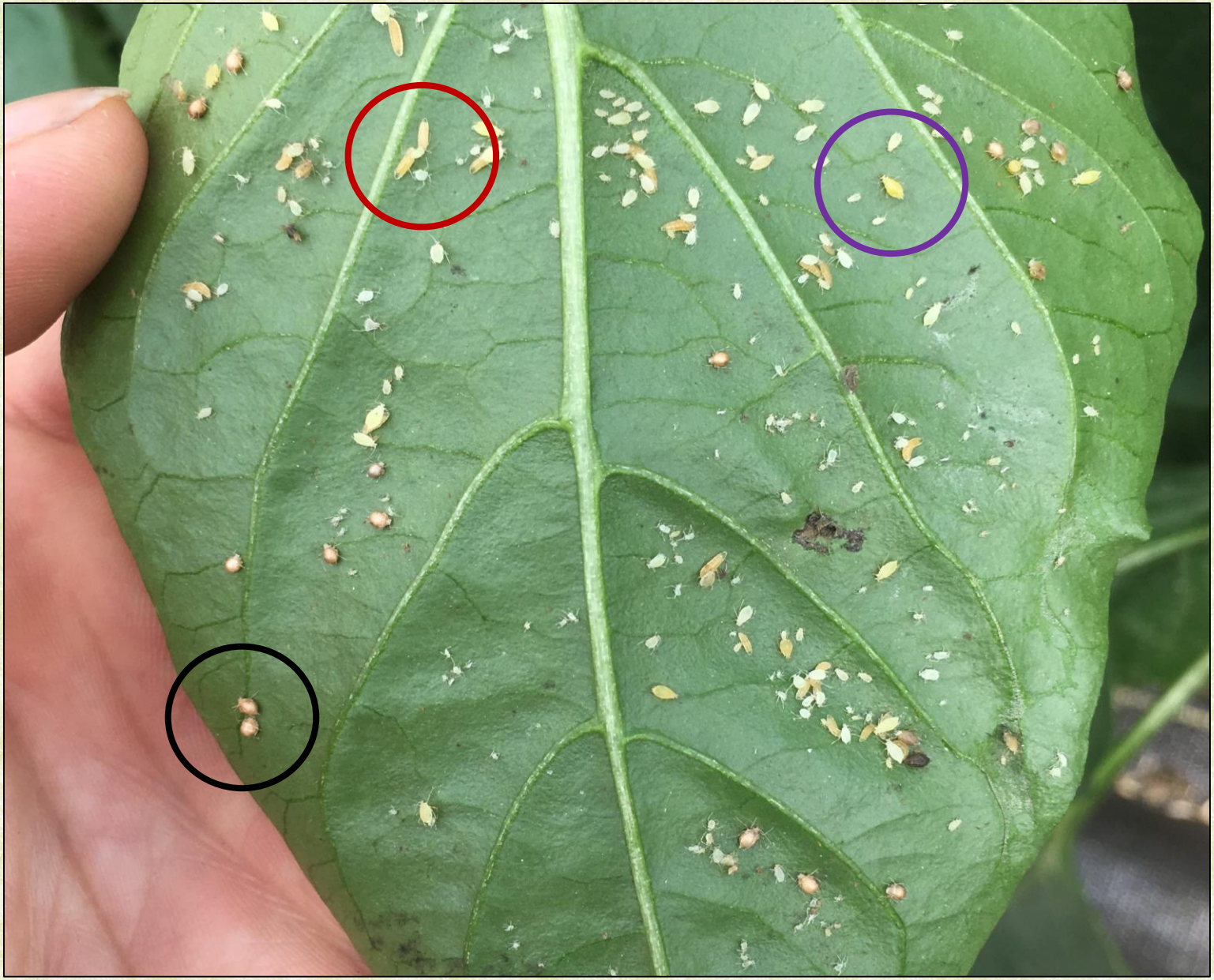
- Set a management goal, start slow, keep it simple
- Scout, scout, scout
- Be sure they are flowering before planting
- Establish within tunnels early

Need to continue to develop, refine & test strategies for the prevention of the aphid apocalypse (especially in winter greens)

Timing is Everything!

Habitats in Action

Now You're An Expert! Friend Or Foe?



Questions?

Thank You!

http://www.uvm.edu/~entlab/

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