The Good, The Bad and The Ugly: Novel IPM Strategies for "Bugs" in the Nursery

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For the 7th Western Native Plants Conference, December 2016

Who Am I?

The Entomology Research Laboratory

Member of a scientific team involved with a wide range of research subjects to address real world issues facing growers.

- **Research Professor of Entomology**

  IPM and biocontrol of key pests in greenhouse ornamentals, high tunnel vegetables, landscapes, forests and field crops

- **Extension Entomologist**

  Insect Identification for growers and the public

  Public Awareness of Exotic Pests

www.uvm.edu/~entlab/

Plant-Mediated IPM Systems

Plants used in combination with IPM to support and enhance biological control and pest suppression

- Indicator/Sentinel Plants
- Trap Plants
- Banker Plants
- Habitat/Insectary/Guardian Plants

Why Bother?

Plant-Mediated IPM Systems

Indicator Plants:

Plants for early pest detection (insects, mites, diseases)

Tomato & Eggplant for whiteflies in poinsettias

Trap Plants:

Plants that attract pests from the crop for management action with natural enemies, chemical insecticides or removal & disposal

Marigold trap plant for thrips

Plant-Mediated IPM Systems

Banker Plants:

Plants that serve as an on-site rearing system to provide a continual supply of natural enemies

Aphid banker plant system to raise the parasitic wasp *Aphidius colemani* for aphids

Plant-Mediated IPM Systems

Habitat Plants:

Plants that provide food & shelter to attract & sustain naturally occurring &/or released natural enemies for a complex of pests

Habitat plant for biocontrol agents of several types of pests

Habitat Plants

Suitable for many types of production, natural and landscaped settings

Outdoor nursery mum plantings

Greenhouse ornamentals

High tunnel vegetables

Habitat rows in nursery and vegetable production

What makes a good Habitat Plant?

- Attractive to pests and natural enemies
- Produces pollen and nectar
- Cheap & easy to produce
- Tolerates wide range of growing conditions (hot or cold and dry)
- Produce lots of flowers all season with low maintenance (1-2 cut backs)
- Not invasive or aggressive

Habitat Plant Options

Annuals

Borage

Calendula

Alyssum/Lobularia

Dill

Green beans

Viola

Hero yellow marigold

Sunflowers

Zinnias

Buckwheat

Coriander/Cilantro

Habitat Plants for High Tunnels for Small Diversified Growers

Overview

3-year study in 3 states (ME, VT, PA) testing habitat plant attractiveness to aphids & their natural enemies

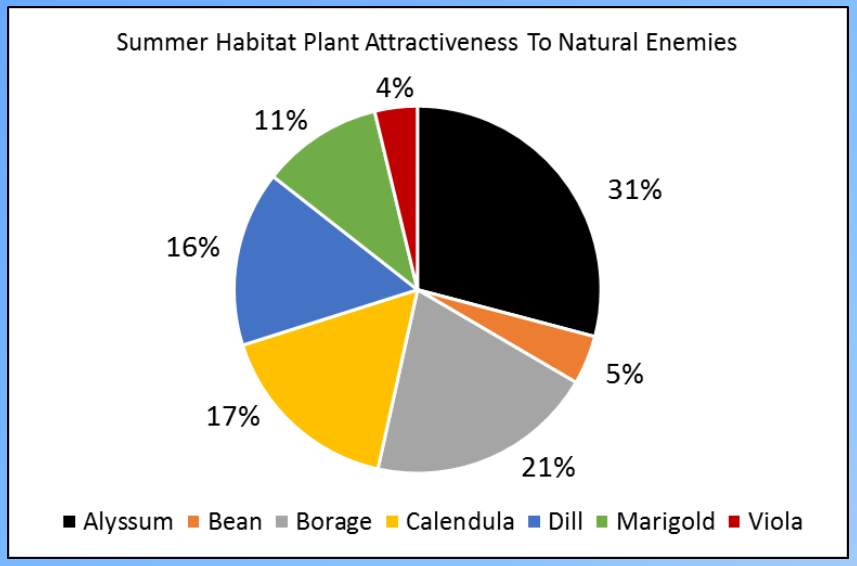
Tunnels in year-round production (spring/summer – tomato, pepper, etc. & fall/winter – greens) with limited fallow periods

Habitat Plant combinations tested:

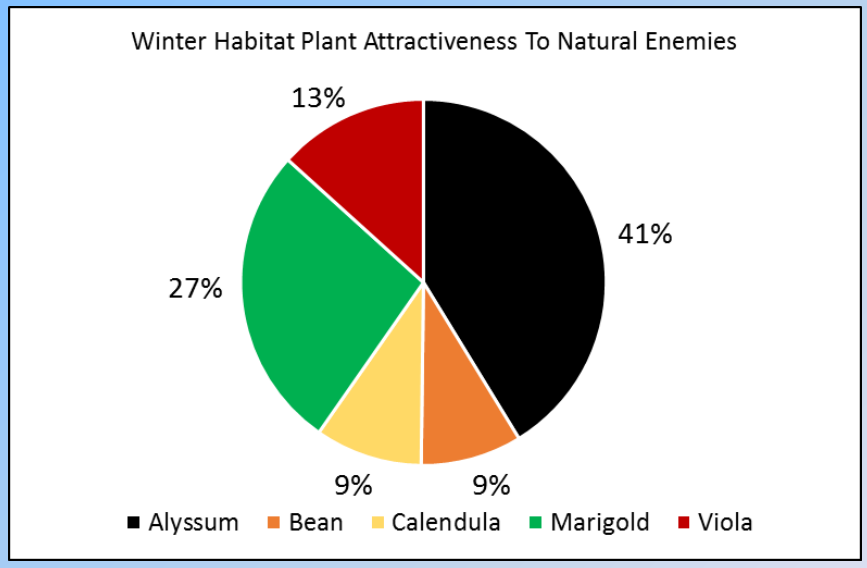
- **Spring/summer:** borage, marigold, bush green bean, alyssum, dill, calendula, viola
- **Fall/winter:** calendula, alyssum, bush bean, marigold, viola

Habitat Plants for High Tunnels

Spring/Summer



Fall/Winter



- Over 1900 individual natural enemies encountered
- **Alyssum** most attractive in summer & winter
- **Borage** 2nd most attractive in summer followed by calendula, marigold & dill
- Marigold attractive (early) in fall/winter when blooming

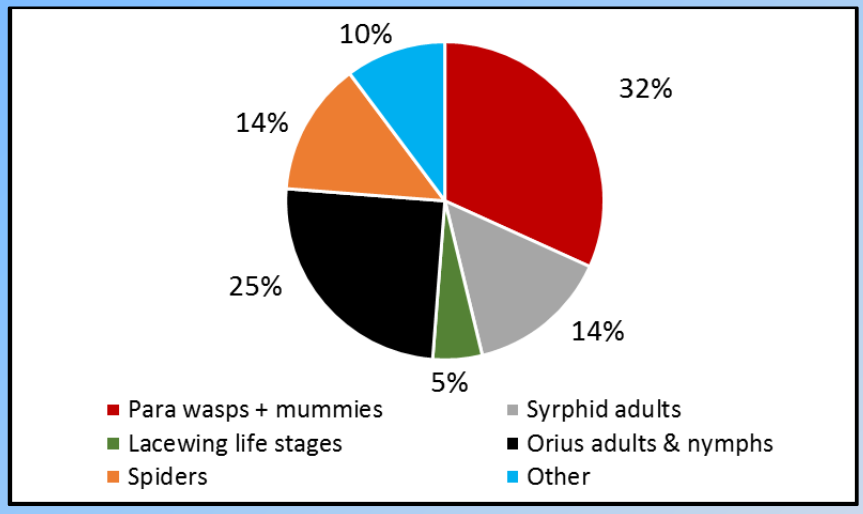
Habitat Plants for High Tunnels

- In Spring/Summer, most were:
  - Parasitic wasp adults & mummies
    Orius adults & nymphs
  - Syrphid fly adults
  - Spiders

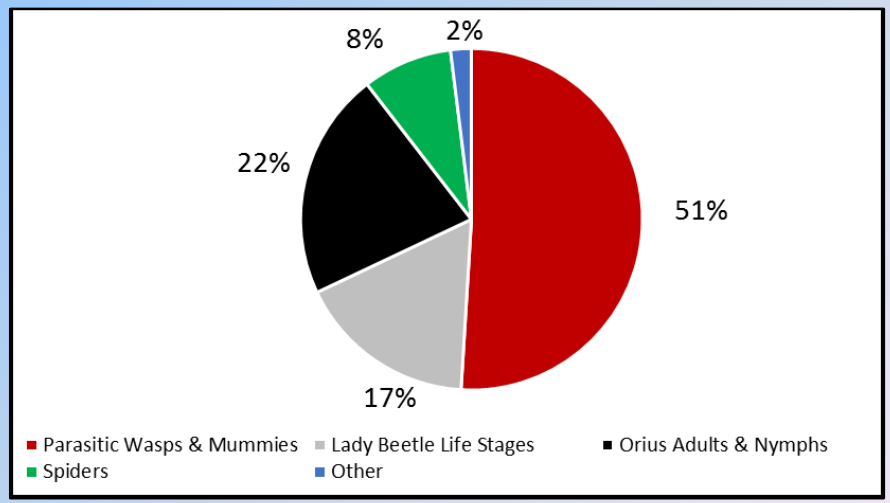
- Others in Spring/Summer were:
  - Lady beetles
  - Predatory fly maggots
  - Assassin bugs
  - Soldier beetles

- In Fall/Winter, most were:
  - Parasitic wasps
  - *Orius* adults & nymphs
  - Lady beetles
  - Spiders

Spring/Summer



Fall/Winter



Natural Enemy Occurrence over Time

Spring/Summer

Parasitic wasps & mummies:

- High presence on borage & calendula due to aphid infestation
- Highest abundance on HPS in July

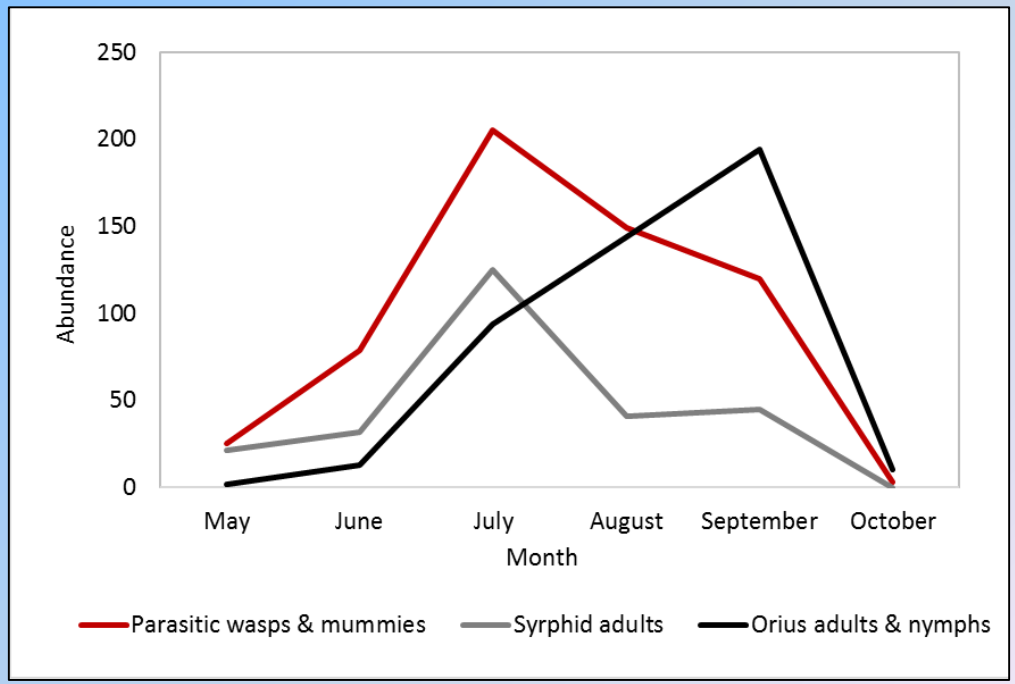
Orius adults & nymphs:

- Peak in late summer

Syrphid adults:

- Highest abundance in mid-summer

Aphids on HPS – Borage & Calendula attracted most



Natural Enemy Occurrence over Time

Fall/Winter

Parasitic wasps & mummies:

- Higher presence on calendula due to additional food of attracted aphids
- Highest abundance in fall

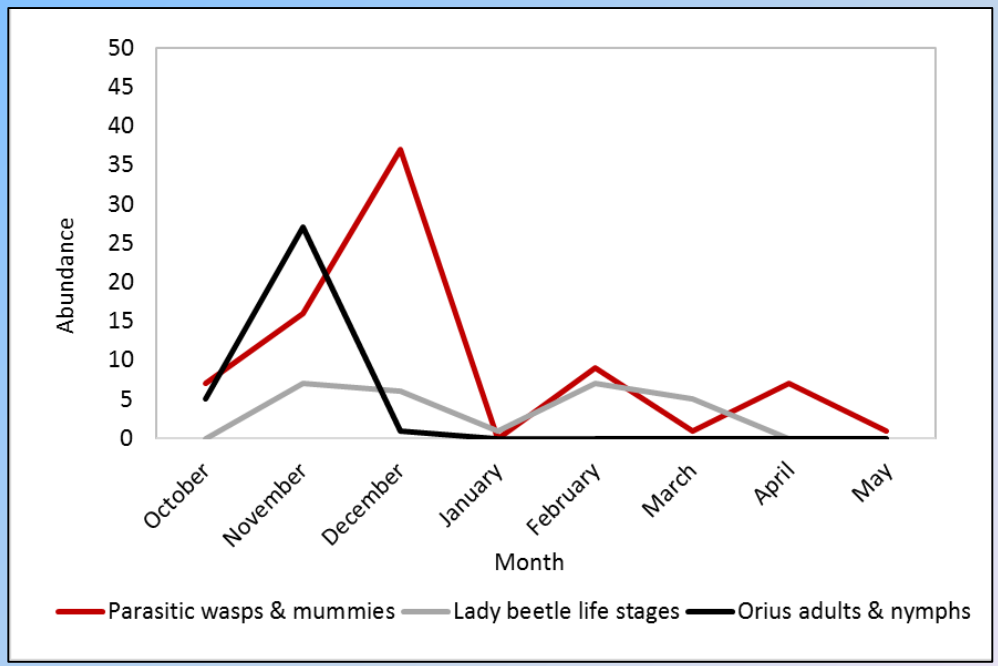
Lady beetle life stages:

- Most were purchased & released
- Steady presence all winter

***Orius* adults & nymphs:**

- Highest abundance in fall

Aphids commonly on Calendula, Viola and Alyssum

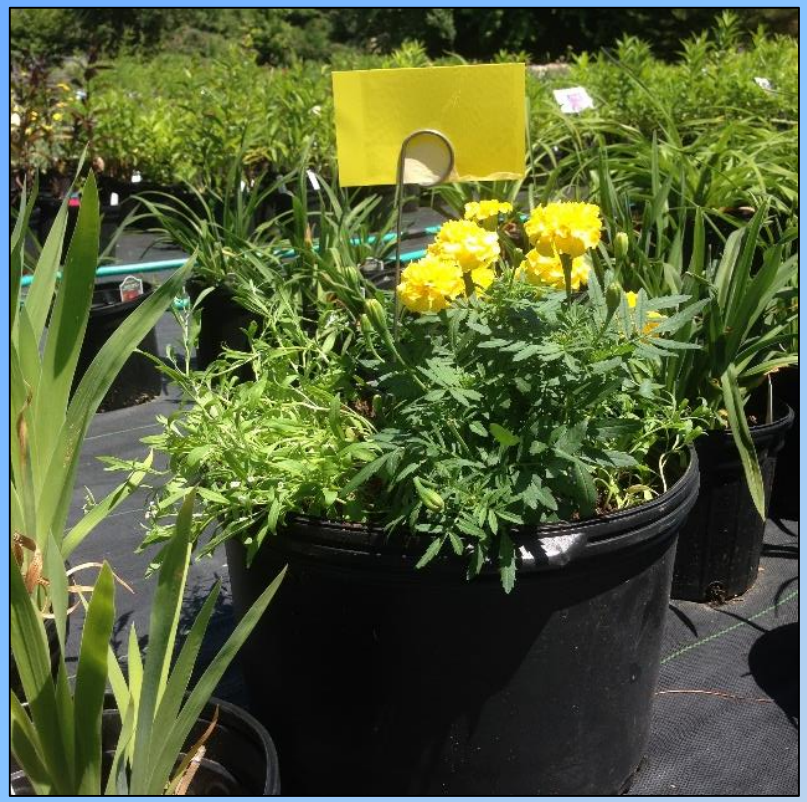


Habitat Plants for Nursery Setting

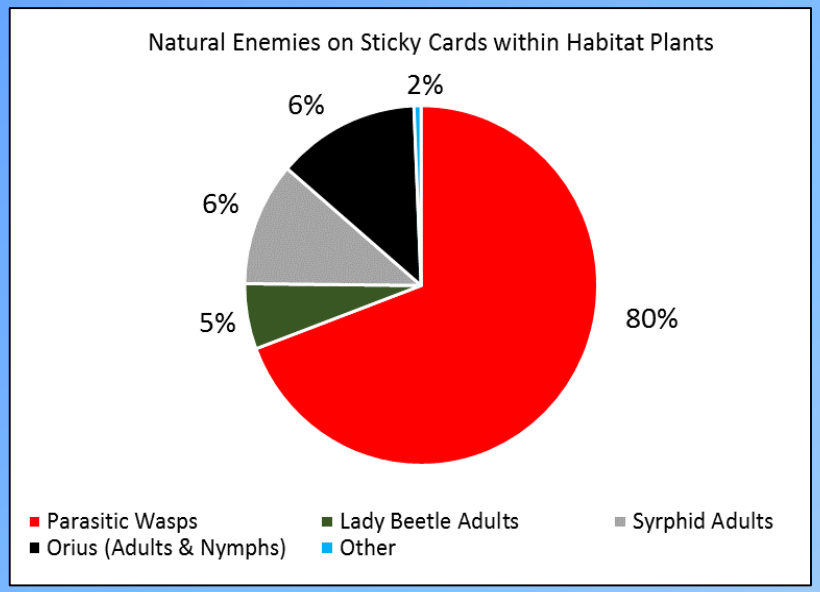
Overview

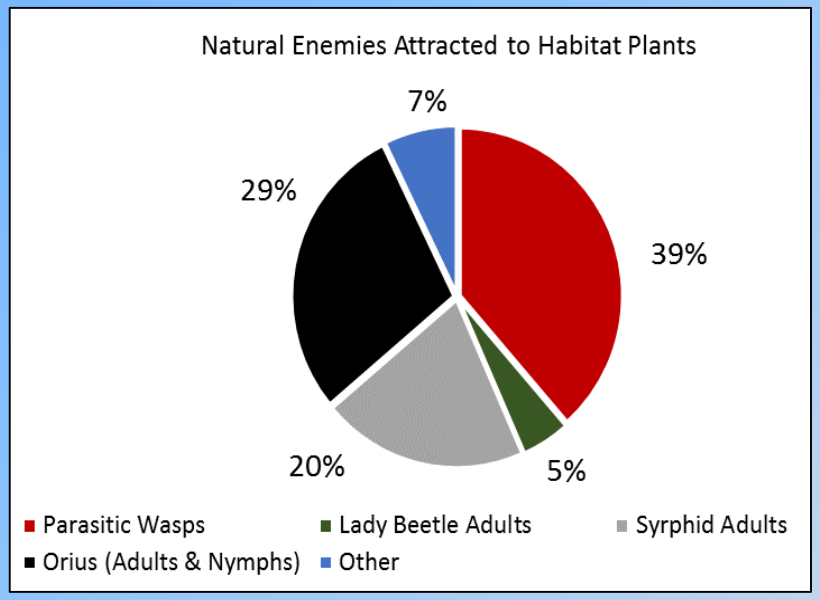
Pilot study at 2 local nurseries in perennials

July-September 2016



Natural Enemy Abundance





Most natural enemies attracted were parasitic wasps, *Orius* & syrphid flies.

Habitat Plant Challenges

Attracted Pests:

- Bean & marigolds sometimes succumbed to spider mites
- Borage & calendula often attracted aphids
- Calendula, marigolds & beans attracted thrips

Other Issues:

- Bean & marigolds first to succumb to cold in fall
- Calendula takes a long time to bloom
- Borage & dill readily self sow (extra weeding)
- Borage high maintenance (robust growth)

Other Benefits of Habitat Plants

Customer Awareness and Approval

Guardian Plant Systems

Getting to know the Good Ones

To Know them is to Love Them

Everyone knows what a lady beetle looks like.

How many can recognize the larvae?

Predatory Beetles

Common Lady Bs

Introduced

Coccinella septempunctata
sevenspotted ‘C-7’

Harmonia axyridis
Asian lady beetle

Propylea quatuordecimpunctata
checker spot ‘P-14’

Other Natives

Coleomegilla maculata
pink spotted

Hippodamia parenthesis
parenthesis

Hippodamia variegata
variegated

Predatory Beetles

Immature Stages

Predatory Beetles

Other Lady Bs

Consumer of fungus spores
(powdery mildew)

Psyllobora vigintimaculata
twenty-spotted

Bad Lady Bs

Mexican Bean Beetle

Squash Lady Beetle

(in most states east of the Rocky Mountains)

Wasp Parasitoids

Developing larva-pupa 'mummy'

Aphidius spp.

Fly Parasitoids

Tachinid fly

Aphidoletes maggots

Adult

Eggs

Pupa

Predatory Flies

Syrphid spp. - Hover/Flower Flies

Adults are bee & wasp mimics

- Black/brown with white/yellow bands/dots
- Feed on honeydew & nectar

Larvae (maggots) eat aphids and other soft bodied insects

- Pink, yellow, green & brown marked with white/black color

Eggs

Pupa

Larvae/Maggots

Predatory Flies

Robber or Assassin Flies (Asilids)

Over 1000 species in N.A.

Brown/black/grey, slender bodied

Voracious appetite with wide prey range

Predatory Bugs

Orius

Piercing sucking mouthparts

Many inject toxins paralyzing prey

Predatory as adults & nymphs

Many immatures are red or orange

Orius best known and available commercially

Adult

Nymph

Predatory Bugs

Damsel

Assassin

Big-eyed

Predatory Beetles

Soldier, Carabid & Rove

Ground beetles (Carabidae) eat soil-dwelling pests (aphids, slug, moth larvae)

Soldier beetles (Cantharidae) larvae are mostly predaceous, but adults consume pests, pollen and nectar.

Rove beetles (Staphylinidae) found around dead and decaying matter, wide diet (fungi, small arthropods, decaying matter). *Dalotia coriaria=Atheta coriaria* commercially available

Lacewings

Adults consume pollen & nectar

Larvae are generalist predators (can be cannibalistic)

Eat soft-bodied insects (e.g., aphids, thrips, spider mites, whiteflies, mealybugs, caterpillars)

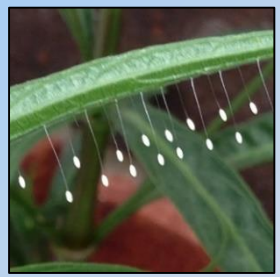
Adults are green or brown

Larvae alligator-like, brown and white, with pinchers

Eggs on stalks (green lacewings) or laid on foliage (brown lacewings)

Pupae in a mesh cocoon

Commercially available & naturally occurring



Other Predators

Some Thrips

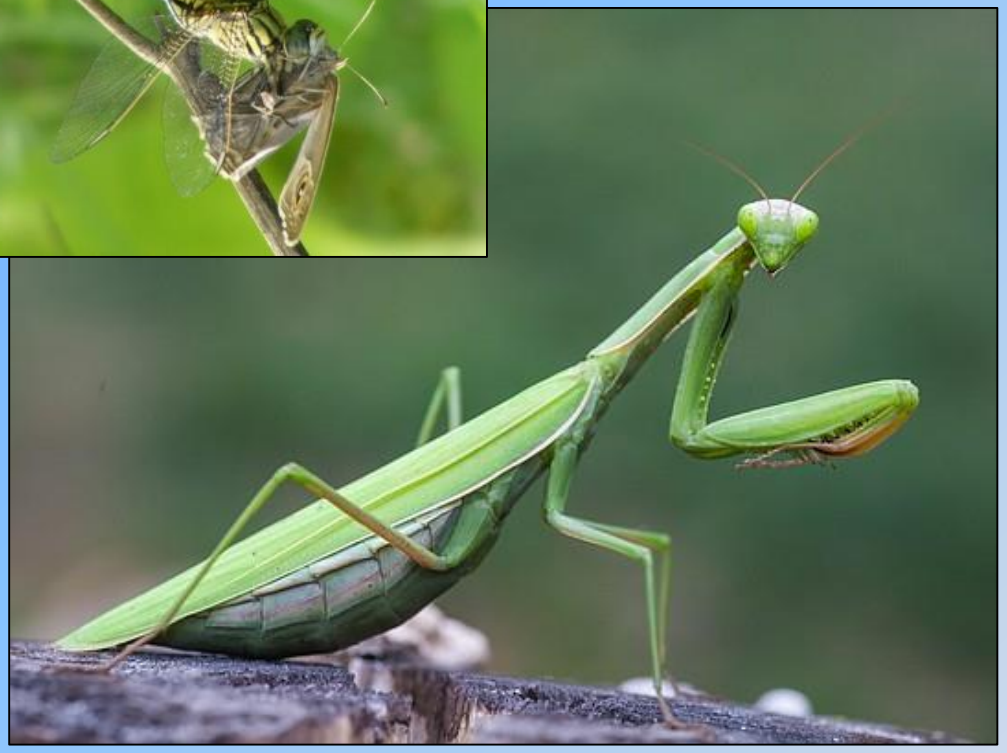
Pierce flesh of prey & suck body fluids out

Attack aphids, mites, lace bugs, whiteflies, scales, bad thrips & other soft bodied insects

Generally larger than pest thrips (0.5 - 3mm)

Other Predators

Dragon/Damselflies, Mantids, Spiders



Habitat Plantings

- A whole-farm, ecological approach used primarily outdoors as hedgerows, borders, rows. Care must be taken to select appropriate plant combos.

- A whole-greenhouse approach to enhance biological diversity within an intensive artificial setting.
  - What will work for your situation?

  Care must be taken to select appropriate plant combos
    - Some harbor more pests than nat. enemies attracted
    - Some plants require too much attention

Landscape Plantings

- Al Hambra in Spain

Landscape designs could be devised to maximize on promoting biological diversity to reduce pest pressure.

The Promise of Habitat Plants

Start slowly and keep it simple!

Alyssum has highest value for a year-round habitat plant

- Cheap & easy to produce
- Tolerant to wide range of heat & cold temperatures
- Prolific blooms all season long with low maintenance (1-2 cut backs)

The Best Things In Life Are FREE!

Questions?

Thank You!

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

This information is based on work supported by the National Institute of Food & Agriculture, US Dept. of Agriculture, Crop Protection & Pest Management Competitive Grants Program, under award #29107 and Green Works, the Vermont Nursery & Landscape Association. Any opinions, findings, conclusions, or recommendations expressed herein are those of the authors and do not necessarily reflect the view of the US Dept. of Agriculture of other funding organizations.

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