THE OHIO STATE UNIVERSITY

COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

Identification and Management of Natural Enemies

Biological Insect Control

Chelsea Smith, Department of Entomology, The Ohio State University, smith.7231@osu.edu

What are we going to cover?

- Biological control
- Identifying natural enemies

Biological control

Controlling pests with other living organisms

- Releasing natural enemies requires less time (compared to repeated sprays)
- Once established they may work around the clock
- REI and PHI is no concern

Biological control

Controlling pests with other living organisms

1. Augmentation

2. Conservation

Biological control

Augmentation biological control

Release of natural enemies to supplement their population where they are absent, occur too late, or in numbers too small to control pests.

In high tunnels it should be used as a prevention measure

Biological control

Augmentation biological control

Essential to select the correct natural enemies
Many have narrow preferences for:

- Air temperature
- Relative humidity
- Pest Hosts

Biological control

Augmentation biological control

1. Reared (by a company and sold)
2. Collected from the wild (by you)
3. Collected from the wild (by a company and sold)

Sources for Biological control agents: anbp.org/index.php/members-products

Biological control

Augmentation biological control

- Some natural enemies may only attack particular life stages of the pest, multiple releases may be necessary
- To prevent pest infestations natural enemies should be released early in the pest lifecycle, just when pests are starting to increase

Biological control

Augmentation biological control

Steps & tips for a successful augmentation biological control program:

1. Start monitoring for pests as soon as conditions are right for their development. Reach out to local extension offices for advice on pest development in your area. Rates of development may vary year to year.

Biological control

Augmentation biological control

Steps & tips for a successful augmentation biological control program:

2. Determine a proper scouting method and stick with it. This can be as simple as counting aphids on leaves or recording the number of thrips on yellow sticky cards. While scouting for pests also observe damage to leaves

3. Keep records and pest numbers and damage

Biological control

Augmentation biological control

Steps & tips for a successful augmentation biological control program:

4. When pests start to increase order the appropriate natural enemies. Be aware that it may take 1-2 weeks or more for your natural enemies to arrive. Release them according to the instructions provided by the distributor

Biological control

Augmentation biological control

Steps & tips for a successful augmentation biological control program:

5. Monitor the quality of the natural enemies as the arrive. Stick with distributors that send active and thriving natural enemies.

Biological control

Augmentation biological control

Steps & tips for a successful augmentation biological control program:

6. Learn to recognize what you have released and the signs that they are working.

7. Avoid pesticides drift from adjacent areas and residues from previous pesticide applications

Biological control

Augmentation biological control

Collecting your own natural enemies

- If you need a small number of natural enemies
- Row covers, gardens, small greenhouses, high tunnels
- Sweep nets make this easier than hand collecting
- Grasslands and alfalfa fields are good places to collect

Biological control

Conservation biological control

The modification of cropping systems, or surrounding landscape to enhance the presence of natural enemies: Areas where beneficial insects and live and reproduce

- Floral resources
- Refugia
- Alternative prey
- Nesting areas

Biological control

Conservation biological control

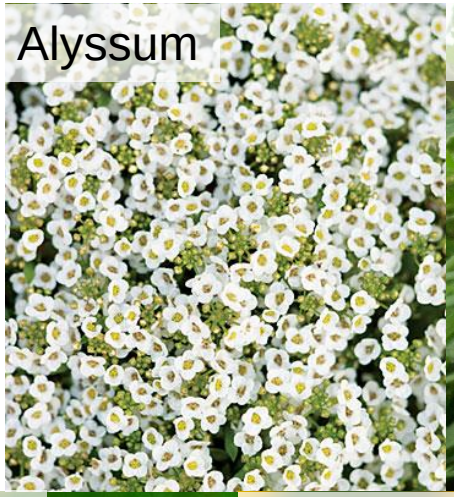
Which Plants???

- Food and shelter season-long
- Diversity of species
- Fall and spring blooming species
- Native and Non-Native species
- Annual and Perennial options
- Note – some hybrids produce little to no pollen or nectar

Biological control

Conservation biological control

Annual Natural Enemy Attractors: *The Sweet Seven*



Biological control

Conservation biological control

Shelter and Overwintering

Predatory mites (Acari)

Prey: Spider mites, aphids, and caterpillar eggs

- Quick, active hunters
- There are many species which range from yellow to red in color, and all have eight legs
- Their rapid movement and coloration is the best way to distinguish them from spider mites
- Providing refugia for overwintering populations such as border planting, hedgerows, and ground covers can conserve populations.
- Lay up to 100 eggs per female within spider mite infestations
- Immatures and adults are predatory. Consume 20-50 spider mites and eggs per day

Left: Two spotted spider mite (pest) Right: Predatory mite

Predatory mites (Acari)

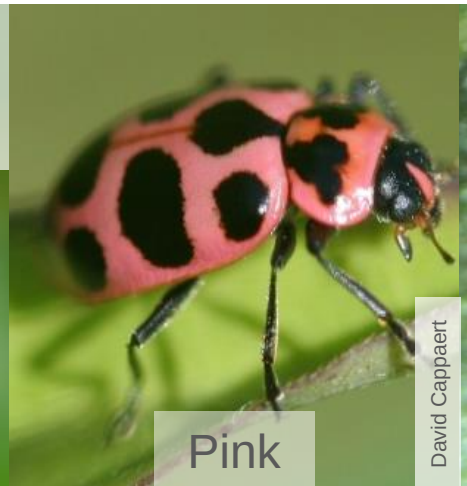
- Shipped as adults and nymphs in a carrier
- Rate of ~30 per 9 sq feet
- 1000 for $35
- *N. fallacis* on pollen, access to this will increase longevity and effectiveness
- Read description carefully to be sure they can survive in your area
- It is important to inspect shipments by sprinkling a small amount on paper to confirm they are alive
- Be sure to order a species that can survive in the climate

Lady beetles (Coccinellidae)

- Many species in Ohio
- High variation in patterns and coloration
- Providing floral resources is beneficial

Prey: Both adults and larvae feed on spider mites, aphids, thrips, and other small soft bodied insects

ADULTS:



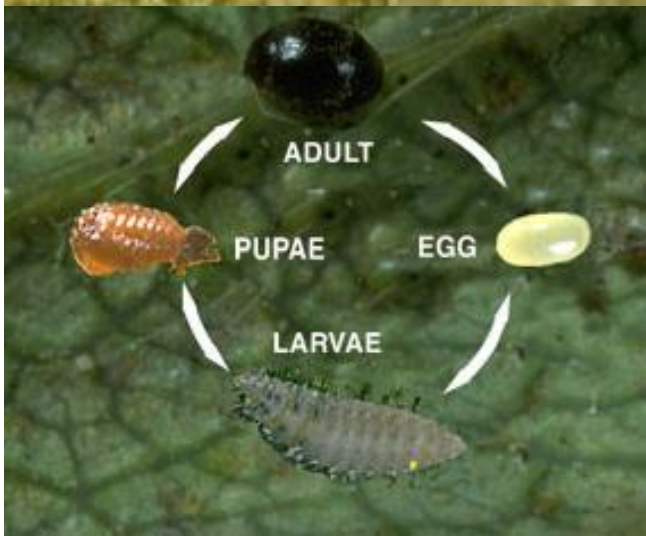
Lady beetles (Coccinellidae)

- We DO NOT advise purchasing convergent lady beetles
- Native populations are in decline
- Concerns for spread and disease and parasites
- They typically disperse anyways

Lady beetles (Coccinellidae)

Mite destroyer: *Stethorus punctillum*

- Tiny (1/10 in.) lady beetle, dark brown to black in color.
- Females lay 10 eggs per day, yellow, deposited singly in or near mite colonies.
- Larvae are slow moving, grey with conspicuous legs.
- Larvae and adults consume 20-40 spider mites per day



Lady beetles (Coccinellidae)

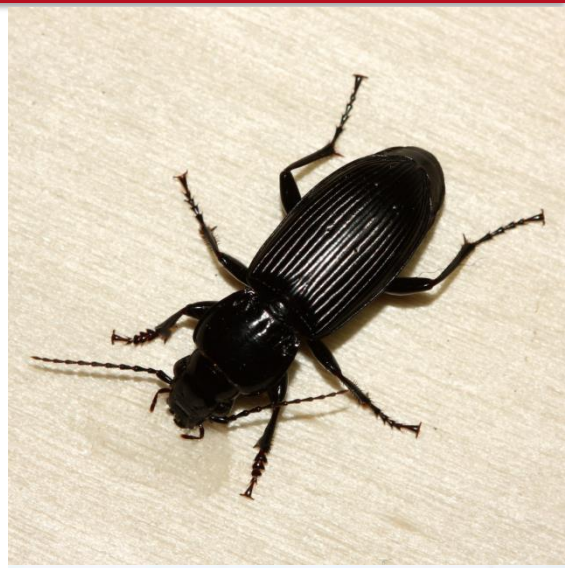
Mite destroyer: *Stethorus punctillum*

- Shipped as adults and larvae in a carrier
- Rate of ~2-4 per 9 sq feet
- 50 for $40
- Feed on pollen, access to this will increase longevity and effectiveness

Ground Beetles (Carabidae)

- Predatory as adults and larvae
- Larvae usually found underground
- Most adults forage on soil surface
- Usually dark and shiny with threadlike antennae.
- Wing covers often have striations or pits

Prey: Eggs and larvae of root maggots, aphids, caterpillars, snails, slugs and weed seeds.



Minute pirate bugs (*Orius* spp.)

- Voracious predators with sucking mouth parts and a wide host range
- Adults and immatures can consume up to 40 spider mites or aphids per day
- Can persist by feeding on pollen and nectar

Prey: Aphids, mites, thrips, caterpillars, and other soft bodied insects.

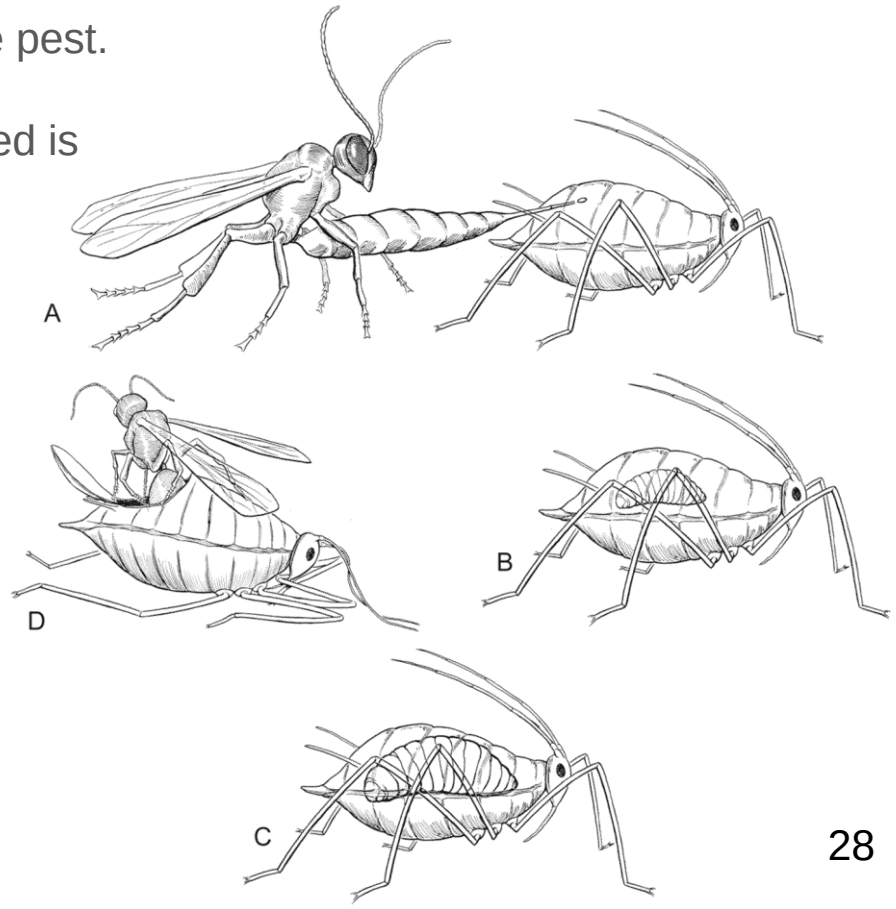
Damsel Bugs

- Adults are gray to brown and slender with enlarged front legs
- Their curved beak is used to suck pests dry!
- Nymphs look similar but lack fully formed wings

Prey: Aphids, caterpillars, and other soft bodied insects

Parasitoid wasps (Hymenoptera)

- They lay their eggs on or in target pests which are killed as the parasitoid larvae develops.
- Can not reproduce without the presence of the pest.
- Can be purchased: knowing the species needed is essential



Parasitoid wasps (Hymenoptera)

Hover Flies (Syrphidae)

- Pollinators as adults and predators as larvae
- Adults resemble bees are wasps
- Females lay eggs near or in aphid colonies
- Providing floral resources and enhance populations

Prey: Aphids

Predatory midge (Cecidomyiidae)

- Thin pink/cream colored adult flies (1/10 inch)
- Females live for 5 days and lay 30+ eggs
- Eggs hatch into yellow larvae, voracious mite predator (15 adults, 30 immatures, or 80 eggs per day!)
- Can feed on spider mites on a variety of crops including ‘hairy plants’ like tomato and eggplant

Predatory midge (Cecidomyiidae)

Prey: Mites, aphids

- Shipped as pupae in container of 250
- $85
- Suggested rates, 4-10 per 9 sq feet
- Release flies as adults, ships with oviposition stimulant, food source for adults to spray on plants

Lacewings(Chrysopidae)

- Efficient and voracious predators
- Both adults and larvae consume pests
- The larvae use their sickle shaped mouth parts to suck fluids from their prey
- Can be purchased

Prey: Mites, aphids, and other soft bodied insects

Spiders (Araneae)

- Among the most abundant predators in many habitats
- Generalist predators
- Serve as buffers that limit initial exponential growth of pest populations
- Do well when pesticide usage is limited
- Conservation biological control

Merle Shepard

Jumping spiders