Biological Control in Gardens & Landscapes

What is Biological Control?
- The use of living natural enemies to manage pests.
- All pest types, including insects, weeds, plant diseases, and rodents have natural enemies.
- Preserve and encourage naturally occurring beneficials!

In this presentation you will learn:
- Why biological control is important for healthy landscapes.
- Types of natural enemies.
- How to identify common beneficiais.
- How to encourage natural enemies by using an IPM program.

Know Your Natural Enemies!
- The most effective natural enemies occur naturally.
- Hundreds of species are common.
- Learn to recognize and protect them.

Main Types of Insect Natural Enemies
- Predators
  - Eat many prey
  - Are larger and stronger than their prey
  - Immatures are predaceous
  - Adults may also be predaceous
- Parasites
- Pathogens

Predators
- Lady beetle
- Green lacewing larva
- Aphid
- Syrphid fly larva
- Beetle larva
- Soil pests
- Spider
- Most insects
**What is Biological Control?**

- **General Predators**
  - Prey on a variety of pests
  - Examples: lacewings, ground beetles, predatory bugs, and spiders
  - Present and helpful, but alone rarely control pests

- **Predatory Mites (e.g., Phytoseiidae family)**
  - Prey on:
    - pest mites
    - scales
    - thrips
    - whitefly nymphs
    - insect eggs

- **Predatory Bugs (Heteroptera)**
  - **Minute pirate bugs** (Anthocoridae) prey:
    - aphids, mealybugs, mites, psyllids, small caterpillars, scales, thrips, and whiteflies
  - **Bigeyed bugs** (Geocorinae) prey:
    - other bugs, flea beetles, small caterpillars, and mites
  - **Assassin bugs** (Reduviidae) stalk:
    - caterpillars, leafhoppers, various small to medium, mobile insects

- **Spiders (Arachnida)**
  - Mostly beneficial predators
  - Most are unlikely to bite people
  - Are not insects: Have 8 legs and 2 body parts

- **Green Lacewings (Chrysopidae)**
- **Brown Lacewings (Hemerobiidae)**
  - Larvae feed on mites and insects:
    - aphids
    - caterpillars
    - mealybugs
    - psyllids
    - scales
    - whiteflies

- **Lady Beetles (Coccinellidae)**
  - The most effective predators specialize on certain prey
  - Convergent lady beetles mostly eat aphids
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**Lady Beetles – Aphid Specialists**

Usually are orangish species

- California lady beetle
- Sevenspotted lady beetle
- Twospotted lady beetle
- Western blood-red lady beetle

**Lady Beetles – Specialized Predators**

- Mealybug destroyer – mealybugs
- Spider mite destroyer – mites
- Twicestabbed – scales
- Vedalia – cottony cushion scale

**Lady Beetles – General Predator Species**

These lady beetles eat:
- aphids
- mites
- psyllids
- scales
- whiteflies

**Predaceous Ground Beetles (Carabidae)**

Adults and larvae live in litter and on soil.

Their prey includes:
- insect eggs, larvae, and pupae
- snails and slugs

**Soldier beetles (Cantharidae) – Leather-winged Beetles**

Larvae are general predators
- Feed under bark or in soil or litter
- Prey on invertebrates, e.g., eggs and larvae of beetles and moths

Adults prefer aphids
- Also eat pollen so often seen on flowers

**Syrphid flies (Syrphidae) – Flower Flies or Hover Flies**

Adults not predaceous:
- Eat pollen and nectar
- Often visit blossoms

Larvae are specialized:
- Usually eat aphids
- Also eat soft-bodied mealybugs, psyllids, whiteflies
**Mantids (Mantidae) – Praying Mantids**

- These fascinating creatures should be preserved.
- They eat both beneficials and pests and are not reliable for controlling pests.

**Parasites (technically Parasitoids)**

- Most are wasps or flies.
- Often smaller than their host.
- Kills only one host individual.
- Develop inside or outside of the host.
- Adult females in certain species feed on hosts.

**Signs of Parasitization**

Adult wasps are very small. You will more likely see evidence of parasite activity:

- Hosts that darken or differ in color from normal.
- The immature parasite itself is sometimes visible through the host’s surface.

**Pathogens**

Beneficial microorganisms that cause disease:

- Bacteria
- Fungi
- Viruses
- Insect-killing nematodes

**Bacillus thuringiensis or Bt subsp. kurstaki**

- Kills only caterpillars that eat Bt-sprayed plants.
- Bt subsp. *israelensis* (Bti) kills larvae of fungus gnats, mosquitoes, and certain other flies.
### Use an IPM Program

Following an IPM program is a great way to preserve and encourage natural enemies.

1. Identify the pest
2. Learn its common natural enemies
3. Preserve and enhance their effectiveness

### Pesticide Toxicity to Natural Enemies

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Contact Toxicity (immediate killing)</th>
<th>Persistence of Toxic Residue*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacillus thuringiensis</td>
<td>No contact</td>
<td>No persistence</td>
</tr>
<tr>
<td>Oils/Soaps</td>
<td>Moderate contact</td>
<td>No persistence</td>
</tr>
<tr>
<td>Botanicals (pyrethrins/azadirachtin)</td>
<td>Moderate to High contact</td>
<td>Short persistence</td>
</tr>
<tr>
<td>Spinosad</td>
<td>Moderate contact</td>
<td>Intermediate persistence</td>
</tr>
<tr>
<td>Organophosphates/Carbamates/Pyrethroids</td>
<td>High contact</td>
<td>Intermediate to long persistence</td>
</tr>
<tr>
<td>Imidacloprid: Foliar spray</td>
<td>Variable: Most natural enemies affected</td>
<td>Intermediate persistence</td>
</tr>
<tr>
<td>Imidacloprid: Soil applied or root/trunk-injected</td>
<td>Bees, predatory beetles and nectar-feeding parasites affected</td>
<td>Long persistence</td>
</tr>
</tbody>
</table>

* Persistence is the length of time a pesticide remains toxic:  
**Intermediate** = toxic for weeks; **Long** = toxic for months

### Reduce Pest Problems With Proper Plant Care

- Improve soil conditions and the plant growing environment
- Provide good drainage
- Irrigate plants appropriately
- Avoid excess fertilization

### Use Physical Controls

- Traps
- Water sprays
- Reflective mulches when plants are small
- Sticky barriers
- Row covers

### Use Physical Controls

- Hose off aphid-infested plants
- Trap snails and slugs

### Ants Often Protect Pests

Manage ants:
- Avoid plants that attract honeydew-producers
- Use sticky barriers
- Install bait stations

### Plants that Improve Biological Control

Adults of many natural enemies eat pollen and nectar.
- If provided, beneficials live longer and lay more eggs
- Insectary plants may provide shelter and alternate prey
- Plants with nectar and a long bloom season are best

**Grow these beneficial-attracting plants in your landscape:**
- buckwheats
- coreopsis
- cosmos
- sweet alyssum
- Queen Anne’s lace
- dill
- fennel
- mustards
- yarrow

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**Biological Control in Gardens & Landscapes**
What is Biological Control?

Using Biological Control

Releasing natural enemies can be somewhat effective in a few situations:

- Lady beetles for aphids
- Insect-killing nematodes for lawn grubs and moths that bore in tree

Applying insect-killing nematodes

Consult University of California Publications For More Information

Online at www.ipm.ucdavis.edu

Natural Enemies Gallery

Pest Notes

University of California Agriculture and Natural Resources
www.ipm.ucdavis.edu

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