Biological Control

After the relative amounts of pests and natural enemies are determined with preliminary monitoring, a number of tactics can be used to enhance biological control and be integrated into an IPM program:

1. Protecting natural enemies from disturbances such as pesticides, other management practices, their own natural enemies (e.g., ants), or adverse environmental conditions.

2. Providing supplementary nectar or pollen sources, alternate hosts, or shelter.

3. Manipulating the behaviors of natural enemies with food sprays, kairomones, or plant structure and arrangement.

4. Augmenting natural enemy populations with mass releases of lab-reared individuals.

5. Introducing natural enemies that are totally absent from an area.

General Observation Tips

1. When doing visual counts, also inspect the underside of leaves

2. Approach fast-moving insects slowly, or use nets, beating trays and traps for these to get a closer look

Distinguishing Natural Enemies
from Plant Pests in General

1. Spend a few extra seconds or minutes observing the specimen to see if it feeds on animals or plants

2. To see if a particular natural enemy attacks a target pest species, place them together in an enclosed environment that allows both animals room to move
**Predacious Hoverflies** (Diptera: Syrphidae)

**Identification** 1/4 - 3/4”
Adults are mimics of wasps & bees, but fly more quickly or hover, often with yellow markings, larvae maggotlike, eggs small, whitish and oblong

**Observation Tips**
Eggs, larvae, and tar-like excrement are found at aphid colonies, adults mostly found on or hovering at flowers

**Predacious Activity**
Larvae prey mostly on aphids & scale insects, adults obligate flower feeders, some species not predacious

**Other Insects Confused with Hoverflies**
- bee flies
- bees
- wasps

**Ground or ‘Carabid’ Beetles** (Coleoptera: Carabidae)

**Identification**
Adults are dark or metallic with ridged wing covers, larvae grublike with large mandibles

**Predacious Activity**
Larvae prey mostly on aphids & scale insects, adults obligate flower feeders, some species not predacious

**Observation Tips**
Adults mostly active at night. Look for fast running adults under objects on soil surface or in soil samples, larvae in soil samples

**Other Beetles Confused with Carabids**
- Tenebrionid beetles
- Rove Beetles

**Parasitoid Tachinid Flies** (Diptera: Tachinidae)

**Identification** 1/3 - 2/3”
Adults similar to houseflies, but with very long bristles on tail end, puparia red to brown & oblong, larvae inside host, eggs white & oblong on host

**Parasitic Activity**
Important endoparasitoids of many worm, beetle, sawfly and bug pests, can increase populations rapidly

**Observation Tips**
Adults seen on flowers, look for eggs on host, puparia near host

**Other Beetles Confused with Carabids**
- Tenebrionid beetles
- Rove Beetles

**Rove Beetles** (Coleoptera: Staphylinidae)

**Identification**
1/8 – 1/3”

**Predacious Activity**
Prey mostly on small soil organisms

**Observation Tips**
Adults small with short wing covers not covering abdomen

**Other Insects Confused with Rove Beetles**
- carrion beetles
- earwigs (adults > 1/3”)

**Damsel or ‘Nabid’ Bugs** (Hemiptera: Nabidae)

**Identification** 1/3 – 1/2”
Adults & nymphs long and thin with front legs slightly enlarged for grabbing prey

**Predacious Activity**
Prey mostly on soil organisms, some others feed on seeds

**Observation Tips**
Adults mostly active at night. Look for fast running adults under objects on soil surface or in soil samples, larvae in soil samples

**Predacious Activity**
Most commonly found running on low, dense vegetation

**Other Bugs Confused with Nabid Bugs**
- some of the thinner Mirid bugs
- assassin bugs
- stilt bugs

**Predacious Stink Bugs** (Hemiptera: Pentatomidae)

**Identification** 1/3 – 2/3”
Adults & nymphs have a broad pentagon or shield shape. Usually brown or grey rather than green

**Predacious Activity**
Adults and nymphs prey on other insects in same habitat

**Observation Tips**
Found on vegetation, may have to observe activity to determine if a the species is predacious or herbivorous

**Similar-looking Herbivorous Stink Bugs**
- Perillus bioculatus
- Brochymena sp. nymph

**Observation Tips**
Adults mostly active at night. Look for fast running adults under objects on soil surface or in soil samples

**Predacious Activity**
Adults and nymphs prey on other insects in same habitat
**Minute Pirate Bug**  
*(Hemiptera: Anthocoridae)*

**Identification**  
<1/8"  
Adults with a black & white cross pattern, larvae orange to dark red

**Predacious Activity**  
Adults and nymphs prey on other small insects in same habitat

**Observation Tips**  
Found on vegetation and flowers, more easily monitored with nets or beating trays due to small size

---

**Assassin Bugs**  
*(Hemiptera: Reduviidae)*

**Identification**  
1/3 – 1"  
Adults & nymphs resemble damsel bugs, but larger, with a wider abdomen, thinner neck and often with spines

**Predacious Activity**  
Adults and nymphs prey on many types of insects in same habitat

**Observation Tips**  
Found on vegetation and flowers

---

**Big-eyed Bugs**  
*(Hemiptera: Lygaedae)*

**Identification**  
<3/16"  
Adults and nymphs with big eyes, fast-moving and slightly larger than minute pirate bugs

**Predacious Activity**  
Adults and nymphs prey on other small insects in same habitat

**Observation Tips**  
Found on vegetation or the ground, more easily monitored with nets or beating trays due to speedy flight & size

---

**Ambush Bugs**  
*(Hemiptera: Phymatidae)*

**Identification**  
1/3 – 2/3"  
Adults and nymphs are often camouflaged like leaves & flowers to ambush prey

**Predacious Activity**  
Adults and nymphs prey on other insects in same habitat

**Observation Tips**  
Found on flowers and vegetation

---

**Tiger Beetles**  
*(Coleoptera: Cicindellidae)*

**Identification**  
1/2 -2/3"  
Adults shiny with large eyes & mandibles, very fast runners and flyers

**Predacious Activity**  
Adults usually seen flying over & running on light & sandy soils

**Observation Tips**  
Found on leaves and flowers

---

**Soldier Beetles**  
*(Coleoptera: Cantharidae)*

**Identification**  
1/2– 1"  
Adults are long and thin with long antennae, often with red or orange markings

**Predacious Activity**  
Adults prey on other insects in same habitat

**Observation Tips**  
Found on leaves and flowers

---

**Similar-looking Bugs**

**Other Bugs Confused with Assassin Bugs**

- damsel bugs
- ambush bugs
- stilt bugs

**Similar Types of Beetles**

- soft-winged flower beetles
- ground beetles

---
**Thread-waisted Wasps**  
*Hymenoptera: Sphecidae*

**Observation Tips**  
Active near open sandy areas and flowers

**Identification**  
Stout-bodied to slender, often with a very narrow waist and wide head

-Trypoxylon sp.

**Predatory Activity**  
Many species specialize on various insect prey species. Females capture prey and bring back to larvae in nests

**Parasitized & Diseased Insect Pests**

**Larger Parasitoid Wasps**  
*Hymenoptera: eg. Ichneumonidae, Braconidae*

**Identification**  
Braconids are < ½", Ichneumonids are usually larger with a longer abdomen

-Ichneumonid wasps

**Parasitic Activity**  
Kill hosts by parasitism or by piercing and feeding; hosts include insect larvae, pupae and aphids

-Braconid wasps

**Observation Tips**  
Adults found at flowers or looking for hosts; monitor by looking for parasitized hosts (p. 23)

**Support for this project provided by:**

**Smaller Parasitoid Wasps**  
*Hymenoptera: eg. Chalcididae, Eulophidae, Encyrtidae, Trichogrammatidae, Aphelinidae, Pteromalidae*

**Identification**  
Mostly <1/8”

-Encyrtid Wasp

**Parasitic Activity**  
Kill hosts by parasitism; hosts include insect eggs, larvae & pupae

-Chalcid Wasp

**Observation Tips**  
Monitor by looking for parasitized hosts (p. 23)

-Aphelinus perpallidus

**Dolichovespula maculata**

**Bald-faced Hornet**

**Predatory Activity**  
Adults bring masticated insects, meat and nectar of many types back to the larvae in large nests

-Vespa pensylvanica

**Western Yellowjacket**

**Other Insects Confused with Thread-waisted Wasps**  
hoverflies, Vespid wasps

**Vespid Wasps (yellowjackets, hornets)**  
*Hymenoptera: Vespidae*

**Identification**  
Medium to large, black with yellow or white markings; wings smoky and folded longitudinally

-Dolichovespula maculata

**Predatory Activity**  
Adults bring masticated insects, meat and nectar of many types back to the larvae in large nests

-Vespa pensylvanica

**Western Yellowjacket**

**Other Insects Confused with Vespid Wasps**  
hoverflies, Thread-waisted wasps

**Parasitized & Diseased Insect Pests**

Any comments or questions regarding the content of this pocketbook are welcomed and can be directed to:

Mario Ambrosino  
Integrated Plant Plant Protection Center (IPPC)  
2040 Cordley Hall  
Corvallis, OR 97333  
(541) 737-2638  
ambrosim@science.oregonstate.edu

Support for this project provided by:**

**Oregon Tilth, Inc.**