The Good, the Bad, and the Neutral: Recognizing Utah Arthropods and Their Roles in Orchard and Field Ecology

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An Overview of Today’s Talk

- Terms, Definitions.
- Stand-out characteristics of many beneficial arthropods.
- Developmental stage and ecological context.
- Common groups of natural enemies.
- (Recognize immature stages.)
- (Important arthropods in Utah.)
Life-History Strategies

- **Predator**: consumes (kills) two or more individuals to complete its development.

- **Parasitoid**: consumes (kills) exactly one individual to complete its development.

- **Parasite**: consumes but generally does not cause the death of one or more individuals.

- *(What is the most important group of insect-eating animals?)*
Stand-out Characteristics of Many Beneficial Arthropods

- **Parasitoids:**
  - The “beneficial stage” is the larva (although adult females of certain species can host-feed).
  - **Host-specificity**
  - **Micro-environment specificity**
  - **Endo- and ecto-parasitism**
  - **Ovipositor specialization** (e.g., Hymenoptera).
  - Gregarious egg-laying, polyembryony.

- **Predators (in general):**
  - The “beneficial stage” may be either the immature, the adult, or both.
  - **Raptorial forelegs.** (e.g., Hemiptera, Mantodea)
  - **Forward-oriented mouthparts** (e.g., Hemiptera, Neuroptera).
  - **Chewing mouthparts** (e.g., Coleoptera).
  - Sucking/rasping mouthparts (e.g., Diptera).
  - Relatively large, well-developed eyes.
  - Well-developed legs for running, climbing, jumping.
Consider the Developmental Stage and Ecological Context

- In general, beneficial arthropods can be relied upon to serve specific functions at specific times.
  - Parasitoids typically target very specific stages of a narrow range of host species.
  - Predators generally target a wider range, although there are often particular prey groups on which predators will focus.

- However, predation can be on non-pests (coccinellids feeding on aphids), or on other predator species (robber fly feeding on a yellow-jacket), on their own species (dragonflies), or on their own siblings (lacewing larvae).

- A “pest” at one point in the season can become a “beneficial” later, depending on available resources.
  - Hungry earwigs combing over apples for codling moth eggs.
  - Campylomma nymphs

- Likewise, a beneficial species can become troublesome if it begins disrupting/eating other beneficiais.
  - Ants defending aphids, mealybugs, or caterpillars.

- “Neutral” adults of certain species may produce highly predaceous progeny.
The Predominant Terrestrial Predator Groups

- Hymenoptera (wasps and ants)
- Hemiptera (true bugs)
- Coleoptera (beetles)
- Neuroptera (lacewing larvae)
- Phytoseiid Mites (predatory mites)
- Diptera (tachinid flies, robber flies, midges)
- Odonata (dragonflies)
- Mantodea (mantids)
Wasps and Ants (Hymenoptera)

- Parasitic wasps
- Ants
- Social and solitary wasps.

(Are there any plant-eating Hymenoptera?)
True Bugs (Hemiptera)

- Assassin bugs, ambush bugs.
- Damsel bugs.
- Big-eyed bugs.
- Minute pirate bugs.
- Soldier bugs and stink bugs (certain species).
- Miridae (predominantly plant feeders, but also very opportunistic omnivores).
Beetles (Coleoptera)

- Ground beetles (carabids, roves)
- Lady beetles
- Mealybug destroyers
- Spider mite destroyers (see mounted specimens)
- Soldier Beetles
Lacewings (Neuroptera)

- Green lacewing larvae
- Brown lacewing
- Antlions
Predatory Mites (Phytoseiidae)

- **Western predatory mite**: *Metaseiulus (=Galendromus=Typhlodromus) occidentalis*

- *Phytoseiulus persimilis*

- (Are herbivorous mites the only plant-eating arachnids?)
  - Yes.
Flies (Diptera)

- Asilids (robber flies)
- Parasitoids (macro- and micro-type eggs)
- Syrphids (hover flies)
- Cecidomyiids (midges)
Other Predators

- Earwigs
- Dragonflies
- Mantids
- Spiders
- Snakeflies
Take-home Points

- Try to identify and foster populations of natural enemies in the garden, field, or orchard (even if they are a nuisance, such as spiders, ants, and wasps).

- Bear in mind that natural enemies may not be feeding on the critical pest species.

- Agriculturally important natural enemies are often parasitoids because these species are very host-specific.

- Co-evolution seems to have built enough “inefficiency” into predator-prey relations that natural enemies rarely drive their prey to local extinction. Economic injury levels determine the degree to which control is left to natural enemies.

- Keep a field guide handy.
Encarsia formosa parasitizing whiteflies
Developmental Stages of an Assassin Bug
Lygus Bug (Lygus spp.)
Big-Eyed Bugs (Geocoris spp.)
Metaseiulus occidentalis

Western predatory mites (top and bottom), a spider mite (center), and round spider mite eggs
Western predatory mite attacking spider mite egg
A western predatory mite egg
Phytoseiulus persimilis

Twospotted spider mite (left)
Phytoseiulus sp. (right)

Phytoseiulus persimilis feeding
Sixspotted Thrips and Damsel Bugs: Predaceous as Nymphs and Adults
Minute Pirate Bug (Orius spp.)
Social Insects: Adults Forage/Hunt on Behalf of Immatures
Developmental Stages of the Convergent Lady Beetle
Intra-specific Cannibalism
Predaceous Larvae/Neutral Adult
(Lacewing and Hover fly)
Aphid parasitoid emerging from aphid mummy.
Lacewing Larva Eating Corn
Earworm Larva
Soldier Beetle, Adult (Cantharidae)
Soldier Beetle (Cantharidae)
Earwig Adult (Dermaptera)
Inter-specific Predation *(robber fly)*
Brown Lacewing
Mealybug Destroyer (Cryptolaemus montrouzieri)
Praying Mantid (Mantodea)
Tachinid Fly
Snakefly Adult (Raphidiidae)
Typical Predator Traits: Raptorial Forelegs and Pronounced Rostrum
Raptorial Forelegs

Do all arthropods with raptorial-like forelegs use them for capturing prey?

No. (See cicada nymphs and lice.)
Common Ground Beetle (*Carabidae*)
Egg Parasitoid (Trichogramma spp.)
Larval Parasitoid (*Hyposoter exiguae*)
Caterpillar Egg?
Goniozus legneri searches rotting nuts and fruit for navel orangeworms.
Aphytis and Encarsia: Ecto- and endo-parasitoids of San Jose scale.
Encarsia pupa inside scale body
Aphytis larvae and pupae