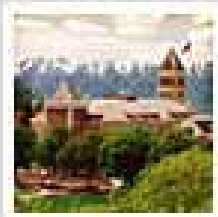
The Good, the Bad, and the Neutral:

Recognizing Utah Arthropods and Their Roles in Orchard and Field Ecology

Shawn Steffan
IPM Project Leader
Utah State University
Logan, Utah



UtahState UNIVERSITY EXTENSION
extending usu to you

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 beneficials**.
  - 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

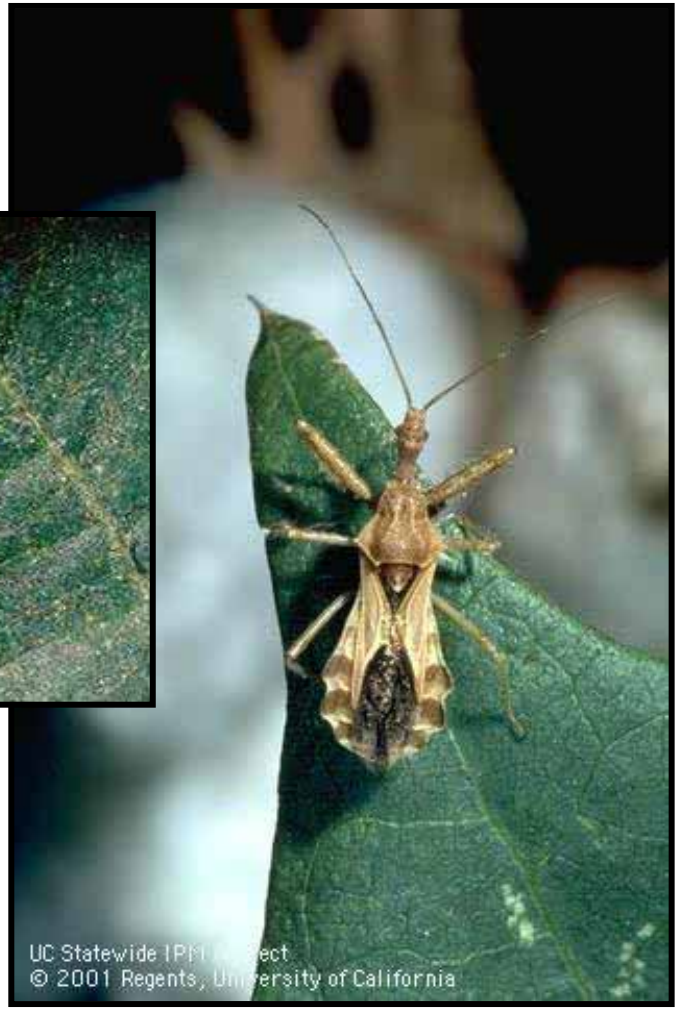
- Earwigs
- Dragonflies
- Mantids
- Spiders
- Snakeflies

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.

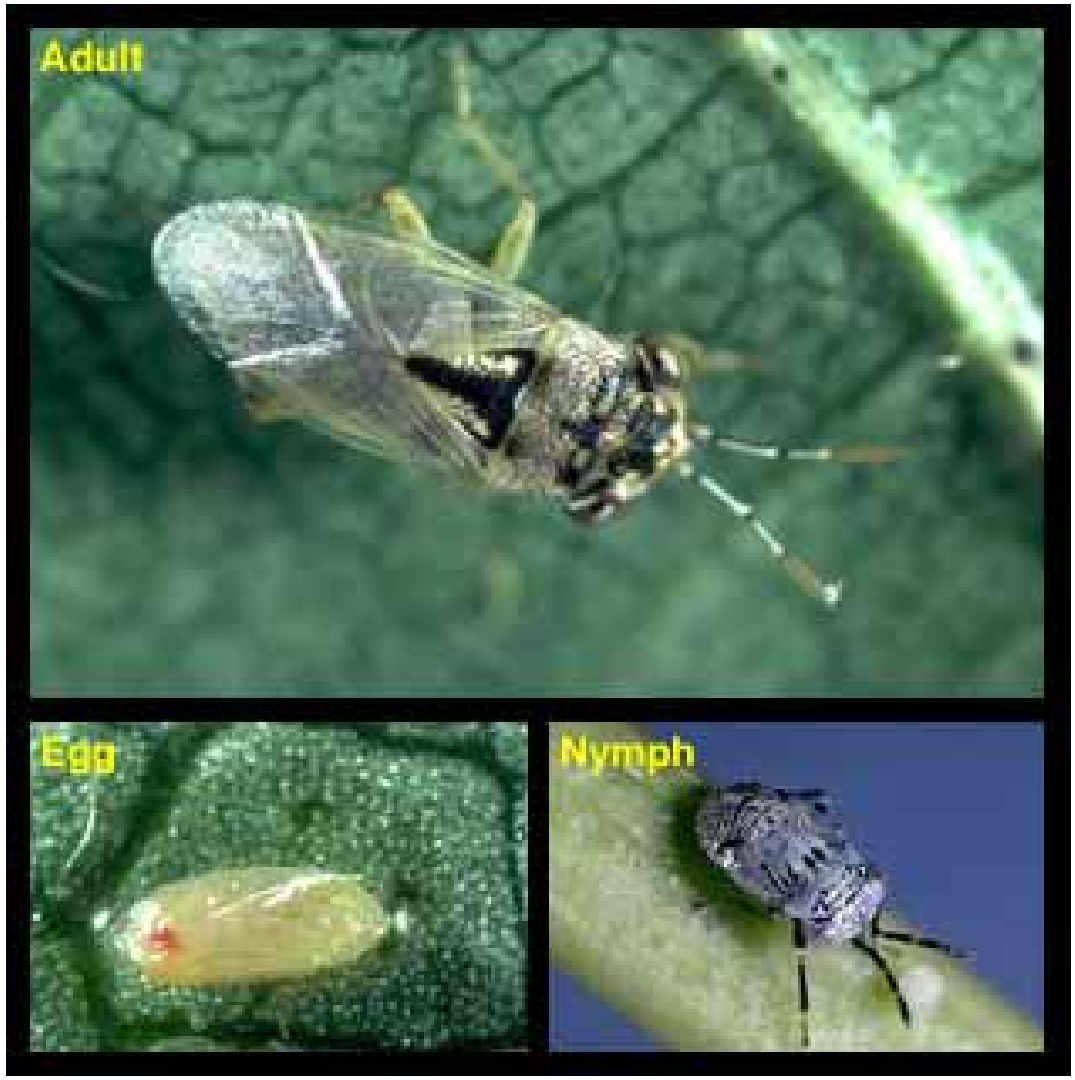
Encarsia formosa parasitizing whiteflies

Developmental Stages of an Assassin Bug



Lygus Bug (*Lygus* spp.)

Big-Eyed Bugs (*Geocoris* spp.)



Metaseiulus occidentalis

Phytoseiulus persimilis

Sixspotted Thrips and Damsel Bugs: Predaceous as Nymphs and Adults

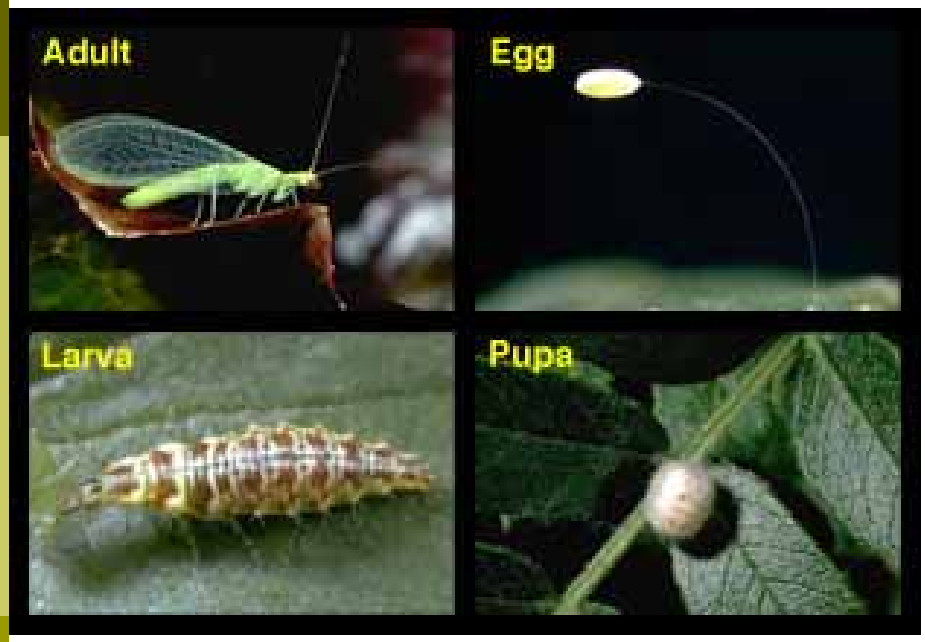
Minute Pirate Bug (*Orius* spp.)

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 (*Hyposeter 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