Lec. 3

Biological control: A tool for pest management

Characteristics of effective biocontrol agents

- **Narrow host range. Generalized predators may be good natural enemies but they do not kill enough pests when other types of prey are also available.**
- **Climatic adaptability. Natural enemies must be able to survive the extremes of temperature and humidity that they will encounter in the new habitat.**
- **Synchrony with host (prey) life cycle. The predator or parasite should be present when the pest first emerges or appears.**
- **High reproductive potential. Good biocontrol agents produce large numbers of offspring. Ideally, a parasite completes more than one generation during each generation of the pest.**
- **Short handling time. Natural enemies that consume prey rapidly or lay eggs quickly have more time to locate and attack other members of the pest population. Small populations of efficient natural enemies may be more effective biocontrol agents than larger populations of less efficient species.**
- **Survival at low host (prey) density. If a natural enemy is too efficient, it may eliminate its own food supply and then starve to death. The most effective biocontrol agents reduce a pest population below its economic threshold and then maintain it at this lower equilibrium level.**

Successes full Examples of Bio control Agents of Insect Pests in world

• **Cottony cushion scale** (*Icerya purchasi*). **This pest of citrus is kept in check by *Rodolia cardinalis*, a ladybeetle introduced from Australia.**

• **Woolly apple aphids** (*Eriosoma lanigerum*). **In apple orchards of the northeastern and northwestern U. S., these aphids are controlled by *Aphelinus mali*, a chalcid parasite native to Europe.**

• **Alfalfa weevils** (*Hypera postica*). **An tachinidae wasp(*Bathyplectes curculionis*) parasitizes this beetle's larvae and a braconid wasp (*Microtonus aethiopoides*) parasitizes the adults.**

• **Cassava mealybugs** (*Phenacoccus manihoti*). **This pest spread throughout much of tropical Africa in the 1980's, but it has been largely brought under control by an achinid wasp (*Apoanagyrus lopezi*) discovered in South America.**

• **Green stink bugs** (*Nezara viridula*). **Tachinid flies (*Trichopoda* spp.) from Antigua and Monserrat were released in Hawaii to control this pest of vegetable crops.**

Some Common Beneficial Insects Natural enemies

Order: coleoptera:

Beetles

• 1/3 of all animals – 40% of all insects – are beetles

• Hard opaque wing covers are called elytra

• Beetles undergo complete metamorphosis

• Larvae and adults have chewing mouthparts

• Larvae have well-developed heads and 3 pairs of legs.

Lady Beetles, Order: Coleoptera, Family: Coccinellidae

Lady Beetles

Larvae and adults eat soft-bodied insects such as aphids, mealybugs, spider mites, caterpillars, insect eggs

Voracious aphid feeders!

Two main body types:

1. Round (hemispherical)
2. Oval

Round lady beetles

Seven-spotted Lady Beetle

7 spots in a 1-4-2 pattern

Seven-spotted **lady beetle** lunches at the aphid café

Seven-spotted lady beetle larvae like aphids too!

Larvae hatching

Larvae feed on grasshopper eggs, adults feed on foliage and fruits

Convergent Lady Beetle

Thorax has two converging white lines and a white margin

larva and eggs

Pink Spotted Lady Beetle

Other Predatory Beetles

Order Coleoptera

Rove Beetle

Adults attack aphids, nematodes, flies; some larvae are parasitic on maggots

Ground Beetle

larva feeding on caterpillar

Larvae and adults attack aphids, slugs, snails, cutworms, caterpillars

nocturnal foragers

adult

adult feeding on snail

Soldier Beetle

Adults feed on grasshopper eggs, ap
a
nd sl

dead fungus-infected soldier beetle

look-alike lightning bug

Tiger Beetle

Adults attack many different insects

Blister Beetle

Larvae feed on grasshopper eggs, adults feed on foliage and fruits

True Bugs

Order Hemiptera

True Bugs

- Two pairs of wings usually present
- Forewings modified to hemelytra, hind wings entirely membranous
- Mouthparts enclosed in a piercing-sucking beak that curves beneath the body
- Incomplete metamorphosis: egg, nymph, adult
- Some groups (e.g., stink bugs) have scent glands on the sides of thorax
- Order includes both plant feeders and predators

Predatory Bugs

Order Hemiptera

Minute Pirate Bug

adult feeding on egg

Adults and nymphs attack aphids, mites, thrips, small caterpillars, and insect eggs

adult feeding on aphid

nymph

Bigeyed Bug

adult

Adults and nymphs attack mites, thrips, flea beetles, small caterpillars, and insect eggs

egg

nymphs

Assassin Bug

adult

eggs

Adults and nymphs attack many insects, including flies, tomato hornworms, and other large caterpillars

adults attacking caterpillar

Damsel Bug

Adults attack aphids, thrips, leafhoppers, flea beetles, plant bugs, and small caterpillars

Adult (left) and nymph

Predatory Stink Bugs

Family Pentatomidae

Spined Soldier Bug

Podisus adult attacking beetle larva

Adults and nymphs attack caterpillars, Colorado potato beetle larvae, Mexican bean beetle larvae

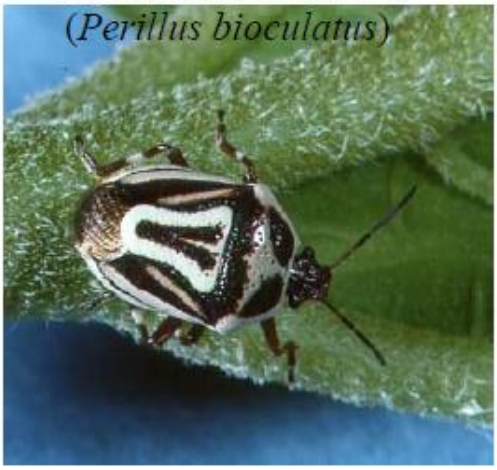
nymph attacking Colorado potato beetle larva

Other Predatory Stink Bugs

Anchor bug (*Stiretrus anchorago*)

Anchor bug feeding on asparagus beetle larva

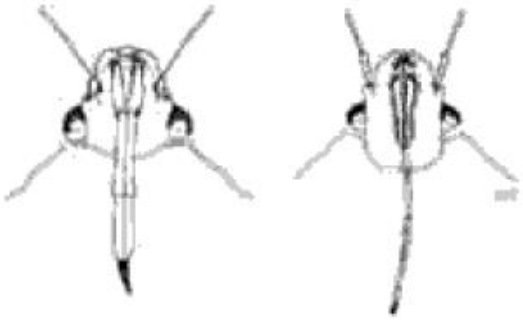
Two spotted stink bug (*Perillus bioculatus*)



nymph

Pest and Beneficial Stink Bugs

beak structures of predaceous (left) and plant-feeding (right) stink bugs



beak structure of brown stink bug and spined soldier bug

Lacewings

Order Neuroptera

Green Lacewing

larva feeding on aphids

larva

Larvae attack soft-bodied insects including aphids, thrips, mealybugs, scales, mites, and caterpillars

adult

stalked eggs

larvae emerging from eggs

Brown Lacewing

larva

adult

egg

pupa

Other Predators