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Entomology

Janet Spencer
Extension Agent, ANR
Isle of Wight County



Entomology

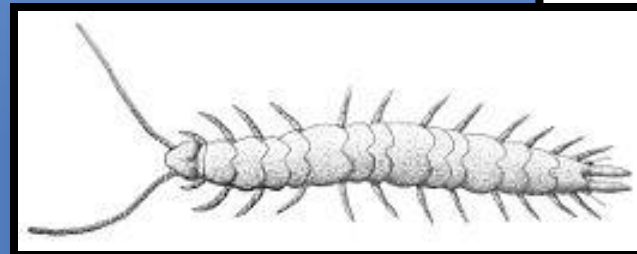
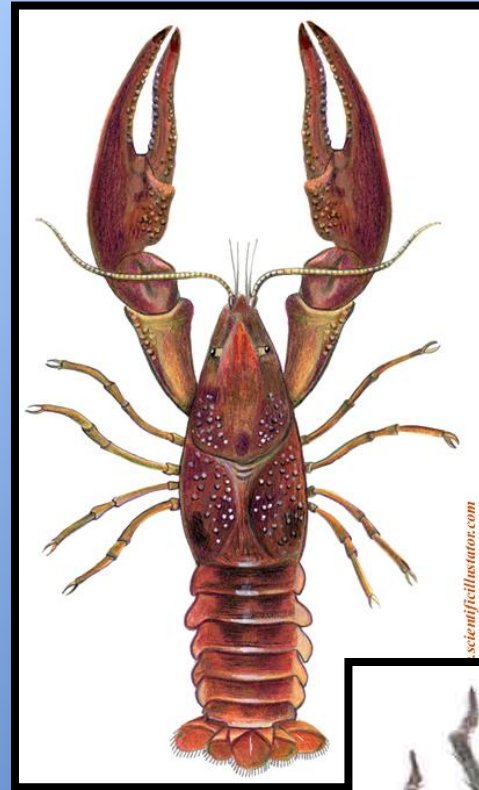
- The study of insects
- Dominant groups of animals on earth today
- Life on earth:
 - Modern humans=200,000 years
 - Insects=350 million years
- 100,000 different species live in North America

Insect Classification

- Hierarchical system of classification
- Kingdom > Phylum > Class > Order > Family > Genus > Species
- Kingdom=Animal
- Phylum=Arthropods
- Class=Insecta

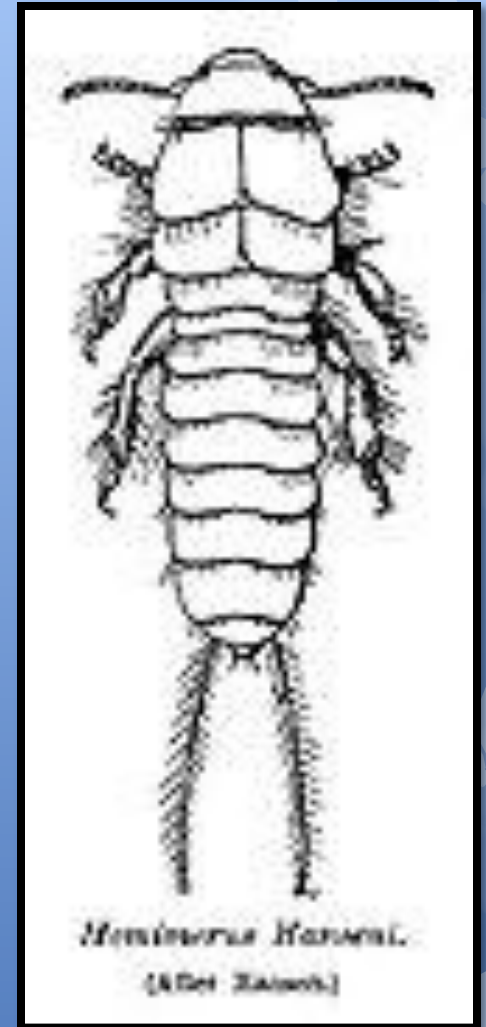
Arthropoda classes

- Crustacea
 - Crayfish, sowbugs
 - 2 body segments and 5 pairs of legs
- Arachnida
 - Spiders, ticks, and mites
 - 2 body segments and 4 pairs of legs
- Symphyla
 - Symphylans
 - 2 body segments and 12 pairs of legs



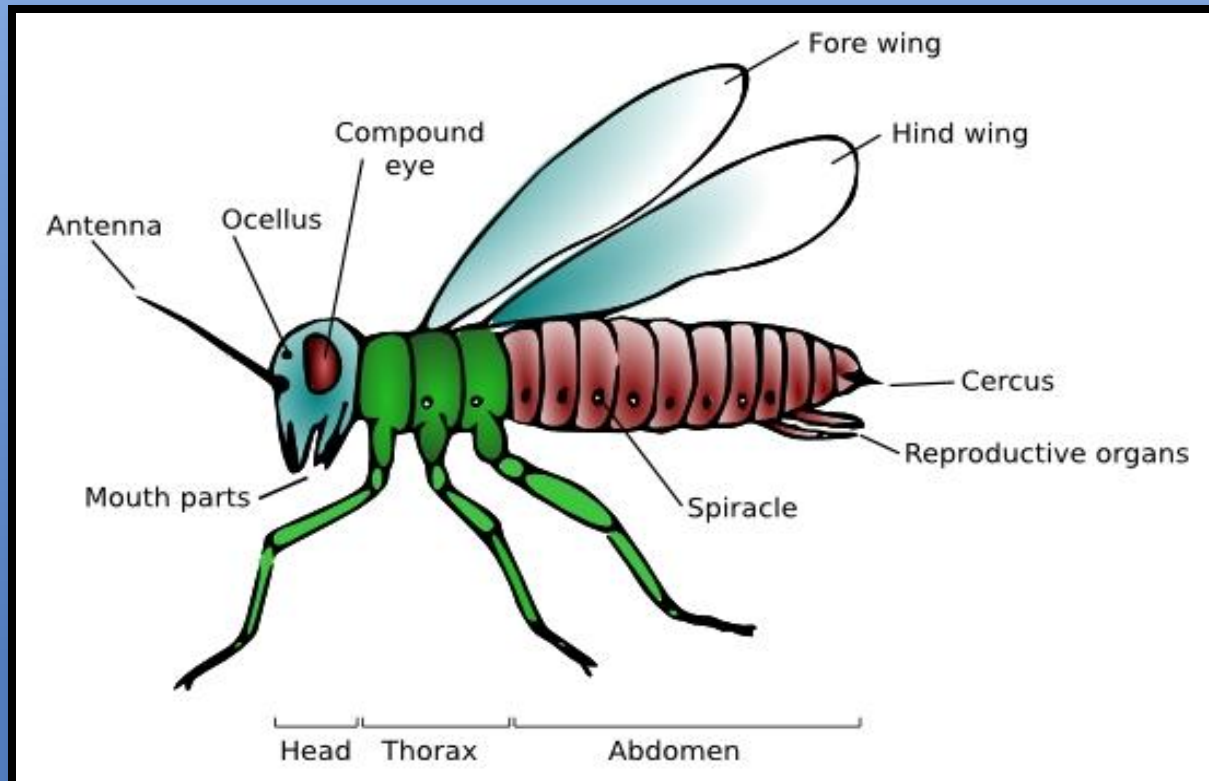
Arthropods

- Segmented body
- Paired appendages
- Bilateral symmetry
- Chitinous exoskeleton
- Tubular alimentary system, with mouth & anus
- Open circulatory system
- Nervous system
- Respiration by gills, trachea, or spiracles
- Sexes are almost always separate



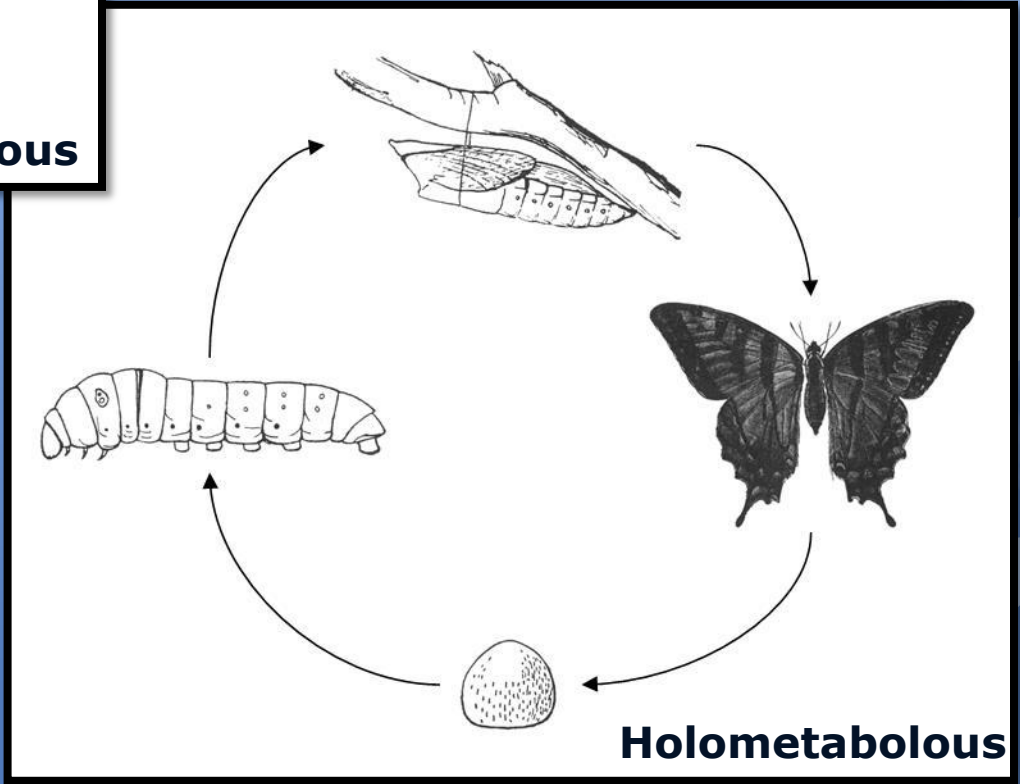
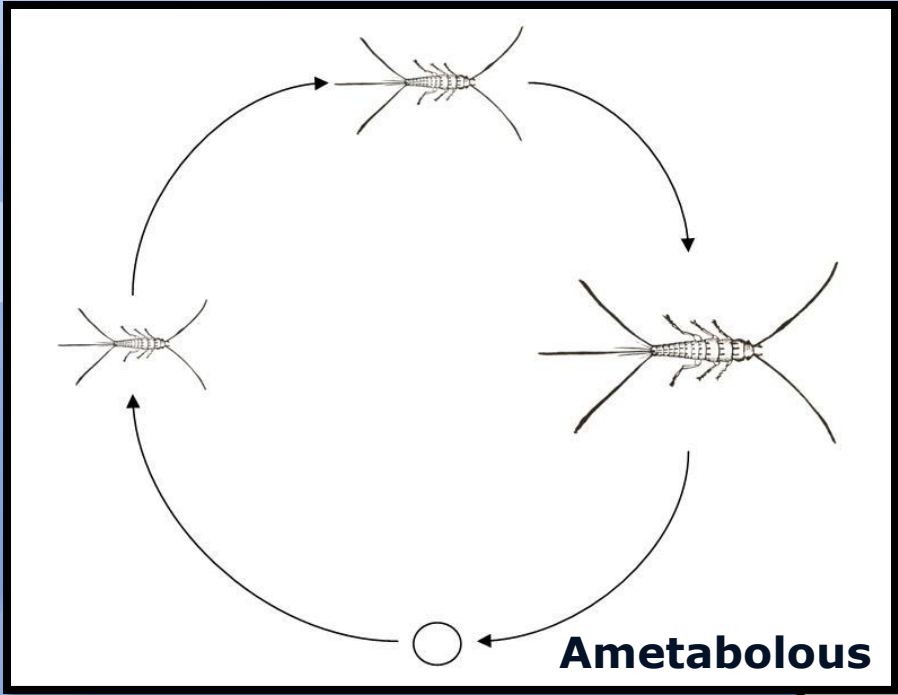
Insecta

- Bugs, beetles, and butterflies
- 3 body segments and 3 pairs of legs

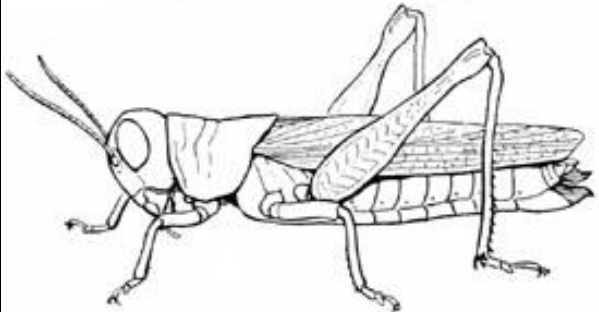
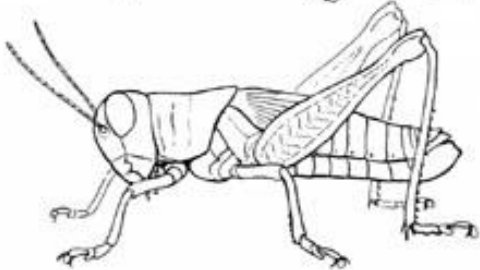


Insect Orders

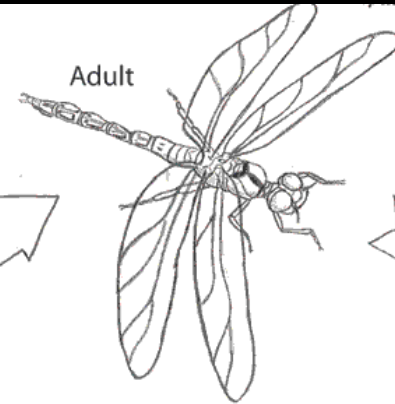
- About 28 different orders of insects
- Divided into these orders based on structure of wings and mouthparts and their type of metamorphosis
- Ametabolous: growth without change
- Paurometabolous: incomplete or gradual
 - Hemimetabolous
- Holometabolous: complete metamorphosis



Paurometabolous



Adult



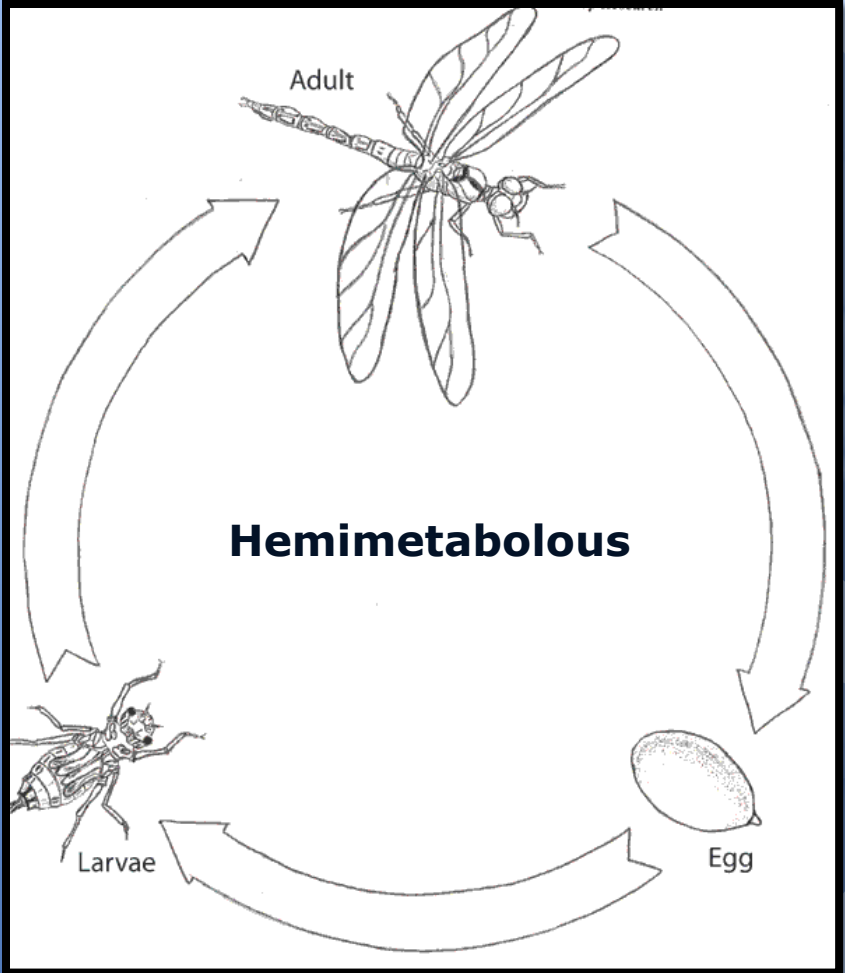
Hemimetabolous



Larvae



Egg



- **Collembola**

- Springtails
- Ametabolous



- **Orthoptera**

- Grasshoppers, crickets
- Paurometabolous



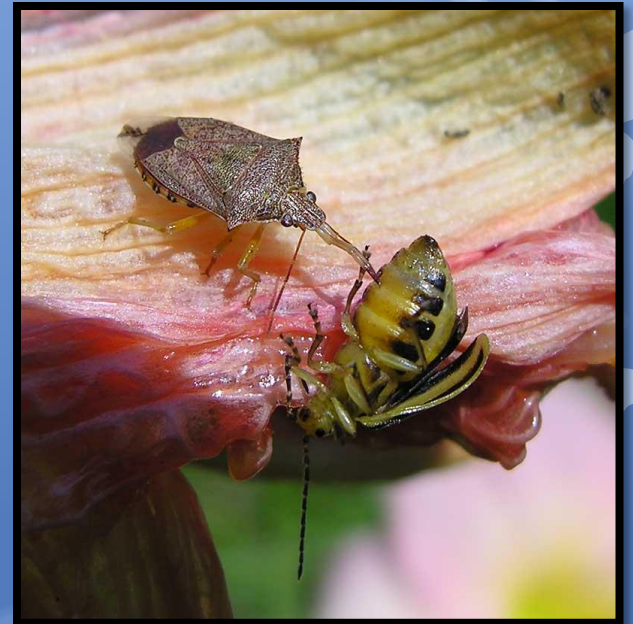
- **Isoptera**

- Termites
- Paurometabolous



- **Hemiptera**

- True bugs
- paurometabolous



- **Homoptera**

- Aphids, scales
- Paurometabolous



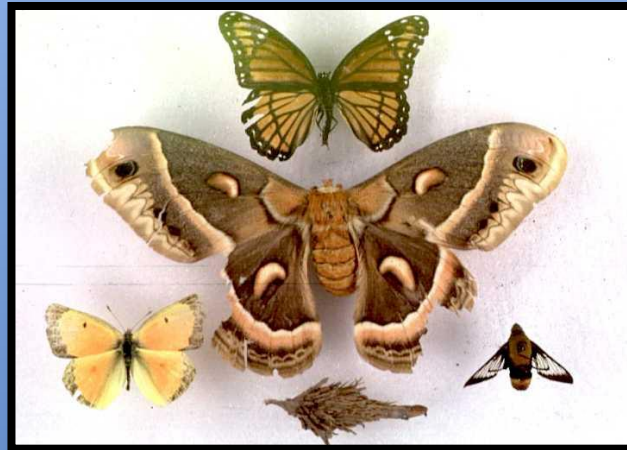
- **Coleoptera**

- Beetles, weevils
- Holometabolous



- **Lepidoptera**

- Butterflies & moths
- Holometabolous



- **Hymenoptera**

- Wasps , bees, ants
- holometabolous



- **Diptera**

- Flies
- Holometabolous



- **Siphonoptera**

- Fleas
- Holometabolous



- **Dermaptera**

- Earwigs
- Paurometabolous



- **Thysanura**

- Silverfish
- ametabolous



- **Ephemeroptera**

- Mayflies
- Hemimetabolous

- **Odonata**

- Dragonflies & damselflies
- Hemimetabolous

- **Blattaria**

- Cockroaches
- Paurometabolous

- **Phasmida**

- Walking sticks
- Paurometabolous



- **Mantodea**

- Mantids
- Paurometabolous



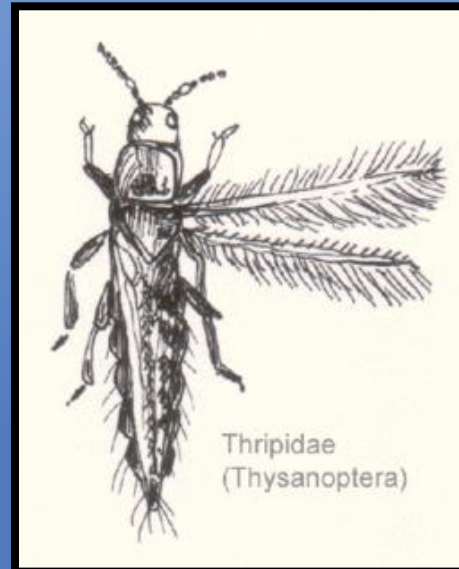
- **Phthiraptera**

- Lice
- Paurometabolous



- **Thysanoptera**

- Thrips
- Hybrid between holo- and pauro-metabolous



- **Neuroptera**

- Lacewings, antlions
- Holometabolous



Morphology

The background of the slide is a light blue gradient. It is decorated with numerous white butterfly silhouettes of various sizes and orientations, scattered across the frame. The word "Morphology" is centered in a bold, black, sans-serif font.

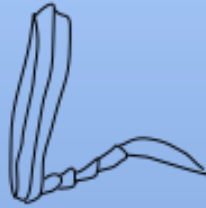
Head: Antennae

- Filiform: threadlike, the segments are nearly uniform in size and usually cylindrical (ground beetle)
- Monofiliform: like a string of beads, segments are similar in size and more or less spherical in shape (some beetles)
- Clavate: segments increasing in diameter distally (ladybird beetles)
- Serrate: sawlike, segments more or less triangular (click beetle)
- Pectinate: comblike, most segments with long, slender, lateral processes (some beetles)
- Setaceous: bristlelike, segments becoming more slender distally (dragonfly, damselfly)
- Plumose: feathery, most segments with whorls of long hair (moth moths; allows for more surface area to pick up pheromones; mosquitoes)
- Aristate: last segment usually enlarged and bearing a conspicuous dorsal bristle (blow flies; used as air speed indicators)



ARISTATE

(Blow flies)



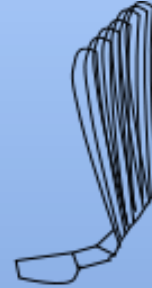
LAMELLATE

(June Beetle)



SERRATE

(Click beetle)



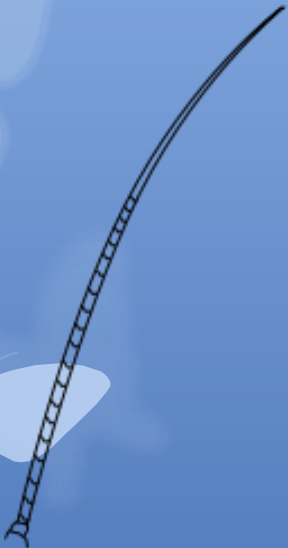
FLABELLATE

(Cedar beetle)



MONILIFORM

(Bark beetles)



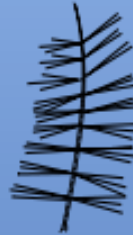
SETACEOUS

(Dragonfly)



GENICULATE

(Chalcid)



PLUMOSE

(Mosquitoes)



PECTINATE

(Fire-colored Beetle)



STYLATE

(Snipe fly)



CLAVATE

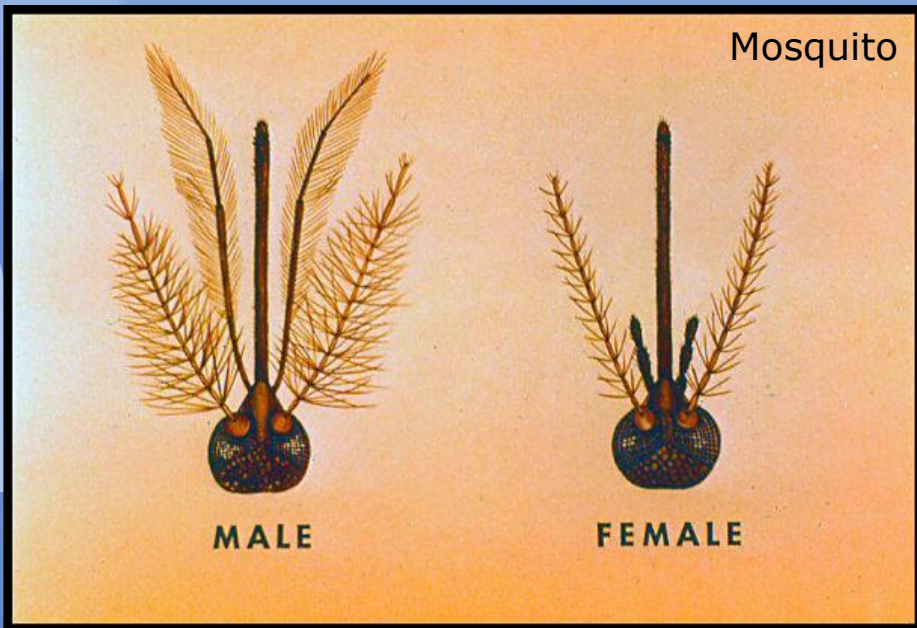
(Ladybird Beetle)



Fire-colored beetle



Butterfly



Mosquito

MALE

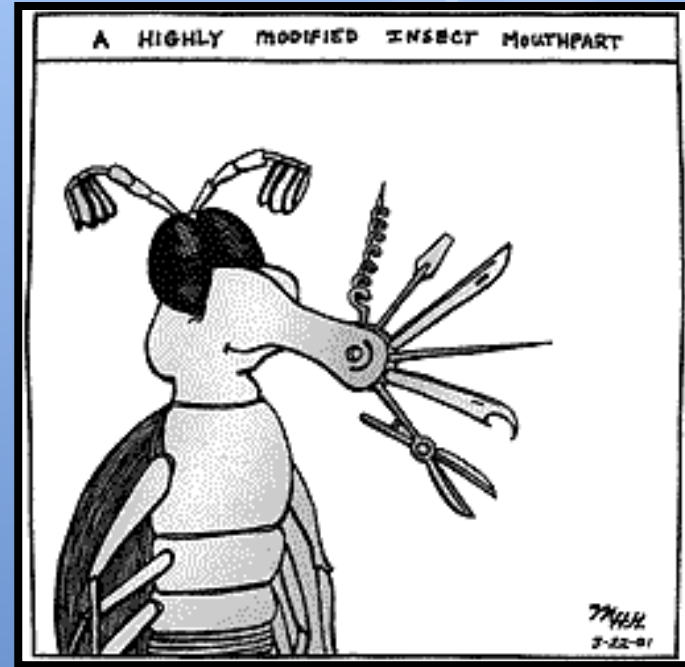
FEMALE

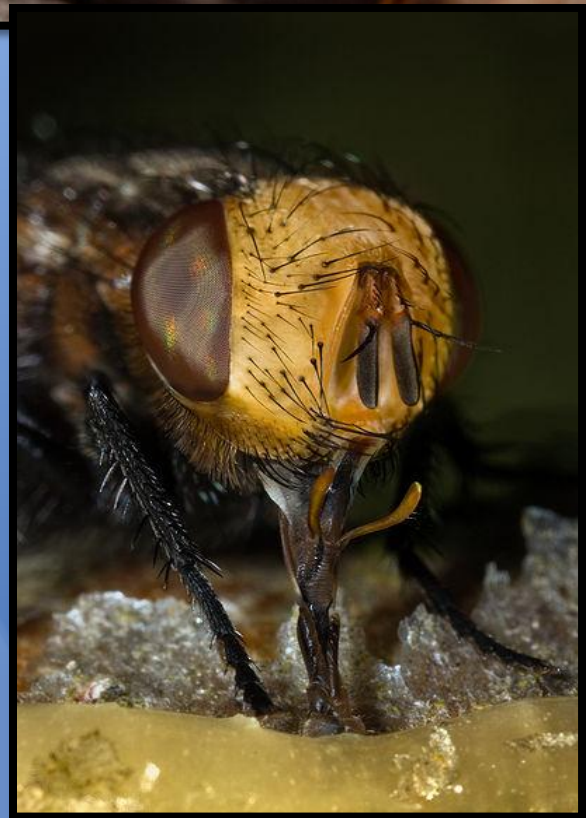
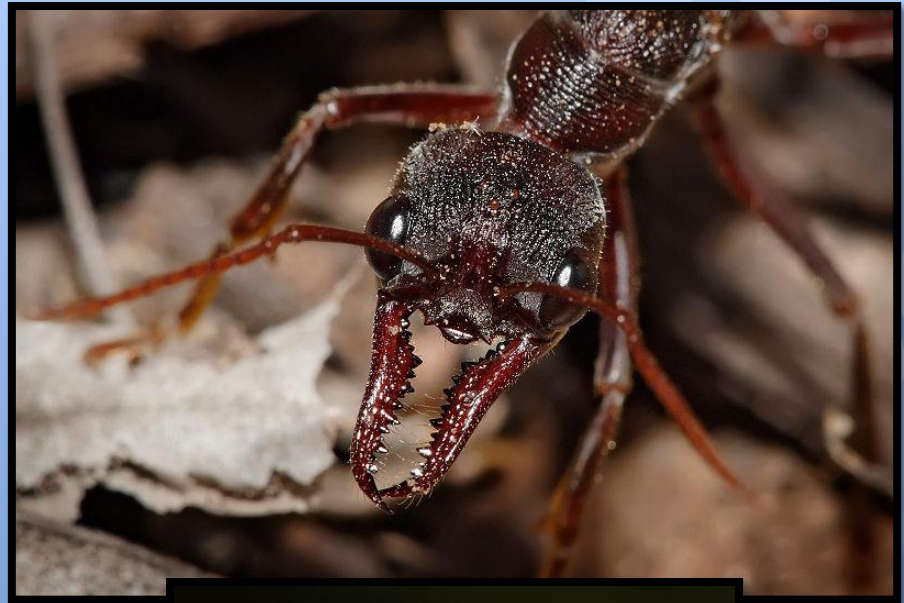


Moth

Head: Mouthparts

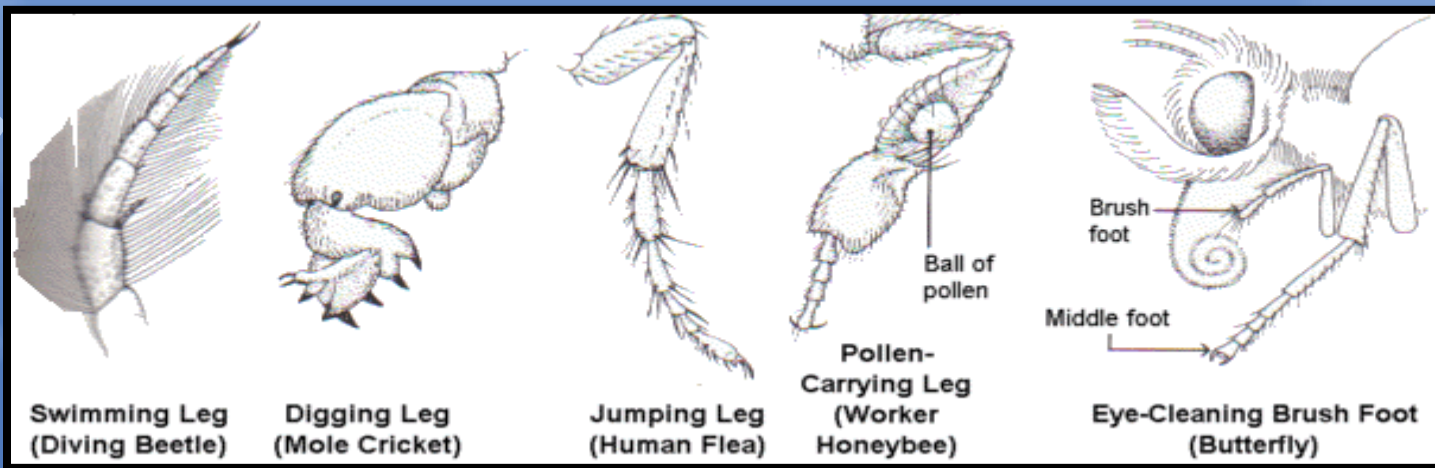
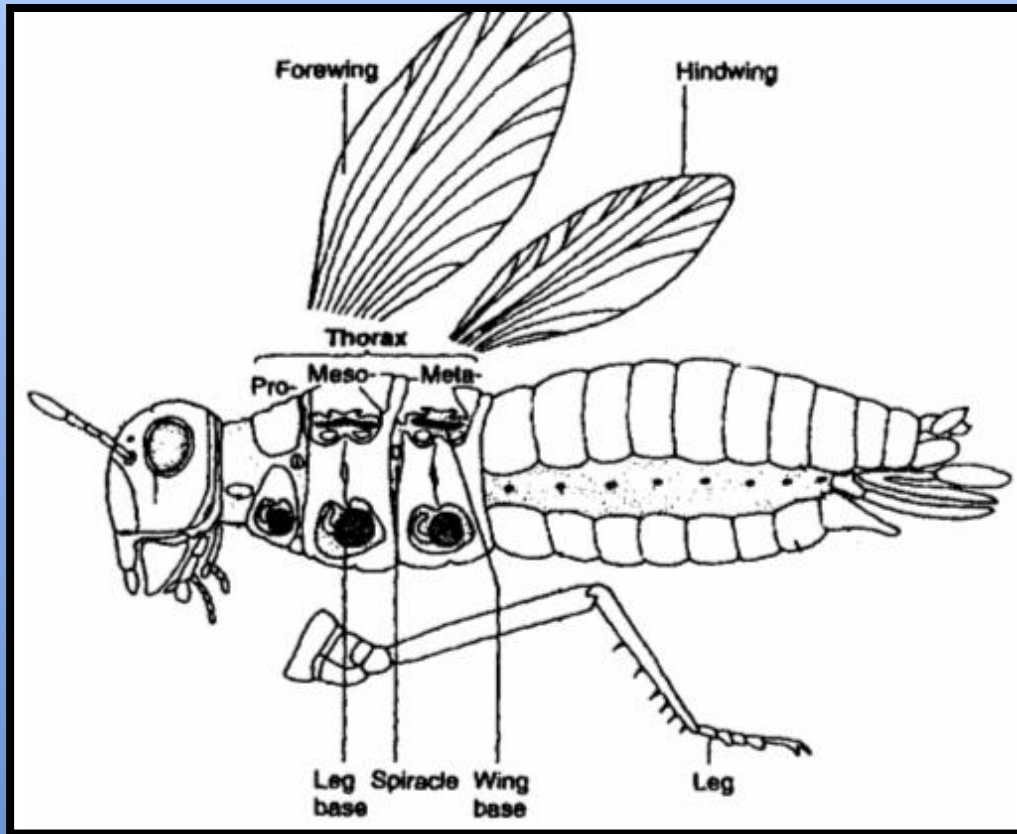
- Chewing
- Rasping-sucking: Thrips
- Piercing-sucking: cicadas and mosquitoes
- Sponging: houseflies (lap up liquids)
- Siphoning: butterflies & moths
- Chewing-lapping: bees (have both mandibles and a proboscis)
- Vestigial: mayflies





Thorax

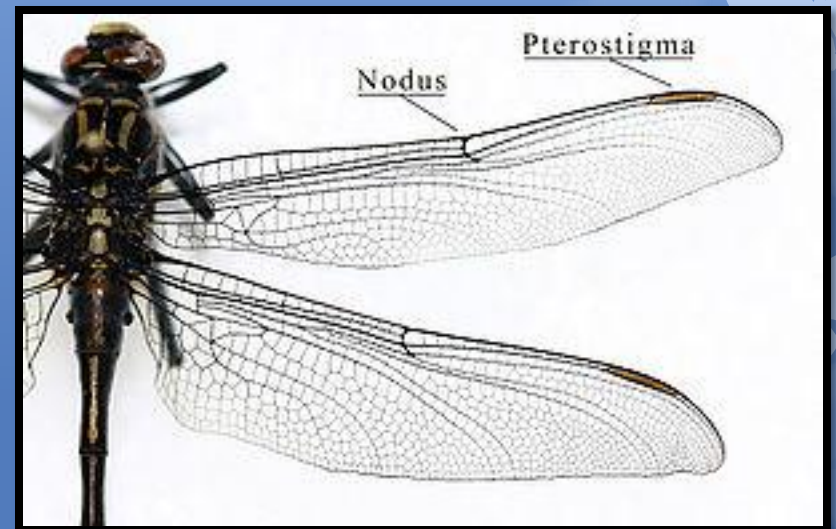
- Prothorax, mesothorax, and metathorax
- Each segment bears a pair of legs
- Wings are attached to the mesothorax and metathorax, but never the prothorax
- Legs of insects vary greatly in size and form and are often used for classification purposes
- Walking, jumping, diggings, grasping, feeling, swimming, carrying loads, building nests, and cleaning
- Leg adaptations
 - Grasshoppers: enlarged femur for jumping
 - Beetle: elongated tarsi for running





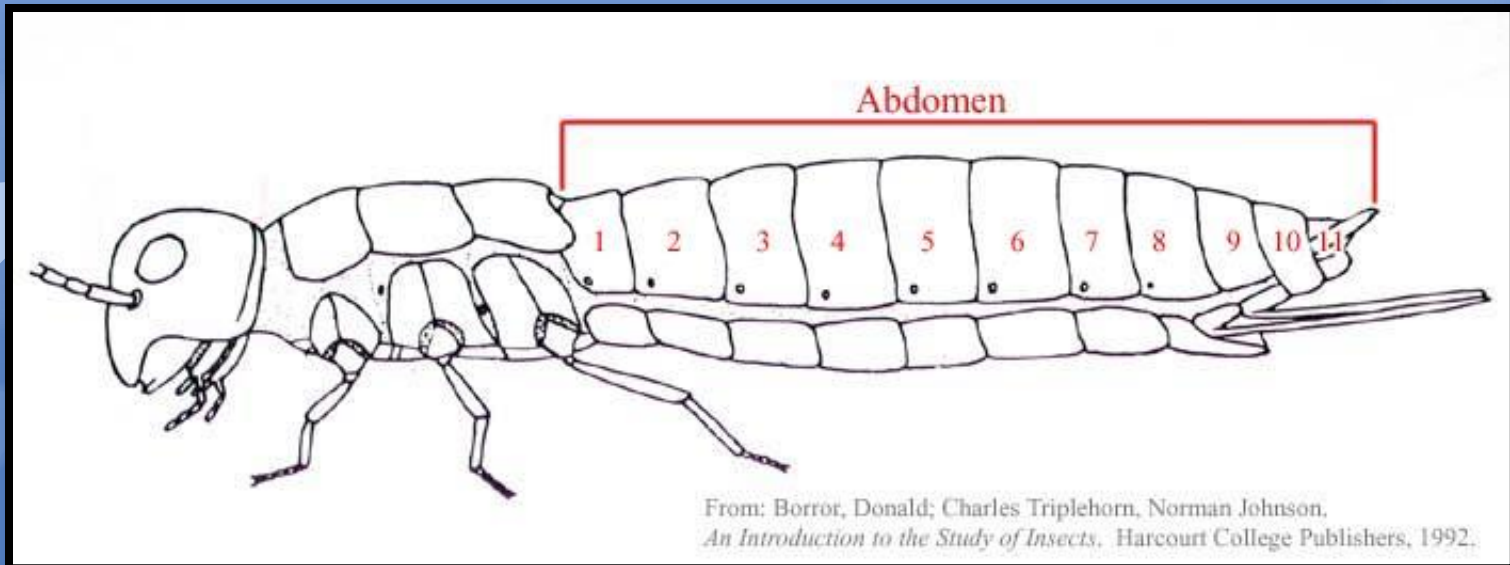
Wings

- Are the outgrowths of the body wall
- Venation can vary dramatically from species to species and is often used as a means for identification
- Most of insect orders end with “ptera”, which is greek for “with wings”
- Can be covered with fine hairs or scales (moths & butterflies) or bare (dragonflies)



Abdomen

- May have 11 or 12 segments, but often hard to distinguish from one another
- Some may have cerci at the tip of the abdomen (earwigs)
- Length can vary greatly from different insect species



Development

- Critical development occurs just after birth or egg hatch
- Reproduction
 - Most need to mate in order for eggs to be fertilized
 - Some are able to reproduce without sperm fertilization
 - Some can reproduce either way

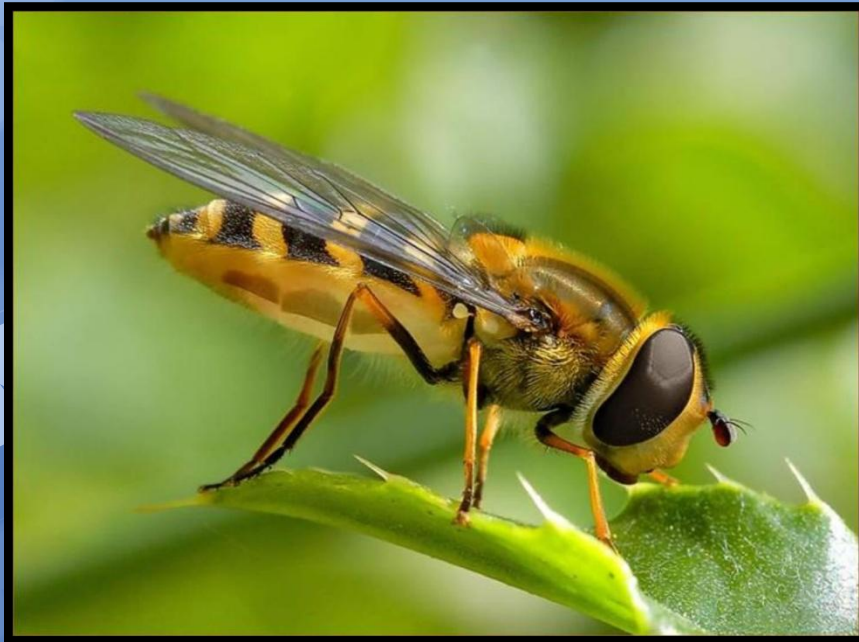


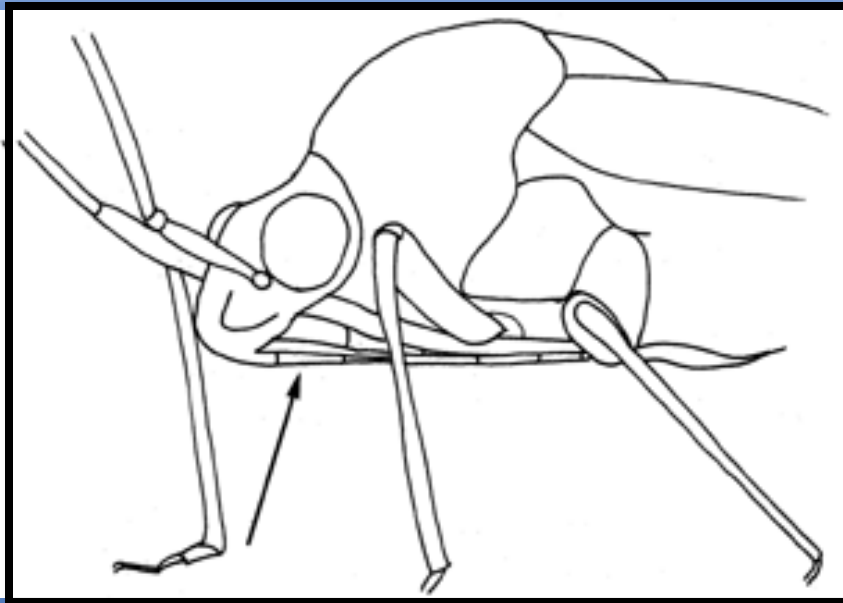
Insect Orders

The background of the slide is a solid light blue color. It is decorated with numerous white and light blue silhouettes of butterflies in various sizes and orientations, scattered across the page. The butterflies are stylized, showing the basic shape of the wings and bodies.

















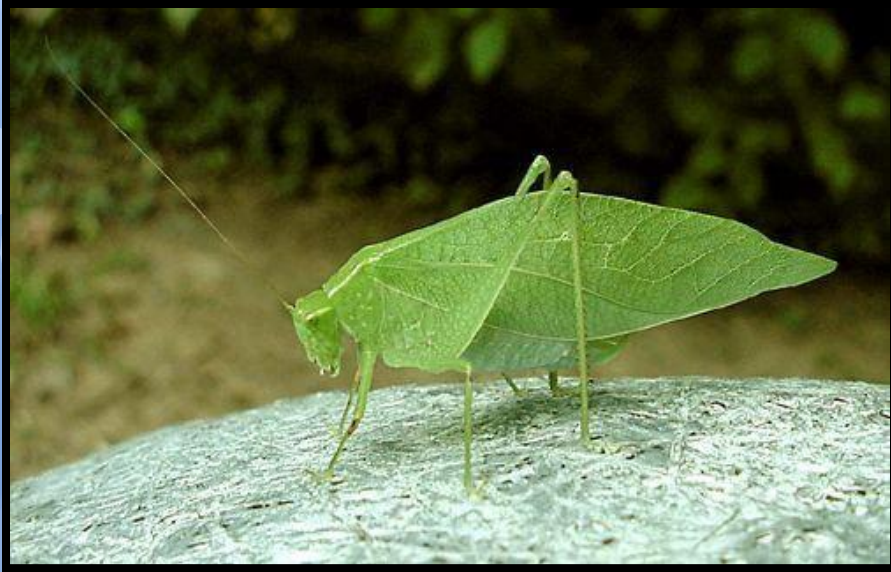
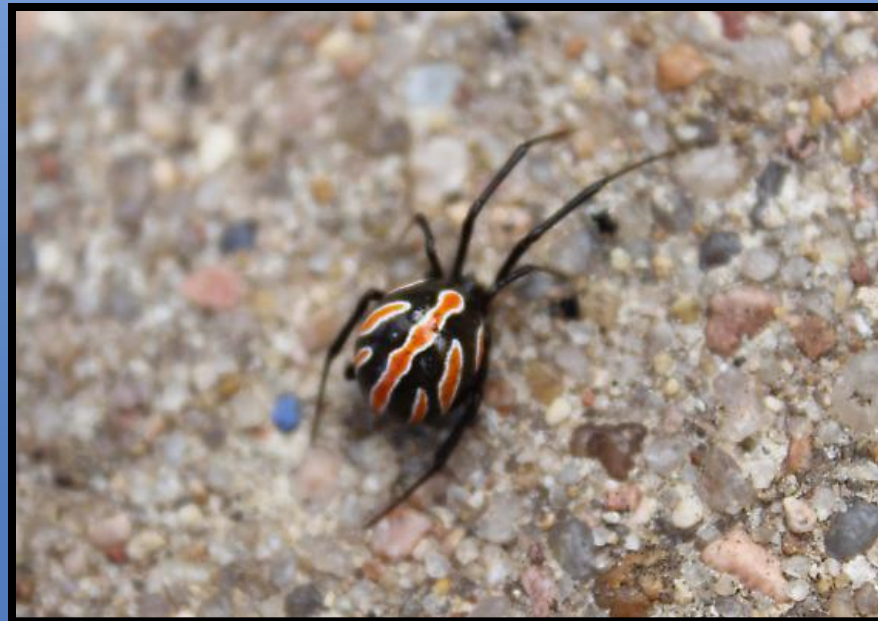








Photo by J. Kalisch
Dept of Entomology - UNL



0 inch

Adult Female

Adult Male

Nymph

Larva

1/4 inch



Blacklegged Tick

1/2 inch



Lone Star Tick

3/4 inch



Dog Tick

Engorged Dog Tick

1 inch



Deer Tick

1 1/4 inch





Insect Injury

- **Chewing insects**

- Chew off portions of plant

- **Piercing-sucking insects**

- Pierce skin and suck up plant juices

- **Internal feeders**

- Gain entrance into plant and feed on the inside

- **Subterranean insects**

- Attack plant from below the soil surface

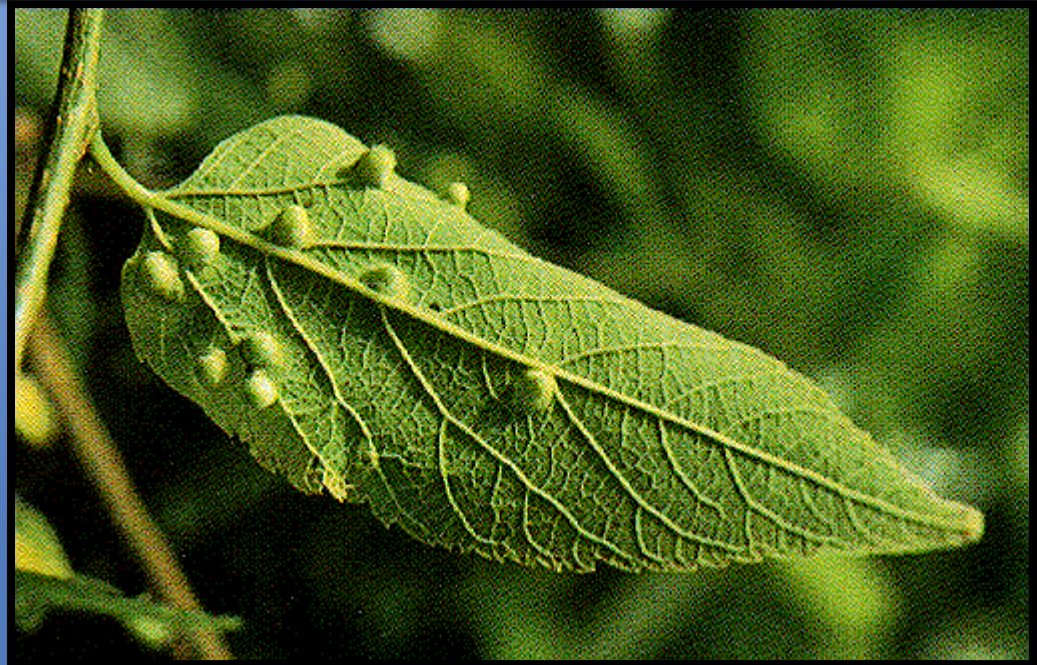
- **Injury by laying eggs**

- **Nest materials**

- Remove tissue to use in nests

- **Vectors of plant diseases**





Squash vine borer damage on Hubbard squash
[Picture by R. Foster]





Beneficial insects

- Pollinators
 - Aid in the production of fruits, seeds, vegetables, and flowers
- Weed feeders
- Improve physical condition of soil and promote fertility by burrowing
 - Millipedes, centipedes
- Scavengers
 - Devouring bodies of dead animals and plants
 - Bury carcasses and dung

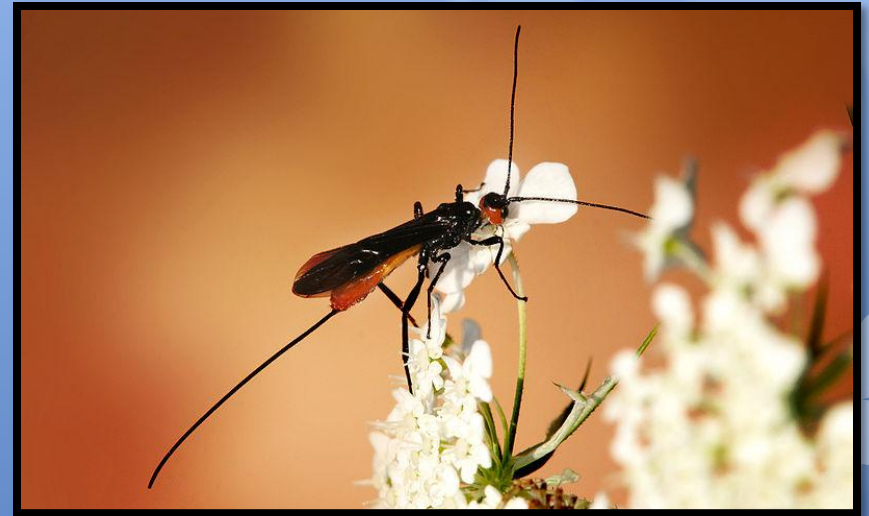
Beneficial insects

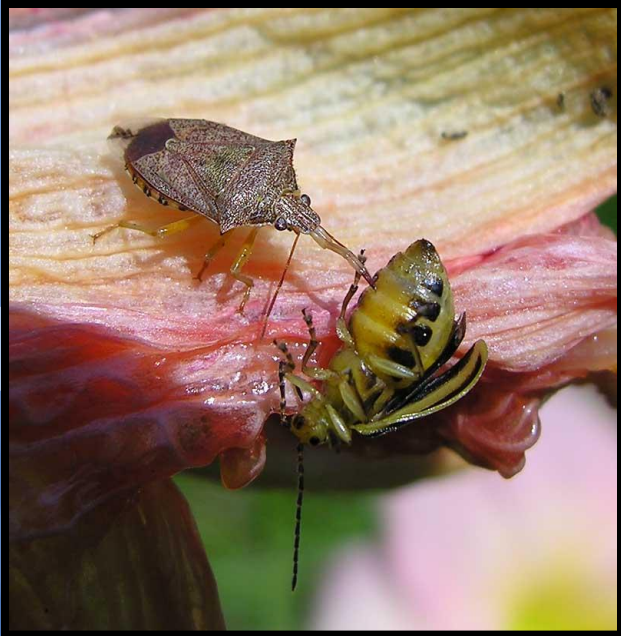
- Predators

- Catch and feed on other creatures (prey)
- Ground beetles
- Lace wings and lady bugs

- Parasites

- Live on or in the bodies of living organisms (hosts)
- Host are usually larger and stronger than the parasites and are not killed promptly
- Parasitic wasps of aphids and hornworms







Questions???

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757-365-6262
jaashle2@vt.edu