Entomology

Janet Spencer

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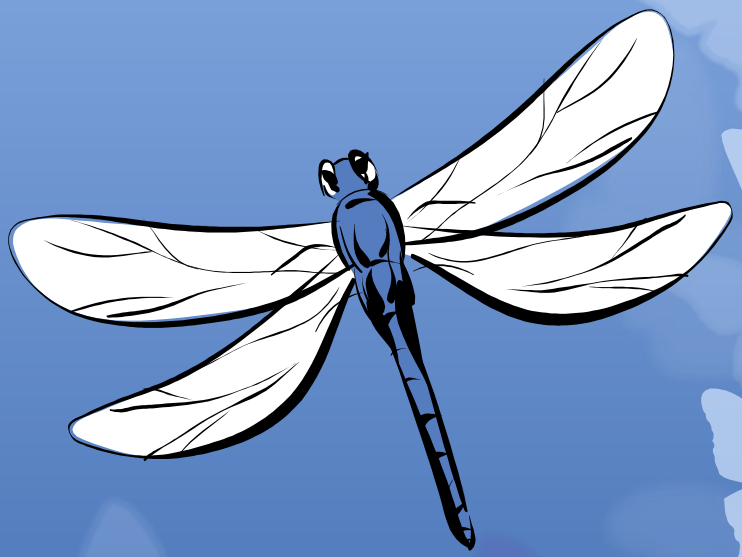
Isle of Wight County



Entomology

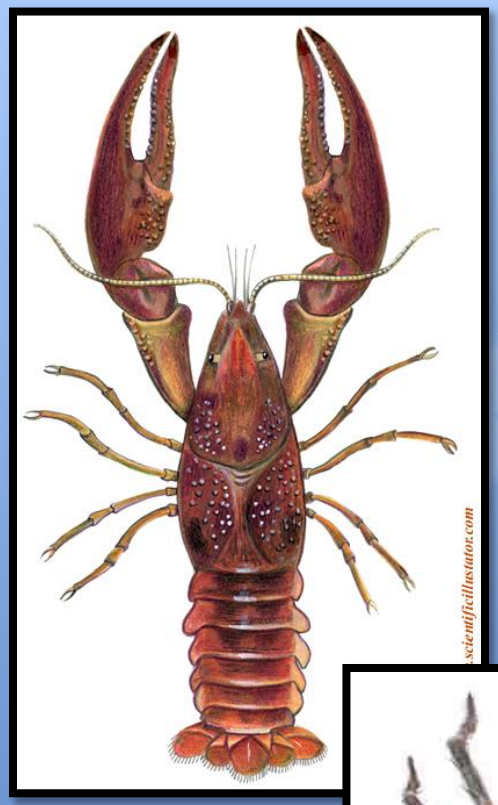
- The study of insects
- Dominant groups of animals on earth today
- Life on earth:
  - Modern humans=200,000 years
  - Insects=350 million years
- 100,000 different species live in North America

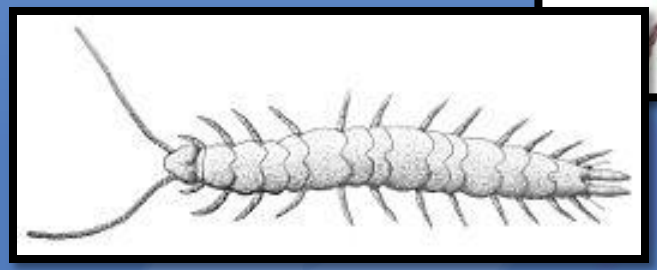
Insect Classification

- Hierarchal 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



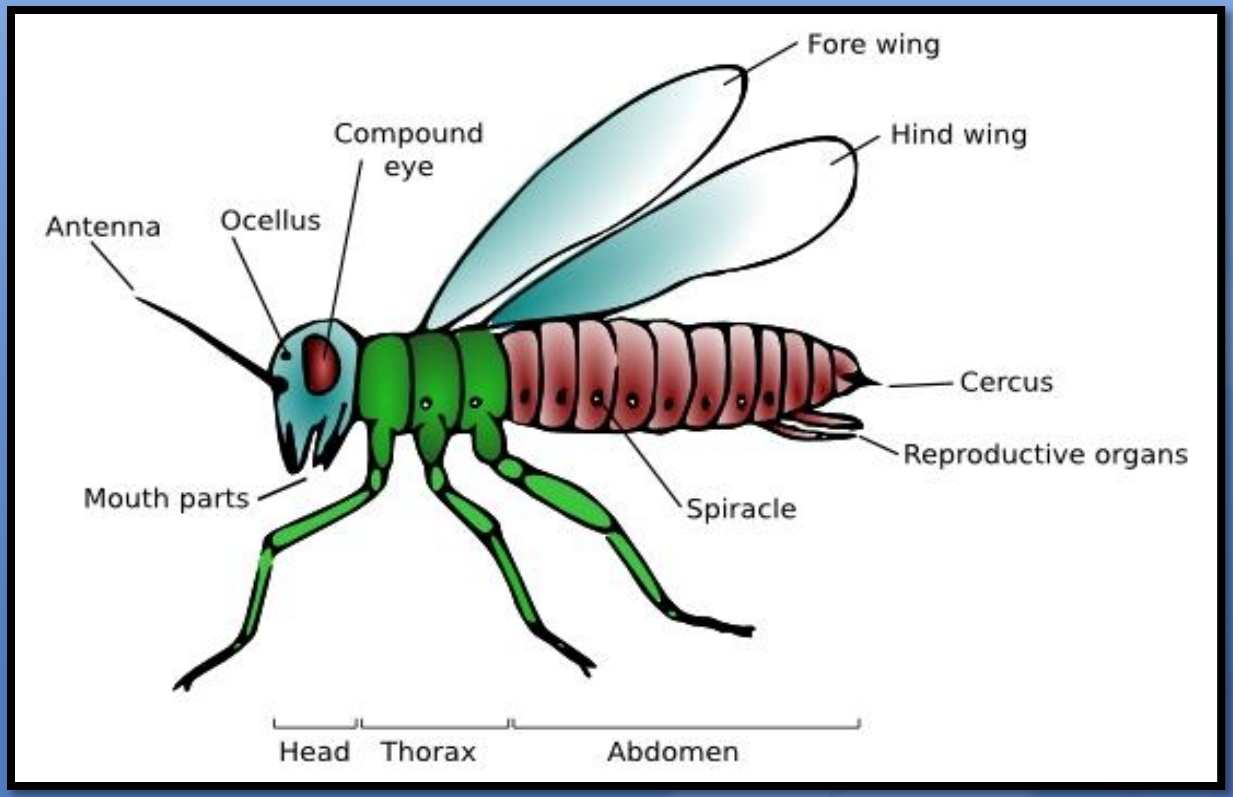


Arthropods

- 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

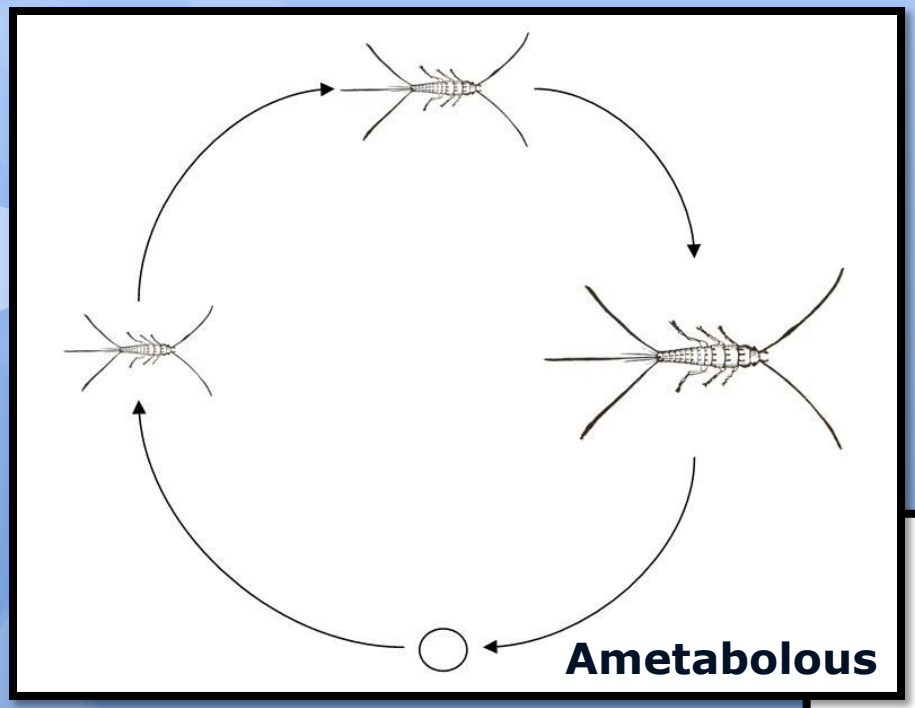
Insecta

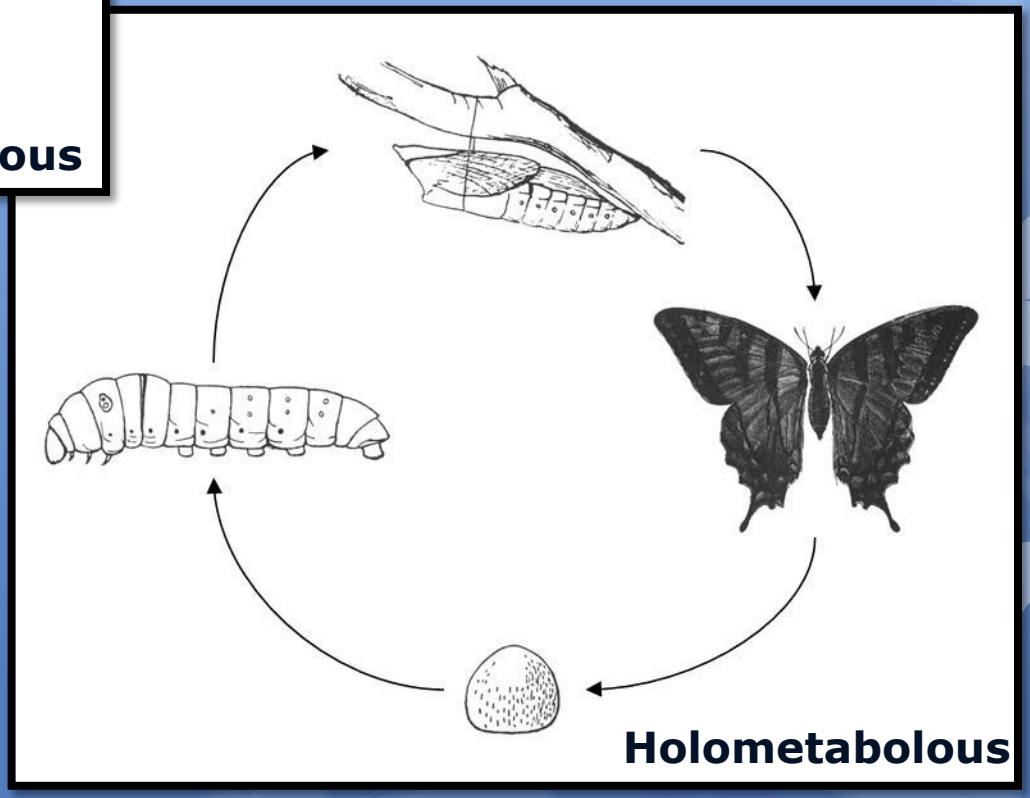
- Bugs, beetles, and butterflies
- 3 body segments and 3 pairs of legs



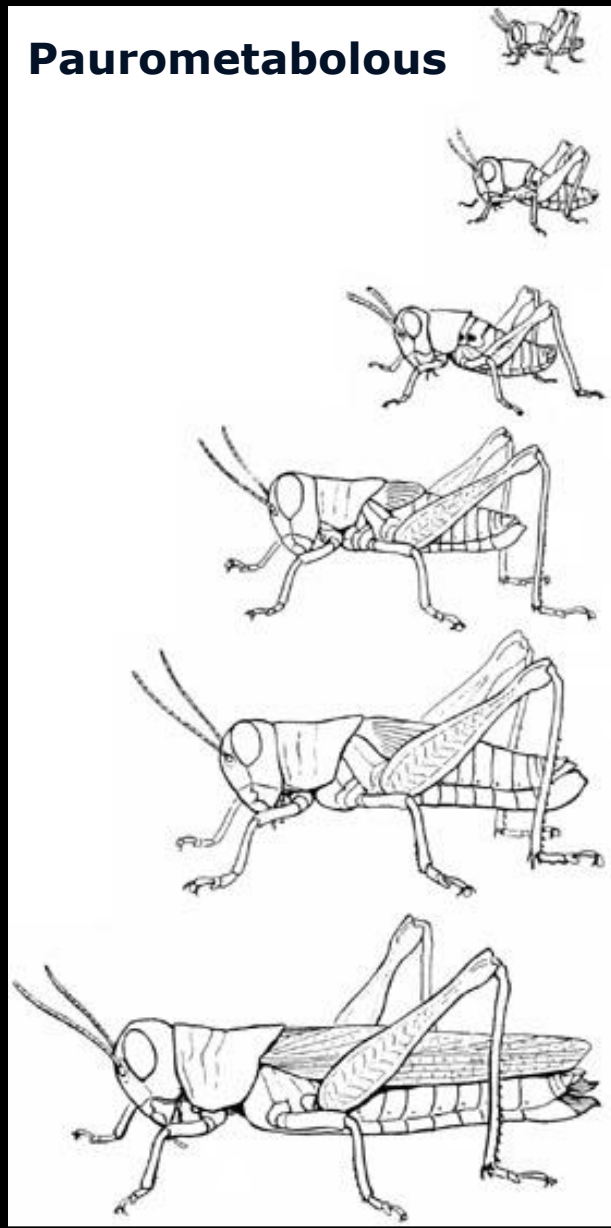
Insect Orders

- 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

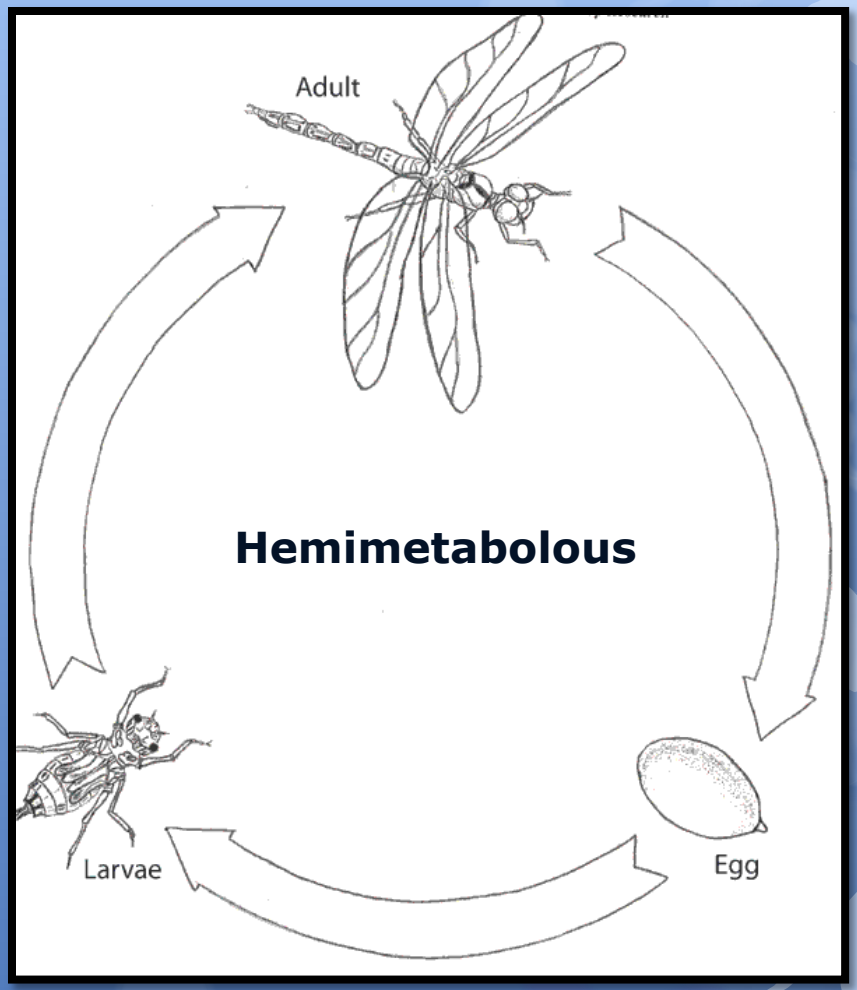

Ametabolous


Holometabolous

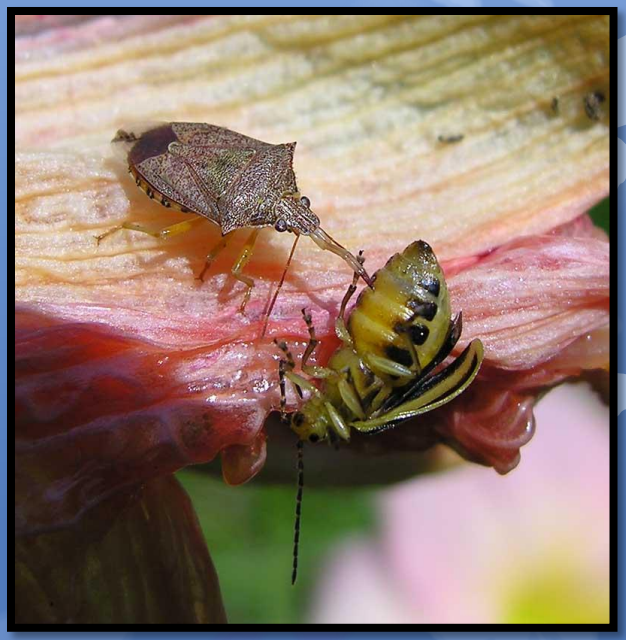
Paurometabolous



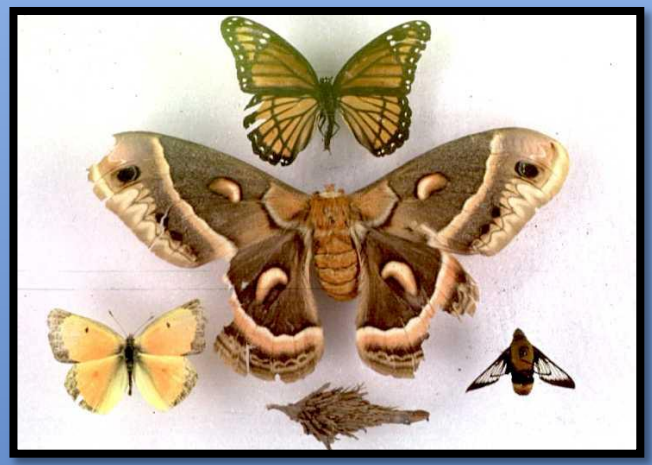
Hemimetabolous



- **Collembola**
  - Springtails
  - Ametabolous
- **Orthoptera**
  - Grasshoppers, crickets
  - Paurometabolous
- **Isoptera**
  - Termites
  - Paurometabolous
- **Hemiptera**
  - True bugs
  - paurometabolous



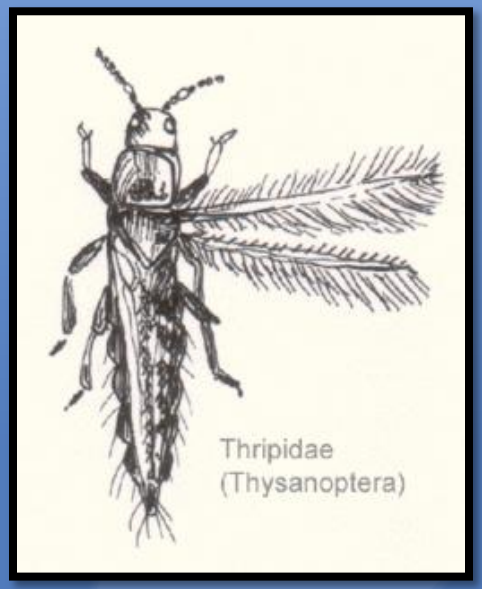
- **Homoptera**
  - Aphids, scales
  - Paurometabolous
- **Coleoptera**
  - Beetles, weevils
  - Holometabolous
- **Lepidoptera**
  - Butterflies & moths
  - Holometabolous
- **Hymenoptera**
  - Wasps , bees, ants
  - holometabolous



- **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

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 (math moths; allows for more surface area to pick up pheromones; mosquitoes)
- Aristate: last segment usually enlarged and bearing a conspicuous dorsal bristal (blow flies; used as air speed indicators)

ARISTATE

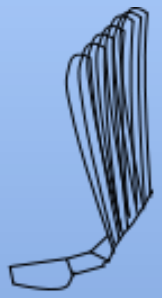
(Blow flies)

LAMELLATE

(June Beetle)

SERRATE

(Click beetle)



FLABELLATE

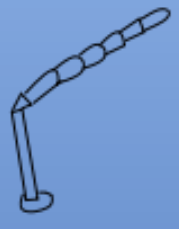
(Cedar beetle)

MONILIFORM

(Bark beetles)

SETACEOUS

(Dragonfly)



GENICULATE

(Chalcid)

PLUMOSE

(Mosquitoes)

PECTINATE

(Fire-colored Beetle)

STYLATE

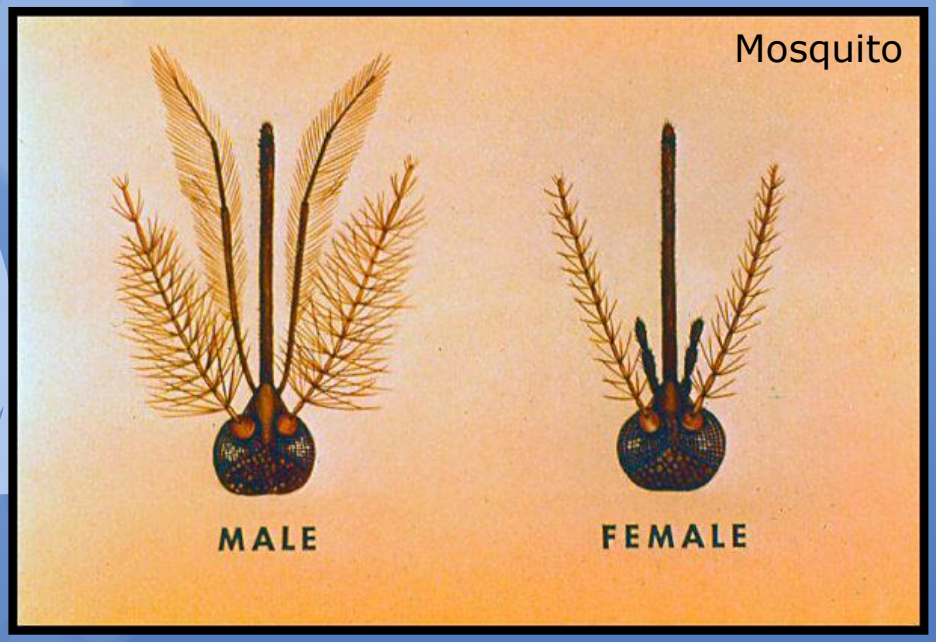
(Snipe fly)

CLAVATE

(Ladybird Beetle)

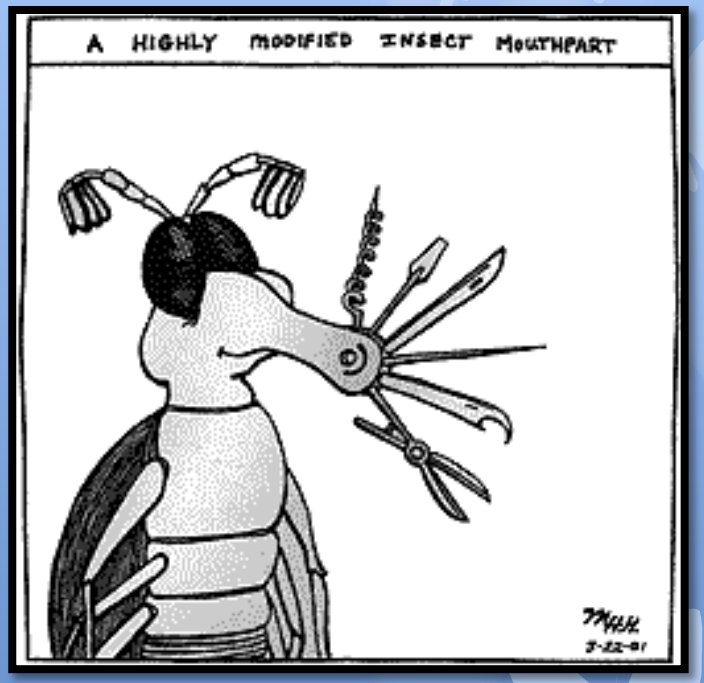

Fire-colored beetle


Butterfly

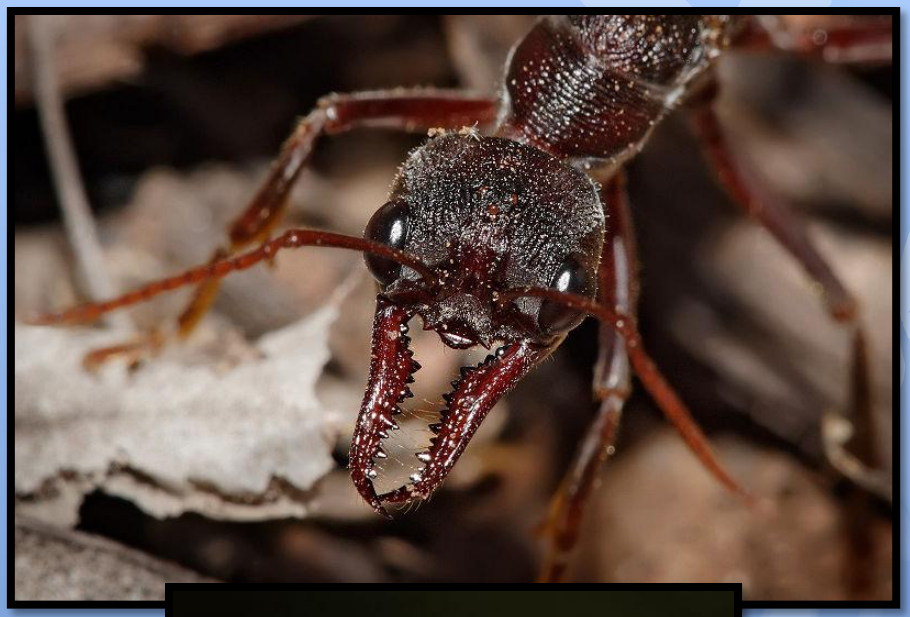

Mosquito
MALE
FEMALE

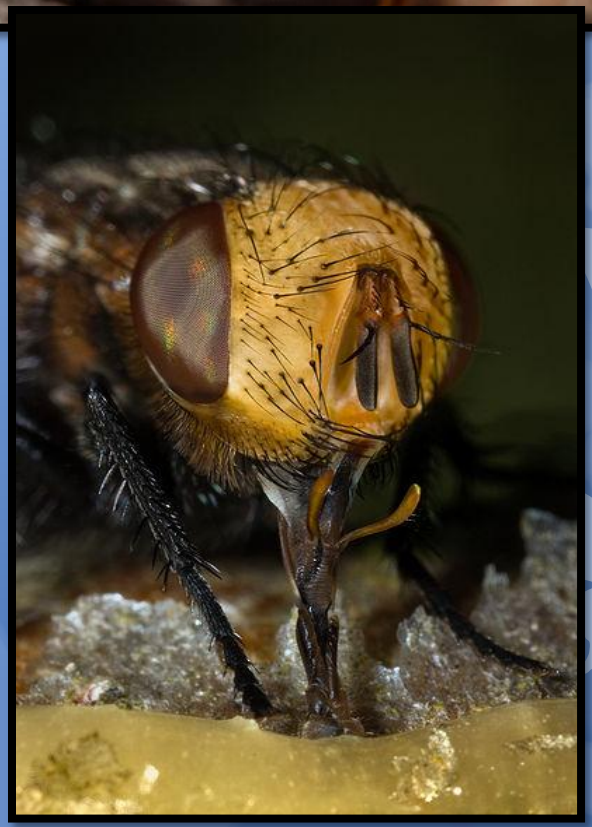

Moth

Head: Mouthparts



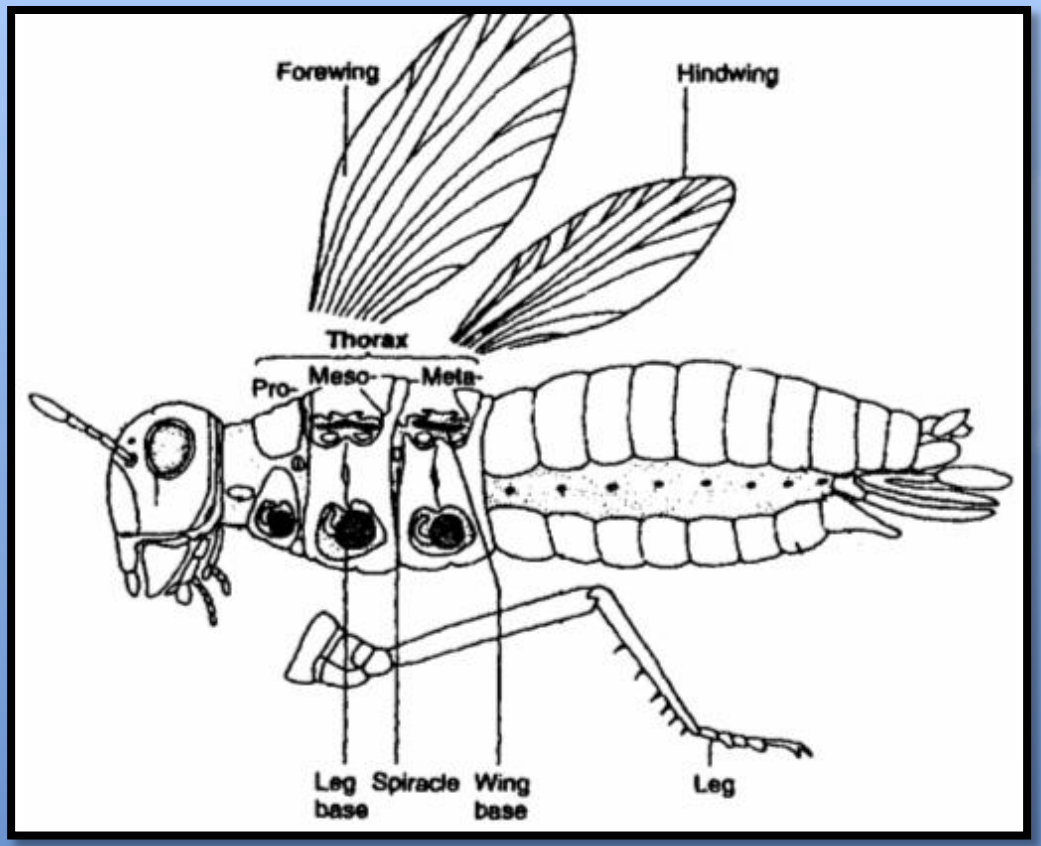
- Chewing
- Rasping-sucking: Thrips
- Piercing-sucking: cicadas and mosquitoes
- Sponging: houseflies (lap up liquids)
- Siphoning: butterflies & moths
- Chewing-lapping: bees (have both mandibles and a proboscis)
- Vestigial: mayflies

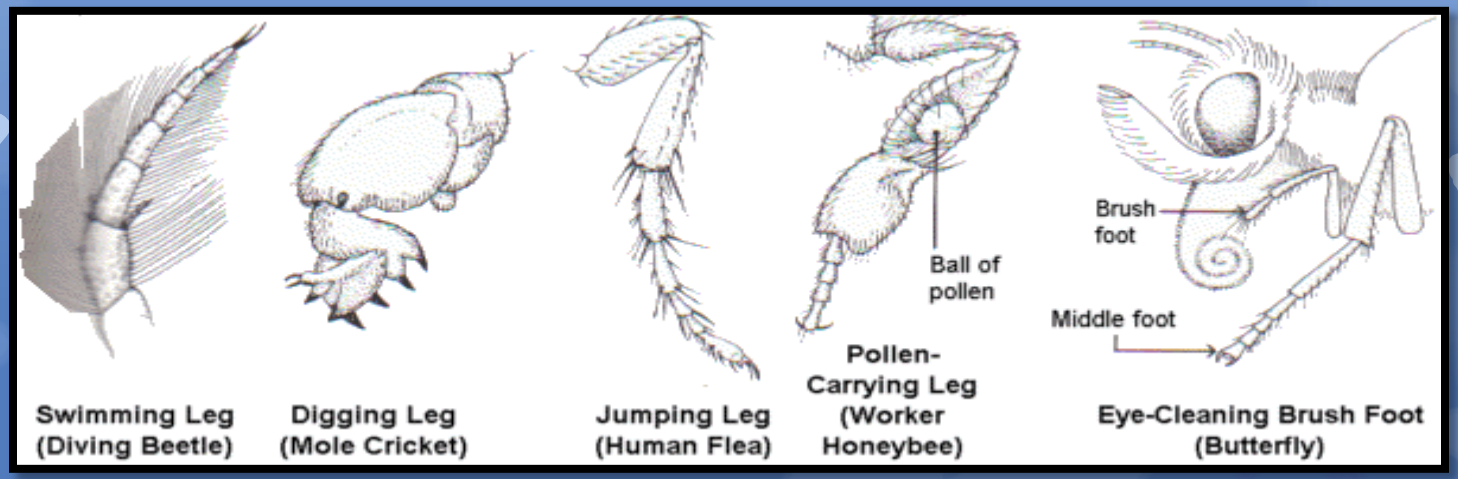




Thorax

- 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: enlongated tarsi for running


Forewing
Hindwing
Thorax
Pro-
Meso-
Meta-
Leg base
Spiracle
Wing base
Leg


Swimming Leg (Diving Beetle)
Digging Leg (Mole Cricket)
Jumping Leg (Human Flea)
Ball of pollen
Pollen-Carrying Leg (Worker Honeybee)
Brush foot
Middle foot
Eye-Cleaning Brush Foot (Butterfly)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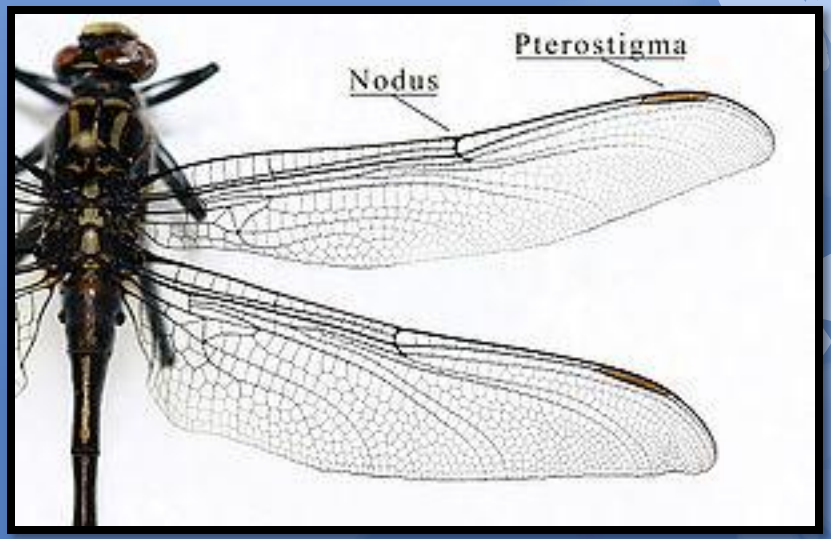
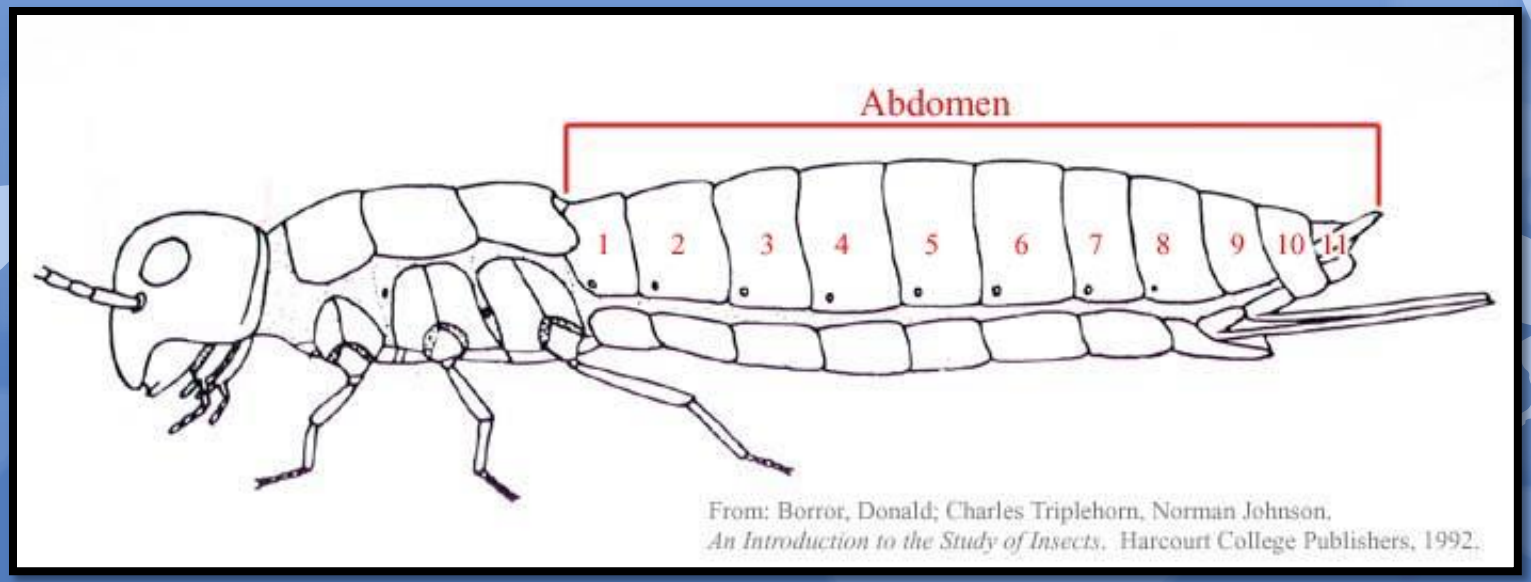
Wings

- 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



From: Borror, Donald; Charles Triplehorn, Norman Johnson, *An Introduction to the Study of Insects*. Harcourt College Publishers, 1992.

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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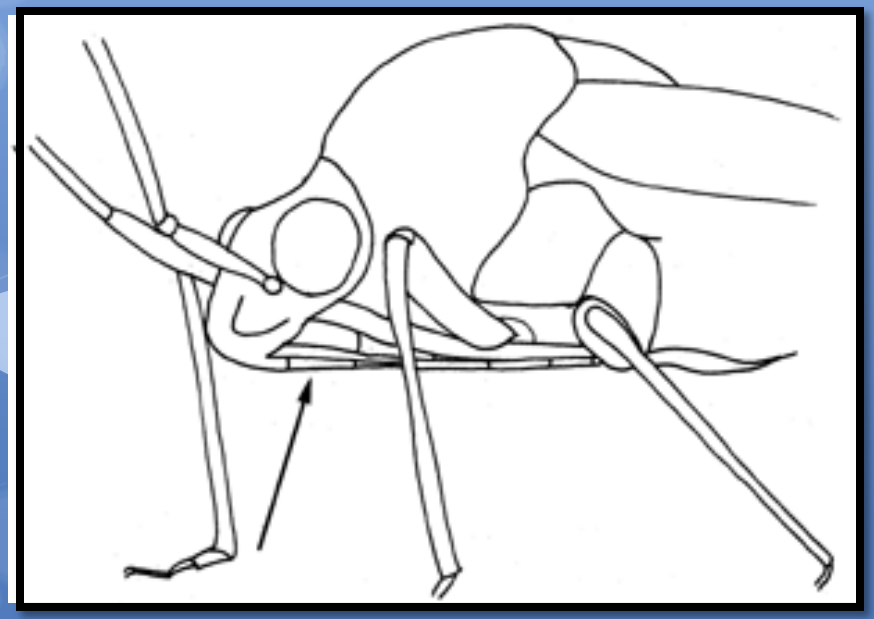


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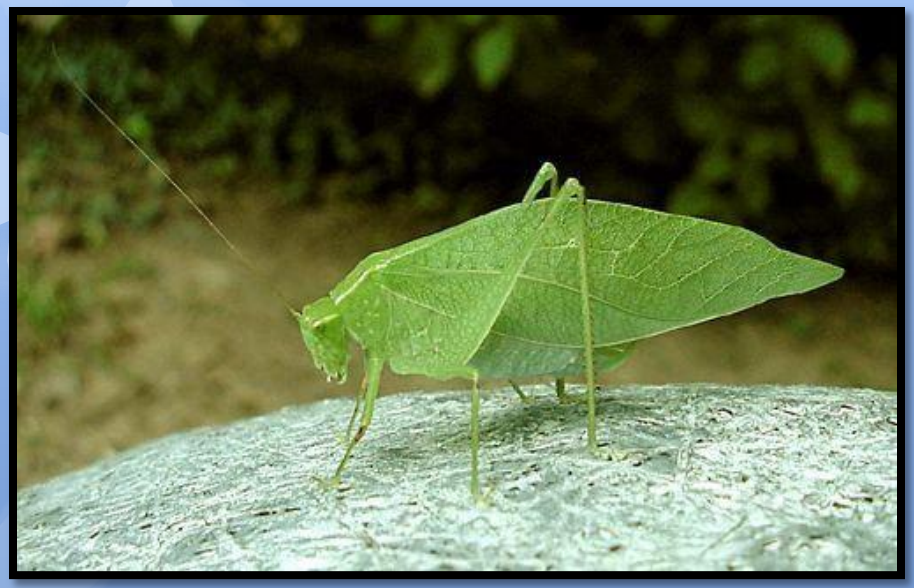



UF/Castner

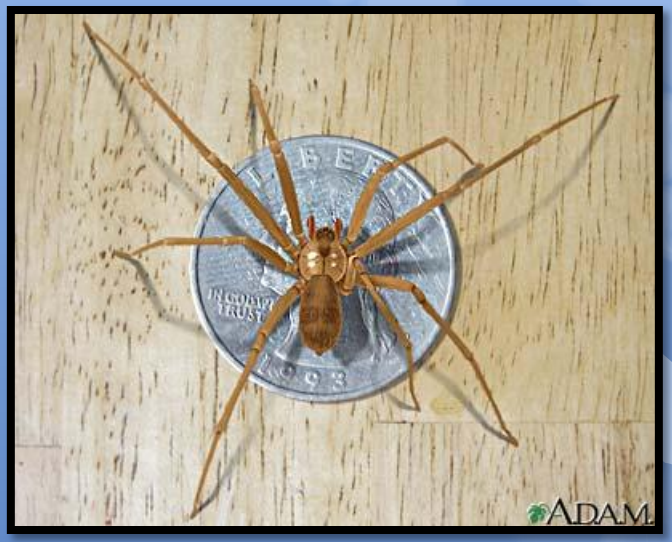
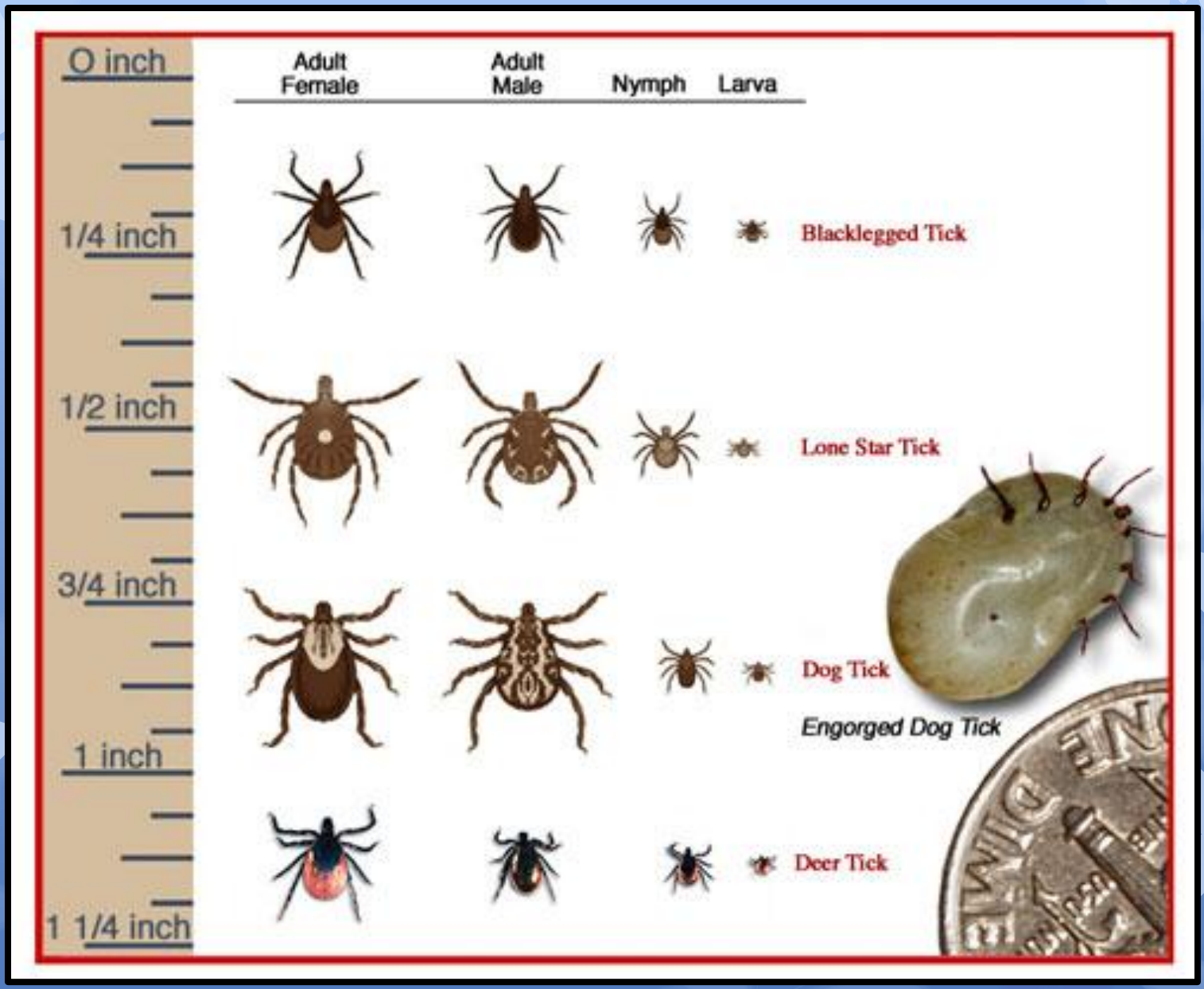

ADAM


Photo by J. Kalisch
Dept of Entomology - UNL


O inch
1/4 inch
1/2 inch
3/4 inch
1 inch
1 1/4 inch
Adult Female
Adult Male
Nymph
Larva
Blacklegged Tick
Lone Star Tick
Dog Tick
Engorged Dog Tick
Deer Tick

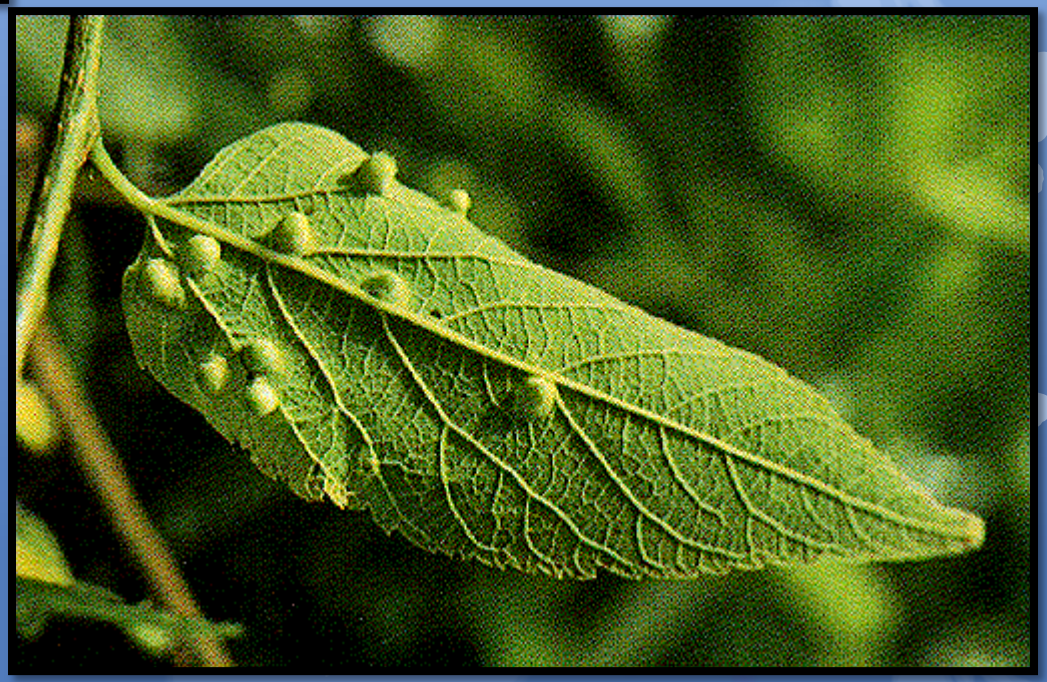

University of Nebraska
Department of Entomology

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]

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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


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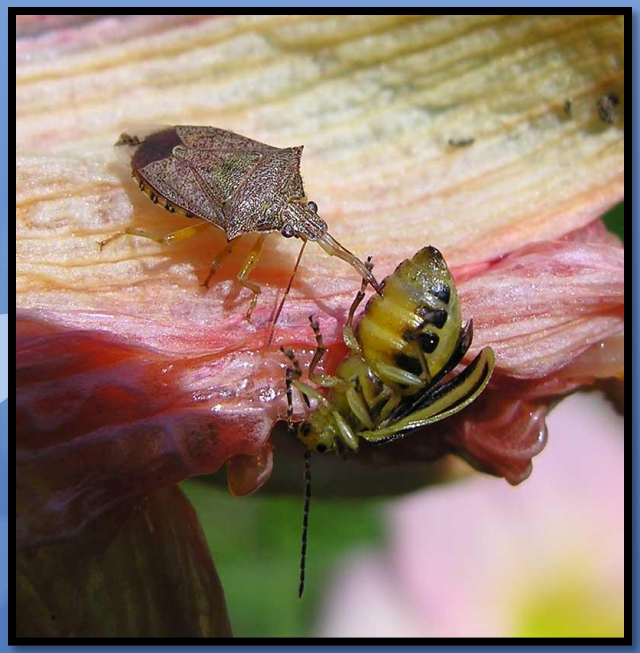


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Questions???

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