Entomology

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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

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)
Fire-colored beetle

Mosquito

Moth

Butterfly
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
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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