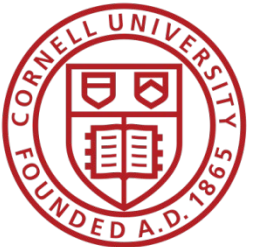


Entomology

Master Gardener Volunteer Training
May 2022

Cornell Cooperative Extension
Orange County



Overview

- **Arthropods**
- **Insects**
- **Insect Orders**



Taxonomy

- **Kingdom - Animal**
 - **Phylum**
 - **Class**
 - **Order**
 - **Family**
 - **Genus**
 - **Species**



Taxonomy

- **Kingdom - Animal**
 - **Phylum - Arthropoda**
 - **Class**
 - **Order**
 - **Family**
 - **Genus**
 - **Species**



Arthropods

- Subphylum

- Crustacea

Crustaceans



Arthropods

- **Subphylum:** Crustacea
 - **Class:** Malacostraca
 - **Order:** Isopoda



Arthropods

- **Subphylum**

- Crustacea

- **Myriapoda**

- **Class:**

- **Chilopoda** - Centipedes

- **Diplopoda** - Millipedes



Arthropods

- **Subphylum:** Myriapoda
 - **Class:** Chilopoda – Centipedes
 - Flat body
 - One pair of legs per segment
 - Predators
 - Venomous (most)



Arthropods

- **Subphylum:** Myriapoda
 - **Class:** Diplopoda
 - Rounded body
 - Two pairs of legs per segment
 - Detritivores





Arthropods

- **Subphylum**

- Crustacea

- Myriapoda

- **Chelicerata**

- **Class:**

- **Arachnida**



“claw horn”

Arthropods

- **Subphylum: Chelicerata**

- **Class: Arachnida**

- **Subclasses and Orders:**

- **Acari** – mites & ticks

- **Araneae** - spiders

- **Opiliones** – harvestmen or daddy longlegs

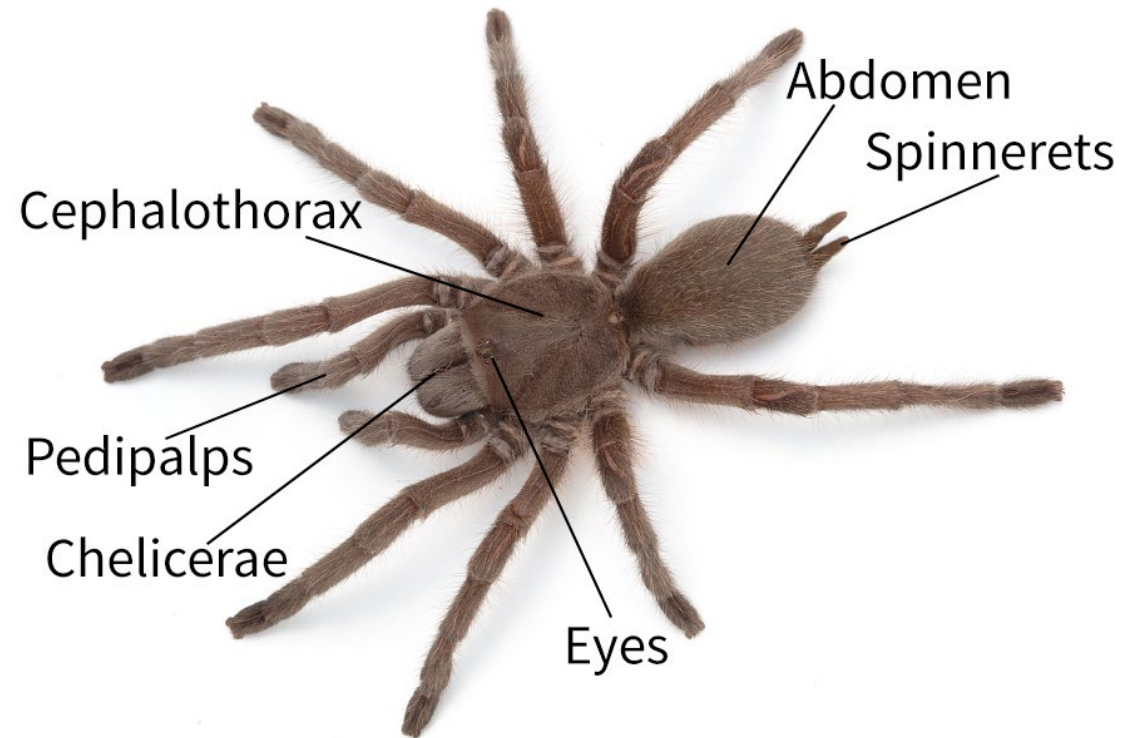


Arthropods

- **Subphylum: Chelicerata**

- **Class: Arachnida**

- Two body parts
 - 8 legs
 - Chelicerae
 - Pedipalps



Arthropods

- **Subphylum: Chelicerata**

- **Class: Arachnida**

- **Subclasses and Orders:**

- **Acari** – mites & ticks

- **Araneae** - spiders

- **Opiliones** – harvestmen or daddy longlegs



Arthropods

- **Subphylum: Chelicerata**

- **Class: Arachnida**

- **Orders: Acari - Mites**

- includes ticks

- pests

- twospotted spider mite

- predators



Arthropods

- **Subphylum:** Chelicerata
 - **Class:** Arachnida
 - **Orders:** Araneae – Spiders
 - Important predators
 - We do NOT identify spiders!



Arthropods

- **Subphylum:** Chelicerata
 - **Class:** Arachnida
 - **Orders:** Opiliones
 - NOT spiders
 - omnivorous





Arthropods

- **Subphylum**

- Crustacea

- Myriapoda

- Chelicerata

- **Hexapoda**

- **Class:**

- Entognatha

- Insecta

Arthropods

- **Subphylum: Hexapoda**
 - **Class: Entognatha**
 - **Subclasses and Orders:**
 - Protura
 - Diplura
 - Collembola – spring tails



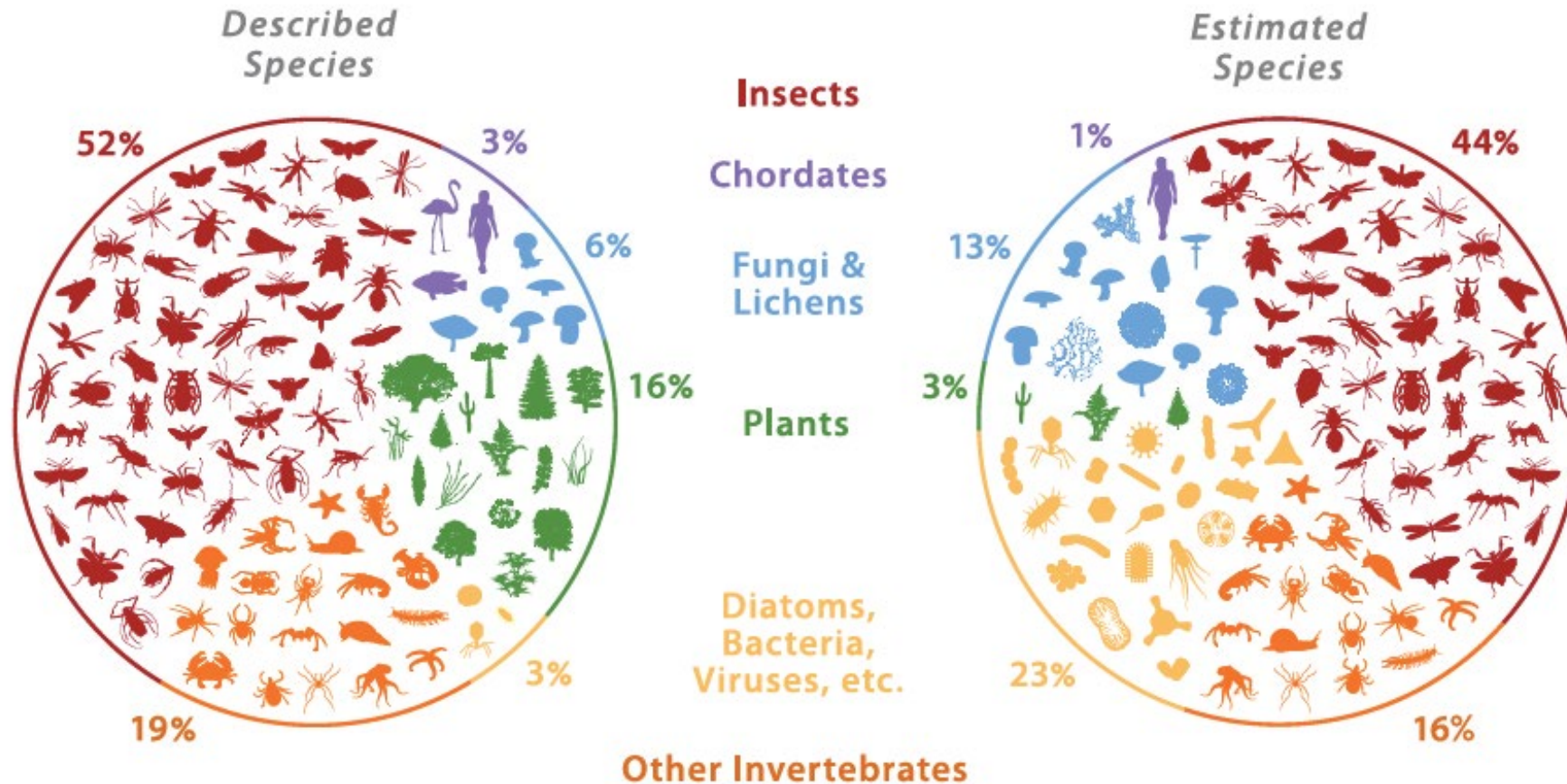
Arthropods

- **Subphylum:** Hexapoda
 - **Class:** Insecta
 - **Orders:**
 - 29 Orders



Insects

EARTH'S INHABITANTS





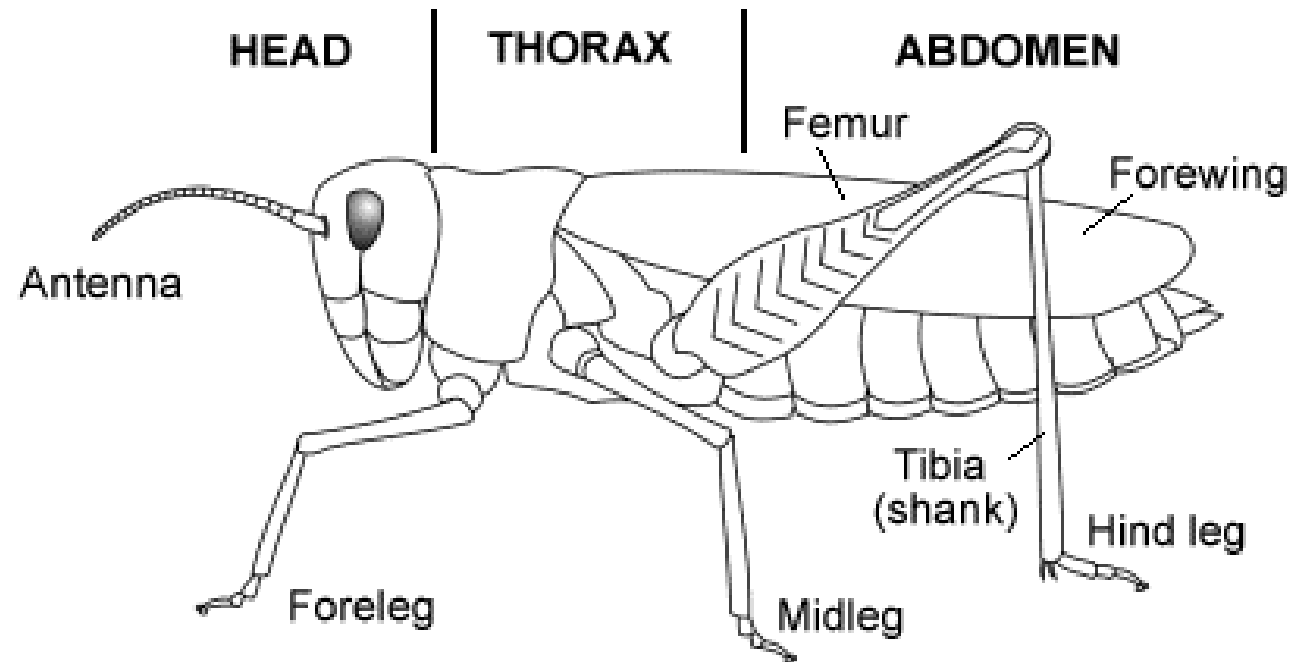
Insects

- Archaeognatha
- Zygentoma
- Ephemeroptera
- Odonata
- Orthoptera
- Neuroptera
- Phasmida
- Embioptera
- Grylloblattodea
- Mantophasmatodea
- Plecoptera
- Dermaptera
- Zoraptera
- Mantodea
- Blattodea
- Pscoptera
- Phthrioptera
- Thysanoptera
- Hemiptera
- Hymenoptera
- Strepsiptera
- Coleoptera
- Megaloptera
- Raphidioptera
- Trichoptera
- Lepidoptera
- Diptera
- Siphonoptera
- Mecoptera

Insects

Parts of an Insect

- Head
 - One pair of antenna
 - Compound eyes
- Thorax
 - Three pairs of legs
 - Two pairs of wings
- Abdomen



Insects

- Mouth Parts

sucking



butterfly
(side view)

lapping



bee
(front view)

chewing



beetle
(front view)



cicada
(front view)



housefly
(front view)



grasshopper
(side view)



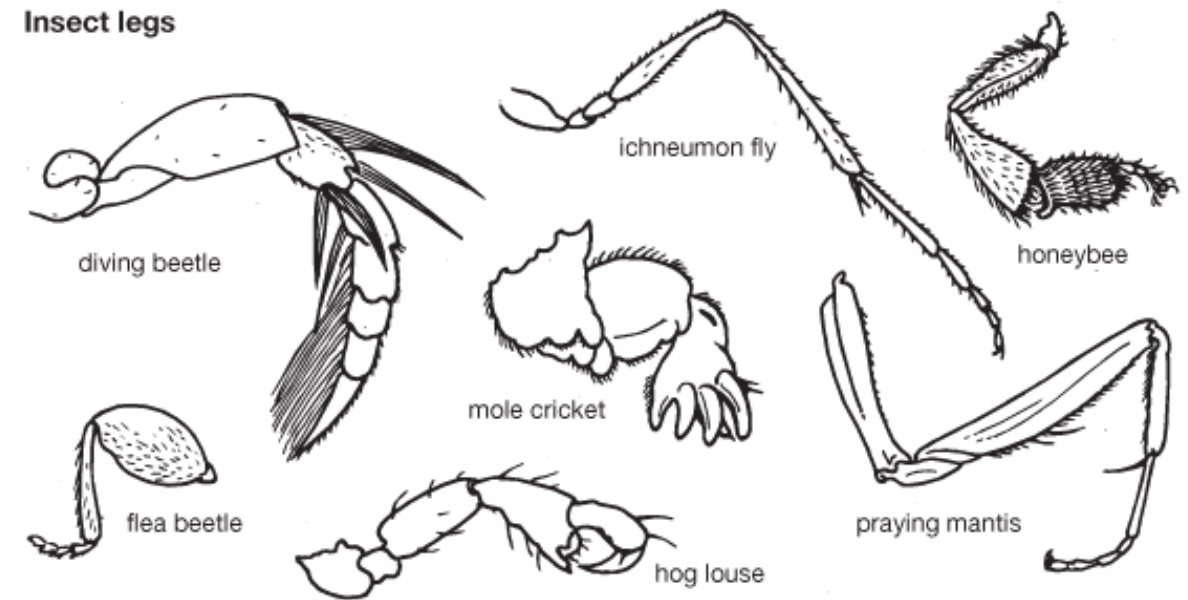
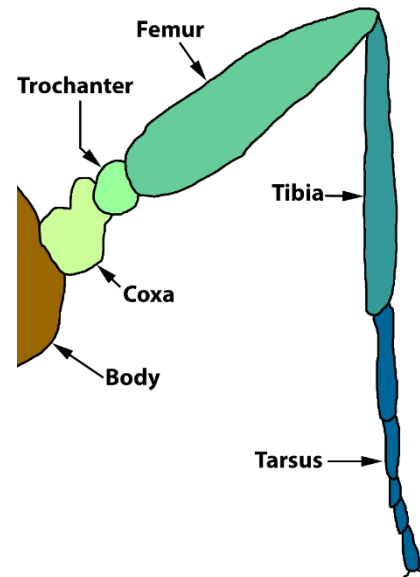
Insects

- Mouth Parts
 - Piercing / Sucking
 - Chewing / Biting



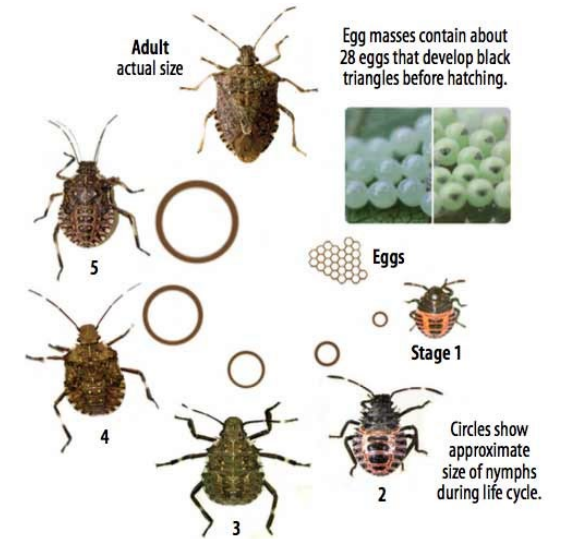
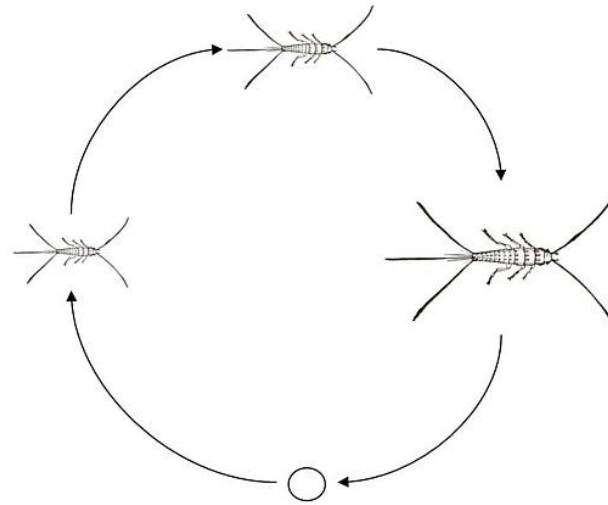
Insects

- Leg morphology
 - Swimming
 - Jumping
 - Digging
 - Clasping
 - Running
 - Hunting
 - Carrying

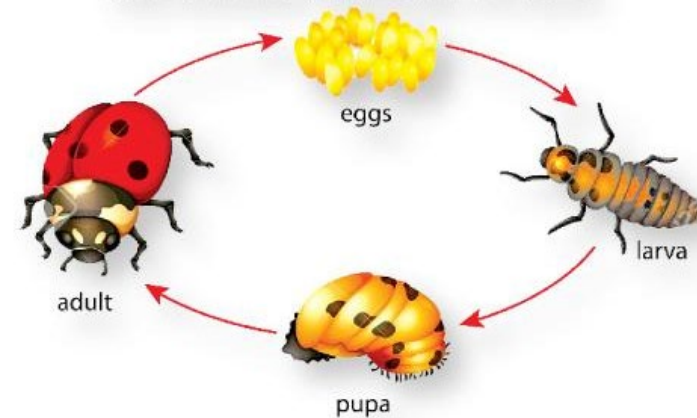


Insects

- Metamorphosis
 - None
 - Incomplete
 - Complete



Coccinellidae (ladybug) Life Cycle





Insects

- Zygentoma
- Odonata
- Orthoptera
- Dermaptera
- Mantodea
- Blattodea
- Hemiptera
- Thysanoptera
- Phthrioptera
- Coleoptera
- Neuroptera
- Hymenoptera
- Lepidoptera
- Siphonaptera
- Diptera

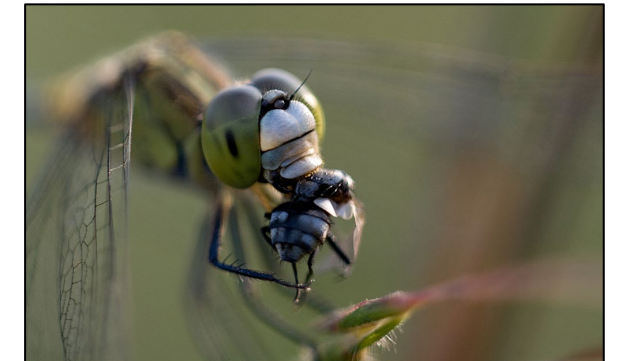
Insects

- **Order: Zygentoma (formerly Thysanura)**
 - Silverfish
 - **No metamorphosis**
 - **No wings**
 - **Chewing mouth parts**
 - **Household pest**



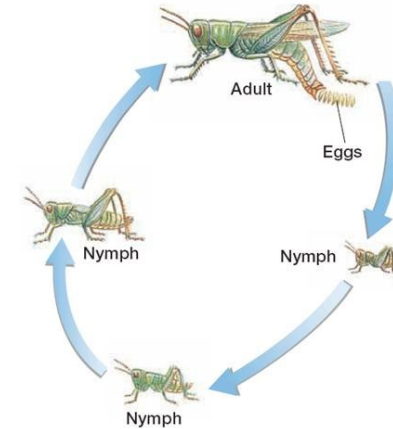
Insects

- **Order: Odonata**
 - Dragonflies and Damselflies
 - **Incomplete metamorphosis**
 - **Naiad:** aquatic nymphal form
 - **Chewing mouth parts**
 - **Predatory**



Insects

- **Order: Orthoptera**
 - Grasshoppers, Crickets, Katydid
 - **Incomplete metamorphosis**
 - **Chewing mouth parts**
 - **Household pest**
 - **Agricultural pest**



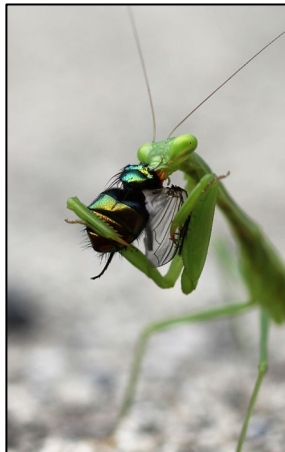
Insects

- **Order: Demaptera**
 - Earwigs
 - Incomplete metamorphosis
 - Chewing mouth parts
 - Household pests
 - Agricultural pest
 - Predators



Insects

- **Order: Mantodea**
 - Mantids
 - Incomplete metamorphosis
 - Chewing mouth parts
 - Predators



Insects

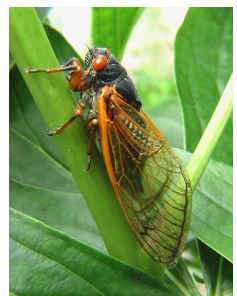
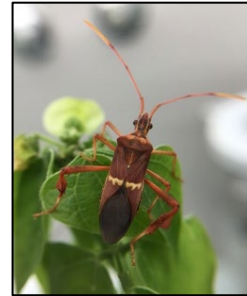
- **Order: Blattodea**
 - Cockroaches and Termites (formerly Isoptera)
 - **Incomplete metamorphosis**
 - **Chewing mouth parts**
 - **Household pests**





Insects

- **Order: Hemiptera**
 - True Bugs and Aphids, Scales and Hoppers (formerly Homoptera)
 - **Incomplete metamorphosis**
 - **Piercing / Sucking mouth parts**
 - **Household pests**
 - **Med / Vet pests**
 - **Agricultural pests**
 - **Predators**



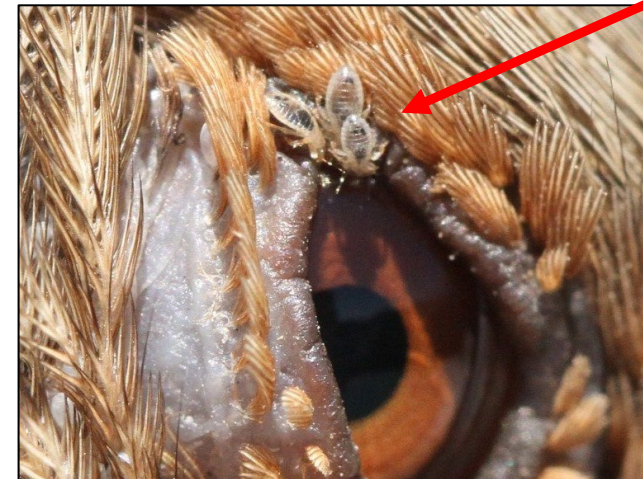
Insects

- **Order: Thysanoptera**
 - Thrips
 - Incomplete metamorphosis
 - Rasping / Sucking mouth parts
 - Agricultural pests
 - Plant disease vector
 - Predatory



Insects

- **Order: Phthiraptera**
 - Lice
 - Incomplete metamorphosis
 - Piercing / Sucking mouth parts
 - Med / Vet pests
 - Ectoparasite

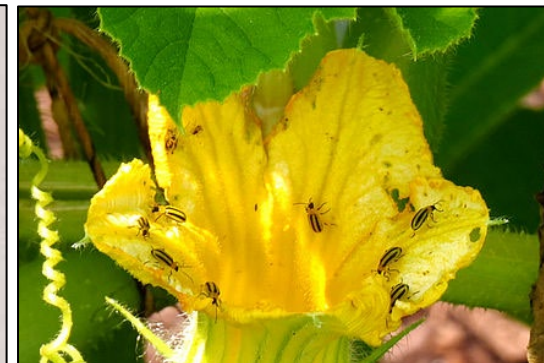


Insects

- **Order: Coleoptera**

- **Beetles**

- **Complete metamorphosis**
- **Chewing mouth parts**
- **Household pest**
- **Agricultural pest**
- **Predators**



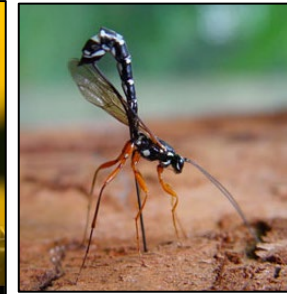
Insects

- **Order: Neuroptera**
 - Lacewings
 - **Complete metamorphosis**
 - **Chewing mouth parts**
 - **Predators**



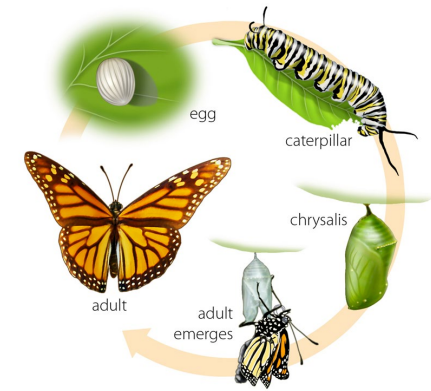
Insects

- **Order: Hymenoptera**
 - Sawflies, bees, wasps, ants
 - **Complete metamorphosis**
 - **Chewing mouth parts**
 - **Household pests**
 - **Ag. / Horticultural pests**
 - **Med / Vet pests**
 - **Predators / Parasitoids**



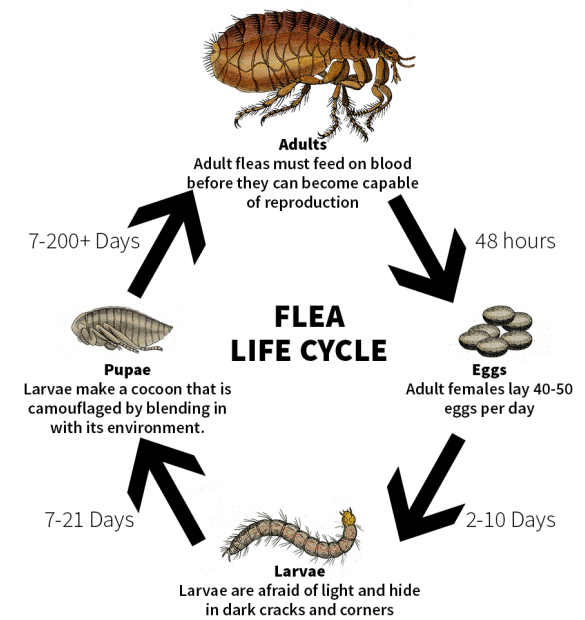
Insects

- **Order: Lepidoptera**
 - Butterflies and moths
 - Complete metamorphosis
 - Chewing mouth parts (larvae) & sucking mouth parts (adults)
 - Household pests
 - Agricultural pests



Insects

- **Order: Siphonaptera**
 - Fleas
 - **Complete metamorphosis**
 - **Piercing / Sucking mouth parts**
 - **Med / Vet pests**
 - **Ectoparasite**



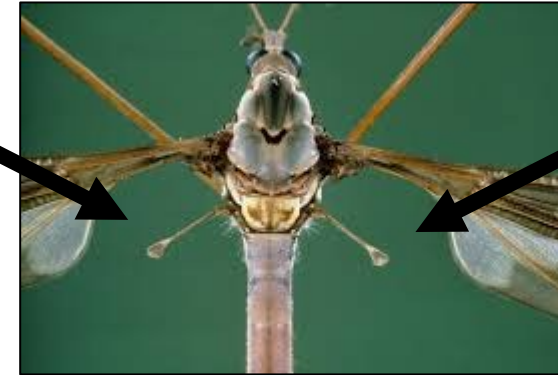
Insects

- **Order: Diptera**
 - Flies, Mosquitoes, Gnats
 - **Halteres**
 - **Complete metamorphosis**
 - **Various mouth parts**
 - **Household pests**
 - **Med / Vet pests**
 - **Agricultural pests**
 - **Predators / Parasitoids**



Insects

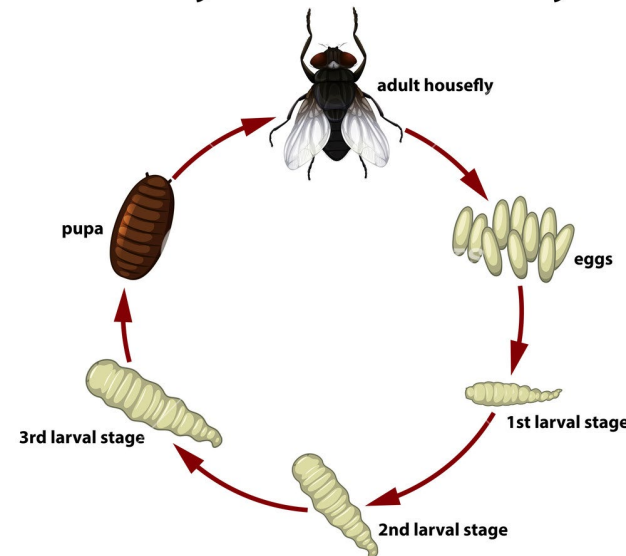
- **Order: Diptera**
 - Flies, Mosquitoes, Gnats
 - **Halteres**



Insects

- **Order: Diptera**
 - Flies, Mosquitoes, Gnats
 - Halteres
 - Complete metamorphosis
 - Various mouth parts
 - Household pests
 - Med / Vet pests
 - Agricultural pests
 - Predators / Parasitoids

Life Cycle of a Housefly



Insects

- **Order: Diptera**
 - Flies, Mosquitoes, Gnats
 - Halteres
 - Complete metamorphosis
 - Various mouth parts
 - Household pests
 - Med / Vet pests
 - Agricultural pests
 - Predators / Parasitoids



Review

- **Arthropods**
- **Why We Identify Insects!**
- **Insects**
- **Insect Orders**
- **Key to Hexapod Orders**





Questions?