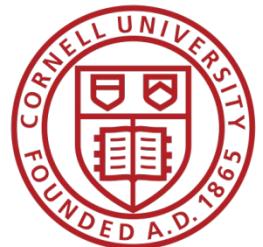


Entomology

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: Myriopoda**
 - **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:**



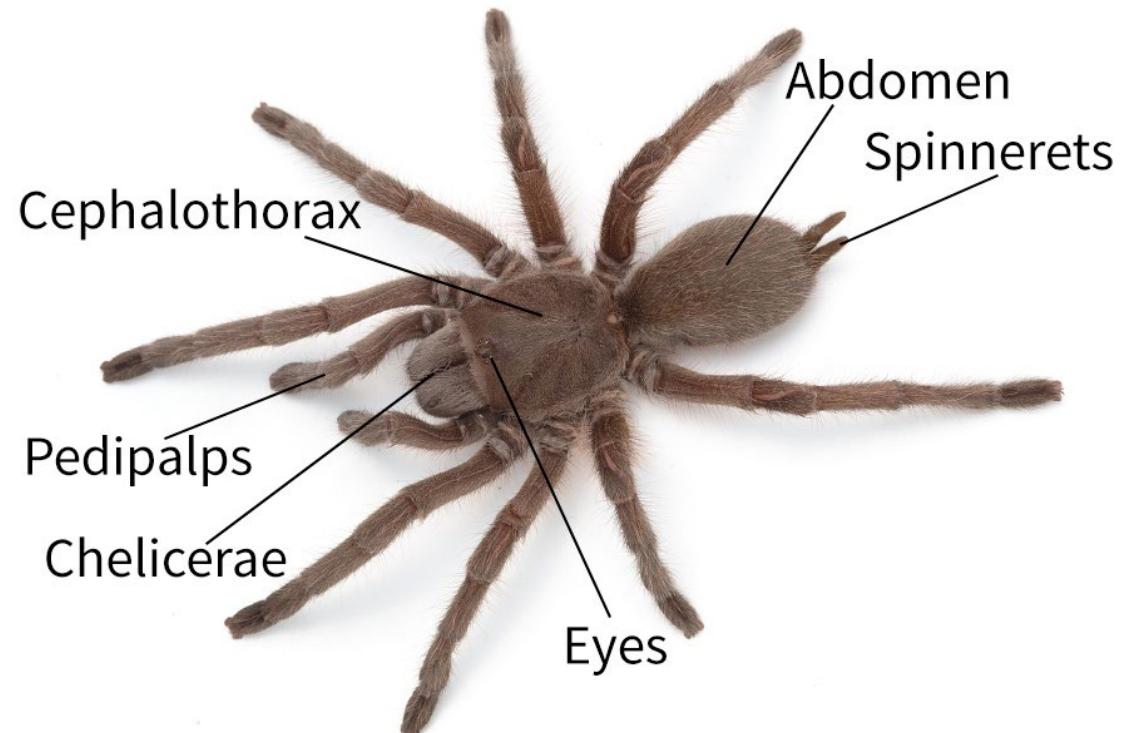
- **Acari** – mites & ticks
 - **Araneae** - spiders
 - **Opiliones** – harvestmen or daddy longlegs





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

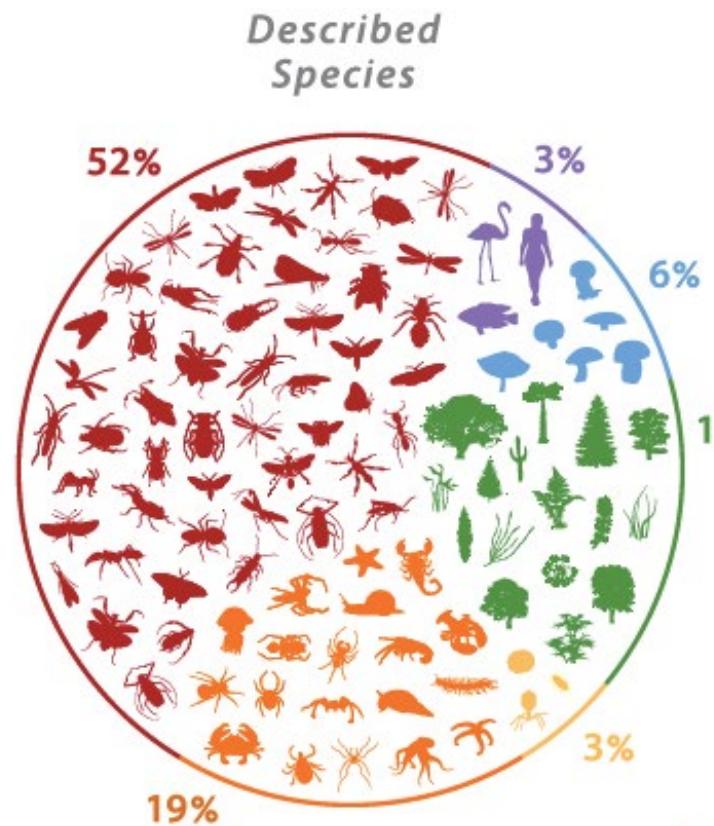
- Orders:

- 29 Orders

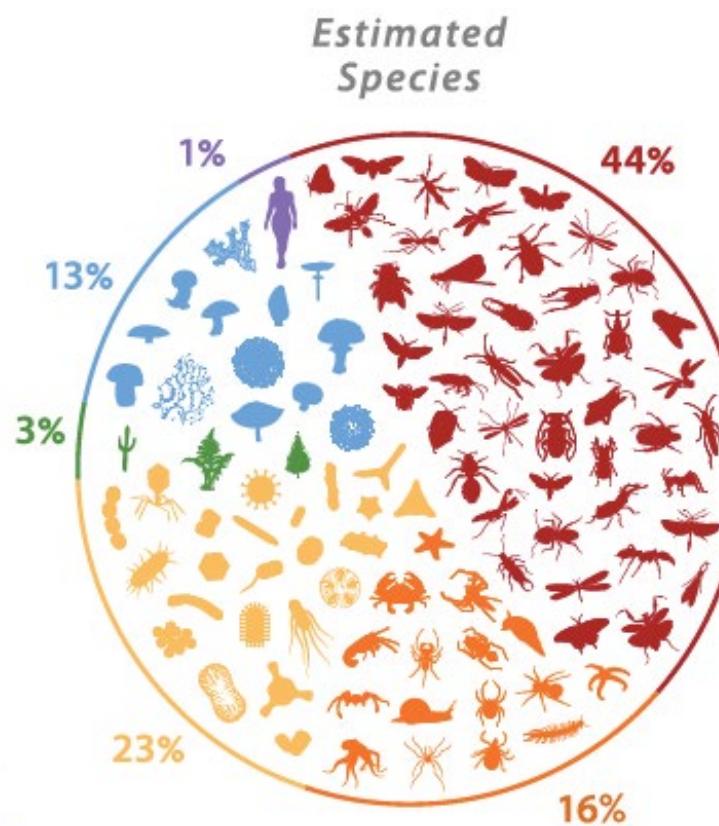


Insects

EARTH'S INHABITANTS



Insects
Chordates
Fungi & Lichens
Plants
Diatoms,
Bacteria,
Viruses, etc.
Other Invertebrates





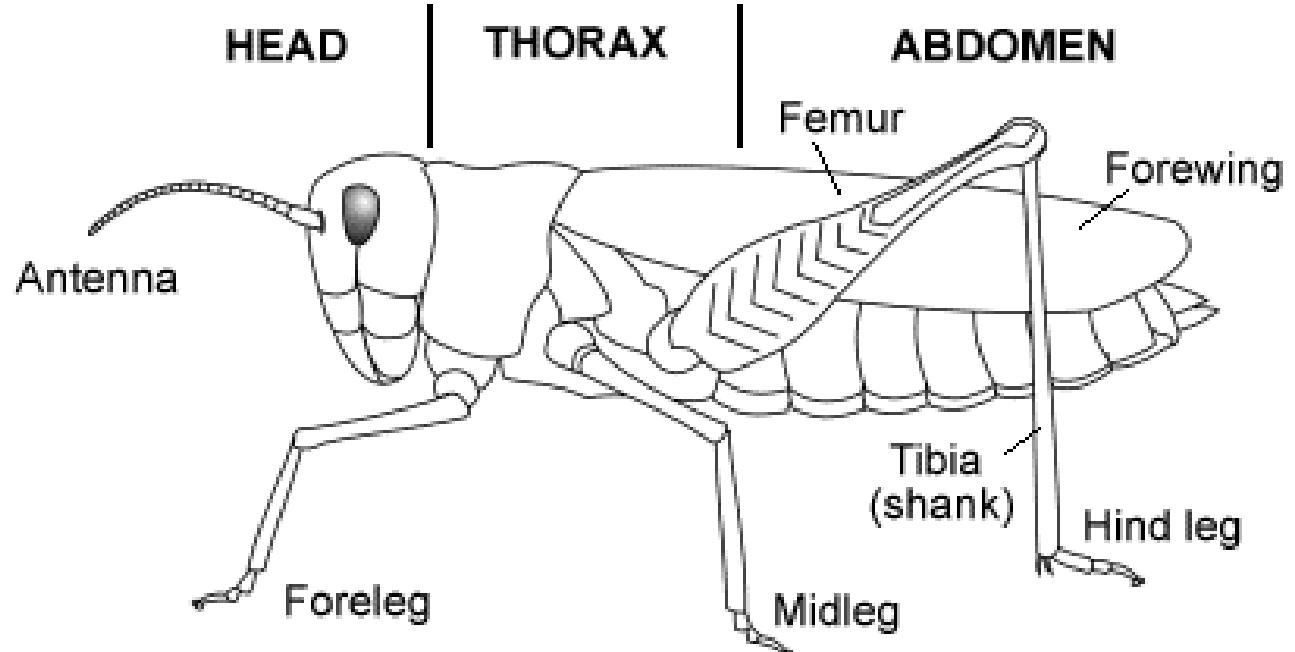
Insects

- Archaeognatha
- Zygentoma
- Ephemeroptera
- Odonata
- Orthoptera
- Neuroptera
- Phasmida
- Embioptera
- Grylloblattodea
- Mantophasmatodea
- Plecoptera
- Dermaptera
- Zoraptera
- Mantodea
- Blattodea
- Pscoptera
- Phthriptrea
- 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



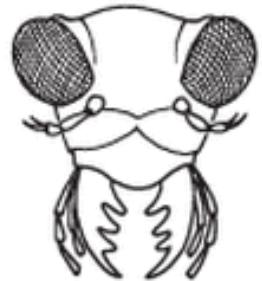
butterfly
(side view)

lapping



bee
(front view)

chewing



beetle
(front view)



cicada
(front view)



housefly
(front view)



grasshopper
(side view)



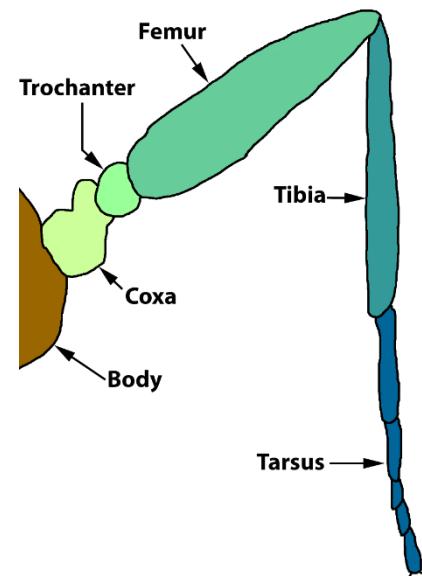
Insects

- Mouth Parts
 - Piercing / Sucking
 - Chewing / Biting

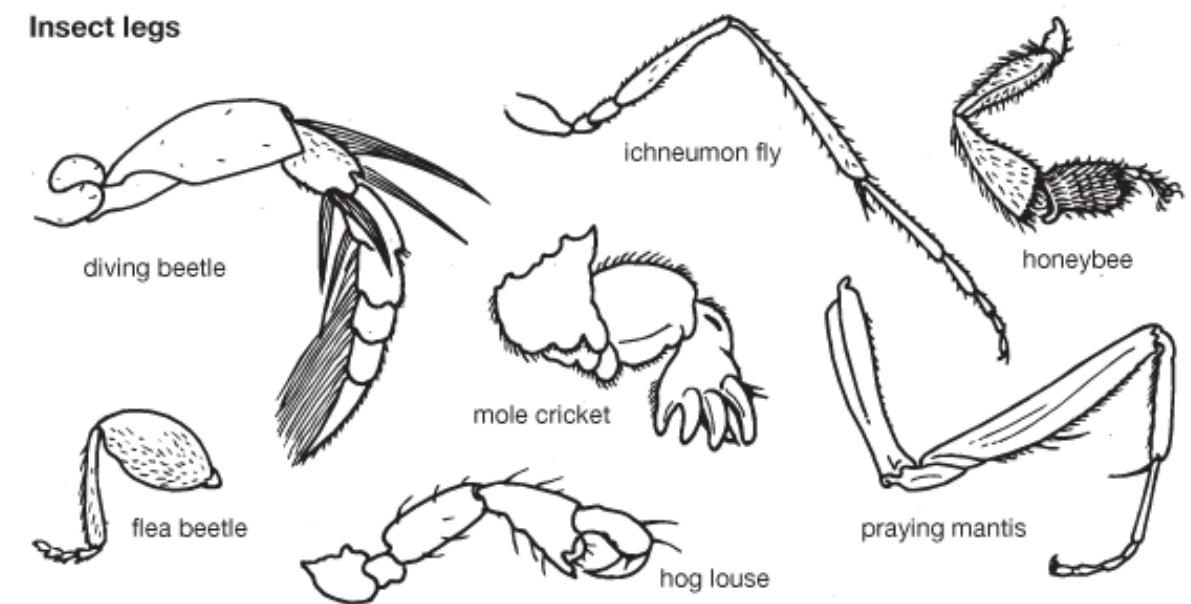


Insects

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



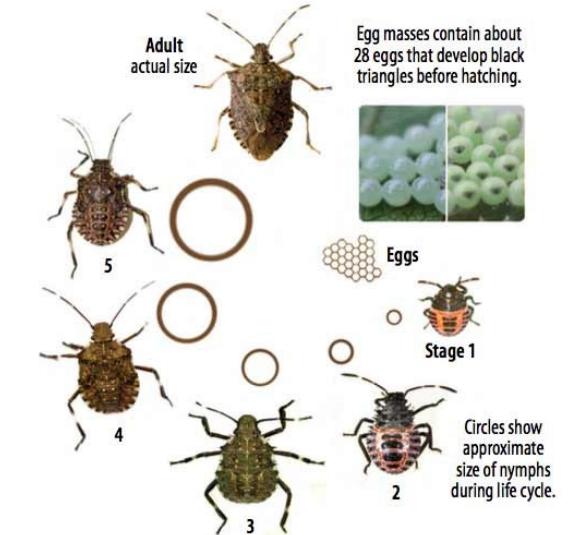
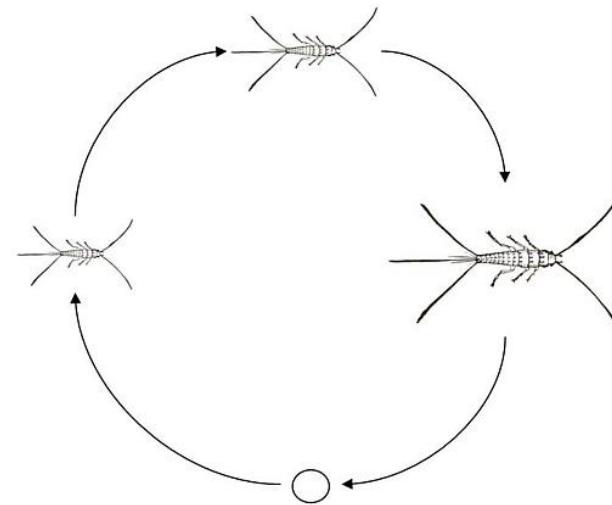
Insect legs



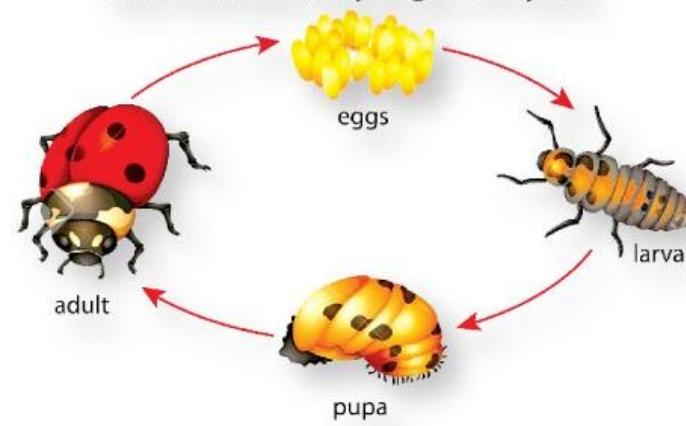


Insects

- Metamorphosis
 - None
 - Incomplete
 - Complete



Coccinellidae (ladybug) Life Cycle





Insects

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



Insects

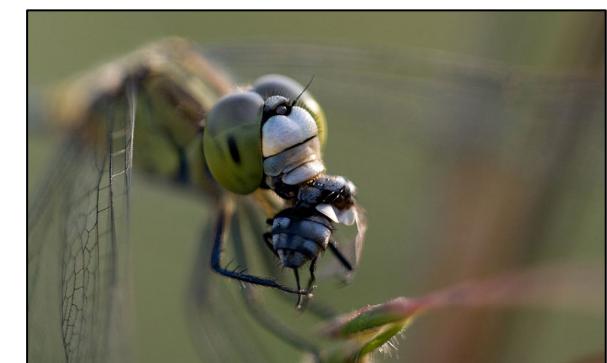
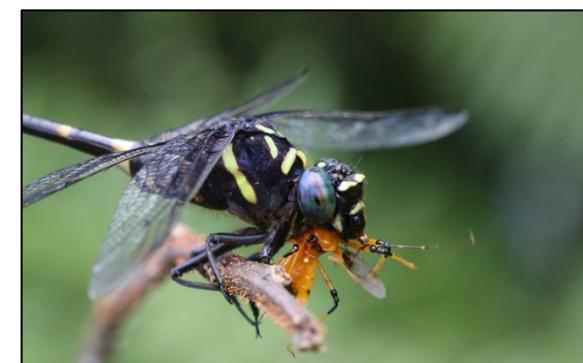
- Order: Zygentoma (formerly Thysanura)
 - Silverfish
 - No metamorphosis
 - No wings
 - Chewing mouth parts
 - Household pest





Insects

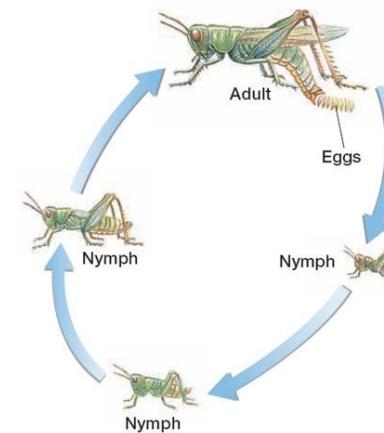
- Order: Odonata
 - Dragonflies and Damselflies
 - **Incomplete metamorphosis**
 - **Naiad:** aquatic nymphal form
 - **Chewing mouth parts**
 - **Predatory**





Insects

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





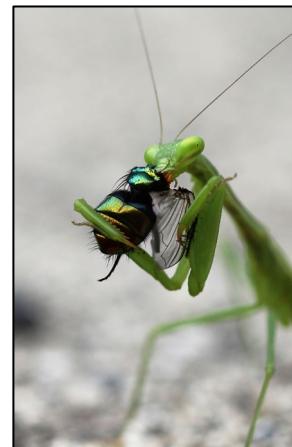
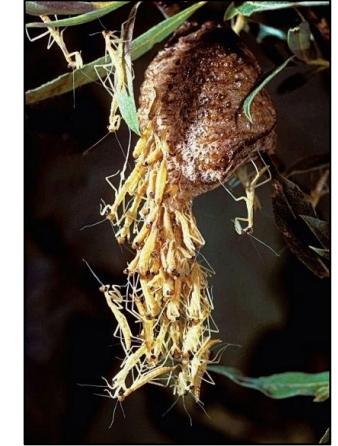
Insects

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



Insects

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





Insects

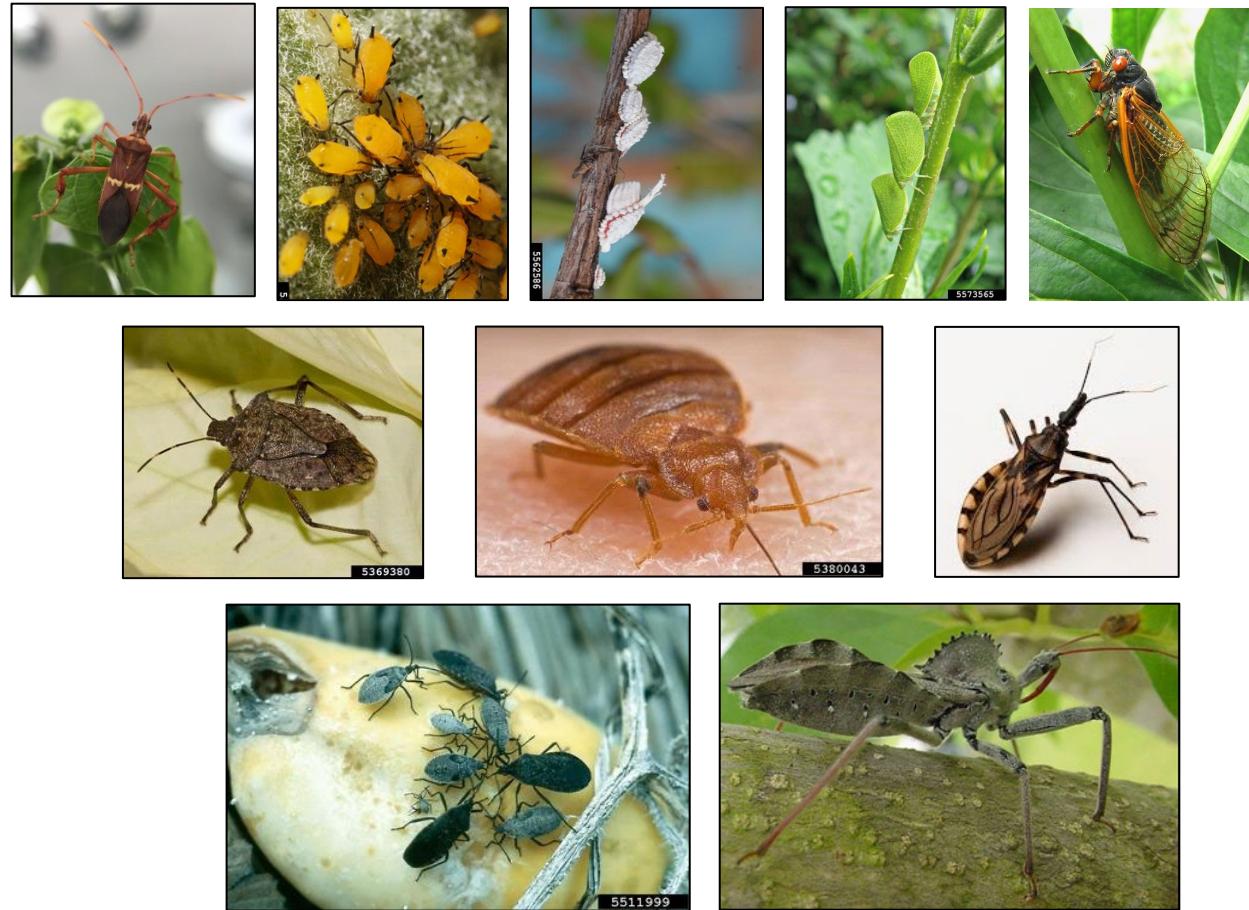
- Order: Blattodea
 - Cockroaches and Termites (formerly Isoptera)
 - **Incomplete metamorphosis**
 - **Chewing mouth parts**
 - **Household pests**





Insects

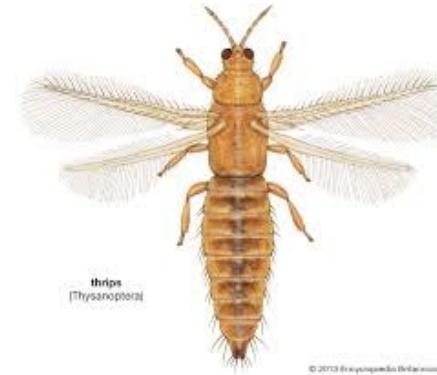
- **Order: Hemiptera**
 - True Bugs and Aphids, Scales and Hoppers (formerly Homoptera)
 - **Incomplete metamorphosis**
 - **Piercing / Sucking mouth parts**
 - **Household pests**
 - **Med / Vet pests**
 - **Agricultural pests**
 - **Predators**





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**

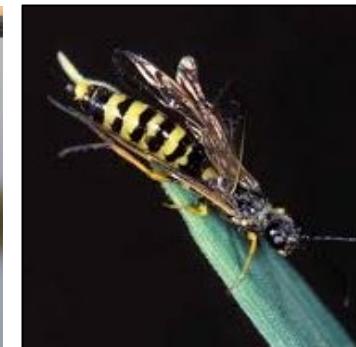
- **Chewing mouth parts**

- **Household pests**

- **Ag. / Horticultural pests**

- **Med / Vet pests**

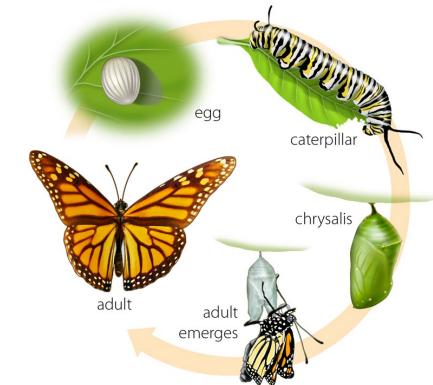
- **Predators / Parasitoids**





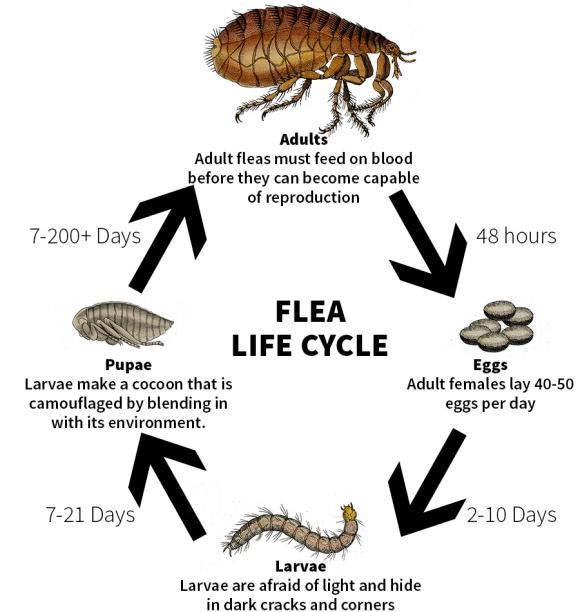
Insects

- 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





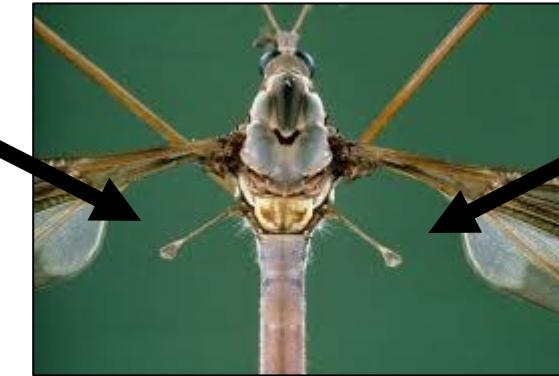
Insects

- **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**

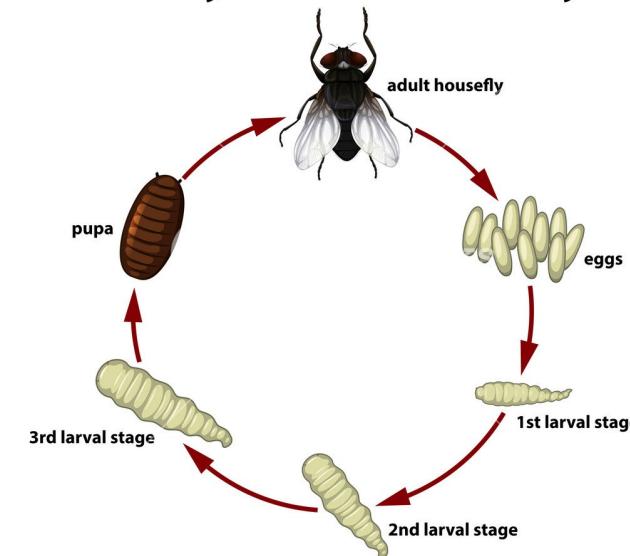




Insects

- **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?