Basic Entomology for Master Gardeners Class 9/7/16

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Outline

- Higher taxonomy
- Anatomy
- Ecology
- Common Orders and Families
- Discussion

Higher Taxonomy

- Phylum Arthropoda
  - Subphylum Trilobita
  - Subphylum Chelicerata
    - Class Merostomata
      - Horseshoe crabs
    - Class Arachnida
      - Spiders, mites, scorpions
    - Class Pycnogonida
      - Sea spiders

http://www.bath.ac.uk/bio-sci/biodiversity-lab/research.html

http://beachchairscientist.wordpress.com/2008/07/13/hello-world/

http://tiger.gsfc.nasa.gov/wildlife.html

Order Acari

- Mites and Ticks
- Plant pests and parasites
- Some predators

Two-spotted spider mite

Deer tick

Predatory mite

Higher Taxonomy

- Subphylum Crustacea
  - Ostracods
  - Copepods
  - Lobsters
  - Crabs
  - Shrimp
  - Crayfish
  - Pill bugs (rolly-pollys)

http://mumbaifish.com/forms/CateListTwo.aspx

http://www.activepestcontrol.com/learn_more/index.php

Higher Taxonomy

- Subphylum Myriapoda
  - Class Diplopoda
    - Millipedes
  - Class Chilopoda
    - Centipedes
  - Class Pauropoda
  - Class Symphyla

Higher Taxonomy

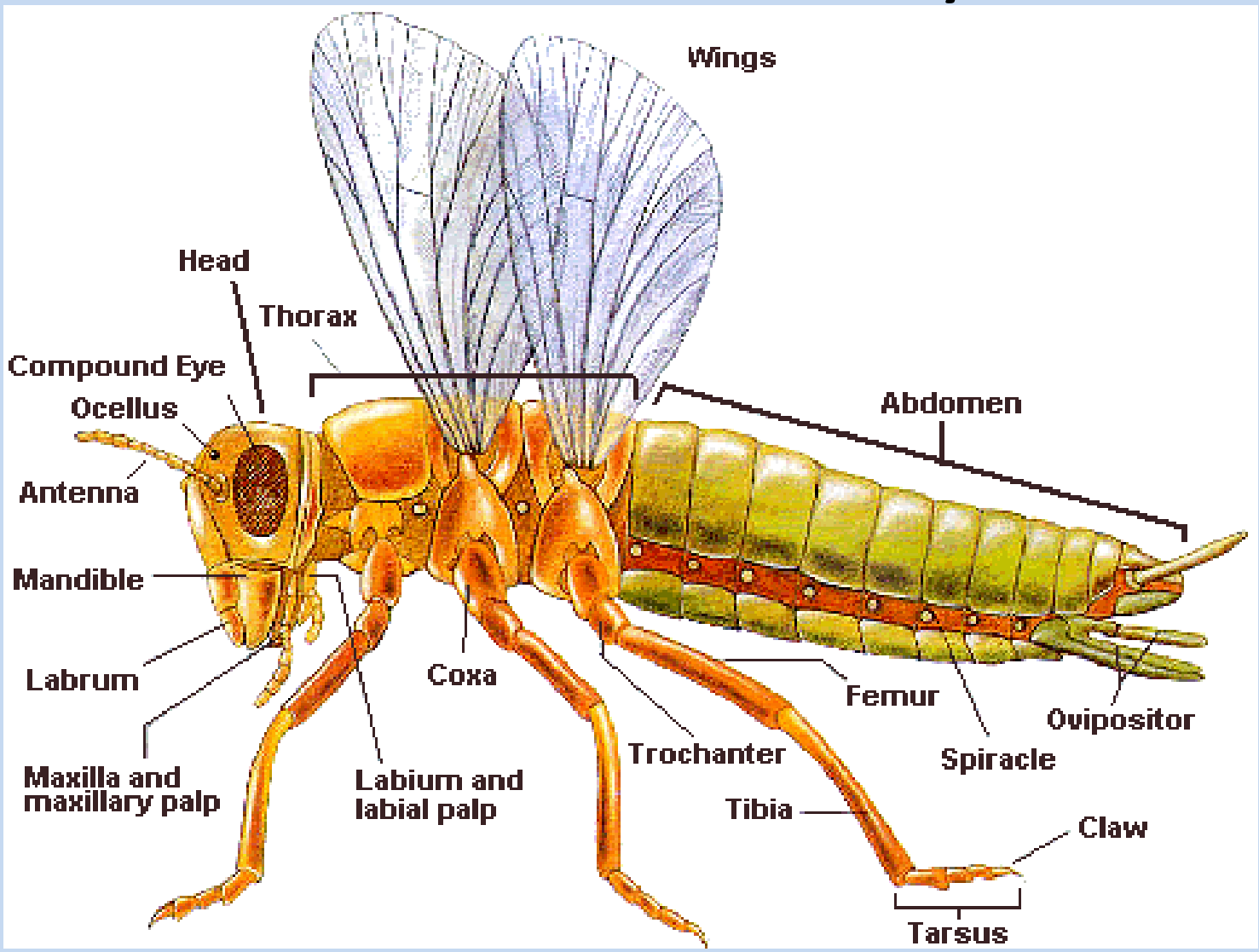
- Subphylum Hexapoda
  - Class Collembola
    - Springtails
  - Class Diplura
    - Two-pronged bristletails
  - Class Insecta
    - Insects
  - Class Protura
    - Coneheads

Insecta

- One pair of antennae
- Two pairs of wings or none
- Three body regions
  - Head, thorax, abdomen
- Three pairs of legs
- Tracheal respiratory system

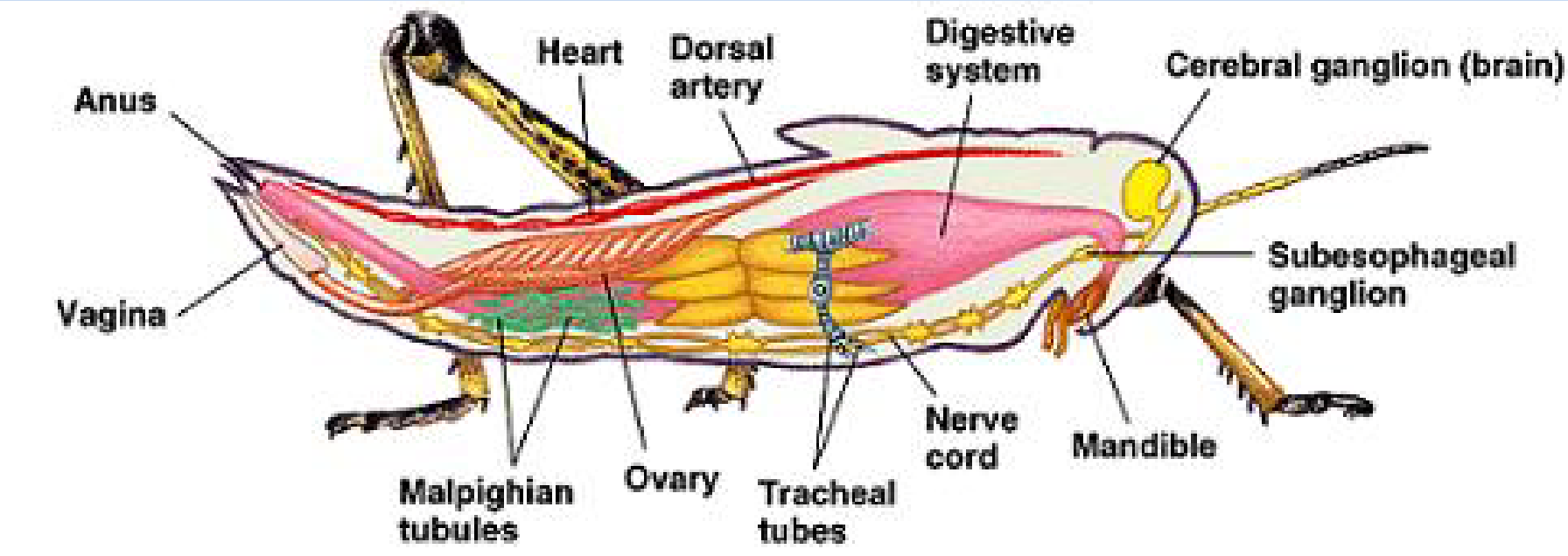
C. V. Covell, UF

External Anatomy



http://www.cartage.org.lb/en/themes/sciences/zoology/Insects/InsectAnatomy/Introduction/Introduction.htm

Internal Anatomy



http://scienceblogs.com/evolgen/2007/03/science_spring_showdown_octopu_2.php

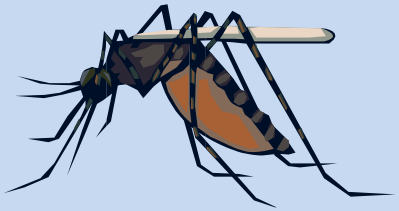
Ecology

- Live everywhere except the oceans
- Herbivores
- Predators
- Parasitoids
- Parasites
- Decomposers
- Prey
- Pollinators
- Soil improvers
- And more!

In Human Terms

- Pestiferous
  - Crop pests
    - Direct (part we eat)
    - indirect
  - Urban pests
    - Decomposers
    - Landscape pests

- Pestiferous
  - Med / Vet pests
    - Livestock, poultry, pig, etc.
    - Transmit human diseases
  - Aesthetic pests
    - It’s an insect, its gross, I don’t want to see it



In Human Terms

- Beneficial
  - Predators / parasitoids of pests
  - Herbivores eat pest plants
  - Pollinators
  - Makers of useful things
    - honey, silk, etc.
- Beneficial
  - Decomposers
    - Forensic entomology
  - Soil improvers
  - Medicinal
  - Food
  - Art

How Many?!

- Nearly 60% of all described plant and animal species are insects
- About 1 million described species
  - Only 1% serious pests & about 10,000 occasional pests
- Estimates from 3 – 50 million insect species total

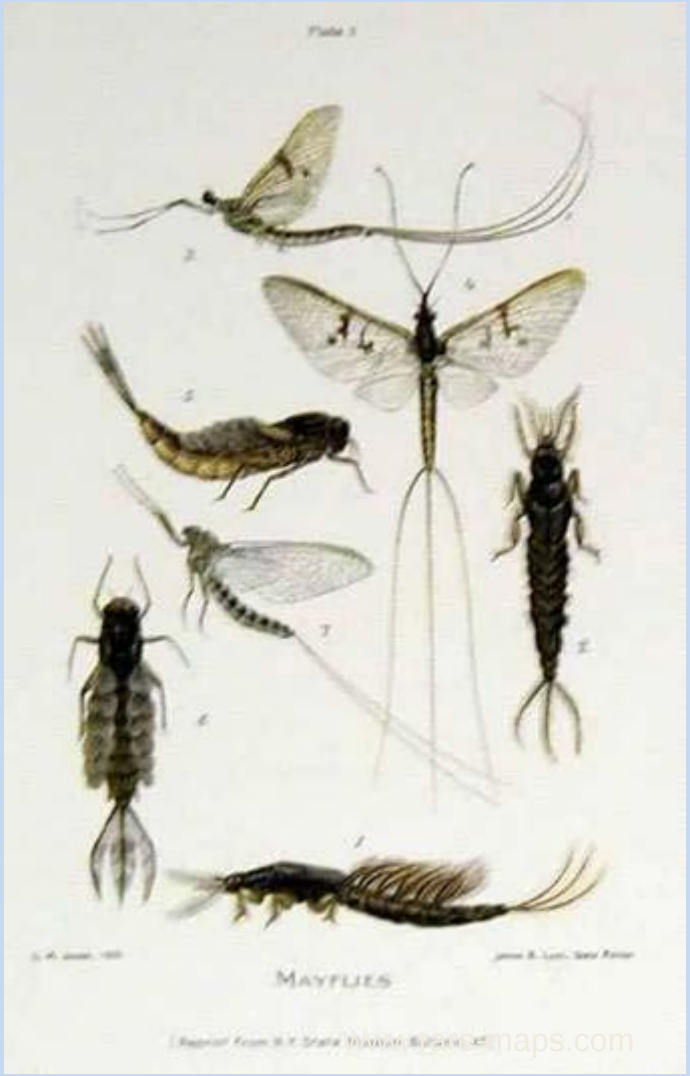
Price, P. W. 1997. Insect Ecology. John Wiley & Sons, Inc. New York, NY.

INSECT ORDERS

Zygentoma (silverfish)

Ephemeroptera (mayflies)

- Immatures called naiads
- Subimago
  - Immature stage with wings
- Adults emerge en mass and are very short lived
- Simple metamorphosis



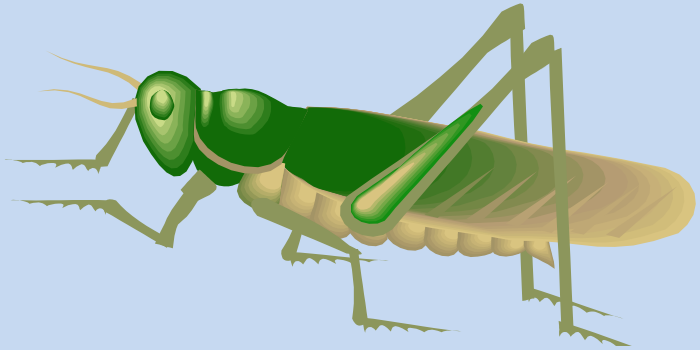
Odonata beneficial

- Naiads
- Simple metamorphosis
- Predatory

- Anisoptera (dragonflies)
  - Hold wings out
- Zygoptera (damselflies)
  - Hold wings over body

Orthoptera

- Leathery forewings
- Jumping legs
- “sing”
- Tympanum (ear)
- Herbivores
- Simple metamorphosis



Orthoptera

Acrididae (Locustidae) (grasshoppers)

Gryllidae (crickets)

Tettigoniidae (katydids)

Gryllotalpidae (mole crickets)

Phasmatodea (walking sticks)

- Reduced or absent wings
- Resemble sticks
- Herbivores
- Simple metamorphosis
- Secrete stinky substance when disturbed

Dermaptera (earwigs)

- Forcepslike cerci
- Mostly decomposers
- Nocturnal
- Simple metamorphosis

Mantodea (Mantids) beneficial

- Raptorial forelegs
- Predatory
- Females eats male during or after copulation
- Simple metamorphosis

Blattodea (cockroaches)

Blattidae

Blattellidae

pests

- Winged and wingless species
- Very fast
- Decomposers
- Simple metamorphosis

Blattodea (termites)pests

- 4 membranous, equally sized wings
- Abdomen broadly joined to thorax
- Decompose dead wood with the help of gut symbionts
- Simple metamorphosis
- Social (reproductives (king & queen), workers, soldiers

Hemiptera (bugs)

- Heteroptera (true bugs)
  - Hemelytra
- Auchenorrhyncha
  - Free living
- Sternorrhyncha
  - Plant parasites

- Piercing-sucking mouthparts
- Simple metamorphosis
- Herbivorus
- Some predatory

Heteroptera (aquatic)

Gerridae (water striders)

Belastomatidae
(giant water bugs)

Nepidae (water scorpions)

Gelastocoridae (toad bugs)

Corixidae (water boatmen)

Notonectidae
(backswimmers)

Heteroptera (pests)

Pentatomidae (stink bugs)

Cimicidae (bed bugs)

Miridae (leaf or plant bugs)

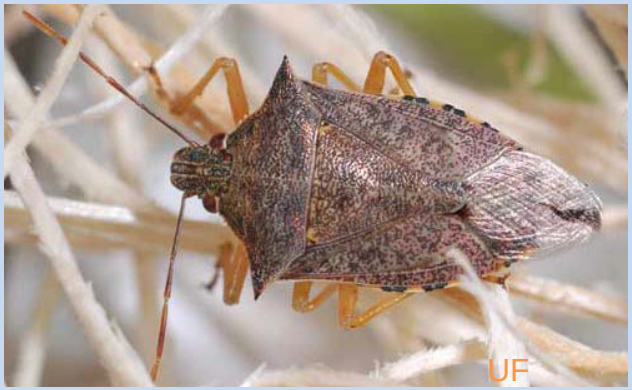
Lygaeidae (seed bugs)

Coreidae (leaf-footed and squash bugs)

Heteroptera (beneficial)

Reduviidae (assassin bugs)

Anthocoridae (minute pirate bugs)



Pentatomidae (stink bugs)

Geocoridae (big-eyed bugs)

Auchenorrhyncha

Cicadidae (cicadas)

Cercopidae (froghoppers, spittlebugs)

Membracidae (treehoppers)

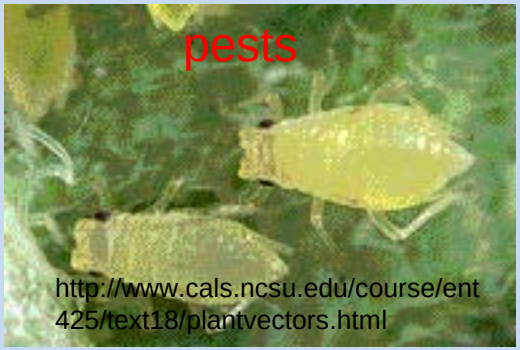
Cicadellidae (leafhoppers)

Superfamily Fulgoroidea (planthoppers)

Sternorrhyncha

Psyllidae (psyllids, jumping lice)

Aleyrodidae (whiteflies)



Aphididae (aphids)

Superfamily Coccoidea (scales and mealybugs)

Thysanoptera (thrips)

- Tiny (~1 mm)
- Bristle-like wings
- Punch and suck mouthparts

  pests beneficial
- Herbivores, predators, and decomposers
- In between simple and complete metamorphosis

Psocoptera (lice)

- Barklice and booklice
  - Small (~6 mm)
  - Booklice live in books and papers in houses
  - Barklice live in bark
  - Winged and wingless species
  - Simple metamorphosis

Parasitic lice

pests

Pediculidae (head and body lice)

Pthiridae (crab lice)

- Small
- Wingless
- Ectoparasites
- Simple metamorphosis

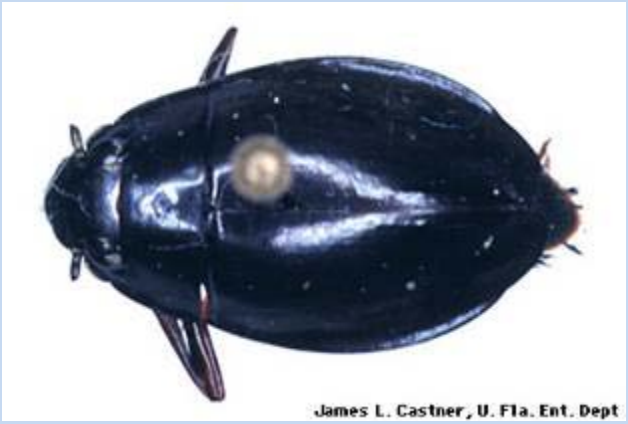
Coleoptera (beetles)

- Elytra (hardened forewings)
- Chewing mouthparts
- Herbivores, predators, and decomposers
- Complete metamorphosis
  - Larvae of some species are called grubs

Coleoptera

Dytiscidae (predacious diving beetles)

Elateridae (click beetles)



Gyrinidae (whirligig beetles)

Lampyridae (fireflies, lightning bugs)

Coleoptera (pests)

White grub

Scarabaeidae (scarab, June, and dung beetles)

Chrysomelidae (leaf and flea beetles and rootworms)

Cuculionidae (weevils)

Coleoptera (beneficial)

Coccinelidae (ladybird beetles)

Carabidae (ground beetles)

Neuroptera

- lacewings, antlions, and owlflies
- Lacey wings
- Complete metamorphosis
- Some larvae are predators
- Adults feed on nectar if at all

beneficial

Hymenoptera

- Sawflies, wasps, ants, bees
- Hind wing smaller than forewing
- Predators, parasitoids, pollinators
- Complete metamorphosis
- Stinger is modified ovipositor
  - Not all sting!
- Many are social
  - Female queens and workers
  - Male drones for reproduction only

Diprionidae (conifer sawflies)

Sawfly larvae (Diprionidae)

Wasps

beneficial

Scoliidae (scoliid wasps)

beneficial

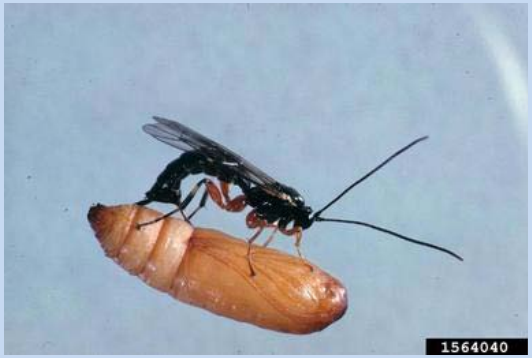
Sphecidae (mud-daubers)

beneficial

Chalcidoidea (tiny parasitic wasps)

beneficial

Braconidae



Ichneumonidae

Wasps

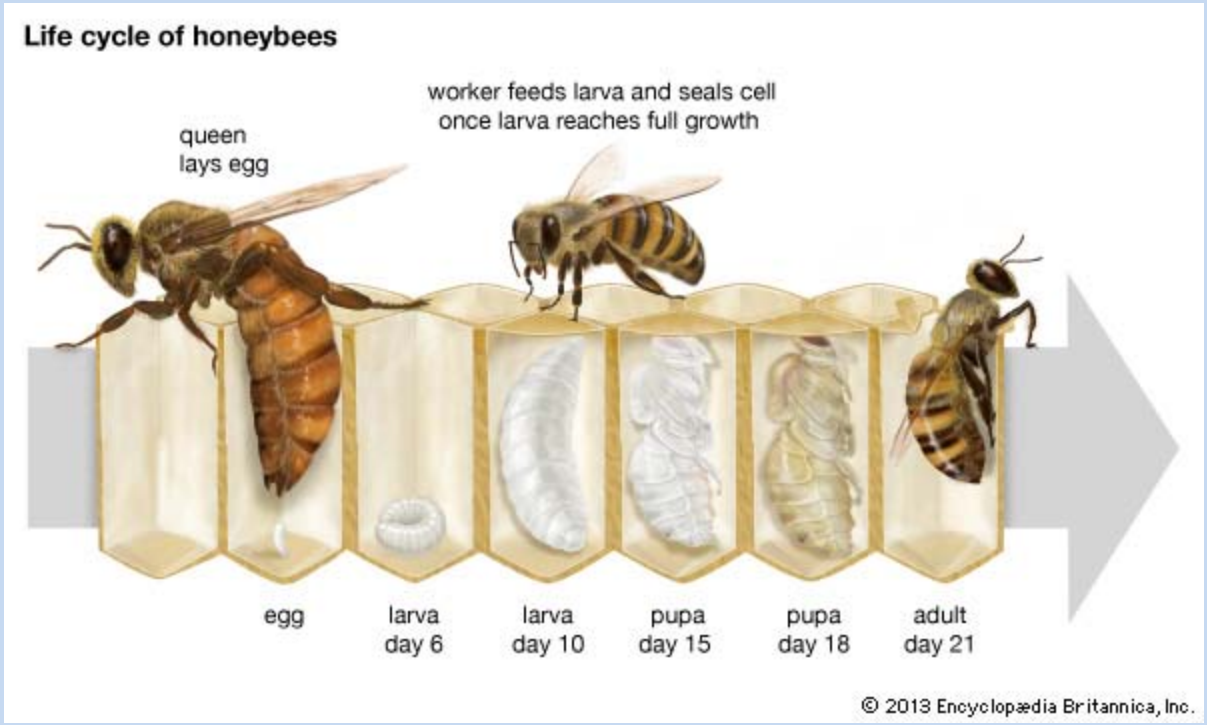
Vespidae (paper wasps, yellow jackets, hornets, mason wasps, potter wasps)

Mutillidae (velvet ants)

Bees beneficial

Halictidae
(sweat bees)

Apidae (honey, bumble, orchid, cuckoo, digger, and carpenter bees)



Ants (Formicidae)

Red imported fire ant (pest)

Lepidoptera

- Butterflies, skippers, moths
- Siphoning mouthparts (adults)
  - Feed on nectar while pollinating
- Wings covered with scales
- Complete metamorphosis
  - Larvae called caterpillars
    - herbivores

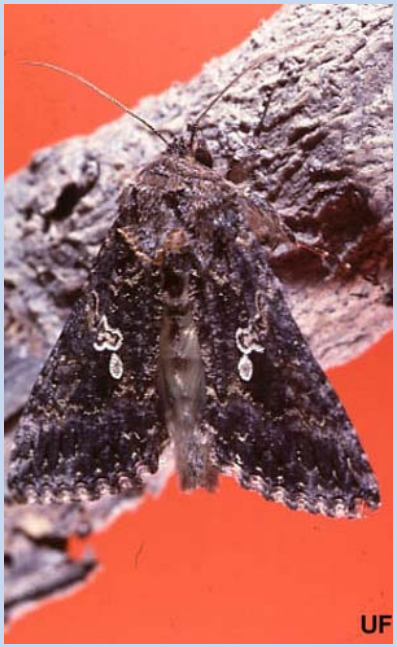
Danaidae (milkweed butterflies)

Lepidopteran pests

Spingidae (sphinx moths / hornworms)

Plutellidae (diamondback moth)

Lepidopteran pests



Cabbage looper

Armyworms

Corn earworm

Noctuidae

Siphonaptera (fleas) pests

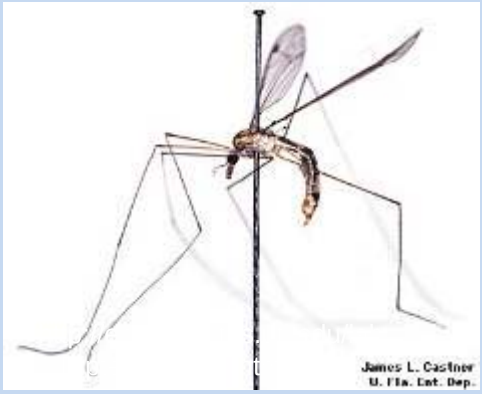
- Small
- Wingless
- Complete metamorphosis
- Ectoparasites

Pulicidae (common fleas)

Diptera (flies)

- Hind wings reduced to halteres
- Predators, parasitoids, parasites, herbivores, decomposers, pollinators
- Complete metamorphosis
  - Some larvae are called maggots

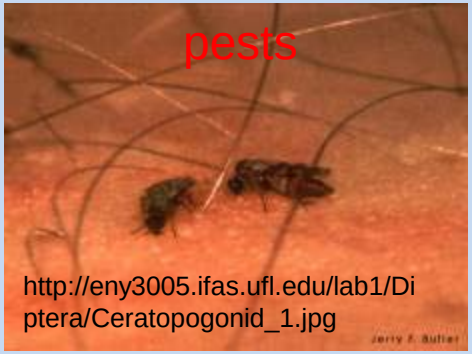
Suborder Nematocera (long-horned flies)



Tipulidae (crane flies)

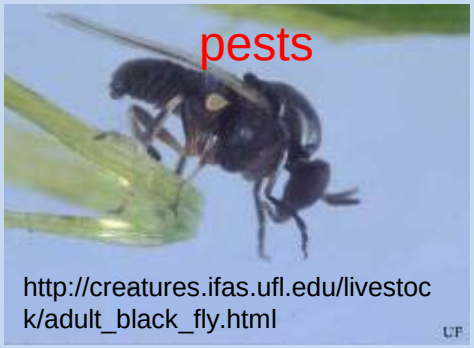
pests

Culicidae (mosquitoes)



Ceratopogonidae (punkies, biting midges)

Chironomidae (midges)



Simuliidae (black flies)

Bibionidae (march flies aka love bugs)

Cecidomyiidae (gall midges)

Suborder Brachycera (short-horned flies)

Syrphidae (flower and hover flies)

Asilidae (robber flies)

Bombyliidae (bee flies)

Tachinidae (tachinid flies)

Suborder Brachycera (short-horned flies)

pests

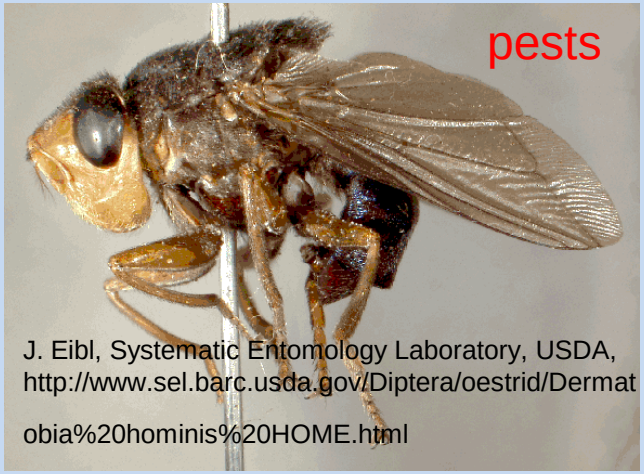
Tabanidae (horse and dear flies)

Tephritidae (fruit flies)

Agromyzidae (leafminer flies)

Drosophilidae (pomace and vineger flies)

Suborder Brachycera (short-horned flies)



Oestridae (bot flies)

Muscidae (house, horn, and stable flies)

Calliphoridae (blow flies)

Sarcophagidae (flesh flies)

Fly larvae

Mosquito larvae

Seed corn maggot

http://plantandsoil.unl.edu/croptechnology2005/cpnrm/?what=topicsD&informationModuleId=1029338910&topicOrder=9&max=11&min=0&