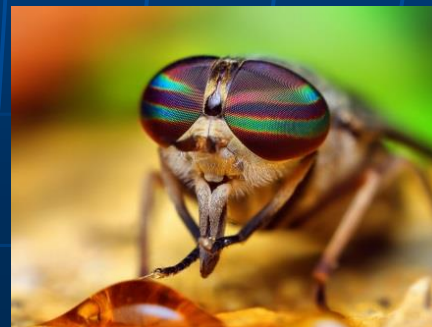


Insect Diversity 101



Larry Dapsis

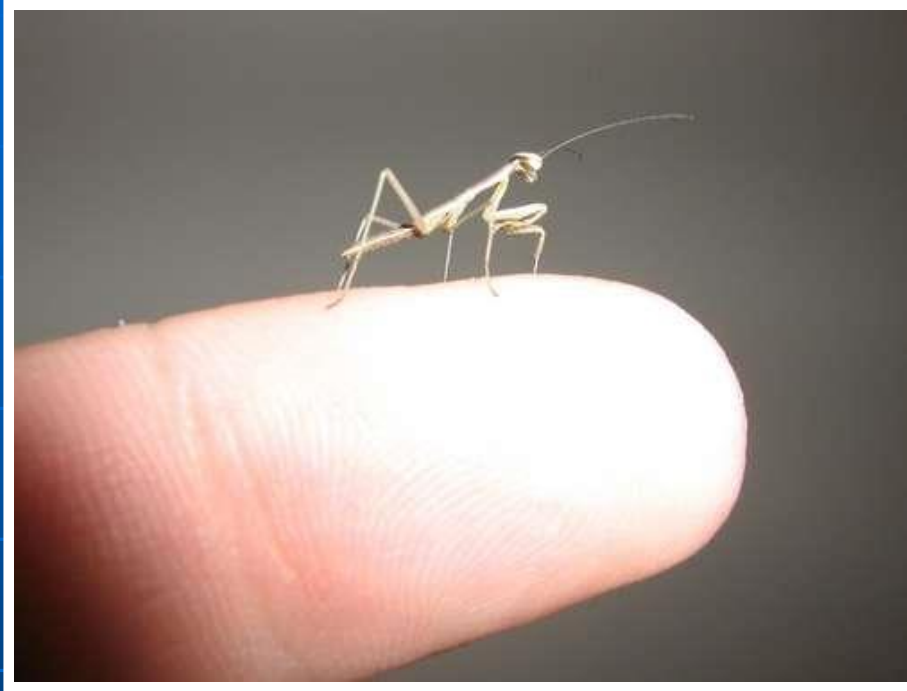
*Cape Cod Cooperative
Extension*

www.capecodextension.org

508-375-6642



Lotsa' "Baby" Praying Mantis'....



Off to School...

Environmental Science/Biology

Entomology - Vegetable Crops

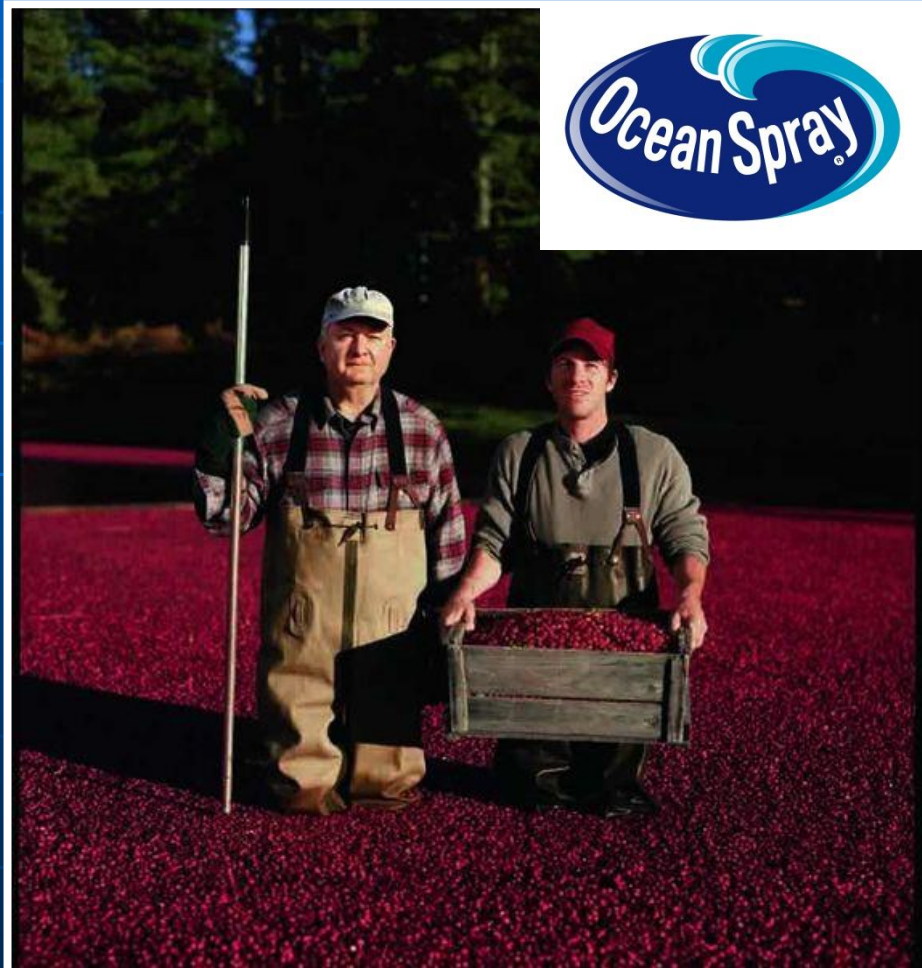
From School to....Consumer Product Development



Consumer Product Development



...Then back to Agriculture, Integrated Pest Management



Mammals

5,600 species estimated

5,501 (98%) species discovered



Birds

10,500

10,064 (96%)



Reptiles

12,000

9,547 (80%)



Amphibians

15,000

6,771 (45%)



Fish

45,000

32,400 (72%)



Crustaceans

150,000

47,000 (31%)



Mollusks

200,000

85,000 (43%)



Arachnids

600,000

102,248 (17%)

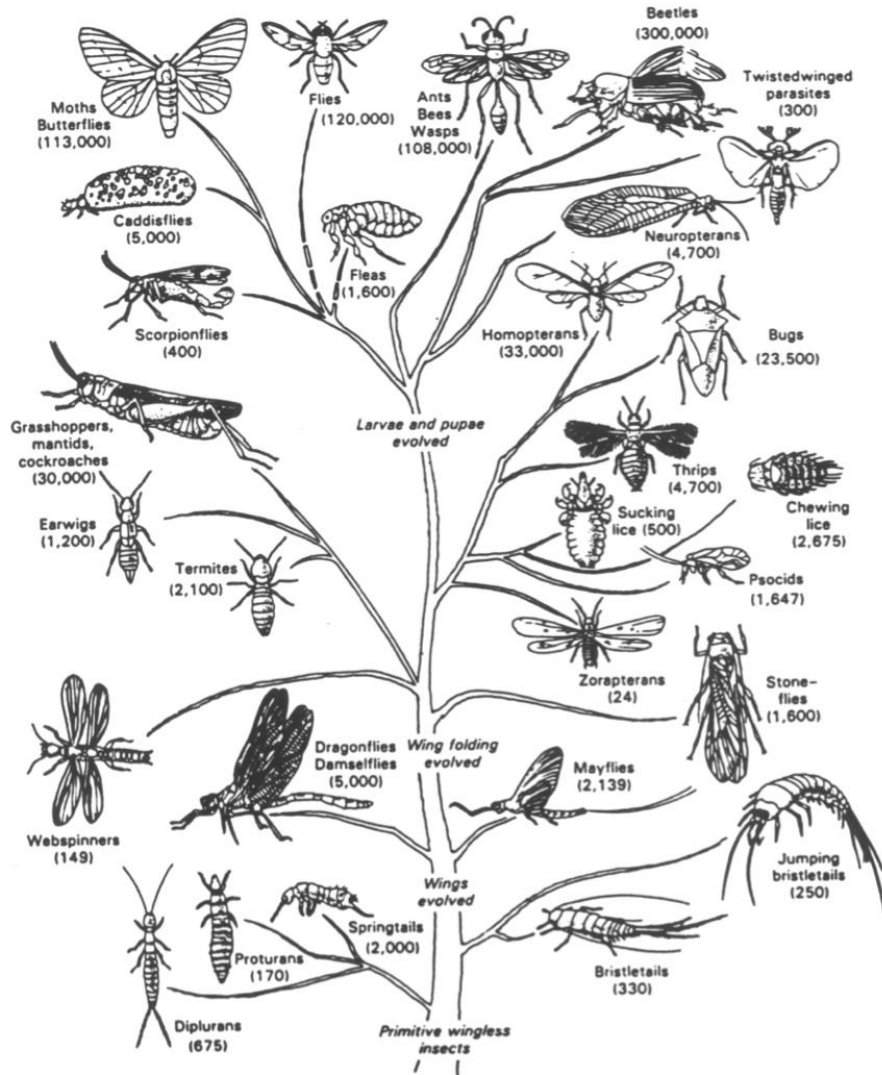


Insects

5,000,000

1,000,000 (20%)

Insect Orders - 31 classified “buckets”



Housefly

Kingdom

Animalia

Phylum

Arthropoda

Class

Insect

Order

Diptera

Family

Muscidae

Genus

Musca

Species

domestica



Insect morphology

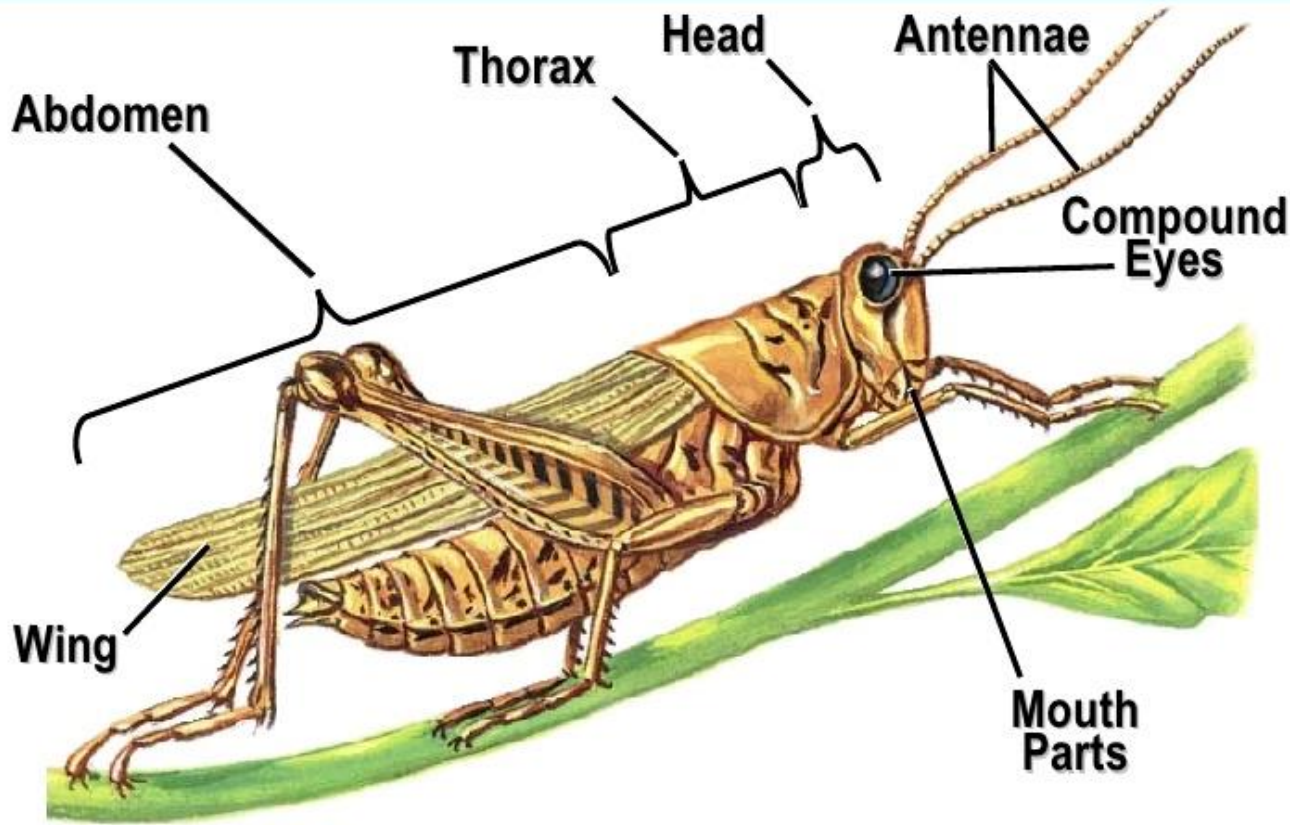
Basic body plan...



Chapter 22

32

Insect Body Plan





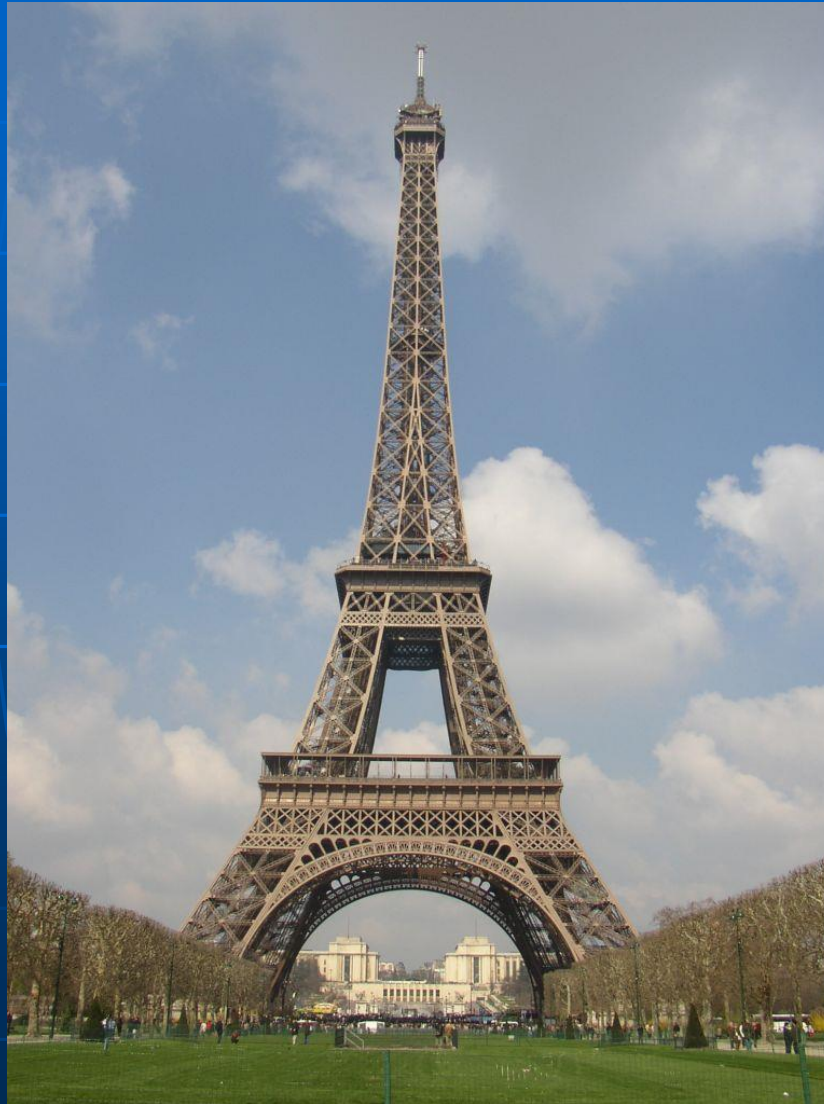
■ Order Collembola - Springtails

Furcula



6 mm or less

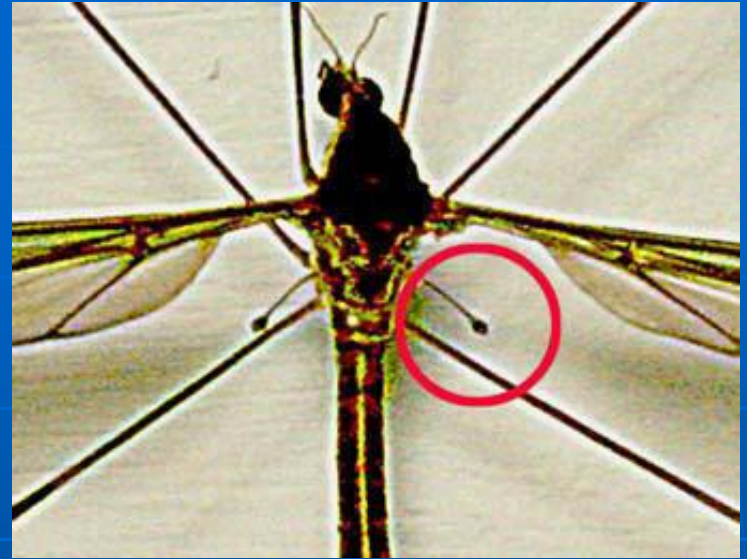
7 inch jump =



1,063 feet

Order Diptera - Flies

One pair of wings...

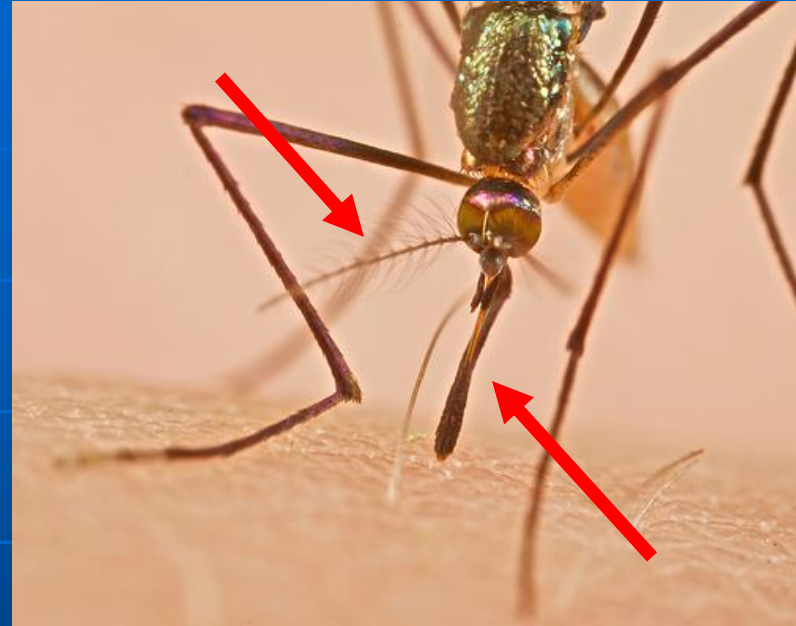


Halteres

Order Diptera - Flies

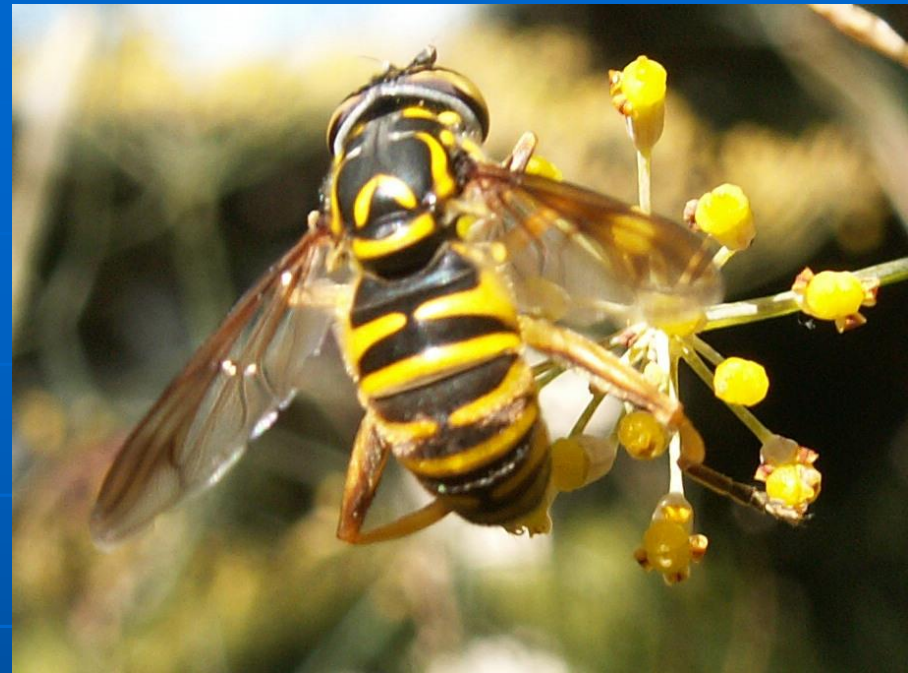
Mouthparts can be
spongy (below) or
modified into a tube
(right)

Antennae short or long
and feathery...



Not Wasps or Bees....

Order Diptera –
Flies...one pair of
wings...Mimicry



Eyes can be the dominant part of the head

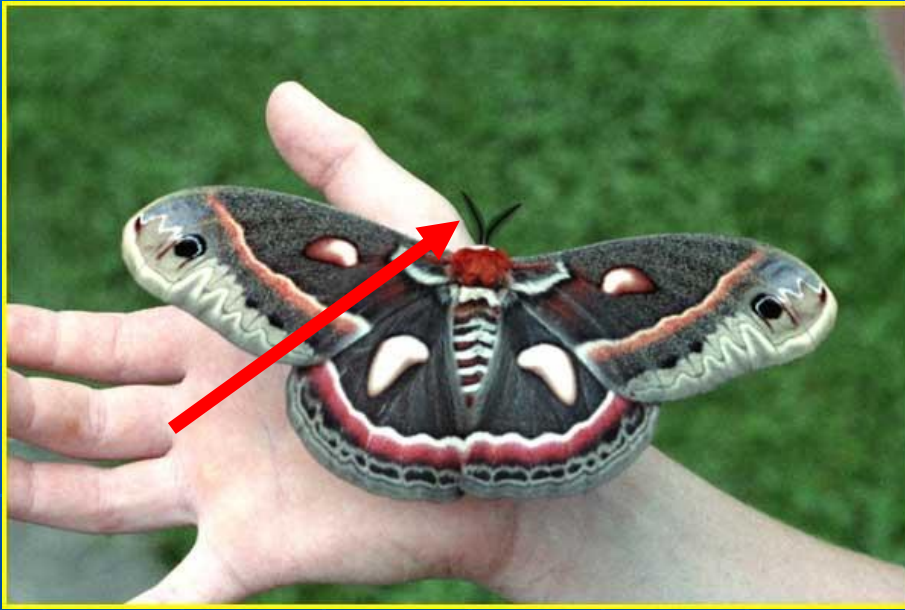


Eye diversity to the
max!

Stalkeyed fly



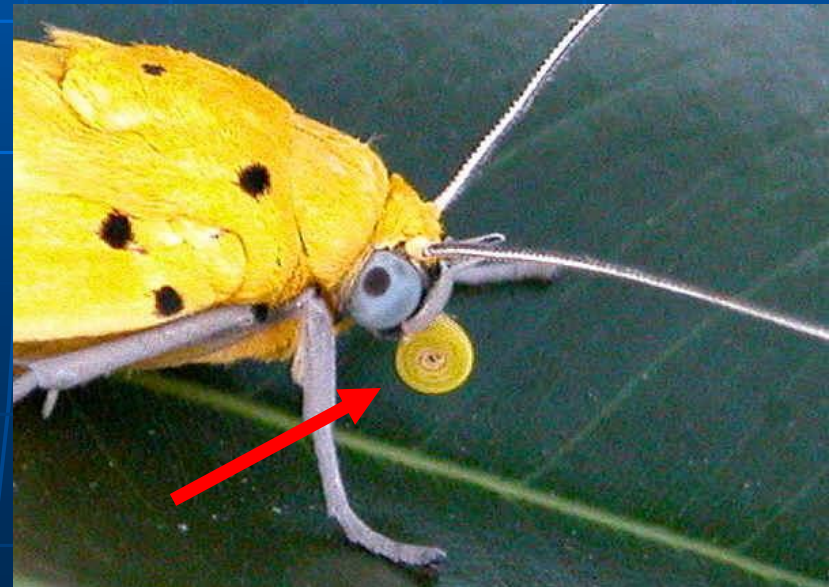
Order Lepidoptera – Butterflies, Moths and Skippers



Large wings with respect to body size

Antennae - Feathered or thin with a club

Mouthparts usually long and coiled



Vampire Moth



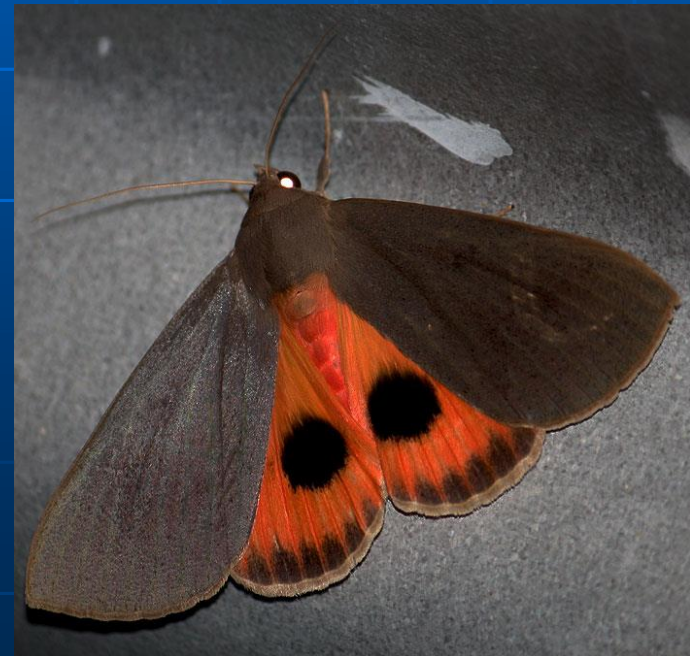


**Moths largely
nocturnal**

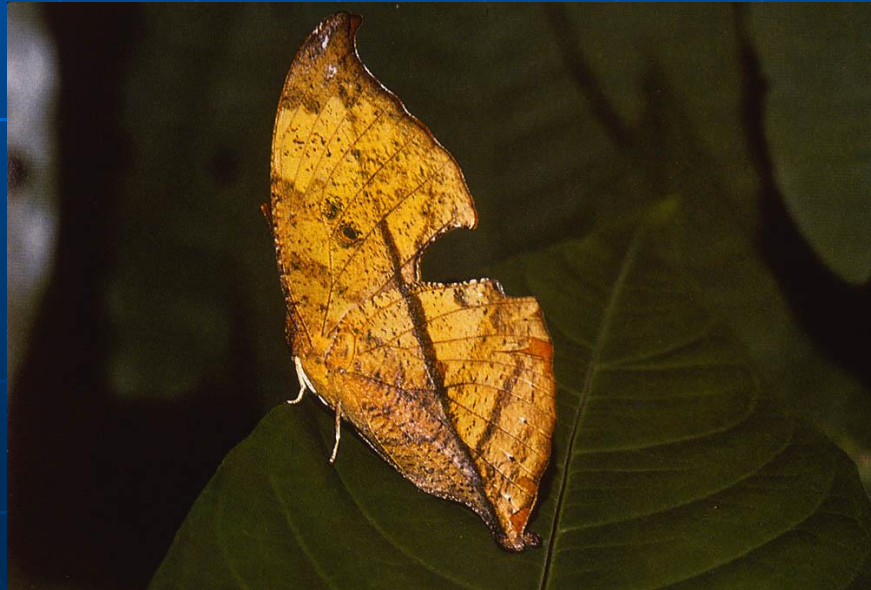
**Cryptic
appearance**

**Moth predation daytime:
Birds have excellent vision...**

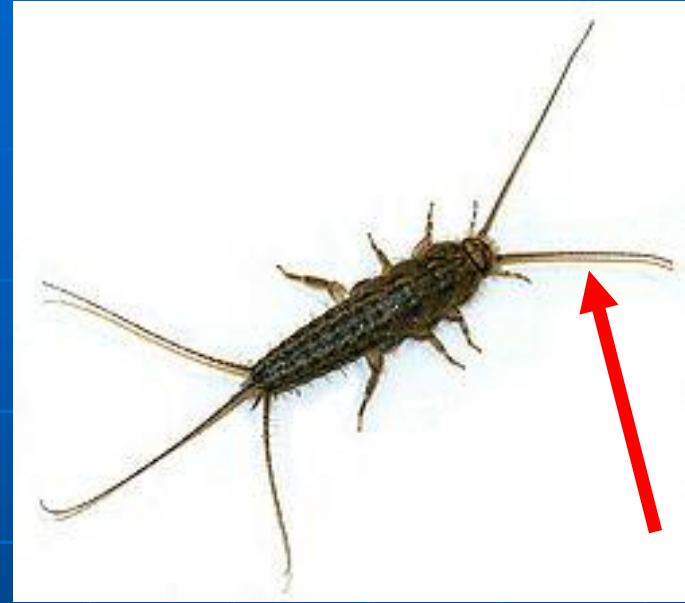
Underwing Moth



Great Lep Impersonations...



Order Thysanura – Silverfish and Firebrats



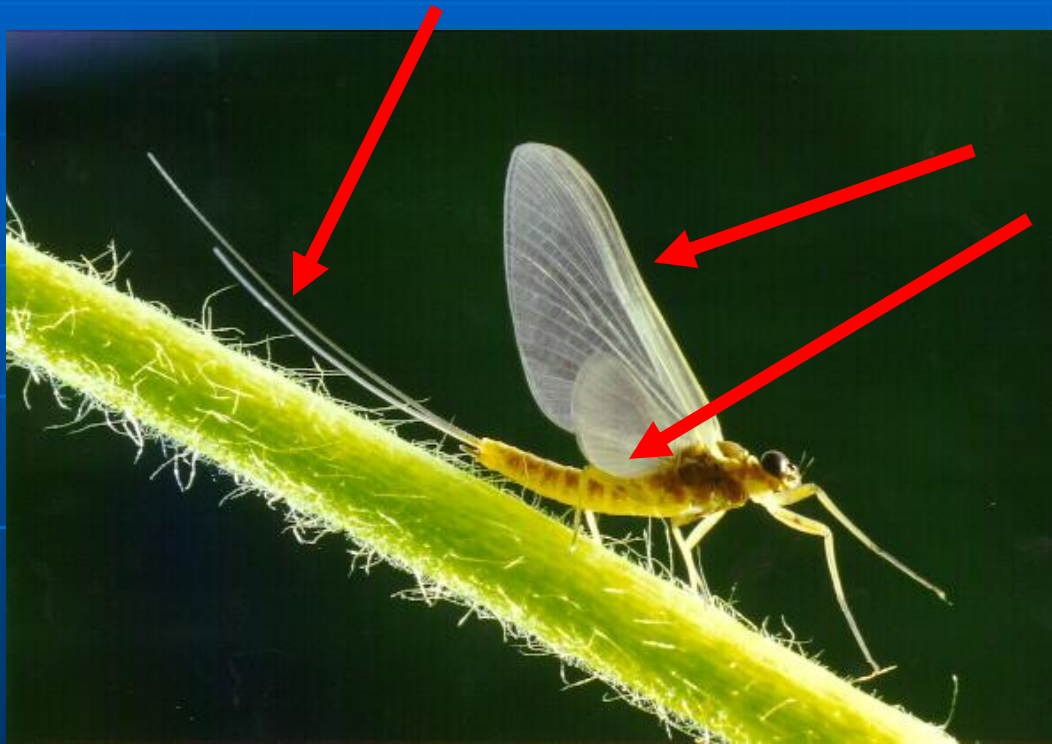
Soft bodied

No wings

Three filaments on abdomen

Long slender antennae

Order Ephemeroptera - Mayflies



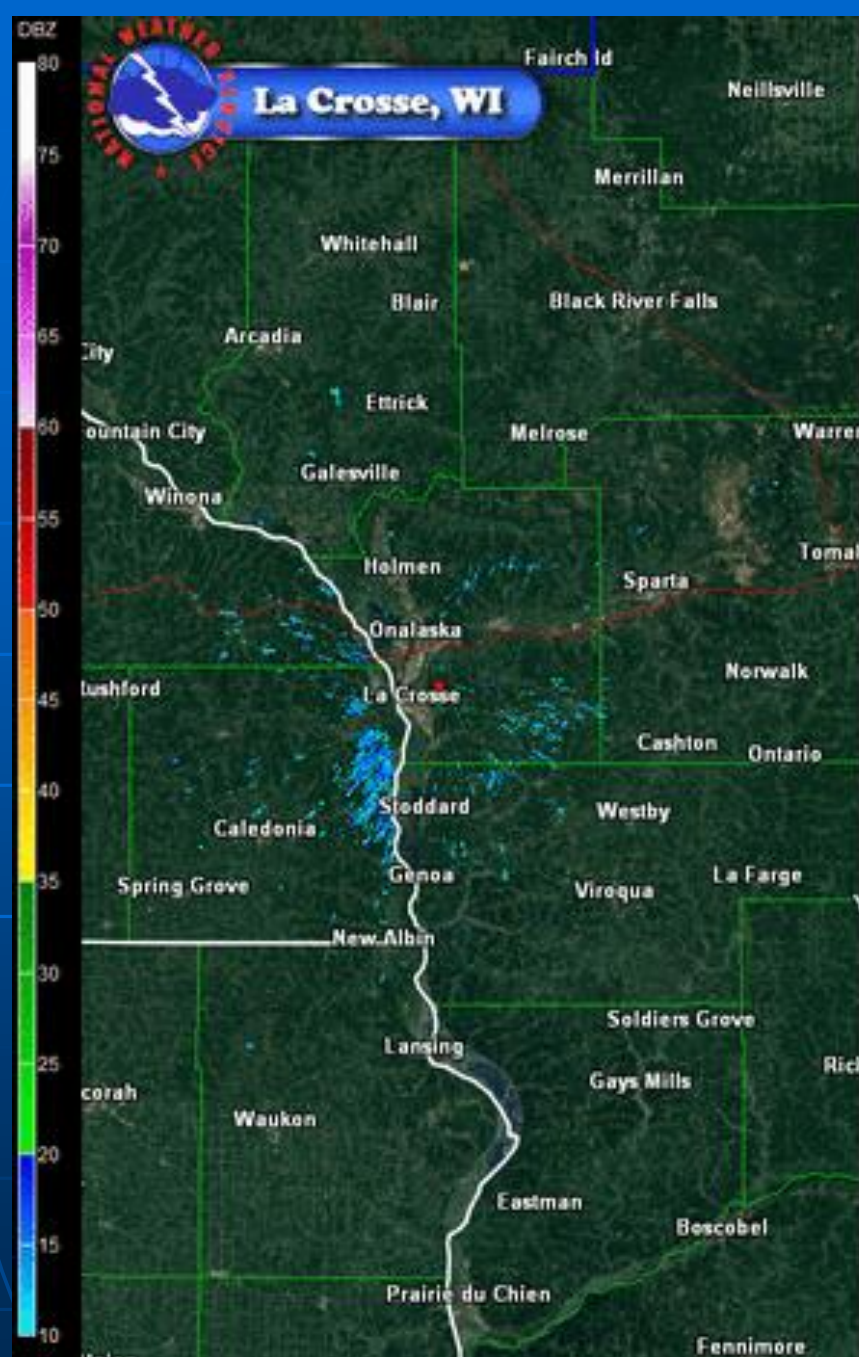
Aquatic

Long slender bodies

Front wings large and triangular, hind wings much smaller

Held vertically over the body

Three caudal filaments on abdomen



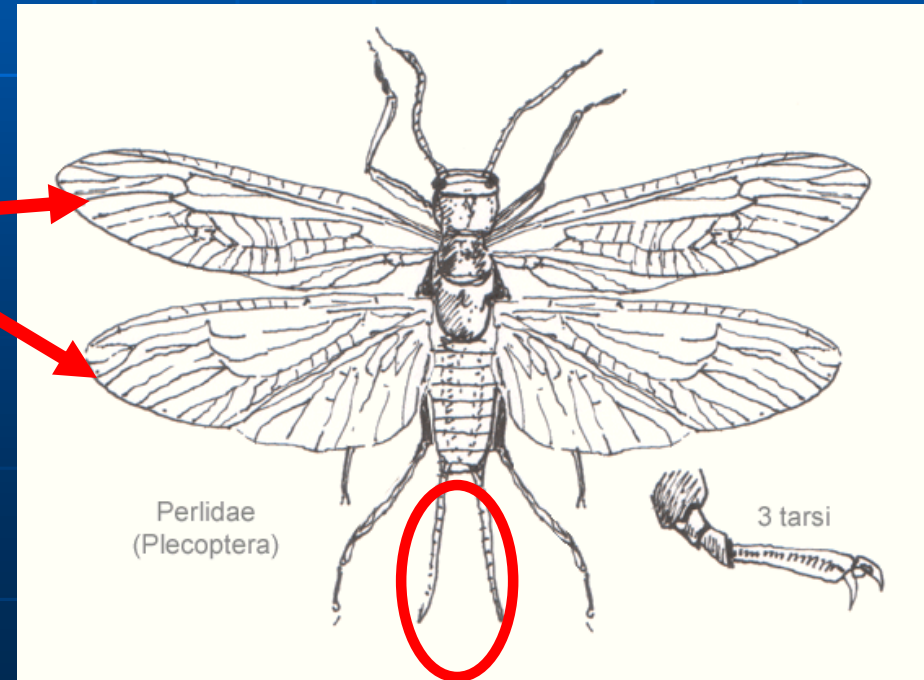
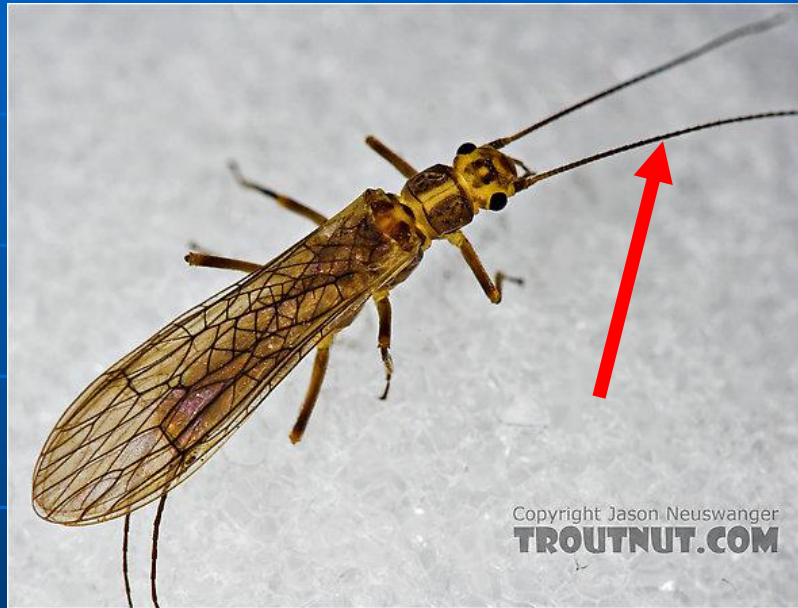
http://www.huffingtonpost.com/2014/07/23/mayfly-hatch-wisconsin-photos-radar_n_5614449.html

Order Plecoptera - Stoneflies

Aquatic...2 pairs of
wings equal in size

Long slender antennae

One pair of caudal
filaments (mayflies 3)

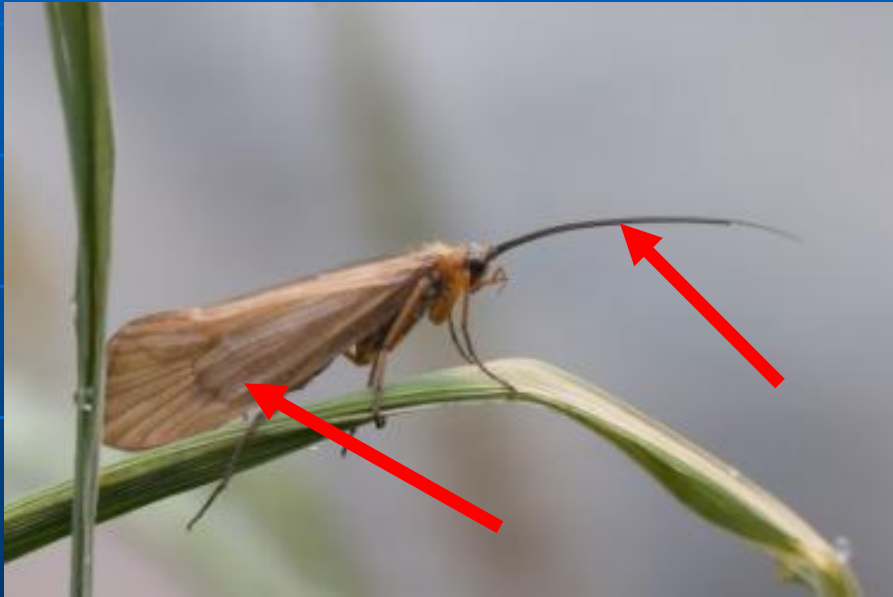


Order Trichoptera - Caddisflies

Aquatic

Wings held in an “A-frame”

Long thin antennae

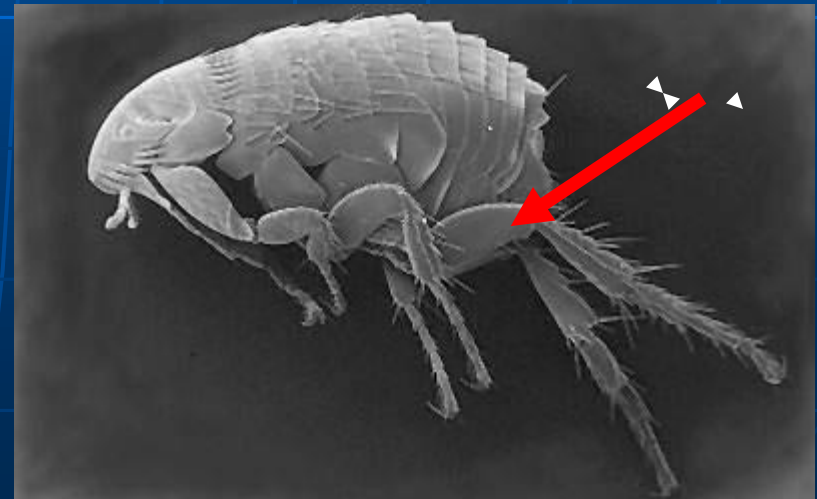


Order Siphonaptera - Fleas

Genal comb

Strongly flattened body

Powerful jumping legs...



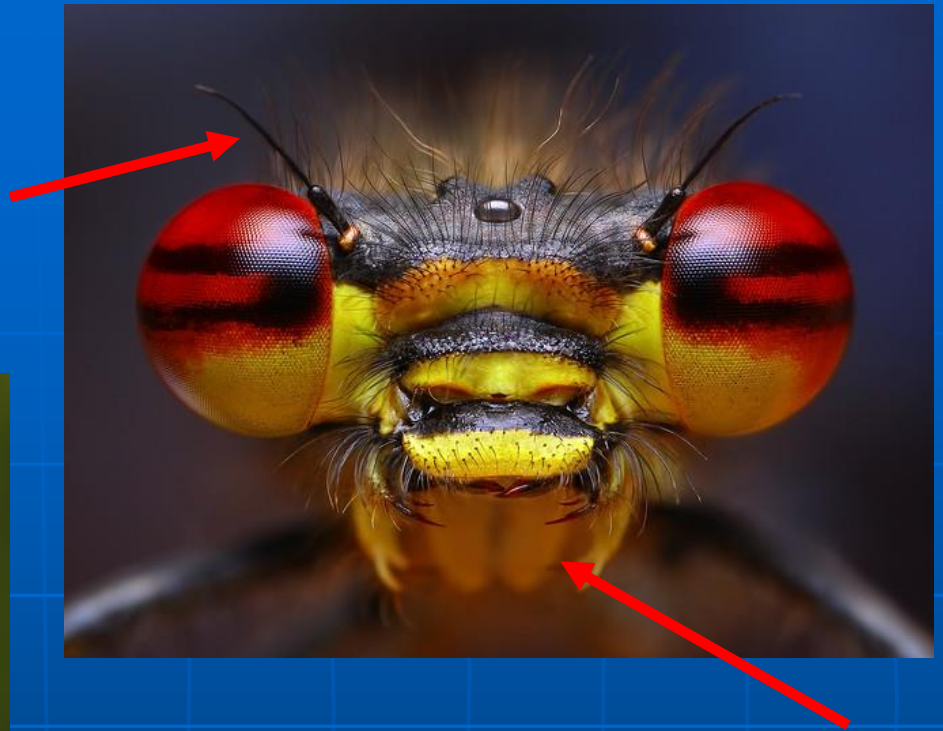
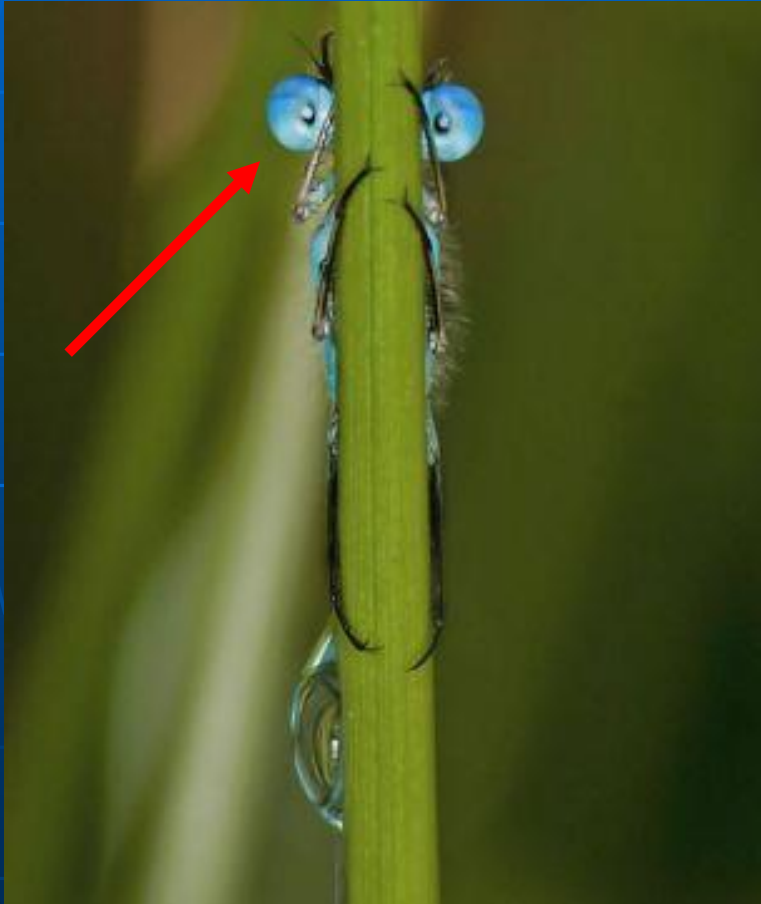


Order Mecoptera – Scorpionflies

“Long face”

Male genitalia scorpionlike...

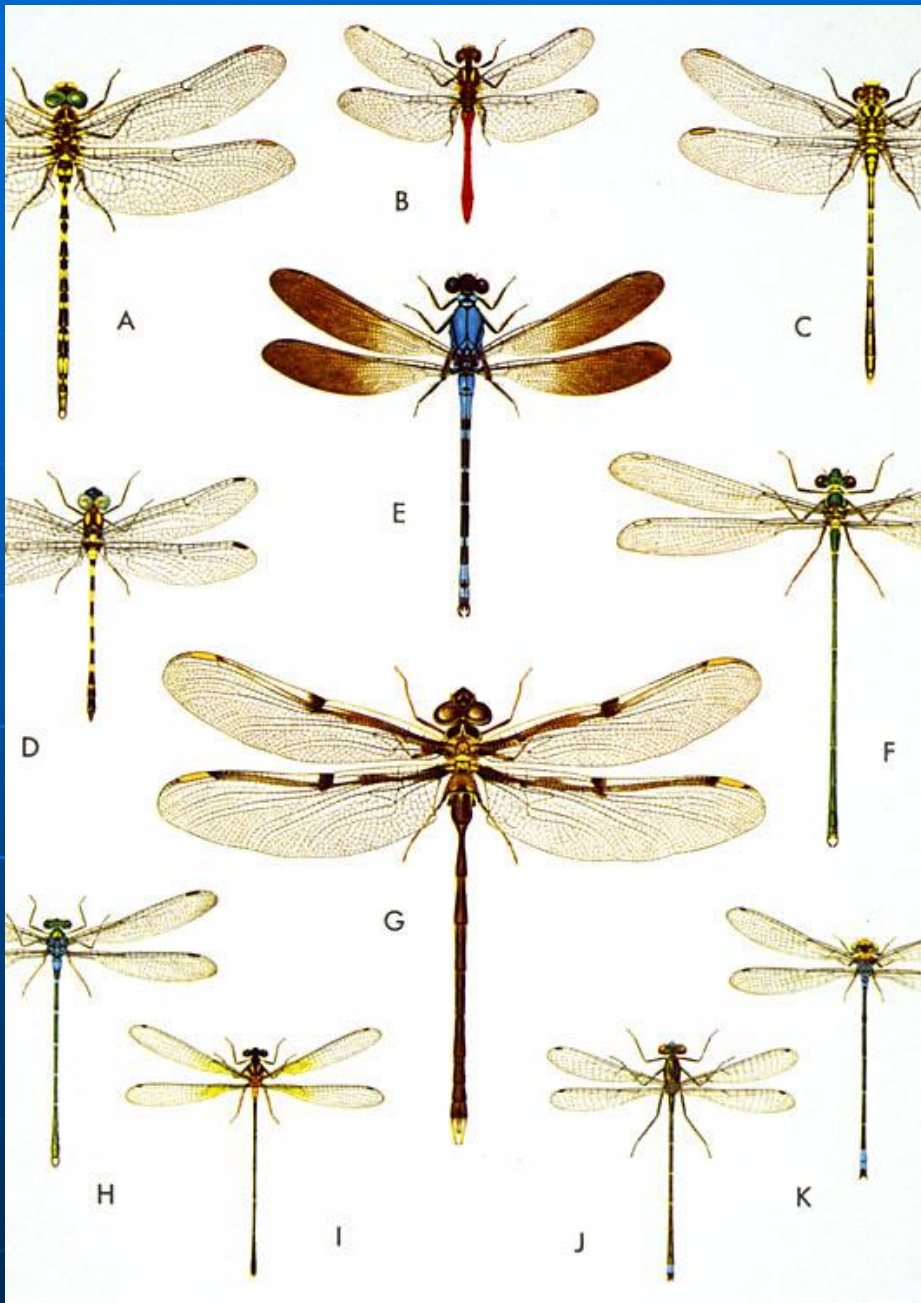
Order Odonata – Dragonflies & Damselflies



Large Eyes...good vision

Spindle shaped antennae

Well developed
mandibles



Two pairs of semi-transparent wings

Long slender abdomen



Dragonfly wings are held out against the body

Damselfly wings are held back along the body



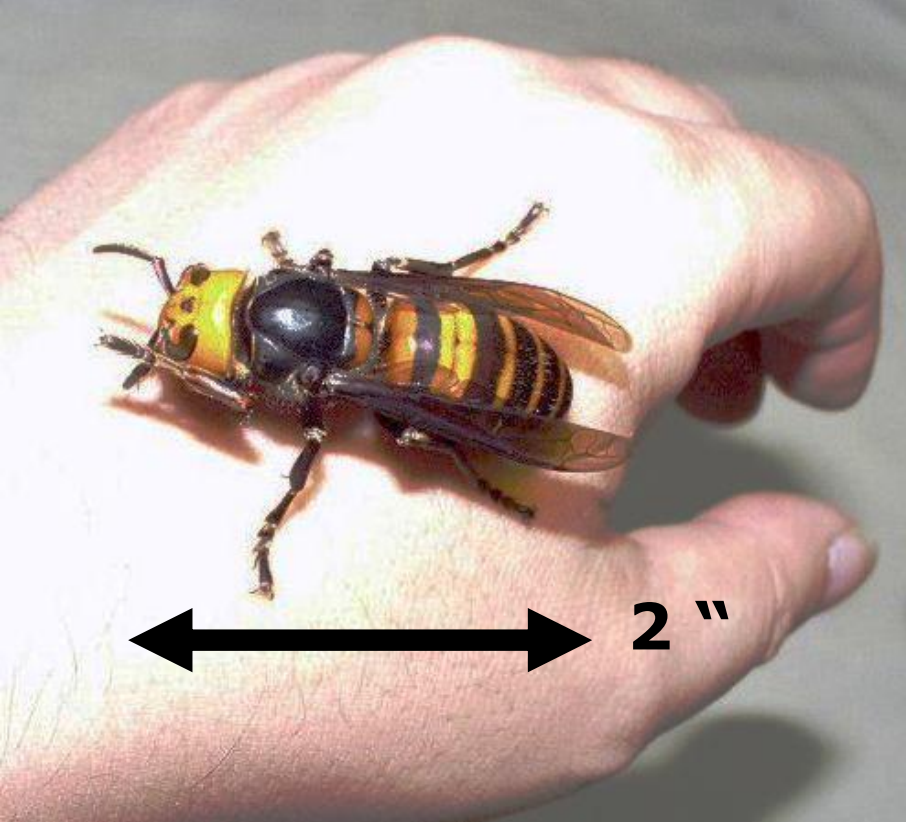
Order Hymenoptera – Wasps, Bees, Ants

Wasps - Two pairs of membranous wings

Abdomen highly constricted “wasp waist”



See The Insect Societies...E.O. Wilson

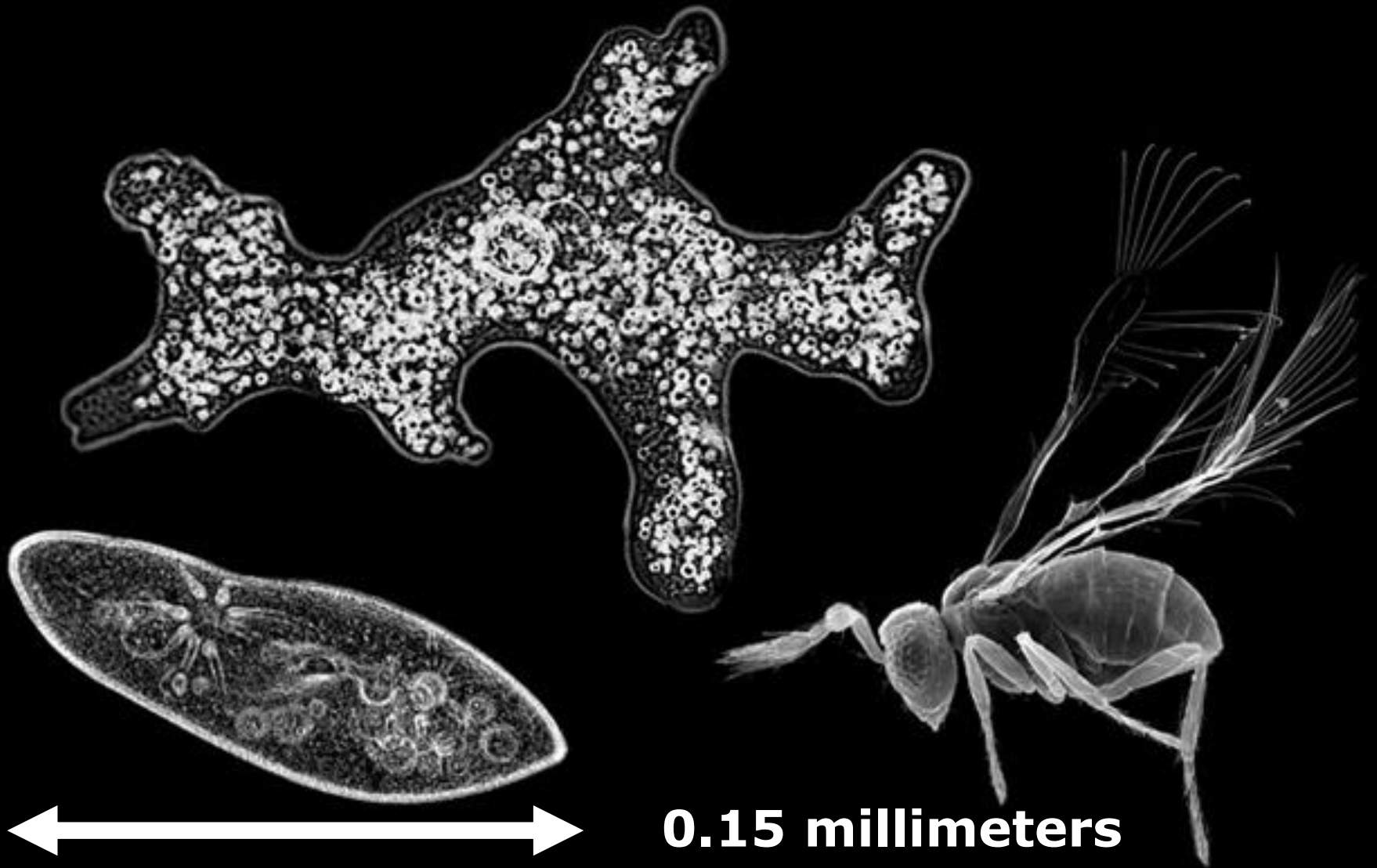


Asian Giant Hornet...aka Yak-Killer

Very large size range



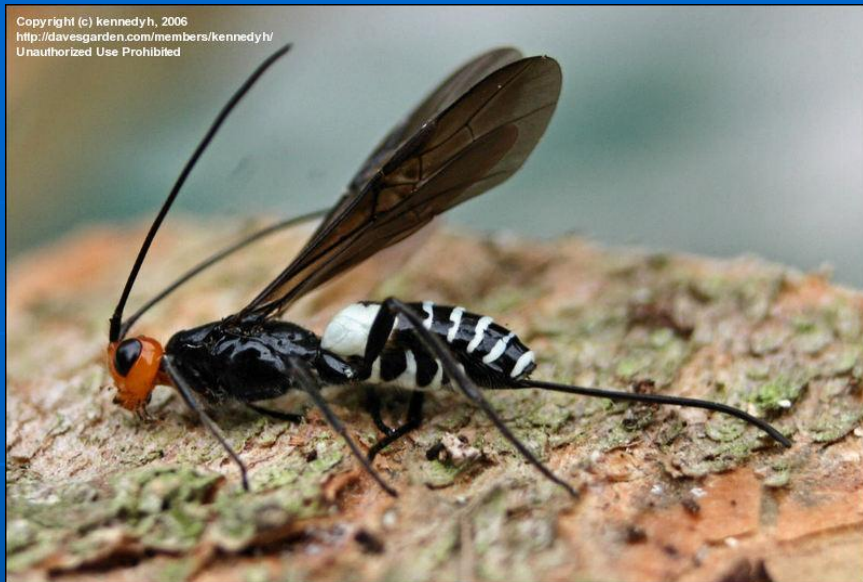
Fairy Wasp...



0.15 millimeters



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Unauthorized Use Prohibited



Braconid wasp

© 2007 GCMGA Inc., All Rights Reserved
<http://aggie-horticulture.tamu.edu/galveston>



Parasitized
Tomato Hornworm

Polyembryony

Order Hymenoptera - Wasps



Woodboring beetle
parasitoid



White grub parasitoid



Order Hymenoptera - Bees

*Bumblebee Economics,
Bern Heinrich*

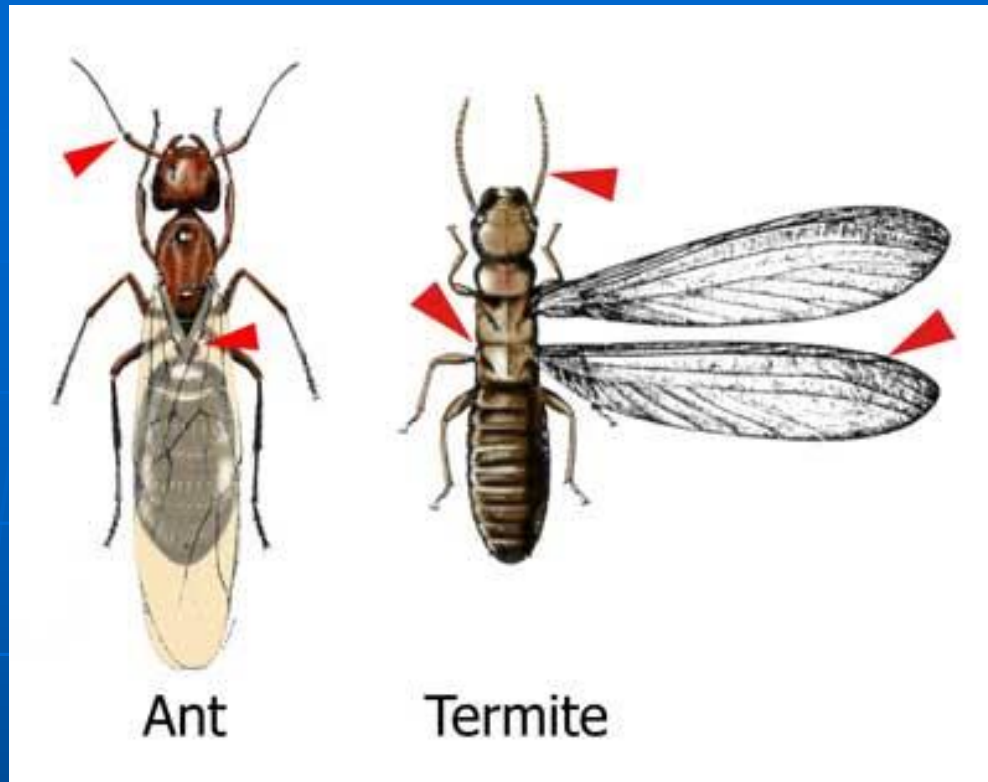


Order Hymenoptera - Ants

Elbowed antennae

Constricted “waist”
between the thorax
and abdomen





Termites – sometimes confused with swarming carpenter ants...

Ant - Elbowed antennae, pinched waist)

Termite - Filiform antennae, abdomen as wide as thorax

Ant Mimicry

Crab spider



Treehopper

Order Dermaptera - Earwigs



Cerci, forcep-like



(C) Takeshi Yamada, St. Helena Giant Earwig

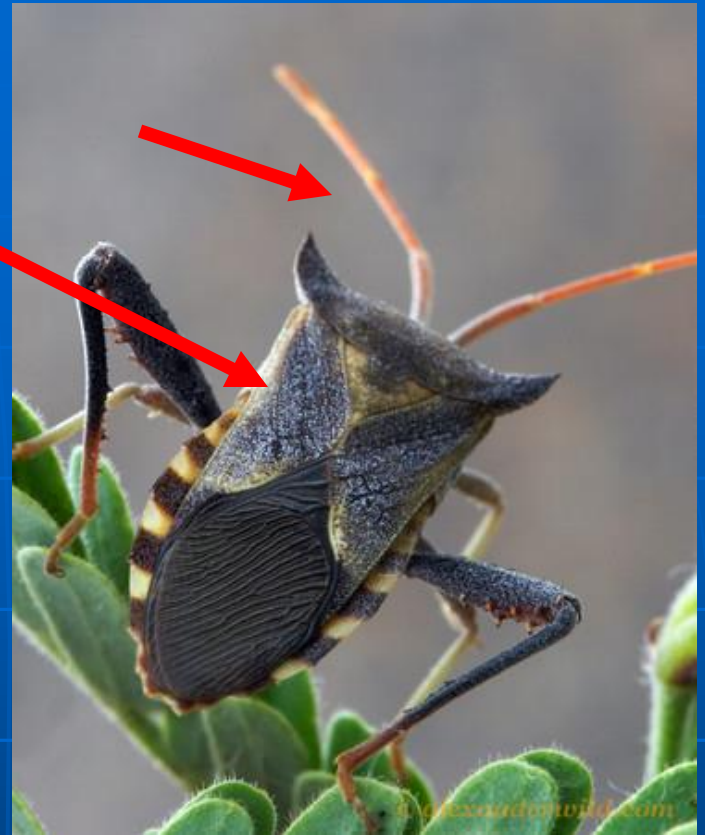
Order Hemiptera - Bugs

Front wing thickened at base,
membranous at tip

Antennae (if present) long

Beaklike mouthparts

Center of thorax triangular.





Spined Soldier Bug

Tarnished Plant Bug



Hemiptera: Some are beneficial predators. Others feed on plants and can be significant agricultural pests.



- Hemipterans make great models for the people that make movies about predatory space aliens...



Order Homoptera –
planthoppers,
treehoppers, cicadas &
aphids

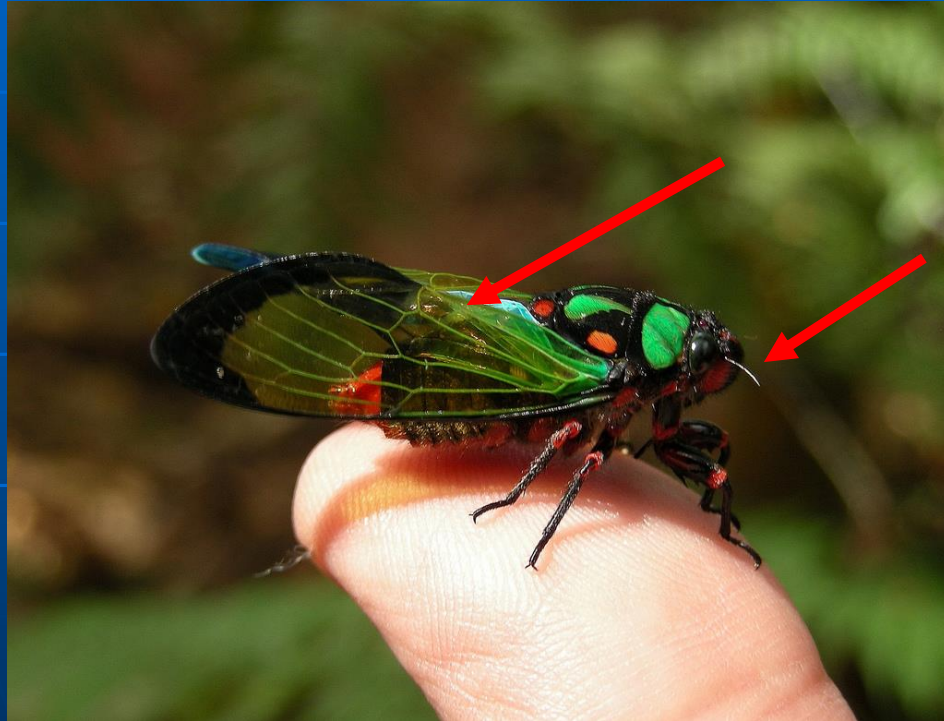
Hoppers – Bristle-like
antennae

Beak mouthparts

Mimicry



Cicada – Membranous wings and bristle-like antennae. Some cicadas spend 7, 13 or 17 years as nymphs in the soil and emerge synchronously, and are **VERY Loud...**



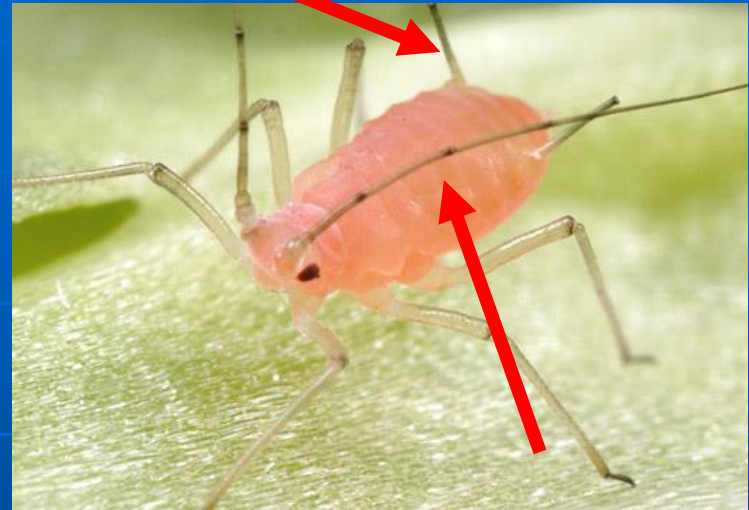
Cicadamania.com

Order Homoptera:

Aphids – Soft-bodied.
Long antennae and
cornicles

Aphids with wings
lay eggs

Wingless females
parthenogenetic



Order Dictyoptera – Cockroaches and Mantids

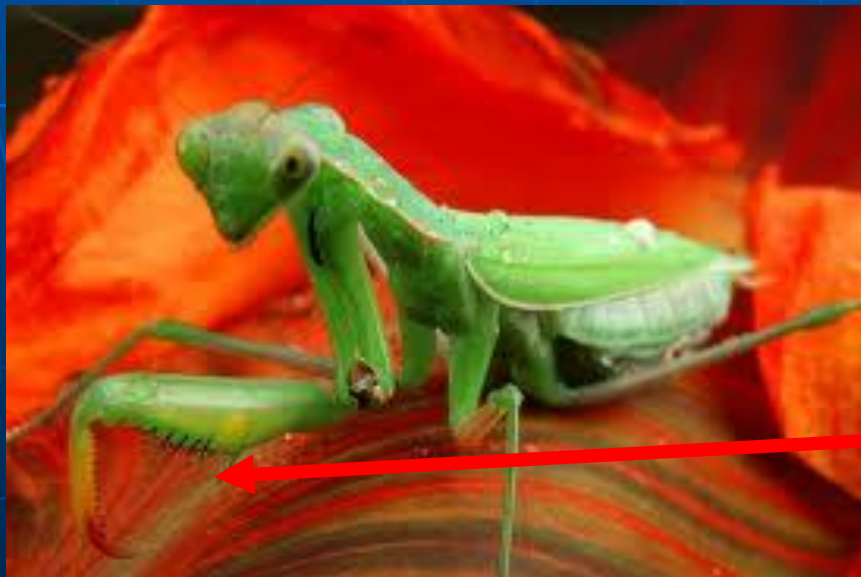


Cockroach

Flattened body with head concealed from above

Wings usually present

Long antennae



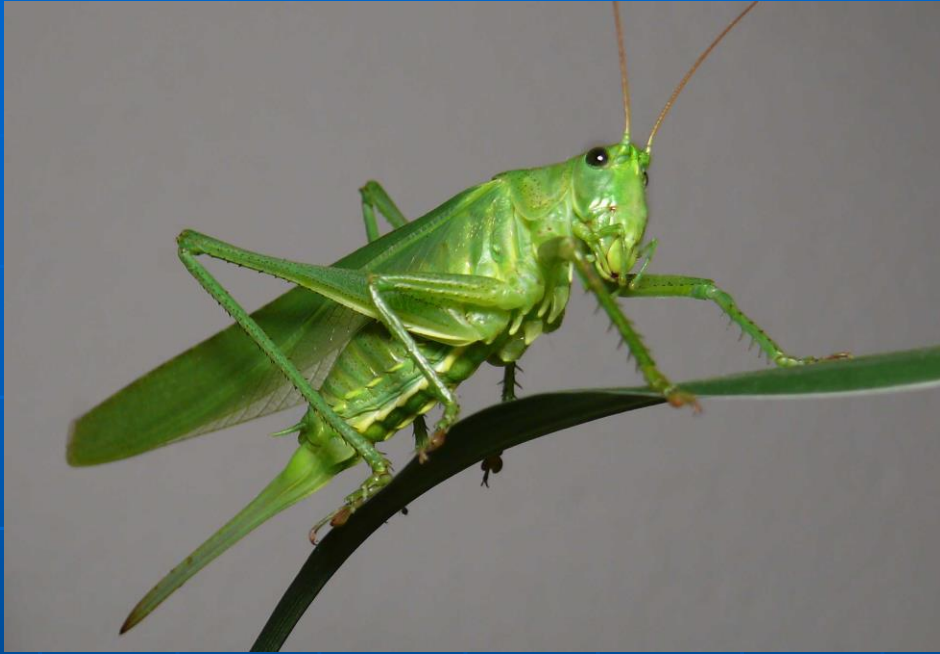
Mantids Wings, two pair

Front legs raptorial



Orthoptera (grasshoppers, crickets) vs Dictyoptera

Cockroaches and mantids used to be
classified as Orthoptera...



Orthoptera - robust
cylindrical body

Cockroaches - flattened



Order Coleoptera - Beetles

Front wings - hard or
leathery.

Hind wings
membranous

Chewing mouthparts





Seven Spot Ladybird Beetle – Massachusetts State Insect

1974...Franklin, MA...

The MOST diverse insect order...

400,000 species...

...50% of total animal
species on the planet!!!



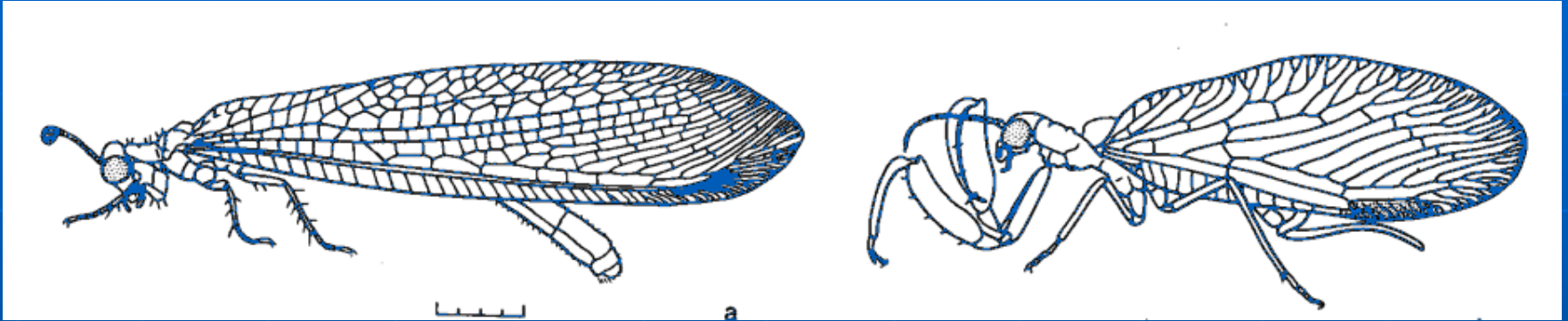


ARKive
www.arkive.org



© Nick Gordon / www.ardea.com

Order Neuroptera: lacewings, antlions, owlflies



2 pairs of membranous wings

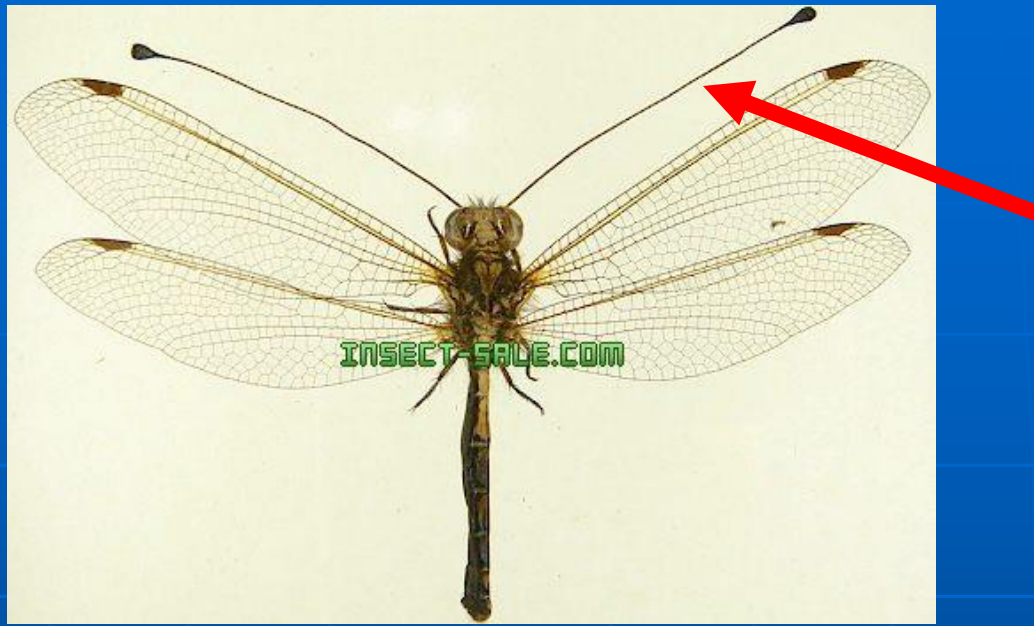
Variability in overall structure...



Not a stonefly....fishfly, Order Neuroptera
...Aquatic, like a stonefly but no cerci...



Not a paper wasp...mantisfly, Order Neuroptera
...note front legs, raptorial



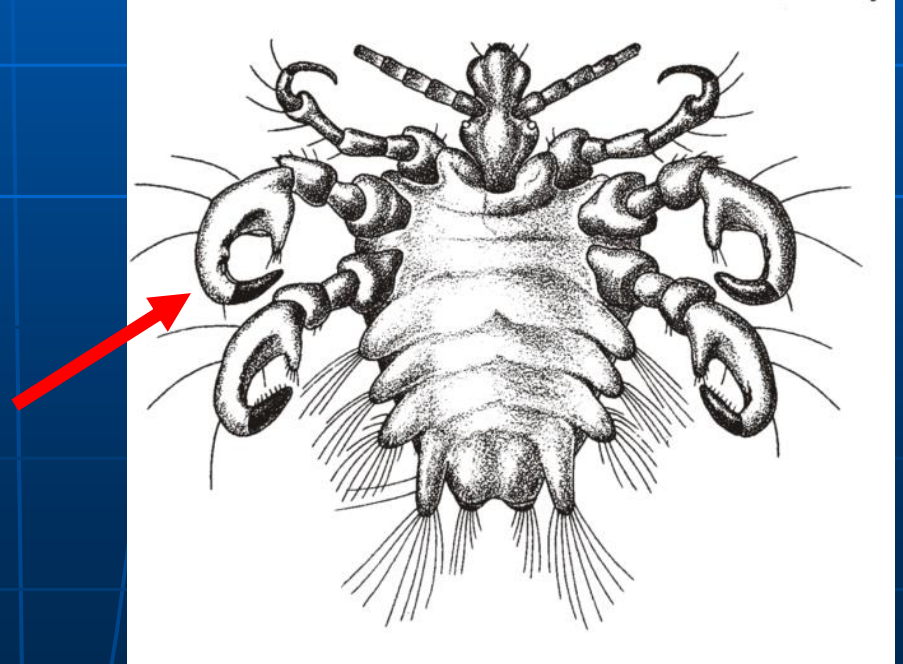
Not a dragonfly....owlfly, Order Neuroptera
...note long antennae

Order Phthiraptera - Lice

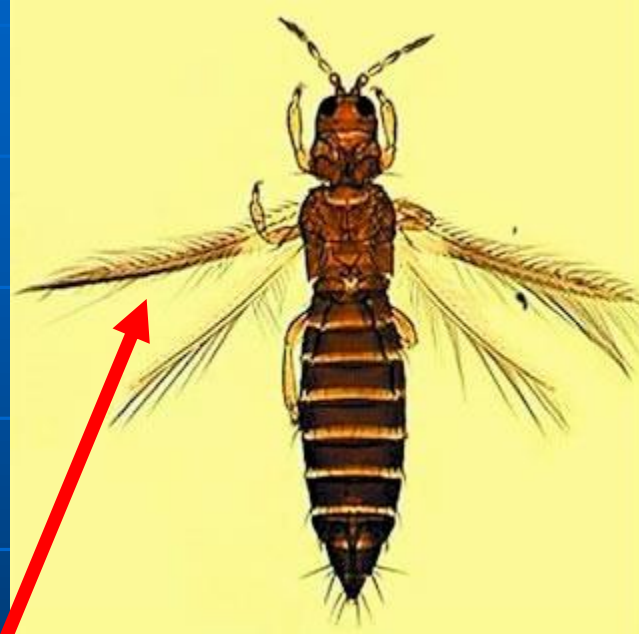
Body highly
flattened

Legs have
prominent claws

Very host specific



Order Thysanoptera - Thrips



Fringed wings

Onion Thrips Damage





**OK team
Wolbachia...start
your PCR engines...**

Insect Collecting Tips

- Habitats like open meadows are very rich in species composition
- Rip apart logs, look under bark...
- Flowering plants attract many insects...you may find ambush bugs (Order Hemiptera) that have the same coloration as the flower
- Hang a white sheet and place a black light to illuminate it....you can find some really cool insects this way, especially if you are next to a pond or a stream
- Piles of dead leaves with some soil can be put into a Berlese funnel (easy to make). Great way to collect springtails, ground Inbeetles and creatures like whip scorpions (they do not sting)
- Window sills and light fixtures...better than you think
- Farms...growers will gladly let you take away their bugs like Colorado potato beetle, striped cucumber beetle, mexican bean beetle, flea beetles, etc.
- Put out a saucer with cider vinegar and a drop of dish detergent...fruit fly party
- Inspect spider webs

Insect Collecting Resources

- bioquip.com
- extension.entm.purdue.edu/401Book
- <http://mississippientomologicalmuseum.org.msstate.edu/collecting.preparation.methods/Blacklight.traps.htm#.WKHuPWeFPcs>
 - Black light and a white sheet...attracts an amazing number of insects. Try hanging the sheet next to a pond!
- <https://www.youtube.com/watch?v=J5rGo3uBFIU>
 - How to make a Berlese funnel...simple way to collect insects in soil/leaf litter



Spending time outside learning about ecological habitats is great.

Deer ticks and their ability to vector five very significant diseases is a real thing.

The bright spot in this is that tick-borne illnesses are entirely preventable

See www.capecodextension.org

...Do not let one bite CHANGE your life,
cause it can...

I lifted pictures for this deck from a number of sources. But I recommend you check out this site in particular:

www.alexanderwild.com

Alex is a professor of entomology at the University of Illinois. He is an awesome insect photographer...definitely check this site out...