



Basic Entomology



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“If all insects on Earth disappeared, within 50 years all life on Earth would end. If all human beings disappeared from the Earth, within 50 years all forms of life would flourish.”
— Jonas Salk



Overview

- Classification
- Important Orders...to gardeners
- Types of Damage
- Beneficial's

Why Insects?

- Most numerous group of animals on earth
- Estimated that over 30 million different species exist
- Beneficial
- Pests (less than 3%)

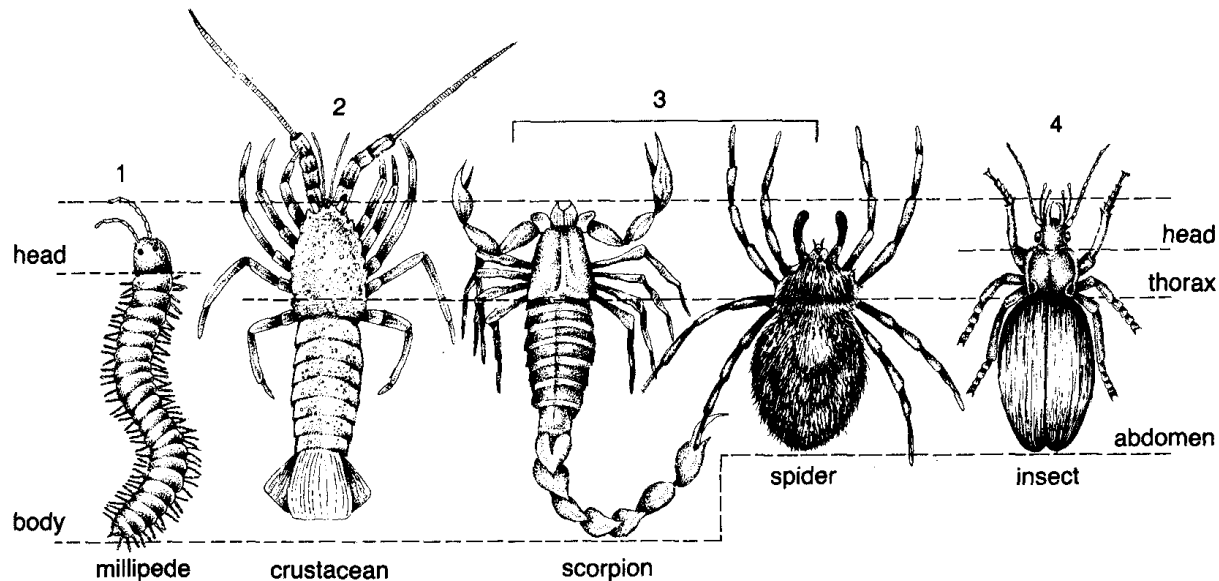
Classification

Red Saddlebag Dragonfly

Level	Mnemonic	Example
Kingdom	King	Animalia
Phylum	Phillip	Arthropoda
Class	Came	Insecta
Order	Over	Odonata
Family	From	Libellulidae
Genus	German	<i>Tramea</i>
Species	Soil	<i>onusta</i>

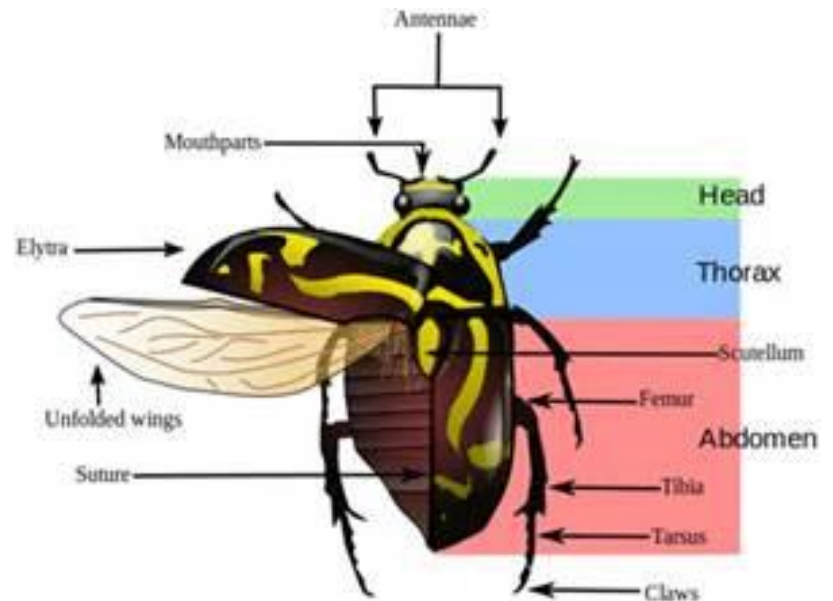
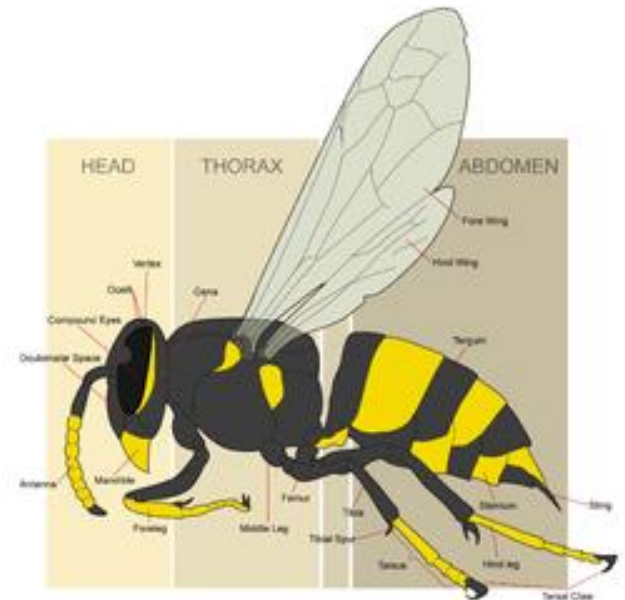
Arthropods

- Segmented body
 - Segmented appendages
 - Bilateral symmetry
 - Exoskeletons
- Examples:
 - Insects
 - Crabs
 - Shrimp
 - Ticks
 - Spiders



Class Insecta

- Broken into Orders based on:
 - Metamorphosis
 - Mouthparts
 - Wings
- 3 body regions
 - Head, abdomen, thorax
- 3 pairs of legs
- Pair of antennae
- Exoskeleton
 - Cuticle
 - Chitin
- 2 pairs of wings (most)



Head

- Eyes
- Antennae
- Mouthparts
 - Can be different in adults and immatures



Antennae

filiform



moniliform



clavate



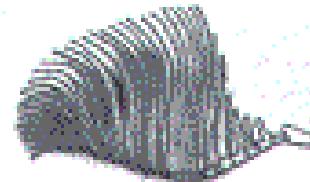
serrate



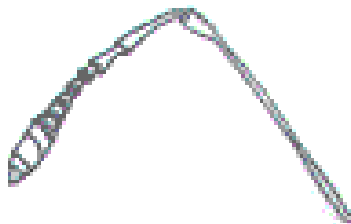
pectinate



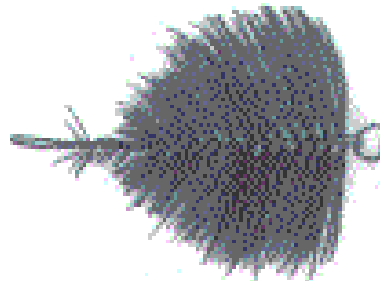
flabellate



geniculate



plumose

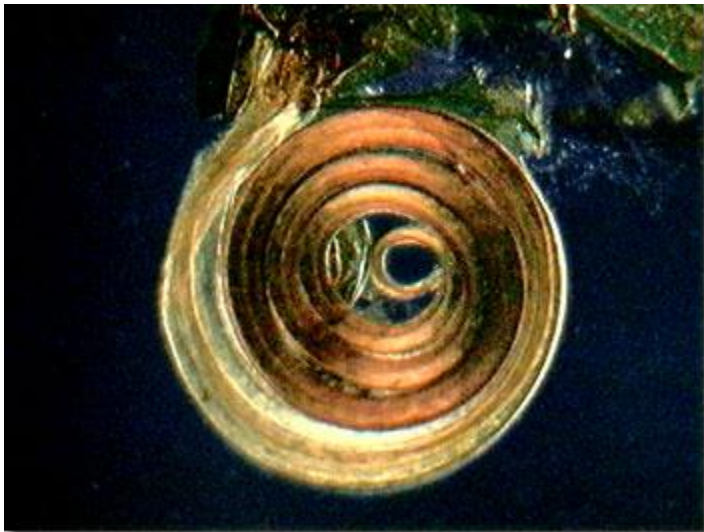
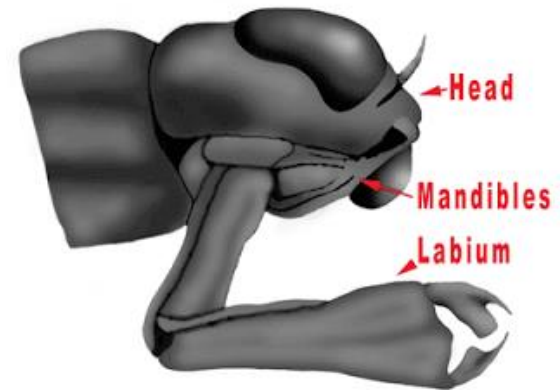
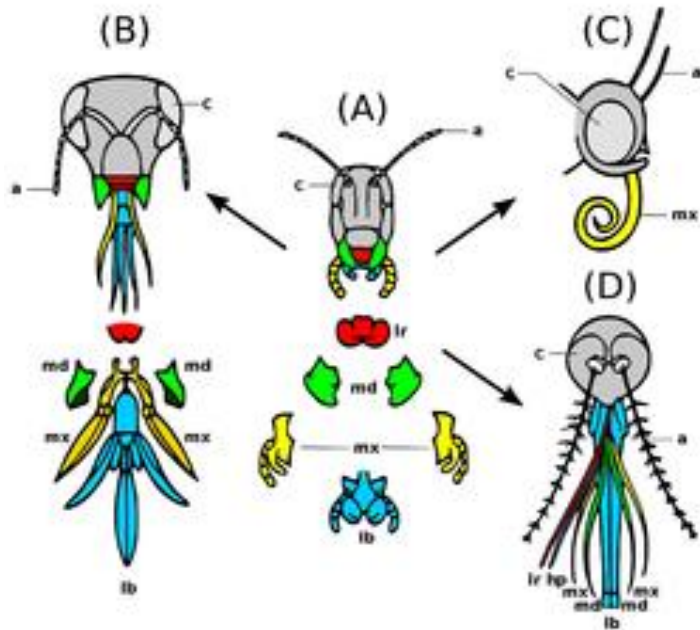


aristate



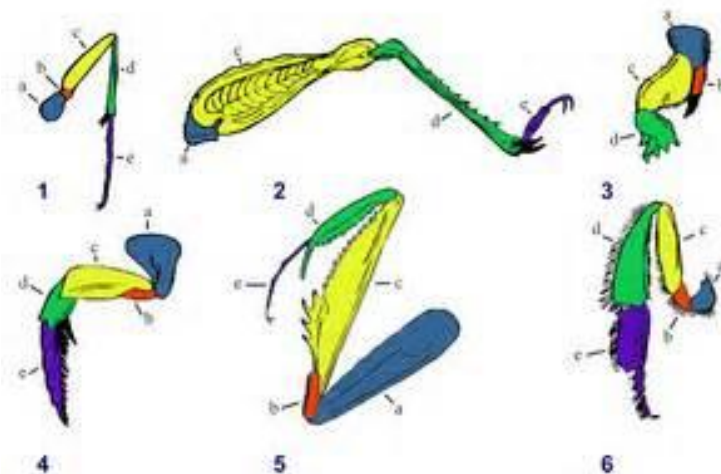
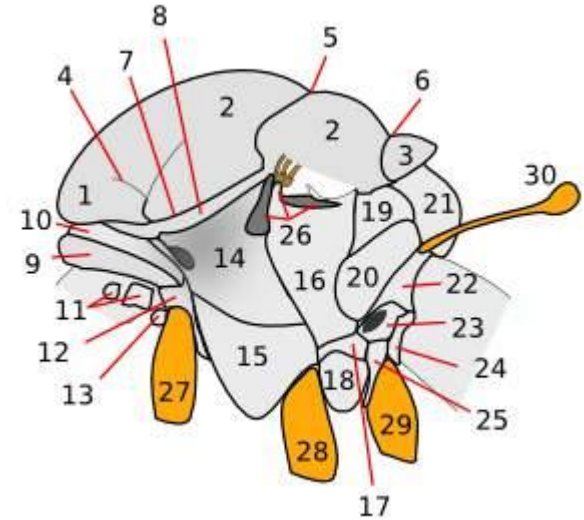
www.bumblebee.org

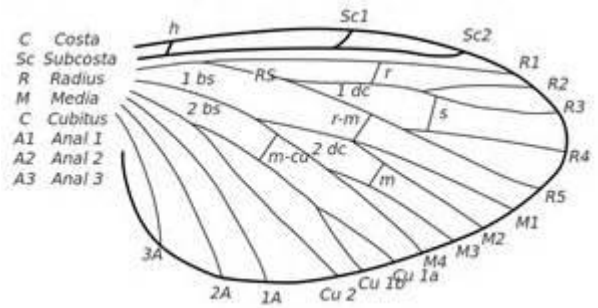
Mouthparts



Thorax

- Wings and Legs attached
- Legs
 - Coxa
 - Trochanter
 - Femur
 - Tibia
 - Tarsus





Wings

- “-ptera” with wings
- Some covered in hair and scales
- Look at Venation
- Only adult stage has wings
- Immature can have wing pads



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Abdomen

- 11-12 segments
- Cerci
 - At the end
 - Earwigs
 - Cockroaches

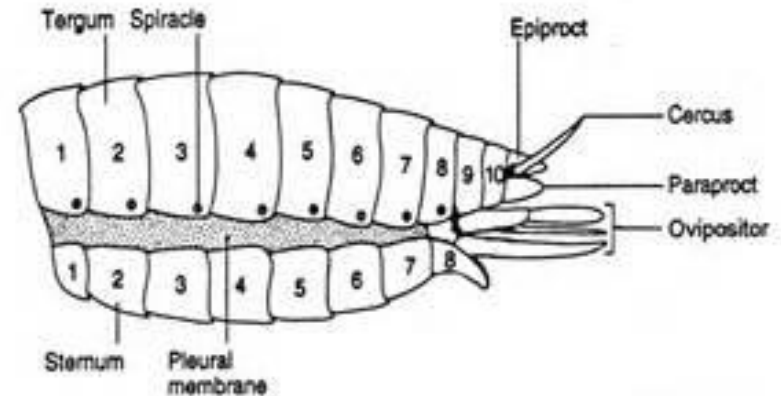
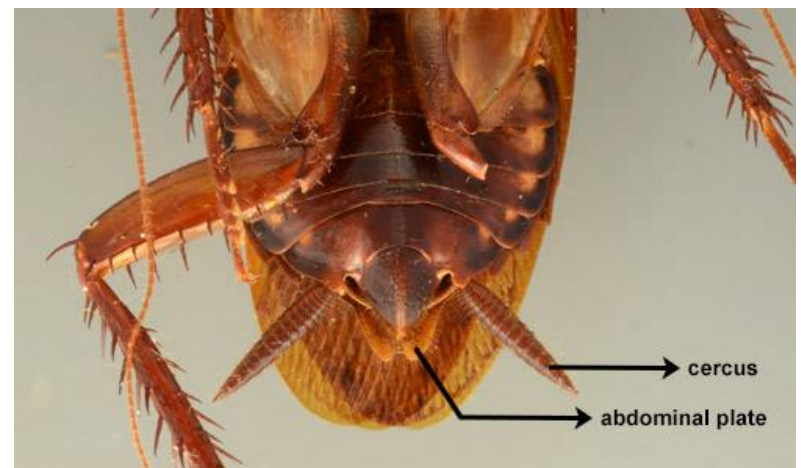


Figure 2.8. Generalized insect abdomen (from DuPorte 1961).

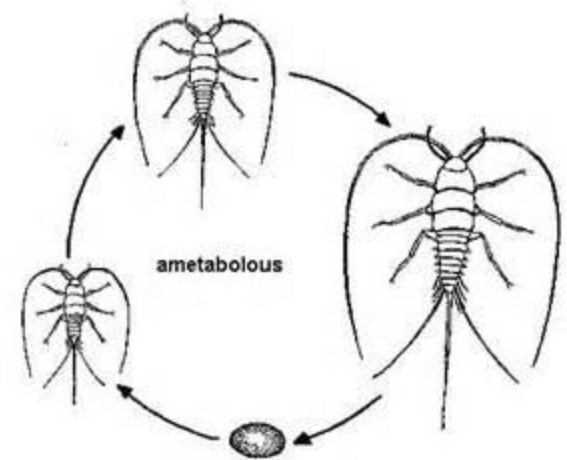


Metamorphosis

- Change in developmental stages
- Molting-shed exoskeleton
- Instar-stage between each molt
- Ametabolous
- Hemimetabolous
- Holometabolous

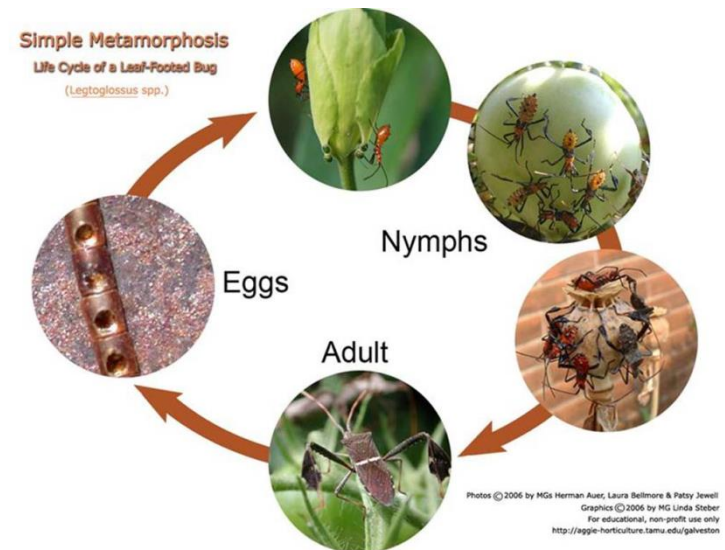
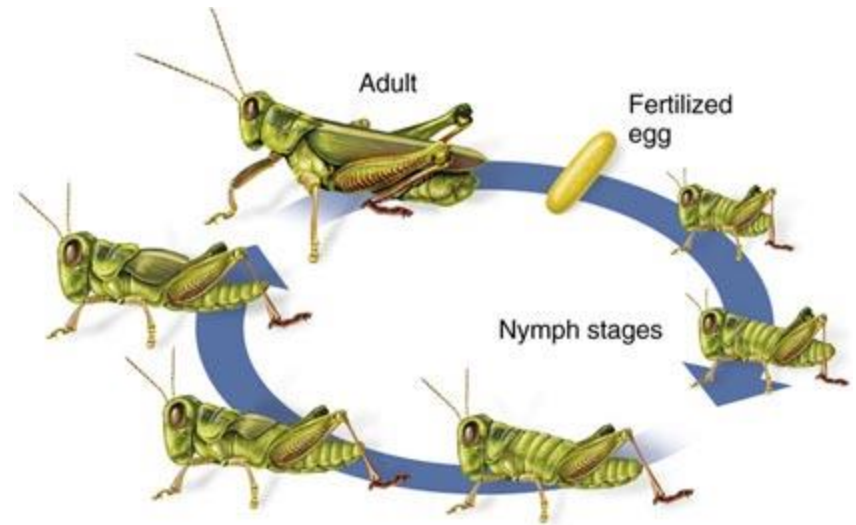
Ametabolous

- Adults are wingless and look like large immatures
- Egg-immature-adult
- Protura- coneheads
- Diplura- bristletails
- Thysanura- silverfish
- Collembola- spring tails



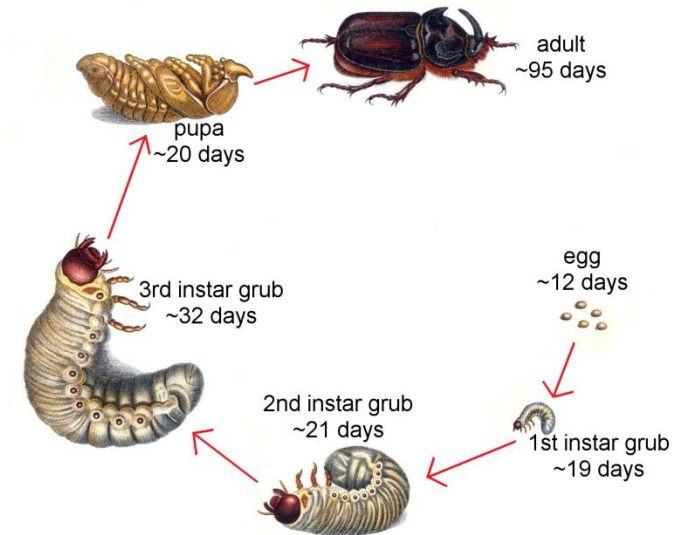
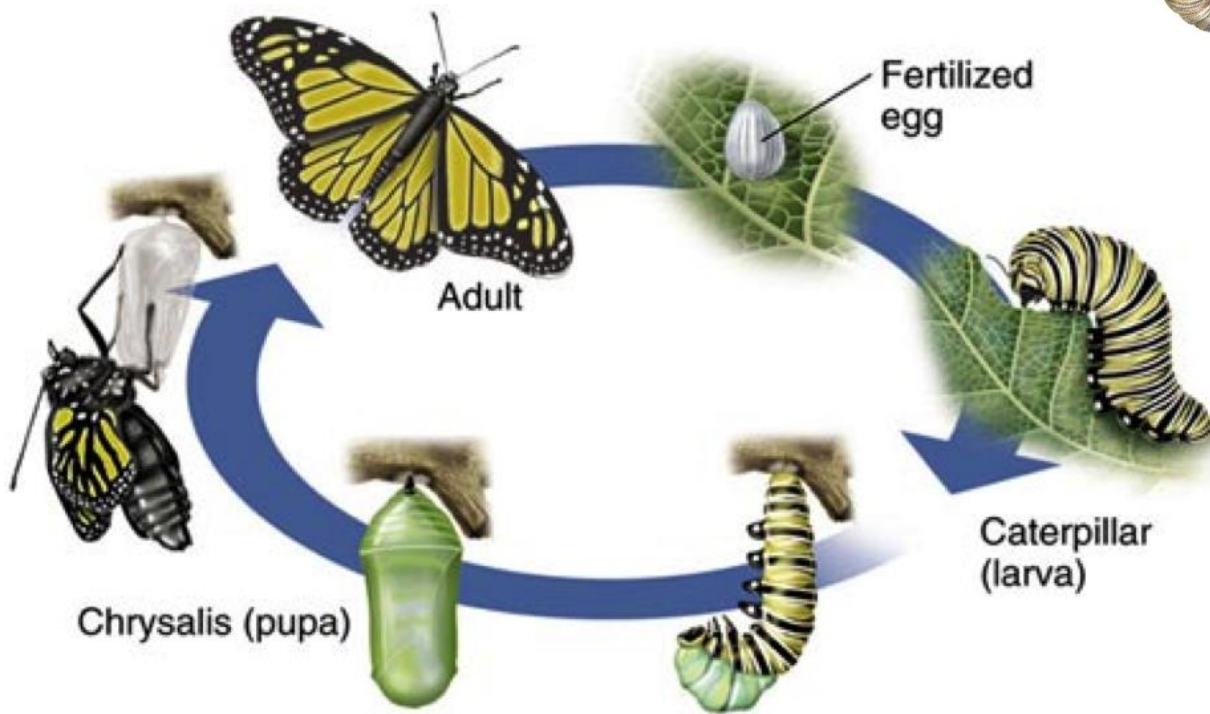
Hemimetabolous

- Egg-Immature-Adult
- Immatures
 - Nymphs-land
 - Naiad- water



Holometabolous

- Complete Change
- Egg-larvae-pupa- adult
- Butterflies
- Beetles



Identification

Features of Immature and Mature Insects

Immature Insects

Sometimes worm-like or grubs

Number of legs can vary

Body generally soft and/or fleshy

Lack wings

Most move slowly

Adult Insects

Three body regions

Three pairs of legs

Usually with tough body wall

May have wings

Most can move quickly

Questions to ask yourself

- Where was it found?
- What was it eating?
- What type of mouthparts?
- Does it have wings?
- What are its colors?
- What type of legs?
- What type of antennae?

Submitting an Insect Sample

- Try to diagnose yourself
- Consult your Extension Agent
- Take good quality pictures
- Note its host

Common Insect Orders

- Orthoptera- Grasshoppers, katydids, crickets
- Blattodea- Termites, Roaches
- Mantodea- Mantids
- Phasmida- Stick bugs
- Dermaptera- Earwigs
- Hemiptera- True bugs, Stink bugs, Plant bugs, Scales, Aphids
- Coleoptera- Beetles, grubs
- Thysanoptera- Thrips
- Hymenoptera- Bees, Wasps, Ants, Sawflies, hornets
- Diptera- Flies, Mosquitoes, Gnats, Midges
- Lepidoptera- Moths, butterflies, caterpillars
- Neuroptera- Lacewings, Dobsonflies, antlions, alderfly

Orthoptera: Grasshoppers, Katydid, Crickets

- Mouthparts: Chewing-damaging
- Antennae: Usually long filamentous
- Metamorphosis: Simple
- Wings:
 - Forewing: elongated, narrow, hardened
 - Hindwing: Membranous and folded
- Legs: Hind legs enlarged for Jumping

Orthoptera



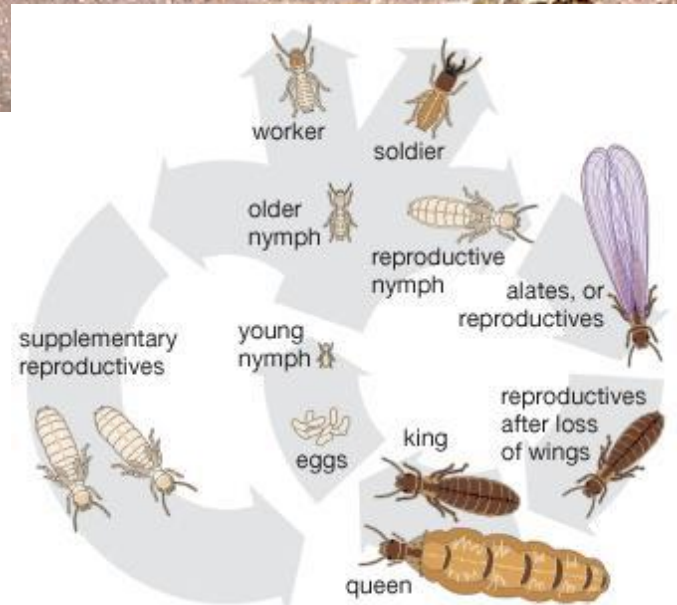
Blattodea: Cockroaches, Termites

- Mouthparts: Chewing
- Metamorphosis: Simple
- Wings: 2 pair in reproductive adults
- Characteristics:
 - Roaches: Oval, flattened bodies. Reddish-brown. Fast runners.
 - Termites: Soft, Clear-ish, bodies. Ant-like. Live in decaying wood.

Blattodea



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Mantodea: Mantids

- Mouthparts: Chewing- eat other arthropods
- Metamorphosis: Simple
- Wings:
 - Forewing: elongated, narrow and hard
 - Hindwings: membranous and folded
- Appearance: Elongated bodies, large eyes, raptorial front legs.

Mantodea



Phasmida: Walking Sticks

- Mouthparts: Chewing
- Antennae: long
- Metamorphosis: simple
- Wings: Some do; some do not
- Appearance: twigs, sticks...that walk slowly

Phasmida



Dermatoptera: Earwigs

- Mouthparts: Chewing
- Metamorphosis: Gradual
- Wings: some wingless
 - Forewings: Hardened and short
 - Hindwings: Folded and Membranous
- Appearance: Elongated. Flattened. Forceps at end of abdomen.

Dermaptera



Hemiptera: True bugs, cicada, hoppers, aphids, and scales

- Mouthparts: Sucking
 - Some
 - Plant-feeders
 - Blood-feeders
 - Transmit plant, human and animal diseases
- Antennae: filiform
- Metamorphosis: Gradual
- Wings: some wingless
 - Forewings: Top half is hard; bottom half membranous
 - Hindwing: Membranous
- Appearance: Diverse, soft-bodied, hard-bodied

Hemiptera: Auchenorrhyncha

- Spittle bugs, Cicadas, leafhoppers, treehoppers, planthoppers.



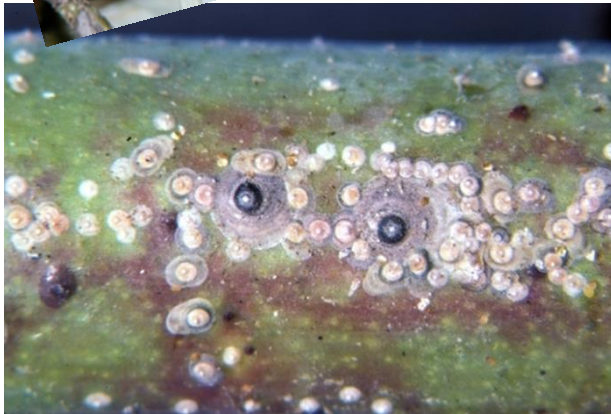
Hemiptera: Heteroptera

- Stink bugs, leaf-footed bug, Big-eyed bug, kissing bugs, plant bugs.



Hemiptera: Sternorrhyncha

- Hard-bodied Scales, Soft-bodied scales, mealybugs.



Coleoptera: Beetles, Weevils, White Grubs, Borers

- Mouthparts: Chewing
- Antennae: Variable
- Metamorphosis: Complete
 - Immatures=grubs
- Wings:
 - Forewing: Elytra (hardened)
 - Hindwing: membranous
- Appearance: Hard-bodied. Vary in size and colors. Weevils have snouts.

Coleoptera: Weevils



Coleoptera: Grubs



Coleoptera: Scarab



Thysanoptera: One Thrips, Two Thrips

- Mouthparts: Rasping-sucking
- Metamorphosis: Gradual and complete
- Wings: slender with fringes
- Appearance: Small. Soft-bodied.



Hymenoptera: Bees, wasps, ants, sawflies, hornets

- Mouthparts: Chewing
- Metamorphosis: Complete
- Wings: 2 pairs of membranous
- Appearance: Soft to hard bodies. Narrow waists, broad waists (sawflies). Social insects.

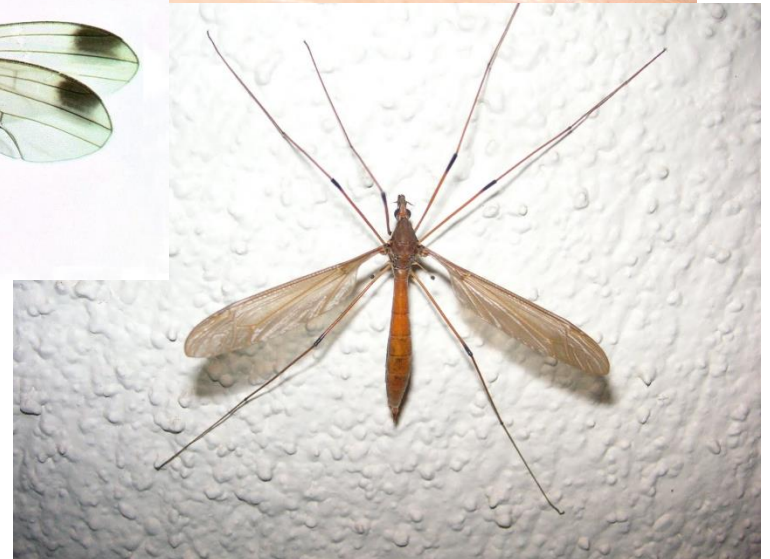
Hymenoptera



Diptera: Flies, Mosquitos, Gnats, Midges

- Mouthparts:
 - Chewing/hooks: Immature/maggots
 - Sponging or piercing sucking: Adults
- Metamorphosis: Complete
- Wings: 1 pair
- Appearance: Soft-bodied. Covered in bristles. Long-narrow bodies with large thorax (mosquitoes) or rounded body (house flies)

Diptera



Lepidoptera: Butterflies, Moths, Caterpillars, Cutworms

- Mouthparts:
 - Chewing: Immature
 - Nectar sucking tube: Adults
- Metamorphosis: Complete
- Wings: 2 pairs covered in hairs
- Appearance:
 - Immatures: hairy or smooth, 3 legs, prolegs, and worm-like.
 - Adults: Wings covered in colored scales that remove when touched.

Lepidoptera: Butterflies



Lepidoptera: Moths



Neuroptera: Lacewings, Dobsonflies, Antlions.

- Mouthparts: Chewing/predators
- Antennae: Long
- Metamorphosis: Complete
- Wings: 2 pairs membranous held like tent over body

Neuroptera: Lacewings, Dobsonflies, Antlions.



Other Arthropods

- Arachnids: Spiders, Mites, Ticks, Daddy long-legs
- Diplopoda: Millipedes
- Chilopoda: Centipedes
- Isopoda: Mealybugs, sow bugs

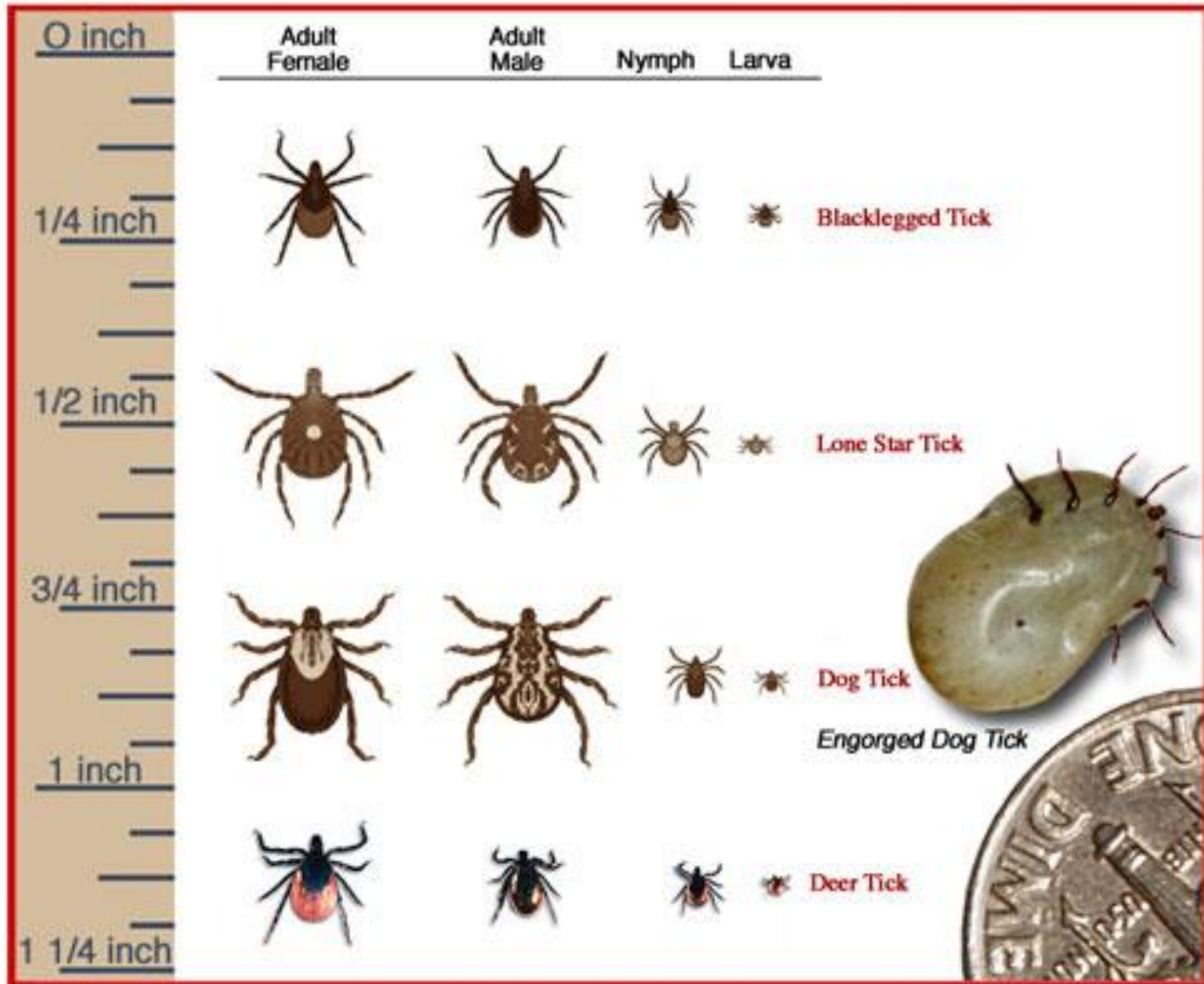
Arachnids



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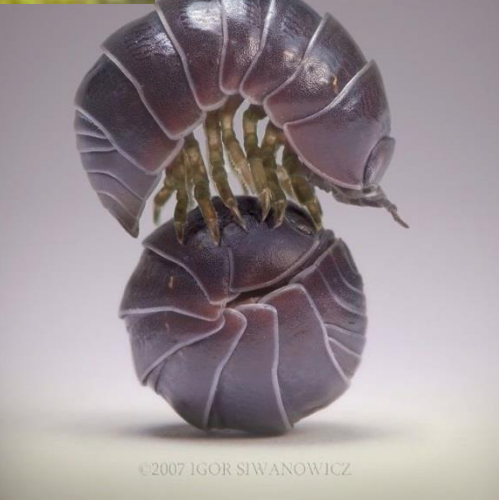
Ticks



Ticks and Diseases

Illness or Condition	Vector Tick Species	Tick Stage(s) Transmitting Disease	Minimum Feeding Time for Disease Transmission
Acquired Red Meat Allergy	Lone Star Tick	Larva, Nymph, Adult	Unknown
Anaplasmosis	Blacklegged Tick	Nymph, Adult	24 Hours
Babesiosis	Blacklegged Tick	Nymph, Adult	36 hours
<i>Borrelia miyamotoi</i> Disease	Blacklegged Tick	Larva, Nymph, Adult	24 Hours
Ehrlichiosis	Lone Star Tick	Nymph, Adult	24 Hours
Heartland Virus	Lone Star Tick	Nymph, Adult	Unknown
Lyme Disease	Blacklegged Tick	Nymph, Adult	36 Hours
Powassan Virus	Blacklegged Tick	Nymph, Adult	15 minutes
<i>Rickettsia parkeri</i> Disease	Gulf Coast Tick	Adult	Unknown
	Lone Star Tick	Larva, Nymph, Adult	
Rocky Mountain Spotted Fever	American Dog Tick	Adult	2-20 hours
	Brown Dog Tick	Nymph, Adult	
	Lone Star Tick	Larva, Nymph, Adult	
Southern Tick Associated Rash Illness (STARI)	Lone Star Tick	Nymph, Adult, ?	Unknown
Tularemia	American Dog Tick	Adult	Unknown
	Lone Star Tick	Nymph, Adult	

Decomposers



Types of Insect Injury

- Chewing
- Piercing-sucking
- Internal feeding
- Subterranean Insects
- Laying eggs
- Nesting
- Spread plant diseases

Chewing Injury



Sucking Injury



Injury through internal feeding



Subterranean injury



Injury by Laying Eggs

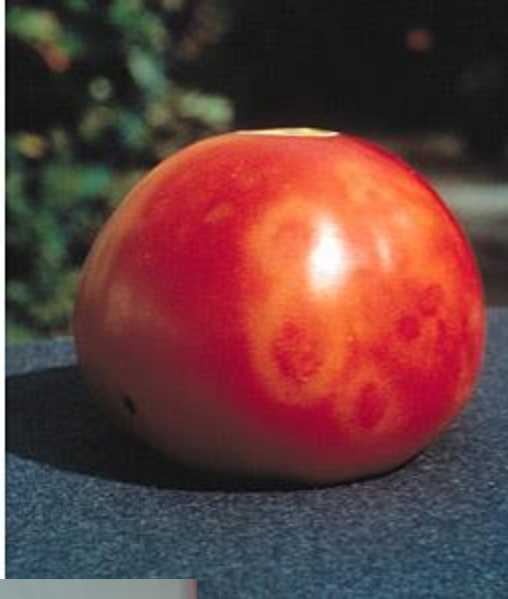


Injury through using parts of plant in nests



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Vectors of Diseases



Beneficials

- Predators
- Pollinators
- Weed control
- Scavengers
- Decomposers
- Parasitoids

Predators



John Meyer
NC STATE UNIVERSITY

Weed control

Leafy Spurge



Scavengers and Decomposers



Parasitoids



Review

- Classification
- Important Orders...to gardeners
- Types of Damage
- Beneficial's

Questions?

Laura
Maxey-Nay

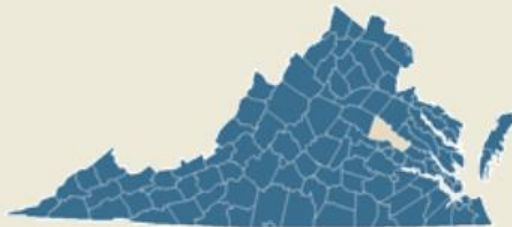
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Monday - Friday

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