Forest Entomology

The Study of Insects that Interact with the Forest Ecosystem

Laboratory #2: Learning Objectives

- To learn the roles insects play in our everyday life
- To understand insect classification and the types of insects in the Orders we discuss
- To learn insect anatomy by examining specimens
- To understand metamorphosis

General Entomology

Insects serve a variety of roles:

1. Parasites of animals / humans
2. Animal/human disease vectors
3. Plant disease vectors
4. Pests of plants
5. Predators of other insects

Parasites of Humans

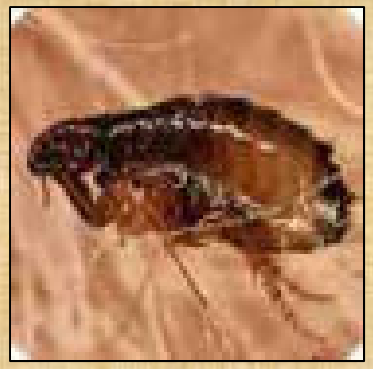
Botflies

Follicle Mites

Human Disease Vectors

Malaria, Dengue

Chagas



Plague

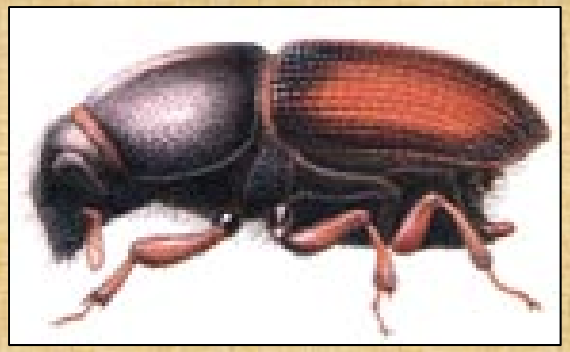
River Blindness

African Sleeping Sickness

Plant Disease Vectors

Nitidulid Beetle

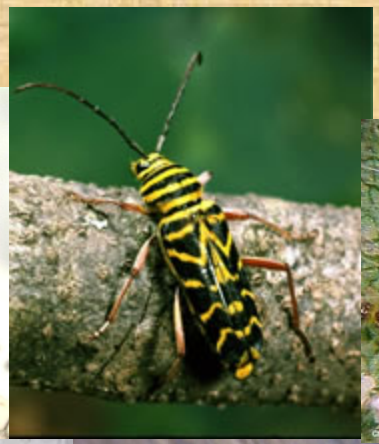
Oak Wilt

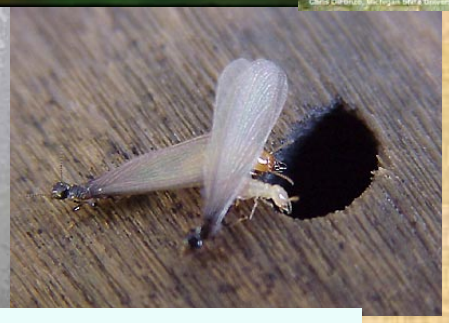


European Elm
Bark Beetle

Dutch Elm Disease

Pests of Plants





Insect Predators

Insect Classification

Kingdom

Phylum

Subphylum

Class

Subclass

Order

Suborder

Family

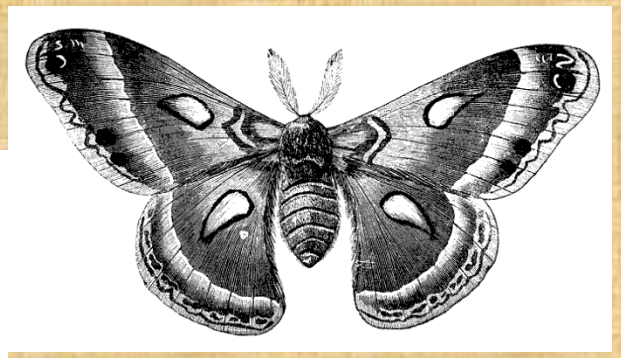
Subfamily

Tribe

Genus

Species

Lepidoptera

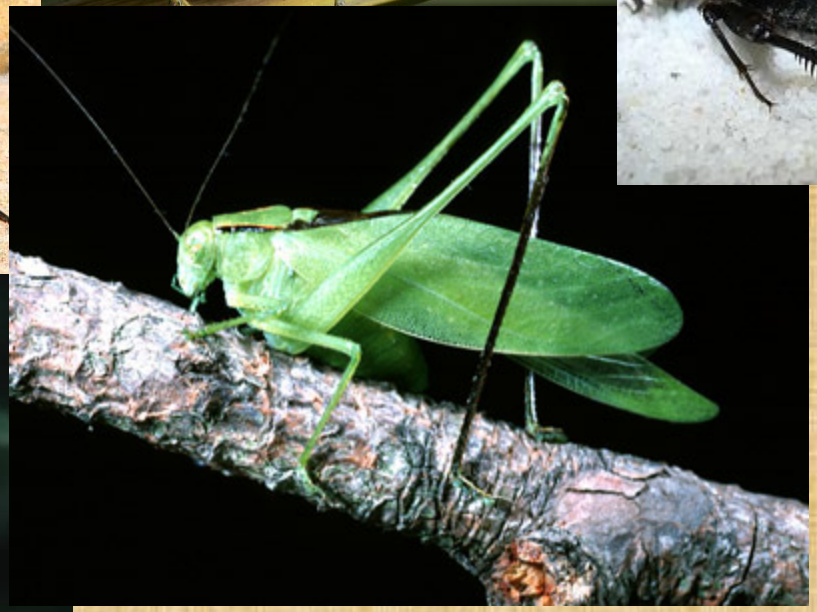


Coleoptera

Hymenoptera

Homoptera-Hemiptera

Orthoptera



Diptera

Isoptera

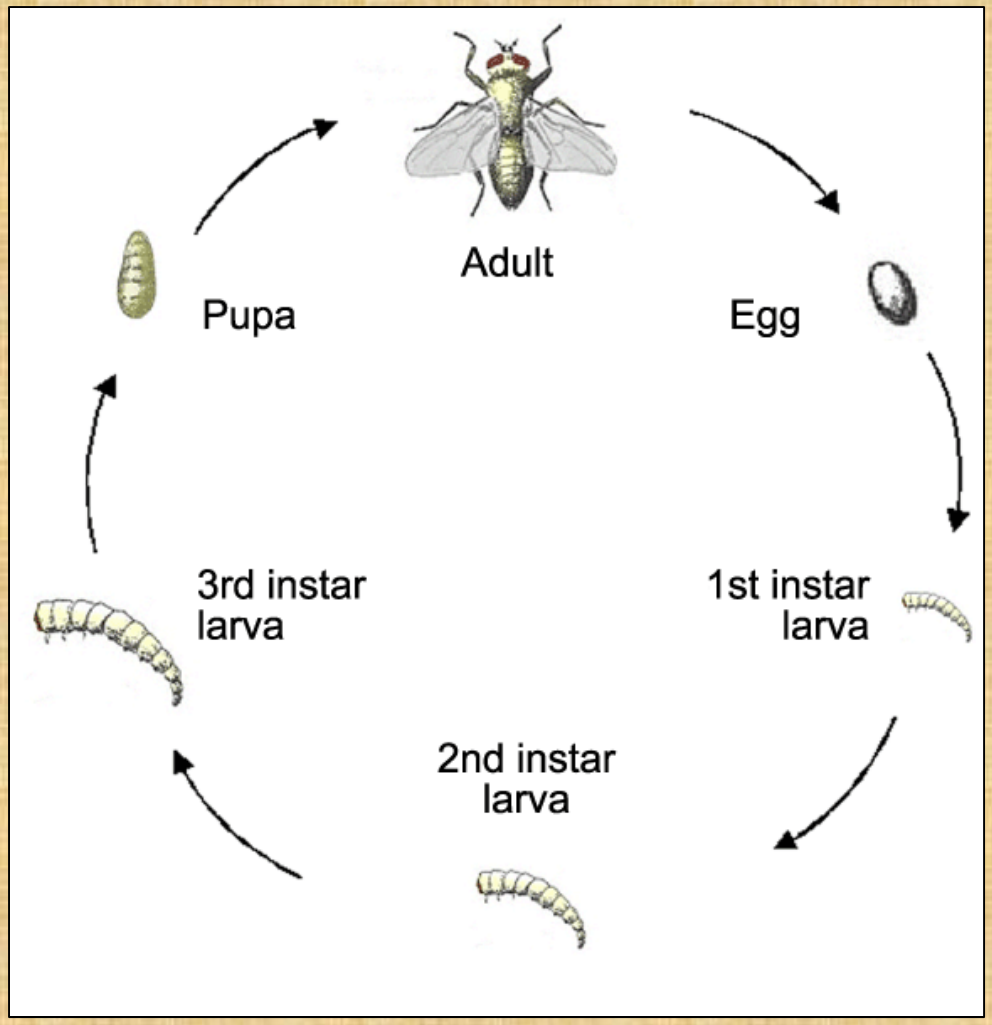
Metamorphosis: A biological process, whereby an organism physically changes through development from an egg to adult

Instar: Stages of larval growth until an adult stage; periods between molts

Generations: Number of life cycles that yield offspring in a given amount of time; > 2 per year = an insect pest

Complete Metamorphosis

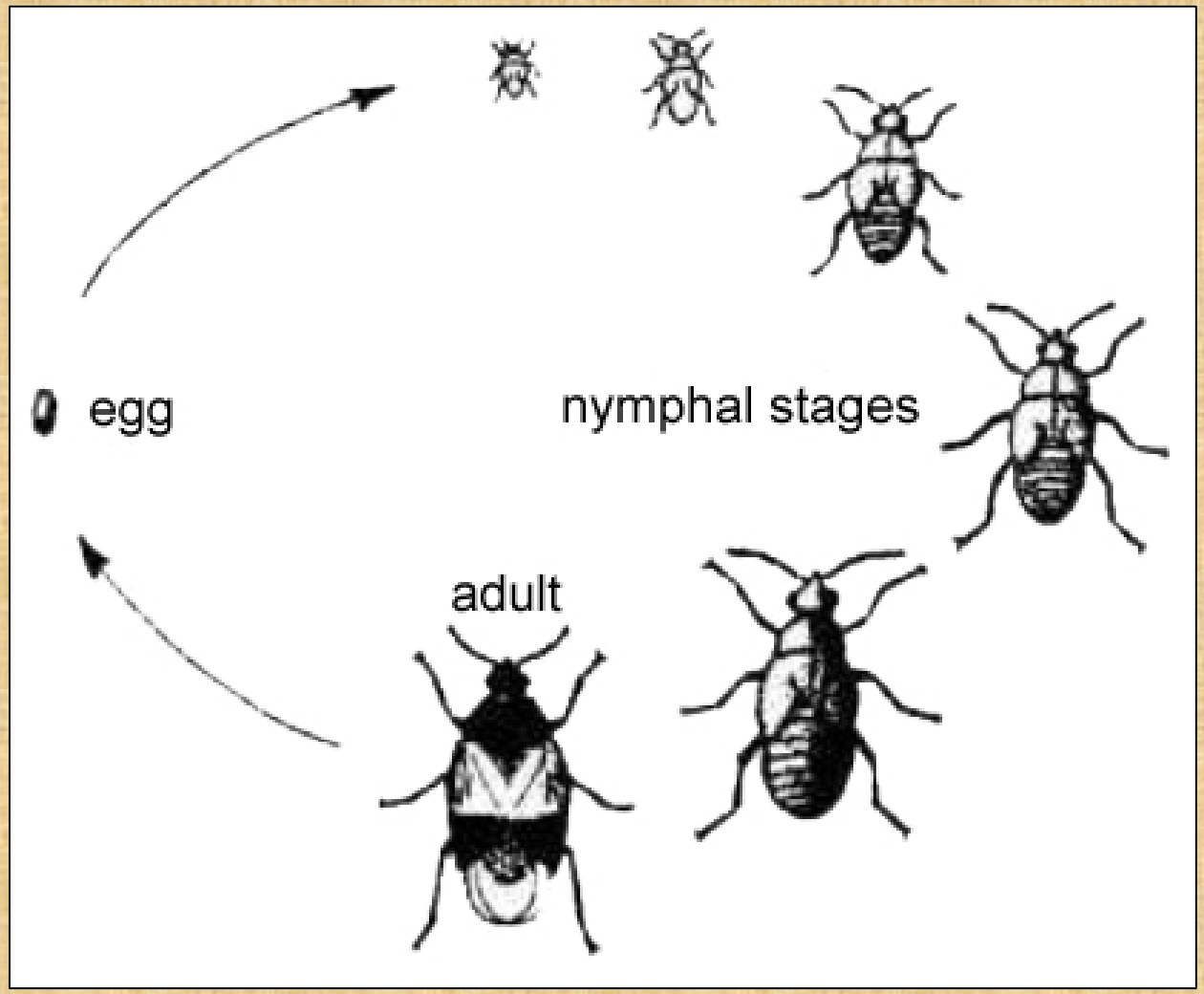
(Ex: Beetles, Moths, Butterflies, Sawflies, Parasitic Wasps, & Flies)



Egg → Larva (1st instar) → 2nd → 3rd → Pupa → Adult

Gradual Metamorphosis

(Ex: True bugs, Termites, Grasshoppers, & Aphids)



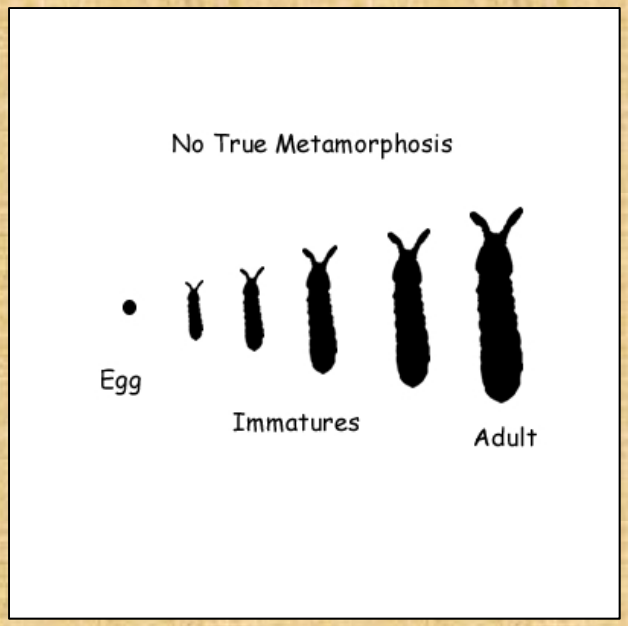
Egg → Nymph → Adult

Incomplete Metamorphosis

Egg → Nymph→ Naiads→ Adult

- Each instar is larger than the previous and progressively takes on adult characteristics (Ex: Mayflies & Dragonflies)
- Instars are aquatic and adults are terrestrial
- Adults look totally different than juveniles

No Metamorphosis



- Each instar looks exactly like the previous except that subsequent instars become larger.

- Adults look like the nymphs but are sexually mature
(Ex: Springtails & Silverfish)

Comparative Lengths of Metamorphosis

Species	Egg	Larva/Nymph	Pupa	Adult
Housefly	1 day	2 weeks	1 week	2 weeks
Ladybug	4 days	2 weeks	2 weeks	3-9 months
Monarch Butterfly	4 days	2 weeks	10 days	2-6 weeks
Periodical Cicada	1 month	13/17 years	N/A	2 months
Mayfly	I month	3 years	N/A	1 day
Cockroach	1 month	3 months	N/A	9 months

Complete Metamorphosis

Lepidoptera

Diptera

Hymenoptera

Orders with Both

Coleoptera

Orthoptera

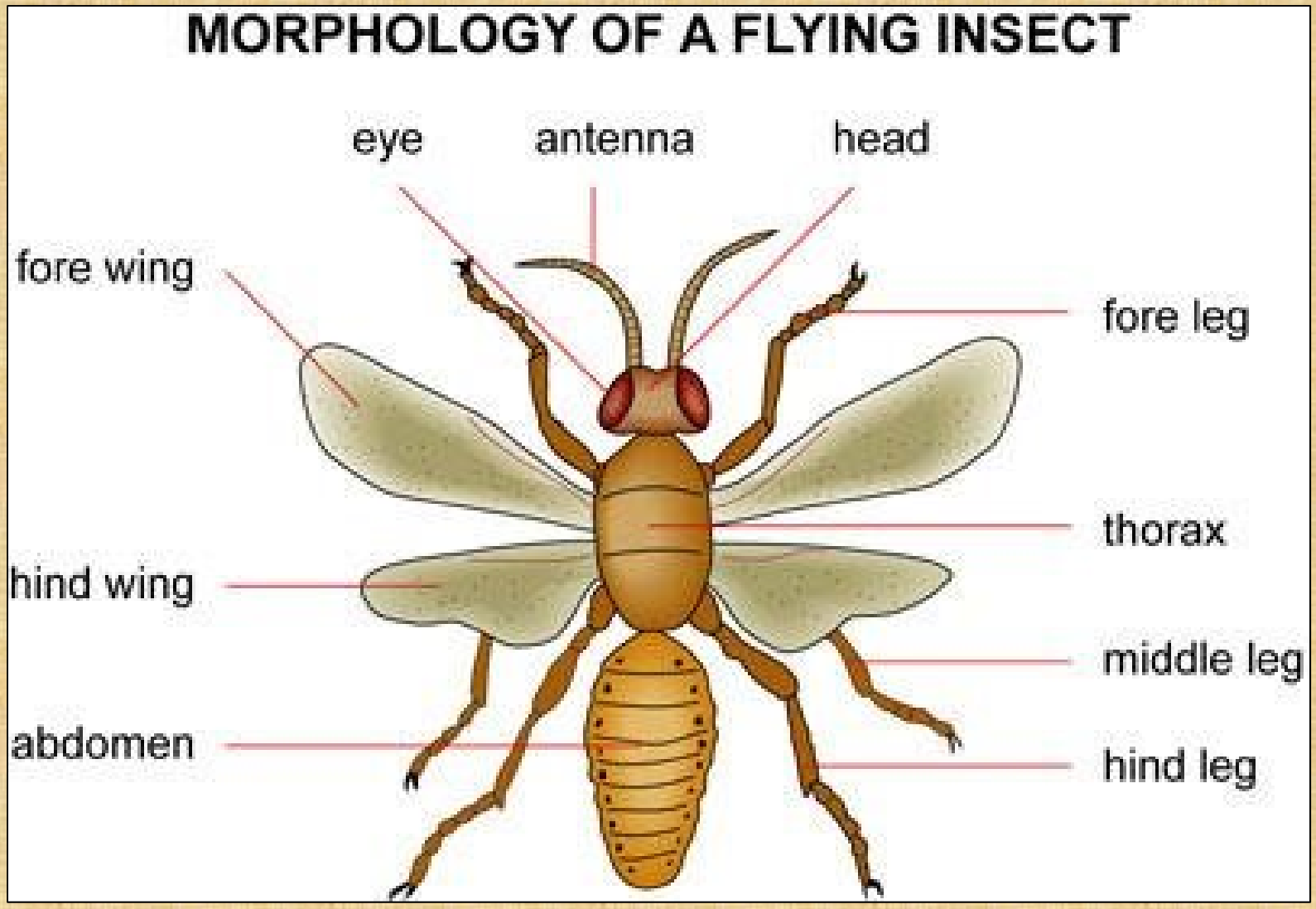
Gradual Metamorphosis

Hemiptera

Homoptera

Isoptera

Laboratory Exercise: Examine the Insect Parts



Laboratory Exercise

Examine the grasshopper

- Antennae (1 pair)
- Mouthparts
  - Mandibles
  - Maxillae
  - Labium
- Eyes
  - Compound
  - Ocelli (simple)
- Wings (2 pair)
  - Leathery & Membranous
- Legs
  - Coxa
  - Femur
  - Tibia
  - Tarsi
  - Tarsal claw

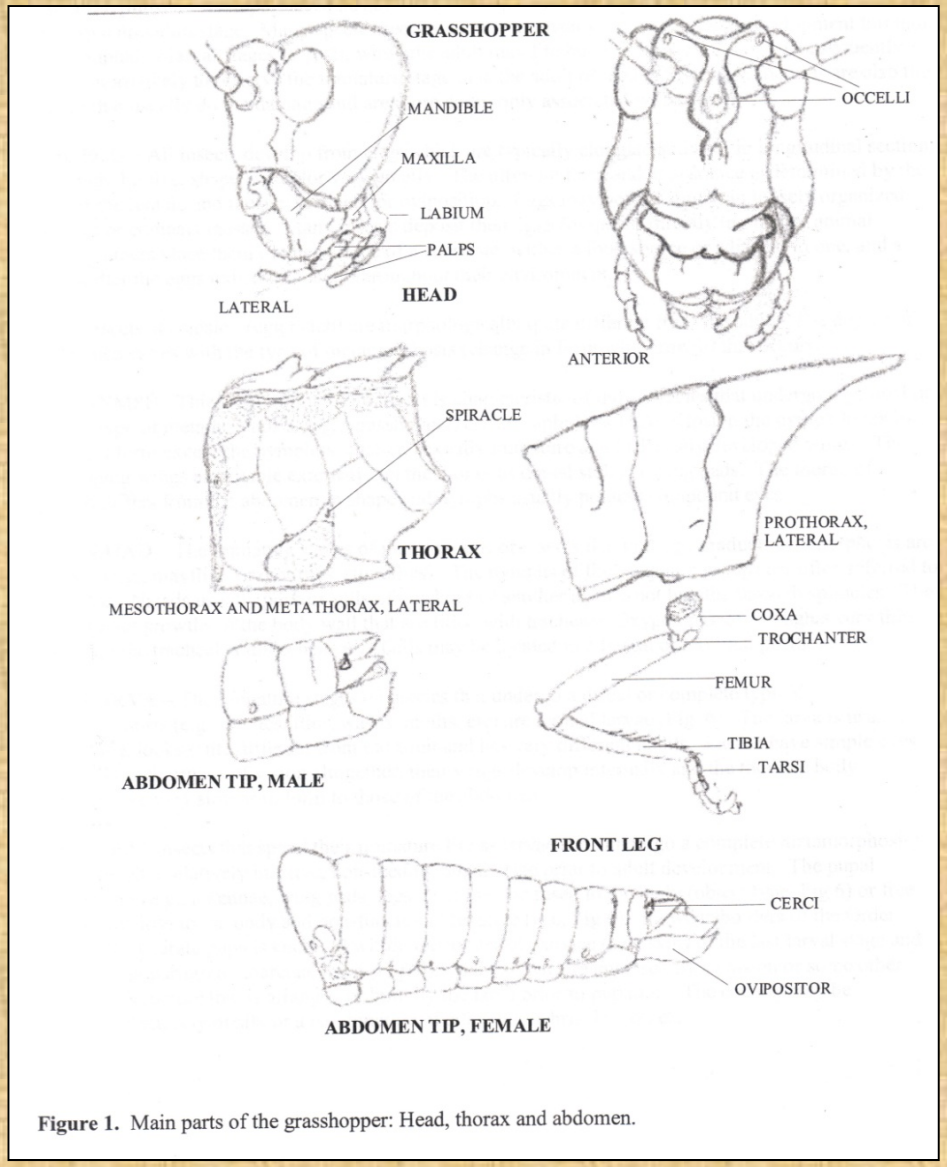
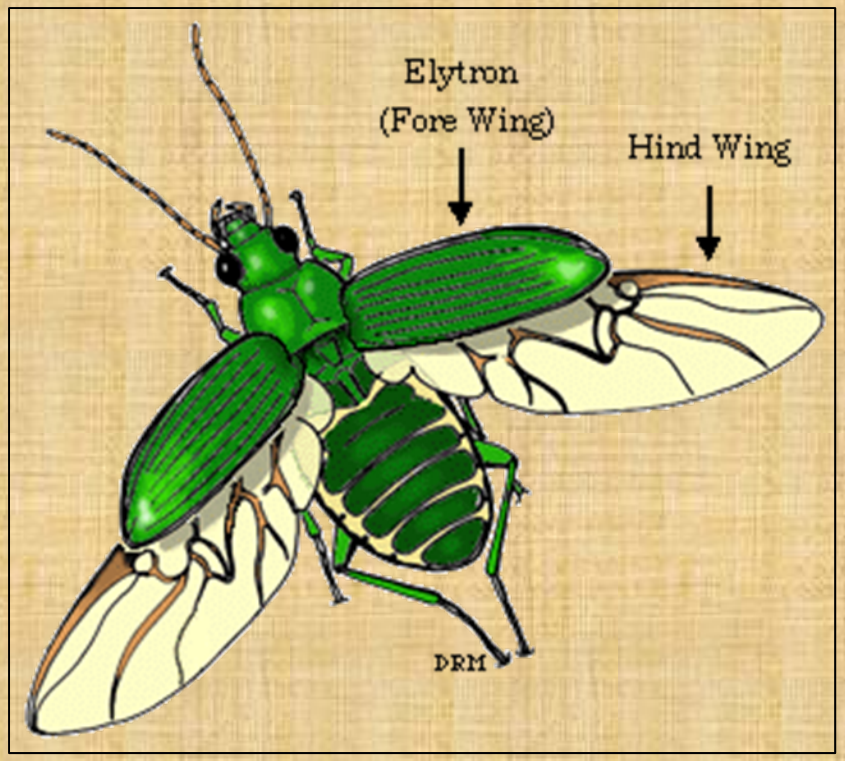


Figure 1. Main parts of the grasshopper: Head, thorax and abdomen.

Laboratory Exercise

- Examine the drawers of insects. Note wings, antennae, legs, and body shape.



Laboratory Exercise

Examine representatives of the following orders of insects that comprise the majority of insects important to forestry.

- Coleoptera
  - Beetles, weevils
- Hemiptera
  - Seedbugs, stinkbugs
- Isoptera
  - Termites
- Homoptera
  - Aphids, scales, spittlebugs
- Lepidoptera
  - Butterflies, moths
- Hymenoptera
  - Bees, wasps, sawflies, ants
- Diptera
  - Flies, skeletonizers, midges
- Orthoptera
  - Grasshoppers, cicadas

Laboratory Exercise

Using the dichotomous key provided, key the unknowns – even if you know what order they are by sight.

- Work in pairs
- One read the couplets and the other examine the insect.
- Switch roles halfway through