Class Insecta - The insects

A Introduction

1. Very species rich
2. Characteristics
    a. 3 pairs of legs
    b. 2 pairs of wings (most) except flies (1 pair of wings - Diptera)

B. Distribution

1. All habitats except saltwater - replaced by crustacea there
    a. Freshwater
    b. Terrestrial
    c. Ocean beaches
2. Very adaptable

C. External Anatomy

1. Three segments - really tagmata - head, thorax and abdomen
2. Compound eyes
3. Highly specialized mouthparts - fit ecology

D. Internal Anatomy

1. Nutrition
    a. Phytophagous - eat plants
    b. Predaceous
    c. Saprophagous - eat dead animals
    d. Parasites -
        1. Fleas on vertebrates
        2. Wasps on other insects - caterpilars
2. Gas exchange
    1. Tracheal system - thin-walled tubes that are distributed through body
        a. Spiracles are openings on sides of insect
        b. Trachea -->tracheoles (smaller)
        c. Every living cell near a tracheole

d. Muscular motion pumps air

2. Gills - a few juvenile stages have tracheal gills - extensions of body wall attached to tracheids

3. Excretion and water balance

a. Malpighian tubules - excretory organs and conserve body fluids

4. Sense Organs

a. Compound eyes

1. Visual acuity lower than humans - I don't believe this

a. What about dragonflies on summer lake?

b. Sounds by tympanic organs on sensilla

5. Reproduction

a. Separate sexes

b. Sex attractants (pheromones)

c. Many species normally lay eggs on food plants - find them by chemical cues

6. Metamorphosis and growth

a. Change in form as they grow - radically

1. Change in ecological niche

2. Molts - stage between molts is an "instar"

b. Holometabolous development (complete metamorphosis)

1. egg

2. Larva - radically different life style from adult

3. Pupa - reorganization of anatomy -

4. Adult

5. Representative butterfly

c. Hemimetablous development (incomplete metamorphosis)

1. egg

2. nymph - no wings

3. Adult - wings

4. No pupa to reorganize anatomy

d. Metamorphosis regulated by hormones

7. Diapause

a. Resting period - usually winter

b. Set off by external Environment

E. Behavior

1. Highly programed, instinctual behavior - respond to specific stimuli

2. Chemical signals - Pheromones = substances secreted by one organism that affect another

a. Effective in very small quantities

b. Colony markers in social insects

c. Sex attractants in moths

1. Gypsy moth - used to trap males

2. Could be used as a non-toxic pesticide to disrupt reproduction

2. Sound

a. Also used to attract mates

b. Crickets, cicadas

3. Visual signals - fire flies

a. Frequency of light flashes identifies species

b. Used as a sex attractant - female in vegetation - flashes at male

1. Species specific pattern

c. Predator fireflies mimic flashes of other species, catch and devour males

F. Social Behavior

1. Bees, wasps, ants and termites

2. Some of the most social of all animals - live in large colonies

3. Bee Hive

a. Queen is female - rest of hive is sterile female workers

b. Queen lays eggs to produce workers

c. Workers perform maintainence tasks for hive

1. Food getting - nectar and pollen from flowers

2. Construct comb of wax - bee's wax - hexagonal chambers - contain either growing larvae or honey storage (regurgitated nectar)

3. Care for young

d. Normal reproduction queen lays eggs and workers feed them

1. If hive gets too large, queen withholds sperm from eggs

a. Get male (drone)

2. Workers feed selected larvae royal jelly - contains pheromone that causes larva to become queen

3. When larvae become adults, new queens mate with drones - drones die new queen splits hive with old queen - find new location (swarm)

e. Bee society representative of other hymenoptera - very complex

E, Insects and Human Welfare

1. Symbioic relationship between bees and flowering plants

a. Not mentioned by your book. - It is a fundamental relationship in nature

b. Insects are major pollinators of flowering plants

c. Probably evolved together - flowers are structures to attract insects (mostly)

d. Pollinators take pollen from one plant to other - allows fertilization of ova in plants

e. Nectar is a reward to insect for pollination

2. Predators kill harmful insects

3. Food for important human food animals

a. Freshwater fish - Trout?

4. Harmful insects - lots

a. Parasites on humans - lice, mosquitos, black flies

b. Eat human food

- c. Carry disease - mosquitos, fleas, flies

5. Control of insects
    - a. Development of chemicals to kill insects
        1. Not very selective
    - b. Alternatives
        1. Resistant crops
        2. Introduction of insect predators
    - c. Integrated Pest Management
        1. Understand ecology of insect pest
        2. Use various techniques to combat insect
            - a. Control times of planting
            - b. Resistant plant varieties
            - c. biological controls
            - d. sparing use of insecticides