

Lecture: 1 by Dr. Banaz S. Abdulla

: Insects and its related animal phylum: Arthropoda

The arthropods possess:

- a. The segmented body
- b. Bilateral symmetry
- c. Paired jointed appendages usually terminates in a class
- d. Chitinous exoskeleton
- e. Ventral nervous system and
- f. Dorsal heart.
- g. Haemocoelic body cavity
- h. Muscles are composed of striated fibres, ciliated epithelium absent
- i. Open type of circulatory system

It is the largest phylum in the animal kingdom. Besides insects, many creatures like crayfish, crabs, lobsters, centipedes, millipedes, spiders, mites, ticks, scorpions etc come under this category.

Phylum arthropoda is classified into 7 classes

1. Onychophora (claw bearing): eg: peripatus
2. Crustacea (crusta-shell): eg: prawns, crabs, wood louse
3. Arachnida (Arachine-spider): eg: scorpion, spider, ticks, mites
4. Chilopoda (chilo-lip, poda-legs): eg: centipedes
5. Diplopoda (diplo-two, poda-legs): eg: millipedes
6. Trilobita (an extinct group)
7. Hexopoda (hexa-Six; poda-legs) eg. insects

What is an insect?

Insect are invertebrate animals that belong to the phylum Arthropod, the phylum that includes, as we have seen, crabs and lobsters. Insects occupy 2/3rd of total population of Phylum Arthropoda and belong to sub phylum mandibulata. is characterized in more detail below.

What do insect eat?

Insects eat plants (stem, roots, sap and leaves), Fruit, seeds, manure and other small animals.

Characters of Class insecta :

1. Body divided in to head, thorax and abdomen
2. Possess three pairs of legs, hence the name Hexapoda
3. Presence of one or two pairs of wings
4. A pair of antennae
5. Respiration by means of internal air tubes known as trachea
6. Genital opening situated at the posterior end of the body
7. Presence of metamorphosis (incomplete/complete) during development
8. Possess exoskeleton made up of hard cuticle which plays important role for survival.
9. Excretion is mainly by malpighian tubules which help in maintaining ionic Balance

What is Entomology?

Entomology is the study of insects. Entomologists, the people who study insects, observe, collect, rear, and experiment with insects. Research undertaken by entomologists covers the total range of biological disciplines, including evolution, ecology, behavior, anatomy, physiology,

biochemistry, and genetics. Biologists work with insects for many reasons: ease of culturing in a laboratory, rapid population turnover, and Availability of many individuals is important factors.

Disciplines within the science of entomology

Forest Entomology: Study of forest pests and their control.

Veterinary Entomology: Study of insects related to live stock and veterinary

Medical Entomology: Study of insects in relation to Human beings

Apiculture: study of honey bees and honey production and marketing.

Applied Entomology: study of various control methods for pest insect.

Biological control: Spin-off of applied entomology using parasites, pathogens and predators to control insects.

Insect ecology: Life systems of insects including wild as well as pest insects.

Characters contributing to the success of insect.

1) Exoskeleton: The insect body has an outer exoskeleton or body wall made up of cuticular protein called as chitin. It is responsible for protection from, Desiccation or water loss, from the body Physical or mechanical injuries and to maintain shape and size of the body, Providing area for muscle attachment, Giving strength to the body appendages

2) Small size: Insects, due to their small size, require less space (for shelter), food and energy for their survival and can easily escape from their natural enemies.

3) Functional wings: Two pairs of wings are mainly helpful for taking flight from one place to another in search of food, shelter or to find a mate, to oviposit or to get protection from their natural enemies.

4) High fecundity: Fecundity is defined as the egg laying capacity of a female insects. It helps to increase the population at faster rate.

5) Method of reproduction: Insects can reproduce both sexually as well as a parthenogenetically.

6) Short life cycle: Most of insects have very short life cycle i.e. 2 to 4 weeks which help insects to complete more number of generations in a definite period of time.

7) Complex metamorphosis under hormonal control permits two distinct life-styles in most species.

8) Specificity of food: There is diversity in food habits among different species of insects. As they differ in their preference for particular type of food, there will not be any competition among them. Less competition for food increases their chances of survival and further multiplication.

9) Morphological adaptations: The body color and shape of some insects make them look like part of the plant, thereby protecting themselves from natural enemies eg: **stick insects** and **leaf insects**

10) Physiological adaptations: Some insects produce or release poisonous or unpleasant odors from their body or possess warning coloration by imitating certain distasteful insects. Eg: **Stink bugs** have specialized exocrine glands located in the thorax or abdomen that produce foul smelling hydrocarbons. some **blister beetles** (Meloidae) produce **cantharidin**, a strong irritant and blistering agent.

11) Behavioral adaptations: It is a defense strategy adopted by some insects through feigning death or imitating the voice of dangerous insects or mimicry. **Eg: Colorado potato beetles** when disturbed draw their legs beneath and drop to the ground and pretend as if dead.

Insects of economic importance (Insects and humans). The relationship between insects and humans is long and complex. Since antiquity, insects have infected us with disease, attacked our crops, infested our food stores, and pestered our animals. And although we derive considerable benefit from their services, including pollination, honey and wax production, and the biological control of pests and weeds.

1- Insects as pests

a) Agricultural pests: Plant-feeding insects once established, these pests quickly multiplied and spread, threatening economic ruin for entire regions. More than 6,000 species of thrips, true bugs, homopterans, beetles, flies, butterflies and moths, ant, wasps, and even a few termites are considered serious agricultural pests throughout the world.

b) Forest pests: In temperate forests, adult and larval moths and beetles, and to a lesser extent sawfly and horntail wasps and a few flies, attack stands of living, dying, or dead trees.

c) Storage pests: Insects feed on stored products and cause economic loss. (eg) Rice weevil, Pulse beetle.

d) Pest attacking cattle and domestic animals: Cattle are affected by pests like Horse fly, Fleshfly, Fleas and Lice, harass, weaken, infect, or kill livestock, poultry, and pests and the damaged hides and reduction in meat, milk, egg and wool production result in economic loss.

e) House hold and disease carrying insects: House hold pests include cockroach, ants, etc. Disease carrying insects are mosquitoes, houseflies, bed bugs, fleas etc.

f) Pests which cause damage to belongings of human being like furniture, wool, paper etc. Eg. Cockroaches, furniture beetle, silver fish etc.

g) Pests which cause painful bite, inject venoms. Eg. Wasps, bees sting us. Hairy caterpillar netting hairs are poisonous. Mosquitoes, bugs bite, pierce and suck blood from us.

h) Disease causing Mosquito - Malaria, Filariasis, dengue fever. Housefly - Typhoid, Cholera, Leprosy, Anthrax

2. Beneficial insects

a) Productive insects

Silk worm:-The silk worm (*Bombyx mori*) filament secreted from the salivary gland of the larva helps us in producing silk.

Honey bee:-Provides us with honey and many other byproducts like royal jelly and bees wax. Beeswax, which can be used as a base for ointments, polishes, and candle making. Forty percent of all beeswax is used in cosmetic manufacture for lotions, creams, and lipsticks.

Lac insects:-The secretion from the body of these scale insects *Laccifer lacca*. Lac is an important ingredient of many items, including floor polishes, shoe polishes, insulators, various sealants, printing inks, and varnish.

Dyes. Many species of scale insects provide dyes that are used in many products, including cosmetics and for coloring cakes, medicines and beverages. Cochineal is a bright red pigment that is gained from the bodies of a scale insect, *Coccus cacti*, which lives on cactus plants. Tannin is a dye that is gained from insect galls and is used in the tanning of hides and in the production of permanent durable inks. There are other galls that produce dyes.

Insects useful as medicine cantharidin - extracted from blister beetle has been used to treat epilepsy, sterility, asthma, rabies, and lesions resulting from gonorrhoea. During world war I, it was discovered that some wound-infesting maggots consumed only dead tissue. As they fed, the maggot excreted large quantities of the nitrogenous substance called allantoin that acted as a sterilizing agent.

Insect as food - eating insect or Entomophagy. Insects are an excellent source of fat and protein and were no doubt a staple in the diet of early hunter/gatherers. For animals- aquatic insects used as fish food. Grasshoppers, termites, pupae of moths, They have been used as food by human beings in different parts of the world.

b) Helpful insects

Insect as bio indicator. Researchers use insects as indicator species to measure environmental disturbances. The responses of some sensitive insects to habitat disturbances. For eg. Aquatic beetles and larvae of mayfly, stoneflies, dragonflies and damselflies are especially sensitive to even subtle changes in water temperature, chemistry and turbidity.

Insect as educational tools. Process found in all animals, such as growth and reproduction, are easily observed in insect. Their relative short life cycles and dramatic physical transformations during the growth process make them ideal subject for classroom and laboratory study. They are readily available, inexpensive, and easy to maintain and handle, eg. Fruit flies (*Drosophila*) and mosquitoes are useful in genetic and toxicological studies respectively.

Insects as biological control. Biological control is the naturally occurring enemies (parasites and predators) of a pest to reduce or eliminate reliance on expensive and potentially ecologically disastrous pesticides.

Parasites: These are small insects which feed and live on harmful insects by completing their life cycle in a host and kill the host insect. Eg egg, larval and pupal parasitoids

Predators: These are large insects which capture and devour harmful insects. Eg Coccinellids, Preying mantids.

Scavengers: Insects which feed on dead and decaying matter are called scavengers. They are important for maintaining hygiene in the surroundings. Eg Carrion beetles, Rove beetles feed on dead animals and plants.

Pollinators: Many cross-pollinated plants depend on insects for pollination and fruit set. Brightly colored flowers with highly attractive odors draw insect seeking nutritious pollen and nectar. Pollen is an excellent source of protein, nectar is high in carbohydrates. Eg Honey bees, aid in pollination of sunflower crop.

Apiculture. The rearing and management of honey bees is called apiculture. *Apis mellifera*, is widely kept by humans for their honey and wax production.