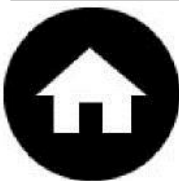


## LESSON EIGHT: TAXONOMY AND CLASSIFICATION OF INSECTS

### 8.1. Introduction



**Classification** refers to the arrangement of the kinds of individuals living organisms into groups and the groups into systems called classification.

**TAXONOMY** This is the science of identifying, naming and classifying organisms. Taxonomy is the day today practice dealing with organism kinds, handling and identification of specimen, publication of data, study of literature and analysis of variations shown by specimens. The taxonomists assign the names to plants and animals.

### 8.2. Lesson Objectives

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After completing this section students should be able to:

- Describe the basic classification used for insects and other animals.
- Explain how taxonomic keys help in the identification of insect orders.
- List the major orders by technical and common name.
- Describe the wide range of metamorphosis that occurs in the insect orders

### 8.3. Classification, taxonomy and systematics

The fundamental unit of systematics is the species. Discovering the patterns of relations of species at higher levels, building classification based on this patterns and naming the appropriate taxa (taxonomy). Application of this pattern knowledge to studying changes in the organisms' features through time (evolution).

#### 8.3.1 Components of Classification

It is the grouping of species into groups called taxa (taxon).

The classification of animals and plants is based primarily on the physical characteristics and relationships of the animals and plants. The order of classification follows this pattern: **kingdom, phylum, class, order, family, genus, and species**. The words used in classification are from Latin.

The largest groups are the **kingdoms**.

The next group, called **phylum** has about 20 phyla for animals. Insects belong to the Phylum Arthropoda.

The group called **class** is the next and insects belong to the class Insecta. It is comprised of related orders.

**Order-** It is comprised of related families. All insects of an ovipositor belong to the order hymenoptera.

**Family-** Related genera constitute of the family. All members of the family share particular characteristics, although the nature of the shared traits varies from family to family

The name is capitalized but not italicized. Family names always end in "idae".

**Genus-** This is the assemblage of closely related species. The names are italicized and capitalized.

The **species** is the fundamental unit of the classification system. A species is a group of animals with similar physical characteristics that can and do interbreed and share the same gene pool and produce a viable/fertile offspring

#### 8.3.2. Distinguishing characteristics of phylum Arthropoda

- Belongs to the subgrade coelomate in which the body is metamerically segmented i.e. a series of similar somites/metameres
- Body is covered with thick tough non-living chitinous exoskeleton – the cuticle is moulted at interval in young arthropod to permit growth
- Paired appendages present in some or all the segments. The segments are typically jointed and they are modified to form jaws gills legs etc

- Body is trophoblastic (ectoderm, mesoderm and endoderm) and coelom is greatly reduced. Perivisceral cavity is also the haemocoel.
- Musculature consists of separate muscles instead of continuous muscle layers
- The gut is usually straight or nearly so and anus is terminal or subterminal
- Circulatory system is open i.e. blood not confined to blood vessels and it flows freely in the haemocoel.
- Respiration is carried through body surface or through gills (aquatic) or trachea or book-lung in terrestrial forms
- Excretion is by use of malpighian tubules associated with the hind gut

### *Characteristics of Class Insecta*

Insects can be distinguished from others by the following characteristics. Three distinct body parts, namely the head, thorax and the abdomen, One pair of antennae, a pair of compound eyes, mouth parts consist of labrum, a pair of mandibles and maxillae, hypopharynx and a labium, three pair of legs on the thorax, one or two pair of wings on the thorax attached to the mesothorax and metathorax.

### *Insect orders*

The insect group includes many subgroups: termites; grasshoppers, crickets and cockroaches; earwigs; lice; true bugs; beetles and grubs; butterflies, moths and caterpillars; fleas; flies, gnats and maggots; and bees and wasps.

Class insecta is divided into 2 subclasses namely Apterygota (wingless) and pterygota (winged). Pterygota are also the winged insects, some wingless, which also undergo metamorphosis. There are two divisions or super orders in this subclass. They include the **Exopterygota**/Heterometabola or hemimetabola- these are the insects that undergoes incomplete metamorphosis and **Endopterygota**/ Holometabola – these are the insects that undergo complete metamorphosis.

Some of the insect orders in which of pests and natural enemies belong to include;

### **Odonata** (dragonflies and damselflies)

- Insects with 2 pairs of wings and biting mouthparts with Most have thin legs and short antennae. Heads mobile with large compound eyes nearly covering head. Worldwide distribution, nymphs aquatic and moist habitat required for development, adults are mainly diurnal or crepuscular (active in the evening); numbers: approx 5,000 spp. Mouthparts: biting and chewing, are toothed. Two pairs membranous wings; large, net-veined, dragonflies are unable to fold their wings and hold them stiffly out at the sides when at rest, damselflies are able to fold their wings vertically over their bodies when resting. Abdomen with a pair of long cerci, often with median caudal filament.

Metamorphosis is gradual (incomplete), nymphs are aquatic and called nyads; predatory with caudal tracheal gills. Economic significance: generally beneficial predators. **Phasmida** (Stick insects and leaf insects)

Large sized insects with elongate (twig-like) body, short prothorax, large mesothorax and metathorax. Broad head bearing a pair of long filiform or moniliform antennae, compound eyes and 2-3 or no ocelli, Biting mouth parts Wings present or absent, 11 segmented abdomen

### **Dermaptera** (Ear wigs)

Insects with biting and chewing mouthparts and long antennae. Have elongated, flat, dark brown body with filiform antennae. Two pairs of wings, forewings short, leathery and veinless; hind wings large, semi-circular, membranous, radially veined and folded over forewings at rest. Some forms wingless. Tarsi are 3-segmented, cerci are unjointed and modified into stout pincers or forceps for defense and offense. Metamorphosis is gradual, most live in rotting plants

### **Orthoptera** (grasshoppers, crickets and true locusts).

Insects move with great agility with variety of shapes and characteristics. Distribution: worldwide, nearly all habitats, both diurnal and nocturnal species.; numbers: approx. 25,000 species. Pair of antennae with variable structure, compound eyes with 2 or 3 ocelli. Wings: sometimes absent or vestigial, some females in some of the species are wingless. When present, wings are straight, fold over their body when not in use. Fore wings hard, narrow, parchment-like, opaque with indistinct venation. Mouthparts: biting and chewing. Abdomen 11 segmented, females with ovipositor and cerci (short, long clasper-like, segmented or not). Metamorphosis: gradual; Economic significance: some are serious crop pests (locusts and grasshoppers); preying mantids are beneficial predators.

### **Isoptera** (termites)

The name Isoptera comes from the latin *iso* which means equal because both the front and hind wings of these insects are about the same size. Worldwide distribution in tropical and warmer temperate regions; numbers: approx. 2,000 species. Wings: two pairs, long and narrow, nearly equal in size, most often wingless; Mouthparts: biting and chewing; Social insects, with two or more distinct forms, reproductive forms (males and females) and non-reproductive forms (workers and soldiers), only reproductive forms have wings, live in colonies with a social system called a caste - males and females serving to reproduce the sp. while workers carry out the activities of the colony and soldiers defend the colony, their diet of wood is actually digested by protozoan, mutualistic symbiosis, sometimes erroneously referred to as white ants. Metamorphosis is

gradual; Economic significance: seriously destructive to wood structures in many regions.

**Thysanoptera** (Thrips e.g. *Heliothrips*)

- Minute to small-sized insects with slender body. Compound eyes small, ocelli 3 in winged forms and absent in wingless forms; Short (6-10 segmented) antennae, Rasping and sucking mouthparts with right mandible reduced or absent, Two pairs of narrow fringed wings, co-opted by basal hooks, 10-11 segmented abdomen with ovipositor but no cerci, Metamorphosis is simple

**Dictyoptera** (Cockroaches and mantids) - Insects that lay their eggs in enclosed capsules called oothecae.

**Blattaria** (Cockroaches)

Medium to large-sized insects, somewhat dorso-ventrally flattened, Chewing mouth parts, Well developed compound eyes, 2 ocelli, Long filiform antennae, Pair of styli on 9<sup>th</sup> sternum of males, females with reduced ovipositor concealed by 7<sup>th</sup> sternum, Simple metamorphosis.

**Mantodea** (mantids)

Medium to large sized insects, Body usually elongate, somewhat cylindrical with elongated prothorax. Small triangular head bearing large compound eyes with 3 or more ocelli, Chewing mouth parts, Raptorial forelegs at anterior end of elongated prothorax, Wings usually in males reduced or absent in females, Comparatively short abdomen, multi-segmented cerci, pair of styli on 9<sup>th</sup> male sternum, Metamorphosis is simple.

**Hemiptera (Heteroptera)** (True Bugs e.g. water bugs, water scorpions, water boatman)

Insects with unusual heads. Worldwide distribution in most habitats, also aquatic environments; numbers: approx. 50,000 species. The head has a snout used for piercing and sucking. The wings are usually hard and held flat against the body, two pairs of wings: the first pair is thickened at the base to form a protective cover, the outer half of the first pair of wings is membranous and overlapping; the bottom portion of their wings near their body is leathery, and the tip of their wings is membranous. Metamorphosis is gradual (incomplete); Economic significance: some are serious plant pests - important transmitters of plant diseases; also some transmit animal diseases (e.g. bedbugs); some species are predacious and eat economically and environmentally beneficial insects.

**Homoptera** (bedbugs, scale insects, aphids/plant lice, leaf hoppers, cicadas, lac insects)

Insects with piercing/sucking mouthparts. They feed exclusively on plants. Worldwide distribution, terrestrial habitats; numbers: approx. 40,000 species. Their wings are membranous from base to tip. Have two pairs of wings (sometimes absent), both of the same texture, and held over the body in a roof-like position at rest; Metamorphosis is gradual/incomplete (larva are called nymphs); Economic significance: almost all are plant feeders, large numbers of aphids can seriously weaken a plant, and some species transmit plant diseases.

### **Coleoptera** (Beetles)

This is the largest order of insects. Mouthparts: biting and chewing type; Variable antennae, usually 11 segments, have two pairs of wings: the front pair thick and hard, meeting in the midline when closed, and forming a protective sheath-like cover for the body. The hind pair is membranous, folded beneath the front pair at rest, and employed for flying; Metamorphosis: complete, Economic significance: fairly minor; most species are neutral; some are pollinators; many are predaceous; some are crop and stored-food pests.

### **Neuroptera** (Lacewings -*Chrysopa*, Antilions)

Insects with large, membranous wings with a dense network of veins. Small to very large medium sized, soft bodied insects, Chewing mouth parts in adults and grasping-sucking in larvae, Compound eyes with or without ocelli, long filiform antennae, Two wing pairs, similar in size and appearance. No cerci, ovipositor present and variously modified, Complete metamorphosis

### **Diptera** (True flies- houseflies, blackflies, fruit flies and mosquitoes)

Insects with 1 pair of wings and compound eyes. Their mouthparts may be the sucking kind or the sponge-like absorbing kind. Worldwide distribution in most habitats; numbers: approx. 75,000 species, Mouth parts: adapted for piercing and sucking or lapping and sponging; Metamorphosis is complete; Economic significance: flies and mosquitoes are capable of transmitting many diseases to man and other animals; the dipterans are the most serious insect pests in public health.

### **Trichoptera** (Caddis fly)

Insects with long antennae and legs. They have hairs on the surface of their wings. Small to medium sized insects, Non-feeding mouth parts in adult but adapted for fluid imbibing, mandibles weakly developed, Chewing mouth parts in larvae, Posses compound eyes with 0-3 ocelli, Antennae range from setaceous to filiform, Two pairs of membranous

wings, hind pair broader than fore and covered with modified hair-like setae, Cerci present, 1 or 2 segmented. Metamorphosis complete (holometabola), larvae aquatic

### **Lepidoptera** (butterflies and moths)

The name comes from *lipido* which means scale. The wings of these insects are covered by small, overlapping and often colorful scales, Distribution: worldwide in most habitats; numbers: approx. 105,000 species, Have two pairs of wings:, usually large, often brightly colored, covered with tiny overlapping scales that are easily rubbed off; Mouthparts are chewing in larvae, sucking type in most adults; Metamorphosis is complete and larvae are called caterpillars; Economic significance: important pollinators, but some larvae are destructive crop and forest pests.

### **Hymenoptera** (ants, wasps and bees)

Insects with 4 wings, long legs, and compound eyes. Worldwide distribution in most habitats, diurnal (active in day); numbers: approx. 120,000 species.; Their mouthparts may be sponging, sucking, or biting or chewing and sucking; Have two pairs of membranous wings, the hind pair smaller, sometimes lack wings (e.g. most ants except for the winged, reproductive form); Stinger of bees and wasps is a modified ovipositor (egg-laying appendage) and present only on females, Metamorphosis is complete; Large, diverse order demonstrating significant "industrial" and "social" organization; Economic significance: generally, beneficial, but mostly neutral, valuable as pollinators and producers of honey, many predacious and some parasitic forms help control insect and other arthropod pests.

### *Summary*



Phylum arthropoda is subdivided into classes. Class insecta is subdivided into orders. There are both exopterygota and endopterygota.

ACTIVITIES



1. Distinguish between the endopterygotes and exopterygotes.
2. List down a number of insects found in the order Hymenoptera and coleoptera