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Basic of Systematic Entomology	عنوان المحاضرة باللغة الإنكليزية
1	رقم المحاضرة

Systematic Entomology

Taxonomy is the branch of biology that classifies all living things. It was developed by the Swedish botanist Carolus Linnaeus. Linnaeus invented *binomial nomenclature*, the system of giving each type of organism a **genus** and **species** name. Linnaeus also developed a classification system called the taxonomic hierarchy, which has seven ranks: **kingdom, Phylum, class, order, family, genus, and species**.

Ex: *Musca domestica* (housefly)

Kingdom: Animalia

Phylum: Arthropoda

Subphylum: Hexapoda

Class: **Insecta**

Infraclass: Neoptera

Subclass: Pterygota

Order: **Diptera**

Suborder: Brachycera

Infraorder: Cyclorrhapha

Family: **Muscidae**

Subfamily: Muscinae

Tribe: Muscini

Genus: *Musca*



Species: *Musca domestica* Linnaeus, 1758

Insects are perhaps the most eminently successful animals due to their vast number of species, wide distribution, reproductive capacity and adaptability to survive in extreme conditions. With roughly 1 million recognized species and 5-10 million estimated actual number of species, they dominate the current land fauna. Insects are known to perform a variety of functions. Many insects are beneficial for human beings. They are excellent pollinators, environmental quality indicators, produce commercially important substances, act as scavengers, and are exceptional research models. On the other hand, several species of insects are devastating crop pests, household pests and even some are the significant disease carriers. For example; **bedbugs, mosquitoes, houseflies, fleas**, etc., transmit deadly diseases among human beings. The insect-borne diseases, such as **dengue, malaria, typhus fever, plague, Chagas**, etc. are some of the prevalent diseases worldwide.

Distinguishing taxonomic features

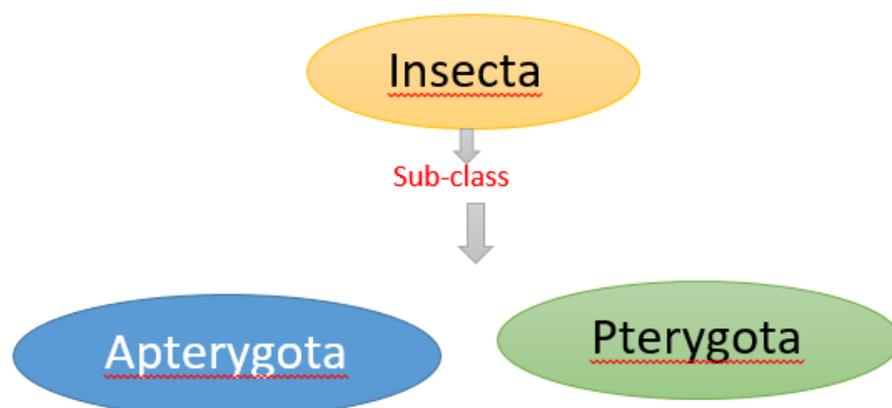
The class Insecta is divided into orders on the basis of the structure of the [head](#), including eyes, [mouthparts](#), and antennae; the [thorax](#), including legs and wings; and the [abdomen](#), including segmentation, spiracles, and appendages (cerci, styli, furcula). The genitalia and their accessory structures, usually located in the ninth abdominal segment, are important in [classification](#). Other taxonomic [criteria](#) include bristles (their form and arrangement are known as chaetotaxy), sensory receptors (spines, hairs, sensilla, tympanal organs), pattern of wing venation, and position of mouthparts. In addition, type of [metamorphosis](#) and form of larva and [pupa](#) are used to distinguish insects.

Annotated classification

- **Class Insecta**

Body divided into [head](#), [thorax](#), and abdomen; head with 1 pair of antennae, [mouthparts](#) consisting of a pair of mandibles and 2 pairs of maxillae, the 2nd pair fused medially; thorax with 3 pairs of legs and usually 1 or 2 pairs of wings; segmented [abdomen](#) lacks walking appendages; genital opening near anus; [metamorphosis](#) usually occurs; about 1,000,000 [species](#) named; worldwide distribution.

Class Insecta is categorized into two sub based on the presence of absence of wings. Class Insecta is categorized into two sub based on the presence of absence of wings.- classes: **Apterygota** and **Pterygota**



Sub-class Apterygota (Ametabola) These are small insects which are primitively wingless insects. They never had wings in their evolutionary history. The adults possess variable number of pregenital abdominal appendages. The head is prognathous with mouth parts directed anteriorly and generally concealed (Entognatha). Mandibles are attached to the head at one only point and are thus, monocondylic. The nymphs develop through slight or without any metamorphosis, and thus, resemble adults.

Apterygota divided into two groups

- 1) **Entognatha** comprise three orders; **Protura**, **Collembola**, **Diplura**
- 2) **Ectognatha** include one order : **Zygentoma**(**Thysanura**) Previously called **Thysanura**.

Order 1: Protura (Gr., proto- = "first"; ura = tail); Common Name = Coneheads

Proturans are numerous found in moist soils, mosses, leaf litter, turf and decomposing logs; and feed on decomposing organic matter and fungal spores. They are found worldwide and at present, approximately 200 species are known.

Characteristic Features

- a)** Proturans are minute (< 2 mm long) whitish/pale insects, with piercing mouth parts.
- b)** Head is conical and lacks antennae and eyes.
- c)** Abdomen is 11-segmented with first 3 segments having a pair of small pregenital appendages. Abdomen is terminated by a telson and cerci are absent.
- d)** Forelegs are held forward and are primarily sensory in function. **e)** Metamorphosis is accompanied by increase in the number of abdominal segments after each moult, termed as anamorphosis. **Example:** *Eosentomon indicus*, *Acerentomon doderoi*



(a) *Acerentomon doderoi*

Order 2: Collembola (Gr., coli = glue; embol = a wedge/peg); Common name: Springtails, Snow flea Collembola are found in diverse but moist habitats; especially in soil, leaf litter and decaying organic matter. These are widely distributed in arctic, tropic and temperate regions. At present, approximately 6,000 species are known.

Characteristic Features

- a) These are minute insects (< 6 mm), with biting type mouth parts and 4-segmented antennae.
- b) Compound eyes are absent. One to several pairs of lateral ocelli form an eye patch.
- c) Abdomen is 6-segmented with three pregenital appendages.
- d) Ventral tube (Collophore or Glue peg) is a bilobed structure present on the first abdominal segment and helps in balancing, excretion, respiration, adhesion and water absorption.
- e) Retinaculum (Hamula or Tenaculum) is present on the III abdominal segment. It holds the next appendage, furcula.
- f) Furcula or springing organ is a forked jumping organ present on the IV abdominal segment. When released, it snaps against the ground helping animal to jump . Example: *Isotoma viridis*, *Anurida maritima*.



Anurida maritima.

Order 3: Diplura (Gr., dipl= two; ura= tail); Common name: Two-pronged bristle tails
These are found in damp places in the soil, under bark, under stones or logs, in rotting wood, in caves, and in similar moist situations. About 800 species have been described so far.

Characteristic Features

- a) These are small to large (<5- 50 mm), pale, narrow-bodied insects.
- b) The antennae are moniliform and multi-segmented while compound eyes and ocelli are absent.
- c) Abdomen is 10-segmented, with lateral appendages on most of the pregenital segments.
- d) A pair of cerci is present at the abdominal end .Example: *Campodea staphylinus*, *Japyx diversiungus*



(c) *Campodea staphylinus*

Order 4: Zygentoma (Thysanura) (Gr., thysan = fringe; ura = tail); Common name: Silverfish, Firebrats, Bristle tails Silverfishes prefer moist places, such as soil, leaf litters, rotting wood, under stones or logs, etc. They can also be located behind old paintings, books, etc. On the other hand, firebrats are found in warmer places, such as around steam pipes, furnaces, etc. Currently, about 550 species are known.

Characteristic Features

- a) They are approximately 6–18 mm long with metallic lustre of grey, brown or white scale and mandibulate mouth parts.
- b) Antennae are long, multi-segmented with basal segment provided with muscles.

- c) Compound eyes may be present or absent.
- d) Abdomen is 11-segmented with variable number of lateral pregenital appendages. The last segment ends in a pair of cerci and a median filament .
Example: *Lepisma sacharina*, *Thermobia domestica*.



Thermobia domestica.



Lepisma sacharina

Classification

Kingdom Animalia (Animals)
 Phylum Arthropoda (Arthropods)
 Subphylum Hexapoda (Hexapods)
 Class Insecta (Insects)
 Sub-class Apterygota
 Order Zygentoma (Thysanura)(Silverfish)
 Family Lepismatidae
 Genus *Thermobia*
 Species *domestica* (Firebrat)

Q1/Give the scientific classification of *Campodea staphylinus*

Q2/What is anamorphosis? Which order exhibits this phenomenon?

Q3/Name the organ after which Collembolans are named ? what its benefit?

