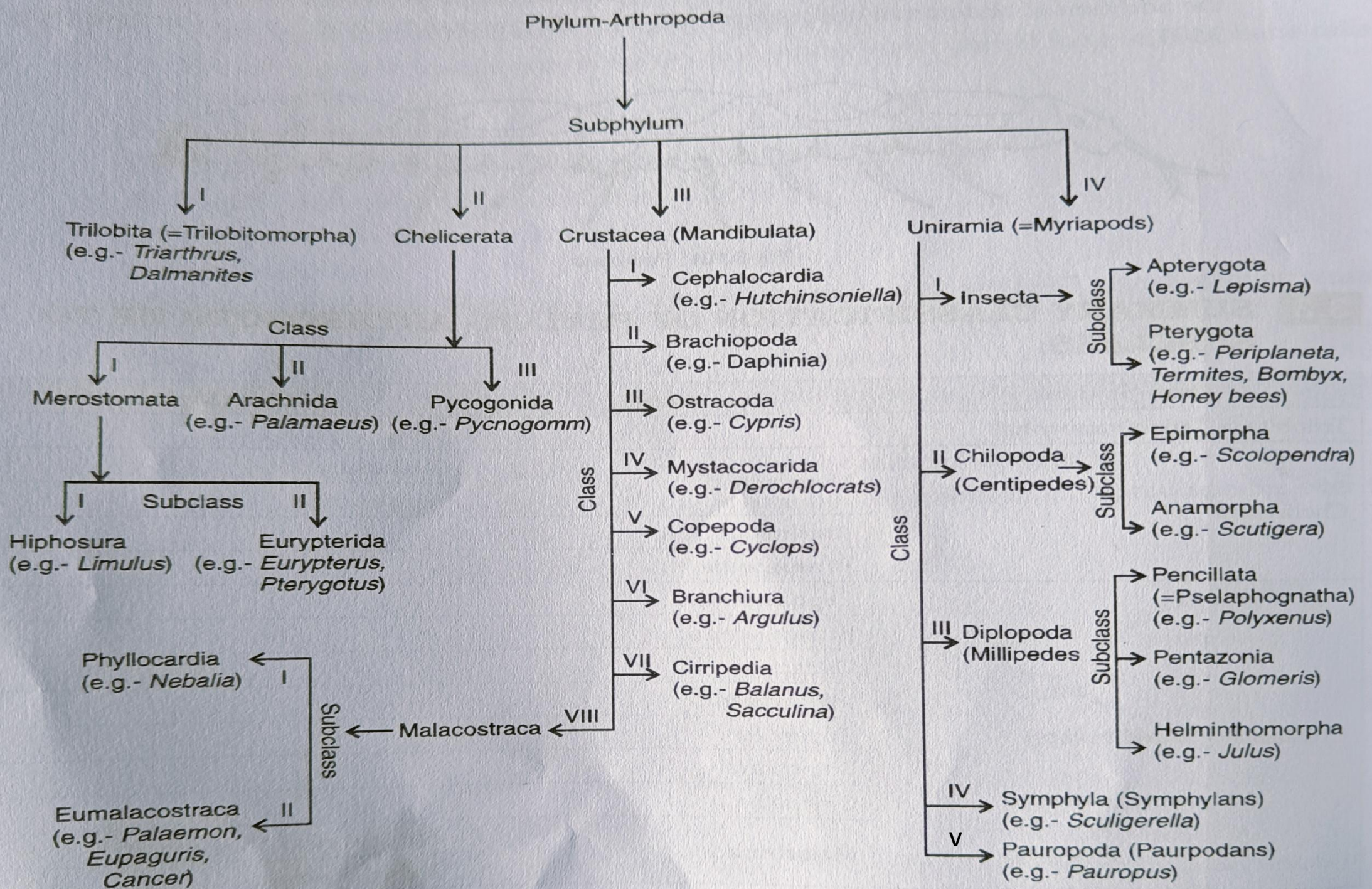


Classification : Arthropoda

(Barnes 1986)

Classification of Arthropoda up to classes



Subphylum I- Trilobitomorpha

Subphylum I. Trilobitomorpha

(Gr., *tri*, three + *lobos*, lobe + *morphe*, form)

1. Fossil trilobites. Mostly marine and bottom-dwellers. Cambrian to Permian.
2. Body 3-lobed, due to 2 longitudinal furrows.
3. Head distinct. Probably one pair of antennae.
4. Biramous appendages on all segments except the last one.

Examples : *Triarthrus*, *Dalmanites*.



Subphylum II - Chelicerata

Subphylum II. Chelicerata

(Gr., *chele*, claw + *keros*, horn + *ata*, group)

1. Body divided into an anterior cephalothorax (prosoma) and a posterior abdomen (opisthosoma).
2. Prosomatic appendages 6 pairs. First pair of preoral chelicerae with claws, followed by postoral pedipalps and 4 pairs of walking legs.
3. Antennae and true jaws absent.

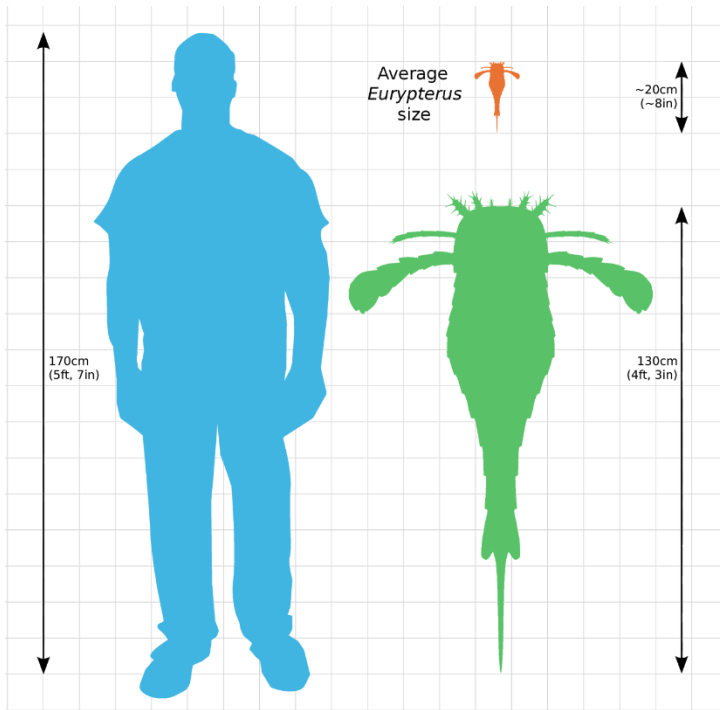
Class I: Merostomata

(Gr., *meros*, thigh + *stoma*, mouth)

1. Marine with median simple and lateral compound eyes.
2. 5 to 6 pairs of abdominal appendages with book-gills.
3. Abdomen ending in a sharp telson or spine.
4. Excretion by coxal glands. No Malpighian tubules.



7. 1. Extinct marine, giant water scorpions.
s 2. Cephalothorax small. Carapace plain, not
s extended.
n 3. Abdomen 12-segmented and narrowed
of behind.
s Examples : *Eurypterus*, *Pterygotus*.



Class II: Arachnida

(Gr., *arachne*, spider)

1. Terrestrial or aquatic. Eyes simple. No compound eyes.
2. Cephalothorax (prosoma) with 2 chelicerae, 2 pedipalps and 4 pairs of walking legs.
3. Abdomen generally without appendages.
4. Respiration by tracheae, book-lungs or both.
5. Excretion by coxal glands and malpighian tubules.
6. Dioecious. Mostly oviparous courtship before

Order 1. Scorpionida (= Scorpiones)

1. Elongated, fair-sized true scorpions.
 2. Small prosoma broadly joined to large opisthosoma, which is made of a broad anterior 7-segmented mesosoma, and a narrow posterior 5-segmented metasoma.
 3. Metasoma ending in a telson and poison sting.
 4. Two ventral comb-like sensory pectines on 2nd abdominal segment.
 5. Respiration by 4 pairs of book lungs.
- Examples : *Buthus*, *Palamnaeus*, *Androctonus*, *Centruroides* (= *Centrurus*).



Order 2. Pseudoscorpionida (= Chelonethida)

1. Tiny false scorpions.
 2. Abdomen 11- segmented, without sting and telson.
 3. Chelicerae 2. jointed, with comb-like serrations.
- Examples : *Chelifer*, *Microcreagris*.



Order 3. Araneae

1. True spiders Prosoma and opisthosoma without visible segments and joined by a narrow pedicel.
2. Chelicerae 2-jointed. With a poison duct in terminal claw.
3. Pedipalps leg-like, used for transfer of sperms in male.
4. Opisthosoma with 3 pairs of spinnerets. No telson.

Examples: *Lycosa* (wolf spider), *Agelena* (funnel-web spider), *Latrodectus* (black widow), *Achaearanea* (house spider), *Argiope* (writing spider).



Order 4. Solifugida (=Solifugae)

1. False spiders, sun spiders or wind spiders.
2. Prosoma divided into a large anterior and a small posterior part.
3. Opisthosoma of 10 or 11 segments. No spinnerets.
4. Chelicerae very large forming heavy pincers. No poison glands.
5. A flagellum on each chelicera of male, for sperm transfer.

Example : *Galeodes*.



Order 5. Palpigradi

1. Small-sized microwhip scorpions. Without eyes.

2. Prosomal carapace made of large anterior and small posterior portions.

3. Opisthosoma 11-segmented, ending in a large 15-jointed telson or flagellum.

Example : *Koenenia*.



Order 6. Pedipelpi (= Uropygi)

1. Elongate whip scorpions with 1 pair of eyes.
2. Prosomal carapace entire.
3. Opisthosoma 12-segmented. Last segment with a long flagellum or telson.
4. Pedipalps large, heavy, with terminal pincer.

Examples : *Mastigoproctus*, *Thelyphonus*.



Order 7. Amblypygi (= Phrynichida)

1. Flattened scorpion-spiders or tailers whip scorpions.
 2. Carapace undivided. Pedipalps large and raptorial.
 3. Abdomen 12-segmented, without flagellum.
 4. First pair of legs long, whip-like, sensory.
- Example: *Charinus*.



Order 8. Ricinulei (= Podogna)

1. Rare, small, tick-like, heavy-bodied arachnids.
2. Carapace with an anterior hood-like movable plate.
3. Opisthosoma 6-segmented. Narrow anteriorly with a posterior tubercle bearing anus.
4. Third pair of legs in male form copulatory organs.

Examples : *Ricinoides*, *Cryptocellus*.



Order 9. Opioliones (= Phalangida)

1. Spider-like Harvest-men, Harvest-spiders or daddy longlegs.
 2. Body small, oval. Legs extremely long, slender.
 3. Prosoma broadly joined to Opisthosoma.
 4. Scent glands under carapace. Two eyes.
- Examples : *Phalangium*, *Leiobunum*.



Order 10. Acarina

1. Ticks and mites. Free-living or parasitic.
2. Body small, oval, unsegmented, with no distinction between prosoma and opisthosoma.
3. Largest arachnid order with 20,000 species.
Examples : *Sarcoptes* (Itchomite), *Ixodes* (Sheep tick), *Dermacentor* (Dog tick), *Argas* (Bird tick).



Class3: Pycnogonida

1. Commonly referred to as sea spiders.
 2. Very small in size.
 3. Body mainly consists of cephalothorax, abdomen reduced.
 4. Pedipalpi short segmented and chelicerae very small.
 5. Usually eight pairs of long walking legs.
 6. Mouth placed on a long proboscis.
 7. Eyes simple and 4 in number.
 8. Respiratory and excretory organs wanting.
 9. Sexes separate (dioecious); females with a pair of ovigers for carrying eggs.
- Examples : *Pycnogonum*, *Nymphon*.



Subphylum: Crustacea (Mandibulata)

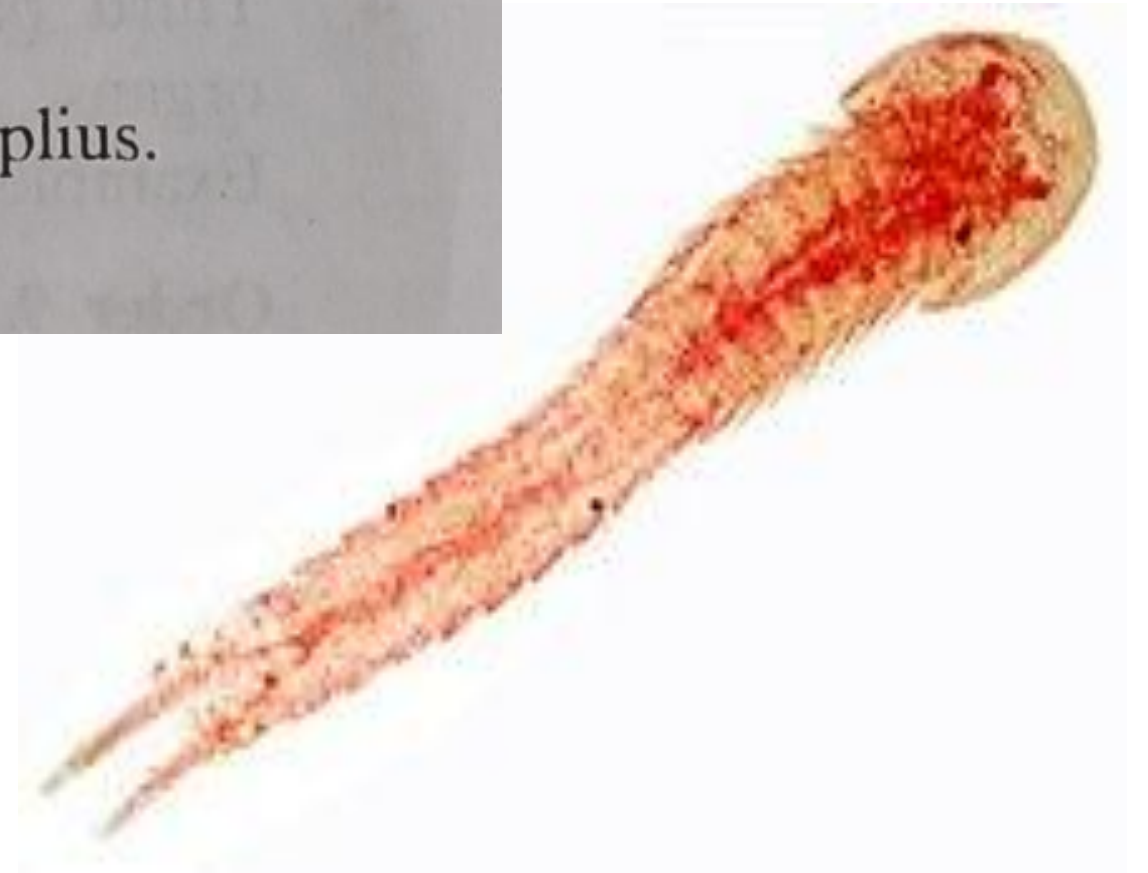
(L., *mandibula*, mandible + *ata*, group)

1. Body divisible into head, thorax and abdomen.
2. Head appendages are 1 or 2 pairs of antennae, 1 pair of jaws or mandibles and 1 or 2 pairs of maxillae.
3. Compound eyes common.

Class 1

Cephalocarida

1. Body made of a horseshoe-shaped head and 19 trunk segments. Only anterior 9 trunk segments bear appendages that appear triramous.
2. Antennae short. Eyes absent.
3. Hermaphrodite. Larva a metanauplius.
Example : *Hutchinsoniella*.



Class2 *Branchiopoda*

1. Primitive, small-sized, mostly freshwater.
2. Trunk appendages leaf-like, serving for respiration (gills), locomotion and filter-feeding.
3. Antennules and 2nd maxillae reduced or absent.
4. Abdomen ends in a pair of jointed or unjointed caudal styles or cercopods.



Class3

Ostracoda

1. Minute mussel or seed shrimps with poorly segmented body entirely enclosed in a bivalved carapace.
2. Trunk appendages 2 pairs, leg-like.
3. Antennules and antennae large, used in swimming.

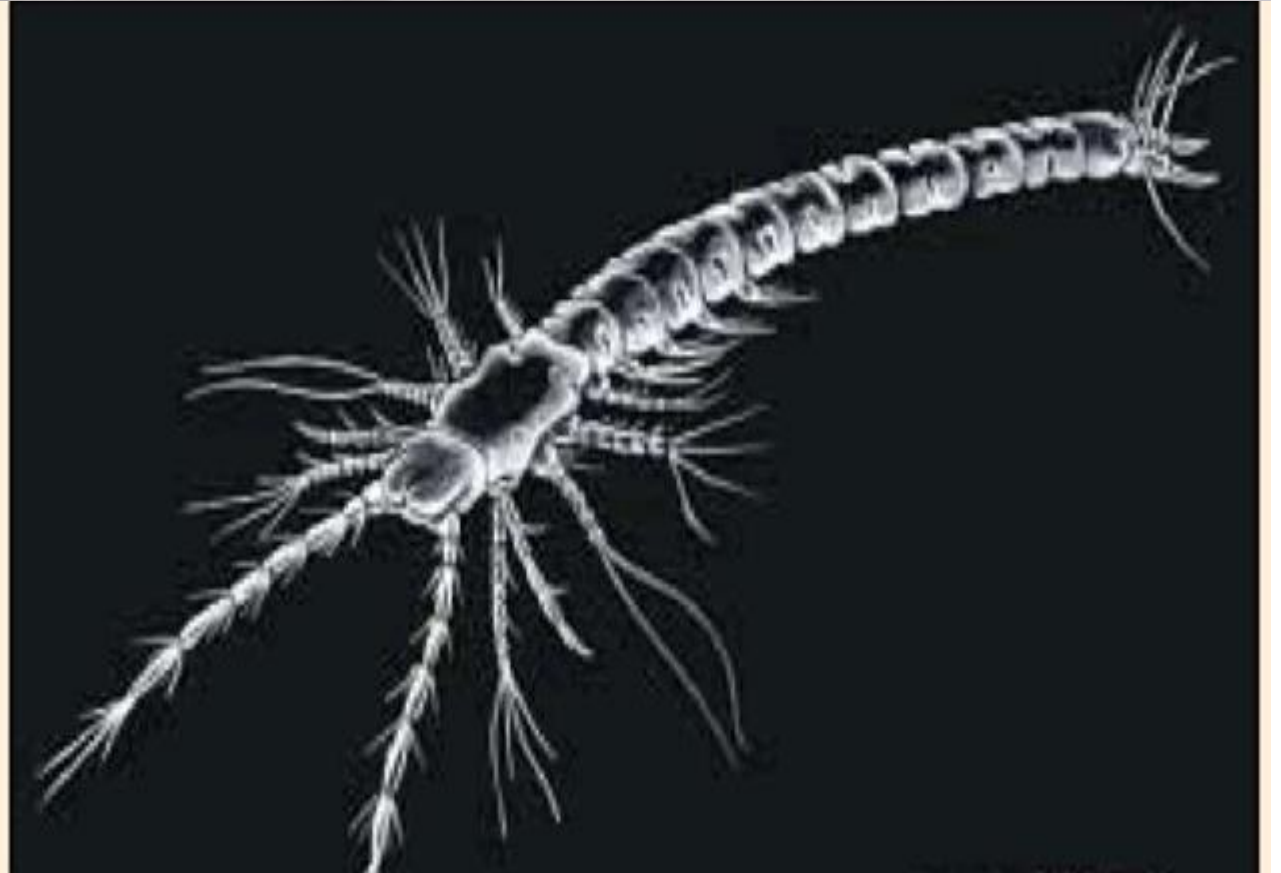


Cypridina

Class4

Mystacocarida

1. Primitive. Body microscopic. Antennules and Antennae prominent.
2. A single median eye. No compound eyes.
3. Abdomen limbless. A pair of caudal styles.
Example : *Derocheilocaris*.



Class5

Copepoda

1. Body small, made of head, thorax and abdomen.

2. No carapace. No compound eyes but a median eye.

3. Antennules long. Antennae smaller.

4. Abdomen limbless. Telson with two caudal styles.

Examples : *Cyclops*, *Ergasilus*, *Caligus*.



Class6

Branchiura

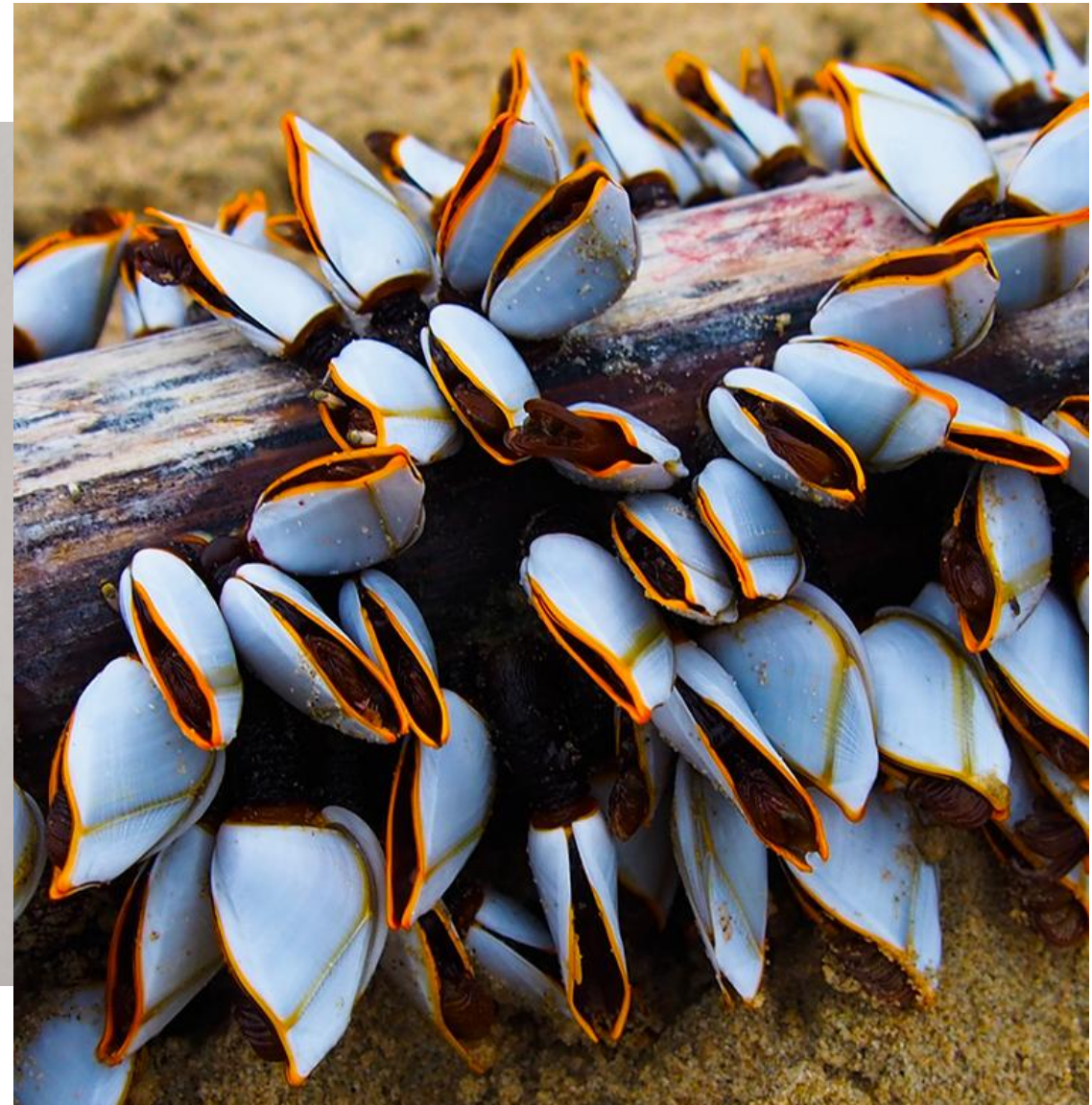
1. Fish lice. Temporarily ectoparasites of skin and gill chambers of fishes and some amphibians.
2. Body dorso-ventrally flattened.
3. Shield-like carapace covers head and thorax.
4. A pair of sessile compound eyes. Mouth suctorial.
5. Antennules and antennae reduced.
6. First maxillae modified into suckers.
7. Abdomen unsegmented, bilobed. Caudal claws minute.

Examples : *Argulus*, *Dolops*.



Class7 *Cirripedia*

1. Barnacles. Adults sessile, attached or parasitic.
2. Carapace forms two folds of mantle surrounding body and covered externally by calcareous plates.
3. Thoracic limbs 6 pairs, biramous and cirriform.
4. Antennules become cement glands for attachment.
5. Antennae and compound eyes are lost in adult.
6. Abdomen rudimentary with caudal styles.
7. Nauplius larva passes through a cypris stage.



Class8 *Malacostraca*

Body large-sized. Typically made of 19 segments.

Head and one or more thoracic segments form cephalothorax.

Carapace well-formed or vestigial or absent.

Paired compound eyes stalked or sessile.

Abdomen ends in a telson. No caudal styles.

Important orders are as follows :

Shrimps, crayfishes, Lobsters, prawns, crabs, etc.

Carapace well-developed. Usually enclosing gill chambers on sides of cephalothorax.

First 3 pairs of thoracic limbs form maxillipedes.

Gills usually in 3 series present on thorax.

Statocyst present. Larva typically a zoea.



Subclass- Phyllocardia:

1. Comprises of most primitive existing malacostracans.
2. Abdomen 8 segmented.
3. Carapace bivalve, e.g. – *Nebalia* (Fig- 3.40).



Subclass: Eumalacostraca:

1. Antenna without 3 flagella.
2. Abdomen without 7th segment.
3. Carapace present or absent; if present shield like.
4. Tubular heart.
5. Uropod modified to fan like tail.
6. Gills thoracic or abdominal.
7. Carapace shield like.
8. Compound eyes with or without stalks, e.g. - *Mysis* (Opossum shrimp) (Fig- 3.41), *Oniscus*, (Fig- 3.42), *Squilla* (Mantis shrimps) (Fig- 3.43), *Caprella* (Fig- 3.44), *Palaemon* (Prawn) (Fig- 3.45), *Anaspides* (Fig- 3.46), *Parabathynella* (Fig- 3.47), *Euphausia* (Fig- 3.48), *Diastylis* (Fig- 3.49), *Leptochelia* (Fig- 3.50), *Eupagurus* (= *Pagurus*), Cancer.



Subphylum IV: Uniramia or Myriapod

1. Bears unbranched appendages.
2. Bears a single pair of antennae.
3. Exchange of gases through tracheae.
4. Excretory organs are malpighian tubules.
5. Heart is a dorsal tube extending through the length of the trunk having a pair of ostia in each segment.
6. Ventral nerve cord contains a ganglion in each segment.
7. Spermatophore is highly developed for indirect transfer of sperms.

Class I- Insecta

(*L. insectus*, cut or divided)

1. Body made of head (6 fused segments), thorax (3 segments) and abdomen (up to 11 segments).
2. Head with compound eyes (1 pair), antennae (1 pair) mandibles (1 pair) and maxillae (2 pairs).
3. Mouth parts modified for different feeding habits.
4. Thorax with 3 pairs of jointed legs and 1 or 2 pairs of wings which may be absent.
5. Respiration by tracheae. Spiracles lateral.
6. Excretion by Malpighian tubules.
7. Unisexual. Fertilization internal.
Development usually with metamorphosis.

Subclass 1. Apterygota (Ametabola)

1. Primitively wingless insects.
2. Abdomen with cerci and style-like appendages.
3. Little or no metamorphosis.

Order 1. Protura

1. No antennae, true eyes and metamorphosis.
2. Abdomen of 11 segments plus a telson.

Example : *Acerentulus*.



Order 2. Collembola

1. No eyes, tracheae, Malpighian tubules and metamorphosis. Mouth parts chewing or sucking.
2. Abdomen 6-segmented, with a springing organ.
Examples : Springtails. *Achorutes*, *Sminthurus*.



Order 3. Thysanura

1. Body covered by minute silvery scales.
2. Antennae long. Mouth parts chewing.
3. Abdomen 11-segmented. Cerci and telson long.

Example : *Lepisma* (silver fish)



Subclass 2. Pterygota (Metabola)

1. Wings present. Secondarily lost in some.
2. No abdominal appendages except cerci.
3. Metamorphosis complete or incomplete.

Division (a). Exopterygota (Heterometabola)

1. Wings develop externally as buds.
2. Metamorphosis gradual. Young stages are nymphs.

Order 1. Orthoptera

1. Wings 2 pairs. Forewings straight and leathery. Hindwings membranous and folded at rest.
2. Mouth parts chewing. Prothorax large. Hindlegs jumping.

Examples: *Romalia* and *Poecillocercus* (Grasshoppers), *Schistocerca* (Locust), *Periplaneta* (Cockroach), *Gryllus* or *Acheta* (Cricket), *Mantis* (Praying mantis), *Phyllium* (Leaf insect), *Carausius* (Stick insect).



Order 2. Isoptera

1. Wings 2 pairs. Held flat on back. Or wingless.
2. Mouth parts chewing. Social insects with many castes.
Examples : Termites or white ants.



Order 3. Dermaptera

1. Forewings small, leathery. Hindwings large, semicircular.
2. Mouth parts chewing. Forcep-like cerci at the tip of abdomen for offense and defense.
Example : *Forficula* (Earwig).



Order 4. Ephemeroptera

1. Wings 2 pairs, membranous. Forewings longer and triangular. Hindwings smaller and rounded.
2. Adult mouth parts vestigial. Mandibulate in nymphs.
3. Abdomen carries long cerci and caudal filament.

Example : *Ephemera* (Mayfly).



Order 5. Odonata

1. Wings 2 pairs, membranous. Eyes very large.
 2. Mouth parts chewing. Predaceous.
- Examples : Dragon flies, Damsel flies.



Order 6. Plecoptera

1. Wings 2 pairs, membranous, longer than body.
 2. Antennae long. Mouth parts chewing.
 3. Naiads usually with tracheal gills.
- Example : *Isoperla* (Stonefly).



Order 7. Psocoptera (= Corrodentia)

1. Wingless or forewings larger than hindwings.
2. Antennae long. Mouthparts chewing. Cerci absent.

Examples: Book lice (wingless), Bark lice (winged).



Order 8. Mallophaga

1. Wings absent. Body small. Head large. Mouth parts chewing. Eyes degenerate. Legs clasping.
2. Ectoparasitic on skin, hairs and feathers of mammals and birds.
Examples : Bird lice, Biting lice (on mammals).



Order 9. Anoplura (= Siphunculata)

1. No wings. Body broad, flat. Head small. Mouth parts piercing and sucking.
2. Claws clinging to hairs. Ectoparasitic on mammals.

Example : *Pediculus* (Human louse). (Z-1)



Order 10. Thysanoptera

1. Wings 2 pairs, similar, fringed with long hairs.
2. Mouth parts rasping and sucking.
Example : Thrips.



Order 11. Hemiptera

1. Wings 2 pairs or wingless. Forewings thickened at base, membranous at tip (*hemelytra*).
2. Mouth parts piercing-sucking, forming jointed beak.

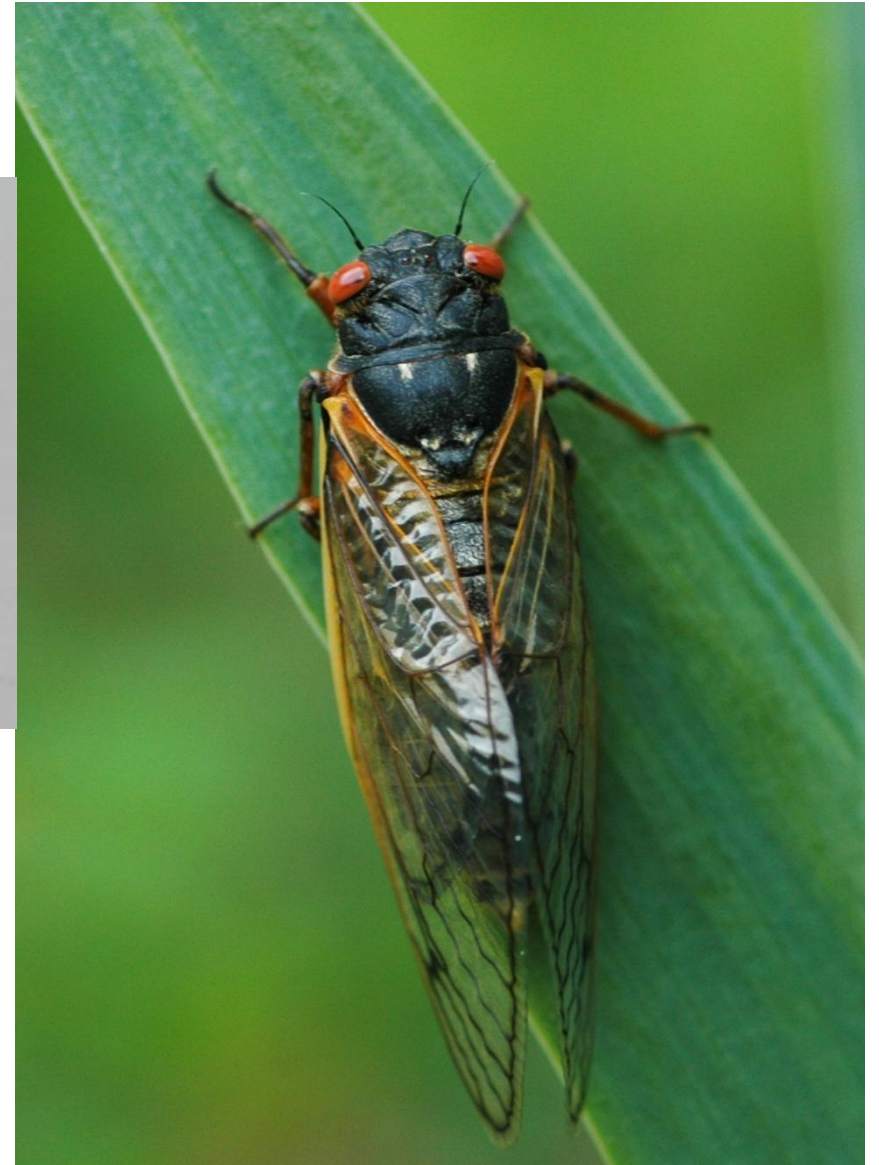
Examples : Bedbug (*Cimex*), Giant water bug (*Belostoma*), Water scorpion (*Ranatra*).



Order 12. Homoptera

1. Wingless or 2 pairs of uniform membranous wings.
2. Mouth parts form a piercing and sucking beak.

Examples : Cicadas, Aphids, Scale insects.



Division (b). Endopterygota (Holometabola)

1. Wings develop internally in pupal case.
2. Metamorphosis complete with larval and pupal stages.

Order 1. Neuroptera

1. Wings large, membranous, many-veined.
2. Antennae long. Mouth parts chewing. Cerci absent.
3. Larvae carnivorous. Abdominal gills in aquatic larvae.

Examples : *Crysopa* (Lacewing), *Myrmeleon* (Antlion).



Order 2. Coleoptera

1. Forewings leathery (elytra). Hindwings membranous, folding.
2. Antennae variously modified. Mouth parts chewing.

Examples : Beetles.



Order 3. Mecoptera

1. Wings long, similar, narrow, membranous.
2. Mouth parts chewing, on a prolonged beak.
3. In male, tip of abdomen curved sting-like.

Example : *Panorpa* (Scorpion fly).



Order 4. Trichoptera

1. Wings long, hairy, folded roof-like over abdomen.
2. Antennae long. Mouth parts rudimentary.
3. Larva pupates within a tube of foreign particles.
Example : Caddis flies.



Order 5. Lepidoptera

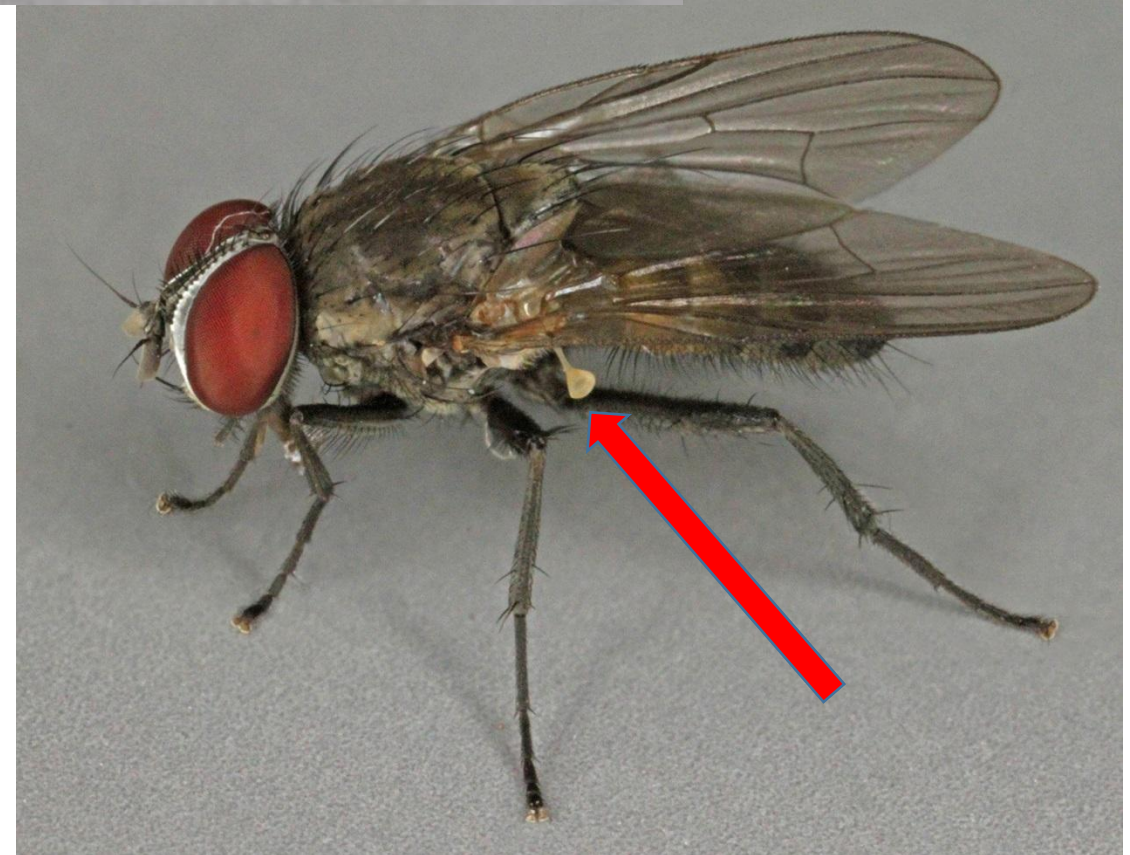
1. Wings membranous, covered with overlapping scales.
2. Mouth parts sucking, coiled under head.
3. Larva a caterpillar with chewing mouth parts.

Examples : Butterflies (antennae filamentous), Moths (antennae feathery).



Order 6. Diptera

1. Wings 1 pair. Hindwings as knob-like halteres.
 2. Mouth parts piercing-sucking or sponging.
 3. Larva limbless, wormlike, called maggot.
- Examples : *Musca* (House fly), *Culex* (Mosquito), *Drosophila* (Fruit fly).



Order 7. Hymenoptera

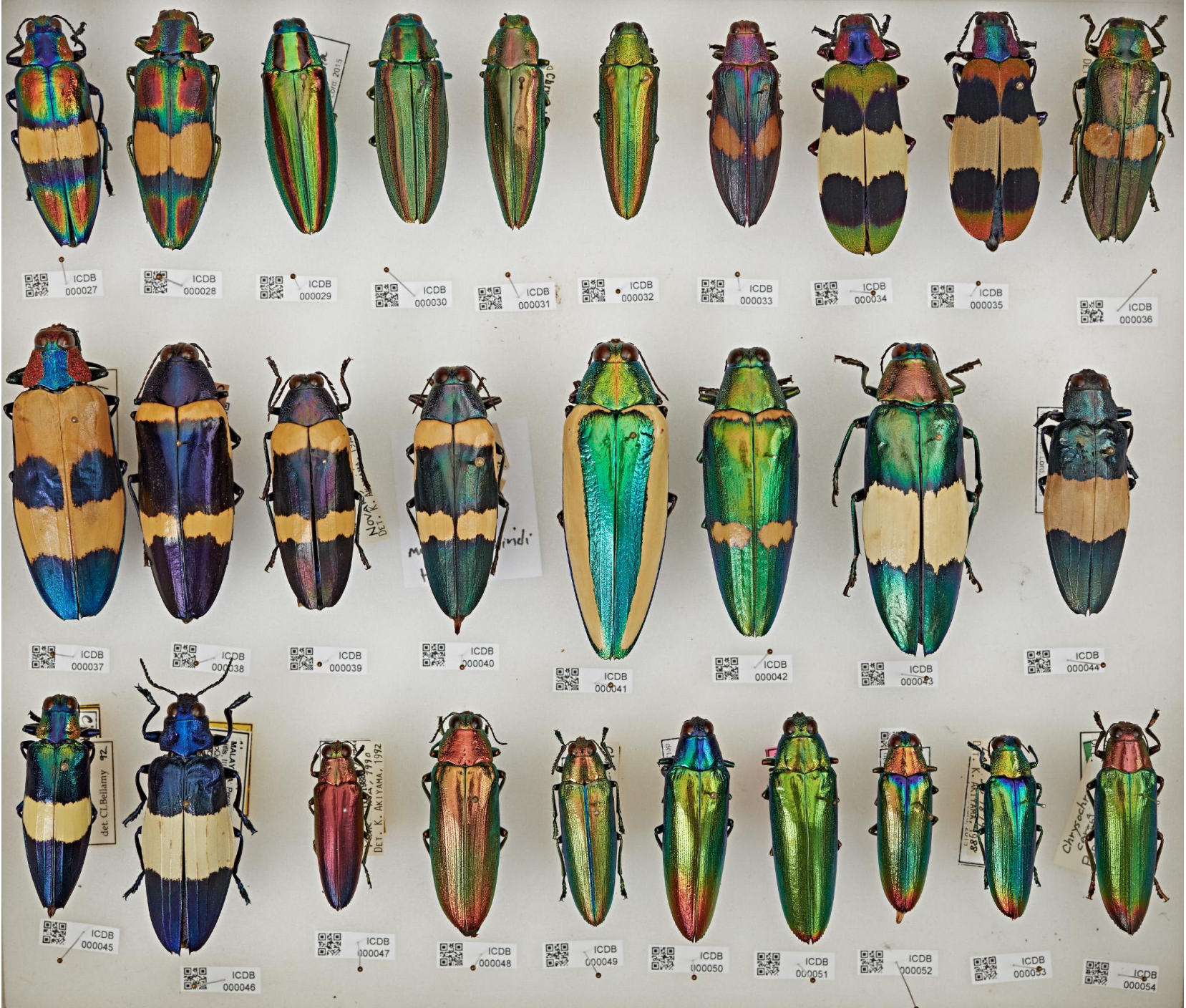
1. Wings 2 pairs, similar, membranous. On each side hooked together during flight.
2. Mouth parts sucking or chewing. Ovipositor of female usually forms a piercing sting.
3. Highly specialized. Some social in behaviour.
Examples : *Apis* (Honey bee), *Vespa*, Ants.



Order 8. Siphonaptera

1. Small. Laterally flattened. Secondarily wingless.
2. Mouth parts piercing-sucking. Legs long, leaping.
3. Ectoparasites on birds and mammals.
Examples : *Pulex* and *Xenopsylla* (Fleas).









ClassII- Chilopoda

(Gr., *cheilos*, lip + *pous* (foot))

1. Centipedes. Body dorso-ventrally flattened and divisible into head and 15 to 173 trunk segments.
 2. Legs 1 pair on each trunk segment.
 3. Mandibles 1 pair. Maxillae 2 pairs (Trignatha)
 4. First pair of legs form poison claws.
- Examples : *Scutigera*, *Lithobius*, *Scolopendra*.



ClassIII- Diplopoda

1. Includes **millipedes** or thousand-leggers.
2. Body cylindrical, subcylindrical, elongated and capable of being rolled up.
3. Body divisible into **head, thorax** and **abdomen**.
4. Head consists of five segments, thorax of four segments and abdomen of 20–100 segments.
5. Head possesses one pair of **antennae**, one pair of **mandibles** and one pair of **maxillae**.
6. Thoracic segments with one pair of legs in each, while abdominal segments bear two pairs of legs.
7. Poison claws not found.
8. **Herbivorous** in food habit.
9. Gonopores mid-ventrally situated on 3rd abdominal segment.

Order 1. Pselaphognatha

1. Minute, body covered with serrated bristles.
2. Trunk bears 11 or 13 segments.
3. Gnathochilarium (fused maxillae of both the sides) with a pair of palps.
4. Integument soft.
5. Stink glands absent.

Examples : *Polyxenus*, *Lophoproctus*.



Order 2. Pentazonia

1. Body capable of being rolled up into a tight ball.
2. Trunk with 13–15 segments.
3. Each trunk segment with five sclerites.
4. One or two pairs of male gonopods, *i.e.*, clasping organs present.
5. Stink glands not found.

Examples : *Glomeris*, *Onomeris*.



Order 3. Nematomorpha

1. Body segments 26 to 60; trunk segments 26 to 32.
2. Spinning glands two or three pairs.
3. Male gonopods one or two pairs on 7th segment.
4. Eyes present.
5. Commonly referred to as silk-spinning millipedes.

Examples : *Striaria*, *Cleidogono*.



Order 4. Juliformia

1. Trunk with 40 or more segments, commonly called snake millipedes.
2. Male gonopods one or two pairs on 7th segment.
3. Spinning glands not found.
4. Stink glands present on most of the trunk segments.

Examples : *Julus*, *Spirobolus*.



Order 5. Colobognatha

1. Trunk with 30 to 192 flattened segments commonly called **suctorial millipedes**.
2. Head conical and mouth parts small.
3. Male gonopods two pairs, one pair each in segments 7th and 8th.
4. Stink glands present.

Examples : *Polyzonium*, *Platydesmus*.



Order 6. Polydesmoidea

1. Trunk with 19 to 22 segments, commonly called **flat-backed millipedes**.
2. Male gonopods one or two pairs on 7th segments.
3. Spinning glands absent but stink glands present.

Examples : *Polydesmus*, *Oxidus*.



Class IV- Symphyla

(Gr., *Syn*, together + *phylon*, tribe)
Body slender made of head and 15-22 trunk segments with 10-12 pairs of legs. No eyes.
Example : *Scutigera*.



Class V- Pauropoda

(Gr., *pauros*, small + *pous*, foot)

Minute grub-like body divisible into head and 11-12 trunk segments with 9-10 pairs of legs. No eyes.

Example : *Pauropus*.



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