DEPARTMENT OF ZOOLOGY

RANIGANJ GIRLS' COLLEGE

SEARSOL, RANIGANJ,

PASCHIM BARDHAMAN

CLASS - III

CORE COURSE - III

UNIT - 3

GENERAL CHARACTERISTICS AND CLASSIFICATION OF THE PHYLUM ARTHROPODA

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GENERAL CHARACTERISTICS OF THE PHYLUM ARTHROPODA

[Greek: *arthron*, 'joint' + *podos*, 'feet']

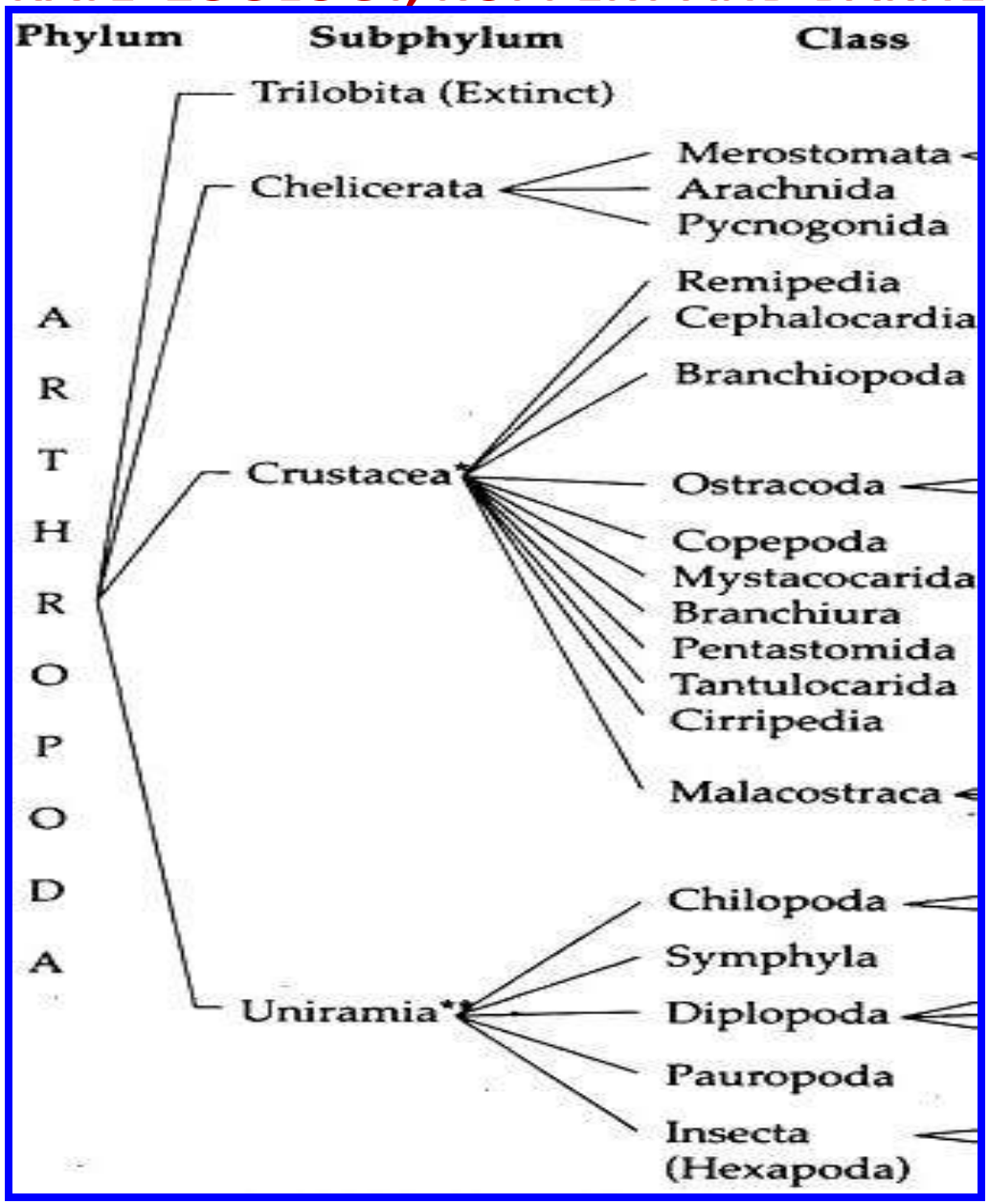
- **Protostomes are bilaterally symmetrical and triploblastic.**
- **Body is segmented both externally and internally.**
- **Body segmentation is due to the teleoblastic growth.**
- **Body divided into head (cephalon) and trunk.**
- **Additional regional segmentation (tagmosis) may occur.**
- **Head consists of labrum and non segmental acron.**
- **Cuticular exoskeleton is composed of chitin and resilin protein.**
- **Cuticles are dorsal sclerites, lateral pleurites and ventral sternites.**
- **Body segment bears paired jointed appendages, attached ventrally.**
- **Appendages are made of a protopod and a telopod.**
- **Protopod articles with medial endites and lateral exites.**
- **Head with a pair of compound eyes and one to several simple eyes.**
- **Coelom is restricted in reproductive and excretory system.**

- **Body cavity is hemocoel or mixocoel.**
- **Open circulatory system.**
- **Heart is a dorsal muscular pump with ostia.**
- **Nervous system bears cerebral ganglia, circumoesophagial connectives and paired ganglionated nerve cords.**
- **Inner wall of the gut is lined by peritrophic membrane.**
- **Protocerebrum form ocular centre.**
- **Deutocerebrum form antennal centre.**
- **Gut is complete and highly regionalized.**
- **Muscles metamerically arranged, striated and grouped.**
- **Circular somatic muscle absent.**
- **Intersegmental tendon system persist.**
- **Excretory organs are malpighian tubules and saccules (end sacs).**
- **Most are dioecious; some are parthenogenic.**
- **Centrolecithal egg; superficial cleavage.**
- **Metamorphosis is ecdysone mediated moulting (ecdysis).**
- **Development is direct, indirect or mixed.**

PHYLUM ARTHROPODA: CLASSIFICATION UPTO CLASSES

[INVERTEBRATE ZOOLOGY, RUPPERT AND BARNES, 1994]

THE OUTLINE CLASSIFICATORY PLAN



❖ SCHEME OF ARTHROPOD CLASSIFICATION WITH EXAMPLE

❖PHYLUM: ARTHROPODA

1. SUBPHYLUM:TRILOBITA (Extinct)

Example: *Rediaspis*

2. SUBPHYLUM:CHELICERATA

- CLASS: Merostomata
  - Example: *Limulus*
- CLASS: Pycnogonida
  - Example: *Pycnogonum*
- CLASS: Arachnida
  - Example: *Buthus*

3. SUBPHYLUM:CRUSTACEA

- CLASS: Remipedia
  - Example: *Pleomothra*
- CLASS: Cephalocarida
  - Example: *Chiltoniella*
- CLASS: Branchiopoda
  - Example: *Daphnia*
- CLASS: Ostracoda
  - Example: *Cypris*
- CLASS: Copepoda
  - Example: *Cyclops*
- CLASS: Mystacocarida
  - Example: *Derocheilocaris*
- CLASS: Tantulocarida
  - Example: *Basipodella*
- CLASS: Branchiura
  - Example: *Argulus*
- CLASS: Cirripedia
  - Example: *Lepas*
- CLASS: Malacostraca
  - Example: *Hippa*

4. SUBPHYLUM:UNIRAMIA

- CLASS: Chilopoda
  - Example: *Scolopendra*
- CLASS: Symphyla
  - Example: *Scolopendrella*
- CLASS: Diplopoda
  - Example: *Glomeris*
- CLASS: Pauropoda
  - Example: *Pauropus*
- CLASS: Insecta
  - Example: *Culex*

❑ 1. SUBPHYLUM: TRILOBITA

- Extinct, Paleozoic forms.
- Body is Trilobed and divided into cephalon, thorax and pygidium.

✓ **Example:** ***Rediaspis, Megalaspis*** **etc.**

❑ 2. SUBPHYLUM: CHELICERATA [Greek: *chele,* 'talon' + *cerata,* 'horns']

- Body composed of prosoma and opisthosoma.
- Prosoma consists of presegmental acron and six somites.
- Prosoma often covered by dorsal carapace.
- Opisthosoma is made by upto 12 segments with no legs.
- Opisthosoma bears a post-segmental tail.
- Prosoma bears multiarticulated and uniramous appendages.
- Appendages are 1 pair chelicerae, 1 pair pedipalpi and 4 pairs legs.
- No antennae and jaws.
- Median ocelli present.
- 8^{th} segment bears gonopore.

➢ CLASS: MEROSTOMATA

- [Greek: *meros,* 'part'+ *stoma,* 'mouth'].

- Marine chelicerates.
- Prosoma is enclosed by large shield-like carapace.
- Opisthosoma undivided in some forms.
- Opisthosoma may divided into mesosoma and metasoma.
- Telson is long, prominent, spiked.
- Opisthosomal appendages (5-6 pairs) modified as gills.
- Gill or book gill helps in respiration.
- Pedipalps and walking legs are similar.

✓Example: *Limulus, Pterygotus* etc.

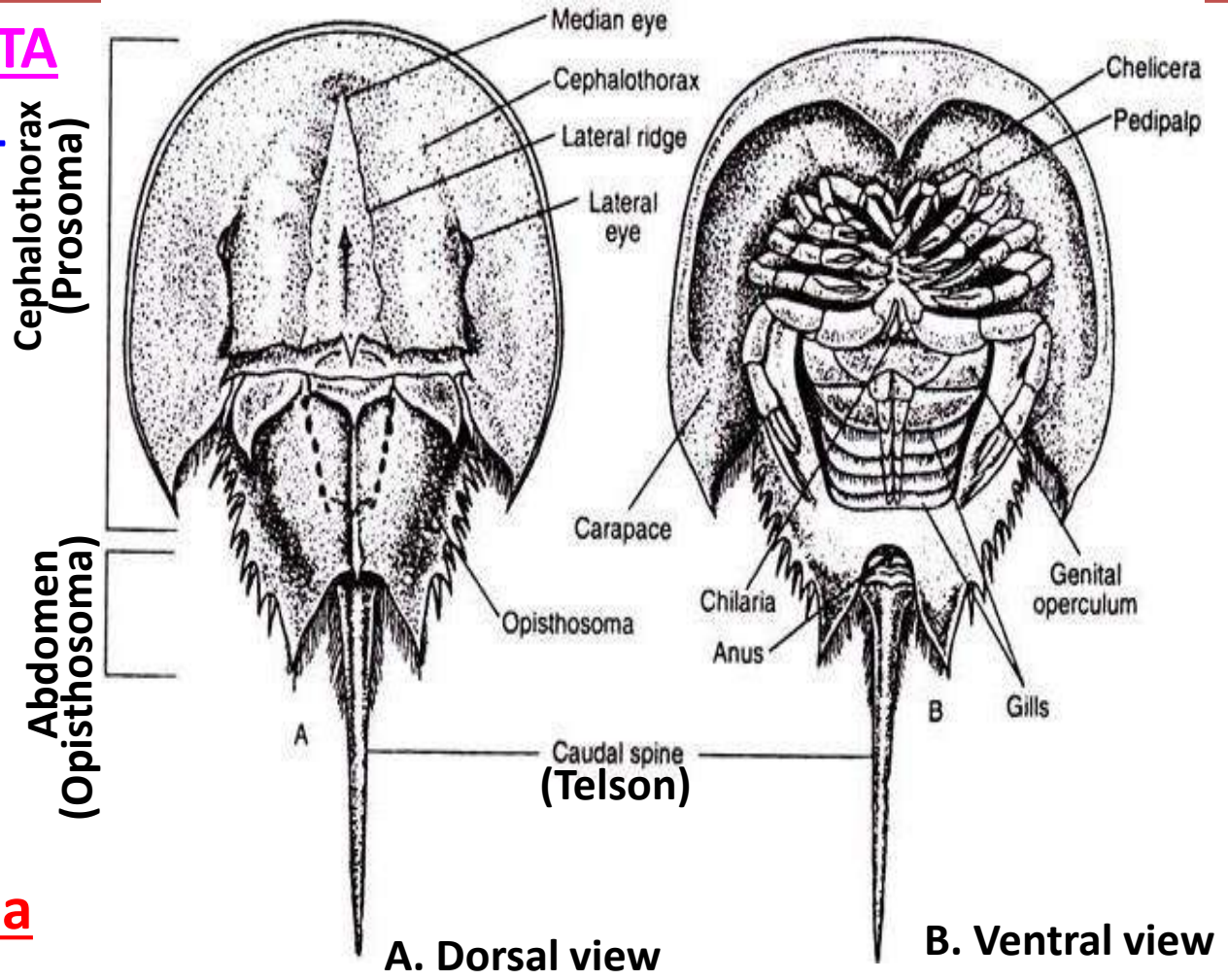


Fig: External features of *Limulus.*

➢ CLASS: PYCNOGONIDA (SEA SPIDERS)

○ [Greek: *pyknos,* 'thick' + *gony,* 'knee']

- Small, benthic, marine.
- Body consists of cephalothorax and abdomen.
- Abdomen reduced.
- Long anterior proboscis bears mouth.
- Head bears four eyes.
- 1 pair of ovigerous legs,
  1 pair pedipalps and
  4 pairs walking legs.
- Multiple gonopores.
- No special organ of respiration and excretion.
- Dioecious, life cycle involves protonymphon larva.

✓ Example: *Pycnogonum, Nymphon* etc.

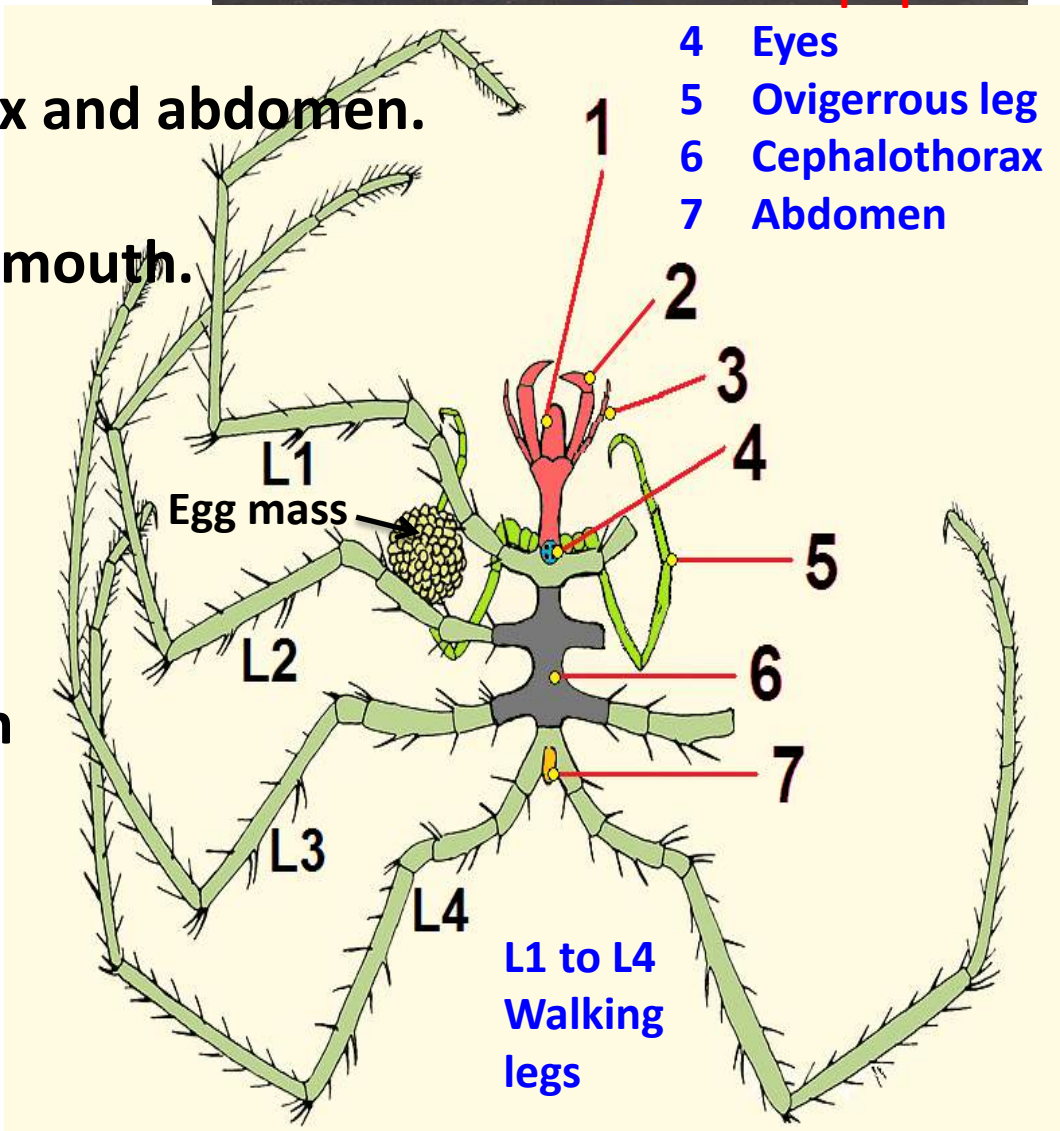


Fig. External features of *Nymphon*

➢ CLASS: ARACHNIDA [Greek: *arakhne*, 'spider']

- Body divided into prosoma and ophisthosoma.
- Prosoma bears simple eyes.
- Prosoma with1 pair chelicerae, 1 pair pedipalps and 4 pairs legs.
- Opisthosomal appendages may modified into spinnerets.
- Trachea or book lung as respiratory organ.
- Dioecious, internal fertilization.
- Excretory organs are malpighian tubules, coxal gands and nephrocytes.
- Predatory form use poison or silk in prey capturing.

✓ Example: *Buthus* (Scorpion), *Lycosa* (Spider) etc.

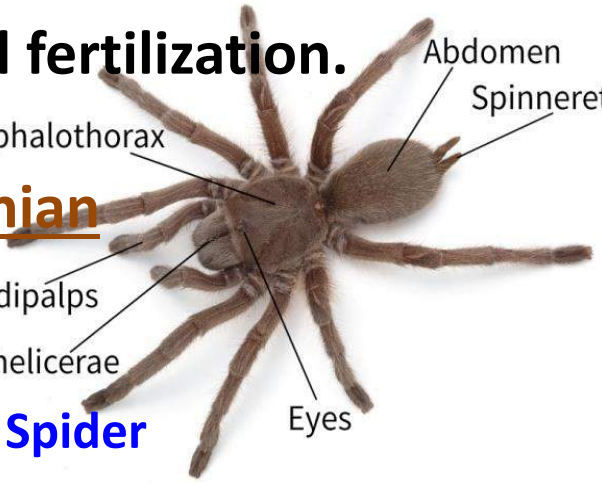
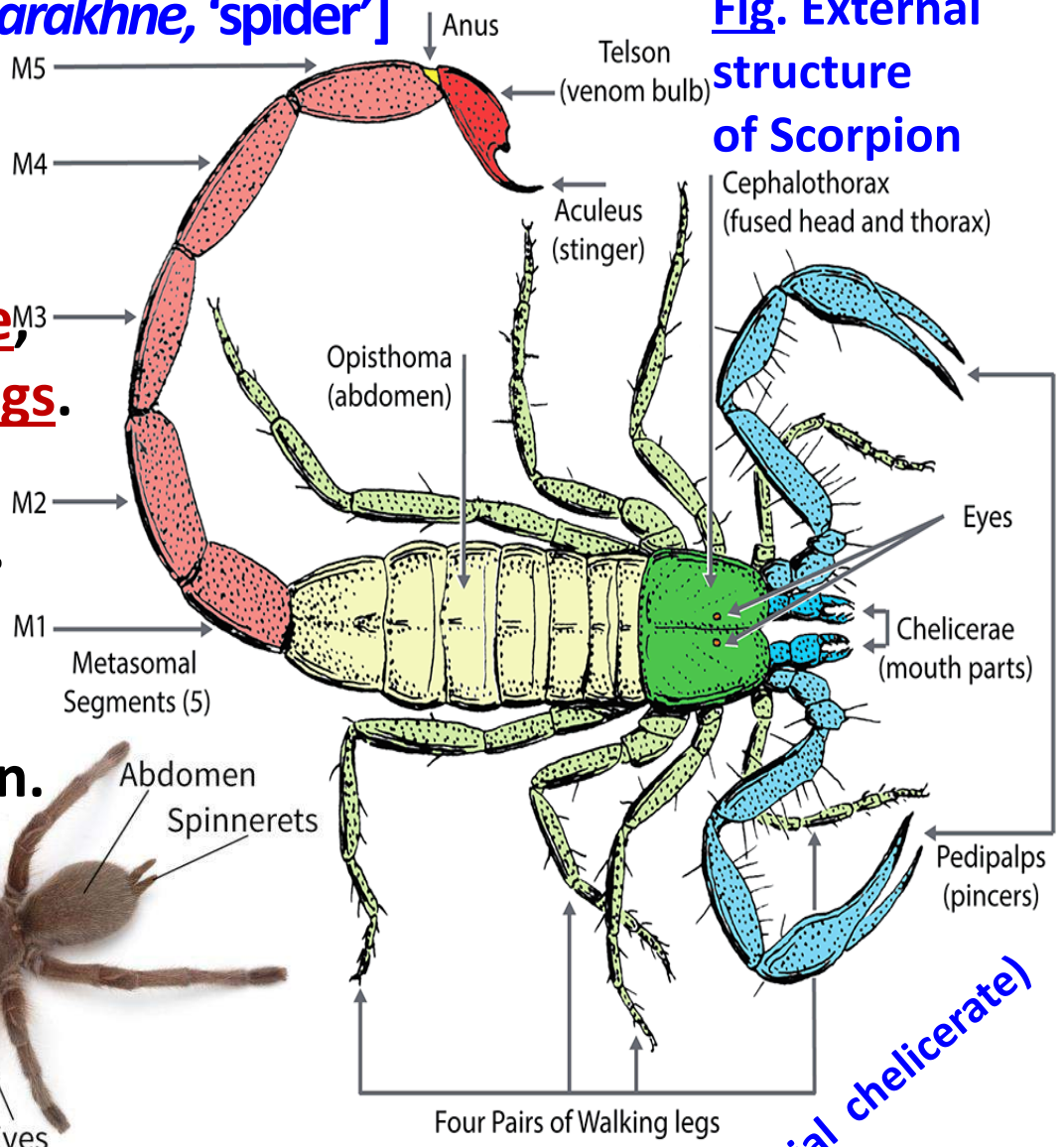


Fig. Spider

Fig. External structure of Scorpion



(All are terrestrial chelicerate)

3. SUBPHYLUM: CRUSTACEA [Latin: *crusta*, 'a crust']

- Body divisible into head and cephalon with acron.
- Head contain 2 pairs antennae, 1 pair mandibles & 2 pairs maxillae.
- Cylindrical or leaf like appendages are biramous.
- Head and thorax often fused to form cephalothorax.
- Cephalothorax covered by dorsal carapace.
- Presence of compound eyes and/or median naupliar eye.
- Long postcephalic trunk with thorax and abdomen.
- Trunk ends in uropods and a telson.
- Each segment covered by sclerite (exoskeleton).
- Digestive caeca present.
- Respiration through gills.
- Excretory organs are green glands.
- Development involve larval forms like nauplius, zoea etc.

CLASS: REMIPEDIA

- [Latin: *remipedes*, 'oar-footed']
- Marine, elongated, worm like.
- Translucent and segmented body .
- Short, carapace-less cephalothorax.
- Trunk bears over 30 similar segments.
- Each segment bears paired laterally directed biramous appendages.
- 1st trunk appendages are modified as prehensile maxillipeds.
- Eyes absent.
- Hermaphrodite.
- ✓ Example: *Pleomothra, Godzillius* etc.
- Venomous crustacean:

  Speleonectes tulumensis.

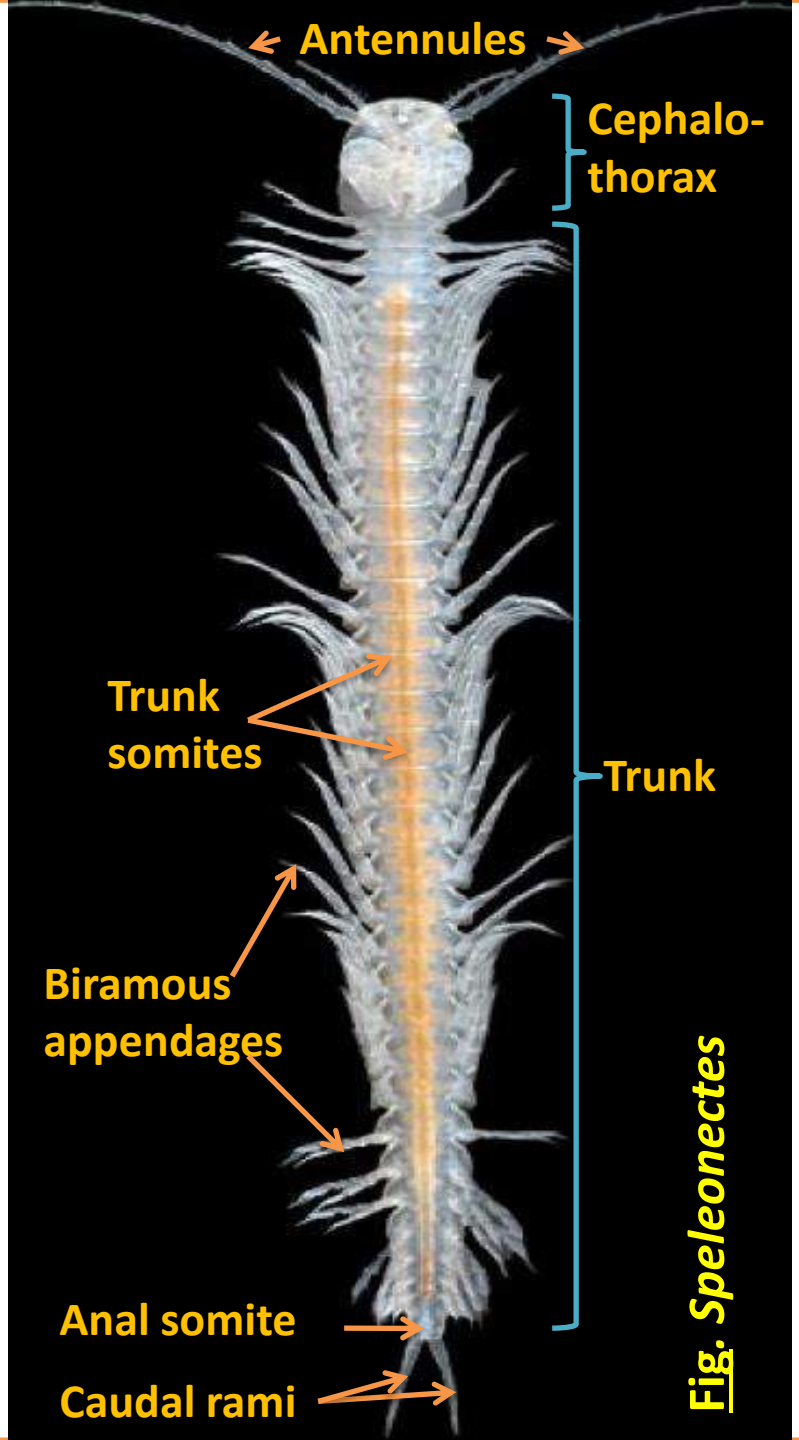


Fig. *Speleonectes*

➢ CLASS: CEPHALOCARIDA

- [Greek: *kephale*,'head'+*karis*,'shrimp']
- Marine, benthic.
- Body divided head, thorax and abdomen.
- Trunk elongated, segmented; bears a telson with a long furca.
- 8 pairs of thoracic appendages are identical.
- No eyes.
- No cephalothorax or carapace.
- Limbs have 3 parts.
- Exopodite 4-jointed, leaf like and bear lateral pseudoepipodites.
- Hermaphrodite, development involves metanauplius larva.

✓ **Example:** *Chiltoniella, Lightiella* etc.

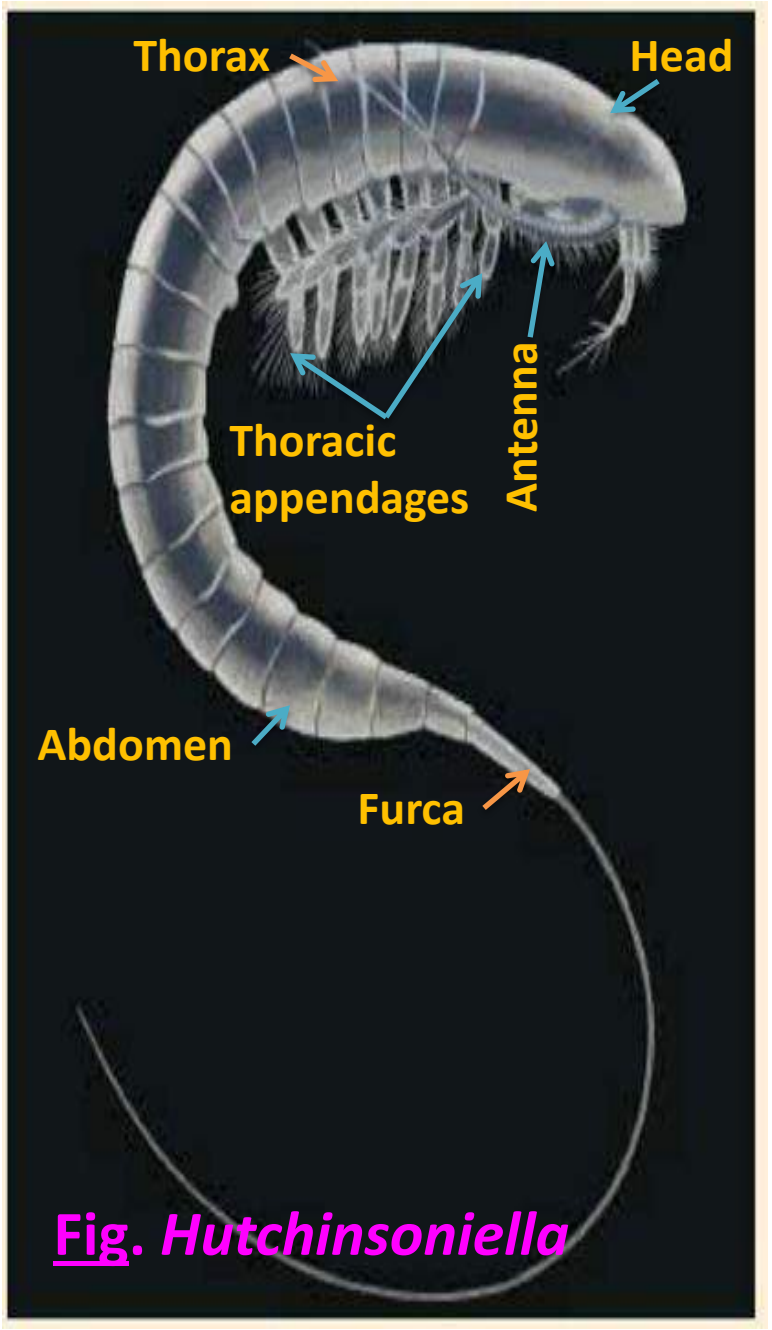


Fig. *Hutchinsoniella*

➢ CLASS: BRANCHIOPODA (GILL FEET)

- [Greek: *brankhia,* 'gills'+ *pous,* 'foot']
- Bivalve shell or dorsal shield covers the body.
- Trunk appendages uniform and flattened leaf like.
- Flattened epipod serves as gill (commonly called gill feet).
- Antennules and maxillae absent.
- Thorax enclosed by a carapace.
- Caudal styles paired, jointed or unjointed.
- Parthenogenesis is common.

✓ Example: *Daphnia* (water flea), *Triops* (tadpole shrimp) etc.

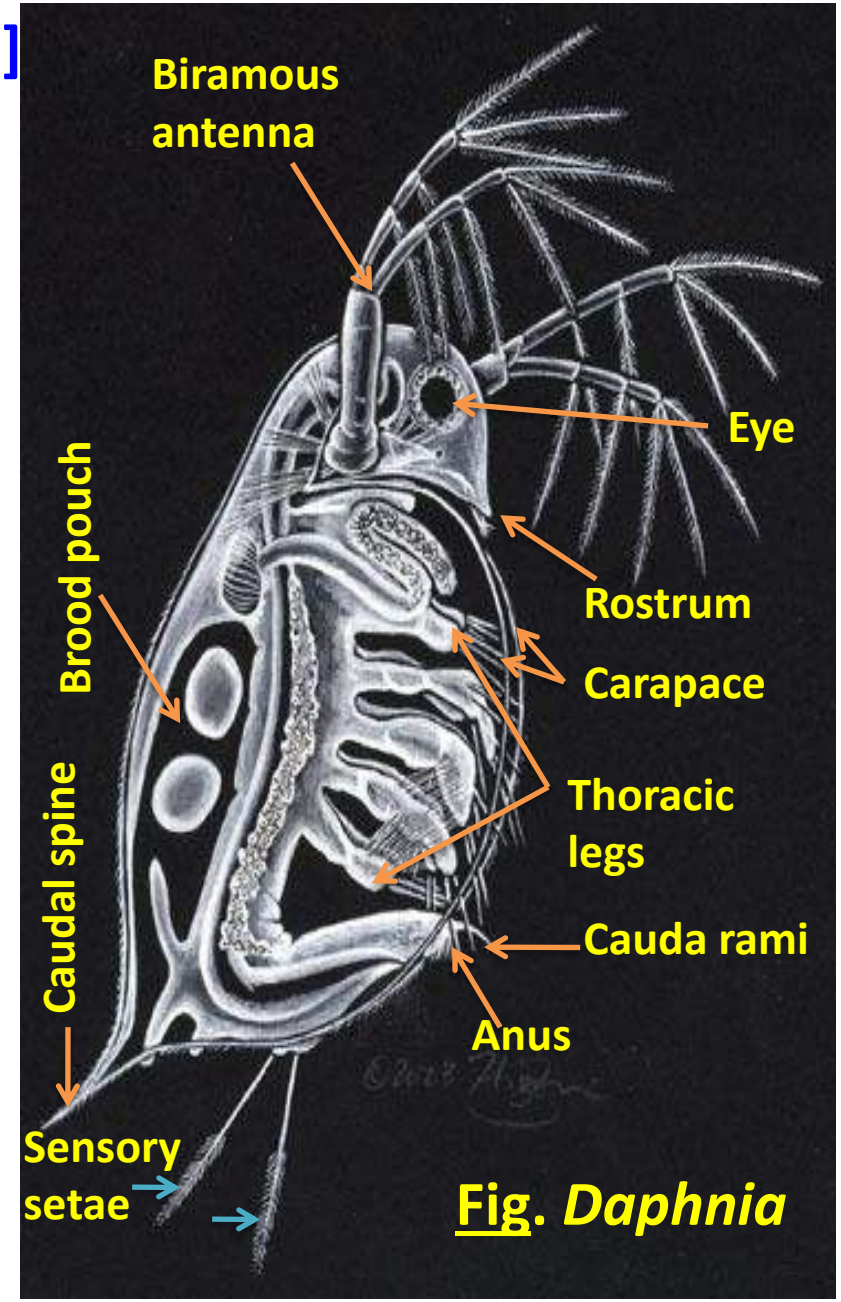
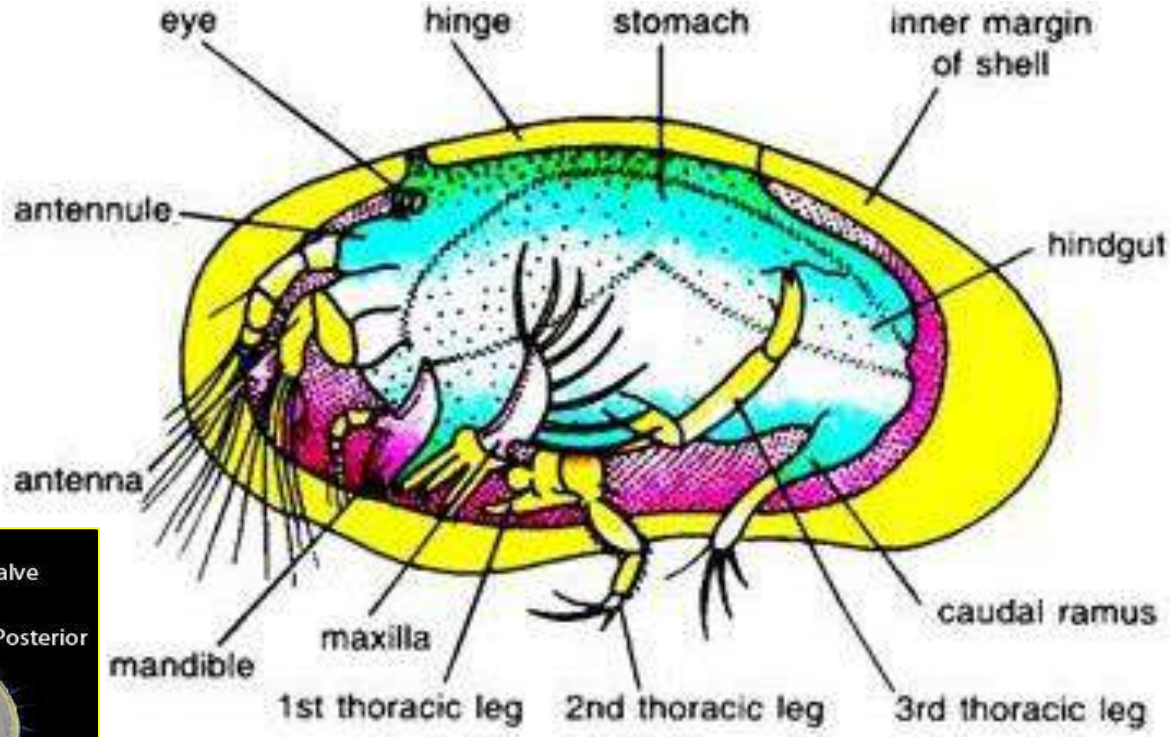


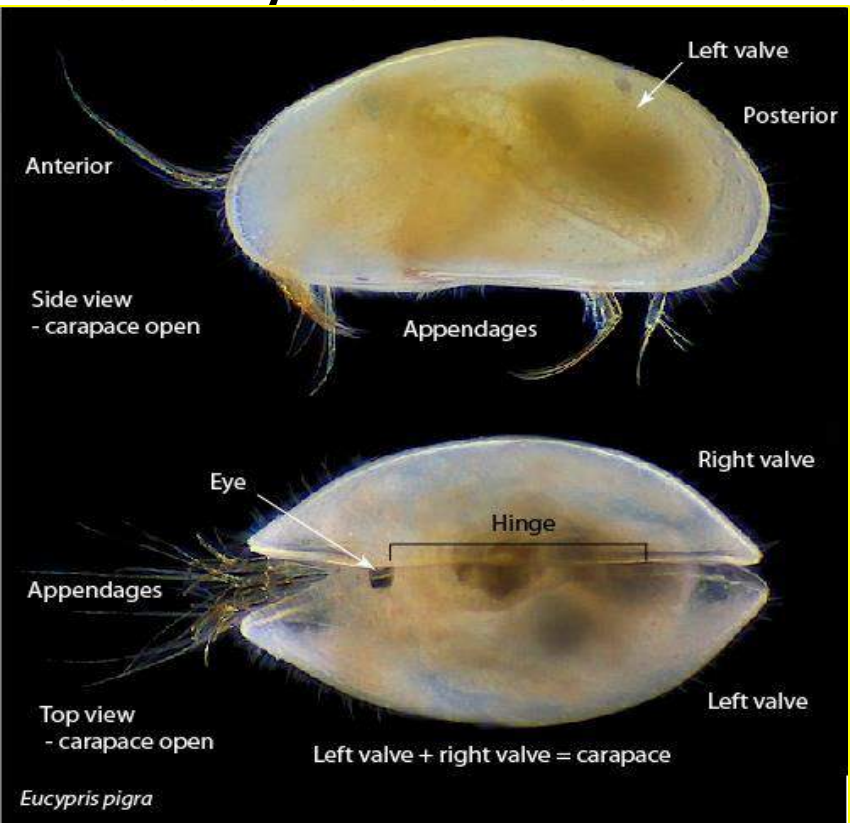
Fig. *Daphnia*

➢ CLASS: OSTRACODA (SEED SHRIMP)

Fig. *Cypris* (colour is not natural)



- [Greek: *ostrakon,* 'shell']
- Aquatic forms, laterally compressed body, no distinct segmentation.
- Bivalve carapace covers head and trunk.
- Trunk bears 1-3 pairs of stout cylindrical limbs.



- Abdomen bears caudal rami.
- Male bears copulatory limbs.
- A median, simple naupliar or 'maxillopodan eye'.
- Large head contains antennules, antennae, mandibles and 1st maxillae.
- No gill, respiration through integument.

✓ Example: *Cypris, Eucypris.*

➢ CLASS: COPEPODA (paddle-like feet) [Greek: *kope,* 'handle' + *pous,* 'foot']

- Cylindrical body, covered by cephalic shield, no carapace.
- Body bears cephalosome, metasome and urosome.
- 5 pairs of thoracic biramous appendages.
- Abdomen with no appendages.
- No compound eyes.
- Maxillopodan eye present.
- Telson present.

✓ **Example:** *Cyclops, Calanus* etc.

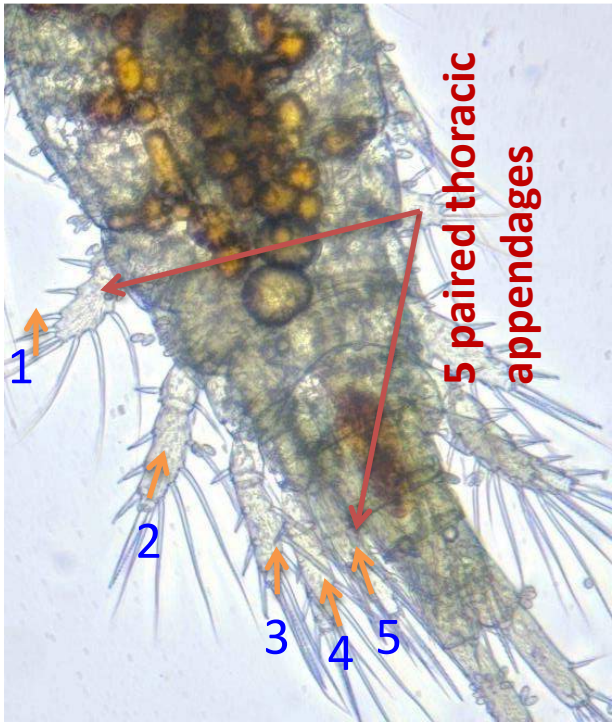


Fig. Cyclop; posterior part

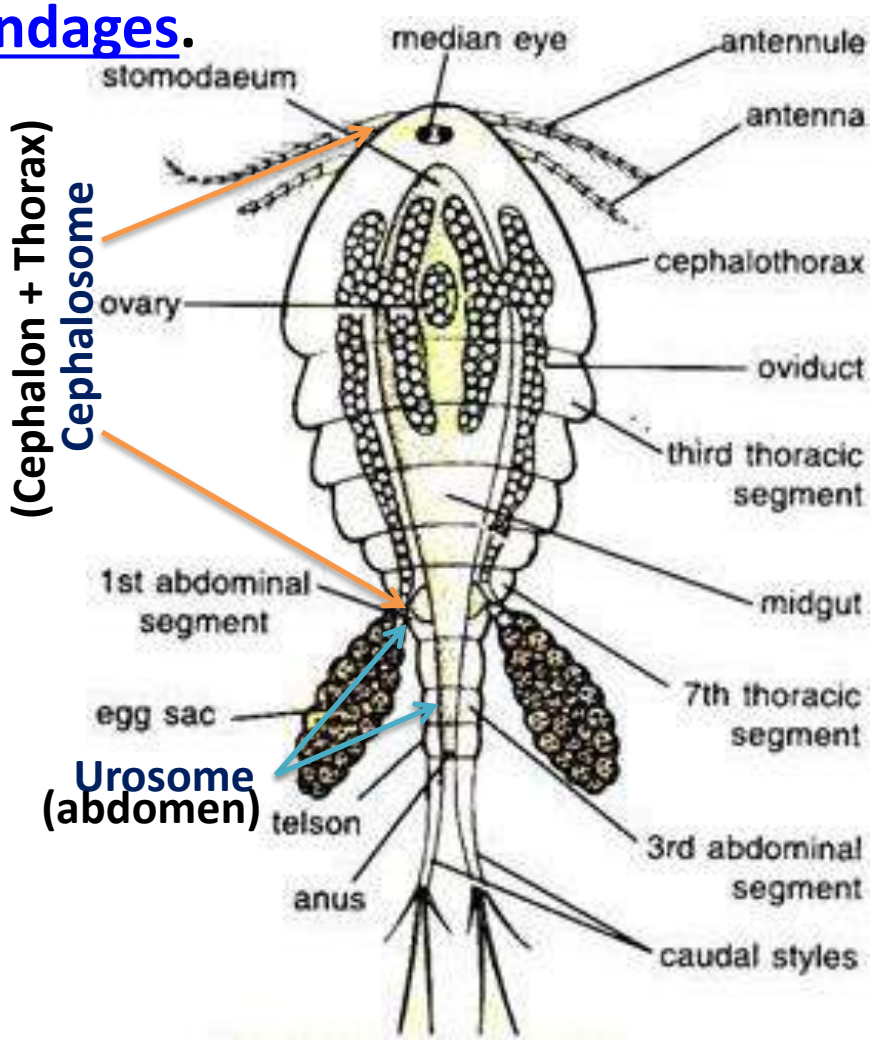


Fig. *Cyclops*

➢ CLASS: MYSTACOCARIDA ('BRUSH SHRIMP')

- [Greek: *mystak, 'u*pper lip'(moustache)]

- Marine, microscopic.
- Head divisible into small anterior and a large posterior part.
- Body elongated with cephalic appendages.
- Trunk with 10 segments; first five bear appendages, first one is maxilliped.
- Caudal styles are 2, work as spincers.
- No compound eye
- Median naupliar eye present

✓ **Example:** *Derocheilocaris, Ctenocheilocaris.*

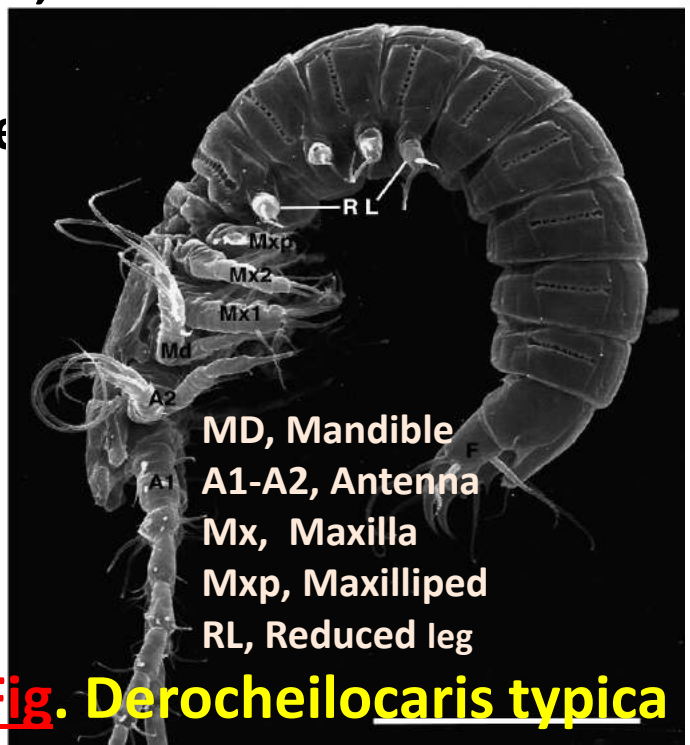


Fig. Derocheilocaris typica

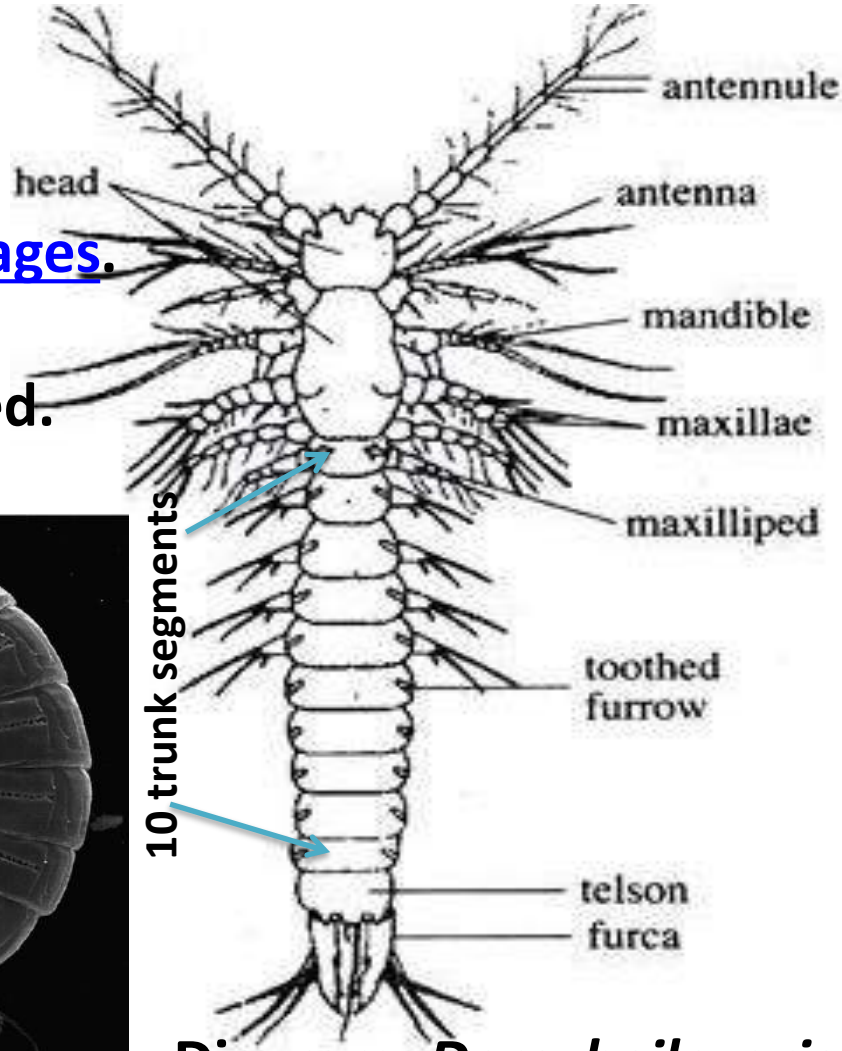


Diagram: *Derocheilocaris*

➢ CLASS: TANTULOCARIDA

- Marine, minute, ectoparasitic.
- Lack of cephalic appendages.
- Elongated body, no trunk appendages.
- Head with no appendage and eye.
- 6 abdominal somites.
- Thorax six segmented bearing five pairs of biramous limbs and a posterior uniramous one.
- Cephalic stylet persist.

✓ **Example:** ***Basipodella, Serratotantulus.***

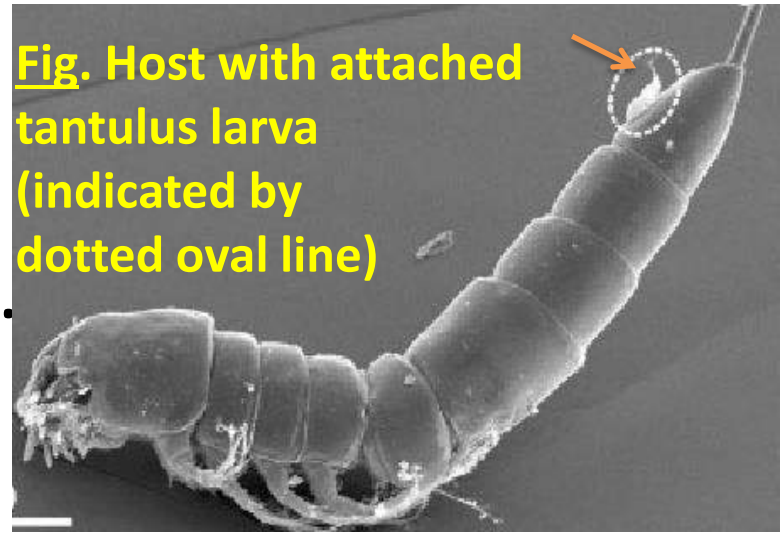


Fig. Host with attached tantulus larva (indicated by dotted oval line)

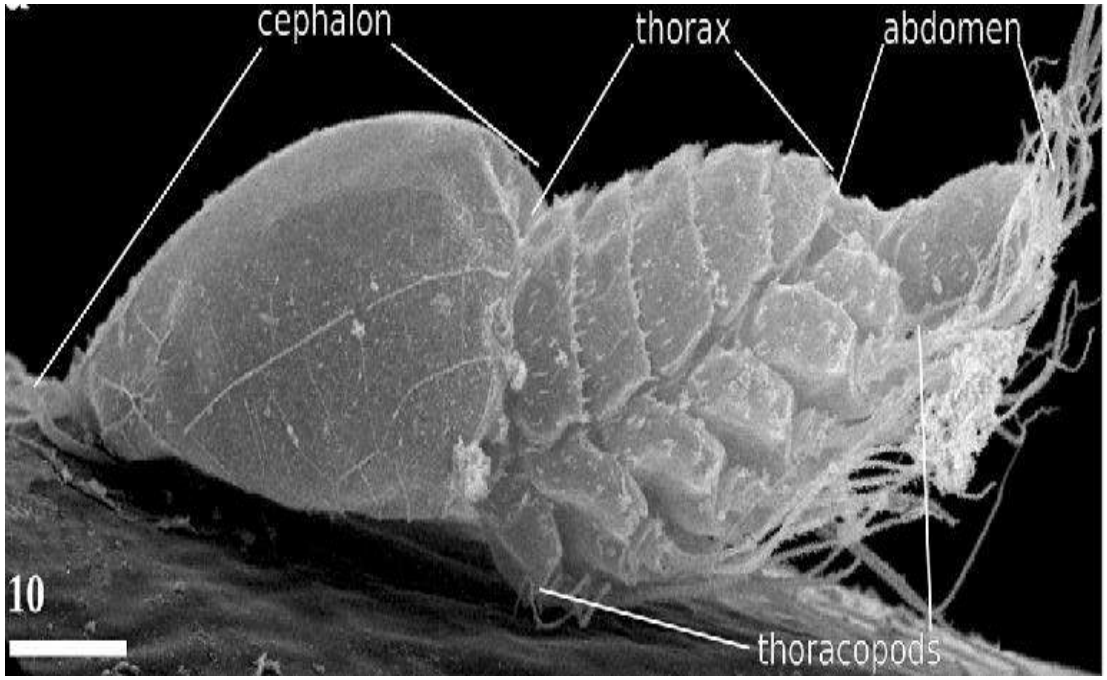


Fig. General morphology of the tantulus larva. *Serratotantulus chetoprudae.*

➢ CLASS: BRANCHIURA

- **Ectoparasite of fish.**
- **Body oval, compact and** dorsoventrally flattened**.**
- **Head and most of the trunk covered by carapace.**
- **Abdomen small, unsegmented, bilobed, with no limbs.**
- **Antennae and antennules reduced.**
- **Bases of the maxillae modified into 2 suckers.**
- **4 pairs of thoracic appendages for swimming.**
- **Paired compound eyes are sessile.**
- **Median simple eyes 1-3 in number.**

✓**Example:** ***Argulus, Dolops*** **etc.**

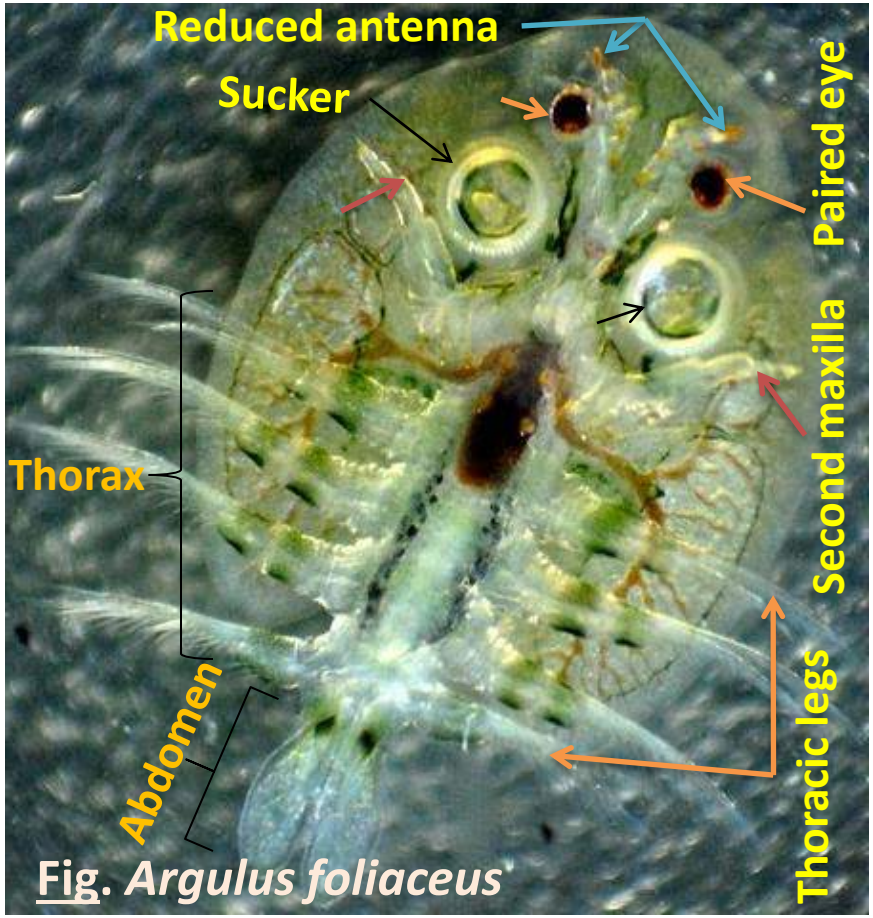
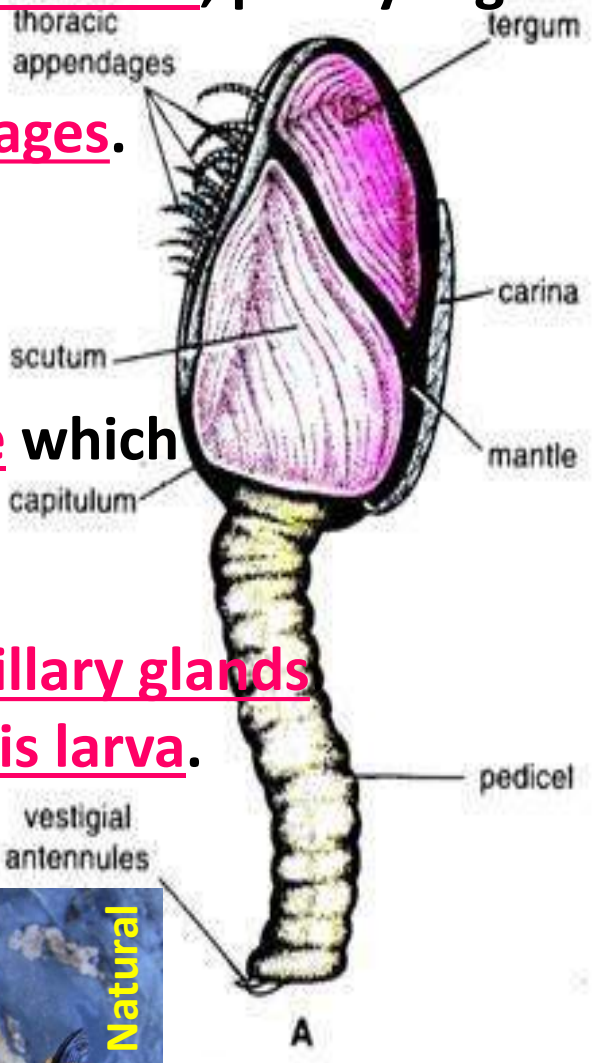


Fig. *Argulus foliaceus*

➢ CLASS: CIRRIPEDIA (BARNACLES) [Latin: *cirrus*,'fringe'+ pes 'foot']

- Exclusively marine; nonmobile, poorly segmented Body.
- Thorax 6 segmented with biramous appendages.
- Abdomen limbless.
- Caudal rami present.
- No telson.
- Carapace forms mantle which covers whole body.
- Gill absent.
- Excretion through maxillary glands
- Life cycle involves Cypris larva.

✓ Example: *Lepas*, *Balanus* etc.



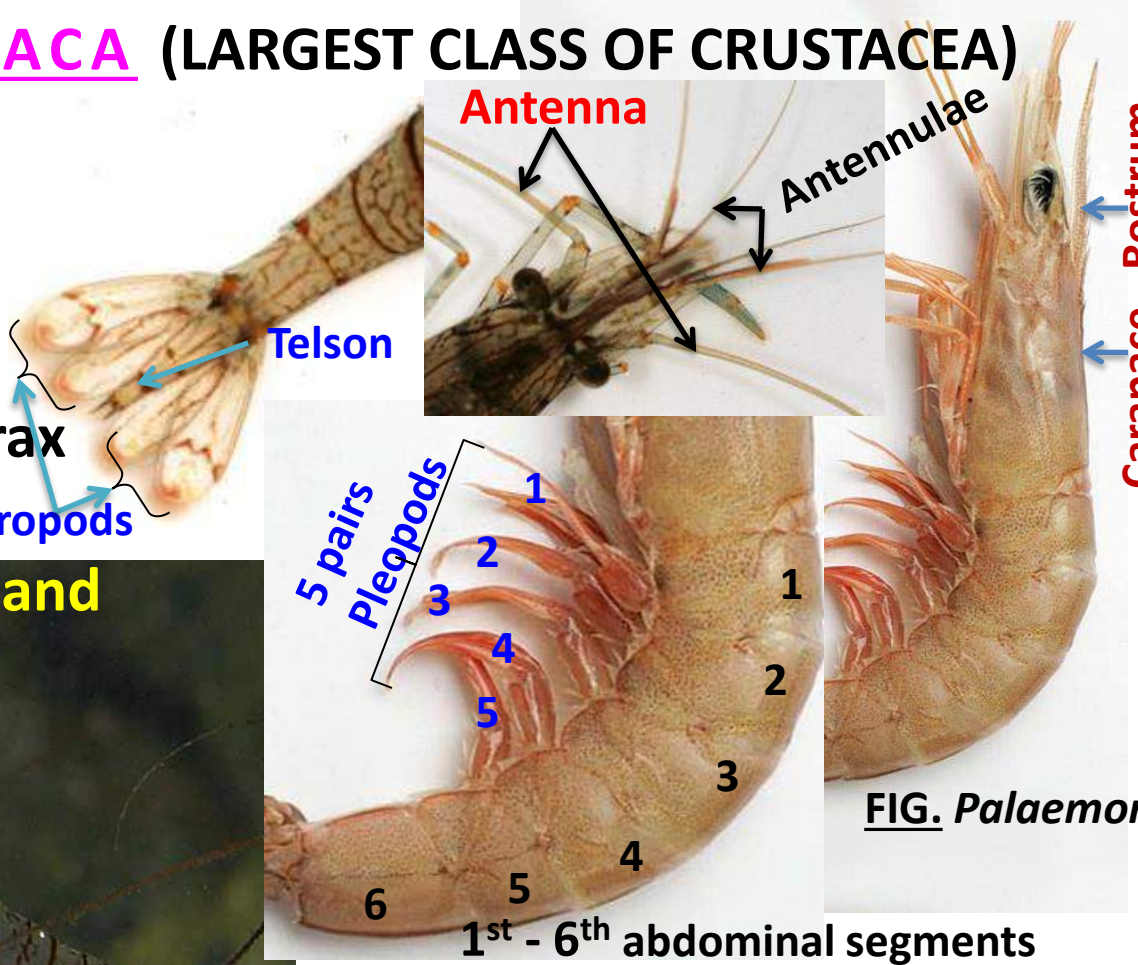
Lepas. A—Entire animal; B—Carapace removed.

Fig. *Lepus*, Natural

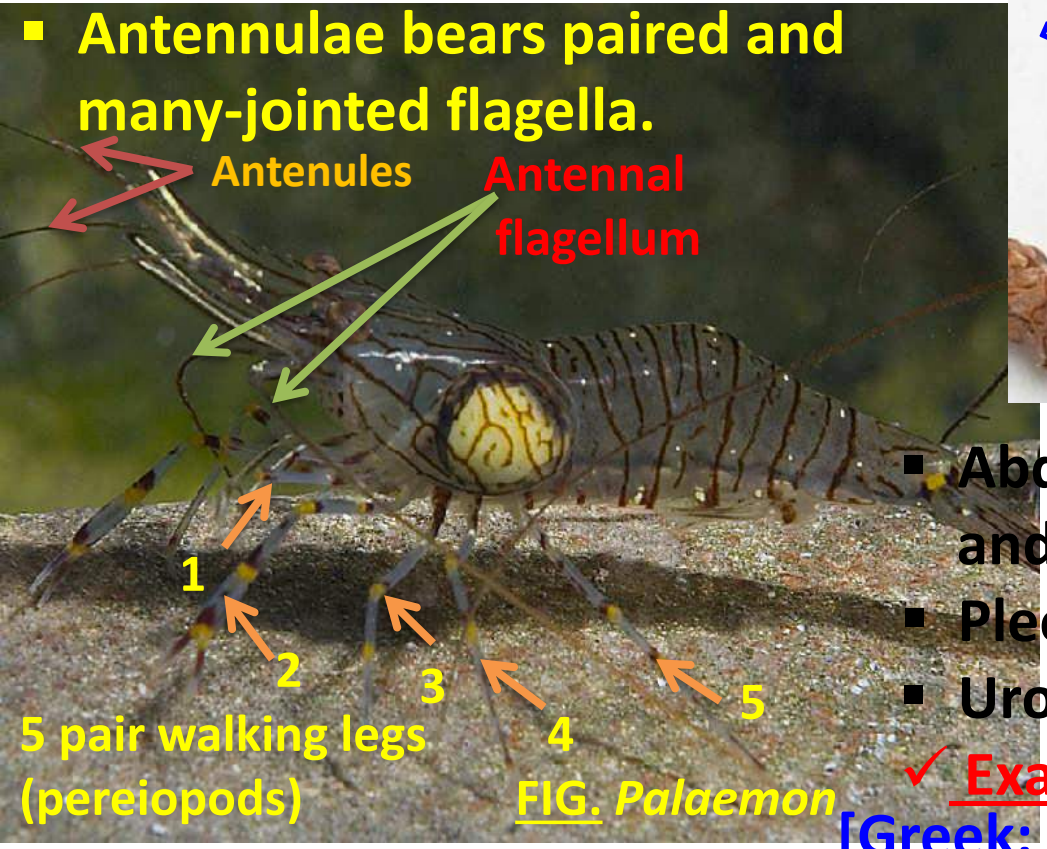
Colour, not natural

➢ CLASS: MALACOSTRACA (LARGEST CLASS OF CRUSTACEA)

- Body 19-20 segmented.
- Cephalon 5 segmented.
- Thorax 8 segmented.
- Abdomen 6-7 segmented.
- Cephalon and part of thorax covered by carapace.



- Antennulae bears paired and many-jointed flagella.



- Abdomen with 5 pairs pleopods and one pair uropod.
- Pleopods and uropods are biramous.
- Uropods bears fan like telson.

✓ **Example:** *Hippa, Palaemon* etc.

[Greek: *malakos* 'soft'+ *ostrakon* 'shell']

4. SUBPHYLUM: UNIRAMIA [Latin: *unus*, 'one' + *ramus*, 'branch']

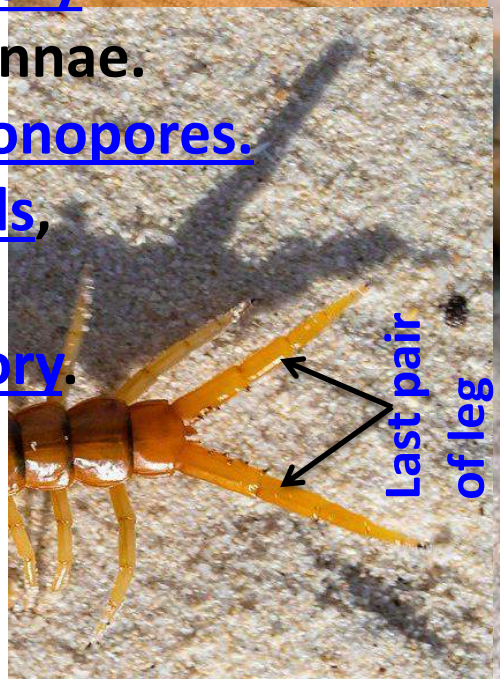
- Body consists of head and trunk.
- Trunk may be divided into thorax and abdomen.
- Abdominal appendages are reduced or missing.
- Trunk segment with paired walking legs.
- Compound eyes, median ocelli present.
- Multiarticulated, uniramous appendages .
- Head bears antennae, mandibles, maxillae, and labrum; some with 2nd pair of maxillae.
- Trachae, spiracles for respiration.
- Malpighian tubules for excretion.
- No carapace.
- Dioecious; development direct or indirect.

➢ CLASS: CHILOPODA (CENTIPEDES) [Greek: *kheilos*, 'lip' + *pous*, 'foot']

- Head with simple antennae, paired maxillae.
- Multisegmented, dorsoventrally flattened trunk.
- Each segment with paired legs; last 2 segments legless.
- 1st pair legs modified as poison claws (forcipules) with fang.
- Sensory 'Organs of Tomosvary' present at the base of antennae.
- Last body segment bears gonopores.
- Both sexes carries gonopods, helping reproduction.
- Last pair legs non locomotory.

✓ **Example:**
Scolopendra, Scutigera etc.

Fig. *Scolopendra*



➢ CLASS: SYMPHYLA (PSEUDOCENTIPEDES)

- Body small, 14-segmented, eyeless.
- 12 pair legs, spinnerets present.
- Antennae simple, long.
- Dorsal tergal plates 15-24.
- 1st maxillae fused medially.
- 2nd maxillae fused to form a labium.
- 3rd trunk segment with gonopores.
- 2 terminal segments with no leg.
- Last segment with 1 pair of cerci and trichobothria (sensory hair).
- 1 pair spiracle open near the head.
- Dioecious, parthenogenetic.
- Life-long persistence of moulting.

✓Example:

Scolopendrella, *Scutigerella* etc.

[Latin: *sym*,'together' + Greek: *phule, phulon* 'tribe']

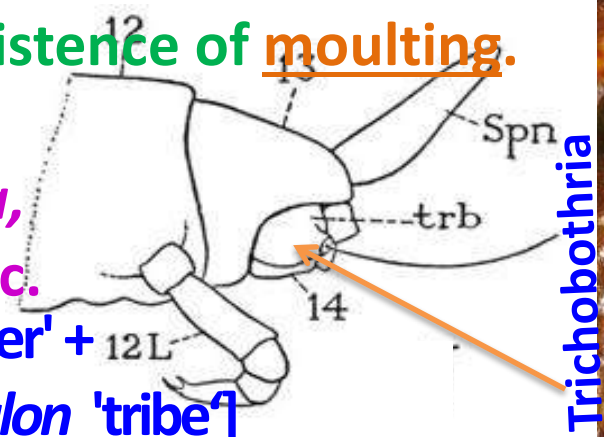
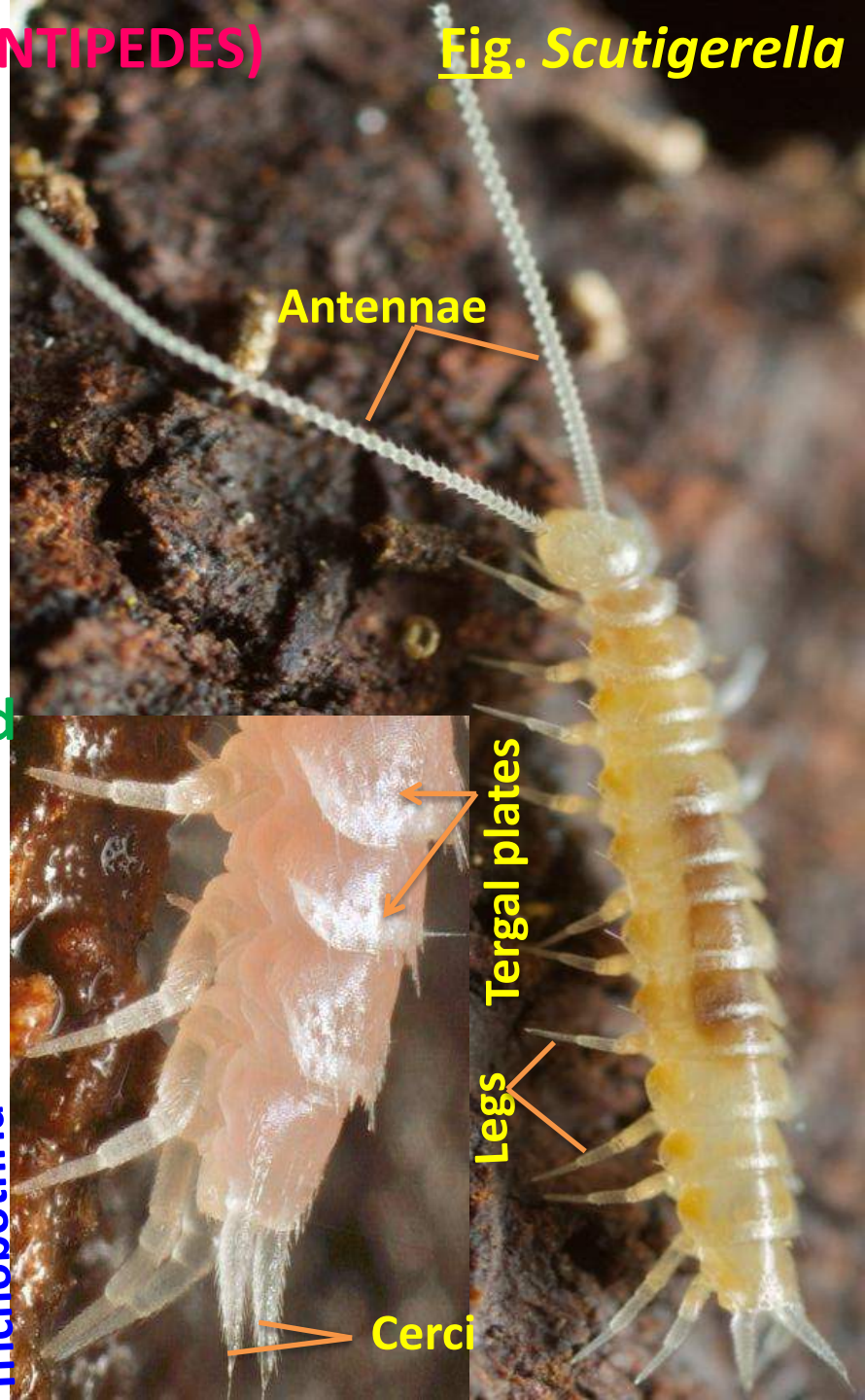


Fig. *Scutigerella*

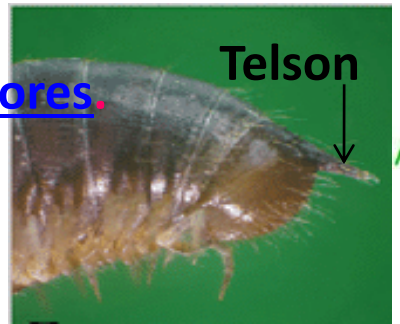


➢ CLASS: DIPLOPODA (MILLIPEDES) [Greek: *diploos* 'double' + *pous*, 'foot']

- Two trunk segments are fused to form a diplosegment.
- Each diplosegment bears 2 pairs of legs, spiracles, ganglia, heart, ostia.
- Each diplosegment bears 1 tergite, 2 pleura, 1-3 sternites.
- Exoskeleton is calcified.
- Gnathochilarium is formed by the fusion of 1st maxillae.
- 2nd pair maxillae absent.
- Trunk segment bears lateral repugnatorial gland secreting noxious chemicals.
- 1st segment legless, modified as collum.
- 2nd, 3rd and 4th segments are haplosegments with 1 pair of leg.
- From 5th segment all are diplosegments with 2 pairs of legs.
- 3rd segment bears gonopores.

✓Example: *Julus, Glomeris, Oxidus* etc.

Fig. *Julus*



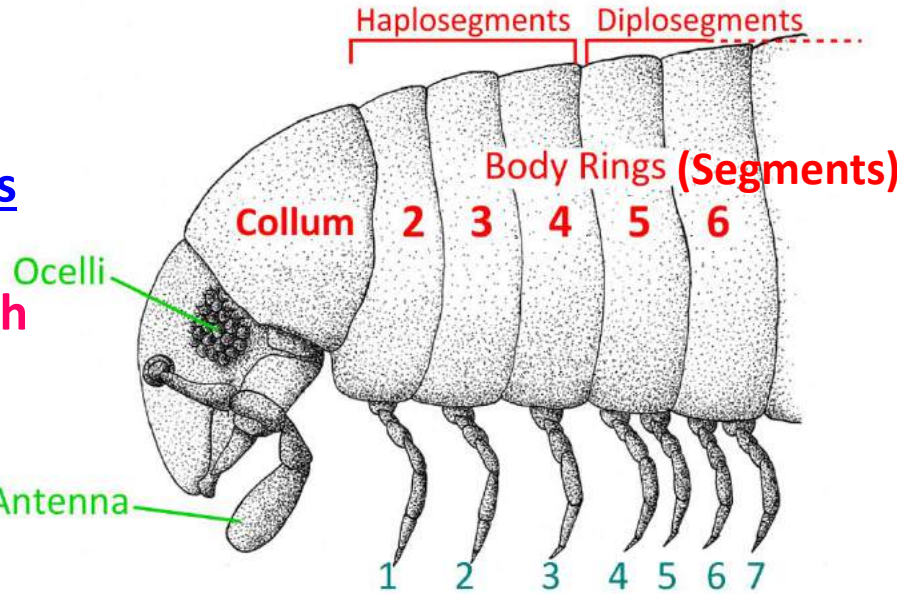


Diagram: *Julus*

➢ CLASS: PAUROPODA [Greek: *pauros*,'small' + *pous*,'foot']

- Minute, grub like, eyeless.
- Body divided into head and 11 segmented trunk.
- 9 pairs of legs; 1st and 2nd trunk segment legless.
- Cuticle soft, uncalcified.
- Trachea and heart absent.
- Trachea and heart absent.
- Head bears 5 segments and branched antennae.
- Trunk bears 5 dorsal tergal plates with lateral setae.
- Sensory 'Organs of Tomosvary' present.
- Telson present.

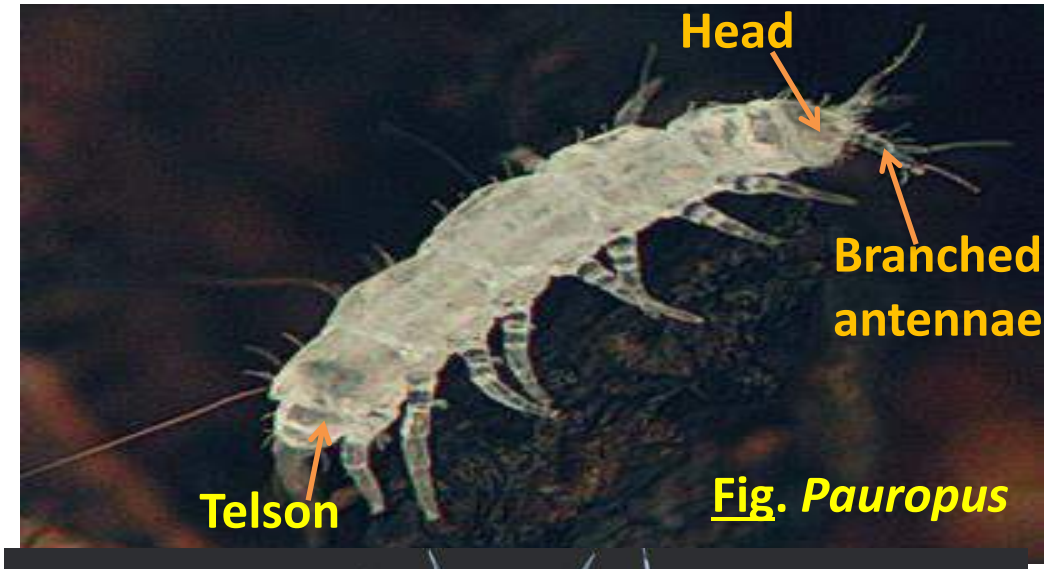


Fig. *Pauropus*

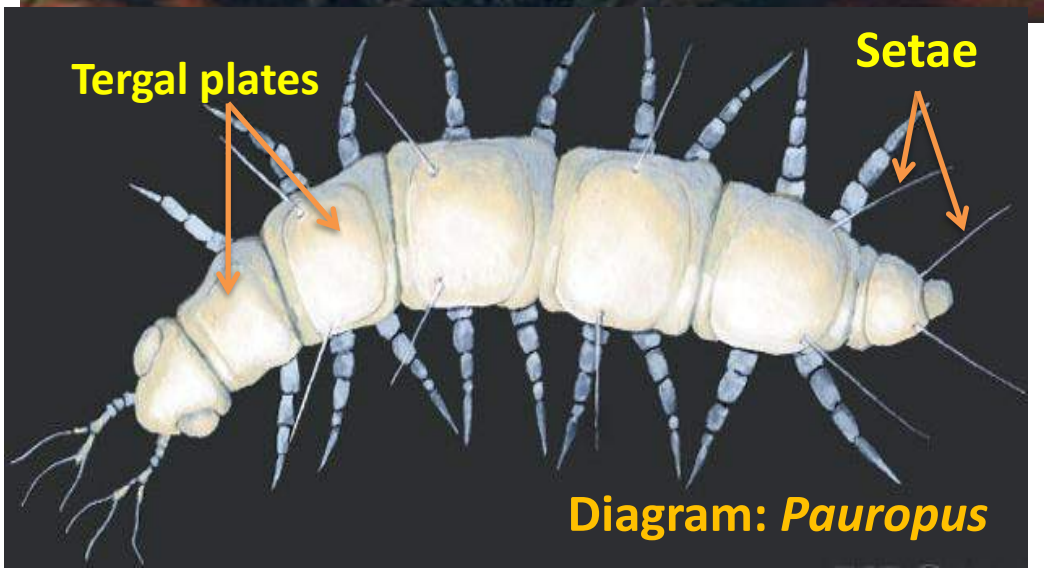


Diagram: *Pauropus*

✓ Example: *Pauropus.*

➢ CLASS: INSECTA (HEXAPODA) [Latin: *insectum*, 'cut up'(segmented)] [Greek: *hex* 'six' + *pous* 'foot']

- Body consists of 19 somites and acron.
- Head, thorax and abdomen formed by 5, 3 and 11 somites respectively.
- 3 pairs of jointed thoracic legs present.
- Compound eyes, median ocelli present.
- Leg bears coxa, trochanter,femur, tibia, tarsus and pretarsus.
- Fused exoskeleton of the head forms internal tentorium.
- Gastric caeca present.
- Excretion through Malpighian tubules.
- Dioecious; development is direct or indirect.

✓ Example: *Periplaneta, Isotoma* etc.

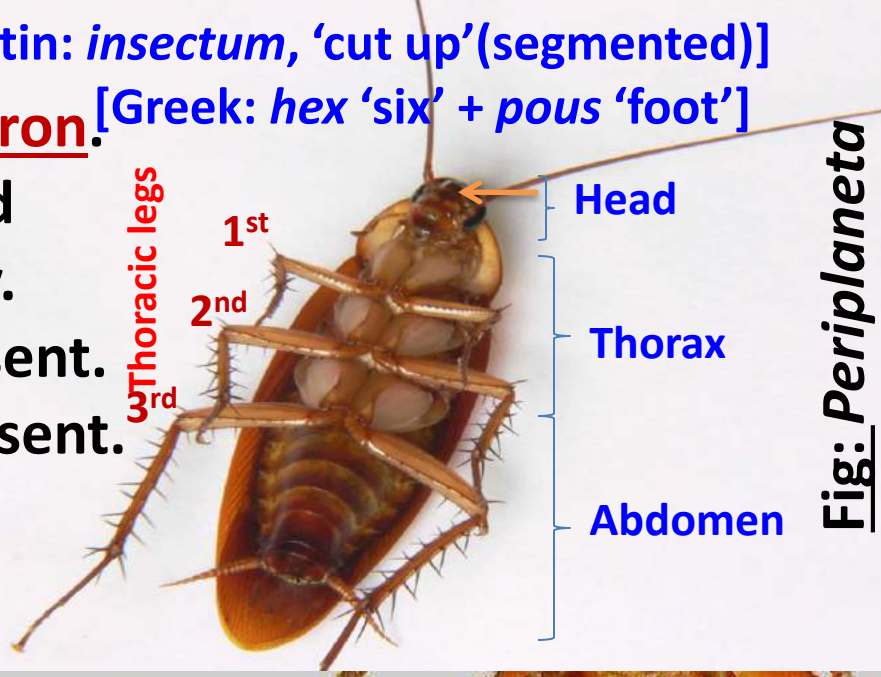
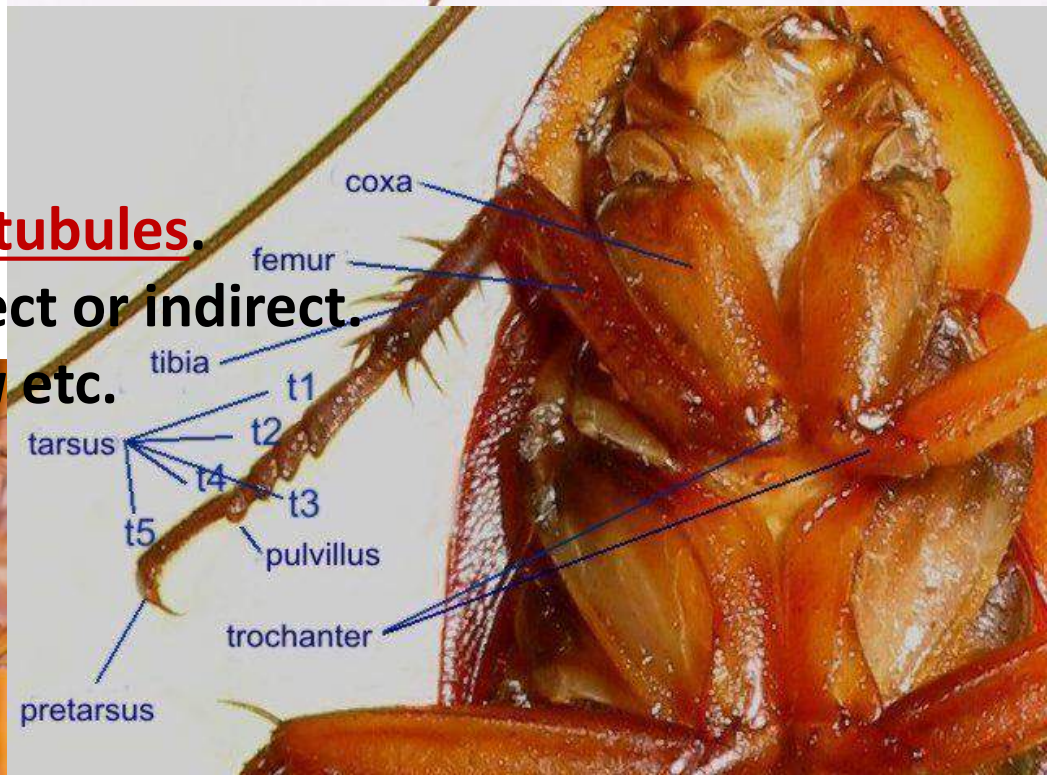


Fig: *Periplaneta*



“Stay home Stay safe”

Thank You