SCIENTIFIC CLASSIFICATION

- Kingdom:Animalia
- Phylum:Arthropoda
- Subphylum:Chelicerata
- Class:Arachnida
- Subclass:Dromopoda
- Order: Scorpiones

Class Arachnida

- Terrestrial
  - Orders: spiders, mites, ticks, scorpions, ddll
  - 4 pairs of walking legs, one pair of pedipalps
- Head and thorax fused = prosoma
  - In ticks the prosoma and opisthosoma fuse

  = carapace

Order Scorpiones

- Most ancient arachnid (and therefore most primitive terrestrial arthropod)
- Also the largest arachnid is a scorpion (18cm)

General characters

- **Description of Scorpion:**
- The Scorpion, *Palamnaeus* sp. belongs to the class Arachnida, phylum Arthropoda.
- Scorpions are one of the oldest terrestrial arthropods and the present day species dif-fer very little from their fossil ancestors.
- Scorpions are widely distributed and found in tropical and subtropical regions, from mountains to plains, rain forests to deserts.
- They live in holes, crevices, under stones, logs of wood, decaying leaves and organic matters, within sand and many other places.

- Scorpions are nocturnal animals.
- During the day they hide under wood, stones, loose bark, in sand, crevices and holes, and in the debris on the ground, etc.
- They are carnivorous and predaceous, feeding for the most part on insects, spiders and other small animals.
- They catch their preys by the chelate pedipalpi, kill them with the sting and finally suck their juices.
- Cannibalism has also been found in them as they devour young ones of their own kind.

- The body of scorpion is elongated, narrow and dorsoventrally flattened.
- The size varies from species to species. The smallest scorpion*, Microbuthus pusillus* is about 1.3 cm in length, while the largest species *Pandinus imperator* is about 20 cm in length.
- In India, the adult of *Buthus famulus* measures about 7 to 9 cm in length, while the largest Indian scorpion *Palamneus swammerdami* measures up to 15 cm in length.

1. These are commonly known as **“Scorpions”** and are found under **stones, bark of trees, rotten leaves, cow dung** and in burrows and crevices in dark places.

2. Body elongated, segmented, slightly compressed dorsoventrally and is divided into a prosoma (capahalothorax) and an opisthosoma.

3. The **prosoma is un-segmented, narrow in front and broad behind** and bears a pair of large medium eyes and 4 pairs of lateral eyes.

4. The opisthosoma is comprised of seven segmented mesosoma, five segmented slender metasoma and a sting or telson at the hind end.

5. The mesosoma is broad and jointed with prosoma and the second mesosomatic somite bears a pair of comb-like sensory pectins below.

Scorpion

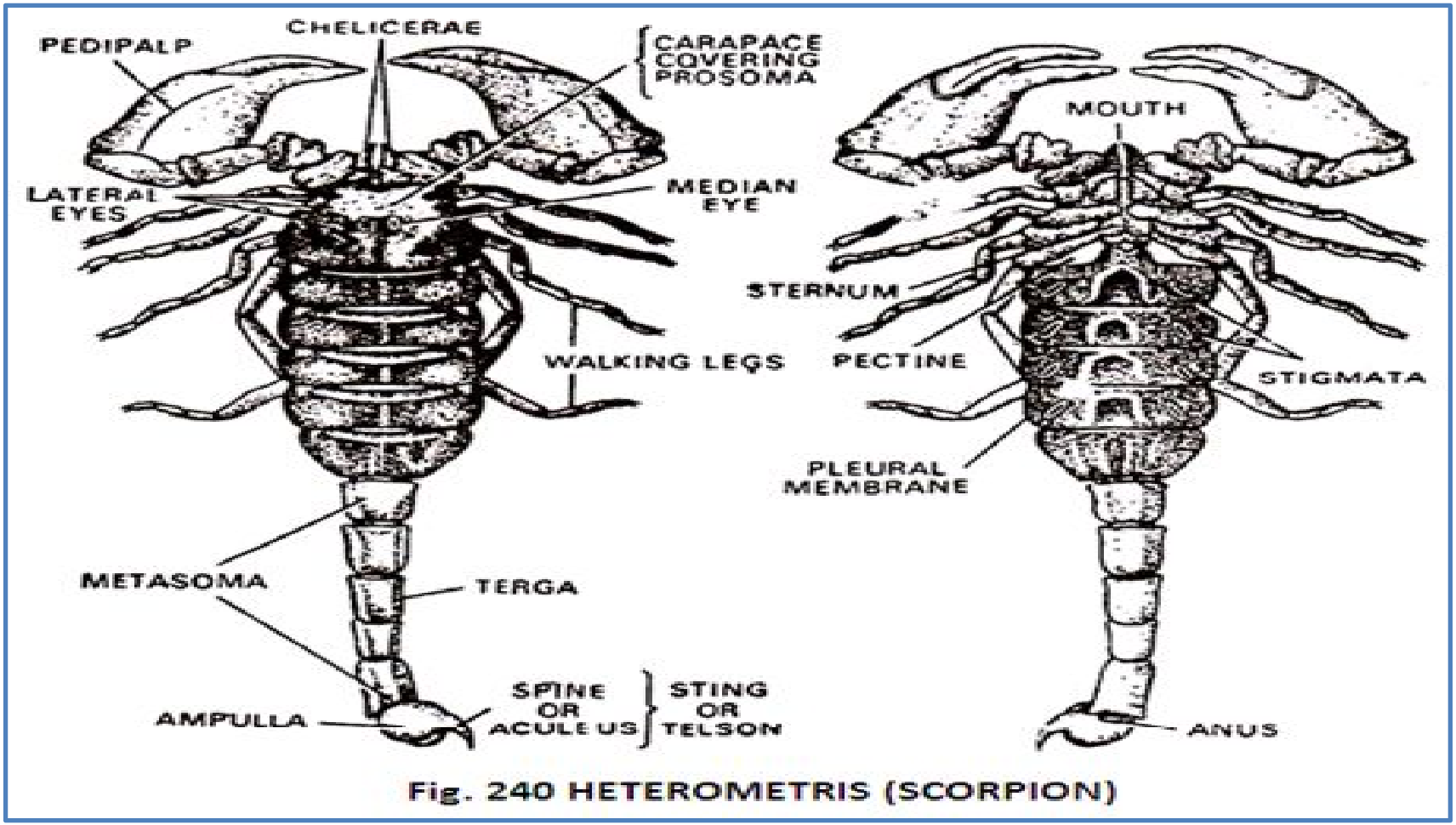


Fig. 240 HETEROMETRIS (SCORPION)

Appendages of scorpion

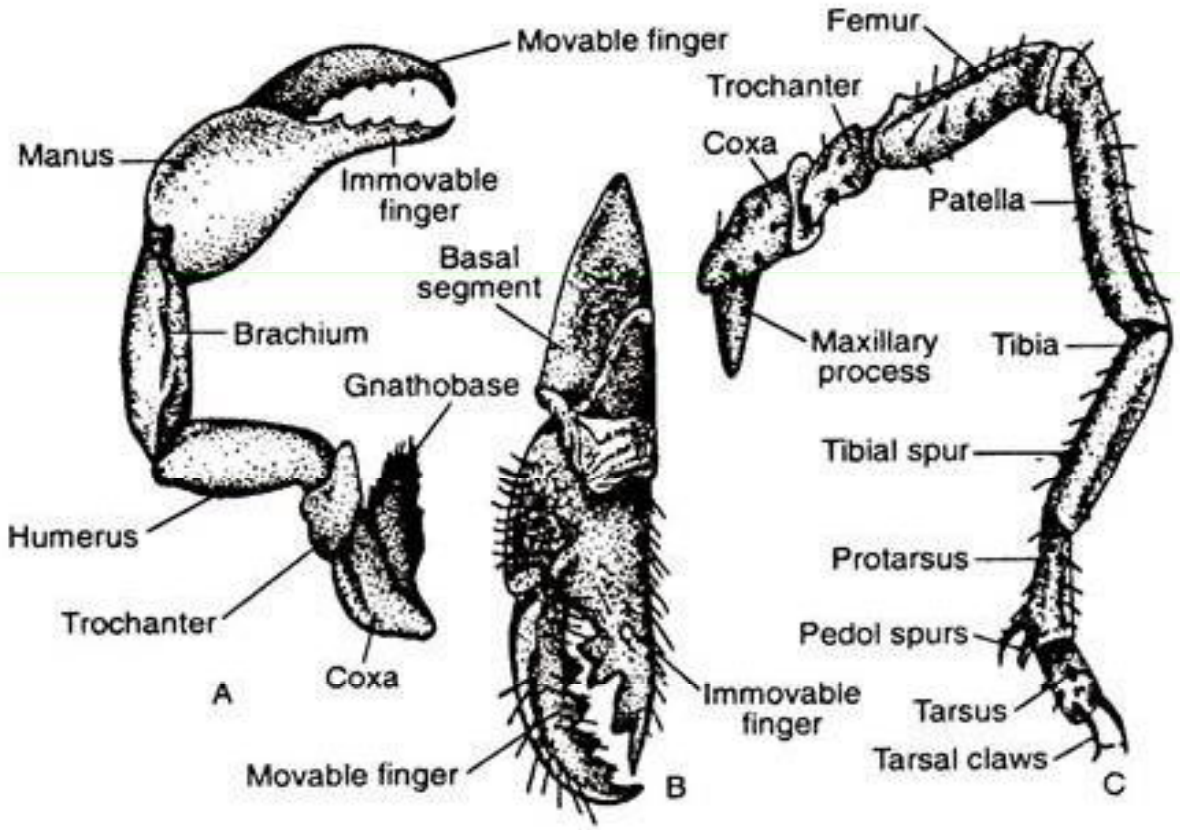


Fig. 18.108: Appendages of scorpion. A = Pedipalp, B = Chelicera, C = First walking leg.

Chelicerae:

- Paired, preoral in position.
- The appendage is small, three-jointed, ending in a chela.

Function:

- Holding the prey.

Pedipalpi:

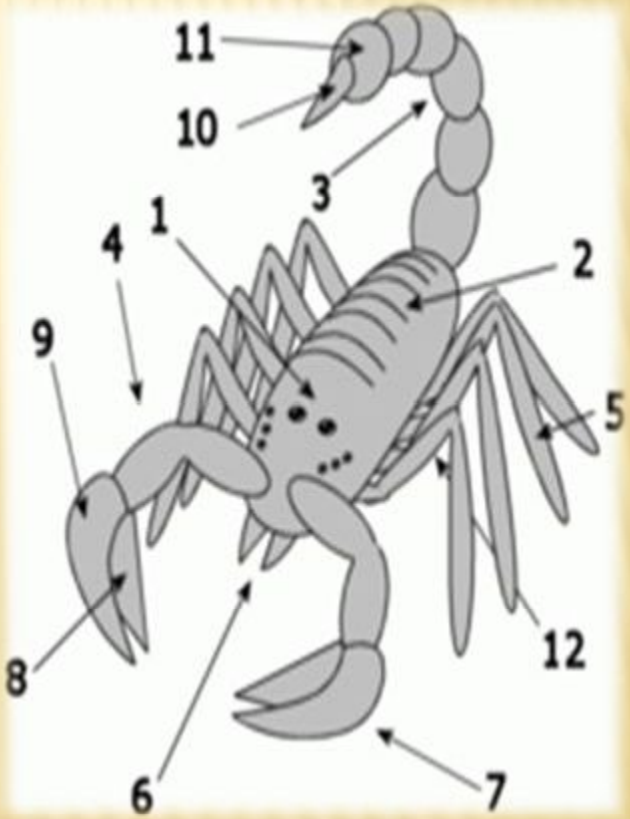
- Paired, post-oral in position.
- It is a large, six-jointed structure ending in a great chela.

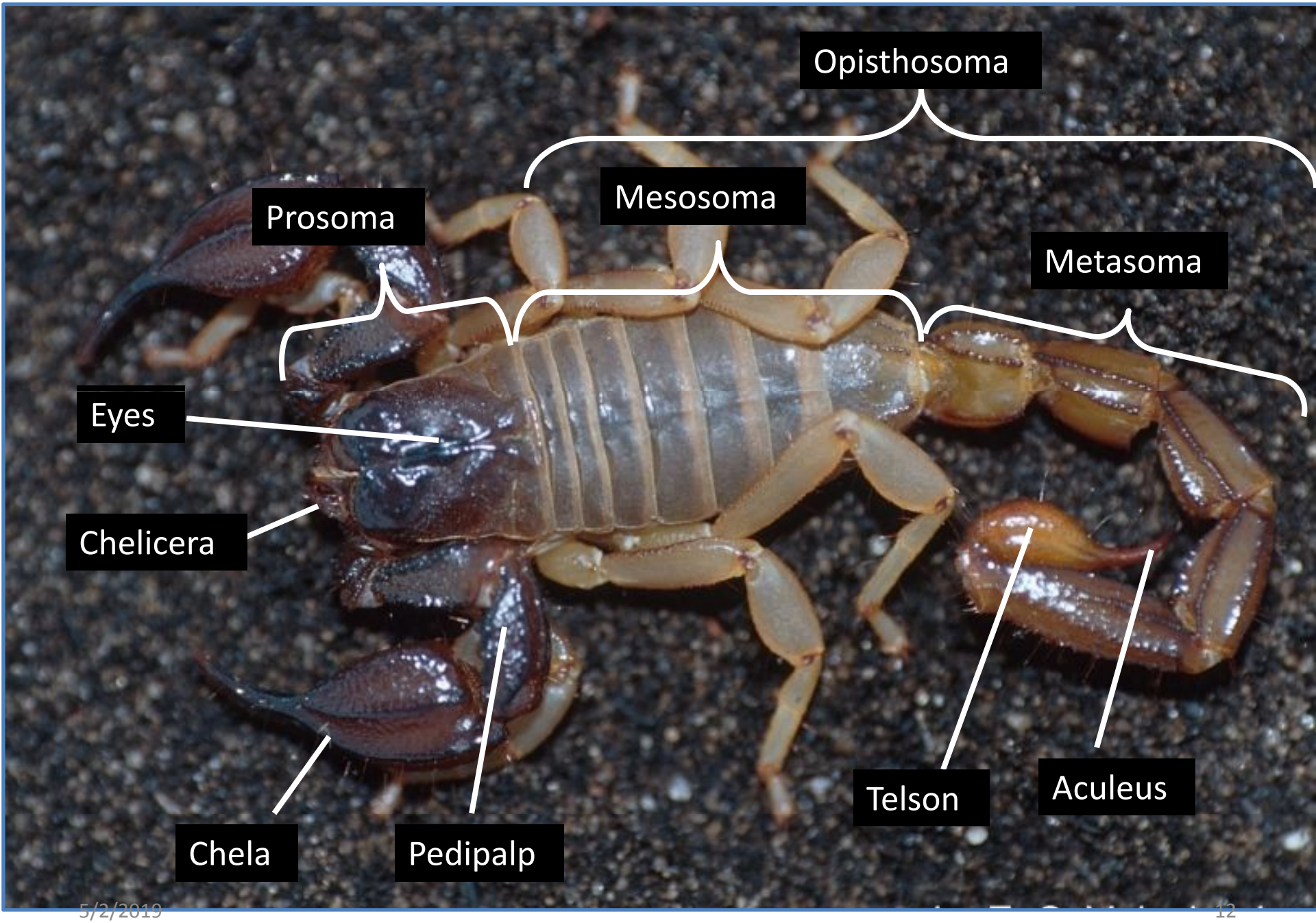
Functions:

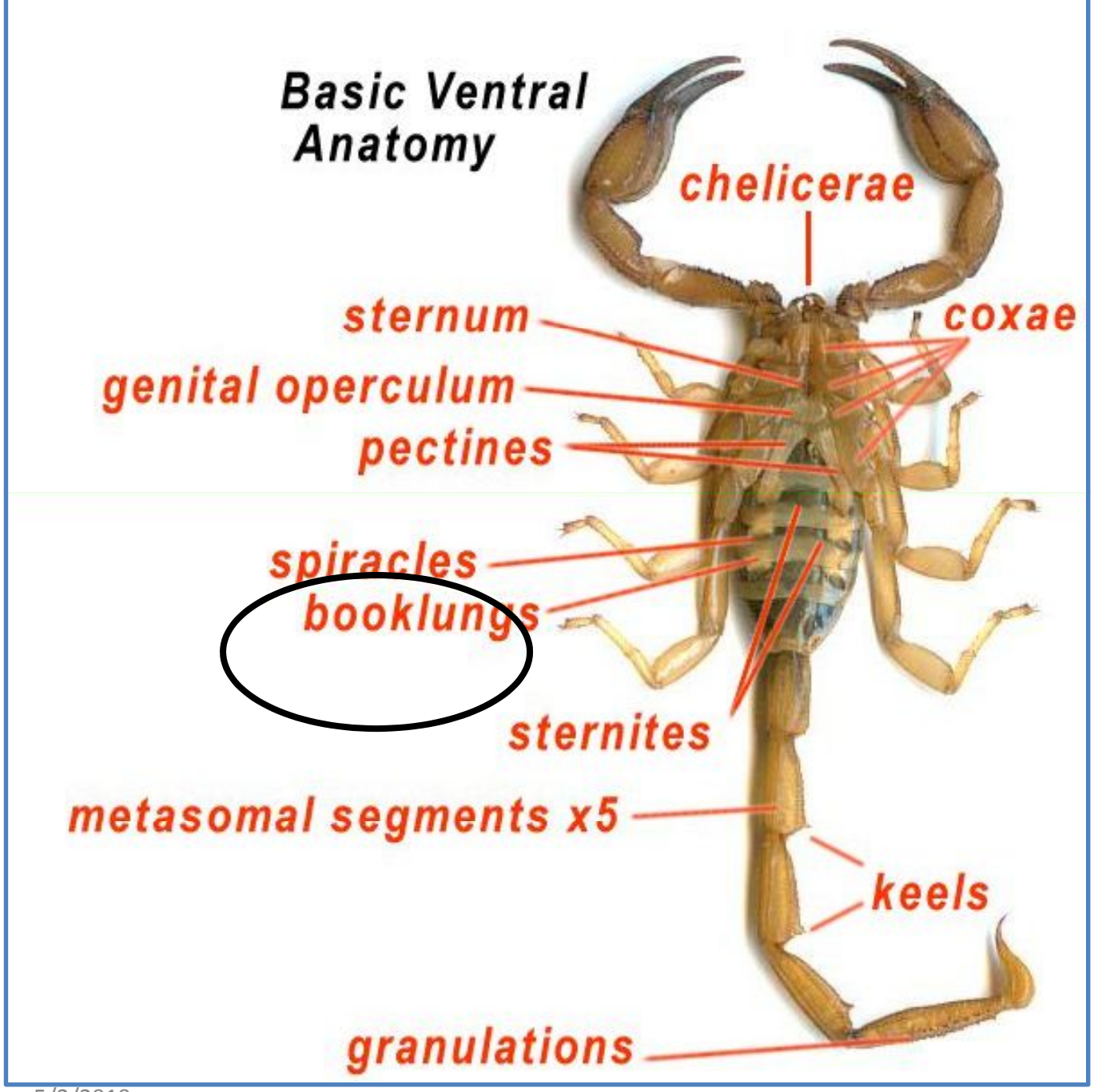
- Seizure of prey and mastication by the bases.

SCORPION ANATOMY

1 = Cephalothorax or *Prosoma*;
2 = Abdomen or *Mesosoma*;
3 = Tail or *Metasoma*;
4 = Claws or *Pedipalps*
5 = Legs;
6 = Mouth parts or *Chelicerae*;
7 = pincers or Chelae;
8 = Moveable claw or *Tarsus*;
9 = Fixed claw or *Manus*;
10 = Sting or *Telson*;
11 = Anus.




Opisthosoma
Mesosoma
Prosoma
Metasoma
Eyes
Chelicera
Chela
Pedipalp
Telson
Aculeus


Basic Ventral Anatomy
chelicerae
sternum
coxae
genital operculum
pectines
spiracles
booklungs
sternites
metasomal segments x5
keels
granulations


1 mm

6. The 3-6 mesosomatic segments bear paired stigmata or book-lungs along their ventrolateral sides for respiration.
7. The metasoma is slender, movably articulated and without appendages but is armed with poison apparatus.
8. The prosoma bears six pairs of appendages below, of which first pair is chelicerae, second padipaipi and the remaining four pairs are walking legs.
9. The poison apparatus comprises an ampulla and curved spine or aculeus—the sting.
10. Sexes are separate and animals are viviparous.

Respiratory System of Scorpion:

The Palamnaeus live on land and the respiratory structures, book-lungs can use atmospheric oxygen.

- Though physiologically less efficient, the book-lung is a more highly evolved respiratory organ, than those in other arthropods.

Respiratory organs:

- The respiratory organs consist of four pairs of book-lungs.
- The book-lungs open to the exterior by four pairs of apertures, the stigmata .

- Sternum of each of the 3rd, 4th, 5th and 6th pre-abdominal segments bears a pair of stigmata on its ventro-lateral sides. These are narrow oblique slits.
- Each stigmata opens directly into a book- lung and they are not interconnected.
- Each book-lung is a compressed sac lined with a thin cuticle.
- The lining mem-brane is folded up into numerous delicate laminae lying parallel to one another like the pages of a book, roughly 130-150 in number.
- Deoxygenated haemolymph flows through the narrow space in each lamina, separated from the air only by the membra-nous walls of the lamina.

Book Lungs

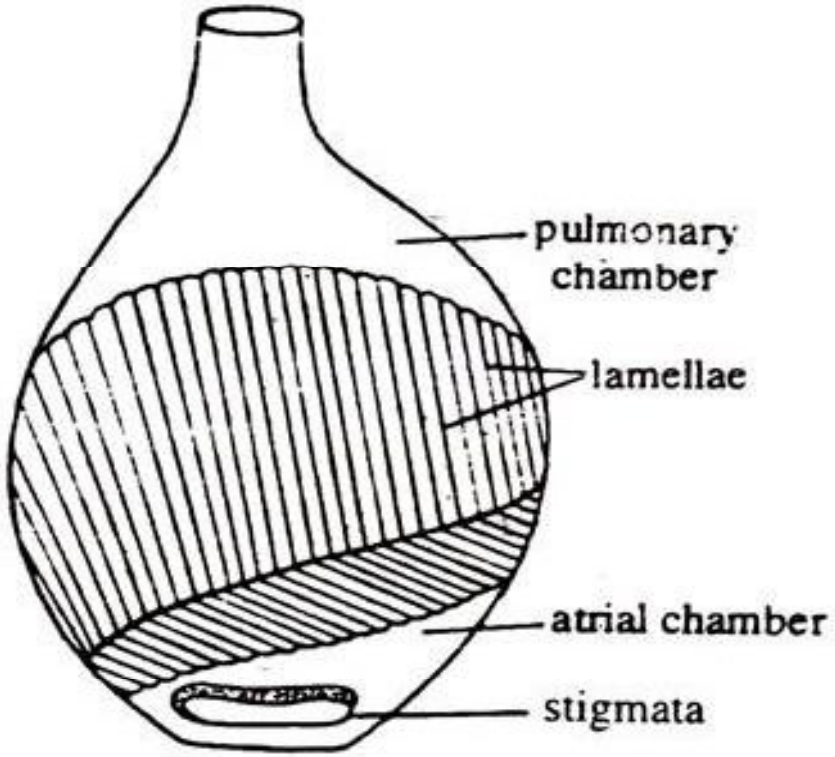


Fig. 25.40. Palamnaeus sp. A book lung

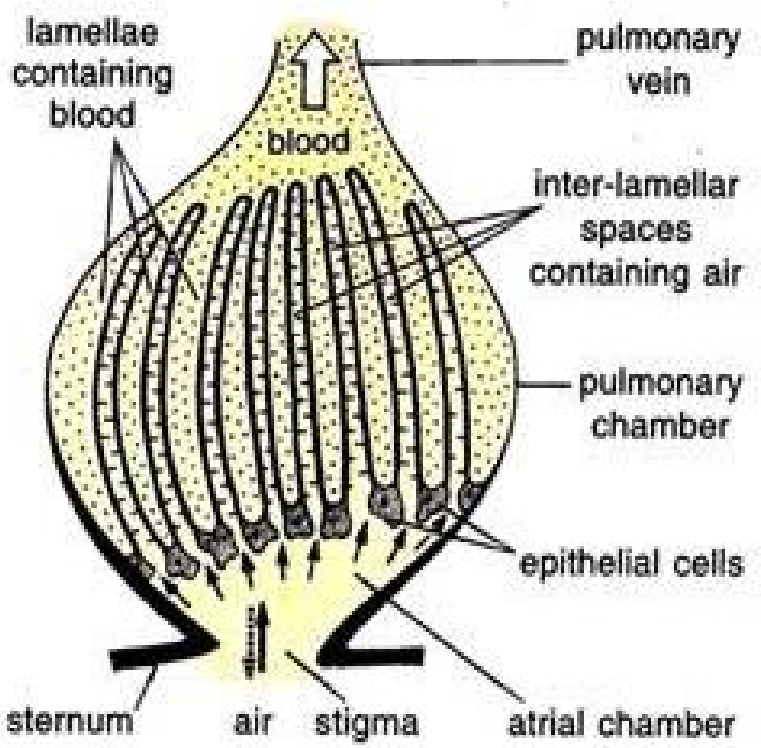


Fig. 72.12. Scorpion. Vertical section of book-lung to show the mechanism of respiration.

Mechanism of respiration:

- The alternate expansion and contraction of the abdomen brings inhalation and exha-lation of air in the book-lungs.
- Gaseous ex-change takes place between the haemolymph in the laminae and the air in between the laminae.

Mouth:

- A small transverse opening in-side the preoral cavity, near the base of the labrum.
- It leads to the pharynx.

Prosoma:

- **It is formed by the fusion of five segments:**
- Dorsally, the prosoma is covered by an unsegmented, more or less square Carapace, formed by the fusion of the terga of the segments.
- The anterior border of the cara-pace is notched, forming a right and a left frontal lobe.

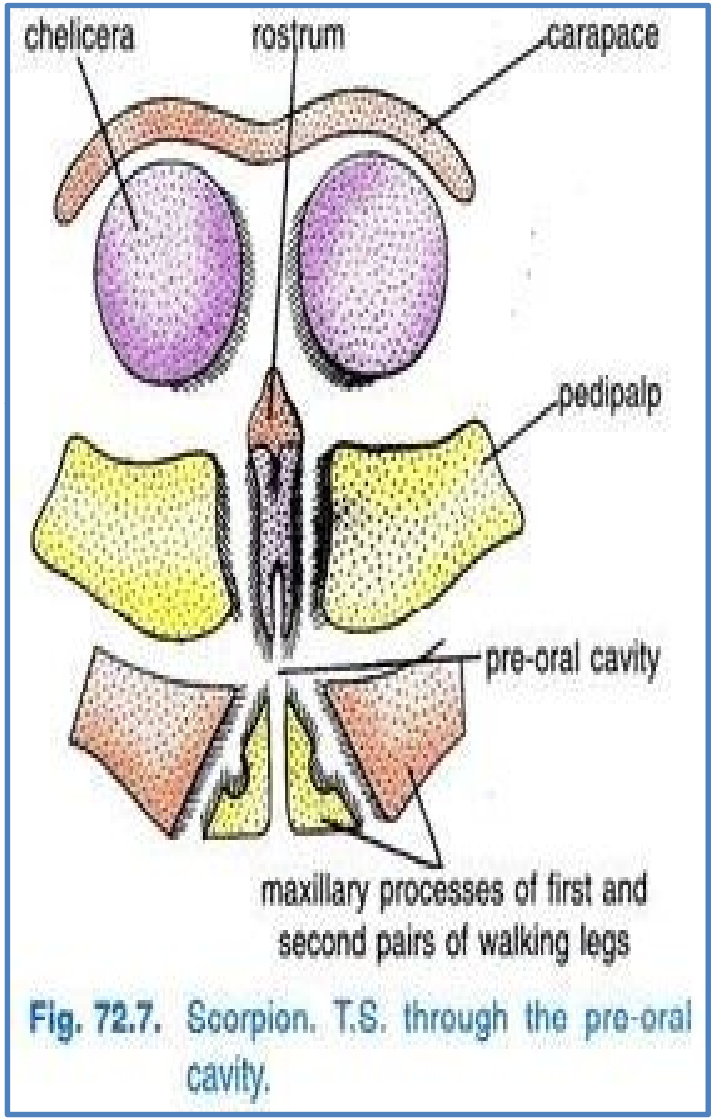


Fig. 72.7. Scorpion. T.S. through the pre-oral cavity.

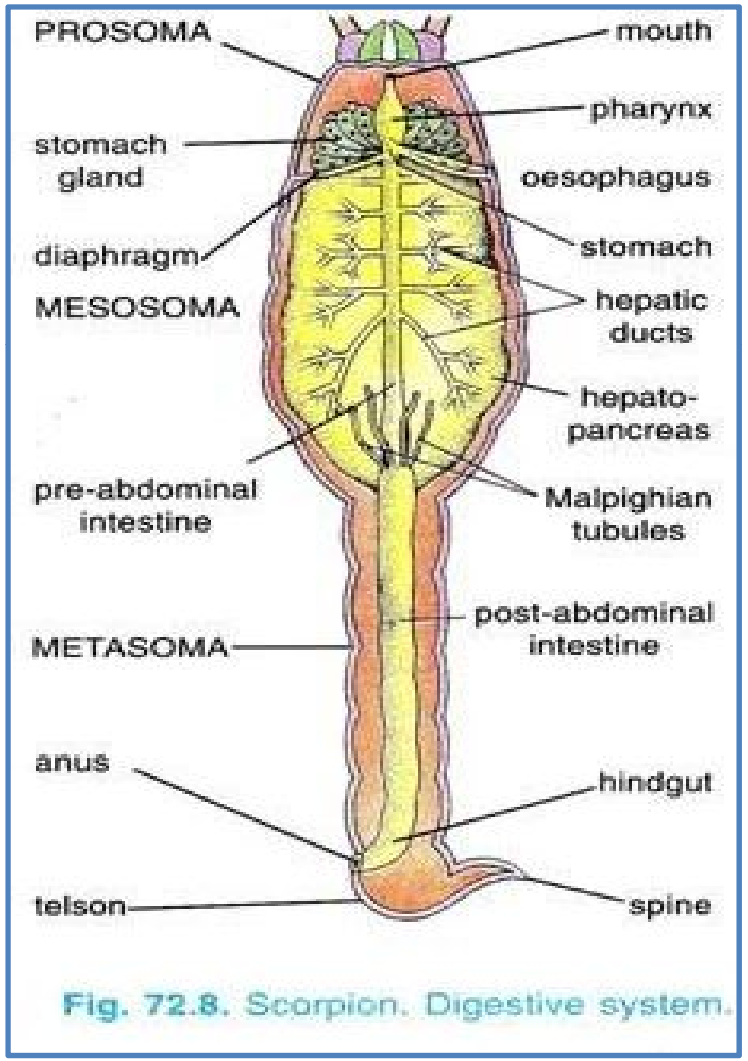


Fig. 72.8. Scorpion. Digestive system.

- A single, triangular plate formed by the fusion of sternites, cover the ventral surface of the prosoma.
- A pair of simple, median eyes at the middle and 2-3 pairs of lateral eyes on the anterolateral margins are present in the cara-pace.
- The mouth is a small, transverse, ven-trally located opening at the anterior end of the cephalothorax.
- A small, fleshy labrum overhangs the mouth ventrally.

Eyes

Eyes:

- Both the median and lateral eyes are simple eyes and provided with a lens.
- **a. Median eye:**
- It is diplostichus type
- i. In the lower part of the lens the hypo- dermal cells form a vitreous body.
- ii. The rhabdome of the retinulae is formed of five rhabdomeres.
- **b. Lateral eye:**
- It is monostichus type. The vitreous body is absent; the rhabdome is of irregular shape.

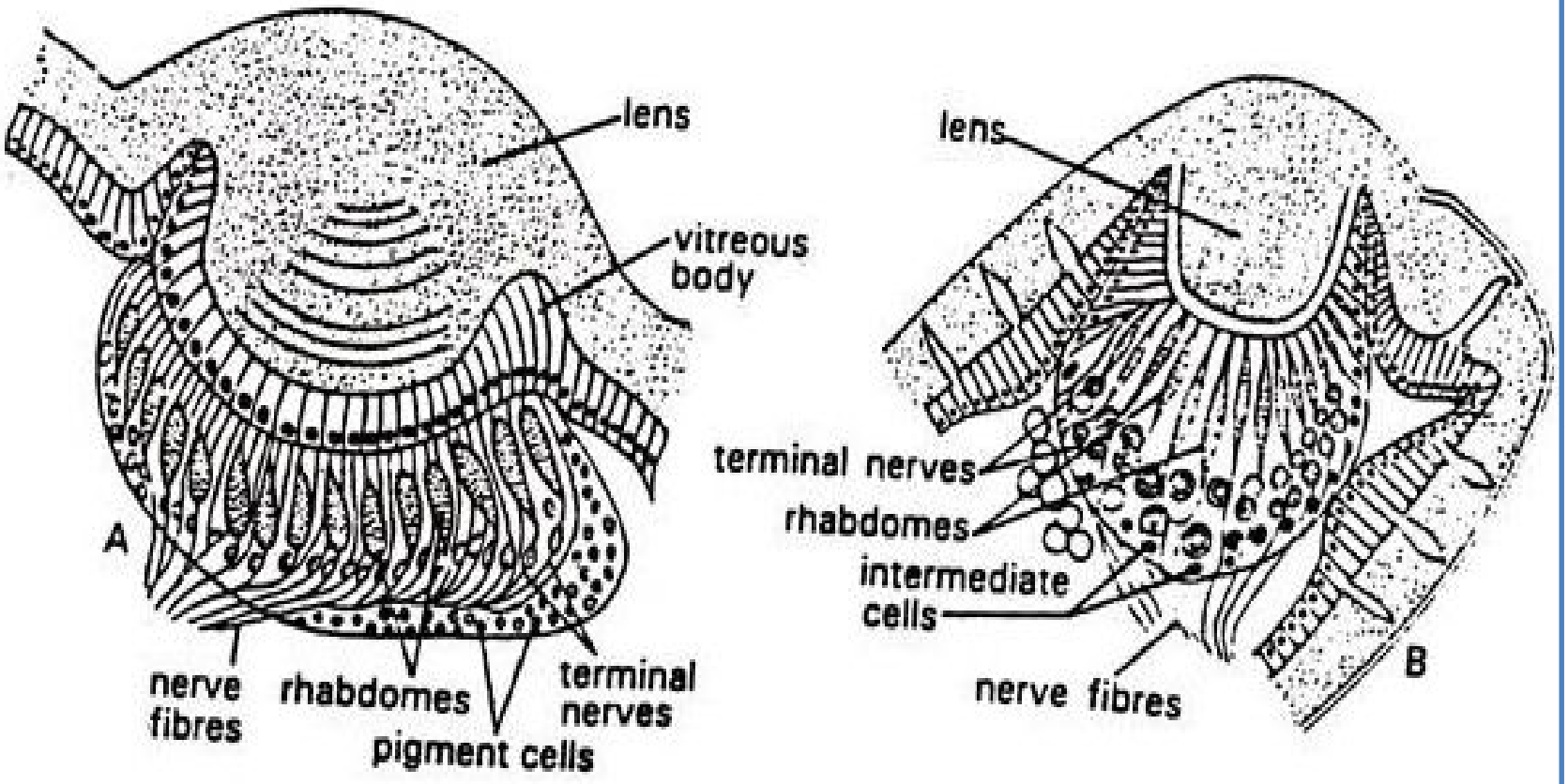


Fig. 25.45. Palamnaeus sp. Eyes (vertical section) A. Median eye. B. Lateral eye

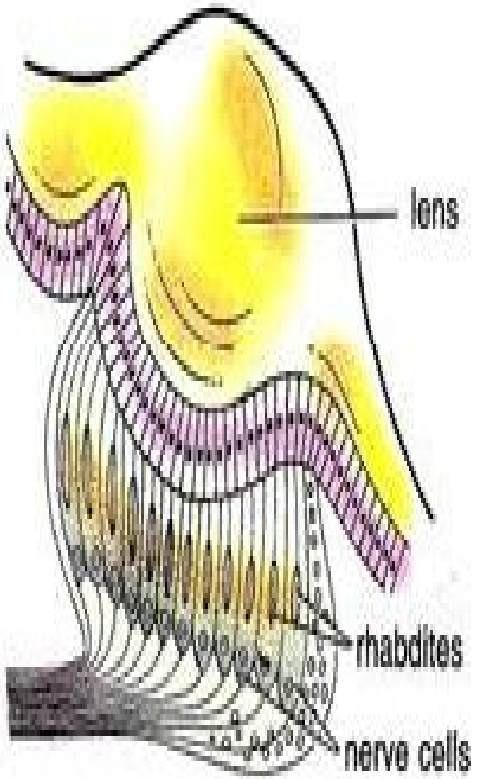


Fig. 72.18. Scorpion. V.S. of median eye.

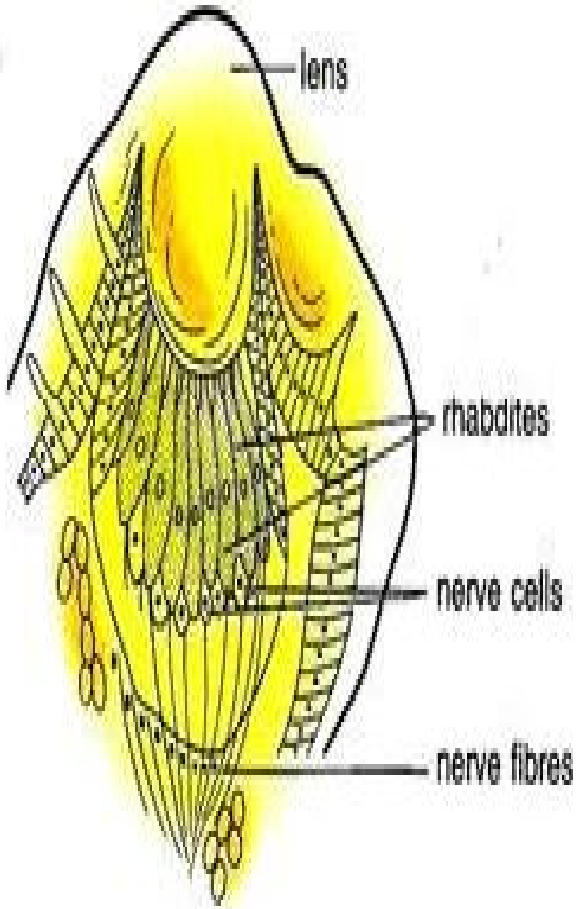


Fig. 72.19. Scorpion. V.S. of lateral eye.

Eyes:

There are four pairs of eyes in scorpions, a pair of median eyes and three pairs of lateral eyes.

- **(i) Median Eyes:**
- Median eye is like a cup covered externally by a cuticular lens or cornea which is continuous with the cuticle but is much thicker.
- Inside the pigmented cup are rhabdomes, each enclosed inside several retinal cells which receive nerve fibres of an optic nerve. Median eyes of scorpion are intermediate between compound and simple eyes of insects.
- They resemble a compound eye in having their retinal cells arranged in groups around each rhabdome as in ommatidia, but unlike the compound eyes of insects and crustaceans the sensory retinal cells both receive stimuli and transmit impulses.
- Both lateral and median eyes are sensitive to light changes but are incapable of forming images.

Lateral Eyes:

Lateral eyes are like simple eyes of insects.

- It is like a pigmented cup covered externally by a biconvex lens formed from transparent cuticle, inside the cup are several longitudinal optic rods called rhabdomes associated with retinal cell or retinulae.
- The retinal cells receive nerve fibres.
- It is also regarded that in some species of scorpions, stridulating organs are found on the coxae of the pedipalpi or first pair of legs, in the form of ridges across which file-like surface can be drawn to produce sound.
- It indicates that scorpions probably have some perception of sound.

Excretory System of Scorpion:

- **The excretory organs consist of a few Malpighian tubules and a pair of coxal glands.**
- **Malpighian tubules:**
- The Malpighian tubules are delicate tubes and are one or two pairs in number, attached to the intestine.
- Each tubule is a hollow structure opening into the lumen of the intestine and the wall is made of a single layer of glandular cells.
- Nitrogenous wastes are absorbed by the cells from the haemolymph and the same are discharged into the lumen of the tubule which, in turn, convey the wastes into the lumen of the intestine .

Excretory System of Scorpion

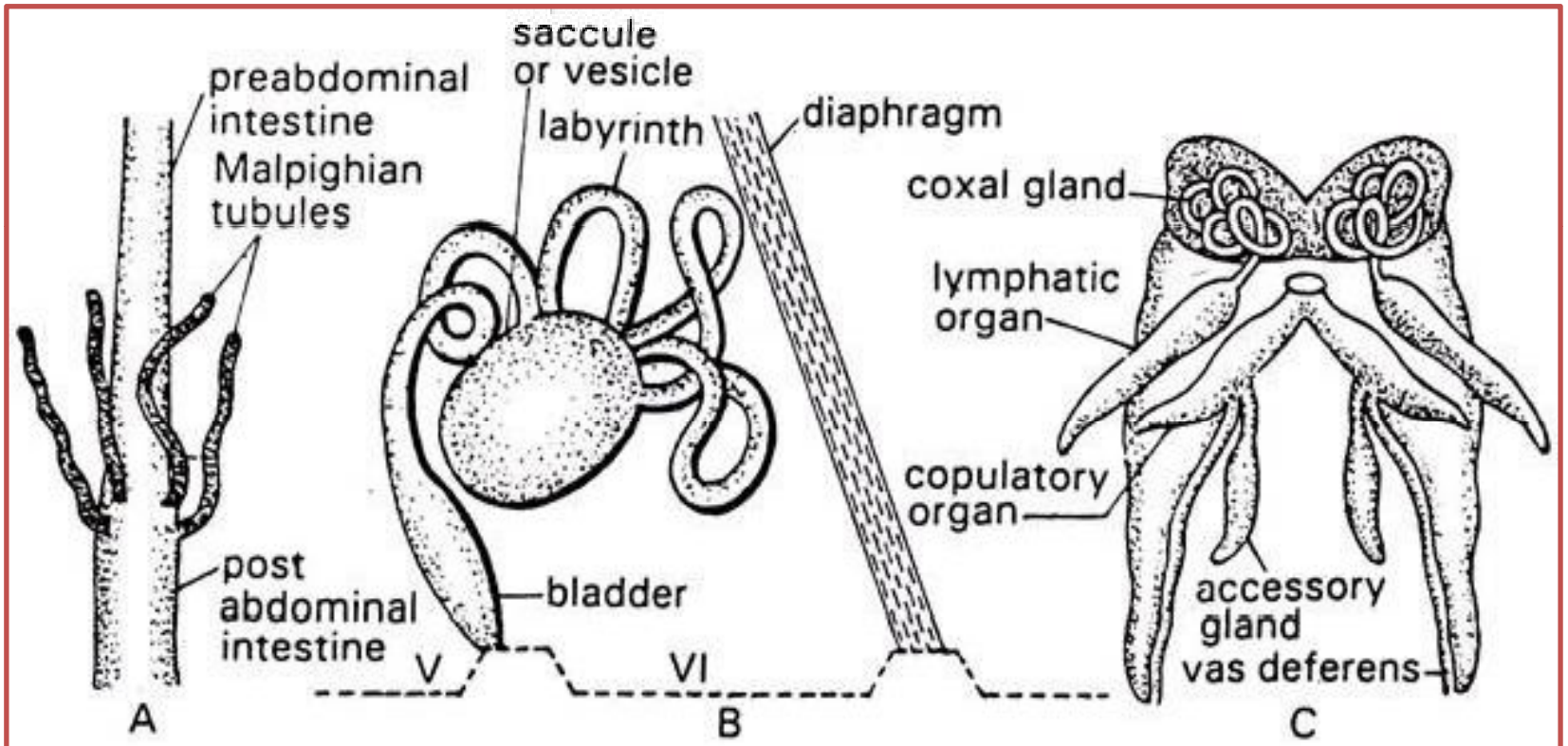


Fig. 25.43. Palamnaeus sp. Excretory organs.
A. Malpighian tubules. B. Coxal gland. C. Coxal gland and lymphatic organs

Coxal glands:

- A pair of coxal glands are found near the bases of the 3rd walking legs in the 5th segment of the prosoma.
- These are derived from coelomoducts and function as excretory organs.
- In the embryo of scorpion, the coelomoducts are found in the 3rd, 4th, 5th, 6th and 8th segments.
- All of them disappear in the adult except those in the 5th segment which persist as coxal glands.
- Each coxal gland consists of an end sac, a colied tube and a bladder opening to the exterior by a duct at the base of the 3rd walking leg.

Lymphatic organ:

- A diverticulum or lymphatic organ, possibly excretory (phagocytic) in function, lies on each side of abdomen connected with the coxal gland of the side.

Nephrocytes:

- The nephrocytes are large cells, located in the walls of the mesosoma and are be-lieved to be of excretory function.