Water Vascular System In Echinodermata

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Note - 2

Introduction :-

The water vascular system (WVS) , one of the most distinctive characteristic of Echinodermata is a system of canals and appendages of the body wall that functions as a means of locomotion . Also known as the ambulacral system , it is derived entirely from the coelom and the canals are linked by ciliated epithelium and filled with watery fluid along with certain corpuscles .

Essential Parts of the Water Vascular System :-

The essential parts of the Water Vascular System are :-

- The Madreporite
- Stone Canal
- Ring Canal
- Radial Canals
- Tiedmann’s bodies
- Polian Vesticles
- Lateral Canals
- Tube feet

Madreporite :

It is a hard rounded and calcareous plate lying on the aboral surface . It is situated in the inter radial position . The surface of the madreporite is provided with a number of radiating grooves or furrows . The bottom of these furrows are perforated by minute pores , so that the whole plate looks like a sieve . Each pore leads into a pore – canal and all the pore canals merge into collecting canals . The collecting canals converge into a small bag – like ampulla beneath the madreporite . The ampulla opens into a stone canal .

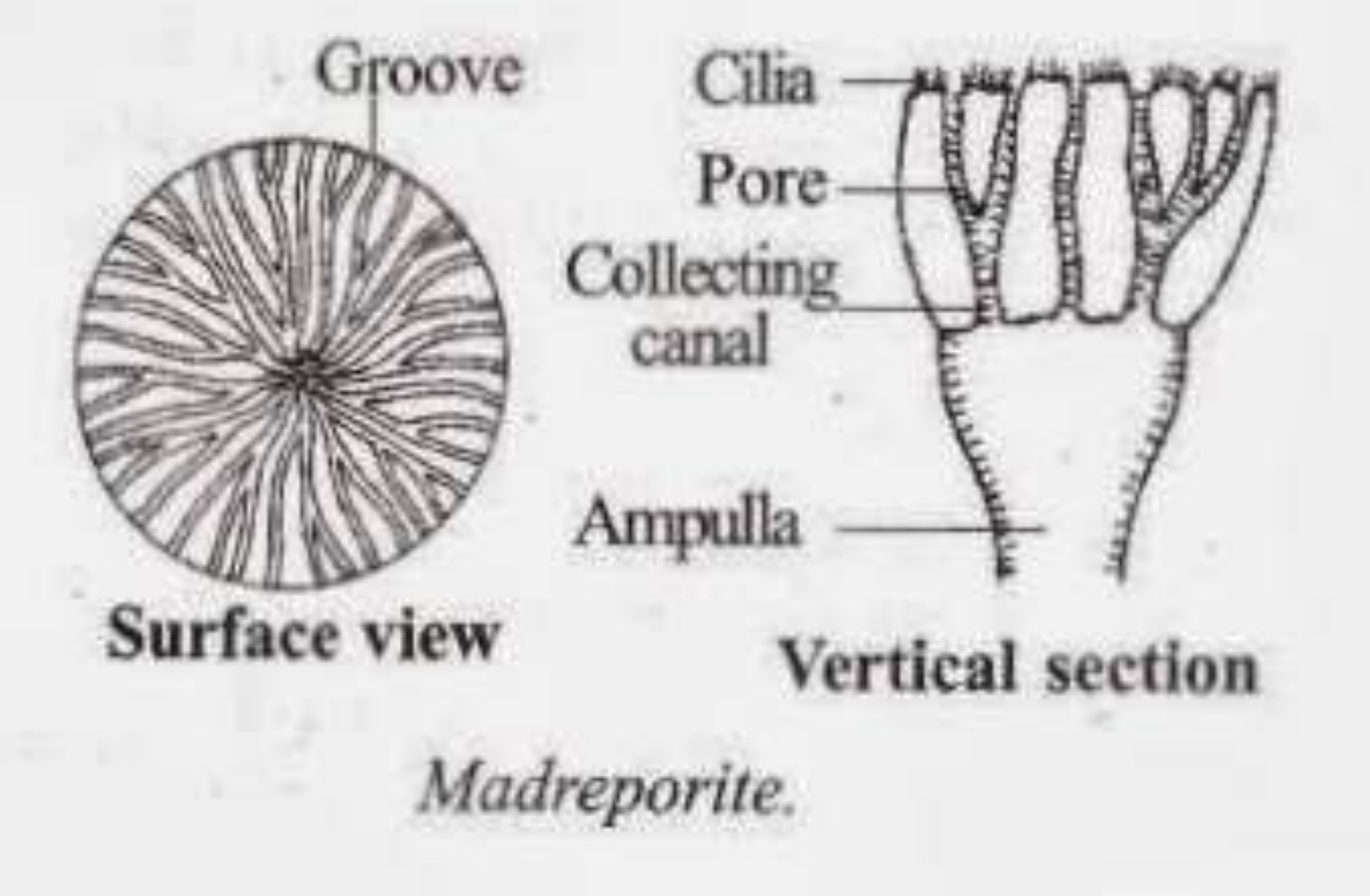

Fig.1 : Madreporite

- **Stone Canal :**

  It is an S – shaped canal . The walls are strengthened by a series of calcareous rings and hence the name . Internally the stone canal is lined with cilia , the movement of which draws the sea water from outside into the canal . One end of the tube opens to the outside through the madreporite . The other ends opens into a ring canal . The lumen of the stone canal is occupied by a ridge with spirally coiled lamellae .

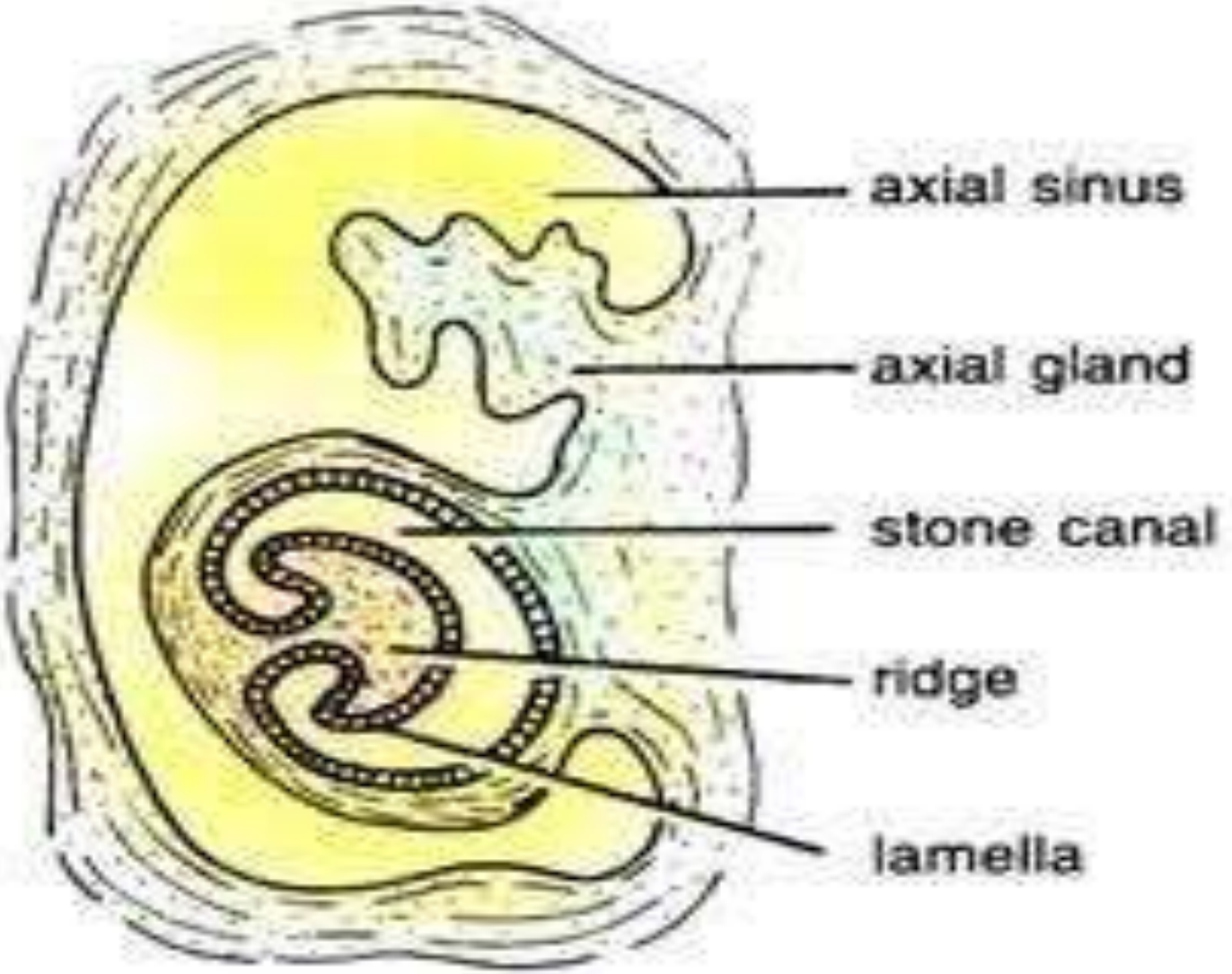

Fig.2 : T.S. of stone canal

Ring Canal :

It is a white pentagonal ring - vessel lying around the mouth .

Radial Canals :

From its outer surface the ring canal gives off five radial canals , one entering each arm . The radial canal runs upto the tip of the arm and ends in the terminal tentacles .

➢ Tiedmann's Bodies :

The ring canal gives off inter radially from its inner surface 10 small yellowish rounded glandular bodies called Tiedmann's bodies . In Asterias only 9 Tiedmann's bodies occur , the position of the 10 th being occupied by the stone canal . They produce phagocytes .

Polian Vesicles :

The ring canal bears on it's outer side five pear – shaped structures called polian vesicle . They are inter – radially arranged . These are thin walled bladders with long narrow necks . The polian vesicles serve as store houses for the fluid in the water vascular system .

- **Lateral Canals :**

  Each radial canal gives off many paired lateral canals on both the sides , which lead to a tube foot or podium . Each canal is provided with a valve to prevent backward flow of fluid into the radial canal .

Tube Feet :

The tube – foot is a hollow elastic thin walked closed cylinder . It consists of an upper sac – like ampulla , a middle tubular podium and a terminal disc – like sucker . Muscle fibres are present in the walls of the ampulla and the podium . The tube feet are capable of greater extension and when extended they come out through the ambulacral grooves .

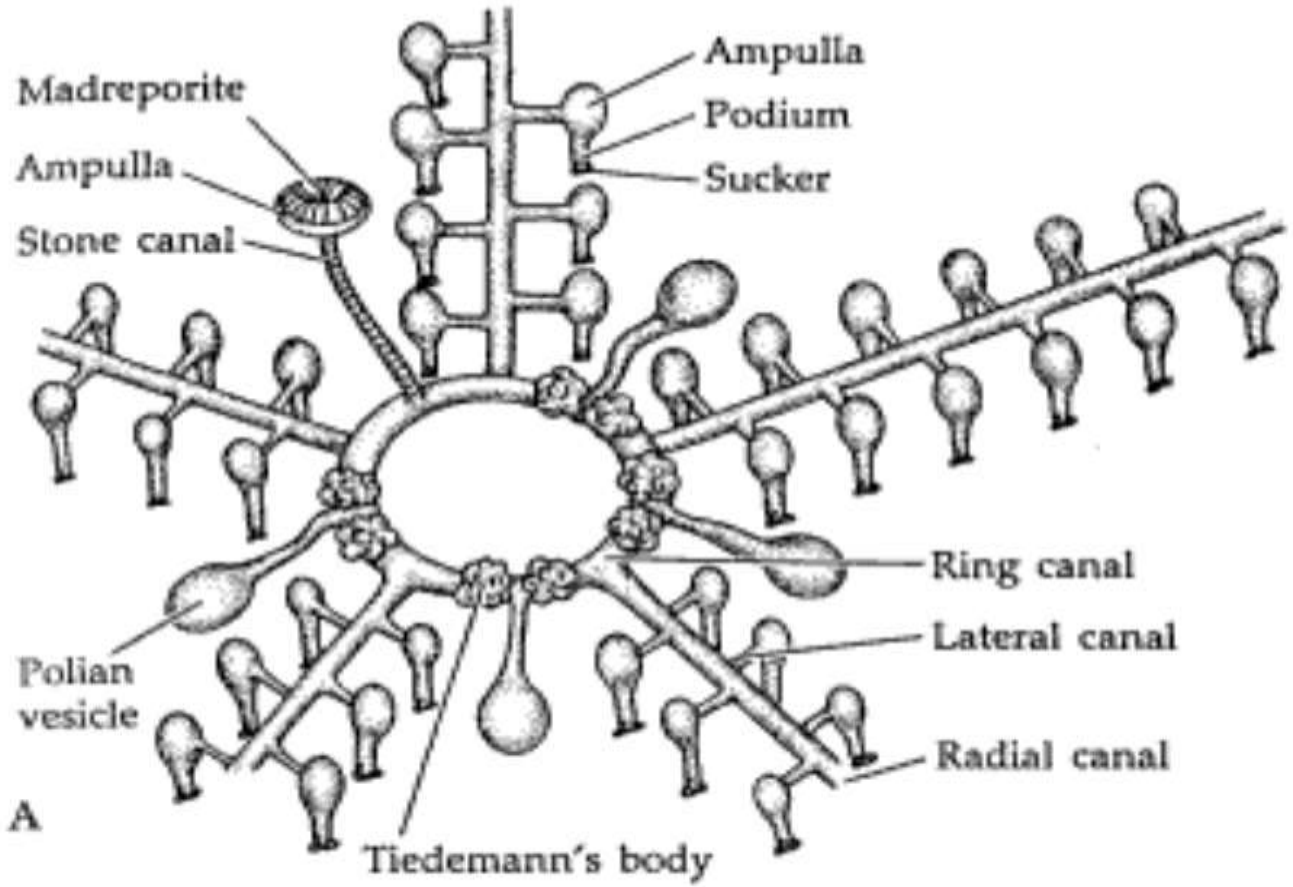

Fig.3 : Star fish (Water Vascular System)

Functions of the water vascular system :-

- The Water Vascular system has three main functions . They are as follows :
  1/ Locomotion
  2/ Food Capture
  3/ Attachment

1/ Locomotion :

1. Starfish exhibits creeping movement with the help of tube feet at a speed of 15 cm/min
2. The water vascular system sets up a hydraulic pressure mechanism which brings about the locomotion .

3. In the direction of movement , one or two arms are slightly raised from the substratum .

4. The ampulla of tube feet contract . The valves in the lateral canals close . The water flows into the podium . The hydraulic pressure within tube feet increases .

5. The tube feet elongate in the direction of movement .

6. The tube feet extend forward and adhere firmly to the substratum by the suckers .

7. After attachment , the tube feet assume a vertical posture by pulling the body forward .

8. The podia now contract . This causes the flow of water from the podia into the ampulla .

9. This results in the shortening of tube feet .

10. The suckers are released and the tube feet are raised and moved forward to repeat the process .

2. Food capture :

The tube – feet are used to capture the prey . The suckers are used to open the shells of molluscs .

3. Attachment :

The star fish can be attached to the rocks by the tube feet.

Recommended Books :-

- A TEXT BOOK OF INVERTEBRATES

BY NAIR , et at al ; SARAS PUBLICATION , 2014

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Page no :- 620 - 621 .

- A TEXT BOOK OF ANIMAL DIVERSITY

BY R.L KOTPAL ; RASTOGI PUBLICATIONS , 2020

Page no :- 391 – 403.