VIDYASAGAR UNIVERSITY

PROJECT REPORT ON
LARVAL FROMS OF ECHINODERMATA (Asterias sp.)

B.Sc ZOOLOGY(Hons) 2nd Semester

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Yours faithfully
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A. INTRODUCTION:

Bipinnaria-larva is present in the life-cycle of all the members of class- Asteroidea, subphylum-Asterozoa, phylum-Echinodermata (classification based on Ruppert and Barnes,1994)

Two types of development occurs in Asteroids. In direct development, the eggs are large and yolky and no free swimming larval stages. In indirect development, different types of free-swimming larvae are formed.

systematic Position:

Phylum- Echinodermata

Subphylum- Asterozoa

Class- Asteroidea

Order- Forcipulata

Genus- Asterias

Species- rubens

Larval forms of Echinodermata (Asterias sp.)

Larva:

1. The larvae hatch in water, feed and grow through successive larval stages to become adults.
2. Larvae of Echinoderms are bilaterally symmetrical but lose symmetry during metamorphosis.
3. Different classes of Echinoderms show structurally different larval of Echinoderms show structurally different larval stages.

Characters of Echinodermata larva:

I. Most important features of Echinodermata larvae, They are bilaterally symmetrical which each in contrast to the radial symmetry of adult.
II. Larvae have complete alimentary canal with ciliated stomodium.
III. Cilia set up water current, that draw food (diatoms) into the gut.

Larval forms of different classes:

Class	Larval form
Asteroidea	Bipinnaria
Ophiuroidea	Ophiopluteus
Echinoidea	Echinopluteus
Holothuroidea	Auricularia
Crinoidea	Doliolaria/ Pentacrinoid

❖ Habit and Habitat of adult organism:

Asterias is exclusively marine and widely distributed member of Echinoderm. All the species under this genus are benthonic animals, because they inhabit the bottom of the sea. They are quite abundant on various types of sea-bottoms, specially at places where bivalves are available as food. They are carnivorous and predacious animals. Majority of the forms are photonegative and prefer to live in shade areas.

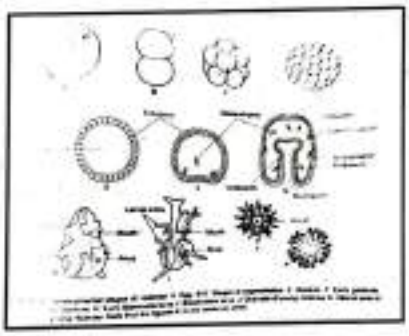
❖ Reproduction Strategy:

Reproduction, in Asterias is mainly sexual but asexual reproduction by splitting of the body also take place. The sexes are separate but sexual dimorphism is absent. The ovaries and testes are similar in appearance. They are situated in the same place of the body.

❖ Life history and development of Asterias:

1.Fertilization:-

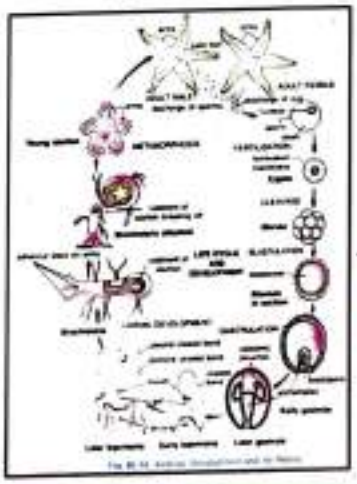
The sex cells are set freeinto the sea water and the fertilization is external.



2. Development :-

The development sequences are best known in an allied form of Asterias. The eggs are spherical and yolks are 0.5 mm in diameter. The egg is homolecenthal cleavage is holoblastic. This swims in water.

Eventually, three additional arms develop at the front end of the larva; at this point it becomes a brachiolaria. In some species, including the common starfish Asterias, the bipinnaria develops directly into an adult.



❖ Bipinnaria Larva :

In larval forms and diversifications of phylum – Echinodermata –ranks second to the phylum- Arthropoda, not only that these larval forms are also important for phylogenetical relationship with others.[Echinodermata-larva show the bilaterally-symmetry but adult is radially symmetrical]

History :- Morphology of different larval forms have been given by Hyman (1945,47,49). The role of larva in Echinnodermata phylogeny has elaborately described by H.B.Fells (1948,66).

❖ Larval form:

These type of larva is characteristics of the Class – Asteroidea.

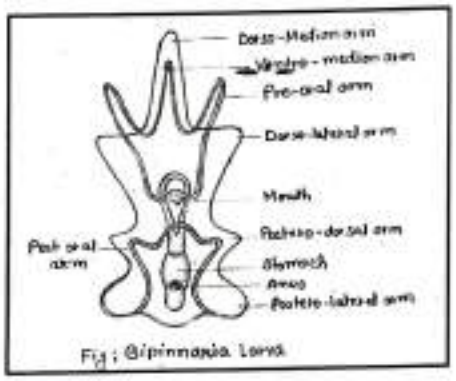


Fig : Bipinnaria Larva

➢ Morphologycal features:-

1) Body shaped –
   The body of Bipinnaria is transparent and extremely bilaterally symmetrical.
2) Ciliated bands :-
   It has two ciliated bands, one is pre-oral and other is post-oral ciliated band.
3) Arms:-
   The arms are provided with muscles and are contractile in nature. The other lateral arms are absent.
4) Name and number of arms:-
   The name and number of the arms developing from pre-oral and post-oral ciliated bands as follows-

Name	Number of Arms
Postero lateral	2
Postero dorsal	2
Antero dorsal	2
Post oral	2
Pre oral	2
Mid ventral arm	1
Mid dorsal arm	1

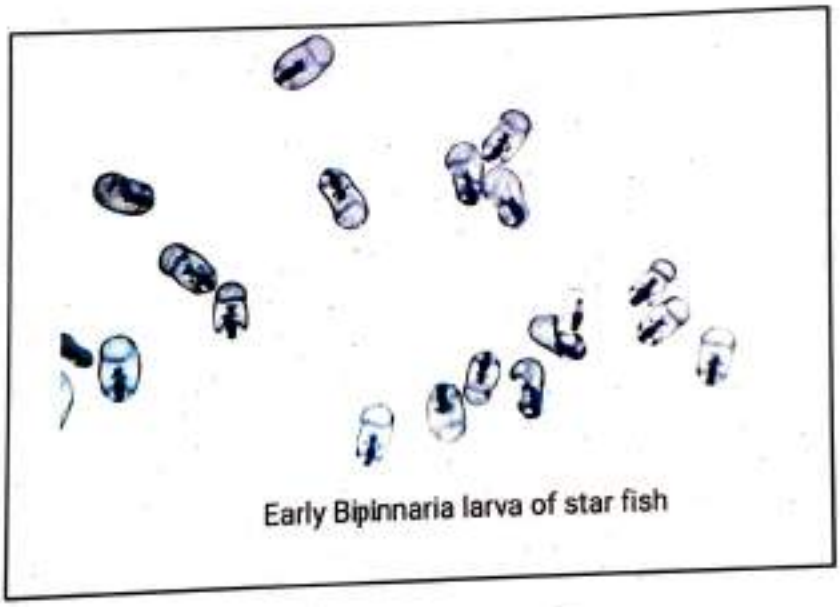
❖ Anatomical features:

I. Within the body alimentary canal and coelomic apparatus are present.

II. It feeds on plankton (diatoms), create food current by ciliary movement.

III. The presence of powerful ciliary bands on the stomodeal walls helps in feeding.

After some weeks of free swimming left bipinnaria is converted in "brachiolaria larva".



Early Bipinnaria larva of star fish

❖ Special features:

I. Bipinnaria larva possesses 5 pairs of ciliated arms which do not have any skeleton support inside.

II. These arms are used for swimming in water while feeding on planktons.

III. Pre-oral and post oral ciliary bands are also present.

E. Food and feeding of larva:

In the echinoderms with open ambulacral grooves, the podia primarily have a food gathering function. They feed on microscopic organisms and fine particles by muco ciliary meth od. Mucus prospects the surface to collect the small particles. Giston(1924) recorded it in Asteroids and crinoids.

F. Metamorphosis of larva:

Metamorphosis takes place about 4 mo after fertilization, Without the larva's passing through a brachiolaria stage. The full-grown bipinnaria is 2.5mm long and has five pairs of bipinnaria arms. At metamorphosis the larval part is absorbed into the asteroid rudiment. Juveniles are about 730 qm in diameter.

G. Evolutionary significance of Echinoderms larvae

It is seen that different classes of echinoderms have somewhat different larvae which are differently named.

1. Common origin of classes:

Except the larvae of Crinoidea which becomes sedentary , the larvae of rest of the classes have some fundamental resemblances. They are constructed on the same general Fundamental plan with bilateral symmetry. They have somewhat flattened body, longitudinally looped ciliated bands, gut and enterocoelic coelom. With so many common characters one mey conclude the origin of their respective classes (groups) from a common ancestor which was a coelomate, bilateral and freeswimming. Dipleurula and pentactula larva are two such hypothetical ancestors suggested by Zoologists. It is believed that all modern echinoderms have originated from them.

2. Taxonomic affinities:

Closely looking at the classification of the phylum, it is sen that the larval similarities do not indicate taxonomic affinities. Among Eleutherozoa, two well marked lrval froms occur:

I. Pluteus group is common to ophiuroids

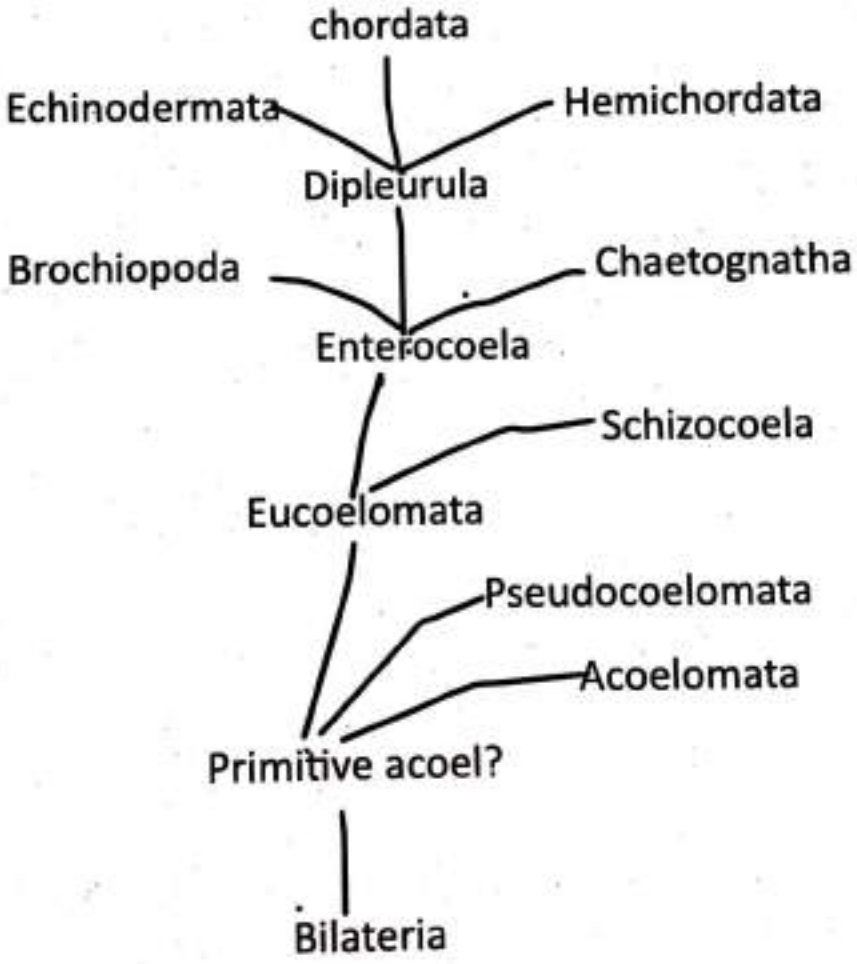
And echinoids, bilaterally symmetrical with long arms,

II. Auricularia group is common to asteroids and holothurians, has a winding ciliated bands which may be produced into lobes. On the basis of larval similarities ophiuroids should be placed near to echinoids and asteroids near to holothurians. But this is not in agreement with the palaeontological and morphological result, according to which asteroids and ophiuroids are closely related to each other while echinoids seem to have followed an

entirely independent evolution.

3. Phylogenetic affinities:

A survey of larval types throughout echinoderms indicates several example of close larval resemblances e.g., ophiopluteus and echinopluteus. This must be due to convergent larval evolution. Occurrence of convergence in development is seen among unrelated groups such as Asteroidea, Holothuroidea and Crinoidea. Similarly, larva of closely related forms such as asteroids and ophiuroid, exhibit major differences, which must be due to



H. Conclusion

The diversity of larval forms in marine invertebrates has long fuelled discussion on evolutionary origins of novel features and pathway of evolutionary change. Most phyla of animals are marine, and most of these animals, annelids, molluscs, echinoderms, hemichordates, brachiopods, phoronids, sipunculans, ascidians and others are benthic as adults, but have planktonic so called 'primary' larvae with different body plans than possessed by adults.

The most convincing affinities are noted between the echinoderms and the chordates. Hence many workers regarded the echinoderms to be the nearest group to the chordates. However, modern workers do not support the contention and they hold that the echinoderms and the chordates diverged separately from a common basic ancestor.

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