Structure and Life History of Pila Globosa – Part II

BSc. Part I Zoology (Subsidiary)

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1. Reproductive System of Pila Globosa:

In Pila Globosa, the sexes are separate, i.e., dioecious and there is a definite sexual dimorphism. The shell of the male is usually smaller in size and less swollen than the female. There is a well-developed copulatory organ in the male but it is quite rudimentary in the female.

(i) Male Reproductive Organs of Pila Globosa:

The male reproductive organs consist of:

1. Testis with its fine vasa efferentia

2. Vas deferens with the vesicula seminalis and the terminal glandular part of the vas deferens

3. Penis with its sheath

4. Hypobranchial glands.

1. Testis:

It is a flat plate-like whitish structure, more or less triangular in outline, situated in the upper part of the first 2½ – 3 whorls of the shell. It lies closely attached to the digestive gland along its upper and inner or columellar edge and is separated from the shell by a thin cutaneous membrane.

The cream-coloured testis is easily distinguished from the digestive gland which is brownish or dirty green. Minute ducts the vasa efferentia lead downwards from the different parts of the testis and may unite with one another before opening into the vas deferens.

2. Vas Deferens:

From the posterior end of testis arises a thin vas deferens.

It consists of three distinct parts:

(i) Proximal thin tubular portion leading from the testis,

(ii) Vesicula seminalis and

(iii) Thick glandular portion which opens into the mantle cavity near the anal opening. The vas deferens starts from the posterior end of the testis and runs immediately beneath the skin along the inner or columellar edge up to the postero-renal chamber. It then turns to the left and on reaching the level of the pericardium turns upwards and to the right to open into the vesicula seminalis on its ventral side.

The vesicula seminalis lies to the right of the pericardium immediately below the line of junction of the anterior and posterior renal chambers. It is slightly curved and has a flask-shaped appearance with its posterior blind end broadly rounded.

The vesicula seminalis opens on the left side into the terminal glandular part of the vas deferens. In the mantle-cavity, the vas deferens lies closely attached to the left side of the rectum and ends in a prominent claw- shaped structure the genital papilla having the male genital aperture a little behind the anus.

3. Penis Sheath and Penis:

The edge of the mantle bears on its inner surface a thick glandular flap of a yellowish colour. The flap is attached on its right-side but is free on its left; its edges are slightly rolled in to form a spout-like sheath, penis sheath for the penis. The penis is a long and stout flagellar structure, about half an inch long arising from the attached right side of the flap of the mantle.

It is seen as a slightly curved structure lying within its sheath. It is swollen at its point of attachment but gradually tapers to the free tip, bearing a deep groove all along its length on its inner surface. The penis is capable of extension.

4. Hypobranchial Gland:

At the base of penis sheath is an oval hypo-branchial gland. It consists of tall cells containing small basal nuclei. The surface of the glandular area is somewhat pleated but there is no duct and the secretions of the gland cells are apparently poured directly on the surface.

The spermatogenesis of Pila globosa has been worked out by Sharma, G. P., Gupta, Brij Lal, and Mital, O.P. (1959) and they have reported that the spermatozoa of Pila are of two kinds:

(i) Eupyrene sperms and

(ii) Oligopyrene sperms.

The eupyrene sperms are hair-like having an elongated spirally twisted nucleus with a small conical acrosome in front, and a mitochondrial middle piece behind, followed by the end piece in the form of a long vibrating tail.

The anterior and posterior limits of middle piece are marked by the proximal ring-shaped centrosome and distal granular centrosome respectively. The axial filament springs up from the

proximal centrosome; in the region of the middle piece the axial filament is enseathed by the mitochondrial material, but in the end piece the filament is naked.

These sperms move actively forward in a spiral course, measure about 25 μ in length and 1.2 μ in breadth and they can only fertilise the eggs. The oligopyrene sperms on the other hand, have a very sluggish and serpent-like movement.

The acrosome is poorly developed, the nucleus is elongated, broad and curved but not spirally coiled ; the middle piece is short and the number of axial filaments varies from 4—8. These sperms measure about 32.5 μ in length and 3 μ in width and they cannot fertilise the eggs; these are probably having some secondary function.

(ii) Female Reproductive Organs:

The female reproductive organs consist of:

1. Ovary with numerous minute ducts

2. Main oviduct

3. Receptaculum seminis

4. Uterus

5. Vagina

6. Hypobranchial gland.

1. Ovary:

The ovary in the female lies in the same position as the testis in the male but it is not so extensive. It occupies the upper and inner surfaces on the first 2 – 2½ whorls and is covered over by a thin but stout skin-coat. Ovary is a much branched structure of a light orange colour which becomes darker in fully mature individuals.

The branches of ovary consist of single-layered acini which are more or less flask-shaped, with their closed rounded ends directed outwards and the elongated necks of the flasks descending to meet those of the adjacent acini to form minute ducts which in their turn open into the main oviduct.

2. Oviduct:

The narrow and transparent oviduct originates from about the middle of the ovary. It runs anteriorly just below the skin along the inner margin of the digestive gland. Near the renal organ it turns downwards and then upwards to enter the receptaculum seminis.

3. Receptaculum Seminis:

It is a bean-shaped structure, lying in the cavity of the posterior renal chamber closely attached to the uterus. A thin-walled pouch arises directly from the wall of the uterus and is called the pouch of the receptaculum.

4. Uterus:

It is a large pear-shaped structure, deep-yellow in colour. It lies inside the body whorl below the intestine and the right of the renal chambers. The apex of the uterus points forwards and is continued as the vagina, while its basal portion is broad and rounded and is connected on its outer side with the receptaculum seminis.

5. Vagina:

The vagina is a white or cream coloured, band-like structure lying immediately beneath the skin. It extends from the uterus to the upper end of the columellar muscle. The vagina enters the mantle cavity at its right posterior corner and continues forwards to the female genital aperture situated on a small papilla, a little behind the anus.

6. Hypobranchial Gland:

The hypobranchial gland of female is poorly developed. There is a rudimentary glandular thickening in the area of hypobranchial gland.

7. Copulatory Apparatus:

The female has a rudimentary penis lying beneath the glandular fold at the edge of the mantle. It is a thin flagellar structure with a rudimentary groove along its inner surface. The flagellum is about a quarter of an inch in length and has nearly the same thickness throughout except the tip where it is slightly pointed. There is no trace of the folding's of the penis sheath.

2. Copulation in Pila Globosa:

Copulation in Pila globosa (Fig. 60.30) occurs either in water or on land, it lasts for 3 hours. Male and female Pila come together facing each other.

The penis of the male is expanded and gets attached to the genital papilla by its base. Then the penis and its sheath are inserted into the mantle cavity of the female. The tip of the penis is put into the female genital aperture and spermatozoa are transferred through the vagina into the receptaculum seminis.

3. Fertilisation of Pila Globosa:

Eggs are fertilised in the uterus and oviposition starts a day or two later. The fertilised eggs are laid in masses of 200 to 800 in moist earth near ponds and lakes.

4. Development of Pila Globosa:

In their development Mollusca pass through two larval stages, there is a trochosphere larva which soon grows into a veliger larva.

The development of the trochosphere is the same as in polychaete Annelida. The typical trochosphere develops in Patella. A free- swimming trochosphere is found only in some primitive gastropods, such as Diotocardia, but in all others the trochosphere stage is reduced and passed within the egg.

More characteristic of marine gastropods is a free swimming veliger larva which hatches from the egg.

The veliger is a modified trochosphere but represents a more advanced stage of development, its organs show greater degree of development than those in the trochosphere larva. It has a ciliated apical organ on the head, a curved gut, larval nephridia and a ciliated pre-oral prototroch; but it has organs not found in the trochosphere.

The prototroch develops into a characteristic swimming organ, the velum which is a bilobed circlet with strong cilia, it is formed as an outward extension of the prototroch. The velum causes a current which brings food into the mouth, and it serves as an organ of locomotion for the free-swimming veliger.

On the dorsal side of the veliger is an embryonic shell gland which secretes a shell, the shell soon loses its simple form and assumes a spiral shape due to unequal growth; larval retractor muscles are formed. On the ventral side is a foot lying between the mouth and the anus. On the dorsal side between the velum and the anus the ectoderm forms a mantle.

The mesoderm forms two bands which do not segment but break up into cells, some of which form muscles. Torsion takes place during the veliger stage, the shell and visceral mass are rotated through 180 degrees in relation to the head and the foot, but coiling of the visceral hump usually precedes torsion.

Torsion may be very rapid taking only a few minutes, or it may be a gradual process taking several days.

A stage is reached when the veliger cannot only swim by its velum but it can also creep by its foot. Gradually the velum becomes smaller. In freshwater and terrestrial Mollusca there is no free-swimming larva, both the trochosphere and the veliger stages are passed within the egg shell, and a tiny snail hatches from the egg shell.