

Structure and Life History of Pila Globosa – Part I

BSc. Part I Zoology (Subsidiary)

1. Habit and Habitat of Pila Globosa:

Pila globosa or the apple snail is one of the largest freshwater molluscs. It is commonly found in freshwater ponds, pools, tanks, lakes, marshes, rice fields and sometimes even in streams and rivers. They occur in those areas where there is a large amount of aquatic vegetation like *Vallisneria*, *Pistia*, for food. They are amphibious being adapted for life in water and on land.

The animal creeps very slowly by its ventral muscular foot, covering about five cm per minute.

The movement of the animal is like the gliding movement of planarian. During the rainy seasons *Pila* comes out of the ponds and makes long terrestrial tours, thus, respiring air directly. It can overcome long periods of drought in a dormant condition and buried in the mud; this period of inactivity is called aestivation or summer sleep.

2. External Features of Pila Globosa:

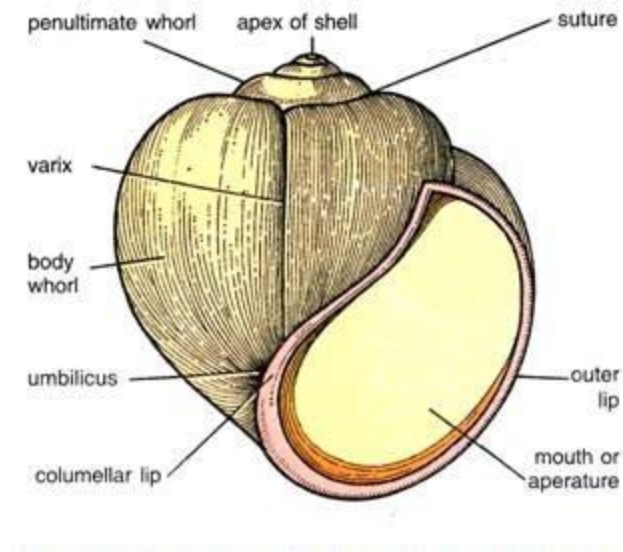
Shell of Pila:

The shell of *Pila globosa*, as in other Gastropoda, is univalve but coiled around a central axis in a right-handed spiral.

The top of the shell is the apex which is formed first and growth of shell takes place from it, the apex contains the smallest and the oldest whorl. Below the apex is a spire consisting of several successively larger whorls or coils followed by penultimate whorl and the largest whorl or body whorl which encloses most of the body.

The lines between the whorls are called sutures. Internally all the whorls of the shell are freely communicated with one another; such a shell is called unilocular. The body whorl has a large mouth or opening, the margin of the mouth is called a peristome from which the head and the foot of the living animal can protrude.

When viewed from the ventral side with the peristome facing the observer, the mouth lies to the right of the columella and the shell is spiralled clockwise, then it is spoken of as being right-handed or dextral. The outer margin of the mouth is called an outer lip, and the inner margin as inner or columellar lip.



In the centre of the shell runs a vertical axis or columella around which the whorls of the shell are coiled; the columella is hollow and its opening to the exterior is known as an umbilicus. Shells with an umbilicus are umbilicate or perforate. The lines of growth of shell are visible, some of them appear as ridges known as varices. The shell of *Pila globosa* varies in colour from yellowish to brown or even blackish.

Operculum of Pila Globosa:

Fitting into the mouth of the shell is a calcareous operculum, its outer surface shows a number of rings of growth around a nucleus; the inner surface has an elliptical boss for attachment of muscles, the boss is cream- coloured and is surrounded by a groove. The operculum is, in fact, secreted by the glandular cells of the foot.

Microscopic Structure of Shell:

The shell of *Pila globosa* consists of an outermost pigmented layer called periostracum made of a horny organic conchiolin, below this is a prismatic layer made of crystalline calcareous plates running vertically, the innermost nacreous layer is made of calcareous plates running longitudinally.

Shells of Gastropoda display an infinite variety of shapes, sculpturing, patterns, and colours. Inside the shell is the mantle which secretes the shell.

Body of Pila:

The body consists of a head, a foot and a visceral surface, mass. In an expanded animal the head and foot come out of the shell-mouth but the visceral mass lies inside the shell whorls. A columellar muscle arises from the foot and is inserted in the columella, it attaches the body to the shell and it withdraws the animal inside and closes the operculum.

(i) Head:

There is a distinct head produced into a snout, the head bears two pairs of tentacles. The first pair of tentacles or labial palps are small and lie in front, behind them there is a second pair of tentacles which are long. The tentacles are hollow and capable of much extension and contraction. Behind the tentacles the head has a pair of eyes borne on stalks or ommatophores.

(ii) Foot:

Below the head is a large muscular foot, its lower surface is gray and flattened sole. It is triangular with the apex pointing backwards, it is used for creeping; its upper surface is spotted and the dorsal posterior surface bears the operculum.

When the foot is withdrawn the operculum closes the mouth of the shell. In the foot is a pedal mucous gland which forms a slime trail during locomotion. Waves of contraction which sweep from the anterior to the posterior end of the foot provide the main power for locomotion.

In fact, the head and the foot together constitute the head-foot complex which is connected to the visceral mass by an inconspicuous neck.

(iii) Visceral Mass:

Above the head-foot complex is a visceral mass containing the main organs, it fills all the whorls of the shell and it is spirally-coiled like the shell. The visceral mass exhibits the phenomenon of torsion which is distinct from coiling. It is soft and grey to dark brown in colour.

(iv) Mantle:

The mantle, also referred to as pallium, covers the visceral mass and it forms a hood over the animal when it is withdrawn. The edge of the mantle is thick and contains shell glands which secrete the shell, above the thickened edge there is a supra-marginal groove.

The mantle also has two fleshy lobes called nuchal lobes or pseudopodia which are joined on either side of the head. The left pseudopodium forms a long tubular respiratory siphon for aerial respiration and a respiratory current enters, through it, the right pseudopodium is less developed and not a regular tube, respiratory current passes out through it.

Mantle Cavity and Pallial Complex:

In the anterior part there is a large space between the mantle and the body, this is a mantle or pallial cavity which has been shifted to the front by a process of torsion. It encloses a number of organs and the head can be withdrawn into it. The mantle or pallial cavity encloses within it a number of important organs which are collectively known as pallial complex.

Near the right pseudopodium is a prominent ridge or epitaenia which runs backwards up to the end of the mantle cavity, it divides the mantle cavity into a right branchial cavity and a left pulmonary sac.

In the branchial cavity or chamber lie a single gill or ctenidium, rectum and anus, the genital aperture and the anterior chamber of the kidney as a reddish mass near the posterior end of the epitaenia. Near the left pseudopodium is a fleshy osphradium a typical molluscan sense organ.

3. Coelom of Pila Globosa:

The coelom is reduced to unpaired cavities of pericardium, kidney and gonad. The renal and pericardial cavities communicate, but the cavity of gonad is unconnected. The visceral organs are surrounded by means of sinuses or spaces containing blood. These blood-filled spaces constitute the haemocoel.

4. Digestive System of Pila Globosa:

The digestive system of Pila Globosa comprises:

1. A tubular alimentary canal
2. A pair of salivary glands
3. A large digestive gland

(i) Alimentary Canal:

The alimentary canal is distinguished into three regions,

1. The foregut or stomodaeum including the buccal mass and oesophagus,
2. The midgut or mesenteron consisting of stomach and intestine, and
3. The hindgut or proctodaeum comprising the rectum. The midgut alone is lined by endoderm, while the other two are lined by ectoderm.

1. Foregut:

The foregut includes the mouth, buccal mass and oesophagus.

(i) Mouth:

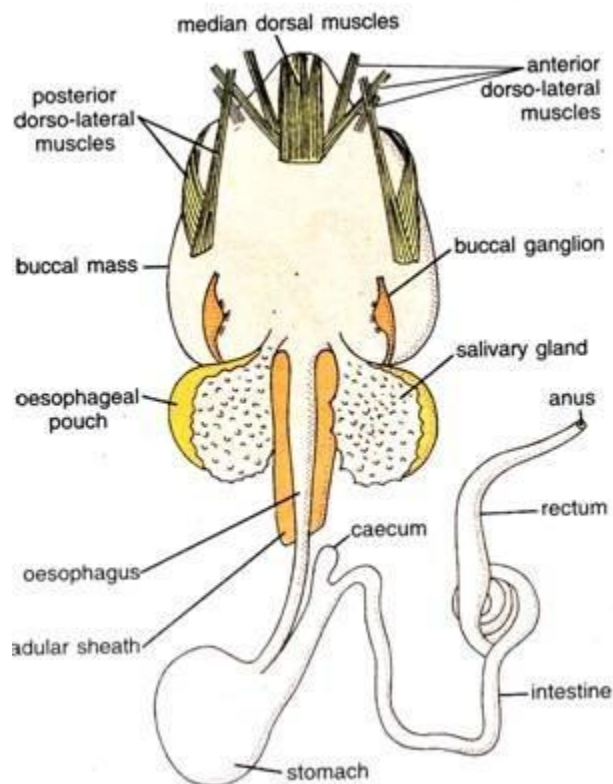
The mouth is a narrow vertical slit situated at the end of snout. There are no true lips but the plicate edges alone serve as secondary lips.

(ii) Buccal Mass:

The mouth leads into a large cavity of buccal mass or pharynx having thick walls with several sets of muscles. The anterior part of the cavity of buccal mass is vestibule. Behind the vestibule are two jaws hanging from the roof of the buccal mass. The jaws bear muscles and their anterior edges have teeth-like projections for cutting up vegetable food.

Buccal Cavity:

Behind the jaws is a large buccal cavity. On the floor of the buccal cavity is a large elevation called odontophore. The front part of odontophore has a furrowed subradular organ which helps in cutting food. The odontophore has protractor and retractor muscles and two pairs of cartilages, a pair of triangular superior cartilages which project into the buccal cavity, and a pair of large S-shaped lateral cartilages.



Radula:

Above and behind the odontophore is a bag-like radular sac which is a diverticulum of the buccal cavity. The radular sac has transverse rows of cells called adontoblasts. Inside the radular sac is a radula which is characteristic of Mollusca. The radula is made of many transverse rows of horny teeth.

Each row has seven teeth, two marginal and one lateral tooth on each side and a central or rachidian tooth in the middle, thus, giving a formula 2, 1, 1, 1, 2. The radula moves forward and

backward on the odontophore for rasping food particles; these movements of radula are called chain saw movements.

The teeth are made of chitin which is reinforced by hardened protein, they have sharp cutting projections which act like a file and rasp vegetable food. The teeth of the radula are worn off in front and new teeth are formed all the time by odontoblasts. On the roof of buccal cavity, above the radula, is a pair of grooved buccal glands which are digestive.

(iii) Oesophagus:

The buccal mass leads into a long narrow oesophagus. From near the origin of the oesophagus arise a pair of round, whitish oesophageal pouches. They arise by short ducts and lie below the salivary glands. They are prolongations of the oesophagus, they probably secrete digestive enzymes.

Oesophageal pouches serve for a temporary storage of food and digestion begins in them. Some extracellular digestion is brought about in the stomach by the enzymes produced by the salivary glands and oesophageal pouches.

2. Midgut:

The midgut includes the stomach and intestine.

(i) Stomach:

The stomach begins on the left side just below the pericardium and runs backwards as a blind pouch on the postero-lateral sides of the main whorl of the visceral mass. It is a rectangular sac of dark red colour having a broad U-shaped internal cavity of rose-red colour. The stomach is differentiated into two chambers—cardiac chamber and pyloric chamber.

The cardiac chamber is rounded in appearance and possesses longitudinal folds on its inner surface. The oesophagus opens into it. The pyloric chamber is tubular and has transverse folds on its inner surface. From the pyloric chamber arises a short bag-like caecum but it has no crystalline style as found in many gastropods. The duct of digestive gland opens into the stomach at the junction of its two chambers.

(ii) Intestine:

From the pyloric chamber arises an intestine which runs along its anterior edge and further along the digestive gland beneath the posterior renal chamber. It then turns upwards and backwards in the visceral mass where it forms $2\frac{1}{2}$ or 3 coils between the gonad in front and the digestive gland behind, before joining the rectum.

3. Hindgut:

The rectum or terminal part of the alimentary canal is a thick-walled tube. It enters the mantle cavity and passes downwards to open by an anus on the right of the head.

Salivary Glands:

The two salivary glands lying one on each side of the posterior limit of the buccal mass and partially cover the oesophagus. The surface and margins of each gland are greatly cut up, giving it the appearance of a somewhat branched type of gland.

The duct of each gland begins near its internal anterior corner and immediately enters the muscles of the buccal mass and opens into the buccal cavity. The secretion of salivary glands contains mucus and an enzyme which digests starch. The mucus lubricates the radula and helps in the transport of food.

Digestive Glands:

The digestive gland, often referred to as liver or hepatopancreas, of *Pila globosa* is a somewhat triangular plate or cone with a very convex outer and more or less flattened inner surface. The cone is spirally coiled from the tip inwards and downwards following the whorls of the shell.

The gland is of a brownish to dirty green colour and is quite soft when fresh. Two main ducts arise from the two main lobes of the digestive gland; these ducts unite just before reaching stomach to open into it by a common aperture.

The digestive gland is made up of a number of fine tubules bound together by connective tissue. These tubules unite with one another to form larger tubules which terminate in two main ducts corresponding to two main lobes of the gland. The terminal part of each tubule is glandular, called the alveolus and the rest of the tubule is ciliated.

The alveoli have three kinds of cells, they are secretory, resorptive and calcareous cells or lime cells. The secretory cells produce a brown liquid containing an enzyme which dissolves cellulose of plants in the stomach converting it into pulp. The resorptive cells produce a proteolytic enzyme. This enzyme brings about intracellular digestion of cellulose pulp. The calcareous cells store phosphate of lime.

(ii) Food and Feeding:

The food consists of aquatic plants of succulent nature like *Vallisneria* and *Platia* which are cut by jaws and the odontophore, then the radula moves forwards and backwards filing the food into small particles exactly like the chain-saw mechanism. Thus, the food is cut up and masticated inside the buccal cavity.

(iii) Digestion:

The salivary glands pour their secretion by means of their ducts into the buccal cavity where it mixes with the food. It helps in digesting the starch by converting it into sugar. In the stomach the food is digested by the secretion of digestive gland. Secretion of digestive gland digests various kinds of food but cellulose is digested inside the resorptive cells only.

Thus, both extracellular and intercellular digestion occur. The stomach is the site of extracellular digestion and the digestive gland is the site of intracellular digestion and absorption, this is characteristic of Mollusca. Absorption of digested food takes place mainly in the digestive gland and some in the intestine.