

A MORPHOLOGICAL STUDY OF REPRODUCTIVE SYSTEM OF PESTIFEROUS LAND SNAIL *MACROCHLAMYS PETROSA* FROM AURANGABAD, MAHARASHTRA, INDIA.

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ABSTRACT

Reproductive system of molluscs is highly complicated with its elaborate arrangement of the convoluted glandular duct system and the details of which are of taxonomic importance. It is therefore not surprising that the elucidations of the structure, function and control of the reproductive activities in pulmonate have been of vital interest to malacologists, ecologists and physiologists.

KEY WORDS: *Macrochlamys petrosa*, Morphology, pestiferous snail, Reproductive system

INTRODUCTION

The functional anatomy and histology of reproductive system of pulmonates have been studied by many workers. A considerable diversity exists in the internal anatomy of the pulmonates (Hyman, 1967 and Morton, 1979). Considerable literature is available on the various aspect of the land pulmonate reproductive system. Majority of pulmonates are hermaphrodites and exhibit varying degree of proterandry, protogyny and simultaneous hermaphroditism (Hyman, 1967). A hermaphrodite is defined as an organism possessing both male and female reproductive organs. Hermaphroditism has been known since antiquity, but its functional significance is, as yet, only partly understood. The study reveals that about 40% of the 5600 molluscs genera either simultaneous or sequential hermaphrodites. Hermaphroditism occurs in 100% of the Solenogastres, 99% of the Opisthobranchia, 100% of Pulmonata, 3% of Prosobranchia and 9% of the Bivalvia. In Stylommatophora the reproductive system is less specialized, there is a common sperm oviduct; the female tract is not clearly differentiated into separate regions, the prostatic follicles open into the male tract (Mead, 1950). This is also true of many of the slugs (Runham and Hunter, 1970). In some slugs the penis and dart sac are lost although the sac is retained in *Philomycus* (Kugler, 1965).

Additional findings on the morphology of the proximal part of the reproductive system of the Stylommatophora, external, internal and histological structures of the fertilization pouch and seminal receptacle complex, shows that oogenesis usually occurs in the time period from April to July, beginning in August, spermatogenesis prevails (Schileyko, and Schileyko, 1992). Lot of research has been done on reproduction, particularly on the freshwater species and very less attention has been paid on garden snails and slugs. Recently, a few attempts have been made to study some aspects of *Macrochlamys* species. Panha and Somsak (1997) also studied some aspects of new species of *Macrochlamys*. In review of the above cited literature, it is clear that practically nothing is known about the breeding biology and reproductive cycle of the terrestrial stylommatophoran snail, *Macrochlamys petrosa* (Hutton).

MATERIALS AND METHODS

M. petrosa were collected monthly, from different localities in and around the city, Aurangabad (Maharashtra, India). The snails were maintained in glass troughs filled with 2 inches humus soil moistened with water and brought to approximate the natural habitat. To avoid overcrowding about 20 to 30 snails were introduced in each trough. They were fed twice in a day with leaves of Cucurbitaceae family plant, certain green leafy vegetables. Before providing food to snails the troughs were cleaned by removing the excreta and left over of food. *M. petrosa* were dissected and observations were made on freshly dissected reproductive system in order to study morphology of reproductive system.

RESULTS AND DISCUSSION

The present snail *Macrochlamys petrosa* is a protandrous hermaphrodite snail having seasonal breeding pattern during annual reproductive cycle. The sexually mature snail measures 1.3 to 1.5 cm shell length. Though these are hermaphrodites do not self fertilize when sexually mature, copulation takes place with exchange of spermatozoa and thereby internal fertilization is insured. Fertilized eggs are laid with in the moist soil. After having sufficient rain during monsoon season, these snails come out of aestivating conditions, and then start the breeding. The process of breeding is continued till end of September, when egg laying is completely stopped. During monsoon season, the environmental conditions are favorable i.e. during July to September of the year. The number of juveniles in laboratory and field were more in the month of August and September, indicating peak breeding activity of the snail, *M. petrosa*.

The climate in Marathwada region of Maharashtra State is characterized by seasonal rainfall from June to August and peak in the month of August. During these months the temperature was constant. Then from September onwards, there is less rain till May.

M. petrosa was dissected in order to expose its reproductive system. After dissecting the entire system intact, morphological observations were made under binocular microscope or using magnifying lenses. The reproductive system of *M. petrosa* is composed of common hermaphrodite gonad, the gonadal lobes are arranged in a line of succession, anterior one is largest and posterior most is smallest in sizes and having made up of 5 to 8 lobes. The number of lobes increases during peak breeding period of the snail. Each gonadal lobe looks like bunch of grapes i.e. made up of oval to circular or irregular, shaped hermaphrodite follicles. Number of follicles in each lobe varies maximum in anterior one and minimum in posterior lobes. During reproductively active period, the number of hermaphrodite follicles are maximum i.e. 30-40 in large sized gonadal lobe. Minimum number 5-8 of gonadal follicles are present during aestivating months i.e. October onwards, which is the reproductively quiescent period of the snails.

Each hermaphrodite follicle is having small ductule which opens together, forming common hermaphrodite duct; in this way, all follicles of each gonadal lobe opens in a same fashion forming a wider common hermaphrodite duct. Prior to open in the region of carrefour there are enlargements within the hermaphrodite duct, which are sac like, forms temporary storage of spermatozoa.

At the region of carrefour, the reproductive tract gets separated into the male reproductive part including prostate gland, vasdeferens, penial complex with dart sac and the female reproductive parts include albumen gland, spermooviduct, uterus and vagina, which open at the base of the right optic tentacle. Attached, to the uterus, there joins a sac with elongated duct called as spermatheca or some times also referred as bursa copulatrix. Each gonadal lobe is having hermaphrodite follicles. Each follicle has small ductules with a thin capsule layer made up of single celled thick ciliated cells. These small ductules join together or open to from common hermaphrodite duct. It is tubular broad and coiled at its proximal end. The middle part of the hermaphrodite duct is compactly arranged and is convoluted. Before joining to the carrefour region, it becomes constricted and looks like a thread. Hermaphrodite duct carries both eggs and sperms, which proceeds to a point where male and female system separate.

Male reproductive tract

1. Seminal vesicle:

The middle portion of the hermaphrodite duct becomes dilated and bears a number of small diverticula within which sperms are stored are called seminal vesicle. The number and size of diverticula vary according to reproductive phase of the snail *M. petrosa*. The lining of seminal vesicle are having made up of large sized, cuboidal cells with basophilic nuclei. Lumen of these vesicles is filled with sperms.

2. Prostate gland:

At the region of carrefour male and female reproductive system gets separated. A pale yellow coloured, multilobed prostate gland is attached at some distance from the carrefour region. It remains loosely associated with spermooviduct. The prostate gland is thin, long tubular gland connected with sperms groove along much of the length of spermooviduct. The prostate gland appears like papillar with elongated prostatic follicles or tubules. The prostate gland is more active during completion of male phase maturation and at the time of copulation period. The prostatic duct opens in to the vas deferens.

3. Vas deferens:

The common spermooviduct divides into two specific ducts, a narrow vas deferens and a wider thick oviduct. The vas deferens at most of its length remains embedded within oviduct in posterior region and appears as a thin transparent tube at the anterior region. It is coiled, takes a twist to penial complex and joins the dart sac. The spermatozoa are traversed through vas deference to penial complex and then discharged at the time of copulation by both copulating partners. Peristaltic movements are observed within vas deferens. Since it is thin, delicate tube was difficult to excise for histological study.

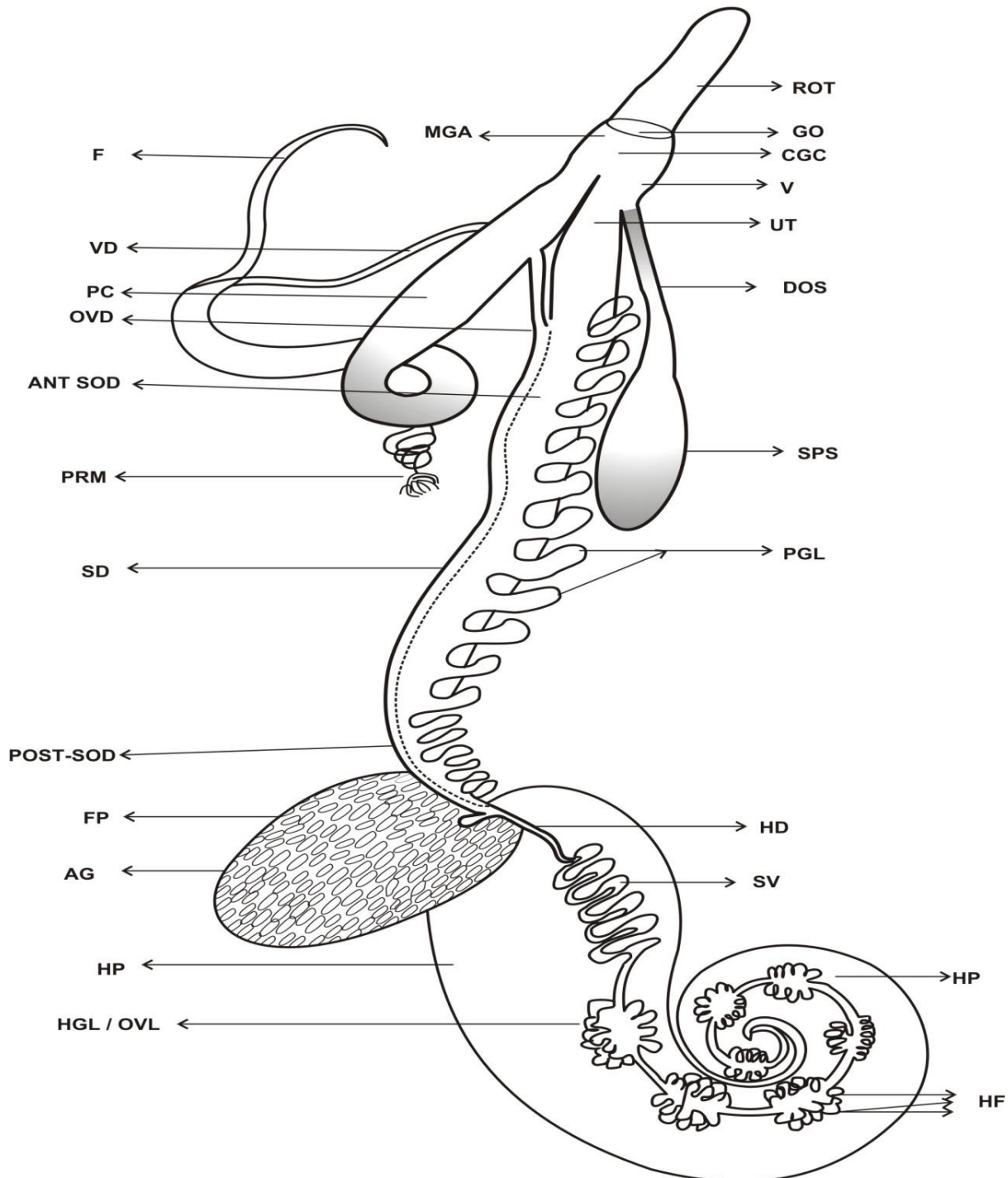
4. Penial Complex:

The penial complex is a highly muscular tube can be everted at the time of copulation. The penis itself lies within the verge sac. Several muscular bands are present on each side of the organ near the genital pore called as protractors. Extruded penis is withdrawn back into the body by a specialized muscle the penial retractor. The penis joins the vagina to form a short common chamber which opens to the exterior through the common gonopore present at the base of right cephalic tentacle.

Female reproductive tract:

1. Fertilization pouch:

At the region of carrefour the female reproductive duct or posterior end of spermooviduct ends with bulbous sac is called as fertilization pouch. It is the blind end of the spermooviduct.



Reproductive system of *Macrochlamys petrosa*

(AG= Albumen gland, Ant.SOD = Anterior spermoviduct, CGC= Common genital chamber, DOS= Duct of spermatheca, F= Flagellum, FP= Fertilization pouch, GO = Genital opening, HD= Hermaphrodite duct, HF= Hermaphrodite follicle, HGL= Hermaphrodite gland lobes, HP= Hepatopancreas, MGA= Male genital aperture, OVD= Origin of vas deferens, OVL= Ovotesticular lobes, PC= Penial complex, PGL= Prostate gland, Post. SOD = Posterior spermoviduct, PRM= Penial retractor muscles, ROT= Right optic tentacle, SD= Sperm duct,

SPS= Spermatheca, SV= Seminal vesicle, UT= Uterus, V= Vagina, VD= Vas deference).

2. Albumen Gland:

Albumen gland is single; bulbous with blunt distal end. It is dirty yellowish in colour. The colour and size of the gland goes on changing with reproductive cycle of the snail. Albumen gland is located within the anterior concave surface of hepatopancreas. It is made up of the lobules with ducts. All ducts join to form duct of albumen gland which opens at common juncture called region of carrefour. During breeding period, it is more bulbous, large in size with distinct secretory lobules/ tubules. It attains lemon yellow colour. But when the breeding activity ceased, its size is reduced and gland is dirty yellow colour. At the time of quiescent reproductive period it is quite small in size some times difficult to locate. The albumen duct opens into the distal portion of the spermoviduct.

3. Posterior Spermoviduct:

It is much more coiled folded part of sperm-oviduct. The folds formed within this region are irregular with continuous canal, through which traverses fertilized eggs and foreign sperm received after copulation.

4. Anterior Spermoviduct:

This part of spermoviduct is slightly dilated and thick, muscular tube with few convulsions at its length. In mature snails, at the time of intense breeding period the width of the duct becomes increased. The duct lumen is also wide, with secretory material enclosed within.

5. Uterus:

It is the most dilated part of the spermoviduct at the anterior region. The number of secretory cells increased in the epithelial layer. The ciliated cuboidal cells intermingled amongst the secretory cells of the uterine epithelium. The sperm duct emerges at this juncture forming vasdeferens.

6. Vagina:

The sperm oviduct gets bifurcated to form vagina and anterior part of the male copulatory organ, penis. It is the globular part of the oviduct receiving the duct of bursa-copulatrix. The vaginal opening opens at the right side of the common genital chamber present at the base of right optic tentacle. The outer lining of the genital chamber is thick, muscular having folds in it.

7. Bursa Copulatrix:

Every stylommatophoran snail has a bursa copulatrix. It is also known as the receptaculum seminis or spermatheca. It is having an elongated duct, which joins the uterus at the anterior region. The spermatheca is stalked sac-like, bulbous portion looks reddish brown in colour. The colour intensity depends upon the reproductive activity of the snail. The bursa receives the spermatozoa at the time of copulation. During non breeding season, these spermatozoa undergo lysis and dissolution of sperm (allosperm) occurs with action of secretion of bursal cells.

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