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On the reproductive anatomy of *Semisulcospira* (Cerithioidea: Pleuroceridae: Semisulcospirinae)

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Specimens of three *Semisulcospira* species (*S. gredleri* (Boettger, 1886) from Tai Hu Lake (Jiangsu Province, China), *S. libertina* (Gould, 1859) from Chiba Lake (Chiba Prefecture, Japan), and *S. forticosta* (Martens, 1886) from a small river in the Korean Peninsula (Chungchongnam Province, South Korea) were studied anatomically. These species have pallial oviducts of similar structure. The lateral lamina of all species consists of the brood pouch with embryos and a small lateral gland disposed in its proximal part. The medial lamina consists of the pallial semen-accepting pocket with the seminal receptacle, both covered by connective tissue. Some interspecific differences in the shape and position of the seminal receptacles were revealed. Data on the pallial oviduct structure of *S. gredleri* and *S. forticosta* are presented for the first time.

К репродуктивной анатомии представителей рода *Semisulcospira* (Cerithioidea: Pleuroceridae: Semisulcospirinae)

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Экземпляры трех видов рода *Semisulcospira: S. gredleri* (Boettger, 1886) из оз. Тайху (провинция Цзянцу, Китай), *S. libertina* (Gould, 1859) из оз. Чиба (префектура Чиба, Япония) и *S. forticosta* (Martens, 1886) из малой реки на п-ове Корея изучены анатомически. Обнаружено, что данные виды имеют паллиальный овидукт сходной структуры. Латеральная пластина у всех видов состоит из выводковой сумки с эмбрионами и небольшой латеральной железы, расположенной в проксимальной части латеральной пластины. Медиальная пластина состоит из семяпринимающего кармана и семяприемника, покрытых вместе соединительной тканью. У рассмотренных видов выявлены некоторые различия в форме семяприемника и его расположении на медиальной пластине. Таким образом, уточнены сведения по репродуктивной анатомии рода, выявлены некоторые анатомические межвидовые различия в пределах рода, впервые представлены данные по строению паллиального овидукта двух видов: китайского *S. gredleri* и корейского *S. forticosta*.

The ovoviviparous freshwater molluscs of the genus *Semisulcospira* Boettger, 1886 belonging to the superfamily Cerithioidea are widely distributed in streams, rivers, ponds and lakes of South-East Asia. The cerithioideans are well known as prosobranchs having very similar shell morphology. That is why identification of representatives of the group is very difficult and needs anatomical data. The literature data on reproductive anatomy of the genus *Semisulcospira* are contradictory and deficient [Itagaki, 1960; Nakano, Nishiwaki, 1989; Rasshepkina, 2004]. In this paper,

the reproductive system of three species of *Semisulcospira* from China, Japan and Korea is described.

Specimens of *S. gredleri* (Boettger, 1886) from the Tai Hu Lake (Jiangsu Province, China), *S. libertina* (Gould, 1859) collected in the Chiba Lake (Chiba Prefecture, Japan) and *S. forticosta* (Martens, 1886) from small river in the Korean Peninsula (Chungchongnam Province, South Korea) are examined. To study the morphology of the pallial oviduct, mantle cavity of ethanol-fixed specimens was dissected and examined under MBS light microscope. For anatomical and histological study the pallial portion of the reproductive system was brought through a percentage series of ethanol to 100%, sectioned at 5–7 μm and stained with hematoxylin and eosin. Prepared sections were examined under Olympus microscope.

The pallial oviduct of the genus *Semisulcospira* like that of other cerithioideans [Dazo, 1965; Houbrick, 1988; Prozorova, 1990; and others] is presented by medial and lateral laminae, with inter lamellar cavity between them. Inter lamellar cavity is widely opened into mantle cavity and close proximally only (Figs. 1, 2).

The lateral lamina includes brood pouch with embryos. Besides brood pouch in proximal part of the laminae of all studied species, we found small lateral gland (Fig. 3A) – special histological structure called by D. Nakano and S. Nishiwaki [1989] as the «proximal portion of lateral lamina». The cells of the gland are stained dark with hematoxylin strongly like that found by D. Nakano and S. Nishiwaki [1989]. In spite of coloration of the cells, the proximal portion of lateral lamina has no mucus.

All three species: *S. gredleri*, *S. libertina* and *S. forticosta* were found to have medial lamina, consisting of seminal receptacle and pallial pocket covered by connective tissue (Figs. 1–3). All spe-

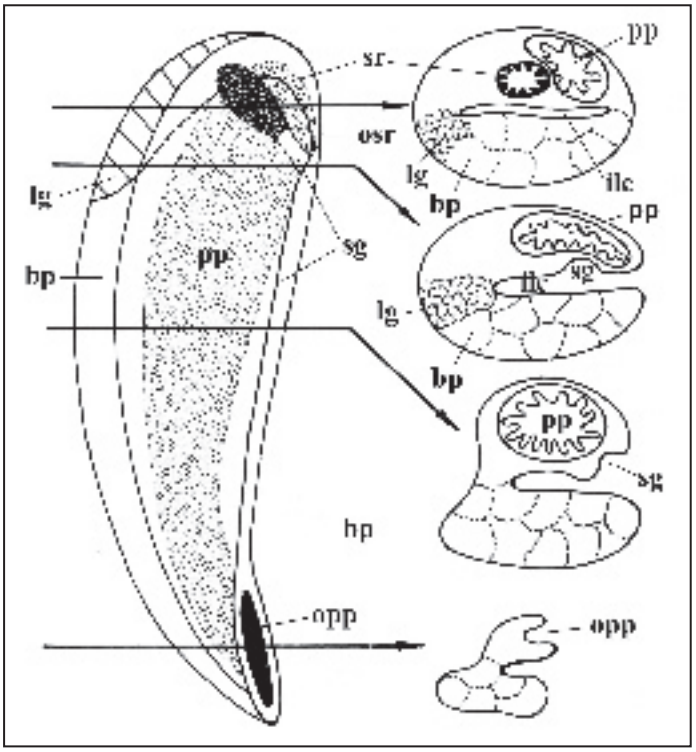

Fig. 1. The pallial oviduct scheme of *Semisulcospira libertina* (Gould, 1859). Abbreviations: sr – seminal receptacle, osr – opening of seminal receptacle, pp – pallial pocket, opp – opening of pallial pocket, bp – brood pooch, lg – lateral gland, ilc – inter lamellar cavity, sg – sperm gutter.

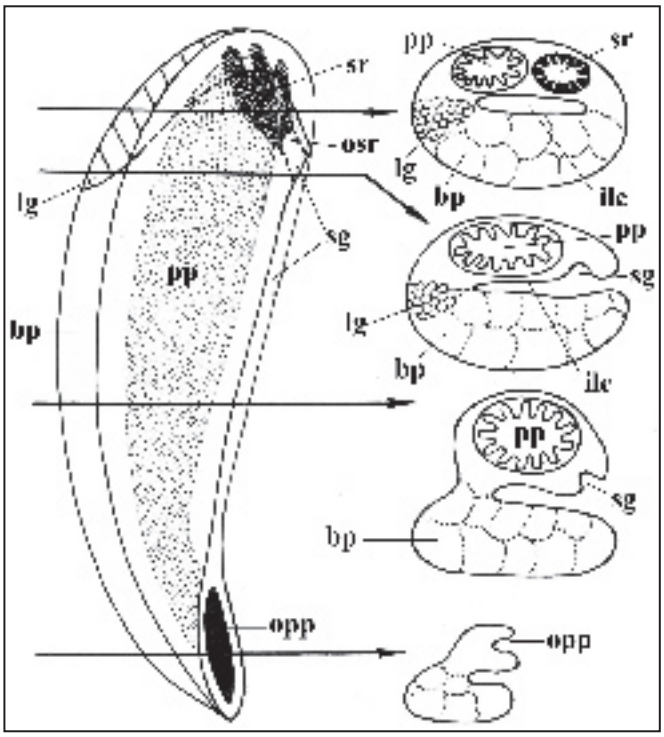

Fig. 2. The pallial oviduct scheme of *Semisulcospira forticosta* (Martens, 1886). For abbreviations, see Fig. 1.

cies have pallial pocket of similar structure. That is represented by the tube with muscle walls containing disintegrated spermatozoa inside and sperm gutter along external side of pallial pocket going to seminal receptacle. We recognize the latter organ as a structure filled by oriented spermatozoa along the falls (Fig. 3).

Some differences in the position of the seminal receptacle of studied *Semisulcospira* species were revealed. Seminal receptacles of both species *S. libertina* and *S. gredleri* are located under pallial pocket from its left side, closer to inner part of

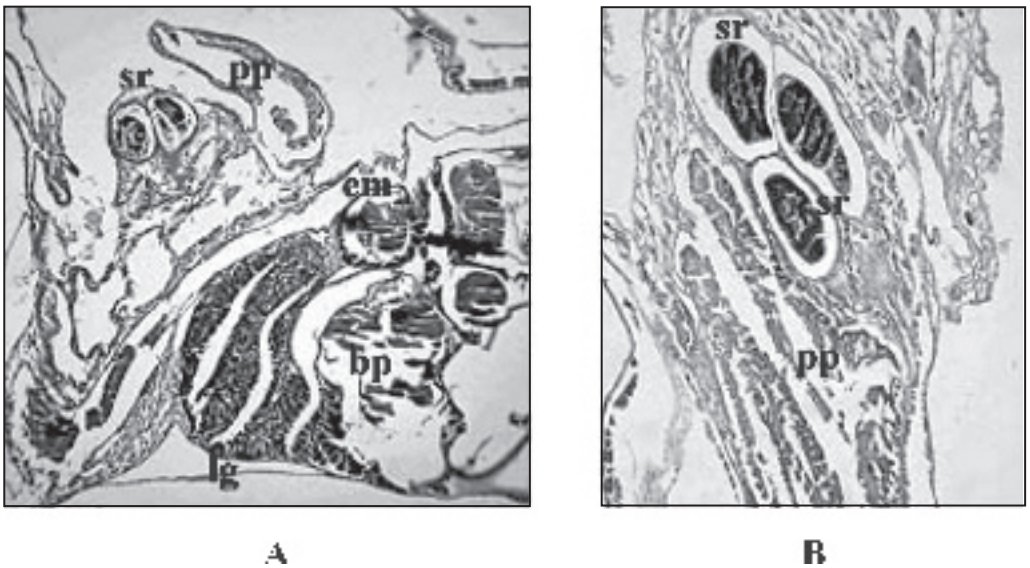

Fig. 3. Transverse histological sections: **A** – section through proximal part of pallial oviduct of *Semisulcospira libertina* showing location of seminal receptacle and lateral gland on medial lamina; **B** – section through proximal part of pallial oviduct of *Semisulcospira forticosta* showing upper part of medial lamina with protrusions of seminal receptacle. Abbreviations: sr, pp, bp, lg – see Fig. 1, em – embryo.

medial lamina (Fig. 1). The seminal receptacle of *S. forticosta* is located on the right side of pallial pocket (Fig. 2). So, sperm gutter of *S. forticosta* take place on the right side of pallial pocket. Sperm gutters of two other species are displaced from right side in the distal part of pallial pocket to its left side in proximal part. *S. gredleri* differs from *S. libertina* in more high location of seminal receptacle on the pallial pocket.

Some differences in the shape of the seminal receptacles were also found. Seminal receptacle of *S. forticosta,* unlike that of other two species, has several protrusions in its proximal part. On the section through top of seminal receptacle we observed three its parts with oriented spermatozoa (Fig. 3B). In distal portion of seminal receptacle, there is the only part with oriented spermatozoa. All studied species have the opening of seminal receptacle into close part of inter lamellar cavity (Fig. 1).

On the basis of study experience of cerithioideans anatomy [Prozorova, 1990; Prozorova, Rasshepkina, 2001; and others], we regard the revealed differences in location and shape of seminal receptacle as species characteristics. Presence of lateral gland or «proximal portion of lateral lamina» is probably generic characteristic of the *Semisulcospira*, belonging to the subfamily Semisulcospirinae Morrison, 1952 of the family Pleuroceridae Fischer, 1885.

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