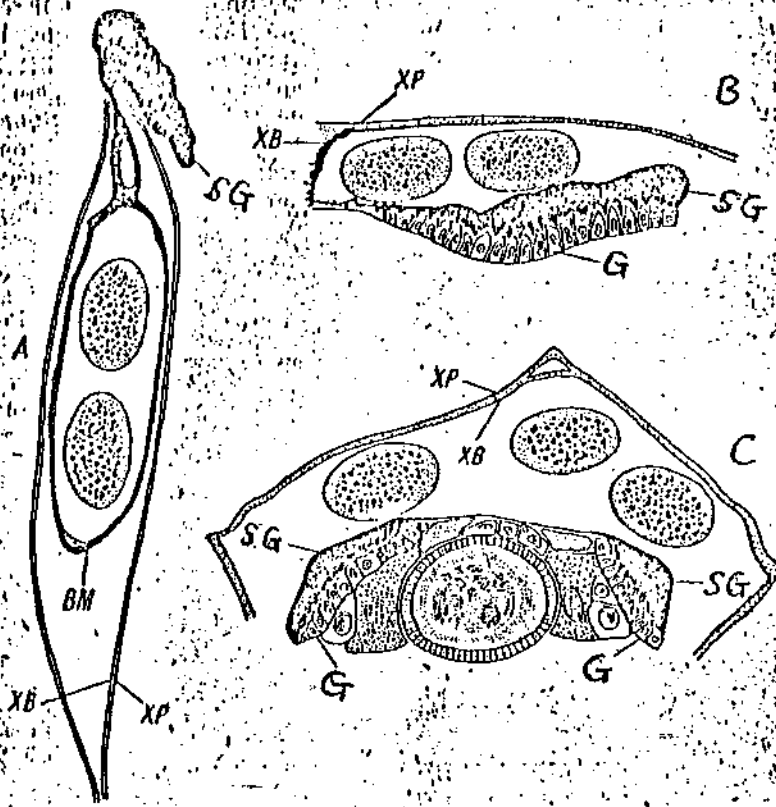


Inf. Byull: Biol. vnutr. Vod, 1, 27-31

In the Ctenopoda (Sididae, Holopedidae), Onychopoda (Polyphemidae) and Haplopoda (Leptodoridae), as also in the most probable ancestors of the Cladocera - the Euphyllopoda, the chitinous armour of the mother does not participate in the formation of the egg case. Ephippia, representing in various degrees changed sections of the armour which is shed in moulting, are found only in Anomopoda. In Macrothricidae, Chydoridae and Bosminidae the winter eggs consist of protoephippia, the valves of which represent little changed sections of chitin of the shell of the female. The number of eggs found in the protoephippium depends on the dimensions of the individuals of the given species and the fecundity of the female. True ephippia are formed only in the Daphniidae, this is a strongly changed section of the chitin of the shell. The number of eggs found in this is strictly constant for each species and does not exceed two.

We studied the structure of the ephippium and the process of its formation in Eurycercus lamellatus (Chydoridae).

According to the data of Scourfield (1902), the ephippium of Chydorus consists of a pair of outer pigmented valves and an inner membrane. The pigmented valves appear to be produced from the outer, but the membrane from the inner layer of the hypodermis of the shell of the crustacean. The membrane forms around the eggs enclosing on all sides a space, and part of it sometimes projects between the pigmented valves of the



Eurycerus lamellatus ephippium

A - transverse section through ephippium B - longitudinal section through brood pouch of ephippial female C - transverse section through brood pouch of ephippial female BM - internal membrane G - gland of brood pouch SG - secretion of gland of brood pouch XB - inner chitinous lining of pouch. XP - outer pigmented layer of chitin of shell.

Ephippia of Eurycerus lamellatus

- A - transverse section through ephippium
- B - longitudinal section through brood pouch of ephippial female
- C - transverse section through brood pouch of ephippial female
- BM - internal membrane
- G - gland of brood pouch
- SG - secretion of gland of brood pouch
- XB - inner chitinous lining of pouch.
- XP - outer pigmented layer of chitin of shell.

ephippium outside. This section of the inner membrane which projects beyond the ephippium serves, according to Scourfield, for attaching the ephippium to an underwater object.

As a result of research on the crustacean, taken from a reservoir in the environs of Leningrad, it was clear to us that in the ephippial females of Eurycercus lamellatus there is a gland (see G in the figure), absent in the parthenogenetic females of this species. The gland represents a double formation, being found on the wall of the trunk segments which are turned inside the brood-pouch. The formation of this gland was observed almost simultaneously in the majority of those found in the reservoir before the multiplying of the parthenogenetic females in the second half of September. The formation of the gland was accompanied by an accumulation of yolk in the first portion of winter eggs in the ovary after the vegetative period, and growth of the young of the last parthenogenetic brood in the brood pouch.

In October, almost all the females in the reservoir reproduced gamogenetically. In investigations on the crustaceans there appeared strict dependance between the state of the ovary, the quantity of secretion accumulated under the gland (see figure, SG) and the intensity of pigmentation of the outer valves forming the ephippia (XP). The cyclic changes of the brood pouch follows after the cyclic changes of the gonads. Each moult, during which the ephippium is cast off, sets in towards the end of the previous cycle of the brood pouch and the ovary, after which the following cycle commences.

In the crustaceans just now casting the ephippium, the section of the chitin of the shell, subsequently forming the

outer valves of the next ephippium, is not pigmented, under the gland lies a very thin layer of secretion, in the brood pouch the next portion of the winter eggs has not yet been forthcoming. The ovary at this time attains maximum dimensions, so that the winter eggs already have completed growth, and in them the preparatory processes go on to the point of ripening.

It is known that in Daphniidae it is only in parthenogenesis that the moult precedes ovulation, and with bisexual reproduction the eggs are transferred to the brood pouch before the moult (Scharfenberg, 1910). In Daphnia magna Strauss the ephippium is formed before the entrance into the brood pouch of the winter eggs, and the latter are laid in already formed ephippia, after which, after some time, occurs the moult, and the ephippium is cast off.

In Eurycerus lamellatus, as with parthenogenesis, so also with the formation of winter eggs, ovulation takes place after the moult. In the beginning of the period of bisexual reproduction, the release of the parthenogenetic young and the ordinary moult precedes the passage into the brood pouch of the first batch of winter eggs after the vegetative period.

After the passage in turn of the next batch of winter eggs into the brood pouch the segment of chitin of the shell, which afterwards forms the outer wall of the ephippium, for some time is not pigmented. In the ovary at this time is already going on the process of accumulation of yolk in the following portions of winter eggs, and under the gland continues the thickening of the layer of secretion. Gradually the valves of the future ephippium darken, and the quantity of secretion on the bottom of the brood pouch and the quantity of yolk in the winter eggs being found in the ovary increase.

The greatest quantity of secretion under the gland (see figure, SG) appears before the moult, when pigmentation of the outer wall of the future ephippium (XP) is complete, and growth of the winter eggs in the ovary is almost finished. At the time of the moult, all secretion accumulated in the pouch is cast off together with the ephippium.

In the formation of the ephippium (see figure) in Eurycerus lamellatus, take part the pigmented layer of chitin covering the shell outside, (XP), the inner chitinous lining of the shell (XB) and the secretion around the gland (SG). The lump of substance projecting outwards, and the inner membrane (BE) sometimes filling the great part of the space between the valves of the ephippium and the eggs which they contain, appear as a secretion of the gland accumulated after the last inter-moult period. With the help of this lump of secretion the ephippial females taken from nature usually under laboratory conditions stick the cast ephippia to the wall of the vessel or to aquatic plants.

In the probable ancestors of the cladocerans - the Euphyllopoda and in the most nearly standing to them, the Ctenopoda, the protection of the resting eggs comes about with the assistance of the secretion of the gland of the sexual ducts, without the participation of the chitinous cover of material (ephippia) (Weissmann, 1877; Linder, 1959). This method of production of the winter eggs remained in Onychopoda and Haplopoda (Weissmann, 1877). Ehippia are formed only in Anomopoda. In Daphniidae, the ehippia of which have achieved a high degree of complexity, the glands of the sexual ducts, forming the egg capsules, are absent (Zwack, 1905; Bronshtein, 1922; Zaffagnini, 1964). A very extensive group, representatives of which form primitive

ephippia," in this regard remain little studied. As was shown above, Eurycerus lamellatus occupies an intermediate position between forms forming a real ephippium and species in which it is absent. The presence of a primitive ephippium in this combines with a more ancient mode of protection of winter eggs with the help of the secretion of the gland of the sexual ducts.

Literature

- Bronshtein Z.S. 1922 On the biology of winter eggs of daphnids. Russk. Hidrobiol. Zhurn. 1.
- Linder H.I. 1959 Studies on the freshwater fairy shrimp Chirephalopsis bundyi (Forbes). I. Structure and histochemistry of the ovary and accessory reproductive tissues. Journ. Morphol. 104, 1..
- Scharfenberg U. 1910 Studien und Experimente über die Eibildung und den Generationszyklus von Daphnia magna. Intern. Rev. Ges. Hydrobiol. u. Hydrogr. Biol. Suppl. 3, 2.
- Scourfield D.I. 1902 The ephippia of the Lynceid Entomostraca. Journ. Quekett Microscop. Club, ser. 2, 8, 50.
- Weissmann A. 1877 Beiträge zur Naturgeschichte der Daphnoiden, Ztschr. wiss. Zool. 28.
- Zaffagnini F. 1964 Genesi delle nuova anfigoniche e formazione dell 'efippio in Daphnia magna. Boll. di zool. 31, fasc. 2.
- Zwack A. 1905 Der feinere Bau und die Bildung des Ephippiums von Daphnia hyalina Leydig. Ztschr. wiss. Zool 79

Notice

Please note that these translations were produced to assist the scientific staff of the FBA (Freshwater Biological Association) in their research. These translations were done by scientific staff with relevant language skills and not by professional translators.