

Short Communication

On Formation of Ehippium in *Wlassicsia Pannonica* Daday, 1904 (Crustacea, Cladocera)

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Abstract

During transition to gamogenesis in females of *Wlassicsia pannonica* an outer layer of shell chitin thickens slightly and the inner layer becomes much thicker locally and acquires similarity with honeycomb-like chitin covering outer part of shells of ehippium in *Daphniidae* and *Moinidae*. In interpretation of [1] *Macrothricinae* is a polyphyletic group as the process of ehippium formation in its representatives differs significantly.

Keywords: *Wlassicsia pannonica*; Crustacea; Cladocera; *Macrothricinae* ehippium

Introduction

Histological studies of cladocerans allow finding details of ehippium formation that are impossible to be uncovered using other methods, specify the idea on species relation degree and enhance the taxonomy of these crustaceans. Initial form of ehippium was shell's leaflets chitin which does not differ from chitin of parthenogenetic females. Such ehippium is still present in *Bosminidae* [2] and in *Ophryoxus gracilis* [3]. Chitin formed by the outer leaf has changed comparing with the initial one in *Daphniidae* [4-6], *Moinidae* and *Bunops serricaudata* [3]. Chitin formed by the inner leaf has changed in *Streblocerus serricaudatus* and *Drepanotrix dentata* (*Macrothricidae*) [3]. Hypoderma of other body parts takes part in ehippium formation in some species. Chitin covering dorsal side of the body became part of the ehippium in *Chydoridae* [7,8], while in *Lathonura rectirostris* ehippium is formed by the chitin of rectum and post abdomen [9,10]. Sticky mucus serving the purpose of attaching ehippium to underwater objects is discharged by the inner leaf of the shell's hypoderma under the chitin inlaying the brood chamber from the inside [11,12] in *Acantholeberis curvirostris*. Aim of the present study was to examine the formation of ehippium in *Wlassicsia pannonica* (*Macrothricidae*).

Material and Methods

W. pannonica were found in the splash zone of Dofinovsky estuary of the Black Sea and bred in the laboratory. They were fed with commercial baker's yeast and *Chlorella*. Fixation was performed using Bouin's fluid. Paraffin sections (7 μ) were stained in haematoxyline according to Heidenhain.

Results and Discussion

Transversal sections of following types of females are given on figures: parthenogenetic (Figure 1A), in transition from parthenogenesis to gamogenesis (Figure 1B) and two gamogenetic ones (C,D). Eggs are still in the ovaries in one of the gamogenetic females (Figure 1(C5)) and in the brood pouch in the other (Figure 1(D2)). Stages of ehippium formation are shown on (Figures 1(B \rightarrow C \rightarrow D)). It is seen that outer chitin has exfoliated (Figure 1(B3, C3, D3)). It is significantly thicker than in the parthenogenetic female

(Figure 1A) where it is adjoined to the hypoderm and therefore almost invisible on the section. Chitin covering the shell's leaflets from the inside is structured resembling honeycombs in gamogenetic females (Figure 1(B4, C4, D4)). Similar structure is seen in *Daphniidae* [4-6] and *Moinidae* [3] ehippium chitin, however it is not the inner chitin which is structured but the outer one. As the molt approaches inner chitin of *W. pannonica* thickens (Figure 1(B4 \rightarrow C4 \rightarrow D4)). Ehippium has brown color. It usually contains two eggs. Ehippium sink. Unlike *Chydoridae* and some *Macrothricidae*, *W. pannonica* does not glue them to underwater objects.

The above stated contradicts with [1] thoughts who united *Drepanotrix*, *Streblocerus*, *Wlassicsia* and *Bunops* genera into *Macrothricinae* group. Cellular chitin is on the inside in *W. pannonica* while in *B. serricaudata* it is one the outside [3]. In *D. dentata* and *S. serricaudatus* the inner chitin is also thickened like in *W. pannonica* but it is unstructured, adhesive and serves the purpose of gluing the ehippium to underwater objects [3]. Differences in ehippium structure in *W. pannonica*, *B. serricaudata*, *D. dentata*

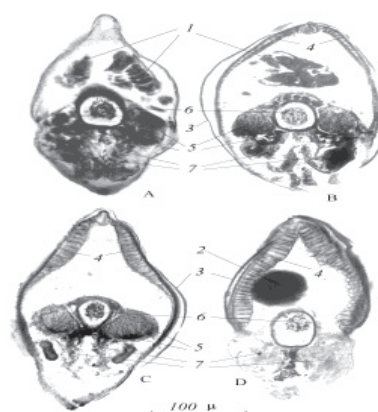


Figure 1: Transverse sections of *Wlassicsia pannonica*, demonstrating formation of ehippium in this species. A-parthenogenetic female, B-female turning from parthenogenesis to gamogenesis, C, D-gamogenetic females; 1-parthenogenetic embryos in a brood pouch, 2-latent egg in a brood pouch, 3-amorphous outer chitin exfoliated from the hypoderma, 4-structured chitin lining an inside part of a brood pouch, 5-ovaries, 6-gut, 7-legs.

and *S. serricaudatus* are as big as they are between *Daphniidae* and *Chydoridae*, for instance. *Macrothricinae* as it is thought of by Dumont and Silva-Briano include representatives of at least three long diverged phylogenetic lines: first-*Wlassicsia*, second-*Streblocerus* and *Drepanotrix*, third-*Bunops*. The ephippium is similar in *Streblocerus* and *Drepanotrix* [3]. The system of *Macrothricinae* by [1] is based upon the results of studies of parthenogenetic females. However, gamogenetic females possess features important from the taxonomic point of view, absent in parthenogenetic females and they should be considered.

References

1. Dumont HJ, Silva-Briano M. A reclassification of the anomopod families *Macrothricidae* and *Chydoridae*, with the creation of a new suborder, the *Radopoda* (*Crustacea: Branchiopoda*). *Hydrobiologia*. 1998; 384: 119-149.
2. Makrushin AV. Resistance to drying of latent eggs of *Bosmina obtusirostris* (*Cladocera, Crustacea*) and their reactivation. *Zoologicheskyy Zhurnal*. 1989; 68: 132-134.
3. Makrushin AV, Markevich GI. On formation of ephippium in some *Cladocera* (*Crustacea*). *Zoologicheskyy Zhurnal*. 1982; 61: 1425-1428.
4. Wolff M. Studies on cuticular genesis and structure and their relationship to the physiology of the matrix. *Biol Centralbl Bd*. 1904; 24: S644-650, 697-722, 761-767.
5. Zwack A. The finer construction and formation of the Ephippium of *Daphnia hyalina* Lydig. *Z wiss Zool*. 1905; 79: S548-S573.
6. Zwack A. Das Ephippium von *Simocephalus vetulus* Schoedler. *Z wiss Zool Bd*. 1907; 86: S304-S310.
7. Makrushin AV. On structure of ephippium of *Eurycerus lamellatus*. *Biologia vnutrennih vod. Informacionny bulletin*. 1967; 27-31.
8. Makrushin AV. Changes in the organisms of females of some species of *Cladocera* (*Crustacea*) under their transition to gamogenesis. *Zoologicheskyy Zhurnal*. 1970; 49: 1573-1575.
9. Makrushin AV. Protoephippial glands in *Cladocera* (*Crustacea*). *Zoologicheskyy Zhurnal*. 1972; 51: 1736-1738.
10. Fryer G. Observations on the ephippia of certain macrothricid cladocerans. *Zool J Linn Soc*. 1972; 51: 79-96.
11. Makrushin AV. Some patterns of the reproductive system in *Cladocera* (*Crustacea*). *Zoologicheskyy Zhurnal*. 1976; 55: 1143-1148.
12. Makrushin AV. The diversity in the structure of ephippium in the *Macrothricidae* (*Crustacea, Cladocera*) and the taxonomic status of this family. *Zoologicheskyy Zhurnal*. 1985; 64: 212-216.