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Research note

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## BRYOZOAN SPECIES *HYALINELLA PUNCTATA* HANCOCK IN THE GUT CONTENT OF CHUB *LEUCISCUS CEPHALUS* L.

**ABSTRACT:** Bryozoans are widely distributed benthic invertebrates which form colonies both in running and stagnant waters. There are 19 freshwater species of Bryozoa in Europe, and only three have been recorded in Serbia so far. Statoblasts (the dormant stages of these colonial animals) are relatively frequently found in the gut contents of fish, but those of the *Hyalinella punctata* species (Phylactolaemata) have not been registered. Statoblasts of *H. punctata* were determined for the first time in the gut content of chub *Leuciscus cephalus* sampled from the Zapadna Morava River (West Serbia, Danube River basin) in late summer and autumn. The intactness in form supports their viability after the passage through intestines, implying that the fish may be a vector of the dispersal of *H. punctata* in new aquatic habitats, as well as a risk factor in the transmission of certain salmonid fish disease agents into fish farms and natural habitats.

**KEY WORDS:** chub, gut content, *Hyalinella punctata*, statoblasts

Bryozoans are a very diverse group of animals, being mostly marine, but also common in freshwater habitats (Lévêque *et al.* 2005). Massard and Geimer (2008) report 88 species of freshwater Bryozoa in the world, and 44 species in the Palearctic region, while Wood

and Okamura (2005) present the checklist of 19 species living in continental Europe, Britain and Ireland. Apart from two records, one in the Vlasina Jezero reservoir (Central Serbia) where *Lophopus crystallinus* (Pallas) and *Paludicella articulata* (Ehrenberg) were found (Simić and Ostojić 1997), and the other of unidentified plumatellid species in the Danube River (Paunović *et al.* 2005), there are no published data on Bryozoa in Serbia. Considering the high animal diversity in the Balkan Peninsula region, a number of bryozoan species should be expected as well.

Statoblasts are the dormant stages of these colonial animals by which they survive unfavorable environmental conditions (Callaghan and Karlson 2002). The statoblasts occurrence in the gut of fish has been reported so far for largemouth bass *Micropterus salmoides* (Lacepède), crappie *Pomoxis annularis* (Rafinesque), gizzard shad *Dorosoma cepedianum* (Lesueur) and bluegill sunfish *Lepomis macrochirus* (Rafinesque) (Osburn 1921, common carp *Cyprinus carpio* (L.) and tench *Tinca tinca* (L.) (Prejs 1973), common carp and gibel carp *Carassius gibelio* (Bloch) (Scherbak and Karaeva 1997) and sunbleak *Leucaspius delineatus* (Heckel) (Gozlan *et al.* 2003).

Although *Hyalinella punctata* (Hancock 1850) is not a very frequent bryozoan species, it has been reported from many countries in Europe. The polypides of the species are immersed in a collective cavity and have 42–58 tentacles (Geimer and Massard 1986). The statoblast of *H. punctata* become floatant only after dessication (Toriumi 1972).

Chub *Leuciscus cephalus* (L.) is a widespread cyprinid species in various European freshwater ecosystems (Kottelat 1997), including Serbian ones (Simonović and Nikolić 1996).

This report on the *H. punctata* statoblast occurrence in the chub gut content is the first ever for this fish species, as well as the first record proving the presence of this bryozoan species in the aquatic fauna of Serbia. It also gives hints as to dispersal of bryozoans in new habitats and their possible implications.

The Zapadna Morava River in Serbia belongs to the Danube River basin. It is the central component of the West Serbia river system, being 298 km long and having the basin area of 15849 km<sup>2</sup> (Marković and Simović 1994). The diversity of hydro-ecological conditions affects the structure of diverse habitats and their fish communities. The fish fauna of the Zapadna Morava river consists of 25 species from 8 families, with a pronounced dominance of representatives of the family Cyprinidae. Bleak *Alburnus alburnus* (L.) is a dominant fish species (21% in total fish numbers), followed by nase *Chondrostoma nasus* (L.) (11%) and chub (10%). Chub is the only predatory fish species abundant in all river sections as an important link in the food web of this river (Marković 2007).

Over the 1996–1999 period, 101 chub individuals from different river sections were

Table 1. The frequency (%) of food items in the gut content of chub *Leuciscus cephalus* (L.) in the Zapadna Morava river (West Serbia, Danube River basin). The frequency of Bryozoa is given in Bold.

Group	Spring (n = 31)	Summer (n = 38)	Autumn (n = 32)
Cyanobacteriophyta	<1	<1	1
Pyrrhophyta	-	<1	-
Bacillariophyta	5	9	9
Chlorophyta	4	14	15
Macrophytes	3	3	3
Rotatoria	-	<1	<1
Nematoda	<1	<1	<1
Mollusca	2	3	3
Oligochaeta	1	<1	<1
Amphipoda	<1	-	-
Ephemeroptera	10	6	9
Odonata	10	9	6
Heteroptera	-	<1	-
Coleoptera (aquatic)	1	-	<1
Diptera –Chironomidae	4	1	1
Diptera - Ceratopogonidae	-	2	-
Diptera – Tipulidae	5	<1	-
Diptera – Tabanidae	2	<1	2
Diptera – Syrphidae	<1	-	-
Trichoptera	21	22	11
Insecta (terrestrial)	16	12	10
<b>Bryozoa</b>	-	<b>4</b>	<b>1</b>
Pisces	1	9	2
Amphibia	-	1	-
Detritus	12	9	22

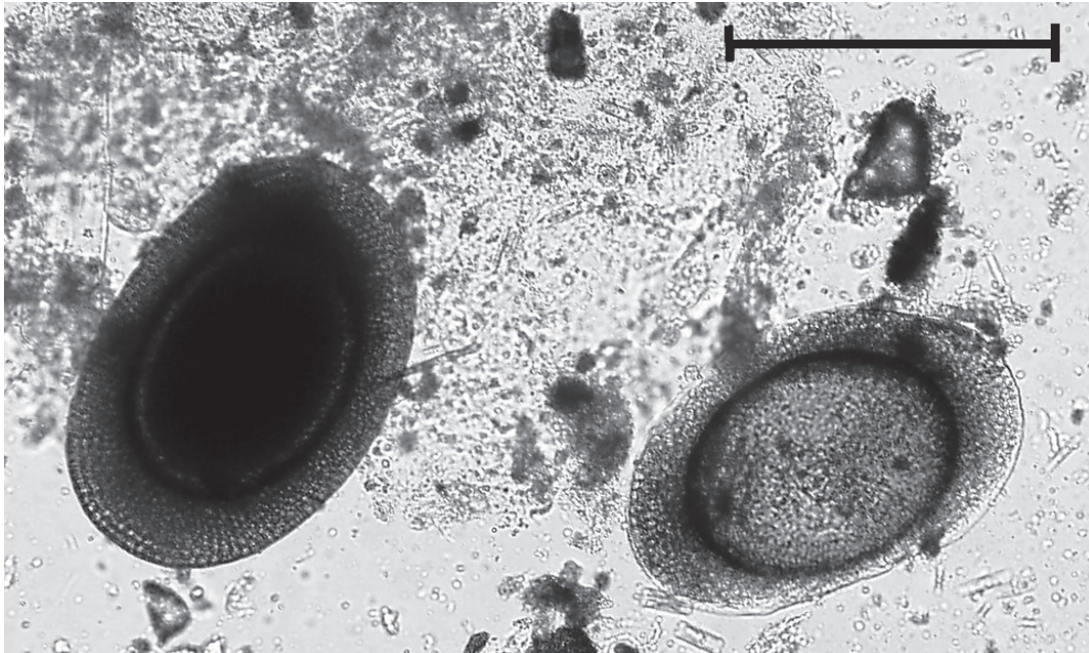


Fig. 1. Darker and lighter forms of statoblasts of *Hyalinella punctata* (bar indicate 0.5 mm).

sampled during three seasons (spring, summer and autumn) at four sampling sites, using various sampling tools (hooks and nets), aiming to examine their feeding characteristics. The sampled individuals were aged 0+ to 9+, their total length ranging from 56–430 mm and weight from 5.4 to 1160.1 g. Another small sample comprising two chub individuals was independently and purposefully taken in September 2004 and analyzed for bryozoan statoblasts.

Fish diet was analyzed from the gut content using MBS-2 and MBDS-10 binoculars and »Studar« microscope. The identification of components extracted from the gut content was accomplished after Hindak (1978) and APHA (1985). The measurement of statoblasts was worked out using the fluorescent microscope Olympus BX 61 with the magnification of 40x.

The spectrum of food items found in the gut content of 101 chub individuals caught in the Zapadna Morava River in 1996–1999 indicated that the diet character was diverse and omnivorous (Cyanobacteriophyta, Bacillariophyta, Chlorophyta, macrophytes, Rotatoria, mollusks, mayflies, damselflies, aquatic coleopterans, chironomid and syrphid dipterans, sedges, terrestrial insects, bryozoans, fish, tadpoles and detritus), as

well as that the macrozoobenthos predominated (Table 1).

Statoblasts of the *H. punctata* species (Fig. 1) were found only in the gut content of chub sampled at one locality, i.e., Jasika (43°37'05" N, 21°18'05" E). They were found in the samples taken in summer (15% of all food items of the gut content) and autumn (0.5%). Another record of bryozoan statoblasts in the content of chub gut was made in September 2004, when in two chub individuals (94 and 140 mm in total length and of age 1+ and 2+, respectively) they were recorded in mass, comprising over 90% of their gut content. Their examination revealed their uniform presence both in the front and rear parts of the gut. They looked similar in both gut sections, with only few of statoblasts looking lighter as compared to others (Fig. 1). A total of 50 randomly chosen statoblasts from the front and rear gut sections were visually examined and their length measured in order to check whether they were decomposed by digestion. It was found that considering their size (average  $469.04 \pm 16.65 \mu\text{m}$  in the front section of the gut; and  $473.00 \pm 15.91 \mu\text{m}$  in the rear section; Student  $t_{[98]} = 1.505$ ,  $P > 0.05$ ) statoblasts were not digested, i.e., they remained intact in the gut of chub.

The diet of chub from the Zapadna Morava River is similar in structure to that reported in other rivers throughout Europe (Mann 1976, Frankiewicz *et al.* 1991, Magalhaes 1993, Balestrieri *et al.* 2006). As regards specifically this novel finding, it is not certain yet whether bryozoans and their statoblasts are the food items deliberately taken by chub, or whether they non-deliberately enter chub guts during search for chironomid larvae or some other food items hiding among colonies of bryozoans (Dendy 1963). Being a robust species of bryozoans with an unsclerotized i.e. soft, thick, translucent body and probably of considerable nutritive value for fish, it is most likely that *H. punctata* can be used as a facultative food by chub, especially if the insect larvae are not present at the same site (T. Wood, pers. comm.). Statoblast production varies in various species of Plumatellids, being more intensive in the warmer part of the year (Wood 1991). Karlson (1991) stated that the larger ramets occurring in the warmer season produce more statoblasts. Considering the high frequency of statoblast occurrence in the gut content of chub, it can be assumed that *H. punctata* colonies in September 2004 at the time of their being consumed were at the peak of the statoblast production.

Scherbak and Karaeva (1997) stated that the introduction of fish may be one way of dispersal of bryozoan populations in water bodies where they have not occurred yet, given that their statoblasts can pass through the intestines of common carp and gibel carp they examined and still remain viable. The intactness of *H. punctata* statoblasts after their passage through the intestine of chub ascertained herewith strongly supports the above statement and implies the possibility of tracing the introductions of fish species into new habitats by detecting the statoblasts they ingested.

In addition, some plumatellid bryozoans are reported as hosts of the myxozoan *Tetracapsuloides bryosalmonae* (Canning *et al.* 1996), the causative agent of the proliferative kidney disease (PKD) (Hedrick *et al.* 2004), whose spores could be transmitted by ingested statoblasts (Anderson *et al.* 1999). The finding of plumatellid *H. punctata*, thus, imposes some novel issues related to the in-

creased risk of salmonid fish diseases (Okamura *et al.* 2001) in Serbia not yet recorded in either farmed rainbow trout *Oncorhynchus mykiss* (Walbaum) or wild salmonids, which frequently live with the chub in the same sites.

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