The Occurrence of Epibionts and Endobionts of Ostracoda (Crustacea) in some parts of the Danube basin in Serbia

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Introduction

Ostracoda is an old and diverse group of small crustaceans, usually not larger than 2 mm. They have bivalved carapace enclosing the whole body with up to 7 appendages. Being highly adaptive to various ecological conditions, they occur in a wide range of aquatic habitats.

So far, relatively few data on the occurrence of these crustaceans in Serbia are available. The only better explored parts are the Fruška Gora Mountain (Karanović, 1996) and Banat district (Petkovski, 1964, 1969; Petkovski et al., 2000, 2002; Karan-Žnidaršič & Petrov, 2005). In southern parts of the Danube drainage in Serbia, there are only a few old and scattered findings of ostracods (Petkovski, 1959; Mikulić, 1970).

During our investigations of these crustaceans, it was noted that they are hosts for several epi- and endobiont species of algae and protists inhabiting their body surfaces and cavities. Epibiosis is a facultative association of two organisms: the epibiont and the basibiont (Wahl 1989). While 'epibiont' includes organisms that are attached to the surface of a living substratum during the sessile phase of their life cycle, the 'basibiont' lodges and constitutes a support for the epibiont (Threlkeld et al., 1993). The term 'endobiont' includes organisms that live in body cavities. The association between basibiont and related organisms (a number of epibionts and endobionts) has been defined by Beklemishev (1951) as 'consortium'. By means of environmental conditions modifying, basibionts determine the development of particular organisms linked with them.
Opportunism practiced by probably free-living or commensal protists should be investigated in future studies of protist-related crustacean health problems. Obviously, epibionts are not always benign; *Apiosoma* sp., *Epistylis* sp., *L. eupagurus*, *Acineta tuberosa*, and *Bodo* sp. can cause gill and surface fouling disease in shrimp at high densities, typically when the host is stressed (Lightner 1996). Persistent low level mortalities of juvenile lobsters *Jasus edwardsii* in rearing systems utilising recirculated seawater were associated with moderate to heavy growths of epibionts (Diggles, 1999).
As omnivorous animals that occur in significant numbers in all kinds of water bodies, ostracods probably have considerable, but not completely known role in aquatic ecosystems (Wetzel, 1983). Considering this statement, it is also important to note their relationships with other organisms and their influence on ostracod life cycle, ecology and health. The aim of the present study was to record ostracods as eligible for supporting epibionts and endobionts, i.e. microflora and fauna.

Materials and Methods

Investigations were conducted within two scientific projects on different topics, both referred to aquatic habitats and organisms. Thus, the collecting of samples was carried out across

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Serbia in more than 100 localities with variable sampling frequency. Some localities were examined every two weeks, while in the others only one sample per site was taken during the research period.

The samples were collected with a planktonic net (mesh size 250µm) in littoral zones of different habitats such as spring waters, ephemeral pools, permanent ponds and lakes, fish-ponds, artificial canals and lowland rivers. The samples of the sediment were taken with a bottom-sampler. All samples were preserved in the field, by adding 35% formaldehyde, washed in laboratory and transferred to 70% ethanol (Martens, 2001). Microscopic slides were made using glycerol and Faure's medium (Langeron, 1942).

Ostracods were identified according to Meisch (2000). Epibionts were routinely identified at 200 fold magnification according to Kudo (1971) and Warren (1986).

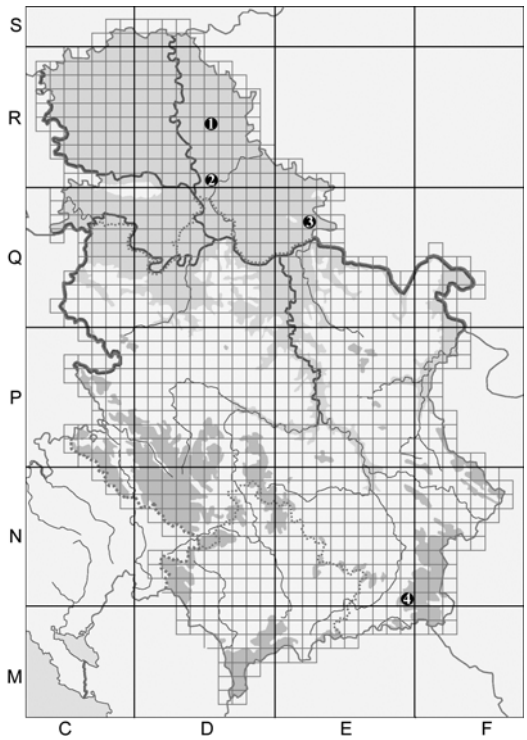

Fig 1: Investigated localities on UTM-map of Serbia (10x10 km).

Results and Discussion

During the observation of the ostracod bodies and appendages, both endobiont and epibiont organisms were found in the samples from 4 different localities (Fig 1). Growing over the surface of the carapace of *Cypris pubera*, two different taxa of algae were perceived (Table 1). The flagellated alga *Colacium cyclopicola* was found on the carapaces of two ostracod species. This is the first finding of *Colacium cyclopicola* (Gicklhorn) Bourrelly 1947 on ostracods, whereas they are common on planktonic cyclopoids and rotifers.

On *Candona* sp., on the superficies of the shell and on limbs, colonies of *Epistylis* sp. were found, while *Tonnacypris lutaria* was a host for a *Tetrahymena pyriformis* complex, which was noted inside its legs and between carapace lamellae (Nikolić & Karan-Žnidaršič, 2005).

Table 1: The presence of epi- and endobionts on ostracods.

Ostracod species	Epi- and endobiont taxa	Presence	Locality
Cypris pubera	*Phormidium* sp.	Growing on carapace surface	2. Perlez
Cypris pubera	Pennatophyceae	Growing on carapace surface	2. Perlez

Cyclocypris ovum	*Colacium ciclopicola*	Growing on carapace surface	2. Perlez
Cypris sp.	*Colacium ciclopicola*	Growing on carapace surface	3. Bela Crkva
Candona sp.	*Epistylis* sp.	Growing on the surface of limbs and on carapace	4. Kriva Feja
Tonnacypris lutaria	*Tetrahymena pyriformis*	Between carapace lamellae and inside limbs	1. Melenci - Bašaid

Ostracod associated organisms encompass endobionts and epibionts. So far it is undetermined if the presence and density of this fauna can reflect the carapace architecture, as well as their ability to protect themselves (by means of bioactive products derived from associated organisms). In this relationship, epibionts are provided with suitable habitat for their development. Owing to more or less constant movement of the hosts, they are well protected from animals that feed on overgrowing organisms, but they could become castaways after ekdysis.

Positive effect of epibionts on their hosts demonstrates that with better camouflage of ostracods, protection from predators is improved. Moreover, the animal might get more oxygen from algal communities on the surface of the carapace, which can be significant in low oxigen conditions, such as in bottom dwelling species or in lymnocrene spring waters.

On the other hand, the effect on predators could be the opposite. For example, Willey et al. (1990) have suggested that phototrophic epibionts on zooplankton may render their substrate organisms more vulnerable to visually orienting predators because of the enhanced contrast provided by the epibionts chlorophyll. So far, it is not possible to determine the influence of sedentary ciliates overgrowing the surfaces of appendages, since they probably obstruct different life activities in certain measure, such as the animal agility, and ventilation of respiratory surfaces.

Summary

Ostracoda is an old and diverse group of small crustaceans. During investigations of these crustaceans, in the samples from 4 different localities, it was noted that they are hosts for several epibiont and endobiont species. On six species of ostracods, three different taxa of algae, and two ciliates were noted. Both positive and negative effects of these relationships are noted in basibionts and the inhabiting organisms.

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