

An Updating of Large Branchiopods (Crustacea: Branchiopoda) Distribution in Serbia

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Abstract: Data hitherto emphasized the problem of inadequate knowledge of Serbia as large branchiopods are concerned. The main objective of this work is to recheck the known distribution of some species and genera, as well as extend this knowledge to the less explored parts of the country. The aim of the survey was also to complement previous data, that were mainly been focused to the northern parts of the country. The study revealed occurrence and updated distribution of *Anostraca* (6 species), *Notostraca* (2 species) and *Spinicaudata* (2 species). We believe that present knowledge of our branchiopod fauna is far from being complete, but this updated distribution would partly filled the gap existing, mainly for Central and Southern regions of Serbia.

Key words: large branchiopods, distribution, Serbia

Introduction

European large branchiopod fauna consists of more than 70 species and subspecies (BRTEK, THIÉRY 1995, BELK, BRTEK 1995, BELK, BRTEK 1997, CVETKOVIĆ-MILIČIĆ, PETROV 2001). This interesting group are called 'living fossils' in literature, due to their Cambrian origin (BRIGGS 1976), and contains high number of relict and endemic species (LÖFFLER 1993, BRTEK, THIÉRY 1995, MURA 1999).

Serbian part of Pannonian Plain results in remarkable diversity of large branchiopods with a high presence of endemics (CVETKOVIĆ-MILIČIĆ *et al.* 2004). There are many scientific reports about their occurrence from the second half of XX century. Most of them are summarized in PETROV, PETROV (1997a) and PETROV, CVETKOVIĆ (1997). According to these sources, 18 species have been reported. However, taxonomical validity of some of them reminded uncertain, since one anostracan and five spinicaudatans

have never put on the Official Register of Zoological Nomenclature of the International Commission of Zoological Nomenclature (ICZN, 1999). Rest of the country (south of rivers Sava and Danube) is inhabited by smaller number of branchiopod taxa. Such situation could be partly because there has not been a regular and equal survey across the whole Serbian territory, or because the 'known range of the species generally reflecting specialist distribution and 'migratory activity', rather than that of the animals themselves' (MURA 2001). These are some of the reasons why we conducted a recent survey of known and new investigated areas in Serbia.

Material and Methods

The main objective of this work is to recheck known distribution of the large branchiopods, complement

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previously data and extend field investigations to the less explored parts of the country. It was also intended to build a unique network research, including NGOs and volunteer students all over the country. Specimens were collected over the last eight years (2004-2012) by both volunteers field trips and University expeditions, under the authority of the Faculty of Biology in Belgrade.

Geographical position of investigated localities was determined by GPS. Localities which are close to each other are merged into sibling groups. In selecting re-visited sites, we used the names of villages from the literature statements, together with approximate coordinates taken from the UTM maps (nevertheless, for some large branchiopods sites we often had a crude positions of the habitats). Distribution pattern of the all visited spots during our investigations is illustrated in Fig. 1.

After catching, specimens were immediately fixed in 70% ethanol and stored in the collection of Institute of Zoology, Faculty of Biology, University of Belgrade.

Results and Discussion

Our investigations confirmed existence of 10 out of 18 previously reported large branchiopods species in Serbia (according to PETROV, PETROV 1997a). They belong to 3 orders (Anostraca, Notostraca and Spinicaudata), 6 families and 7 genera. Among Anostracans we noted the presence of 3 families: Chirocephalidae (*Chirocephalus brevipalpis* (Orghidan, 1953), *C. carnuntanus* (Brauer, 1877) and *Chirocephalus diaphanus* Prevost, 1803, including subspecies *C. d. carinatus* Daday, 1910), Branchinectidae (*Branchinecta ferox* (Milne-Edwards, 1840) and *B. orientalis* G.O. Sars, 1903) and Branchipodidae (*Branchipus schaefferi* Fischer, 1834). From the Notostracans, specimens belonged to *Triops cancriformis* (Bosc, 1801) and *Lepidurus apus* (Linnaeus, 1758) (Triopsidae). Spinicaudatans are presented with *Cyzicus tetracerus* (Krynicky, 1830) (Cyzicidae) and *Leptestheria* Sars, 1898 (Leptestheridae).

In summarizing results, we report several sites of large branchiopods unknown so far in Serbia (Table 1, 2). Data presented here reaffirmed the claim that northern lowlands of the country represents one of the richest area for large branchiopod fauna in Serbia (PETROV, CVETKOVIĆ 1996). For the past six years we recorded 6 species of large branchiopods in this part

of the country. One of the most important new-found site was Special Nature Reserve 'Slano Kopovo' in Banat Province, where we recorded even 5 large branchiopod species. The North-western Serbia has also been insufficiently explored in terms of the presence of large branchiopods. During our investigations, we found *C. brevipalpis* in this area (species with very limited distribution in Serbia, according to PETROV, PETROV 1997b). This is the westernmost known range of *C. brevipalpis*, not only in the territory of Serbia, but also on the European continent.

Several villages around the suburban vicinity of Belgrade (Srem Province) have previously been reported as a large branchiopod sites (MARINČEK, PETROV 1991, PETROV, PETROV 1997b). During the survey 2010-2012 we have found some new localities settled by large branchiopods. Three of five taxa recorded (*C. diaphanus*, *C. brevipalpis* and *Lepidurus apus*) have not been previously known from this area. Unfortunately, it is possible that some of these sites exist no longer because of habitat destruction caused by building the regional road in 2012.

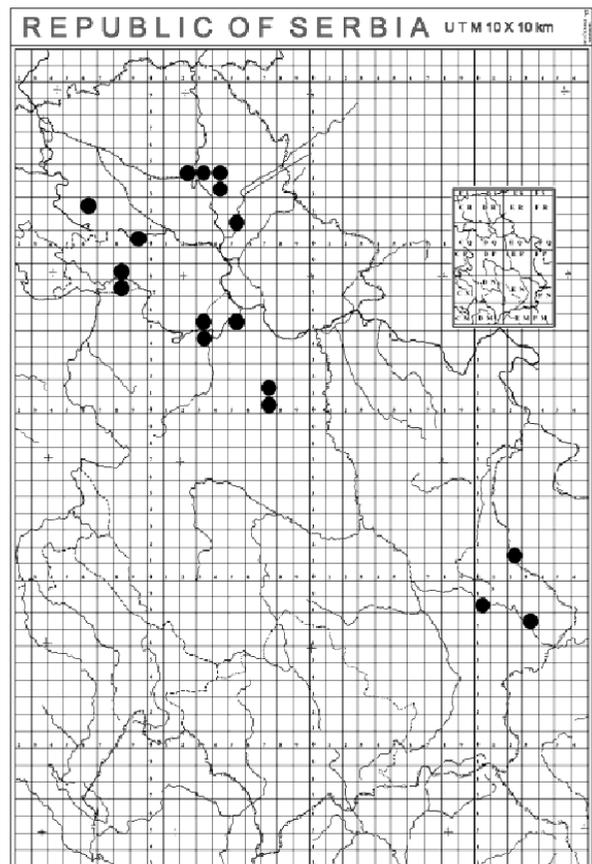


Fig. 1. Investigated large branchiopod sites in Serbia during the period 2004-2012.

Table 1. Previously and new known distribution of order Anostraca in Serbia.

| Species | Previously known distribution in Serbia | Year of last official record in Serbia (bold) | New findings 2004 -2012 | Latitude and longitude | Notes |
|----------------------------------|--|---|---------------------------------------|--------------------------------|---|
| <i>Branchinecta ferox</i> | Northern Serbia (Banat Province) | 1995 PETROV, CVETKOVIĆ (1997) | Special Nature Reserve 'Slano Kopovo' | N45°36'47.47" E20°12'52.96" | New finding of <i>B. ferox</i> in Serbia |
| <i>Branchinecta orientalis</i> | Northern Serbia | 1996 PETROV, PETROV (1997b) | Special Nature Reserve 'Slano Kopovo' | N45°36'47.47" E20°12'52.96" | New finding of <i>B. orientalis</i> in Serbia |
| <i>Branchipus schaefferi</i> | Northern Serbia; Central Serbia; Eastern Serbia | 2004 CVETKOVIĆ-MILIČIĆ <i>et al.</i> (2005) | Bačka Province; | N45°20'37.98" E19°18'45.30" | Both <i>typica</i> and <i>visnyai</i> forms were found |
| | | | Special Nature Reserve 'Slano Kopovo' | N45°35'53.35" E20°12'8.25" | |
| <i>Chirocephalus diaphanus</i> | Northern Serbia; Central Serbia; Southern Serbia | 1995 PETROV, PETROV (1997b) | Near Belgrade | N44°42'14.53" E20°12'12.88" | Both <i>C. diaphanus</i> and <i>C. d. carinatus</i> were found; |
| | | | Stara Planina range | N43°18'39.21" E22°49'33.62" | |
| | | | Suva Planina range | N43°10'33.4" E22°21'39.2" | First findings of <i>C. diaphanus</i> in the Serbian mountains |
| | | | Special Nature Reserve 'Slano Kopovo' | N45°35'53.35" E20°12'8.25" | |
| <i>Chirocephalus brevipalpis</i> | Northern Serbia (Banat Province, Srem Province) | 2007 PETROV <i>et al.</i> (2007) | Northern Serbia (Bačka Province) | N45°20'8.40" E19°18'20.58" | Westernmost located finding of <i>C. brevipalpis</i> in Europe |
| | | | In the vicinity of Belgrade | N44°41'53.74" E20°12'03.27" | Species influenced by habitat destruction elsewhere |
| <i>Chirocephalus carnuntanus</i> | Northern Serbia (Banat Province) | 1995 PETROV, CVETKOVIĆ (1997) | Northern Serbia (Bačka Province) | N45°32'17.34" E20°1'24.19" | New findings of <i>C. carnuntanus</i> in Serbia |
| | | | Special Nature Reserve 'Slano Kopovo' | N45°37'57.37" E20°11'6.73" | |

The hilly part of Serbia is located south of Sava and Danube rivers. To date, there are some data on large branchiopods found in the eastern part of the country (the area of Stara Planina Mt.): *B. schaefferi*, *B. intermedius* Orghidan, 1947, *T. cancriformis*, *Leptestheria*, and *Imnadia* Hertzog, 1935, all found near Serbian-Bulgarian border (PETROV, PETROV 1997b, CVETKOVIĆ-MILIČIĆ, PETROV 2007, MILIČIĆ, PETROV 2007). The presence of *C. diaphanus* we

confirmed for first time in Eastern Serbia, in the area of Suva Planina Mt. This rather common species occurs both in mountains and lowlands. Balkan populations belong mainly to the mountain zoogeographical element, subspecies *C. d. carinatus* (BRTEK, THIÉRY 1995).

During the survey of Central Serbia two large branchiopod species were discovered: *C. diaphanus* (ssp. *carinatus*) and *T. cancriformis*. Previously data

Table 2. Previously and new known distribution of orders Notostraca and Spinicaudata in Serbia.

| Species/Genus | Previously known distribution in Serbia | Year of last official record in Serbia (bold) | New findings 2004- 2012 | Latitude and longitude | Notes |
|----------------------------|--|---|---|--------------------------------|--|
| <i>Triops cancriformis</i> | Northern Serbia; Central Serbia; Southern Serbia | 1996 PETROV, CVETKOVIĆ (1996) | At the broader area of the City of Belgrade | N44°44'23.47" E20°08'32.70" | Habitat under strong human pressure |
| <i>Lepidurus</i> sp. | Northern Serbia (Banat Province, Srem Province) | 2007 PETROV <i>et al.</i> (2007) | On the periphery of City of Belgrade | N44°41'53.74" E20°12'03.27" | New locality; Species influenced by habitat destruction; |
| | | | | N44°42'34.31" E20°12'42.75" | Additional taxonomical analysis is needed |
| <i>Leptestheria</i> sp. | Northern Serbia; Central Serbia; Eastern Serbia | 2004 MILIČIĆ, PETROV (2007) | Along the Danube River (at the foot of the National park 'Fruška Gora') | N45°13'2.84" E19°40'54.49" | New locality; Additional taxonomical analysis is needed |

considered presence of three species: *C. diaphanus*, *Streptocephalus torvicornis* Waga, 1842 and *T. cancriformis*. *S. torvicornis* has not been recorded about fifteen years in Serbia. Last time it was reported in the works of PETROV, PETROV (1997b). Given the large number of potential habitats in central Serbia, it could be expected the presence of this species in future studies.

In spite of a relatively intense researching of the large branchiopod fauna in last 30 years in Serbia, exact number of species is still not fully known, since some populations need additional analysis concerning their accurate taxonomical status. We believe that present knowledge of our branchiopod fauna is far from being complete, but that this updated distribution in certain degree filled the gap existing, mainly in Central and Southern parts of Serbia. Bearing in mind the great diversity of geographic and environmental conditions in our country, and efficient dispersal of the large branchiopod's eggs by migrant birds (BOROS *et al.* 2006), we expect to find some species new for Serbian fauna, which already exist in the neighboring countries. For example, *Chirocephalus chyzeri* Daday, 1890 and *Eubranchipus (Siphonophanes)*

grubii (Dybowski, 1860) are already present in Romanian and Hungarian parts of Pannonian Plain (FORÓ 2000, DEMETER, STOICESKU 2008). We can also expect an occurrence of some coldwater, boreal faunal elements in Serbian mountains, such as *Chirocephalus shadini* (Smirnov 1928) and *Drepanosurus hankoi* (Dudich 1927), currently known from Carpathians (DEMETER, STOICESKU 2008). *Tanymastix stagnalis* (Linnaeus 1758) is also recorded in Carpathians and Hungary, only a few miles away from the Serbian border, while *Eoleptestheria ticinensis* Balsamo-Crivelli 1859 occurred along the coast of Danube River in Hungary, and alongside Romanian-Bulgarian border (FORÓ 2000, DEMETER, STOICESKU 2008). Species which potentially inhabits Balkan range can also be *L. apus*, occurring from early February to mid-April in Serbia (CVETKOVIĆ-MILIČIĆ, PETROV 1999).

Disappearance, destruction and harming of habitats is a major problem for survival of large branchiopods. Protected areas, as a habitats of many important species, are generally preserved better. In this areas, composition of species remains unchanged and appeared regularly over several years. Stable populations of *C. brevivalpis*, *L. apus* and *C.*

tetracerus that we testify in Special Nature Reserve 'Zasavica' (PETROV *et al.* 2007), as well as multispecies occurrence of large branchiopod fauna in the area of Special Nature Reserve 'Slano Kopovo': *B. schaefferi*, *B. ferox*, *B. orientalis*, *C. carnuntanus* and *C. diaphanus* confirms our assertion.

Acknowledgements: This study was supported by the Ministry of Education, Sciences and Technological Development of Republic of Serbia, Grant No. 176019. We would like to express our gratitude to the volunteers from Society for Biological Research 'Sergej D. Matvejev' (<http://www.matvejev.org/>), and from 'Bird Study and Protection Society of Serbia', Novi Sad (<http://www.pticesrbije.rs>). We also thankful to Dr Imre Krizmanić (Institute of Zoology, Faculty of Biology, University of Belgrade) for his help in creating UTM map.

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