

PRELIMINARY LIST OF FRESHWATER OSTRACODA (CRUSTACEA) FROM SLOVENIA

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ABSTRACT

The fauna of Ostracoda in Slovenia is still poorly known. Equally poor are the taxonomic as well as ecological and zoogeographical studies made so far in respect of these freshwater crustaceans. In spite of it all, 47 taxa arranged in 22 genera have been discovered in Slovenia so far. The greater part of research still originates from the period prior to World War II, although a substantial progress has been made in the last three years. The fact, however, that a number of species and even genera have still not been discovered in Slovenia, even though they have been confirmed in its immediate neighbourhood, remains. Among the most thoroughly researched habitats at the moment are caves, springs and upland lakes, while in the remaining surface waters hardly any research has been carried out so far. Also stated in the article are the only data on the Holocene and late Ice Age Ostracoda from the sediments found in Lake Bled.

Key words: Crustacea, Ostracoda, Slovenia, fauna, habitats, paleolimnology

Ključne besede: Crustacea, Ostracoda, dvoklopniki, Slovenija, favna, habitati, paleolimnologija

INTRODUCTION

Slovenia represents a "biodiversity hotspot" within Europe (Gaston & Davis, 1994) and its importance for endemism freshwater hypogean species has been known for many years (e.g. Hodalič, 1993). Amongst these species are a number of freshwater Ostracoda, most described from the period before the 1939-1945 War, and little studied since then. Indeed, amongst the European freshwater Ostracoda, localised endemics are best known from hypogean, often karstic, waters (Danielopol, 1978) and from ancient lakes such as those on the borders of Macedonia (e.g. Mikulič, 1961). Despite this, general faunistic knowledge of the freshwater Ostracoda of Slovenia is remarkably poor and, except for taxonomic studies, very few data are available.

The ostracod faunas of the Balkans generally have been studied somewhat sporadically. That of Bulgaria

has been reported on by Klie (1925, 1937a), Petkovski (1964a) and Sywula (1967), and a small number of contributions deal with the Ostracoda of Greece (e.g. Danielopol, 1979, 1981; Petkovski & Keyser, 1992; Schärer, 1942; Stephanides, 1948). Within the republics of the former Yugoslavia, the history of research into microcrustacean faunas dates to the start of this century but, despite this, published data on ostracods are scant. For Croatia, for example, published accounts are very limited, with Car (1901) and Rogulj *et al.* (1994) providing a small number of species records, although these are augmented by taxonomic papers dealing with taxa from the Island of Hvar (Danielopol, 1969) and the Sava River (Rogulj & Danielopol, 1994). Klie (1937b, 1939, 1941) describes several new taxa from the territories of the former Yugoslav republics, most of these being known from Montenegro, the environs of Skopje, Lake Skadar (Shkodër) and Lake Ohrid, whilst the last of these is dis-

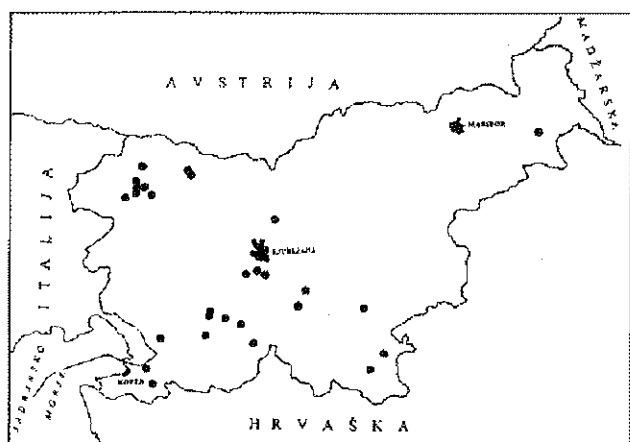


Fig. 1: Map with localities referred to the text (some nearby localities are indicated with a common spot).
Sl. 1: Karta do sedaj znanih najdišč dvoklopnikov (nekatero bližnje lokalitete so označene s skupno piko).

cussed further by the papers of Holmes (1937a,b) and Mikulić (1953, 1961, 1969). To date, however, the best known part of the Balkans in terms of its Ostracoda is Macedonia, not only because of early contributions such as those of Lindner (1920, 1922) and Brehm (1939), but also by virtue of an extended run of articles by Dr. Trajan K. Petkovski of Skopje (see bibliography in Appendix 1).

Although some of Petkovski's papers do mention ostracod records from Slovenia (as reviewed here), only two short articles deal with Slovene ostracods specifically. Walter Klie described three new species from caves in the vicinity of Ljubljana (as "Laibach") (Klie, 1935), and Petkovski & Meisch (1994) give details of a new species of *Cypria* from the Ljubjansko Barje area. Further contributions include those of Klie (1931, 1939), which include single-species descriptions of Slovene species whilst, during revisionary studies, Danielopol (1978, 1982) describes another Slovenian hypogean form. A recent synoptic article on *Candona bimucronata* (Griffiths & Brancelj, in press) provides the first ecological dataset on Slovene ostracods, and includes information derived from five lakes in the Triglav National Park (TNP). In addition to this, several short check-lists that mention Slovene cave-dwelling ostracods have appeared (Sket & Brancelj, 1992; Sket, 1992; Bole *et al.*, 1993) and the first two of these attempt to assess their conservation status. (Of five species listed in the national Red Data List, *Cypria reptans stygia*, *Pseudocandona cavicola*, *P. pretneri*, *P. trigonella* and *Fabaeformiscandona aemona* are all recognised as single-site endemics.) The only other original faunal records to have appeared are those included in a review of the aquatic flora and fauna of the Triglav National Park (TNP) by Brancelj *et al.* (1995).

Although workers have shown historical interest in the description of new species from the territory of

Slovenia there has been almost no systematic study, and epigeic species have attracted almost no attention at all, giving the impression that the ostracod fauna of Slovenia is extremely species-poor. Thus the purpose of the current article is to provide a baseline for renewed ostracod research in the Republic of Slovenia by reviewing the records available in the literature, and correcting some misconceptions that have arisen from these old records. We report also on preliminary results of new ostracod collections made in various parts of Slovenia, that include the notification of several genera and species previously unrecognised from Slovenia. In the present work we aim to provide a preliminary check-list of the modern freshwater fauna which includes also published records arising from palaeolimnological studies of Holocene lake deposits. As sampling is on-going and it is anticipated that further records of note will be uncovered in the near future, we do not attempt to give full and formal site-based listings here, although collecting localities mentioned in the text are shown in Fig. 1.

PRELIMINARY CHECK-LIST OF THE FRESHWATER OSTRACODA OF SLOVENIA

- Phylum or sub-phylum Crustacea PENNANT, 1777
- Class Ostracoda LATREILLE, 1806
- Sub-class Podocopa G.W. MÜLLER, 1894
- Order Podocopida SARS, 1866
- Sub-order Podocopina, SARS 1866
- Superfamily Darwinuloidea BRADY & NORMAN, 1889
- Family Darwinulidae BRADY & NORMAN, 1889
- Genus *Darwinula* BRADY & ROBERTSON, 1885
- Darwinula stevensoni* (BRADY & ROBERTSON, 1870)
- Superfamily Cytheroidea BAIRD, 1850
- Family Cytherideidae SARS, 1925
- Sub-family Cytherideinae SARS, 1925
- Genus *Cytherissa* (SARS, 1863)
- Cytherissa lacustris* (SARS, 1863)
- Family Leptocytheridae HANAI, 1957
- Genus *Leptocythere* SARS, 1925
- Leptocythere fluviatilis* KLIE, 1939
- Family Limnocytheridae KLIE, 1938
- Sub-family Limnocytherinae KLIE, 1938
- Genus *Limnocythere* BRADY, 1867
- Limnocythere inopinata* (BAIRD, 1843)
- Limnocythere sanctipatricii* (BRADY & ROBERTSON, 1869)
- Superfamily Cypridoidea BAIRD, 1845
- Family Ilyocyprididae KAUFMANN, 1900
- Genus *Ilyocypris* BRADY & NORMAN, 1889
- Ilyocypris biplacata* (KOCH, 1858)
- Ilyocypris bradyi* SARS, 1890
- Ilyocypris gibba* (RAMDOHR, 1808)
- Ilyocypris inermis* KAUFMANN, 1900
- Family Candonidae KAUFMANN, 1900
- Sub-family Candoninae KAUFMANN, 1900

- Genus *Candona* s.s. BAIRD, 1845
Candona bimucronata KLIE, 1937
Candona candida (O.F. MÜLLER, 1776)
Candona lindneri PETKOVSKI, 1969
Candona neglecta SARS, 1887
Genus *Cryptocandona* KAUFMANN, 1900
Cryptocandona sp. indet.
Genus *Fabaeformiscandona* KRSTIĆ, 1972
Fabaeformiscandona aemona (KLIE, 1935)
Genus *Nannocandona* EKMAN, 1914
Nannocandona faba EKMAN, 1914
Genus *Pseudocandona* KAUFMANN, 1900
Pseudocandona albicans (BRADY, 1864)
Pseudocandona cavicola (KLIE, 1935)
Pseudocandona eremita (VEJDOVSKY, 1882)
Pseudocandona cf. *marchica* (HARTWIG, 1899)
Pseudocandona pretneri DANIELOPOL, 1978
Pseudocandona cf. *pseudoparallela* (LÖFFLER, 1961)
Pseudocandona trigonella (KLIE, 1931)
Sub-family Cyclocypridinae KAUFMANN, 1900
Genus *Cyclocypris* BRADY & NORMAN, 1889
Cyclocypris laevis (O.F. MÜLLER, 1776)
Cyclocypris ovum (JURINE, 1820)
Genus *Cypria* (ZENKER, 1854)
Cypria bicolor PETKOVSKI & MEISCH, 1994
Cypria exsculpta FISCHER, 1855
Cypria ophthalmica (JURINE, 1820)
Cypria reptans stygia (KLIE, 1935)
Genus *Physocypris* (VÄVRA, 1897)
Physocypris cf. *kliei* SCHÄFFER, 1934
Family Notodromatidae KAUFMANN, 1900
Sub-family Notodromatinae KAUFMANN, 1900
Genus *Notodromas* LILLJEBORG, 1853
Notodromas monacha (O.F. MÜLLER, 1776)
Notodromas persicae GURNEY, 1921
Family Cyprididae BAIRD, 1845
Sub-family Cypricerinae MCKENZIE, 1971
Genus *Bradleycypris* MCKENZIE, 1982
Bradleycypris obliqua (BRADY, 1868)
Sub-family Dolerocypridinae TRIEBEL, 1961
Genus *Dolerocypris* KAUFMANN, 1900
Dolerocypris sinensis SARS, 1903
Sub-family Herpetocypridinae KAUFMANN, 1900
Genus *Psychrodromus* DANIELOPOL & MCKENZIE, 1977
Psychrodromus olivaceus (BRADY & NORMAN, 1889)
Psychrodromus fontinalis (WOLF, 1920)
Sub-family Eucypridinae BRONSHTEIN, 1947
Genus *Eucypris* (VÄVRA, 1891)
Eucypris pigra (FISCHER, 1851)
Eucypris virens (JURINE, 1820)
Sub-family Cyprinotinae BRONSHTEIN, 1947
Genus *Heterocypris* CLAUS, 1892
Heterocypris incongruens (RAMDOHR, 1808)

- Heterocypris reptans* (KAUFMANN, 1900)
Sub-family Cypridopsinae KAUFMANN, 1900
Genus *Cavernocypris* HARTMANN, 1964
Cavernocypris subterranea (WOLF, 1920)
Genus *Cypridopsis* BRADY, 1867
Cypridopsis vidua (O.F. MÜLLER, 1776)
Genus *Potamocypris* BRADY, 1870
Potamocypris fallax FOX, 1967
Potamocypris similis G.W. MÜLLER, 1912
Potamocypris smaragdina (VÄVRA, 1891)
Potamocypris villosa (JURINE, 1820)
Potamocypris zschokkei (KAUFMANN, 1900)

CHECK-LIST OF HOLOCENE AND LAST GLACIATION LATE-GLACIAL SPECIES

Although there has been a comparatively large amount of palaeolimnological work undertaken in Slovenia (e.g. Šercelj, 1996), the only study so far that gives details of freshwater ostracods is that of Löffler (1984). This deals with the palaeolimnology of Lake Bled.

Here (H = Holocene, W = Late Würm):

- Darwinula stevensoni* (BRADY & ROBERTSON, 1870) (H)
Cytherissa lacustris (SARS, 1863) (H,W)
Limnocythere sanctipatricii (BRADY & ROBERTSON, 1869) (H,W)
Candona candida (O.F. MÜLLER, 1776) (H,W)
Cyclocypris cf. *ovum* (JURINE, 1820) (H)
Cypria ophthalmica (JURINE, 1820) (H)
Potamocypris cf. *villosa* (JURINE, 1820) (H)

NOTES ON THE SPECIES REPORTED TO DATE

Darwinula stevensoni BRADY & NORMAN, 1889

This species was reported from Holocene Lake Bled by Löffler (1984). It is now common in the shallower areas of the lake, above the zone of deoxygenation.

Leptocythere fluviatilis KLIE, 1939

Although omitted from all recent check-lists of Slovene ostracods, this species appears to be a Slovene endemic. The species is thus far known only from a single ill-defined locality, somewhere on the Krka River at Novo Mesto (Klie, 1939). The original description is very brief, but material from the type series (held in the Hamburg Zoological Museum) is re-described by Petkovski (sic) & Keyser (1992).

Cytherissa lacustris (SARS, 1863)

First reported from Slovenia as a Late Pleistocene

subfossil from Lake Bled (Löffler, 1984), the species is now known from the modern Triglav area, including Lakes Bohinj and Bled.

***Limnocythere inopinata* (BAIRD, 1843)**

A new record for Slovenia. This species shows an unusual pattern of "geographical" parthenogenesis (Martens, 1994a). It is known from a small number of Slovene localities (e.g. swamp Šijec, lake Spodnje Kriško jezero - TNP), but exclusively as all-female populations.

***Limnocythere sanctipatricii* (BRADY & ROBERTSON, 1869)**

First reported subfossil from Lake Bled (Löffler, 1984), but now also known from the sub-littoral of Lake Bohinj (Griffiths & Brancelj, in press).

***Ilyocypris bradyi* SARS, 1890**

Petkovski (1958a) reports having collected this species at an unnamed locality at Novo Mesto, and it has been found also in collections made at Obrh (near Lož) in September, 1993 and at spring Izvir nad Jezom (Krupa) in March, 1993.

***Ilyocypris biplicata* (KOCH, 1838)**

Reported from Slovenia in collections made at Ljubljana (Petkovski, 1958a) although further details are lacking and there are no subsequent records.

***Ilyocypris gibba* (RAMDOHR, 1808)**

A new record from Slovenia, females having been collected at swamp Šijec in September, 1993.

***Ilyocypris inermis* KAUFMANN, 1900**

A new record from Slovenia, based on a collection made at spring izvir Rizane (Koper) in June, 1994.

***Candona bimucronata* KLIE 1937**

Originally described from Montenegro by Klie (1937b), and subsequently reported from Macedonia by Brehm (1939) and from Bosnia and Macedonia by Petkovski (1958b, 1959). The species now is known also from five sites in the TNP, including Lake Bohinj (Griffiths & Brancelj, in press).

***Candona candida* (O.F. MÜLLER, 1776)**

This species was reported first from Holocene sediments at Lake Bled (Löffler, 1984). It is now known from a

large number of modern sites, e.g. lake Črno jezero, puddel Dol pod Studorjem, lake Dupeljsko jezero, lake Rjavo jezero (all TNP), spring Izvir nad Jezom (Krupa), river Mišca (Bled), cave Črna jama (part of cave system of Postojnska jama) and cave Marnena jama near Pivka. The species appears to be both common and widely distributed.

***Candona lindneri* PETKOVSKI, 1969**

This species was first reported from the Novo Mesto area (as *C. neglecta*) by Petkovski (1959) and also as *C. altoides* by Petkovski (1964a) (see Petkovski, 1969: 94). Since then, 2 males have been found in a collection taken at spring izvir Rizane (Koper) made in June, 1994.

***Candona neglecta* SARS, 1887**

First reported from Slovenia from puddel Dol pod Studorjem (TNP) by Griffiths in Brancelj *et al.* (1995), the species also occurs (in small numbers) in Lake Bled and lake Rjavo jezero (TNP).

***Cryptocandona* sp. indet.**

This genus is known thus far only from undetermined material taken at swamp Šijec in September, 1993.

***Fabaeformiscandona aemonae* (KLIE, 1935)**

An unusual triangulate species, described from two males, three females and larvae collected from drip-water pools in cave Podpeška jama near Videm (Klie, 1935), although now it appears to be widely distributed throughout this system (Griffiths & Brancelj, unpublished data). Bole *et al.* (1993) provide a further record from the same location on Dobropolje, whilst Petkovski & Meisch (1994) list it from a spring izvir Izice near Ig. Transferral to *Fabaeformiscandona follows* Meisch (1996).

***Nannocandona faba* EKMAN, 1914**

The distribution of *N. faba* is reviewed by Marmonier & Danielopol (1988), and the first Slovene record is that from lake Jezero v Ledvicah (TNP) reported by Griffiths in Brancelj *et al.* (1995). Here the species was collected in the June of 1992 and 1993, and in September, 1992.

***Pseudocandona albicans* (BRADY, 1864)**

The species, which is new for Slovenia, is known thus far only from undated material collected from various sampling stations at cave Osapska jama (Koper).

***Pseudocandona cavicola* (KLIE, 1935)**

Originally described from cave Krška jama (Krka) by

Klie (1935) although little other information is given in the description. There is a little confusion with regard to the identity of this species, particularly as the illustrations in Klie's (1935) paper leave a great deal to be desired. Danielopol (1982) states that there is a possibility that *P. cavicola* may be synonymous with *P. pretneri* DANIELOPOL 1978.

***Pseudocandona eremita* (VEJDOVSKY, 1882)**

The inclusion of *P. eremita* within the Slovene fauna is based solely on Paris (1920: 478). Paris states that a female collected in May, 1914 from "Provinz Krain (Austrie) - Podpec Höhle, Podpec, Bezirk Gottschee" had been sent to him by Jeannel and Racovitza. He also notes that the species has been found at "Prague et Agram" (i.e. Zagreb). Danielopol (1978) also lists *P. eremita* from several localities in the former Yugoslav republics, including cave Podpeška jama (Videm) and cave Luknja near Novo Mesto, Zagreb, Skopje and Kosovska Mitrovica.

***Pseudocandona cf. marchica* (HARTWIG, 1899)**

A new record for Slovenia. The record is provisional, however, with the determination being based on a single, highly decalcified specimen taken from a well in Branoslavci (NE Slovenia) in June, 1995.

***Pseudocandona pretneri* DANIELOPOL, 1978**

Danielopol (1978) describes *P. pretneri* from a single individual taken at Rak, a karstic spring in the vicinity of Postojna. No other locality details are given, and the original species description includes no illustrations. Danielopol (1982) provides drawings of the soft parts, SEM illustrations of the valves, and a location map. The species is known thus far from the type locality, and from the Cerknica region (see Bole *et al.*, 1993).

***Pseudocandona cf. pseudoparallela* (LÖFFLER, 1961)**

Until recently *P. pseudoparallela* has been known only from the type locality in the upper catchment area of the Danube (Löffler, 1961). The species was reported from Slovenia (lake Jezero na Planini pri jezeru - TNP) by Griffiths in Brancelj *et al.* (1995). Despite this, the listing of the species from Slovenia is provisional, and based solely on valve material. Meisch (forthcoming) does not accept the validity of this species, considering it to be a junior synonym of *P. albicans*.

***Pseudocandona trigonella* (KLIE, 1931)**

A poorly known and poorly described species. Klie's (1931) description deals with material collected by Dr. H. J. Stammer from "einem kleinen See am Ende eines

als "Tartarus" bezeichneten Seitenganges der Adelsberger Höhle" (i.e. Postojna: Danielopol, 1978: 12). According to Klie, the species was found in association with Ephemeropteran larvae and other ostracods, including *Cypria ophthalmica* and unidentified species of *Potamocypris* and *Cypridopsis*.

***Cypria exsculpta* FISCHER, 1855**

A new record for Slovenia, although again the determination is provisional, being based on dead valves found in benthic samples taken from Lake Bohinj in September, 1993.

***Cypria ophthalmica* (JURINE, 1820)**

This is one of the most common of all freshwater ostracods. The first reports of the species in Slovenia are at Postojna (Klie, 1931) and the *L. fluviatilis* type locality at Novo Mesto (Klie, 1939). It has been reported since from eleven sites in the TNP (Griffiths in Brancelj *et al.*, 1995) and has been found subsequently at a large number of sites throughout the country.

***Cypria reptans stygia* (KLIE, 1935)**

Another of those species described by Klie (1935) (but as *Cypria stygia*). The original report gives few details, other than that 3 males and 15 females were taken at cave Podpeška jama near Videm/Dobropolje. Petkovski (1976) places *C. stygia* into synonymy with *C. reptans* BRONSHTEIN, 1928 but maintains subspecific ranking. *C. r. stygia* has been considered generally as a Slovene endemic, although Petkovski (1976) notes material from both Montenegro and northern Italy. Although it is possible that *C. r. stygia* may still represent an endangered taxon as suggested by Sket & Brancelj (1992), this can not be justified on the grounds of endemism alone. Till now Slovene localities are known from Dobropolje, i.e. cave Podpeška jama (Bole *et al.*, 1993) and spring izvir Izice, near Ig (Petkovski & Meisch, 1994). We have further material (27 females, 3 juveniles) taken from a bank-side seep near the Limnological Station at Lake Bled in September, 1993.

***Cyclocypris laevis* (O.F. MÜLLER, 1776)**

A new national record, despite being a very commonly-distributed species. *C. laevis* is known from a number of sites, including lake Zeleno jezero (TNP) and Lake Bled.

***Cyclocypris ovum* (JURINE, 1820)**

Originally listed from Holocene Lake Bled by Löffler (1984) as *C. cf. ovum*, the species has been found also



Fig. 2: *Cypria ophthalmica* (JURINE, 1820) is one of the most common of all ostracods. It was found at a large number of sites throughout Slovenia (Photo: A. Brancelj).

Sl. 2: *Cypria ophthalmica* (JURINE, 1820) je ena najbolj pogostih vrst dvoklopnikov. V Sloveniji je bila doslej najdena na številnih lokalitetah (Foto: A. Brancelj).

at several sites in the TNP (Griffiths in Brancelj *et al.*, 1995). It appears to be common in standing waters throughout Slovenia.

Notodromas monacha (O.F. MÜLLER, 1776)

Thus far known only from the papers of Petkovski, who states that he has the species "auseinem Wiesentümpel bei Volčji Potok, Ljubljana in Slovenien (leg. R. Grupcer, 9.10.1958)" (Petkovski, 1959).

Notodromas persicae GURNEY, 1921

Described by Petkovski (1959) as "Auf Jugoslawien ist sie von Dr. St. Karaman in der Ljubljana-Höhle bei Ljubljana gefunden wordet; det. Klie,...". There are no subsequent records.

Bradleycypris obliqua (BRADY, 1868)

A new Slovene record, based on specimens taken at lake Cerknjško jezero in the winter of 1993. The generic taxonomy of Cypricerinae, which has been rather confused over recent years, is discussed by Martens (1994b).

Dolerocypris sinensis SARS, 1903

This species is known from a single record published by Petkovski (1960), who states that the species was found in "ein vegetationsreiche Grube bei Ljubljana, 8.6.1958 - Slovenien". Juveniles ascribed of *Dolerocyp-*

ris sp. were collected from lake Rjavo jezero (TNP) in September 1993, although their specific identity cannot be confirmed.

Psychrodromus fontinalis (WOLF, 1920)

A new Slovene record, this spring-dwelling species is known from a number of sites, including the seep near the Lake Bled Limnological Station (collected September, 1993), rivers Mišca and Ribčev graben (Bled; December, 1993). A recent account of the genus is given by Baltan-Els *et al.* (1993). *P. fontinalis* is usually considered to be central European, although these records, plus one from Split, Croatia, are the most southerly for the species yet reported (Baltan-Els *et al.*, 1993).

Psychrodromus olivaceus (BRADY & NORMAN, 1889)

A new record for Slovenia, this rheophilic species is known from 15 females taken from river Mišca (Bled) in December, 1995.

Eucypris pigra (FISCHER, 1851)

A new Slovene record. Thus far known only from two adult valves, certainly subrecent, collected from the cave Mejame near Divača in September, 1992.

Eucypris virens (JURINE, 1820)

A new Slovene record, based on material collected from lake Cerknjško jezero in the winter of 1993.

Heterocypris incongruens (RAMDOHR, 1808)

A new Slovene record. The species is known from material from puddel Mlaka v dolu pod Studorjem (TNP) (dated July and September, 1992) and was also collected from the littoral of Lake Bled in September, 1994.

Heterocypris reptans (KAUFMANN, 1900)

"*Eucypris reptans* s. str. überliessen mir Dr. Marjan Rejc und Dr. Boris Sket, beide aus Ljubljana, die sie in den Küsternen Gegenden Sloweniens und Dalmatiens sammelten". (Petkovski, 1964b: 163). This rare species is now known to belong properly within *Heterocypris* (see Meisch, 1993). Although Meisch does note the species' presence from Croatia, he does not list the Slovene record, and there are no recent reports.

Cavernocypris subterranea (WOLF, 1920)

C. subterranea was reported first from 5 females and 8 juveniles taken at lake Rjavo jezero (TNP) in September, 1993 (Griffiths in Brancelj *et al.*, 1995). The species

is also known from the previously-mentioned seep in the banks of Lake Bled (1 female, September, 1993) and from cave Marnena jama near Pivka (1 female, April, 1993). Formerly placed within *Cypridopsis* s.s., formal transfer to *Cavernocypris* follows Marmonier *et al.* (1989).

***Cypridopsis vidua* (O.F. MÜLLER, 1776)**

Although new record for Slovenia, this is an extremely common freshwater ostracod. *C. vidua* is known from females collected at several sites in the TNP, in lake Cerknjsko jezero near village Dolenje Jezero, in lake Podpeško jezero near Ljubljana and the shallows (depth <0.2 m) of Lake Bled. It has been collected also at other standing water localities, including swamp Šijec.

***Potamocypris fallax* FOX, 1967**

New for Slovenia, this species was originally described from streams in the UK (Fox, 1967) and is now widely-known throughout Europe. In Slovenia it is recorded only from 2 females taken at river Mišca (Bled) in December, 1993.

***Potamocypris similis* G.W. MÜLLER, 1912**

Previously unreported from Slovenia, this taxon is known from material collected in September, 1992 at a spring at Vršič, Trenta, at 1350 m asl, and from material identified as *P. cf. similis* from swamp Šijec collected in September, 1993.

***Potamocypris smaragdina* (VÁVRA, 1891)**

New to Slovenia, the only record for this species to date is in material taken at swamp Šijec in September, 1993.

***Potamocypris villosa* (JURINE, 1820)**

Known from Holocene Lake Bled (Löffler, 1984) (as *P. cf. villosa*), and from a single female in an undated collection from cave Osapska jama (Koper).

***Potamocypris zschokkei* (KAUFMANN, 1900)**

This species was first reported from Slovenia in collections taken in reservoir Močilec (TNP) in September, 1992 (Griffiths in Brancelj *et al.*, 1995) and has been found since in the shallows of Lake Bled in the vicinity of a shore-line seep.

NOTES ON FURTHER RESEARCH

Although the present work considerably increases the data available on freshwater Ostracoda from Slovenia,

there is still a considerable amount of research that remains to be undertaken. For example, a number of genera that clearly should be represented in the fauna remain unrecorded, notably: *Herpetocypris* BRADY & NORMAN, 1889, *Mixtacandona* (Klie, 1938), *Tonnacypris* DIEBEL & PIETRZENIUK, 1975, *Scottia* BRADY & NORMAN, 1889, *Sarsocypridopsis* MCKENZIE, 1977, *Isocypris* G.W. MÜLLER, 1908, *Bradleystrandesia* BROODBAKKER, 1983, *Metacypris* BRADY & ROBERTSON, 1870 and *Cypris* O.F. MÜLLER, 1776. Furthermore, within the genera presently known, *Pseudocandona*, *Fabaeformiscandona* and *Eucypris* are clearly under-represented.

In addition to this, there remain several problems relating to species described from Slovenia. First amongst these is the enigmatic *Leptocythere fluviatilis*, which has not been seen since described in 1939. Moreover, there is the unresolved question of the possible synonymy of *Pseudocandona cavicola* with *P. pretneri* (Danielopol, 1982), which can only be resolved through the study of larger series of material. The question also remains as to whether further species remain to be described from Slovenia, and particularly from hypogean environments in the Slovene karst. Ostracods remain under-researched in many parts of Europe, and the latest new forms to be described from the Balkans have been as recent as 1994 for Slovenia (Petkovski & Meisch, 1994), 1993 for Croatia (Rogulj & Danielopol, 1993), and 1995 and 1996 for Macedonia (Petkovski (sic) & Keyser, 1995; Petkovski & Meisch, 1996).

Lastly comes the question of the conservation status of those species described as Slovene endemics. Certainly, at least in the case of *C. r. stygia*, it is clear that this taxon is not genuinely endemic, but the status of the other species, including all those described by Klie in the 1930s and Danielopol's taxon from 1978, remain unknown, and data on their exact distributions and abundances are not available. It is hoped that those data presented here will help to spur further interest in the group.

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POVZETEK

Članek povzema dosedanje poznavanje razširjenosti sladkovodnih rakov dvoklopnikov (*Ostracoda*) v Sloveniji. Na podlagi literaturnih podatkov in nabranega materiala je z ozemlja Slovenije doslej ugotovljenih 47 taksonov dvoklopnikov, ki so uvrščeni v 22 rodov. Mednje so vključene tudi še nedoločene vrste in vrste, katerih taksonomski status še ni povsem določen. Šest taksonov je doslej označenih za slovenske endemite. Vendar ostaja še odprto vprašanje natančnega taksonomskega položaja nekaterih, v seznamu navedenih vrst. Pri nekaterih izmed njih ni bilo navedeno natančno najdišče, pri drugih pa je bilo najdenih premalo osebkov, da bi lahko z gotovostjo potrdili samostojen takson. Ne glede na to pa lahko tudi na podlagi dosedanjega poznavanja favne dvoklopnikov potrdimo, da je Slovenija ena izmed "biodiverzitetnih vročih točk". Med naštetimi taksoni je približno polovica takih, ki doslej niso bili znani z ozemlja Slovenije. Večji del vrst je bilo najdenih v jamah, izvirih ali v visokogorskih jezerih, ostanke nekaterih vrst pa so našli tudi v sedimentu Blejskega jezera. Zlasti preseneča skoraj popolno nepoznavanje favne dvoklopnikov v površinskih vodah. To le potrjuje predvidevanja, da lahko ob intenzivnejših raziskavah pričakujemo povečanje števila vrst, in sicer tako na račun že znanih vrst kot tudi na račun novih, za znanost še neznanih vrst.

Dosedaje raziskave so bile nesistematične, z izjemo morda visokogorskih jezer. Omejene so bile večinoma le na območje jugozahodno od Save. Z drugih območij Slovenije še ni nobenih podatkov oz. so šele v fazi obdelav. Zanimivih in predvsem za znanost novih vrst si lahko obetamo zlasti iz intenzivnejših raziskav podtalnice, izvirov in jam. Ob sistematičnem raziskovanju površinskih voda pa bomo dobili popolnejšo podobo razširjenosti vsaj najbolj pogostih površinskih vrst. Analiza oz. primerjava slovenske favne s favno sosednjih dežel je pokazala, da je še veliko rodov oz. vrst, za katere v Sloveniji še ni nobenih podatkov o njihovem pojavljanju, v sosednjih pokrajinah pa so splošno razširjene vrste. To velja tudi za njihovo razširjenost znotraj posameznih zoogeografskih regij ali po posameznih habitatih.

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APPENDIX 1:

Papers dealing with Yugoslav Ostracoda by Trajan K. Petkovski.

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