

***Merozoon vestigatum* g. n., sp. n., a new freshwater subterranean isopod
(Isopoda: Sphaeromatidae) from a cave in Croatia.**

Merozoon vestigatum g. n., sp. n., nov sladkovoden, podzemeljski rak
enakonožec (Isopoda: Sphaeromatidae) iz jame na Hrvaškem.

Boris Sket

Department of Biology, Biotechnical faculty, University of Ljubljana, Ljubljana, Slovenia
Oddelek za biologijo, Biotehniška fakulteta, Univerza v Ljubljani, Ljubljana, Slovenia.
correspondence: boris.sket@bf.uni-lj.si

Abstract: A pleon of a new freshwater isopod, provisionally attributed to the family Sphaeromatidae (Monolistrini *sensu* Racovitza, 1910) was found in a cave in Dalmacija (Croatia). Although known from such a small part of the body, *Merozoon vestigatum* g. n., sp. n. is easily recognizable. It is doubtlessly a new species which can only be attributed to a new genus in agreement with the criteria up to now used for this genera-group. All pleonites are fused with the pleotelson, the free epimera of the anterior pleonites are very poorly developed, not reaching the pleotelson lateral borders; uropods are strongly reduced, uniarticulate, inserted in the middle of the pleotelson lateral sides. It could be shown that its inclusion into Sphaeromatidae can hardly be challenged, and that its only alternative, Cirolanidae, is very unlikely.

Keywords: Isopoda, Sphaeromatidae, taxonomy, subterranean, Croatia.

Izvleček: Pleon novega sladkovodnega izopoda, ki ga pripisujemo družini Sphaeromatidae (skupini Monolistrini *sensu* Racovitza, 1910) je bil najden v jami v Dalmaciji (Hrvaška). Čeprav poznamo le tako majhen del njegovega telesa, je *Merozoon vestigatum* g. n., sp. n. zlahka prepoznaven. Je nedvomno nova vrsta, ki jo lahko v skladu z znanimi lastnostmi te skupine rodov pripišemo le novemu rodu. Vsi pleoniti so zliti s pleotelzonom; proste epimere sprednjih pleonitov so zelo slabo razvite in ne dosejajo zunanjih robov pleotelzona; uropodi so močno pokrnjeni, enočlenski, izraščajo iz sredine bočnih strani pleotelzona. Izkazuje se, da bi le težka osporavali pripadnost novega taksona družini Sphaeromatidae, edina alternativa, družina Cirolanidae, je skrajno neverjetna.

Ključne besede: Isopoda, Sphaeromatidae, taksonomija, podzemeljski, Hrvaška.

Introduction

Beside two genera and more than 30 taxa of the species category (Sket 1986a), a number of undescribed taxa of the *Monolistrina*-group (Monolistrini *sensu* Racovitza 1910) are present in the department's collections. Here is described

a putative monolistrine, representing a new, biogeographically very intriguing genus. It was decided to describe this new taxon although only a pleotelson with uropods is available, since the remote locality was visited and thoroughly sampled more than fifteen times without success, during more than 35 years. Further ignorance of

taxonomically and biogeographically so intriguing animal would not be reasonable. Its novelty and uniqueness is out of doubt and even its taxonomical position can only hardly be challenged. The genus-value of the pleon articulation within the actual sphaeromatid system is well established and the position of uropods could only hardly be attributed to a non-sphaeromatid isopod. So, the taxonomic name will persist and can only be attributed to the same taxon when an entire animal will be discovered in next decades, without arising confusion in taxonomy.

***Merozoon* gen. n.**

Diagnosis

Monolistra-shaped pleotelson (Figs 1-2) vaulted (half-hemispherical), without caudal foramen or ventral channel. No complete dorsal articulation within the entire pleon-pleotelson region. First pleonite with epimeral parts poorly developed (weaker than in *Caecosphaeroma* or *Monolistra*); second (pseudo)pleonite with epimeral parts only slightly longer than in the first one, apically rounded, not elaborated as in the above mentioned genera, not reaching ventro-lateral pleotelson margins. Uropods strongly reduced, uniarticulate, attached in the middle of pleotelson lateral parts. Other body parts unknown.

Type and the only species

Merozoon vestigatum sp. n.

Etimology

'Meros' in Greek, a part (of); zoon, in new Latin, 'animal'.

***Merozoon vestigatum* sp. n.**

Material examined (holotype): A complete pleon with pleotelson and uropods, without pleopods. Collected in cave Šipun špilja, Cavtat near Dubrovnik, Croatia, September 1975, coll. B. Sket; deposited in the invertebrate collection of Oddelek za biologijo, Biotehniška fakulteta, Univerza v Ljubljani.

Diagnosis

Characters of the genus. The millimeter long and wide pleotelson smooth, without any ornamentation. Uropods strongly reduced, uniarticulate, their length approximately 35% of pleotelson length, with some setae in their apical part.

Etimology

'Vestigatum' (vestigatus) in Latin, 'searched (for)' - due to the author's 35 years of searching for a more complete specimen.

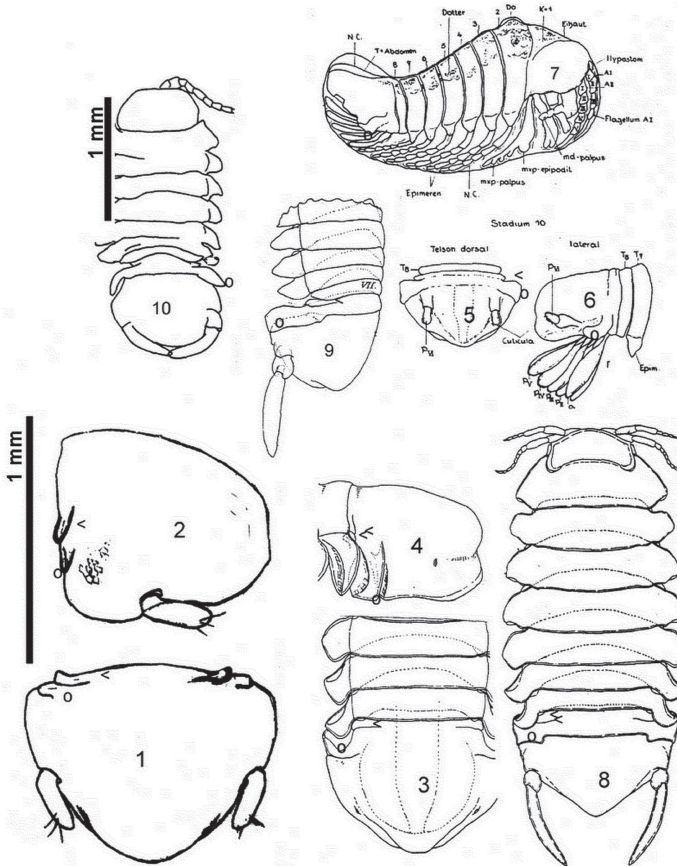
Distribution and Ecology

The fragment was found in the anchihaline lake of the cave Šipun in southern Dalmacija (Dalmatia). It was found together with the freshwater *Proasellus anophthalmus* ssp., in the limnic layer of the mixohaline water body.

Remarks

The pleotelson in concern matches the characters of Sphaeromatidae as described by Harrison and Ellis (1991) and by Poore (1994), but with a progression in the fusion as described for the *Monolistra*-group (Monolistrini) by Racovitza (1910) and Sket (1965). The pleotelson is very variably fused also in some Australian marine sphaeromatids (Bruce 1993, 2003; Poore 1994). All Australian species with fused pleons are very different from the "northern" sphaeromatids in many other morphological characters. Being also geographically so remote, the similarity in the pleon architecture is unquestionably a homoplasy.

Among the Northern Hemisphaera taxa, regarding the fusion of the pleonal regions, the new taxon resembles most closely the genus *Caecosphaeroma*, and less *Monolistra* (Figs 3-4, 8). The two pairs of epimera, however, in both are the latter, however, are much better developed, they reach the pleotelson margins and are included into its anterior ventro-lateral angle. The pleon-pleotelson in *Caecosphaeroma* equals in its shape the same in the related (Racovitza 1910, unpublished molecular data) *Monolistra*, except for the lack of any suture.



Figures 1-10: figs 1-2, *Merozoon vestigatum* sp. n., g. n., pleotelson dorsal and left lateral aspect (with scale bar); figs 3-4, adult *Caecosphaeroma burgundum* Dollfus, pleotelson with posterior pereonites; figs 5-6, stad. 10 intramarsupial stages of *C. burgundum*; fig. 7, stad. 9 of the same; fig. 8, adult *Monolistra caeca* Gerstaecker; figs 9-10, intramarsupial manca stad. of *Monolistra caeca* (10 with scale bar); < – points to the epimeral part of the (pseudo)pleonite I; 0 – of the (pseudo)pleonite II. 3-4, 8 – from Racovitza, 1910; 5-7 – from Daum, 1954; 10 – from Sket, 1965.

Slike 1-10: sl. 1-2, *Merozoon vestigatum* sp. n., g. n., pleotelson od zgoraj in z leve (z merilom); sl. 3-4, odrasla *Caecosphaeroma burgundum* Dollfus, pleotelson z zadnjimi pereoniti; sl. 5-6, *C. burgundum*, intramarsupialni stadij 10; sl. 7, stadij 9 iste; sl. 8, odrasla *Monolistra caeca* Gerstaecker; sl. 9-10, *Monolistra caeca*, intramarsupialni stadij manca (10 z merilom); < – kaže na epimere (pseudo)pleonita I; 0 – ob (pseudo)pleonitu II. 3-4, 8 – po Racovitza, 1910; 5-7 – po Daum, 1954; 10 – po Sket, 1965.

Vestigial epimera can hardly be either a juvenile character or a pedomorphy, as in supposedly related *Monolistra* spp. and *Caecosphaeroma burgundum* Dollfus, the epimera are well developed already in the intramarsupial *manca* stages, or even in the embryo (Figs 5-7, 9-10; see Sket 1965: Plate 26, Fig. 4, Plate 27, Figs. 1-4; Daum 1954: Table 8, Figs. 1, 3). Also the genus specific final

degree of the pleon-pleotelson fusion is reached at the mentioned stages. The available *Merozoon* pleotelson evidently belonged to a free (not marsupial) young or to a mature individual, since it is well sclerotized, while intra-marsupial animals exhibit a soft cuticle and their pleotelsons are less vaulted. The unarticulated uropod of the new taxon resembles the uropods of *Caecosphaeroma*

virei Dollfus, 1896, in its position as well as in its size, although it is less reduced.

The degree of fusion of pleonites within the pleotelsonal region proved to be a useful character for genus definitions in the monolistrines. It characterizes two geographically well delimited groups of species which appeared to be also molecularly related, but very distinct (unpublished data).

The anterior pleonites in Sphaeromatidae are evidently generally partly reduced (pleonite I) and partly fused. In the second pleonite, sutures indicate a fusion of 2-3 somites (Racovitza 1910, Kusakin 1979), therefore Racovitza (1910) calls them warily pseudo-somites. Probably, more than just one pleonite is fused into the pleotelson without a track (without a residual suture). This is most likely the reason why uropods in Sphaeromatidae are only exceptionally inserted at the anterior angle of the pleotelson (see Kusakin 1979), they are usually placed away from it. Such is the situation in the *Monolistra*-group as well as in our new taxon.

While all other sphaeromatid genera with progressively fused pleon are marine and distributed in the Southern Hemisphere, the south-European *Monolistra*-group is biogeographically and morphologically an acceptable candidate for the inclusion of this new taxon.

Another possible candidate for the inclusion of the new taxon would be the family Cirolanidae. In most cirolanids, the pleonites I-V are free while only pleonite VI is fused with the telson and therefore uropods are attached at the antero-lateral angles of the pleotelson, immediately behind the last pleonal epimera (compare Racovitza, 1912, Monod 1972, Botosaneanu et al. 1986). Such is the position of uropods also in *Kensleylana* Bruce and Herrando-Perez (2005) in which the pleon articulation is extremely reduced, but the epimera of the last free pleonite are normally developed, reaching the body margin.

Particularly the insertion points of uropods make the cirolanid affinities with the new taxon very unlikely.

The genus status of this taxon can hardly be challenged. In several tens of taxa of the genus *Monolistra* as well as in both species of *Caecosphaeroma* the pleon is characteristically uniformly structured. However, our sample might belong to a deformed specimen; but among several

hundreds of *Monolistra* specimens we never met anything similar. Another problem might present the phylogenetic position of the new taxon. It could be phylogenetically nested within the genus *Monolistra* and thus render *Monolistra* paraphyletic. Although – considering the kind of the difference – *Monolistra* and *Merozoon* are more probably sister taxa, the above mentioned case is impossible to be excluded without a DNA analysis. But, there are only very few genera which have been verified such a way, and this has nothing to do with the deficiency of the specimen.

Ecology and Biogeography

The nature of the collection locality leaves little doubt that the pleotelson belonged to a freshwater cave animal. The anchihaline cave water in Šipun is mixohaline, i. e. brackish and even euhaline in deeper layers, with a rich anchihaline fauna (see Sket 1986b: Fig. 6; 2004: p. 64). Its surface layer is usually highly diluted and after heavy rains probably absolutely limnic. Together with this fragment of a supposed subterranean sphaeromatid, a living specimen of the freshwater asellid *Proasellus anophthalmus* ssp. was found, also at this occasion only. Very likely, both animals had been drifted into the lake's shallow from the fissure system after a strong rainfall. In other localities of the Dinaric karst, numerous other cave animals were found in similar circumstances, including *Monolistra* spp. (Sket et al. 2004).

The collection site is close to the southeastern border of the distribution for *Monolistra* (Sket 1986a). It has been emphasized that a number of *Monolistra* spp. had invaded continental waters independently from the sea, and that some species invaded caves independently from the surface (Sket 1986c). The morphologically closest genus, *Caecosphaeroma*, is geographically remote from the new taxon, its area in western Europe is separated from the new taxon locality by an area not inhabited by monolistrines, followed by a wide belt of the less similar *Monolistra* species. Therefore, it may be supposed that all three genera (*Monolistra*, *Caecosphaeroma*, *Merozoon*) originated from separate freshwater invasions. The highly apomorphic character of the only facultatively anchihaline *Monolistra* species, *M. radjai* Prevorčnik and Sket (2007),

most probably represents a secondary adaptation to the saline water. If this supposition is correct, no (very) close relative of the subterranean *Monolistra* group is living in the sea recently.

Povzetek

Iz evropskih sladkih voda sta znana dva rodova mokric krogljčark (družina Sphaeromatidae). V zahodni Evropi sta doma dve vrsti rodu *Caecosphaeroma*, v Južnih apeniških Alpah in Dinaridih pa je kar nekaj deset vrst rodu *Monolistra*. Vse so troglobiotske. V dalmatinski jami je bil najden le pleotelzon drugačne vrste, a kljub več obiskom v tej jami skozi 35 let, nismo našli popolnejšega osebk. Ker gre za dokaj svojevrstno žival, menim, da ne moremo več odlašati z objavo tega podatka in s taksonomsko definicijo te živali.

Rakca opisujem pod imenom *Merozoon vestigatum* g. n., sp. n. in ga uvrščam v družino Sphaeromatidae, rodovno skupino *Monolistra* (Monolistrini *sensu* Racovitza). Za novi rod je značilen obokan pleotelzon, z vsemi pleoniti zlitimi vanj; proste so le epimere sprednjih pleonitov, ki pa so slabo razvite in ne segajo do stranskega roba pleotelzona; uropodi so močno reducirani, enočlenski, izraščajo iz sredine pleotelzonovih bočnih strani. Dolžina uropodov je pri tej vrsti le 35% dolžine pleotelzona. Pri obeh doslej znanih rodovih te skupine je zgradba pleona-pleotelzona nespremenljiva. Uropodi so vedno poenostavljeni vsaj do enovejnate oblike, sicer pa je njihova

razvitost od vrste do vrste različna, lahko tudi manjkajo.

O pripadnosti taksona družini Sphaeromatidae priča prav namestitev uropodov daleč za sprednjim robom pleotelzona. Takšno namestitev si lahko razlagamo tako, da je v pleotelzon brez sledu zlit še pleonit ali dva pred zadnjim, ki nosi uropode. Edina druga možnost bi bila pripadnost družini Cirolanidae, a pri njenih članih izraščajo uropodi vedno tik za sprednjim robom pleotelzona; to verjetno pomeni, da nečlenjeni del pleotelzona začne z zadnjim pleonitom.

Dvome o reprezentativnosti tega majhnega dela telesa odklanjam. Slaba razvitost pleonitov ne more biti posledica mladosti, saj imajo mladiči te skupine že v zadnjih stadijih v valilniku enako razvit pleon in pleotelzon, kot odrasli. Sklerotiziranost tega kosa pa priča, da je celo pripadal odraslemu ali mlademu osebkun zunaj valilnika. Členjenost pleona, kot je značilna za eden ali drugi rod monolistrinov, je povsem stabilna. Med stotinami osebkov nismo našli spačka, ki bi bil podoben tukaj opisani živali.

Deli pleona-pleotelzona so nekoliko zlitih pri rodu *Monolistra*, bolj pri zahodnoevropskemu rodu *Caecosphaeroma*, najbolj pa pri novemu rodu *Merozoon*, čeprav je bil ta najden pri južnem koncu areala monolistrine. Kaže, da je nova žival tudi filogenetsko-biogeografsko zanimiva, a za postavitev kakršne koli hipoteze jo bo treba raziskati ne le popolneje morfološko, temveč tudi molekulsko-filogenetsko.

References

- Botosaneanu, L., Bruce, N., Notenboom, J., 1986. Isopoda: Cirolanidae. In: Botosaneanu, L. (Ed.), *Stygofauna Mundi*, pp. 423–427.
- Bruce, N. L., 2003. New genera and species of sphaeromatid isopod crustaceans from Australian marine coastal waters. *Memoirs of Museum Victoria*, 60, 309–369.
- Bruce, N.L., 1993. Two new genera of marine isopod crustaceans (Flabellifera: Sphaeromatidae) from Southern Australia, with a reappraisal of the Sphaeromatidae. *Invertebrate Taxonomy*, 7, 151–171.
- Bruce, N. L., Herrando-Perez, S., 2005. *Kensleylana briani*, a new genus and species of freshwater cave-dwelling cirolanid (Crustacea: Isopoda) from Spain. *Proceedings of the Biological Society of Washington*, 118, 74–83.
- Daum, J., 1954. Zur Biologie einer Isopodenart unterirdischer Gewässer: *Caecosphaeroma (Vireia) burgundum* Dollfus. *Annales Universitatis saraviensis. Naturwissenschaften*, 3, 104–160, tab. 1–11.
- Harrison, K., Ellis, J.P., 1991. The genera of the Sphaeromatidae (Crustacea: Isopoda): a key and distribution list. *Invertebrate Taxonomy*, 5, 915–952.

- Kusakin, O. G., 1979. Morskie i solonovatovodnye ravnonogie rakoobraznye (Isopoda) holodnyh i umerennyh vod severnogo polušarja. Podotrjad Flabellifera. Nauka, Leningrad.
- Prevorčnik, S., Sket, B., 2008. An ecologically peculiar new species of *Monolistra* (Crustacea: Isopoda: Sphaeromatidae) from cave waters in the Dinaric karst of Croatia. *Subterranean Biology*, 5, 23–28.
- Monod, T., 1972. Contribution a l'étude de la Grotte de Sof Omar (Ethiopie Méridionale). No 3 – Sur une espèce nouvelle de Cirolanidé cavernicole, *Skotobaena mortoni* (Crusst., Isopoda). *Annales de Speleologie*, 27, 205–220.
- Poore, G.C.B., 1994. *Maricoccus brucei*, an unusual new genus and species of Sphaeromatidae from Southern Australia (Crustacea: Isopoda). *Memoirs of the Museum of Victoria*, 54, 171–178.
- Racovitza, E.-G., 1910. Sphéromiens (première série) et révision des Monolistrini. *Archives de Zoologie expérimentale et générale*, 5e Ser., 4, 625–758, tab. 18–31.
- Racovitza, E.-G., 1912. Cirolanide (première série). *Archives de Zoologie expérimentale et générale*, 5e Ser., 5, 203–329, tab. 15–28.
- Sket, B., 1965. Östliche Gruppe der Monolistrini. II. Biologischer Teil. *International Journal Speleology*, 1, 249–267, tab. 60–66.
- Sket, B., 1986a. Isopoda: Sphaeromatidae. In: Botosaneanu, L. (Ed.), *Stygofauna Mundi*, pp. 423–427.
- Sket, B., 1986b. Ecology of the mixohaline hypogean fauna along the Yugoslav coast. *Stygologia*, 2, 317–338.
- Sket, B., 1986c. Evaluation of some taxonomically, zoogeographically, or ecologically interesting finds in the hypogean waters of Yugoslavia (in the last decades). *Comunicacions*, 9. Congreso Internacional de Espeleologia, 1, 126–128.
- Sket, B., Trontelj, P., Žagar, C., 2004. Speleobiological characterization of the epikarst and its hydrological neighborhood: its role in dispersion of biota, its ecology and vulnerability. *Epikarst*. Karst Water Institute Special Publication 9, Washington, pp. 104–113.