

<https://zoobank.org/urn:lsid:zoobank.org:pub:D39D3CFE-0B00-4D40-BD5D-61DE84C8052B>

***Neobisium radjai* n. sp. (Neobisiidae: Pseudoscorpiones), a new cave-dwelling pseudoscorpion from Bosnia and Herzegovina**

RAJKO N. DIMITRIJEVIĆ^{1*} & TONČI RAĐA²

¹*Institute of Zoology, University of Belgrade - Faculty of Biology, Studentski Trg 16, 11000 Belgrade, Serbia, e-mail: rajko@bio.bg.ac.rs*

²*Špiljar Speleological Society, Varaždinska 53, 21000 Split, Croatia, e-mail: tonci.radja1@gmail.com*

^{*}*Corresponding author, e-mail: rajko@bio.bg.ac.rs*

Received 20 September 2017 | Accepted by V. Pešić: 28 November 2017 | Published online 30 November 2017.

Abstract

A new cavernicolous pseudoscorpion species, *Neobisium radjai* n. sp., from the Golubanjka pećina Cave, village of Srđevići, near Livno, Hercegbosanska županija county, western Bosnia and Herzegovina, is described and compared to its close congeners. The newly erected taxon represents an endemic and a relict form.

Key words: *Neobisium radjai*, Pseudoscorpiones, Neobisiidae, Bosnia and Herzegovina, cave, endemism, relict.

Introduction

The pseudoscorpion fauna of Bosnia and Herzegovina is insufficiently investigated and known. On the basis on the present knowledge, 58 pseudoscorpion species belonging to 14 genera and seven families are currently known from Bosnia and Herzegovina (Hadži 1932; Beier 1938, 1939; Čurčić 1972, 1974; Harvey 1990; Čurčić *et al.* 2002, 2011a, 2011b, 2011c, 2014a, 2014b, 2014c; Čurčić & Dimitrijević 2007; Harvey 2013). The first significant contribution to the knowledge of this arachnid group in Bosnia and Herzegovina was given in the first half of the XX century by Beier (1938, 1939), who has described the majority of the pseudoscorpion species recorded in the country. Recently, Čurčić *et al.* (2002, 2011, 2011a, 2011b, 2014, 2014a) and Čurčić & Dimitrijević (2007) erected several new, mainly cavernicolous, pseudoscorpion species belonging to the Chthoniidae and Neobisiidae families.

Of the seven pseudoscorpion families recorded in Bosnia and Herzegovina (with 58 species), the Neobisiidae family is the most numerous, with 30 species (51.72%). Second most numerous pseudoscorpion family in Bosnia and Herzegovina is the Chthoniidae family, which comprises 17 species (29.31%). Representatives of other pseudoscorpion families are present in considerably smaller number of species and lower percentages (Cheliferidae and Chernetidae – each with four species or 6.90%, while Garypidae, Olpiidae and Withiidae – each with one species or 1.72%).

Within the family Neobisiidae, 30 species from three genera (*Neobisium* Chamberlin, 1930, *Roncus* L. Koch, 1873 and *Insulocreagris* Čurčić, 1987) are recorded in Bosnia and Herzegovina. Of these, 23

species (76.67%) belong to the genus *Neobisium*, whilst genera *Roncus* and *Insulocreagris* are represented each with six (20.00%) and one species (3.33%), respectively.

The Chthoniidae family in Bosnia and Herzegovina comprises 17 species, of which 16 ones (94.12%) belong to the genus *Chthonius* C. L. Koch, 1843, and one species (5.88%) belongs to the genus *Troglochthonius* Beier, 1939.

Material and Methods

A careful analysis of the collected faunistic material in the Golubanjka Pećina Cave near Livno (western Bosnia and Herzegovina) in 2016 revealed the presence of one specimen of a new pseudoscorpion taxon – *Neobisium radjai* n. sp. The type specimen was collected by hand. The specimen was carefully dissected, measured and mounted in gum-chloral medium (Swan's fluid) in the laboratory of the Institute of Zoology, University of Belgrade - Faculty of Biology, Belgrade, Serbia. The type specimen is deposited in the collection of the Institute of Zoology, University of Belgrade - Faculty of Biology, Belgrade, Serbia. Drawings were made using a Jenamed 2 light binocular stereomicroscope. The photograph of a female specimen was taken using a Nikon DS-Fi2 camera with a Nikon DS-L3 camera controller attached to a Nikon SMZ1270 binocular stereomicroscope. Final stacking was done using the Zerene Stacker software. The final image was processed with Adobe Photoshop CS6.

Taxonomy

Ordo Pseudoscorpiones
Family Neobisiidae Chamberlin, 1930
Neobisium Chamberlin, 1930

***Neobisium radjai* Dimitrijević, n. sp.**
(Figs. 1–9; Table 1)

Derivatio nominis. The erected pseudoscorpion species is named after Tonći Rađa, a distinguished Croatian biospeleologist and the president of the Špiljar Speleological Society (Split, Croatia), who collected the type specimen of the new species. Over the last 25 years, Mr. Rađa significantly contributed to the better knowledge of biospeleology in the Balkan Peninsula.

Material examined. Holotype female labeled as follows: „Bosnia and Herzegovina, Livno, village of Srđevići, Golubanjka Cave, 10.IX.2016, leg. T. Radja“ (white label, printed) / Holotypus *Neobisium radjai* n. sp. Dimitrijević det. 2017” (red label, printed).

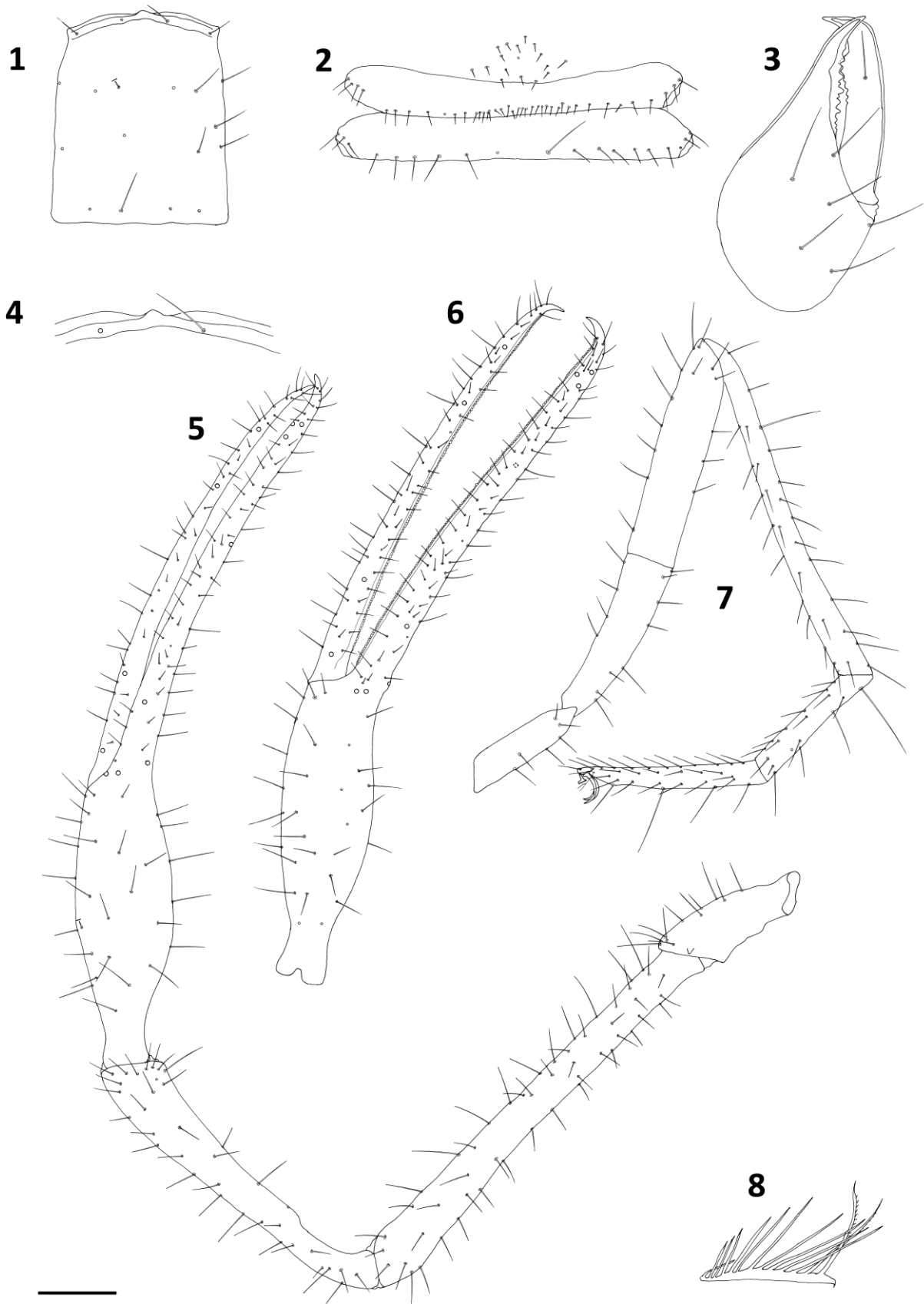
Description. Carapace slightly longer than broad (Table 1; Figs. 1 and 9). Epistome in form of a low hyaline convexity (Fig. 4). No eyes or eye-spots developed. Nineteen setae distributed in four rows on carapax. Carapacial setal formula: 4 + 6 + 5 + 4 = 19. Carapace reticulate.

Chelicera 1.88 times as long as broad (Table 1; Fig. 3). Six setae situated on cheliceral palm, whilst one seta borne on movable cheliceral finger. Tubercle of movable cheliceral finger is a low hyaline convexity. Eleven and seven teeth of uneven size and shape present on fixed and movable cheliceral fingers, respectively. Flagellum of 13 blades. Only the two distal most blades pinnated anteriorly. All other blades smooth, acuminate and decrease in size proximally (Fig. 8).

Tergites I–X smooth, entire and uniseriate. The number of setae on tergites I–X is variable. Tergal setal formula: 3–4–4–5–6–6–7–8–9–8.

Female genital area: sternite II bears a cluster of 17 median setae, sternite III with 33 setae on posterior margin, whilst sternite IV carries 13 setae (Fig. 2). Along each stigma, on sternites III and IV, 3–4 supra-stigmatic setae present. Setal formula of sternites V–X as follows: 15–13–14–17–19–14. Pleural membrane granulostriate.

Male genital area: unknown.



Figures 1–8. *Neobisium radjai* n. sp., holotype female: 1 - carapace; 2 - genital area; 3 - chelicera; 4 - epistome; 5 - pedipalp; 6 - pedipalpal chela; 7 - leg IV; 8 - flagellum. Scales: 0.25 mm (2–4 and 8) and 0.50 mm (1 and 5–7).

Table 1. Linear measurements (in mm) and morphometric ratios in *Neobisium radjai* n. sp., *N. davidbengurioni* and *N. marcchagalli*. F = female.

	<i>N. radjai</i> n. sp.	<i>N. davidbengurioni</i>	<i>N. marcchagalli</i>
Character	F	F	F
Body			
Length (1)	4.26	4.20	4.29
Cephalothorax			
Length (2)	1.54	1.12	1.08
Breadth (2a)	1.375	0.93	0.885
Abdomen			
Length	2.72	3.08	3.21
Chelicerae			
Length (3)	1.09	0.75	0.74
Breadth (4)	0.58	0.37	0.37
Length of movable finger (5)	0.74	0.50	0.52
Ratio 3/5	1.47	1.50	1.42
Ratio 3/4	1.88	2.03	2.00
Pedipalps			
Length with coxa (6)	13.135	9.25	8.855
Ratio 6/1	3.08	2.20	2.06
Length of trochanter	1.19	0.79	0.77
Length of femur (7)	3.48	2.17	2.03
Breadth of femur (8)	0.39	0.28	0.305
Ratio 7/8	8.92	7.75	6.655
Ratio 7/2	2.26	1.94	1.88
Length of patella (tibia) (9)	2.06	1.81	1.66
Breadth of patella (tibia) (10)	0.43	0.34	0.35
Ratio 9/10	4.79	5.32	4.60
Length of chela (11)	5.06	3.535	3.515
Breadth of chela (12)	0.77	0.56	0.65
Ratio 11/12	6.57	6.31	5.41
Length of chelal palm (13)	1.65	1.47	1.51
Ratio 13/12	2.14	2.625	2.48
Length of chelal finger (14)	3.41	2.07	2.00
Ratio 14/13	2.07	1.41	1.32
Leg IV			
Total length	10.17	6.165	6.325
Length of coxa	0.66	0.60	0.585
Length of trochanter (15)	0.96	0.64	0.63
Breadth of trochanter (16)	0.285	0.23	0.23
Ratio 15/16	3.37	2.83	2.74
Length of femur (17)	3.08	1.98	2.00
Breadth of femur (18)	0.37	0.22	0.31
Ratio 17/18	8.32	9.00	6.45
Length of tibia (19)	2.87	1.70	1.59
Breadth of tibia (20)	0.25	0.13	0.17
Ratio 19/20	11.48	13.08	9.35
Length of metatarsus (21)	1.19	0.68	0.62
Breadth of metatarsus (22)	0.18	0.12	0.13
Ratio 21/22	6.61	5.67	4.77
Length of tarsus (23)	1.41	0.92	0.90
Breadth of tarsus (24)	0.16	0.11	0.15
Ratio 23/24	8.81	8.36	6.00
TS ratio - tibia IV	0.25	0.30	0.32
TS ratio - metatarsus	0.08	0.13	0.17
TS ratio - tarsus	0.52	0.455	0.40

Manducatory process of pedipalpal coxa bears four setae. All pedipalpal articles smooth and elongate (Figs. 5 and 9). Fixed and movable pedipalpal chelal fingers carry 178 and 145 teeth, respectively. Teeth on movable chelal finger square-topped and close-set in proximal part of the finger, similar in shape and size to teeth on the fixed chelal finger (Fig. 6). Four trichobothria on movable chelal finger and eight trichobothria on fixed the chelal finger. Pedipalpal femur 8.92 times as long as broad (Table 1), considerably longer than carapace. Pedipalpal patella (tibia) 4.79 times as long as broad (Table 1).

Leg IV: tibia, basitarsus and telotarsus each carry a single tactile seta (Fig. 7). Sub-terminal tarsal setae furcate; each branch has a few tiny spinules.

The linear measurements of different body structures and morphometric ratios are presented in Table 1.



Figure 9. *Neobisium radjai* n. sp., holotype female, habitus. Scale: 5.00 mm.

Differential diagnosis. The new species is compared here with the morphologically closest species, *Neobisium davidbengurioni* Ćurčić & Dimitrijević, 2002 (from two caves on Mt. Durmitor, Montenegro) and *N. marcchagalli* B. Ćurčić & S. Ćurčić, 2002 (from the Velja Peć Cave, near Nikšić, Montenegro).

N. radjai n. sp. can be easily distinguished from *N. davidbengurioni* in several important aspects: the pedipalpal femur length/breadth ratio (8.92 vs. 7.75), pedipalpal femur length (3.48 mm vs. 2.17 mm), pedipalpal tibia length (2.06 mm vs. 1.81 mm), pedipalpal tibia length/breadth ratio (4.79 vs. 5.32), pedipalpal chela length (5.06 mm vs. 3.535 mm), pedipalpal chelal finger/pedipalpal chelal palm length ratio (2.07 vs. 1.41), number of carapacial setae (19 vs. 22), setal formula of tergites I-X (3-4-4-5-6-6-7-8-9-8 vs. 7-6-6-6-7-7-7-7-7-7), numbers of teeth on fixed and movable pedipalpal chelal fingers (178 and 145, respectively vs. 123 and 117, respectively) and setal formula of sternites II-IV (17-33-13 vs. 13-23-9) (Ćurčić *et al.* 2002).

From *N. marcchagalli* the newly erected species *N. radjai* differs also in several respects that enhance the distinction between these two cave-dwelling species: in the form of epistome (wide vs. triangular), number of carapacial setae (19 vs. 21), setal formula of tergites I-X (3-4-4-5-6-6-7-8-9-8 vs. 4-6-6-6-8-8-8-9-9-9), number of setae on sternites II (17 vs. 14) and III (33 vs. 30), setal formula of sternites V-X (15-13-14-17-19-14 vs. 11-11-11-8-8-10) and number of teeth on both fixed and movable pedipalpal chelal fingers (178 and 145, respectively vs. 107 and 103, respectively) (Ćurčić *et al.* 2002).

Discussion

According to the current knowledge, *N. radjai* n. sp. is a cave-dweller, an endemic and a relict form populating only its type locality – the Golubanjka Pećina Cave near Livno, western Bosnia and Herzegovina. Like its closest congeners *N. davidbengurioni* and *N. marcchagalli*, *N. radjai* n. sp. is probably a Tertiary form and a descendant of a humicolous and detriticolous pseudoscorpion fauna which inhabited the Balkan Peninsula in the remote past (Ćurčić 1988; Ćurčić *et al.* 2002).

One more feature is worth mentioning and at the same time intriguing. The number of flagellar blades (13) in the holotype female of *N. radjai* n. sp. is higher than the number of cheliceral blades recorded in all other known cavernicolous *Neobisium* spp. which inhabit the Dinaric Karst. Subsequent analysis of male specimens of this species, when obtained, will show whether the recorded number of flagellar blades is a characteristic of the species or is the result of a teratological variation (phenomenon rarely encountered in cave-dwelling pseudoscorpions) (Muchmore 1967; Ćurčić 1988; Dimitrijević 1997).

Erecting a species new to science based on description of a single available specimen is not uncommon (Heurtault 1975; Mahnert 1985; Henderickx & Vets 2000; Muchmore 2000). We can only hope that future investigations in the Golubanjka Pećina Cave will result in obtaining male and subadult specimens of the new species. Such findings will enable to create an additional description of the species and will give better insight into the intraspecific variability.

Conclusions

Of all republics (now separate countries) of the former Socialistic Federative Republic of Yugoslavia, Bosnia and Herzegovina holds third place in the number of recorded pseudoscorpion species. A fairly low number of known pseudoscorpion taxa in Bosnia and Herzegovina (58 species) can be attributed to the facts that there are no native pseudoscorpionologists in the country and no continuous investigations of both epigean and cavernicolous pseudoscorpion fauna are being carried out in Bosnia and Herzegovina.

Bosnia and Herzegovina is rich in caves, pits, ponors and other types of underground habitats, and future investigations will result in increasing the number of the known pseudoscorpion species and will give better insight into diversity of this group of arachnids in this part of the Balkan Peninsula, which has not been in the focus of arachnologists for many years.

Acknowledgements

The authors would like to express their gratitude to Branko Semrem and Ivica Semrem, members of the Špiljar Speleological Society (Split, Croatia), who took part in the investigations performed in the Golubanjka Pećina Cave and helped us in collecting the pseudoscorpion material.

References

- Beier, M. (1938) Vorläufige Mitteilung über neue Höhlenpseudoscorpione der Balkanhalbinsel. *Studien aus dem Gebiete der Allgemeinen Karstforschung, der Wissenschaftlichen Höhlenkunde, der Eiszeitforschung und den Nachbargebieten*, 3 (8), 5–8.
- Beier, M. (1939) Die Höhlenpseudoscorpione der Balkanhalbinsel. *Studien aus dem Gebiete der Allgemeinen Karstforschung, der Wissenschaftlichen Höhlenkunde, der Eiszeitforschung und den Nachbargebieten*, 4 (10), 1–83.
- Ćurčić, B. P. M. (1972) *Pselaphochernes hadzii* n. sp., nouveau pseudoscorpion des montagnes du sud-est de la Bosnie. *Dissertationes, Academia Scientiarum et Artium Slovenica, Classis IV: Historia Naturalis et Medicina, Ljubljana*, 15, 77–94.
- Ćurčić, B. P. M. (1974) *Catalogus Faunae Jugoslaviae. III/4. Arachnoidea, Pseudoscorpiones*. Academia Scientiarum et Artium Slovenica, Ljubljana, 36 pp.
- Ćurčić, B. P. M. (1988) *Cave-Dwelling Pseudoscorpions of the Dinaric Karst*. Academia Scientiarum et Artium Slovenica, Classis IV: Historia Naturalis et Medicina, Opera 26, Institutum Biologicum Ioannis Hadži, Ljubljana, 191 pp.

- Ćurčić, B. P. M., Ćurčić, S. B., Ćurčić, N. B., Radja, T. & Dimitrijević, R. N. (2011a) On two new pseudoscorpions from Herzegovina. *Archives of Biological Sciences, Belgrade*, 63 (3), 855–865.
- Ćurčić, B. P. M. & Dimitrijević, R. N. (2007) *Roncus travuniensis* sp. n. (Neobisiidae, Pseudoscorpiones), a troglobitic false scorpion from Bosnia-Herzegovina. *Biologia, Bratislava*, 62, 84–87.
- Ćurčić, B. P. M., Dimitrijević, R. N. & Ćurčić, N. B. (2011b) A new cave pseudoscorpion (Pseudoscorpiones, Chthoniidae): *Chthonius (Chthonius) lupinus* n. sp. from Bosnia-Herzegovina. *Archives of Biological Sciences, Belgrade*, 63 (2), 493–497.
- Ćurčić, B. P. M., Dimitrijević, R. N., Ćurčić, S. B., Tomić, V. T. & Ćurčić, N. B. (2002) On some new high altitude, cave, and endemic pseudoscorpions (Pseudoscorpiones, Arachnida) from Croatia and Montenegro. *Acta entomologica serbica*, 7 (1–2), 83–110.
- Ćurčić, B. P. M., Ilić, B. S., Makarov, S. E. & Tomić, V. T. (2011c) On two new cave-dwelling and relict pseudoscorpions of the genus *Chthonius* C. L. Koch (Chthoniidae, Pseudoscorpiones) from Bosnia. *Archives of Biological Sciences, Belgrade*, 63 (3), 847–854.
- Ćurčić, B. P. M., Radja, T., Ćurčić, S. B., Ćurčić, N. B. & Makarov, S. E. (2014a) On two new cave species of pseudoscorpions (Neobisiidae, Pseudoscorpiones) from Herzegovina and Dalmatia. *Archives of Biological Sciences, Belgrade*, 66 (1), 377–384.
- Ćurčić, B. P. M., Radja, T., Dimitrijević, R. N., Ćurčić, S. B., Ćurčić, N. B. & Ilić, B. S. (2014b) *Chthonius (Globochthonius) daorsoni* n. sp. (Chthoniidae, Pseudoscorpiones): a new cave false scorpion from Bosnia and Herzegovina. *Archives of Biological Sciences, Belgrade*, 66 (2), 899–904.
- Ćurčić, B. P. M., Radja, T., Dimitrijević, R. N., Ćurčić, S. B., Makarov, S. E., Antić, D. Ž. & Ilić, B. S. (2014c) A new pseudoscorpion from Bosnia: *Roncus bosniensis* n. sp. (Neobisiidae, Pseudoscorpiones). *Archives of Biological Sciences, Belgrade*, 66 (1), 363–368.
- Dimitrijević, R. N. (1997) Structural anomalies in cave pseudoscorpions of the Balkan Peninsula. *Recueil des rapports du Comité pour le karst et la spéléologie. Ed. Spéc. Académie serbe des sciences et des arts, DCXXXVII, Classe des sciences naturelles et mathématiques*, 70, 107–114.
- Hadži, J. (1932) Prilog poznavanju pećinske faune Vjetrenice. *Glasnik Srpske kraljevske akademije*, 151, 101–157.
- Harvey, M. S. (1990) *Catalogue of the Pseudoscorpionida*. Manchester University Press, Manchester, 726 pp.
- Harvey, M. S. (2013) Pseudoscorpions of the World. Version 3.0. Western Australian Museum, Perth. <<http://museum.wa.gov.au/catalogues-beta/pseudoscorpions/>>, accessed at: 2017.8.25.
- Henderickx, H. & Vets, V. (2000) *Neobisum (Ommatoblothrus) epirensis* sp. n., a new troglobitic pseudoscorpion from Epirus (Arachnida: Pseudoscorpiones: Neobisiidae). *Phegea*, 28 (3), 83–86.
- Heurtault, J. (1975) Deux nouvelles espèces des pseudoscorpions Chthoniidae (Arachnides) cavernicoles de Corse: *Chthonius (E.) remyi* et *Chthonius (E.) siscoensis*. *Annales des Spéléologie*, 30 (2), 313–318.
- Mahnert, V. (1982) Neue höhlenbewohnende Pseudoskorpione aus Spanien, Malta und Griechenland (Arachnida, Pseudoscorpiones). *Mitteilungen der Schweizerischen Entomologischen Gesellschaft*, 55, 297–304.
- Muchmore, W. B. (1967) New cave pseudoscorpions of the genus *Apochthonius* (Arachnida: Chelonethida). *Ohio Journal of Science*, 67 (2), 89–95.
- Muchmore, W. B. (2000) New species and records of *Kleptochthonius* from Indiana (Pseudoscorpionida, Chthoniidae). *The Journal of Arachnology*, 28, 293–299.