

**NEOBISIUM DELTSHEVI (NEOBISIIDAE, PSEUDOSCORPIONES), A NEW ENDEMIC
CAVE-DWELLING PSEUDOSCORPION FROM EAST SERBIA**

B. P. M. ĆURČIĆ, R. N. DIMITRIJEVIĆ and NINA B. ĆURČIĆ

Institute of Zoology, Faculty of Biology, University of Belgrade, 11000 Belgrade, Serbia

Abstract – A new endemic cave-dwelling pseudoscorpion species from the Seselačka Pećina Cave, village Seselac, nr. Soko Banja, East Serbia is presented, described and illustrated. Its main morphometric characteristics and important diagnostic features are analyzed and compared to those of its closest congener *Neobisium carpaticum* (Beier, 1930) from Serbia.

Keywords: Pseudoscorpions, Neobisiidae, endemism, cave-dwelling, *Neobisium deltshevi*, Serbia

UDC 595.47:591.5(497.11)

INTRODUCTION

The family Neobisiidae (Chamberlin 1930) is represented with 43 epigeal and cavernicolous species and subspecies in Serbia (Beier 1928, 1932, 1939; Ćurčić 1972, 1980; Ćurčić & Beron 1981; Ćurčić & Dimitrijević 2003; Ćurčić et al. 2004; Ćurčić & Tomić 2006; Dimitrijević 2000; Hadži 1937). These species pertain to three genera: *Acanthocreagris* (Mahnert 1976), *Neobisium* (Chamberlin 1930) and *Roncus* (L. Koch 1873). Nineteen species and subspecies belong to the genus *Neobisium*.

At present 8 cave-dwelling species are known to inhabit different underground habitats in Serbia. Based on the knowledge of the biodiversity of the genus *Roncus* as well as some other invertebrate groups (spiders and coleoptera) (Ćurčić, Deltshev & Gueorgiev 2005; Ćurčić 2007) we are of the opinion that the number of cavernicolous *Neobisium* species by far exceeds the present known number of taxa pertaining to this genus. Further investigations will most likely confirm this opinion.

A recent visit to the Seselačka pećina Cave, near the village Seselac nr. Soko Banja, East Serbia resulted in the collection of a small sample of pseudoscorpions. Careful examination of the collected pseudoscorpion material revealed the presence of a new taxon

Neobisium deltshevi. The new species represents an endemic form that inhabits a cave in East Serbia. Thus, the number of known cave-dwelling pseudoscorpion species in Serbia has risen to nine.

Specimens examined: – Holotype male and female and paratype male and female from the Seselačka pećina Cave, village of Seselac, nr. Soko Banja, East Serbia collected on 26 September 2009 by Srećko Ćurčić and Romana Bosanac. The holotype specimens are deposited in the collection of the Institute of Zoology (IZB), Faculty of Biology, University of Belgrade, Belgrade, Serbia.

Etymology: – The new species is named after Dr. Christo Deltshev, a world-wide known arachnologist and speleobiologist.

SYSTEMATIC PART

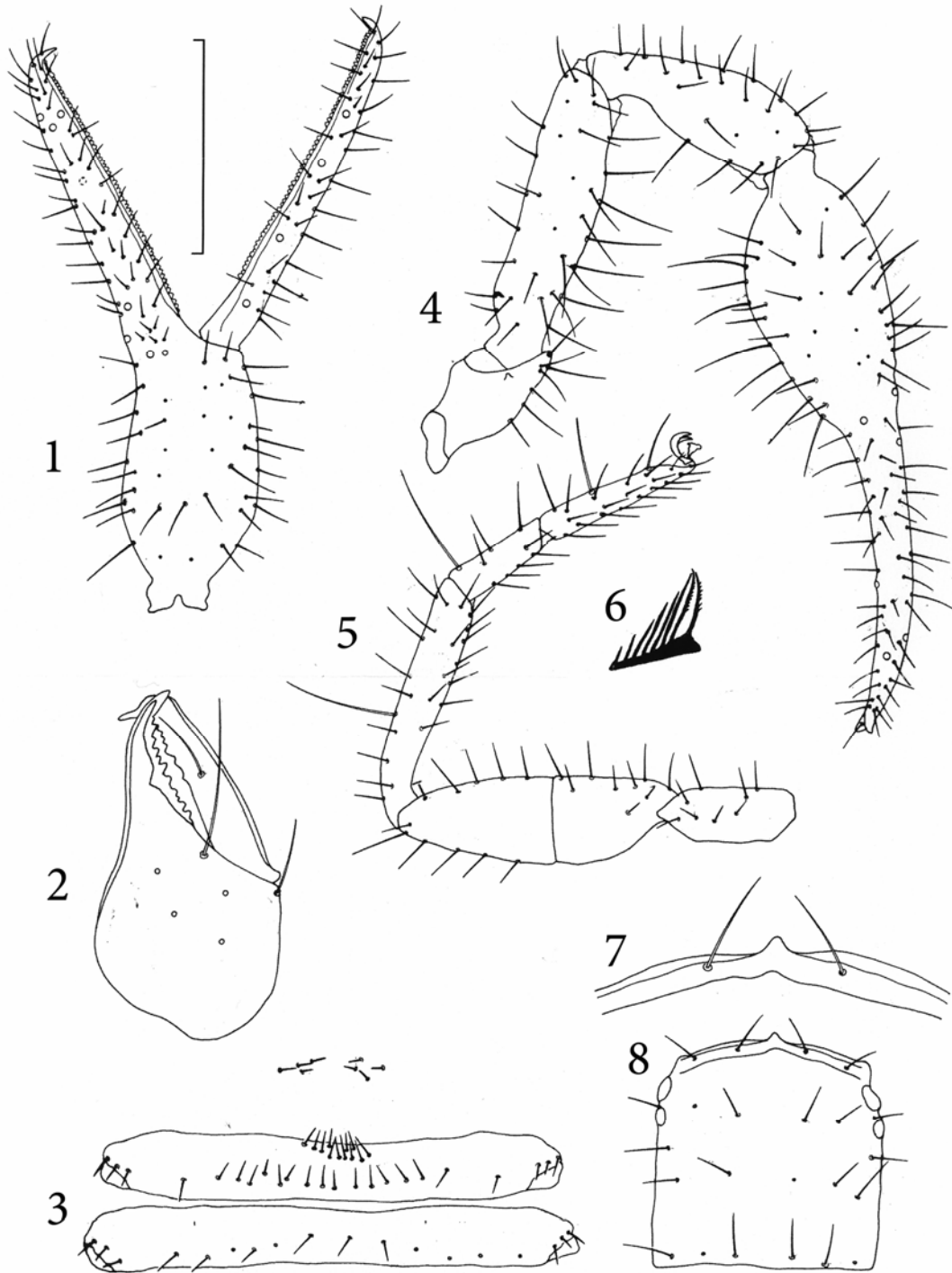
NEOBISIIDAE J.C. CHAMBERLIN, 1930

NEOBISIUM Chamberlin, 1930

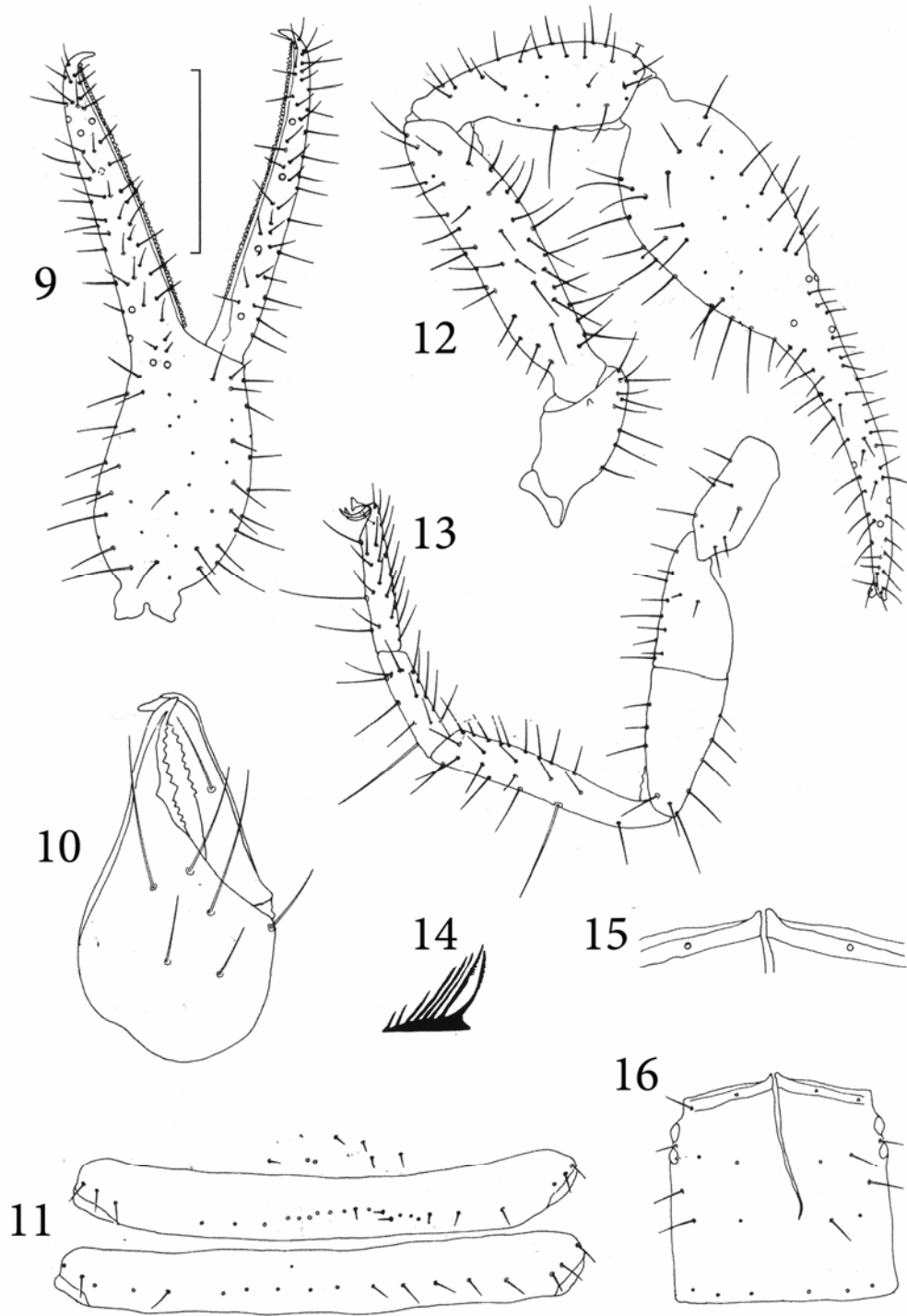
NEOBISIUM DELTSHEVI NEW SPECIES

(Figs. 1-16; Tables 1 and 2)

Description – Male. Carapace slightly longer than broad (Fig. 8, Tab. 1). Epistome small and rounded



Figures 1-8. *Neobisium deltshevi* n. sp. Holotype male: 1 - pedipalpal chela, 2 - chelicera, 3 - male genital area, 4 - pedipalp, 5 - leg IV, 6 - flagellum, 7 - epistome, 8 - carapace. Scales = 0.25 mm (Figs. 2, 3, 6 and 7) and 0.50 mm (Figs. 1, 4, 5 and 8).



Figures 9-16. *Neobisium deltshevi* n. sp. Allotype female: 9 - pedipalpal chela, 10 - chelicera, 11 - female genital area, 12 - pedipalp, 13 - leg IV, 14 - flagellum, 15 - epistome, 16 - carapace. Scales = 0.25 mm (Figs. 10, 11, 14 and 15) and 0.50 mm (Figs. 9, 12, 13 and 16).

Table 1. Linear measurements (in millimeters) and morphometric ratios of holotype male and female of *Neobisium deltshevi* n. sp. from the Seselačka pećina Cave, village Seselac, Soko Banja, East Serbia and *N. carpaticum* Beier from Mt. Avala, Belgrade, Serbia. Abbreviations: F = female, M = male.

Character	<i>N. carpaticum</i> M Mt. Avala, Belgrade	<i>N. deltshevi</i> M Seselačka Pećina Cave	<i>N. carpaticum</i> F Mt. Avala, Belgrade	<i>N. deltshevi</i> F Seselačka Pećina Cave
Body				
length (1)	2.03-2.72	2.31-2.37	2.68-3.59	2.555-3.01
Carapace				
length (2)	0.67-0.76	0.52-0.56	0.80-0.90	0.62-0.63
breadth	0.60-0.78	0.49-0.51	0.72-0.90	0.55-0.57
Abdomen				
length	1.36-2.03	1.79-1.81	1.77-2.73	1.925-2.39
Chelicerae				
length (3)	0.49-0.55	0.40-0.44	0.58-0.675	0.46-0.47
breadth (3a)	0.25-0.29	0.21-0.22	0.30-0.395	0.24-0.25
length of movable finger (4)	0.26-0.37	0.25-0.26	0.385-0.45	0.295
ratio 3/4	1.49-2.00	1.60-1.76	1.59-1.985	1.56-1.59
ratio 3/3a	1.85-2.04	1.90-2.00	1.49-1.58	1.84-1.96
Pedipalps				
length with coxa (5)	4.18-4.72	3.535-3.735	4.52-5.275	4.08-4.13
ratio 5/1	1.61-2.06	1.53-1.757	1.47-1.81	1.355-1.62
length of coxa	0.55-0.68	0.52-0.55	0.66-0.72	0.54-0.56
length of trochanter	0.43-0.525	0.39-0.41	0.51-0.60	0.45-0.46
length of femur (6)	0.88-1.00	0.73-0.75	0.93-1.15	0.87
breadth of femur (7)	0.21-0.245	0.17-0.18	0.24-0.28	0.20
ratio 6/7	3.74-4.36	4.17-4.29	3.875-4.075	4.35
ratio 6/2	1.31-1.36	1.34-1.40	1.02-1.35	1.03-1.38
length of tibia (8)	0.64-0.72	0.53-0.54	0.68-0.80	0.64-0.65
breadth of tibia (9)	0.25-0.29	0.20-0.21	0.29-0.33	0.23-0.25
ratio 8/9	2.46-2.64	2.52-2.70	2.35-2.63	2.56-2.83
length of chela (10)	1.60-1.87	1.355-1.495	1.74-2.09	1.58-1.59
breadth of chela (11)	0.405-0.48	0.315-0.33	0.46-0.57	0.39-0.41
ratio (10/11)	3.54-4.05	4.30-4.53	3.175-3.78	3.85-4.08
length of manus (12)	0.65-0.87	0.54-0.68	0.72-0.89	0.66-0.67
ratio 12/11	1.48-1.72	1.71-2.06	1.47-1.565	1.63-1.69
length of finger (13)	0.93-1.04	0.815	0.97-1.20	0.91-0.93
ratio 13/12	1.25-1.46	1.20-1.51	1.15-1.42	1.36-1.41
Leg IV				
total length	2.905-3.32	2.515-2.575	3.12-3.715	2.905-2.95
length of coxa	0.37-0.44	0.34	0.42-0.50	0.39-0.43
length of trochanter (14)	0.35-0.41	0.305	0.39-0.47	0.36-0.37
breadth of trochanter (15)	0.165-0.18	0.13-0.14	0.18-0.31	0.15
ratio 14/15	2.055-2.38	2.18-2.35	2.00-2.35	2.40-2.47
length of femur (16)	0.79-0.95	0.68-0.70	0.83-1.00	0.77-0.805
breadth of femur (17)	0.26-0.31	0.20	0.27-0.33	0.20-0.24
ratio 16/17	2.87-3.35	2.85-3.50	2.86-3.45	3.215-3.25
length of tibia (18)	0.65-0.78	0.54-0.59	0.69-0.82	0.62-0.65
breadth of tibia (19)	0.12-0.15	0.10	0.13-0.16	0.11
ratio 18/19	4.63-6.00	5.40-5.90	5.125-5.86	3.81-5.91
length of basitarsus (20)	0.29-0.34	0.25	0.33-0.38	0.305
breadth of basitarsus (21)	0.10-0.11	0.07	0.11-0.13	0.08
ratio 20/21	2.86-3.84	3.57	2.92-3.125	3.81
length of telotarsus (22)	0.43-0.48	0.38-0.40	0.46-0.545	0.42-0.43
breadth of telotarsus (23)	0.075-0.09	0.06	0.08-0.10	0.07
ratio 22/23	4.78-6.40	6.33-6.67	5.00-5.875	6.00-6.14
TS ratios:				
tibia IV	0.37-0.48	0.41-0.45	0.41-0.49	0.38-0.42
basitarsus IV	0.11-0.16	0.175-0.20	0.125-0.18	0.10-0.13
telotarsus IV	0.32-0.41	0.35-0.36	0.35-0.43	0.34-0.36

Diagnostic characters of *N. deltshevi* n. sp. are bolded.

Table 2. Setation of various body structures in *Neobisium carpaticum* Beier from Mt. Avala, Belgrade and *Neobisium deltshevi* from the Seselačka pećina Cave, East Serbia.

Character	<i>Neobisium carpaticum</i> male	<i>Neobisium deltshevi</i> male	<i>Neobisium carpaticum</i> female	<i>Neobisium deltshevi</i> female
CARAPACE				
anterior row	4	4	4	4
ocular row	6	6	6	6
median-intermedian row	4-6	6	5-6	6
posterior row	6-7	6	6-7	5-6
total carapacial setae	20-23	22	21-23	21-22
microsetae (anterior to each eye)	1-2	0	1-2	0
CHELICERAE				
movable finger setae	1	1	1	1
fixed finger setae	6	6	6-7	6
movable finger teeth		7-9		9
fixed finger teeth		11-14		11
flagellum	7-9	8	7-9	8
PEDIPALPS				
trichobothria - movable finger	4	4	4	4
trichobothria - fixed finger	8	8	8	8
number of teeth fixed finger	53-62	60-68	53-62	68-73
number of teeth movable finger	67-72	64-73	63-76	76-77
pedipalpal coxa	5	5	5	5
TERGITES				
I	6	6	6-7	6-7
II	6-7	7-9	6-8	6-7
III	9	9-10	9-10	9-11
IV	9-10	10	9-10	10-11
V	9-10	10-12	9-10	10-11
VI	9-10	9-10	9-10	10-11
VII	9-10	10-11	9-10	11
VIII	9-10	10-11	9-10	9-10
IX	9-10	10-11	9-10	9-10
X	9-10	9-10	9-10	9
STERNITES				
II	13-16	8	7-12	7
III	30-38	29	18-24	19-22
IV	13-18	11-12	14-16	12
V	12-14	14-15	11-15	14
VI	11-14	13	12-14	13-15
VII	12-14	12-15	12-15	14
VIII	12-14	13-14	12-14	15-16
IX	13-15	13	12-13	13-14
X	10-11	13-14	10-11	13-14

Diagnostic characters of *N. deltshevi* n. sp. are bolded.

(Fig. 7); 22 setae present on the carapace. Anterior row bears 4 setae while the ocular, intermedian and posterior row carry 6 setae each (Fig. 8). Two pairs of eyes developed, of these the anterior pair is distinctly larger than the posterior pair (Fig. 8).

Cheliceral galea low (Fig. 2), 6 and 1 seta are carried on the fixed and movable cheliceral fingers respectively (Fig. 2). The fixed finger bears 11 teeth and the movable finger 7. Flagellum 8-bladed, only two distal blades are pinnate along the anterior side. All other blades are smooth and acuminate. The proximalmost blade is the smallest (Fig. 6). Chelicera is 1.90 times longer than broad.

Manducatory process (apex) of the pedipalpal coxa with 5 long and acute setae. Pedipalpal articles smooth (Fig. 4). Fixed chelal finger with 64 teeth with rounded tops. Movable chelal finger carries 60 close-set teeth. Eight and 4 trichobothria are carried on the fixed and movable chelal fingers respectively. (Fig. 1).

Trichobothriotaxy: Eight and four trichobothria are present on the fixed and movable pedipalpal fingers respectively. Trichobothria **EB**, **ESB**, **B** and **ISB** on the finger base. Trichobothrium **EST** equidistant from **IT** and **ET**. Trichobothrium **ST** closer to **T** than to **SB**; **SB** closer to **B** than to **ST**.

Chelal finger longer than the chelal palm (Tab. 1). The pedipalpal chelal length to breadth ratio is 4.30. Pedipalpal femur is 4.29 times longer than wide. The pedipalpal tibia is 2.70 times longer than broad.

Abdominal tergites uniseriate and smooth. Setation of tergites I-X as follows: 6-7(9)-9(10)-9(10)-10(12)-9(10)-10(11)-10(11)-10(11)-9(10). Sternite II with 8 setae arranged in two separate groups of 4 setae. Sternite III carries 29 setae. A group of 12 setae is situated in the median part of this sternite, and a row of 17 setae is present along the posterior sternite margin. On both sternites, III and IV, 3 suprastigmatic setae are developed along

each side of the stigma (Fig. 3). Setation of sternites IV-X: 11(12)-14(15)-13-12(15)-13(14)-13-13(14).

Tibia IV, basitarsus IV and telotarsus IV carry a single long tactile seta each (Fig. 5). Subterminal seta furcate, each branch with a few tiny pinnules.

Morphometric ratios and linear measurements (in mm) are presented in Table 1.

Description - Female. Carapace slightly longer than wide (Fig. 16) with a small epistome with a rounded top. As in the male, the carapace carries almost the same number and disposition of setae in setal rows (21-22). In the paratype female 5 setae are present in the posterior row. Two pairs of eyes of uneven size present. The anterior pair of eyes larger than the posterior pair (Fig. 16).

Cheliceral galea low (Fig. 10). As in the male, the same number of seta (6 and 1) developed on the fixed and movable cheliceral finger. 11 and 9 teeth present on the movable and fixed cheliceral finger. Flagellum 8-bladed. Chelicera is 1.54 (1.96) times longer than broad.

Manducatory process of the pedipalpal coxa with 5 seta. Pedipalpal articles smooth (Fig. 12). Fixed and movable chelal finger bear somewhat larger number of teeth than in the male (76 and 68 respectively). Eight and four trichobothria present on the fixed and movable chelal finger.

Trichobothriotaxy: Trichobothria **EB**, **ESB**, **IB** and **ISB** positioned on the finger base. Trichobothrium **EST** slightly closer to **ET** than to **IT**. Trichobothrium **IST** closer to **EST** than to **ISB**.

Chelal finger 1.36 times longer than chelal palm (Tab. 1). The pedipalpal chelal length to breadth ratio is 3.85. Pedipalpal femur is 4.35 times longer than broad. The pedipalpal tibia length to breadth ratio is 2.56.

Abdominal tergites uniseriate and smooth. Setation of tergites I-X as follows: 6(7)-6(7)-9(11)-10(11)-10(11)-10(11)-11-9(10)-9(10)-9. Sternite II with 7 medially situated setae. Sternite III bears a

row of 19 (22) setae. Setation of sternites IV-X: 12-14-13(15)-14-15(16)-13(14)-13(14). Three supra-stigmatic setae developed along each side of the stigma on sternites III and IV (Fig. 11).

Tibia IV, basitarsus IV and telotarsus IV carry a single long tactile seta each (Fig. 13). Subterminal seta furcate, each branch with a few tiny spinules.

Differential diagnosis – Males and females of *Neobisium* n. sp. can be distinguished from their corresponding counterparts of phenetically close congener *Neobisium carpaticum* Beier in several aspects. These differences comprise the smaller dimensions (size) of various body parts in both sexes such as: carapace (shorter vs. longer); chelicerae (shorter vs. longer); pedipalps (including all pedipalpal articles) (shorter vs. longer) and leg IV (shorter vs. longer). In *N. deltshevi* there are no preocular microsetae as in *N. carpaticum*. Furthermore, more important differences between these two species are displayed in the different morphometric ratios of body structures.

These differences are more obvious in the female specimen than in the male.

The females of these two species differ from each other in cheliceral length to breadth ratio (1.49-1.58 in *N. carpaticum* vs. 1.84-1.96 in *N. deltshevi*); pedipalpal femur length to breadth ratio (3.875-4.05 in *N. carpaticum* vs. 4.35 in *N. deltshevi*); pedipalpal chelal palm length to breadth ratio (3.175-3.78 in *N. carpaticum* vs. 3.85-4.08 in *N. deltshevi*); pedipalpal chelal palm length to breadth ratio (1.47-1.565 in *N. carpaticum* vs. 1.63-1.69 in *N. deltshevi*); leg IV: trochanter length to breadth ratio (2.00-2.35 in *N. carpaticum* vs. 2.40-2.47 in *N. deltshevi*); tibia IV length to breadth ratio (5.125-5.86 in *N. carpaticum* vs. 3.81-5.91 in *N. deltshevi*); basitarsus IV length to breadth ratio (2.92-3.125 in *N. carpaticum* vs. 3.81 in *N. deltshevi*); telotarsus IV length to breadth ratio (5.00-5.875 in *N. carpaticum* vs. 6.00-6.14 in *N. deltshevi*).

In the male, differences in the ratios of body parts are less pronounced than in the female. These differences can be clearly demonstrated in the smaller values for pedipalpal chelal length to breadth ratio (3.54-4.05 in *N. carpaticum* vs. 4.30-4.53 in *N. deltshevi*); pedipalpal chelal palm length to breadth ratio (3.53-4.05 in *N. carpaticum* vs. 4.30-4.53 in *N. deltshevi*); and leg IV TS ratio of basitarsus (0.11-0.16 in *N. carpaticum* vs. 1.175-0.20 in *N. deltshevi*).

The tergal setation (I-X) in both sexes of the compared species has similar or identical values (Tab. 2). Sternal counts in the male specimen display slight differences on the sternite II and III. In *N. carpaticum* sternite II bears 13-16 setae vs. 8 setae in *N. deltshevi*, whilst sternite III in *N. carpaticum* carries 30-38 setae vs. 29 setae in *N. deltshevi*.

Taking into account the above-mentioned differences of various body structures as well as the morphometric ratios for several body parts, we are of the opinion that *N. deltshevi* represents a species closely related to *N. carpaticum*. Moreover, it seems likely that the newly established species originated from *N. carpaticum*. It represents a descendant of a population of *N. carpaticum* that has populated the Seselačka pećina Cave and is still going through the process of adaptation to cave conditions (reduction of the posterior pair of eyes).

Distribution – According to present knowledge, the newly established species inhabits only the Seselačka pećina Cave in East Serbia. It is regarded as an endemic neobisiid species from eastern Serbia (one that is still undergoing the process of adaptation to cave conditions).

Acknowledgement – This study is financially supported by the Serbian Ministry of Science and Technological Development (Grant #143053).

REFERENCES

- Beier, M. (1928). Die Pseudoskorpione aus Wiener Naturhistorischen Museums I. Hemictenodactyli. *Annalen des Naturhistorischen Museum in Wien*, **42**, 285-314.

- Beier, M. (1932). Pseudoscorpionidea. I. Subordn. Chthoniinea et Neobisiinea. Das Tierreich, **57**, 1-258.
- Beier, M. (1939). Die Höhlenpseudoscorpione der Balkanhalbinseln. Studien aus dem Gebiete der allgemeinen Karstforschung der wissenschaftlichen Höhlenkunde der Eiszeitforschung und den Nachbargebieten, Brünn, **4**, 1-83.
- Ćurčić, B. P. M. (1972). *Neobisium (Blothrus) stankovici*, nouvelle espèce de pseudoscorpions cavernicoles de la Serbie orientale. *Fragmenta Balcanica*, Skopje, **9**, 84-96.
- Ćurčić, B. P. M. (1980). A new species of cave-dwelling pseudoscorpions from Serbia (Arachnida: Pseudoscorpiones: Neobisiidae). *Senckenbergiana biologica*, Frankfurt a/M, **60**, 249-254.
- Ćurčić, B. P. M., and P. Beron (1981). New and little-known cavernicole pseudoscorpions in Bulgaria (Neobisiidae, Pseudoscorpiones, Arachnida). *Glasnik Srpske akademije nauka, Beograd*, **329**, Cl. Sci.Nat.-Math., **48**, 63-85.
- Ćurčić, B. P. M., R. N. Dimitrijević, and A. Legakis (2004). The pseudoscorpions of Serbia, Montenegro, and the Republic of Macedonia. Monographs, Vol. VIII, Institute of Zoology, Faculty of Biology, University of Belgrade, Hellenic Zoological Society, Committee for Karst and Speleology, Serbian Academy of Sciences and Arts, and Institute of Nature Conservation of the Republic of Serbia, Belgrade-Athens, 400 pp.
- Ćurčić, B. P. M., and V.T. Tomić (2006). *Neobisium rajkodimitrijevići* n. sp. (Neobisiidae, Pseudoscorpiones) a new false scorpion from a cave in eastern Serbia. *Archives of Biological Sciences Belgrade*, **58**(2), 121-124.
- Ćurčić, B. P. M., R. N. Dimitrijević, and S. B. Ćurčić (2003). *Neobisium stitkovense* n. sp., (Neobisiidae, Pseudoscorpiones) an endemic cave species from southeastern Serbia. *Periodicum biologorum*, Zagreb, **105**(4), 479-487.
- Ćurčić, S. B., M. M. Brajković, and B. P. M. Ćurčić (2007). The Carabids of Serbia. Belgrade, 1-1083.
- Dimitrijević, R. N. (2000). A check list of cave-dwelling pseudoscorpions (Pseudoscorpiones, Arachnida) from Yugoslavia (Serbia and Montenegro). *Mémoires de biologie*, **27**, 37-40.
- Hadži, J. (1937). Pseudoskorpioniden aus Südserbien. *Glasnik Skopskog Naučnog društva*, Skopje, **18**, 13-28.

**NEOBISIUM DELTSHEVI (NEOBISIIDAE, PSEUDOSCORPIONES),
НОВА ЕНДЕМИЧНА ВРСТА ПЕЋИНСКИХ ПСЕУДОСКОРПИЈА ИЗ ИСТОЧНЕ СРБИЈЕ**

Б. П. М. ЋУРЧИЋ, Р. Н. ДИМИТРИЈЕВИЋ И НИНА Б. ЋУРЧИЋ

Институт за зоологију, Биолошки факултет, Универзитет у Београду, 11000 Београд, Србија

У раду је описана, илустрована и дијагностификована нова пећинска врста *Neobisium deltshevi* која насељава Сеселачку пећину у близини Соко Бање у источној Србији. Извршена је

анализа појединих морфолошких својстава и дијагностичке одлике су поређене са онима код најсродније врсте *Neobisium carpaticum* Beier из Србије.