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NEOBISIUM NINAE N. SP. (NEOBISIIDAE, PSEUDOSCORPIONES), A NEW ENDEMIC CAVE PSEUDOSCORPION FROM MONTENEGRO

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Abstract — A new cave-dwelling species of pseudoscorpion belonging to the family Neobisiidae – *Neobisium ninae* n. sp. – is described from the Pećina u Dubokom Potoku Cave in the village of Donje Biševo, near Rožaje in Eastern Montenegro. A diagnosis of the new species is presented. This taxon is a relict and endemic to the area studied. Additionally, some taxonomic and biogeographical traits of the new species are discussed in the light of the evolution of the karst relief of the Balkan Peninsula.

Key words: Pseudoscorpions, *Neobisium*, endemism, phylogeny, Montenegro

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INTRODUCTION

Although they are the second largest group of arachnids (after spiders), pseudoscorpions are the object of much less extensive arachnological research. Terrestrial cave-dwellers are usually descendants of a tropical epigean fauna that lived in Europe and North America at the beginning of the Tertiary period (Ćurčić, 1988). The tropical fauna subsequently disappeared from these regions. The species changed, were destroyed, or emigrated towards the modern tropics. Only in caves have some species survived. Simultaneous karstification provided a wide variety of niches underground, resulting in a huge refuge for originally epigean species (Ćurčić et al., 2004).

Underground pseudoscorpions are characteristic of regions with a Mediterranean climate. These species have maintained their habitat deep underground by colonizing caves, fissures of the soil, or the soil itself. The adaptive strategy in each case is different, as illustrated by the small size and flattened body of the inhabitants of fissures, or by the elongated appendages and development of numerous sensitive setae in cave species (Ćurčić, 1988).

We examined a sample of pseudoscorpions collected in 2004. The three specimens studied from the Pećina u Dubokom Potoku Cave in the village of Donje Biševo, near Rožaje in Eastern Montenegro belong to a new endemic and troglobitic species, *Neobisium ninae* n. sp., and are described below.

The type specimens of this new taxon are deposited in the collection of the Institute of Zoology, Faculty of Biology, University of Belgrade, 11000 Belgrade, Serbia (IZB 171-173).

MATERIAL AND METHODS

Material from a sample of pseudoscorpions collected in Montenegro is examined in the present study. The specimens from the Pećina u Dubokom Potoku Cave near Rožaje in Eastern Montenegro, contain a new taxon: *Neobisium ninae* n. sp. All studied pseudoscorpions were mounted on slides in Swan's fluid (gum chloral medium) and deposited in the collection of the Institute of Zoology, 11000 Belgrade, Serbia (IZB 201-203).

The trichobothrial designations follow Beier (1963).

SYSTEMATIC PART

NEOBISIIDAE J. C. CHAMBERLIN, 1930

NEOBISIUM J. C. CHAMBERLIN, 1930

NEOBISIUM NINAE S. ĆURČIĆ & R. N. DIMITRIJEVIĆ, NEW SPECIES
(Figs. 1-21; Table 1; Map 1)

Etymology. — After Ms. Nina Ćurčić, who collected the specimens considered herein.

Material examined. — Holotype male, allotype female, and paratype tritonymph, from under stones in the Pećina u Dubokom Potoku Cave in the village of Donje Biševo near Rožaje in Eastern Montenegro, collected on 22 August 2004 by N. Ćurčić and S. Ćurčić (Map 1).

Description. — The dorsal side of the cephalothorax is considerably longer than broad (Figs. 6, 12, 19; Table 1). The epistome is small and rounded (adults, Figs. 6, 11, 12) or knob-like (tritonymph; Figs. 18, 19). Eyes or eyespots absent. The disposition of the carapacal setae is as follows: 4 + 6 + 5 + 5 = 20 (male), 4 + 6 + 7 + 4 = 21 (female), and 4 + 6 + 7 + 4 = 21 (tritonymph) setae (Figs. 4, 12, 19). The basic setal formula is probably 4 + 6 + 6 + 4 = 20 setae.

The number of setae borne on tergites I-X is variable. In the holotype male, these tergites carry 6-6-6-7-7-9-8-7-8-7 setae, while 5-7-6-7-8-11-10-9-10-8 and 6-6-6-7-9-8-8-8-7-8 setae are carried by the female and tritonymph, respectively. Pleural membranes granulostriate.

In the male, sternite II carries a cluster of 16 setae; sternite III has 14 anterior, 19 posterior setae, and two suprastigmal microsetae on either side (Fig. 5); sternite IV carries nine posterior setae and two small setae along each stigma (Fig. 5). Female genital area (Fig. 13): sternite II with eight small and median setae; sternite III with 21 posterior setae and two suprastigmal microsetae on either side; sternite IV with seven posterior setae and two or three small setae along each stigma (Fig. 13). Tritonymph: sternite II with two small median setae; sternite III with nine posterior setae and two small setae along each stigma; sternite IV with 10 posterior setae and two microsetae along each of the stigma.

Sternites V-X with 12-11-12-11-11-10 (male), 11-13-14-14-12-11 (female), and 12-10-10-12-12-9 (tritonymph) posterior setae. Twelfth abdominal segment with two pairs of small setae. Pleural membranes granulostriate.

The form of the chelicerae is presented in Figs. 4 (male), 14 (female), and 21 (tritonymph). The cheliceral galea is a low hyaline convexity (male; Fig. 4); it is more distinct in the female (Fig. 14) and even more prominent in the tritonymph (Fig. 21). Fixed cheliceral finger with 10 (male), 11 (female), and 10 (tritonymph) small teeth, which are close-set and of irregular form and size. Movable cheliceral finger with seven (male), six to eight (female), and five or six (tritonymph) toothlets of irregular form and size (Figs. 4, 14, 21). The cheliceral flagellum consists of eight (adults; Fig. 10) or seven (tritonymph; Fig. 20) blades; the two distalmost blades are pinnate along their anterior margins; the remaining blades are smooth and diminish in size from distal to proximal (Figs. 10, 20). One chaeta is carried by the movable cheliceral finger (gl), and six (adults) or five (tritonymph) long setae are borne by the cheliceral palm (Figs. 4, 14, 21). The movable cheliceral finger is longer than cheliceral breadth (Table 1), and the chelicera is 1.94 (male) to 2.11 (female) or 2.08 (tritonymph) times as long as broad (Table 1) and 1.47 (male), 1.57 (female), and 1.50 (tritonymph) times as long as its movable finger (Table 1).

Manducatory process with five (adults) or four long acuminate setae (tritonymph). The pedipalpal articles are smooth and elongated, in all forms: male (Figs. 1, 3), female (Figs. 7, 9), and tritonymph (Figs. 15, 16).

The fixed pedipalpal chelal finger has 111 (male), 118 (female), and 107 (tritonymph) small and close-set teeth; 106 (male), 109 (female), and 102 (tritonymph) such teeth are carried by the movable pedipalpal chelal finger. On both fingers, the most distal pointed teeth, slightly asymmetrical, give way to teeth with rounded tops, which are gradually replaced proximally by shorter and flattened teeth.

Four trichobothria are present on the movable finger and eight on the fixed finger of the pedipalpal

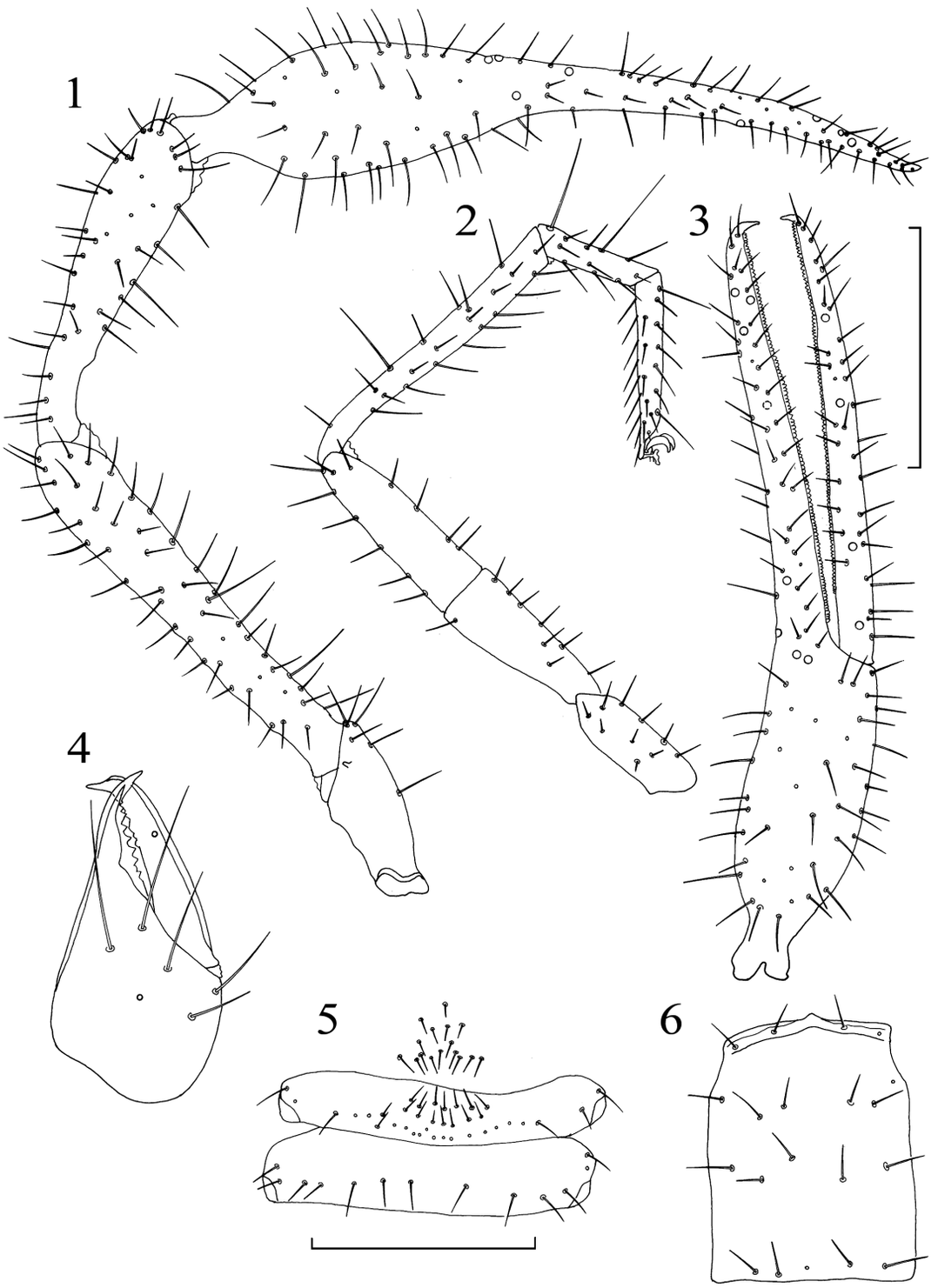

Fig. 1-6. *Neobisium ninae* n. sp., holotype male from Montenegro. 1 – pedipalp; 2 – leg IV; 3 – pedipalpal chela; 4 – chelicera; 5 – genital area; 6 – carapace. Scale lines = 0.25 and 0.50 mm.

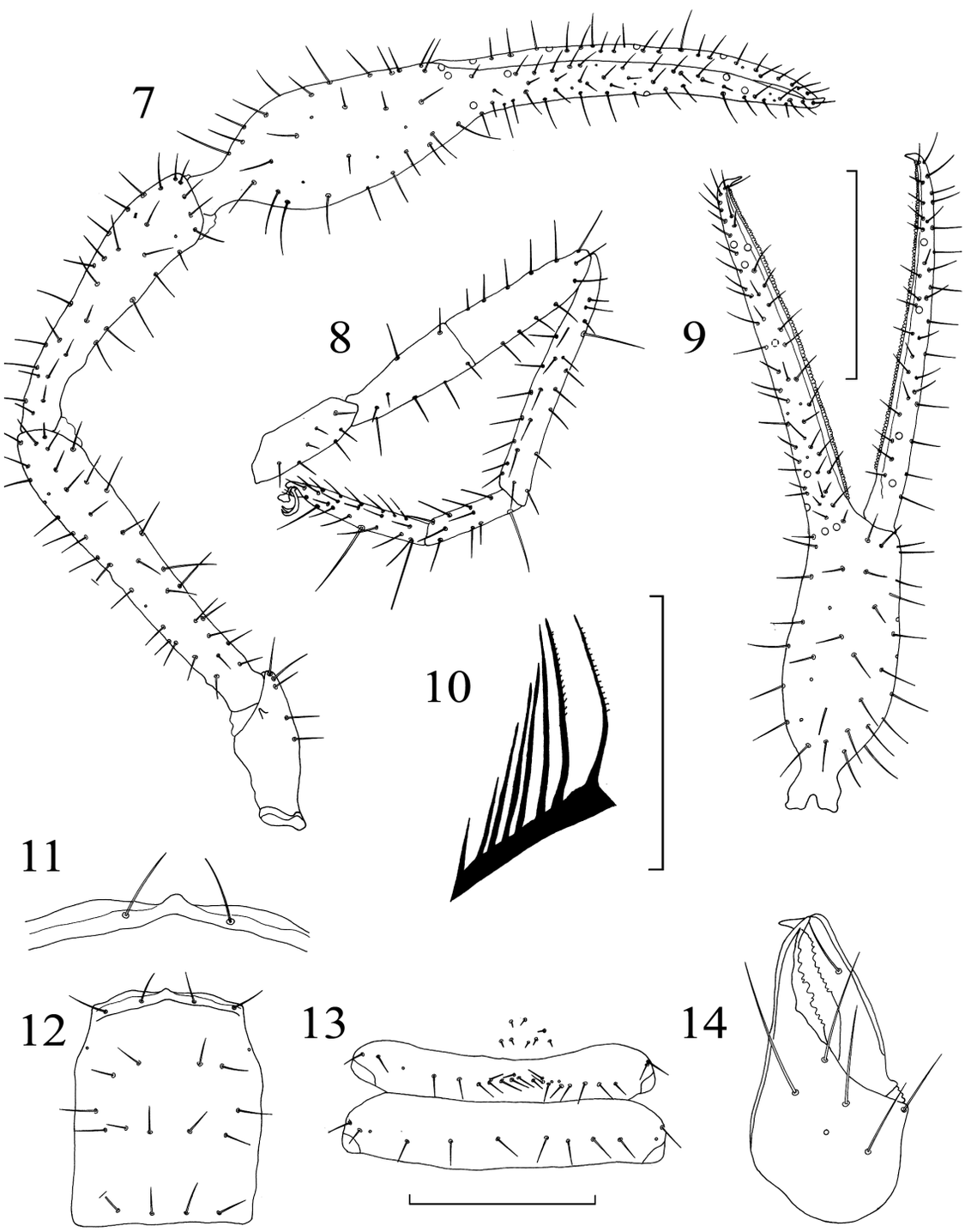

Fig. 7-14. *Neobisium ninae* n. sp., allotype female from Montenegro. 7 – pedipalp; 8 – leg IV; 9 – pedipalpal chela; 10 – flagellum; 11 – epistome; 12 - carapace; 13 – genital area; 14 – chelicera. Scale lines = 0.25 and 0.50 mm.

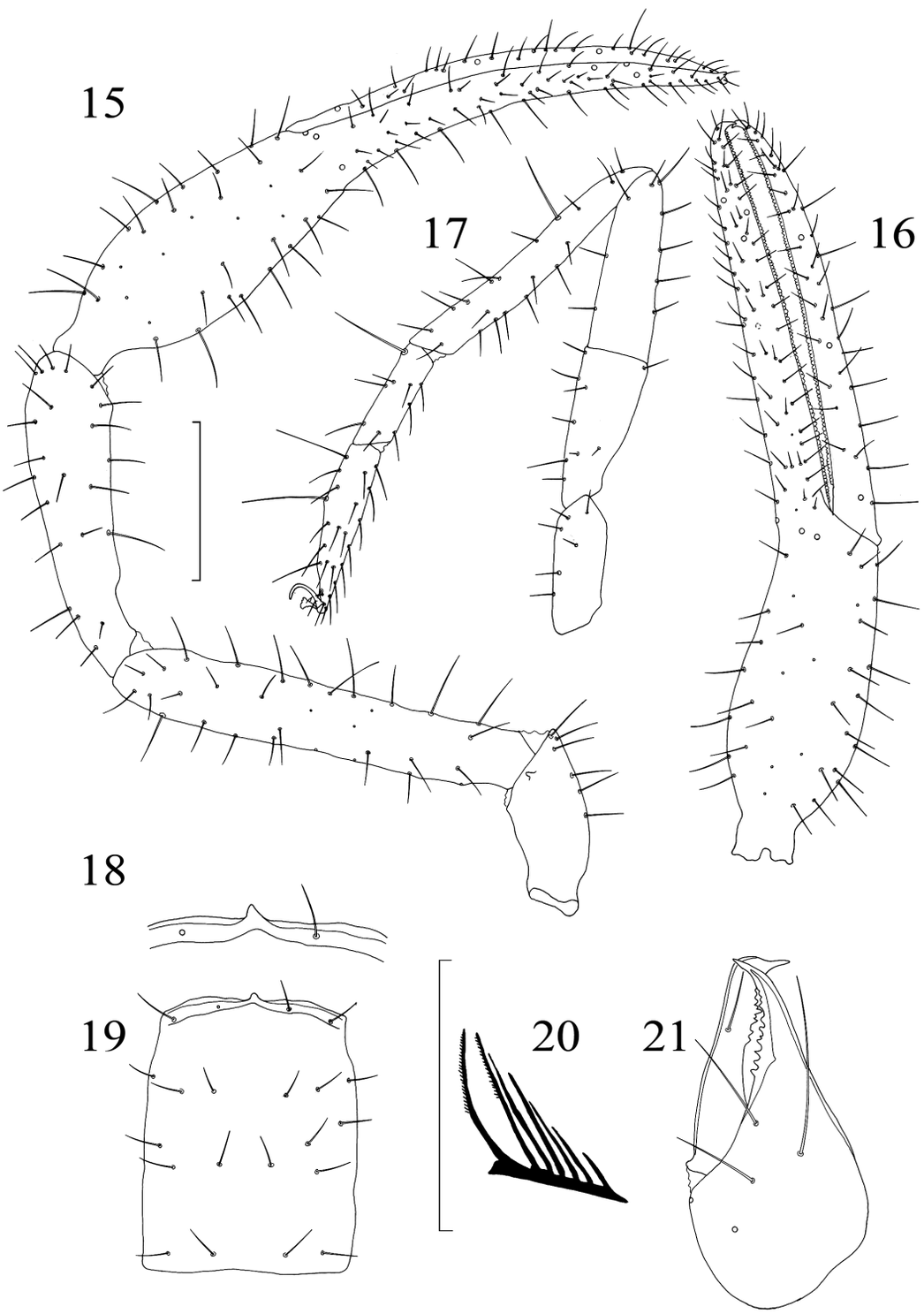

Fig. 15-21. *Neobisium ninae* n. sp., paratype tritonymph from Montenegro. 15 – pedipalp; 16 – pedipalpal chela; 17 – leg IV; 18 – epistome; 19 - carapace; 20 – flagellum; 21 – chelicera. Scale lines = 0.25 and 0.50 mm.

Table 1. Linear measurements (in millimeters) and morphometric ratios in *Neobisium ninae* n.sp., from Montenegro. Abbreviations: M = male, F = female, T = tritonymph.

Character/Sex/Stage	M	F	T
Body			
Length (1)	3.91	4.19	3.21
Cephalothorax			
Length (2)	1.13	1.08	0.88
Breadth (2a)	0.90	0.815	0.65
Ratio 2/2a	1.255	1.325	1.35
Abdomen			
Length	2.78	3.11	2.33
Chelicerae			
Length (3)	0.66	0.74	0.54
Breadth (4)	0.34	0.35	0.26
Length of movable finger (5)	0.45	0.47	0.36
Ratio 3/5	1.47	1.57	1.50
Ratio 3/4	1.94	2.11	2.08
Pedipalps			
Length with coxa (6)	8.25	8.175	5.935
Ratio 6/1	2.11	2.09	1.91
Length of coxa	0.815	0.855	0.62
Length of trochanter	0.825	0.78	0.58
Length of femur (7)	1.98	1.76	1.345
Breadth of femur (8)	0.295	0.305	0.22
Ratio 7/8	6.71	5.77	6.11
Ratio 7/2	1.75	1.63	1.53
Length of patella (tibia) (9)	1.52	1.49	1.03
Breadth of patella (tibia) (10)	0.35	0.35	0.26
Ratio 9/10	4.34	4.26	3.96
Length of chela (11)	3.15	3.29	2.36
Breadth of chela (12)	0.55	0.58	0.43
Ratio 11/12	5.73	5.67	5.49
Length of chelal palm (13)	1.33	1.365	1.05
Ratio 13/12	2.42	2.35	2.44
Length of chelal finger (14)	1.82	1.925	1.31
Ratio 14/13	1.37	1.41	1.25
Leg IV			
Total length	5.445	5.275	3.76
Length of coxa	0.55	0.60	0.42
Length of trochanter (15)	0.59	0.58	0.44
Breadth of trochanter (16)	0.21	0.21	0.16
Ratio 15/16	2.81	2.76	2.75
Length of femur + patella (17)	1.55	1.50	1.08
Breadth of femur + patella (18)	0.275	0.26	0.20
Ratio 17/18	5.64	5.77	5.40
Length of tibia (19)	1.42	1.365	0.91
Breadth of tibia (20)	0.14	0.15	0.13
Ratio 19/20	10.14	9.10	7.00
Length of metatarsus (21)	0.53	0.49	0.37
Breadth of metatarsus (22)	0.12	0.12	0.10
Ratio 21/22	4.42	4.08	3.70
Length of tarsus (23)	0.805	0.74	0.54
Breadth of tarsus (24)	0.11	0.11	0.12
Ratio 23/24	7.32	6.73	4.50
TS ratio - tibia IV	0.34	0.34	0.36
TS ratio - metatarsus IV	0.13	0.125	0.14
TS ratio - tarsus IV	0.405	0.42	0.38

chela in adults (Figs. 3, 9), while three are present on the former and seven on the latter in the tritonymph (Fig. 16). The *ist* trichobothrium is closer to the distal than to the proximal group of trichobothria (Figs. 3, 9, 16).

The pedipalpal femur is 6.71 (male), 5.77 (female), and 6.11 (tritonymph) times as long as broad (Table 1). This podomere is considerably longer than the carapace (Table 1). The pedipalpal patella is 4.34 (male), 4.26 (female), and 3.96 (tritonymph) times as long as broad (Table 1). The pedipalpal chela length to breadth ratio is 5.73 (male), 5.67 (female), and 5.51 (tritonymph) (Table 1), and the pedipalpal chela is 2.11 (male), 2.09 (female), and 1.91 (tritonymph) times longer than carapace + abdomen (Table 1). The pedipalpal chelal fingers are 1.37 (male), 1.41 (female), and 1.25 (tritonymph) times as long as broad (Table 1).

Tibia IV and basitarsus IV each carry a long tactile seta, while tarsus IV carries two such sensitive setae (Figs. 2, 8, 17) (both in adults and tritonymph; Table 1).

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

Differential diagnosis. — From its phenetically close congener, *N. tantaleum* Beier, 1939 from Bosnia, *N. ninae* n. sp. differs clearly in many important respects, such as: tergite I-IV setation in adults (6-4-4-4 *vs.* 6-6-6-7 or 5-7-6-7); the pedipalpal femur length to breadth ratio (9.20 *vs.* 8.175-8.25); the pedipalpal tibia length to breadth ratio (3.50 *vs.* 4.26-4.34); the pedipalpal chela length to breadth ratio (8.30 *vs.* 5.67-5.73); form of the pedipalpal chela (parallel-sided *vs.* ovoid); pedipalpal femur length (2.94 mm *vs.* 1.76-1.98 mm); form of the pedipalpal articles [Figs. 1, 7, 15 *vs.* Fig. 172 (B e i e r, 1963)]; and the disposition of trichobothria [Figs. 3, 9, 16 *vs.* Fig. 172; (B e i e r, 1963)].

Distribution and ecology. — This new species is an endemic and relict inhabitant of caves in Eastern Montenegro (its underground habitat is located at cca 1,300 m a. s. l.). All specimens were found either on wet stalactites and stalagmites or under stones. It seems that *N. ninae* n. sp. is a Tertiary relict which

presently inhabits a part of the primordial distribution area of its ancestor.

Remarks. — Analysis of the once existing fauna of pseudoscorpions on the Balkan Peninsula helps in interpreting the origin and history of other troglobites there. The primordial population colonized the proto-Balkan land mass at the beginning of its existence. Subsequently, it gave birth to a number of phyletic lineages. However, the composition of the old thermophilous fauna was not uniform, and regional differences no doubt existed. With the Ice Age, its distribution changed. This process must have been complicated and cannot be explained only by climatic changes. Moreover, it must have taken place with uneven intensity in different areas (Ćurčić et al., 1998).

The discontinuous ranges of the Mediterranean thermophilous «living fossils» (including pseudoscorpions) clearly indicate that the Tertiary false scorpions were locally more or less exposed to destruction under the influence of different geotectonic events, climatic changes, competition with immigrants, etc.

In conclusion, it is apparent that geomorphological and climatic events in the Balkans, together with pecularities of the historical development of the fauna there, caused the peninsula to become the main center of dispersion and colonization of cave species and groups of species, i. e., the main source for the revitalization and genesis of biological diversity, not just in the Mediterranean region, but throughout all of Southeast Europe and the Middle East (Ćurčić et al., 1997, 1998, 2004).

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NEOBISIUM NINAE N. SP. (NEOBISIIDAE, PSEUDOSCORPIONES), НОВА ЕНДЕМИЧНА ПЕЋИНСКА ПСЕУДОСКОРПИЈА ИЗ ЦРНЕ ГОРЕ

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У овој студији описана је нова врста пећинских псеудоскорпија из пећине у Дубоком Потоку, село Доње Бишево, у близини Рожаја. Изложена је јасна дијагноза новог таксона. читав низ таксономских и биогеографских особености нове врсте разматран је у светлу еволуције крашког рељефа Балканског полуострва.