Advances in Arachnology and Developmental Biology.
Papers dedicated to Prof. Dr. Božidar Ćurčić.
S. E. Makarov & R. N. Dimitrijević (Eds.) 2008.
Inst. Zool., Belgrade; BAS, Sofia; Fac. Life Sci., Vienna;
SASA, Belgrade & UNESCO MAB Serbia.
Vienna — Belgrade — Sofia, **Monographs, 12,** 259-266 .

UDC 595.47(497.5):591.9

ON TWO NEW PSEUDOSCORPIONS (PSEUDOSCORPIONES, ARACHNIDA) FROM DALMATIA (CROATIA)

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Abstract — We studied pseudoscorpions of the genera *Neobisium* Chamberlin, 1930 and *Roncus* L. Koch, 1873 from some caves on Mt. Svilaja and near Metković (Dalmatia, Croatia). Two new species – *N. svilajae* n. sp. and *R. narentae* n. sp. — are described. The specimens studied are thoroughly analyzed and illustrated. Each of these new taxa belongs to a specific group of endemics, geographically restricted either to Mt. Svilaja or to Southern Herzegovina. Taxonomic interrelationships and geographic distributions are briefly discussed.

Key words: Pseudoscorpions, cave fauna, evolution, biogeography, phylogeny, *Neobisium svilajae, Roncus narentae*, Dalmatia (Croatia)

INTRODUCTION

The Dinaric karst of Croatia can be divided into four regions: lowlands, highlands, the Mediterranean Coast, and Islands and the Adriatic Sea. The lowlands are a flat area surrounded by the rivers Sava, Mura, Drava, and Danube, and by the outer Pannonian Hills. The Croatian highlands are part of the Dinaric Massif (the highest mountain, Dinara, with an elevation of 1,831 m). This region is a high karstic belt from mountain to foothill areas with „islands" of impenetrable rocks, karst valleys, and river valleys. A pecuiliarity of the region is the great geomorphological diversity of both underground and epigean karstic forms. It includes the regions Gorski Kotar and Lika. The Mediterranean Coast and Adriatic islands make a narrow coastal belt which is characterized by the presence of islands and high mountains. The belt in question consists of the regions of Istria, Coastlands, Kvarner, and Dalmatia. Dalmatia is well-known as home to the majority of the region's cave invertebrates, particularly cave-dwelling pseudoscorpions and other arachnids that live underground.

Specimens of two new species of the genera *Neobisium* Chamberlin, 1930 and *Roncus* L. Koch, 1873 were found by one of us (TR), carefully dissected, and thoroughly analyzed in the present study.

MATERIAL AND METHODS

We examined material from two samples collected in caves in Dalmatia (Croatia). The first sample (from a cave on Mt. Svilaja) contained a new taxon: *Neobisium svilajae* n. sp. The second sample (from a cave near Metković) contained *Roncus narentae* n. sp. These two species are probably cave-dwelling endemic forms.

The aim of this study is to present a description of two new species of *Neobisium* Chamberlin and *Roncus* L. Koch (Neobisiidae) and discuss their probable origin.

SYSTEMATIC PART

NEOBISIUM SVILAJAE DIMITRIJEVIĆ & RAĐA, NEW SPECIES

(Figs. 1-8; Table 1)

Etymology. – After Mt. Svilaja (Dalmatia), its terra typica.

Material examined. – Holotype male from the Jama na Vlačine Pit (cca 1,100 m a.s.l.), 4 June 2006, Mt. Svilaja, Dalmatia; collected by Tonći Rađa.

Description. – The carapace is considerably longer than broad (Fig. 3; Table 1); the epistome is small, triangular (but apically rounded; Figs. 2, 3). Neither eyes nor eyespots are developed. The carapacal formula is 4 + 6 + 6 + 4 = 20 setae (Fig. 3). Preocular microsetae not visible.

In the holotype male, tergites I-X carry 4-4-4-6-6-6-6-7-8-7 setae. Twelfth abdominal segment with two pairs of small setae. Pleural membranes granulostriate.

Sternite II carries a cluster of 15 setae; sternite III with 16 anterior and centrally located setae, 14 posterior setae, and two suprastigmal microsetae on either side. Sternite IV with 11 posterior setae and two small setae along each stigma. Sternites V-X with 12-13-12-12-11-12 posterior setae.

The shape of the chelicera is as shown in Fig. 6; galea a minute hyaline convexity (almost absent; Fig. 6). Dentition of the movable and fixed cheliceral fingers is presented in Fig. 6. The movable finger has one large tooth; proximally, its teeth end below the site of the galeal seta (Fig. 6). Six setae are found on the cheliceral palm (Fig. 6) and a single seta is present on the movable finger. The flagellum consists of one short proximal blade and seven longer blades distally; only the two distalmost blades are pinnate anteriorly (Fig. 7). The movable finger is longer than cheliceral breadth (Table 1). Each chelicera is considerably more than twice as long as broad (Fig. 6; Table 1).

The manducatory process has four long acuminate setae. The pedipalpal trochanter is smooth and elongate (Fig. 5), as are the remaining pedipalpal articles (Fig. 5). Pedipalpal tibia slightly dilated distally, pedipalpal chelal hand slenderly ovate (dorsal view; Fig. 5).

The movable chelal finger carries 149 teeth, the fixed one 175 (Fig. 4). The teeth of the movable finger are square-topped and similar to those on the fixed chelal finger; the most distal pointed teeth, slightly asymmetrical, give way to teeth with rounded

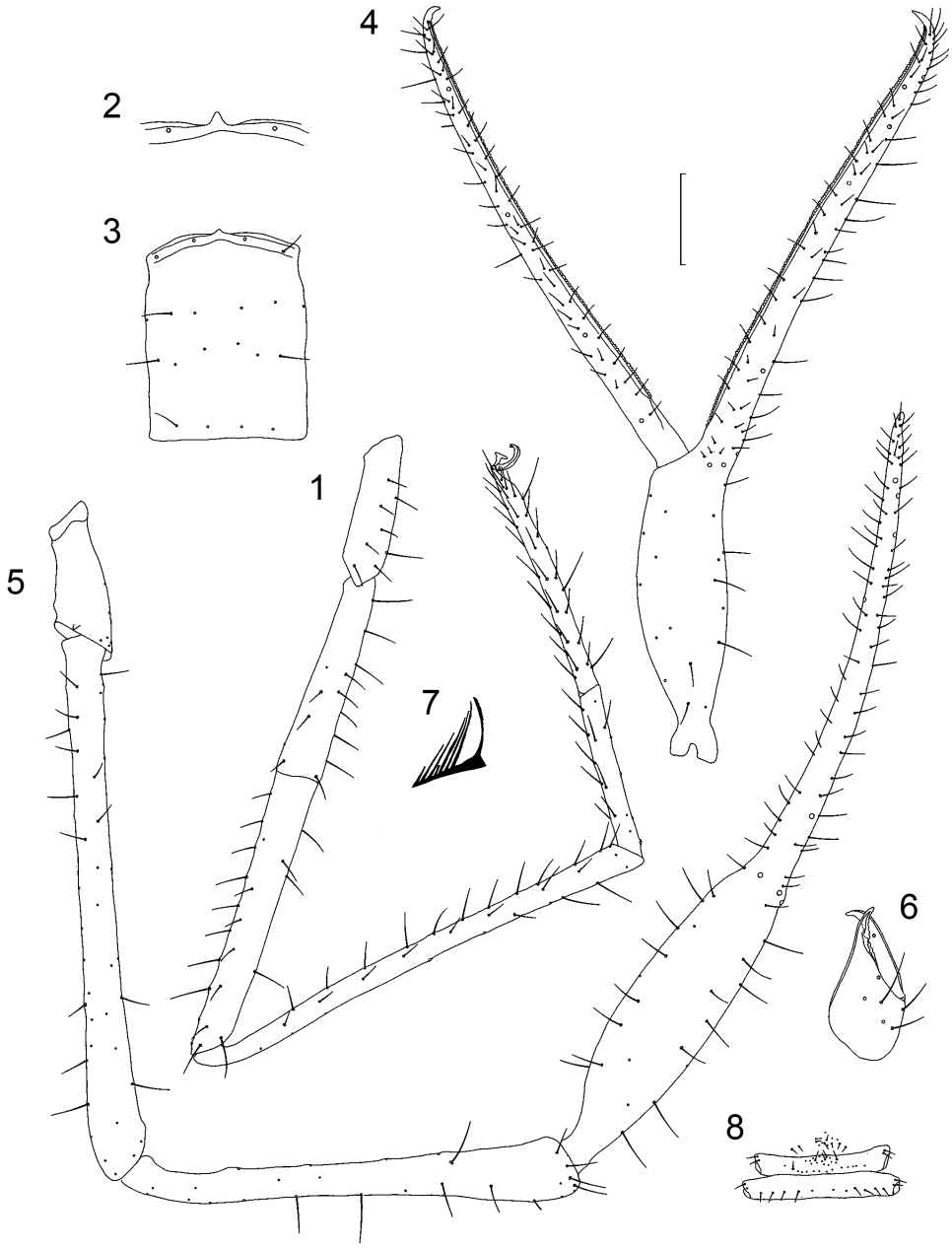

Fig. 1. *Neobisium svilajae* n. sp., holotype male, from a cave on Mt. Svilaja (Dalmatia): 1 – leg IV; 2 – epistome; 3 – carapace; 4 – pedipalpal chela; 5 – pedipalp; 6 – chelicera; 7 – flagellum; 8 – male genital area. Scales = 0.50 mm (Figs. 1, 3, 4, 5, 6, 8) and 0.25 mm (Figs. 2, 7).

tops, which are gradually replaced proximally by shorter flattened teeth. The teeth of the movable finger do not reach the level of **b**, while the teeth of the fixed finger end before the level of **ib** (Fig. 4).

Four trichobothria are present on the movable finger and eight on the fixed finger of the chela (Fig. 4). The **et** and **it** trichobothria are in the distal quarter of the finger and these together with **t**, **est**, **st**, and **ist** are all in the distal half. The proximal half contains **ib**, **esb**, **b**, and **eb**. The **ist** trichobothrium lies above **st** and is considerably closer to the finger tip than to the **eb** and **esb** trichobothria (Fig. 4). Five or six microsetae are present distal to **eb** and **esb**; no microsetae are present distal to these two trichobothria (Fig. 4).

The pedipalpal femur is 10.63 times as long as broad; this podomere is more than twice as long as the carapace (Table 1). The pedipalpal patella is 8.32 times longer than its breadth. The pedipalpal chelal length to breadth ratio is 9.26 (Table 1). The pedipalpal chelal fingers are 1.50 times as long as the chelal palm (Table 1).

Tibia IV, metatarsus IV, and tarsus IV each carry a single sensitive seta (Fig. 5); the tactile seta ratio of the tibia does not exceed 0.50 (Table 1).

Measurements of different body structures and morphometric ratios (in mm) are presented in Table 1.

Remarks. – From its phenetically closest congener, *N. spelaeum* (Schiødte, 1849), the new species differs in many important respects, such as: the setation of tergites I-IV (4-4-4-4 vs. 4-4-4-6) and sternites V-X (14/15-14/15-14/15-14-14-13/15 vs. 12-13-12-12-11-12 setae); the number of teeth on the movable (81 vs. 149) and fixed (94 vs. 175) chelal fingers; the disposition of trichobothria (Fig. 165; Ćurčić, 1988 vs. Fig. 4; present paper); and almost all linear measurements and morphometric ratios (Table 8; Ćurčić, 1988 vs. Table 1; present paper).

RONCUS NARENTAE DIMITRIJEVIĆ & RAĐA, NEW SPECIES

(Figs. 9-15; Table 1)

Etymology. – After the nearby Neretva River (Lat.: Narenta).

Material examined. – Holotype female, from the Šolkina Jama Pit, 27 February 1994, village of Vidonje, near Metković, Dalmatia, Croatia; collected by Tonći Rađa; and paratype female, from the same locality, data, and collector.

Description. – The carapace is distinctly longer than broad (Table 1). The carapace is low and rounded apically (Figs. 11, 13). The carapacal setal formulae are: 4 + 6 + 9 + 6 = 25 and 4 + 6 + 8 + 6 = 24 setae. Neither eyes nor eye-spots are developed (Fig. 13). Tiny preocular microsetae absent (Fig. 13).

The number of setae borne on tergites I-X is variable: 5-7-9-11-11-11-11-11-11-9 and 5-6-8-10-11-12-11-11-10-10. Twelfth abdominal segment with two pairs of small setae. Pleural membranes granulostriate.

Sternite II carries a cluster of 11 small setae on its median and posterior parts, thinning out anteriorly (Fig. 14). Sternite III has 14 or 15 posterior setae and three

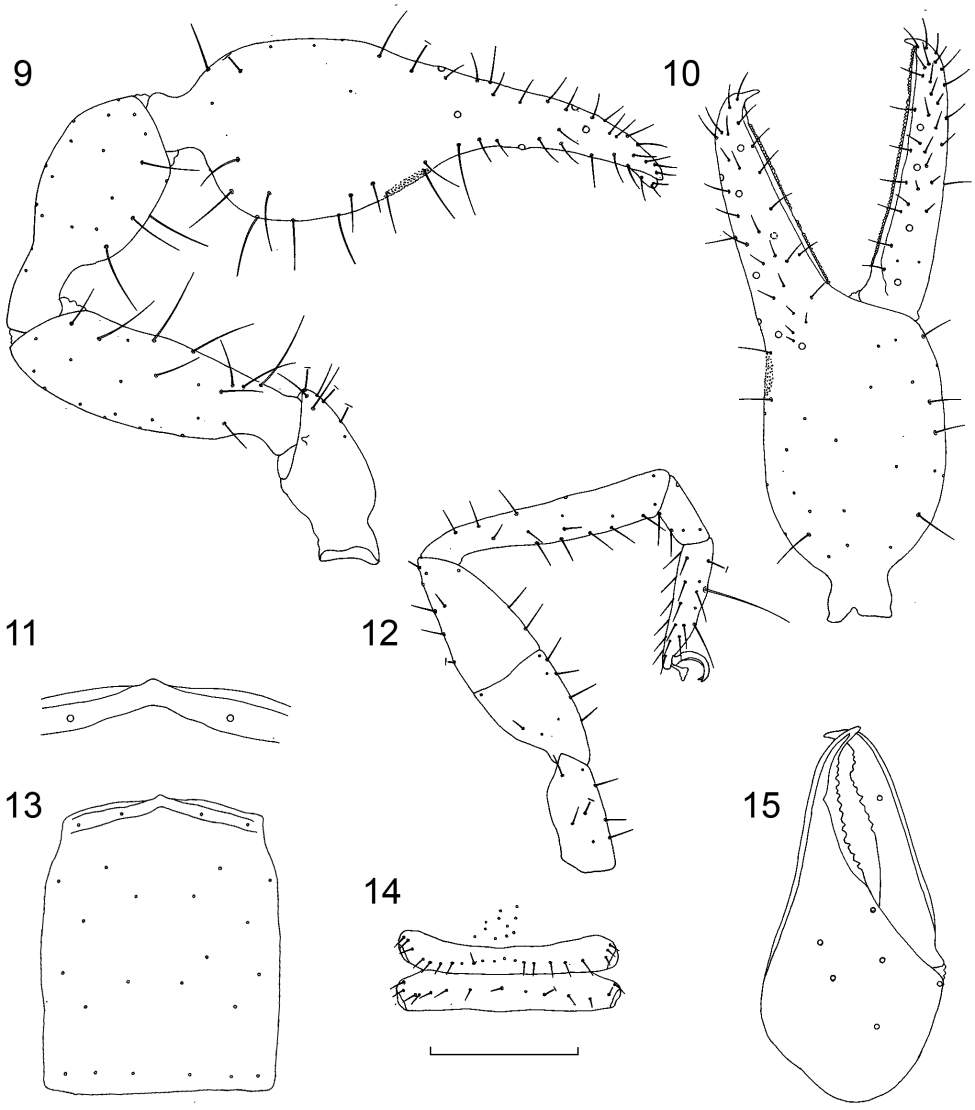

Fig. 1. *Roncus narentae* n. sp., holotype female, from a cave near Metković (Dalmatia): 9 – pedipalp; 10 – pedipalpal chela; 11 – epistome; 12 – leg IV; 13 – carapace; 14 – female genital area; 15 – chelicera. Scales = 0.50 mm (Figs. 9, 10, 12, 13, 14) and 0.25 mm (Figs. 11, 15).

suprastigmatic setae on either side. Sternite IV carries 10 anterior setae and two microsetae along each stigmatic plate. Sternites V-X carry 13-15-12-12-12-11 and 12-13-12-12-12-10 setae.

Cheliceral form as in Fig. 15; galea almost indiscernible (Fig. 15). The movable and fixed teeth carry nine and 12 teeth, of which the proximal and distal members of each series are the smallest. The teeth of the movable finger end well below the insertion site of the galeal seta (**gl**). Six setae are found on the palm of the chelicera,

Table 1. Linear measurements (in mm) and morphometric ratios in *Neobisium svilajae* n. sp. (from Mt. Svilaja, Croatia) and *Roncus narentae* n. sp. (from nr. Metković, Croatia). Abbreviations: M = male, FF = females.

Character/species/sex	*Neobisium svilajae* M	*Roncus narentae* F
Body		
Length (1)	3.71	4.04 - 4.11
Cephalothorax		
Length (2)	1.14	0.92 - 0.97
Breadth (2a)	0.855	0.72 - 0.77
Ratio 2/2a	1.33	1.26 - 1.28
Abdomen		
Length	2.57	3.12 - 3.14
Chelicerae		
Length (3)	0.845	0.60 - 0.61
Breadth (4)	0.41	0.295-0.305
Length of movable finger (5)	0.54	0.43 - 0.44
Ratio 3/5	1.56	1.36 - 1.42
Ratio 3/4	2.61	2.00 - 2.03
Pedipalps		
Length with coxa (6)	12.13	4.915-5.17
Ratio 6/1	3.27	1.22 - 1.26
Length of coxa	0.97	0.63 - 0.66
Length of trochanter	0.88	0.57 - 0.58
Length of femur (7)	3.03	0.97 - 1.07
Breadth of femur (8)	0.285	0.275-0.305
Ratio 7/8	10.63	3.51 - 3.53
Ratio 7/2	2.66	1.05 - 1.10
Length of patella (tibia) (9)	2.62	0.845-0.89
Breadth of patella (tibia) (10)	0.315	0.35 - 0.38
Ratio 9/10	8.32	2.34 - 2.41
Length of chela (11)	4.63	1.90 - 1.97
Breadth of chela (12)	0.50	0.62 - 0.71
Ratio 11/12	9.26	2.77 - 3.06
Length of chelal palm (13)	1.85	0.98 - 0.99
Ratio 13/12	3.70	1.38 - 1.60
Length of chelal finger (14)	2.78	0.91 - 0.99
Ratio 14/13	1.50	0.92 - 1.01
Leg IV		
Total length	9.36	3.22 - 3.305
Length of coxa	0.63	0.43 - 0.45
Length of trochanter (15)	0.835	0.40 - 0.41
Breadth of trochanter (16)	0.23	0.17 - 0.18
Ratio 15/16	3.63	2.22 - 2.42
Length of femur + patella (17)	2.985	0.88 - 0.90
Breadth of femur + patella (18)	0.24	2.25 - 0.275
Ratio 17/18	12.44	3.27 - 3.52
Length of tibia (19)	2.66	0.805-0.835
Breadth of tibia (20)	0.15	0.13 - 0.14
Ratio 19/20	17.73	5.96 - 6.19
Length of metatarsus (21)	0.94	0.26 - 0.275
Breadth of metatarsus (22)	0.13	0.11
Ratio 21/22	7.23	2.36 - 2.50
Length of tarsus (23)	1.31	0.42 - 0.46
Breadth of tarsus (24)	0.11	0.10
Ratio 23/24	11.91	4.60
TS ratio - tibia IV	0.42	0.52 - 0.60
TS ratio - metatarsus IV	0.13	0.185-0.19
TS ratio - tarsus IV	0.43	0.38 - 0.41

while a single seta is present on the movable finger (Fig. 15). The cheliceral flagellum carries seven long blades and one short proximal blade. All blades are pinnate on their anterior sides. The movable cheliceral finger is longer than the cheliceral breadth; the chelicera is twice as long as broad (Table 1).

The apex of the pedipalpal coxa carries four long setae. The pedipalpal trochanter is smooth and carries five small closely-set exterior setae (Fig. 9). The pedipalpal tibia and femur are smooth, while only the distal and interior part of chelal hand is somewhat granulated (Fig. 9). The movable chelal finger carries 63 or 73 teeth, while 68 or 69 teeth are found on the fixed finger. The teeth of the movable finger are square-topped in the proximal range of the row and similar to those of the fixed finger; the most distal pointed teeth, somewhat asymmetrical, give way to teeth with rounded tops, which are gradually replaced proximally by shorter flattened teeth.

Four trichobothria are present on the movable finger and eight on the fixed finger (Fig. 10). The **et** and **it** trichobothria are in the distal part and these together with **t**, **est**, **st**, and **ist** are all in the distal half of the finger. The proximal area contains **ib**, **esb**, **b**, **eb**, **sb**, and **st**. The **ist** trichobothrium is closer to **eb**-**esb** than to the finger tip. No microsetae are developed proximal to **eb** and **esb**; instead, four tiny setae are found distal to these two trichobothria (Fig. 10).

The pedipalpal femur is 3.51-3.53 times as long as broad; this podomere is longer than the carapace (Table 1). The pedipalpal patella is 2.34-2.41 times as long as broad (Table 1). The pedipalpal chelal length to breadth ratio is 2.77-3.06. The chelal finger length to chelal palm length ratio is 0.92-1.01 (Table 1).

Leg IV: tibia, metatarsus, and tarsus each carry a long tactile seta (Fig. 12). The tactile seta ratios of tibia IV exceed 0.50 (0.52-0.60; Table 1).

Measurements of different body structures (in mm) and morphometric ratios are presented in Table 1.

Remarks. – From its phenetically close congener, *R. podaga* Ćurčić, 1988, collected in the vicinity of Split (Dalmatia), this new species differs considerably in the carapacal formula (4 + 6 + 8/9 + 5/6 = 24/25 vs. 4 + 6 + 6 + 6 = 22 setae); in the number of teeth of both the movable (63-73 vs. 86-89) and the fixed chelal finger; in form of the pedipalps (Fig. 9; present paper vs. Fig. 380; Ćurčić, 1988); in disposition of the trichobothria (Fig. 10; present paper vs. Fig. 382; Ćurčić, 1988); in many morphometric ratios and linear measurements (Table 1; present study vs. Table 13; Ćurčić, 1988); and in geographic distribution (valley of the Neretva River vs. Mt. Kozjak).

IN LIEU OF A CONCLUSION

It is not easy to analyze the origin and history of endemic pseudoscorpions of the Dinaric (or Dalmatian) underground milieux because they represent an adaptive and selected fauna. The colonization of Dinaric subterranean habitats must have begun a long time ago and have passed through successive stages during different geological times, parallel with the development of different karstic phenomena. Several historical lineages (such as those inhabiting Mt. Biokovo, Mt. Velebit, Mt.

Mosor, Mt. Durmitor, etc.) can be distinguished, their exact age being difficult to establish (Jeannel, 1943; Beier, 1963; Guéorguiev, 1977; Ćurčić, 1988).

Acknowledgment — Financial support from the Serbian Ministry of Science, Technology, and Development is gratefully acknowledged (Grant # 143053).

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