Arch. Biol. Sci., Belgrade, 62 (2), 503-513, 2010 DOI:10.2298/ABS1002503C

ON *RONCUS ALMISSAE* N. SP., *R. KRUPANJENSIS* N. SP., AND *R. RADJI* N. SP., THREE NEW PSEUDOSCORPIONS (PSEUDOSCORPIONES, NEOBISIIDAE) FROM CROATIA AND SERBIA, RESPECTIVELY

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Abstract. – Three new species of the pseudoscorpion genus *Roncus* L. Koch (Neobisiidae) are described from Croatia (from nr. Omiš, Dalmatia: *R. almissae* n. sp.) and Serbia (near the town of Krupanj, north-western Serbia, Lukića Pećina Cave and nr. Izvor: *R. krupanjensis* n. sp., and *R. radji* n. sp.), and their diagnostic characteristics are illustrated. Their interrelations with phenetically close congeners are analyzed; in addition, the presence/absence of microsetae proximal to the trichobothria *eb* and *esb* is established as an important taxonomic characteristic.

Key words: Pseudoscorpiones, Neobisiidae, *Roncus almissae*, *Roncus krupanjensis*, *Roncus radji*, Dalmatia, Serbia

UDC 595.47(497.5)

INTRODUCTION

Over the past four decades there has been a marked increase in our knowledge of the Neobisiidae of south-eastern Europe (the Balkan Peninsula), and especially of the representatives of the genus *Roncus* L. Koch, 1873 which occur in leaf litters, soil and caves (Ćurčić, 1988; Ćurčić et al., 2004; Harvey, 1990). Increased interest in the soil/litter and cave ecosystems and improved sampling techniques have contributed to this knowledge. During a study of postembryonic development and teratology of the pseudoscorpions in Dalmatia and Serbia, three hitherto undescribed species of *Roncus* were found.

This paper provides descriptions of *Roncus almissae* n. sp., *R. krupanjensis* n. sp., and *R. radji* n. sp., with some details on the comparative morphology of both sexes.

All specimens are mounted on slides in Swan's fluid (gum chloral medium) and all are deposited in the Institute of Zoology, Faculty of Biology (IZB), University of Belgrade, Belgrade, Serbia.

SYSTEMATIC PART

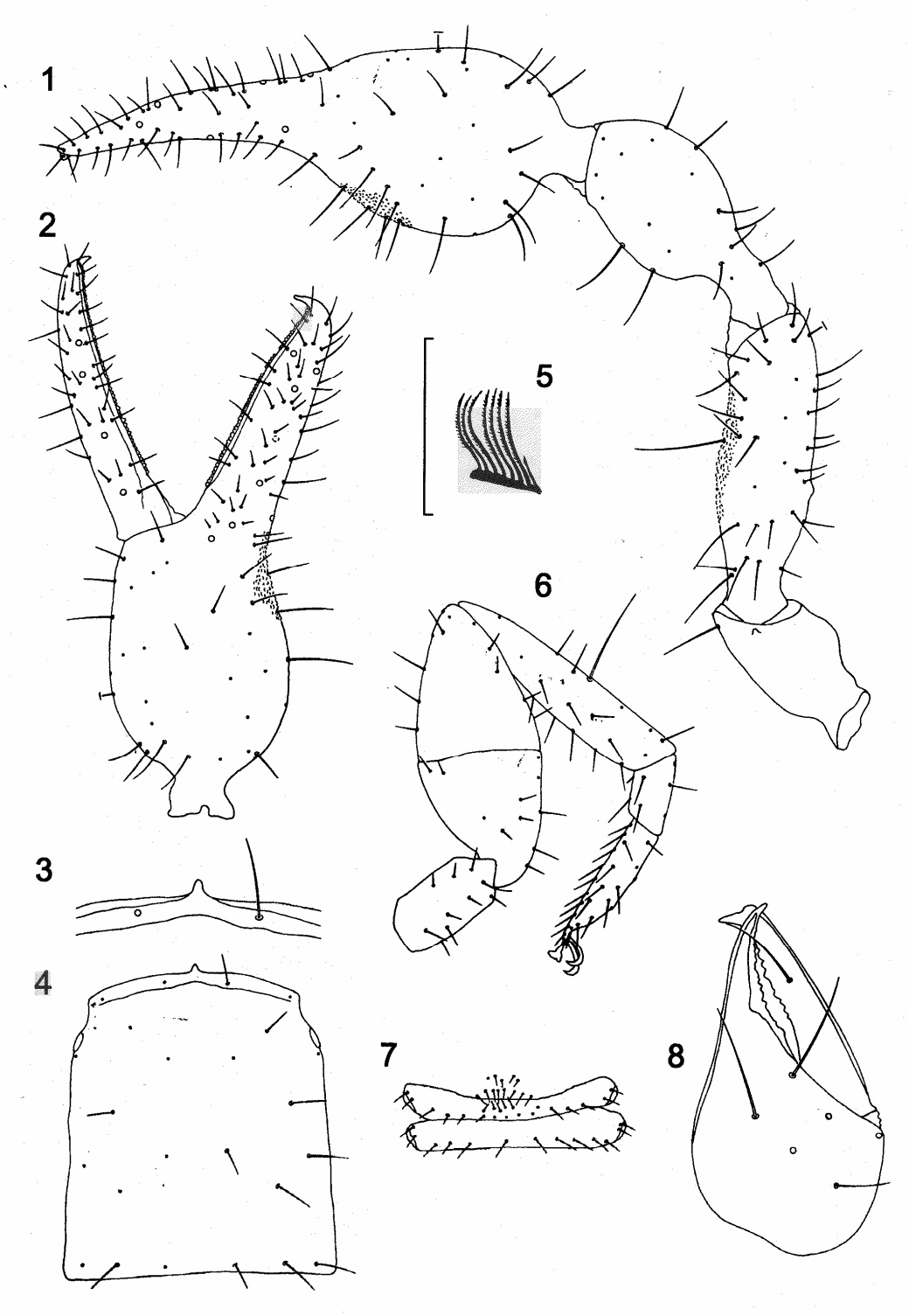
RONCUS ALMISSAE, NEW SPECIES

Etymology. – After Almissa, the old Latin name of Omiš

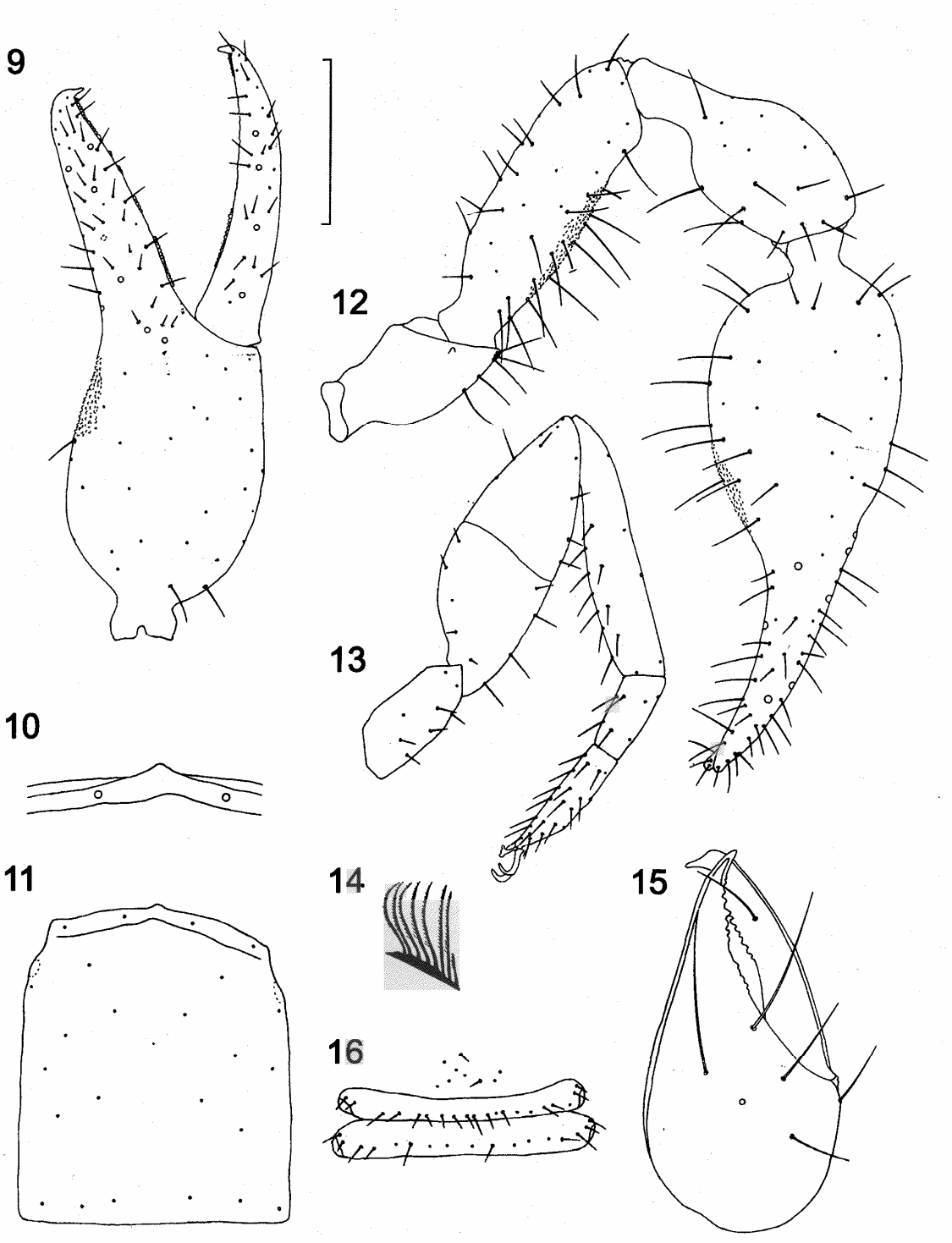
Material. – Holotype male and allotype female samples residing under stone were collected by Tonći Rađa in the village of Podašpilje, nr. Omiš, on the northern slopes of Mt. Omiška Dinara, Dalmatia, Croatia, 22 September.

Description. – Epistome triangular and apically blunt (Figs. 3, 4, 10, and 11). Two small eye-spots present (Figs 4 and 11). Setal formula: 4+6+8+6=24 (in both sexes). Preocular microsetae not developed.

Tergite I with 6 setae, tergite II with 9 (male) or 10 setae (female), tergite III with 9 (female) or 10 (male), tergites IV-X with 10-12-12-11-11-11-10 (male) and 11-12-11-11-11-11-10 setae (female).



Figs. 1-8. *Roncus almissae* n. sp., from Dalmatia. Holotype male: 1 – pedipalp, 2 – pedipalpal chela, 3 – epistome, 4 – carapace, 5 – flagellum, 6 – leg IV, 7 – male genital area, 8 – chelicerae. Scales = 0.50 mm (Figs. 1, 2, 4, 6 and 7) and 0.25 mm (Figs. 3, 5 and 8).



Figs. 9-16. *Roncus almissae* n. sp., from Dalmatia. Allotyep female: 9 – pedipalpal chela, 10 – epistome, 11 – carapace, 12 – pedipalp, 13 – leg IV, 14 – flagellum, 15 – chelicerae, 16 – female genital area. Scales = 0.50 mm (Figs. 9, 11, 12, 13 and 16) and 0.25 mm (Figs. 10, 14 and 15).

Table 1. Linear measurements (in millimetres) and morphometric ratios in *Roncus almissae* n. sp., *R. krupanjensis* n. sp. and *R. radji* n. sp. from Dalmatia (Croatia) and Serbia, respectively. Abbreviations: M = male, MM = males, F = female.

Species	*R. almissae*		*R. krupanjensis*		*R radji*
	M	F	M	F	MM
Body					
Length (1)	3.09	4.00	2.72	2.28	3.395-3.74
Cephalothorax					
Length (2)	0.88	0.97	0.72	0.64	0.95-0.98
Breadth (2a)	0.72	0.805	0.60	0.58	0.70-0.78
Ratio 2/2a	1.22	1.20	1.20	1.19	1.26-1.94
Abdomen					
Length	2.21	3.03	2.00	1.70	2.415-2.79
Chelicerae					
Length (3)	0.51	0.55	0.44	0.40	0.52-0.53
Breadth (4)	0.275	0.295	0.24	0.21	0.275-0.285
Length of movable finger (5)	0.36	0.40	0.315	0.26	0.38-0.39
Ratio 3/5	1.42	1.375	1.40	1.58	1.36-1.37
Ratio 3/4	1.85	1.86	1.83	1.95	1.86-1.89
Pedipalps					
Length with coxa (6)	4.30	4.825	3.85	3.37	5.52-6.195
Ratio 6/1	1.39	1.21	1.415	1.48	1.475-1.82
Length of coxa	0.61	0.68	0.55	0.51	0.69-0.77
Length of trochanter	0.54	0.56	0.47	0.42	0.65-0.77
Length of femur (7)	0.815	1.00	0.80	0.73	1.13-1.385
Breadth of femur (8)	0.26	0.305	0.23	0.21	0.25
Ratio 7/8	3.13	3.28	3.48	3.48	4.52-5.54
Ratio 7/2	0.93	1.03	1.11	1.14	1.19-1.41
Length of patella (tibia) (9)	0.75	0.815	0.64	0.55	0.95-1.01
Breadth of patella (tibia) (10)	0.34	0.36	0.275	0.25	0.34-0.37
Ratio 9/10	2.205	2.26	2.33	2.20	2.73-2.79
Length of chela (11)	1.585	1.77	1.39	1.16	2.10-2.31
Breadth of chela (12)	0.52	0.58	0.41	0.36	0.49-0.56
Ratio 11/12	3.05	3.05	3.39	3.22	4.125-4.285
Length of chelal palm (13)	0.805	0.87	0.68	0.57	1.00-1.06
Ratio 13/12	1.55	1.50	1.66	1.58	1.89-2.04
Length of chelal finger (14)	0.78	0.90	0.71	0.59	1.10-1.25
Ratio 14/13	0.97	1.03	1.04	1.035	1.10-1.18
Leg IV					
Total length	2.975	3.265	2.76	2.27	3.345-3.60
Length of coxa	0.39	0.44	0.40	0.305	0.45-0.46
Length of trochanter (15)	0.36	0.42	0.34	0.285	0.41-0.43
Breadth of trochanter (16)	0.18	0.18	0.14	0.13	0.17-0.18
Ratio 15/16	2.00	2.33	2.43	2.19	2.39-2.41
Length of femur + patella (17)	0.815	0.91	0.74	0.60	0.92-0.93
Breadth of femur + patella (18)	0.35	0.33	0.26	0.23	0.26-0.275
Ratio 17/18	2.33	2.76	2.85	2.61	3.345-3.55
Length of tibia (19)	0.77	0.855	0.65	0.55	0.855-0.92
Breadth of tibia (20)	0.15	0.15	0.12	0.11	0.13-0.15
Ratio 19/20	5.13	5.70	5.42	5.00	6.13-6.58
Length of metatarsus (21)	0.24	0.22	0.24	0.19	0.26-0.35
Breadth of metatarsus (22)	0.11	0.11	0.09	0.08	0.09
Ratio 21/22	2.18	2.00	2.67	2.375	2.89-3.89
Length of tarsus (23)	0.40	0.42	0.39	0.34	0.45-0.51
Breadth of tarsus (24)	0.10	0.10	0.08	0.07	0.08-0.09
Ratio 23/24	4.00	4.20	4.875	4.86	5.625-5.67
TS ratio - tibia IV	0.85	0.595	0.625	0.59	0.58
TS ratio - metatarsus IV	0.17	0.23	0.21	0.16	0.26-0.32
TS ratio - tarsus IV	0.38	0.39	0.34	0.30	0.26-0.32

Male genital area with a cluster of 13 setae medially and posteriorly; of these, 8 longer setae along the posterior sterna margin, and 5 shorter setae mid-posteriorly, thinning out anteriorly (Fig. 7). Sternite III with four anterior and median setae, 12 posterior setae and 2 microsetae along each stigma. Sternite IV with 9 marginal setae and 2 small suprastigmal microsetae on each side. Female genital area (Fig. 16): sternite II with 9 setae constituting a single patch (or arranged into two barely distinguishable groups); sternite III with 16 posterior setae and 2 microsetae along each stigma; sternite IV with 13 setae and 2 small suprastigmal setae on each side. Sternites V-X with 11-10-11-11-11 (male) and 15-16-15-15-15-13 setae (female). Anal papilla with two pairs of small setae.

Galea (cheliceral spinneret) low (Figs. 8 and 15). Cheliceral palm with six setae, movable finger with one seta (both in male and female). Cheliceral dentition as in Figs. 8 (male) and 15 (female). Eight-bladed flagellum (Figs. 5 and 14); one short proximal blade and 7 longer blades distally, all blades denticulate.

Apex of pedipalpal coxa with 4 long acuminate setae. Pedipalpal trochanter with a small lateral tubercle and some rare tiny and inconspicuous denticulations dorsally. Pedipalpal femur with a small exterior and lateral tubercle and with interior and dorsal granulations as in Figs. 5 (male) and 12 (female). Tibia smooth; chelal palm with tiny interior granulations or smooth; exteriorly palm with some rare and inconspicuous surface irregularities (Figs. 5 and 12). No microsetae proximal to *eb* and *esb* (Figs. 2 and 9); however, 4-6 microsetae present distally or laterodistally to *eb* and *esb*. In both sexes, sensillum located between the 10^{th} and 17^{th} teeth. The trichobothrium *ist* slightly closer to *isb* than *est*, or equidistant from them (Figs. 2 and 9).

Fixed chelal finger with 59 (male) or 64 teeth (female). Movable chelal finger with 57 (male) or 60 teeth (female).

Chelal fingers generally as long as the chelal palm and shorter than the pedipalpal femur (Table 1). Pedipalpal femur shorter (male) or slightly longer than carapace (female) (Table 1). Trichobothriotaxy as in Figs. 2 and 9.

Tibia IV, basitarsus IV and telotarsus IV each with a single tactile seta (Figs. 6 and 13). Tactile seta ratios are presented in Table 1.

Remarks. – *Roncus almissaei* n. sp. resembles *R. jarilo* Ćurčić, 1992, from central Serbia (Ćurčić, 1992) in general appearance, but the length of pedipalps is higher in the new species, as are the lengths of chelicerae and leg IV. Furthermore, the two species differ significantly in the number of chelal teeth (46-54 in *jarilo*, vs. 57-64 in *almissae* n. sp.), pedipalpal femur length (0.57-0.775 mm in *jarilo*, vs. 0.815-1.00 mm in *almissae* n. sp.), in the total leg IV length (2.03-2.56 mm in *jarilo* vs. 2.975-3.265 mm in *almissae* n. sp.), length of tibia IV (0.45-0.61 mm in *jarilo*, vs. 0.77-0.855 mm in *almissae* n. sp.), etc.

Based on present knowledge, *R. almissae* n. sp. is known from its type locality only.

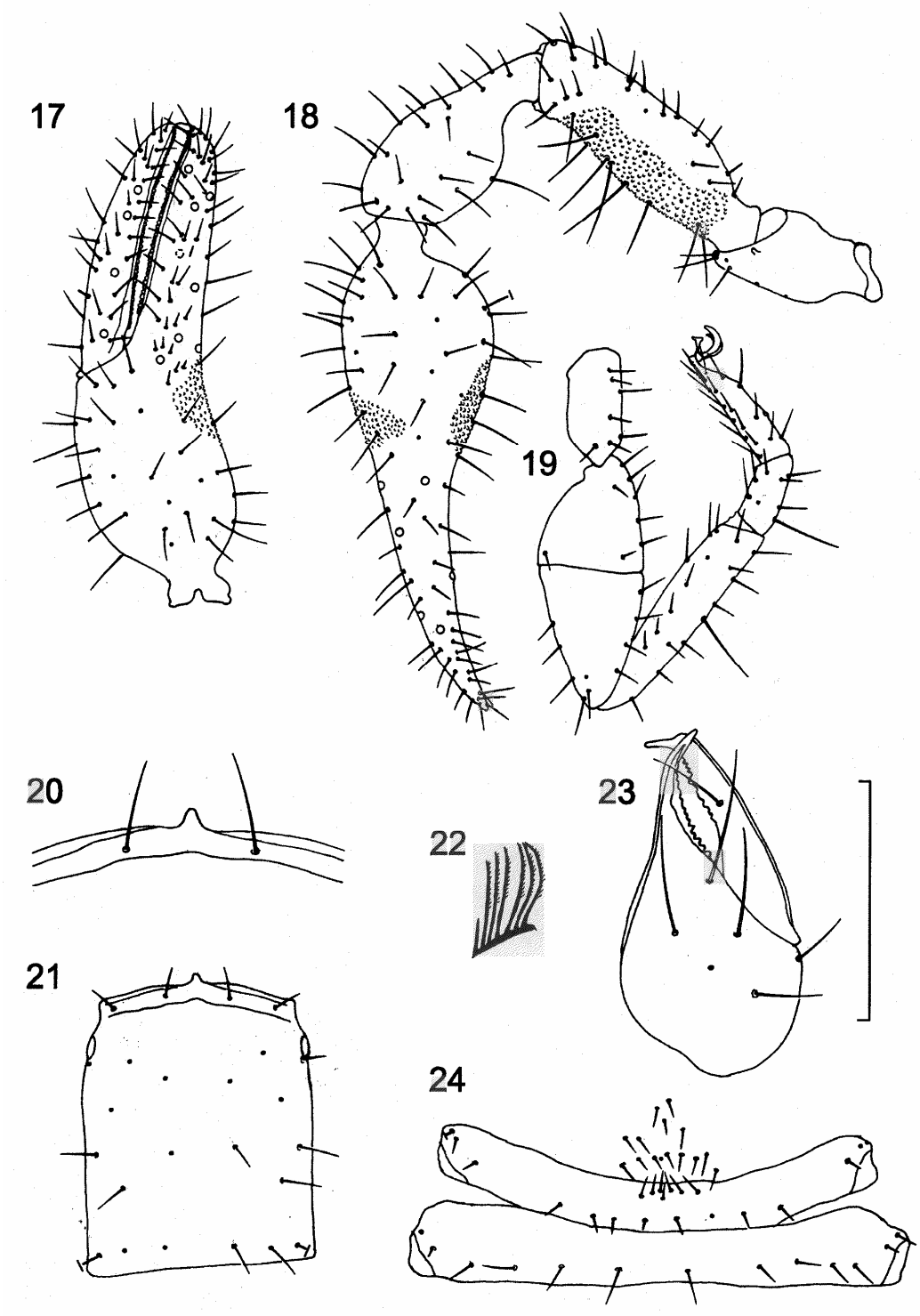
RONCUS KRUPANJENSIS, NEW SPECIES

Type material. – Holotype male and allotype female, from under stones, close to the Kovačevića Pećina Cave, Cerova village, nr. Krupanj, western Serbia, 7 April 2008, no collectors indicated.

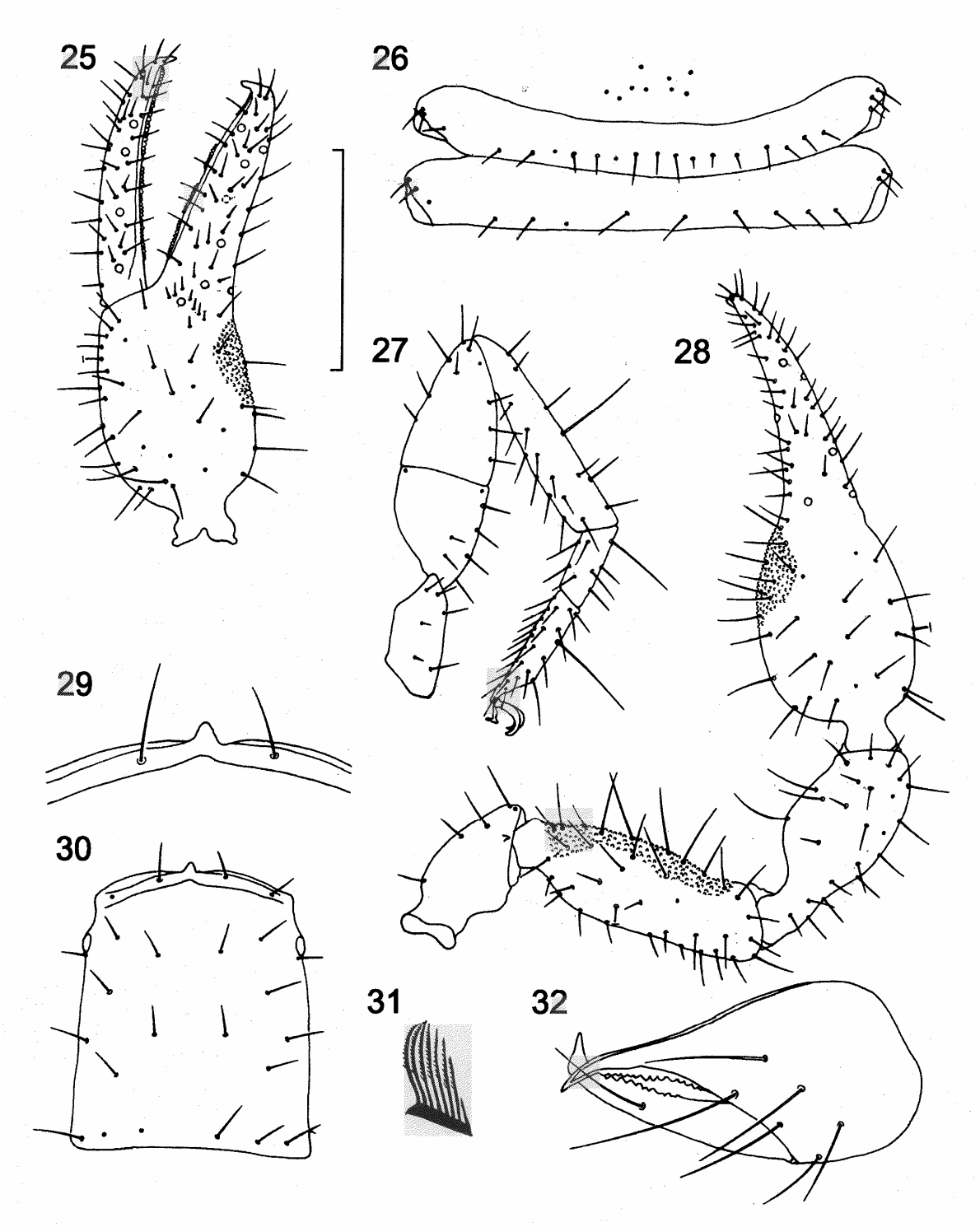
Etymology. – After Krupanj, a town near the type-locality of *R. krupanjensis* n. sp.

Description. – Epistome triangular and apically blunt (Figs. 20, 21, 29 and 30). Two small eyes present (Figs. 21 and 30). Setal formula 4+6+8+6=24 (both in male and female). Carapace longer than broad (Figs. 21 and 30; Table 1). Preocular microsetae not developed (Figs. 21 and 30).

Abdominal tergites I-X smooth, entire, and uniseriate. Number of setae on tergite I (male) (values for female in parentheses): 6 (6), tergite II 9 (8), tergite III 11 (11), tergite IV 11 (11), tergite V 11 (10), tergite VI 11 (11), tergite VII 11 (11), tergite VIII 11 (10), tergite IX 11 (10), and tergite X 10 (9).



Figs. 17-24. *Roncus krupanjensis* n . sp., from Serbia. Holotype male: 17 – pedipalpal chela, 18 – pedipalp, 19 – leg IV, 20 – epistome, 21 – carapace, 22 – epistome, 23 – chelicerae, 24 – male genital area. Scales = 0.50 mm (Figs. 17, 18, 19 and 21) and 0.25 mm (Figs. 20, 22, 23 and 24).



Figs. 25-32. *Roncus krupanjensis* n . sp., from Serbia. Allotype female: 25 – pedipalpal chela, 26 – female genital area, 27 – leg IV, 28 – pedipalp, 29 – epistome, 30 – carapace, 31 – flagellum, 32 – chelicerae. Scales = 0.50 mm (Figs. 25, 27, 28 and 30) and 0.25 mm (Figs. 26, 29, 31 and 32).

Female genital area: sternite II with 8 small, posterior and median setae in the form of an irregular field (or two barely distinguishable groups or patches; Fig. 26). Sternite III with 16 posterior setae and 3 microsetae along each stigma; sternite IV with 9 marginal setae and 2 or 3 microsetae on either side (Fig. 26). Male genital area: sternite II with 18 setae (of these, 11 setae are distributed along the posterior margin and 7 setae are grouped medially. Sternite III with 5 anterior setae, 11 posterior setae, and 2 microsetae along each stigma. Sternite IV with 8 posterior setae and 3 suprastigmal microsetae on either side. Sternites V-X setation male (values for female in parentheses): V 14 (12), VI 14 (13), VII 15 (13), VIII 13 (13), IX 12 (13), and X 12 (10) setae, respectively. Twelfth abdominal segment with two pairs of small setae.

Galea low and rounded (Figs. 23 and 32). Cheliceral palm with 6 setae, movable finger with 1 seta. Cheliceral teeth of unequal form and size (Figs. 23 and 32). Flagellum of 8 blades, pinnate along their anterior margins (Figs. 22 and 30).

Manducatory process with 4 long setae. Pedipalpal articles moderately elongated (Figs. 18 and 28); trochanter with a small exterior tubercle. Pedipalpal femur with distinct interior granulations; chelal palm inconspicuously granulated on its interior and lateral side (Figs. 17, 18, 25 and 28). Pedipalpal tibia smooth. Fixed chelal fingers with 57 (male) and 51 teeth (female), respectively; distal teeth pointed and asymmetrical, followed by small, closely-set and square grouped teeth proximally. Movable chelal finger with 58 (male) and 41 teeth (female); only distal teeth pointed and retroconical, other teeth rounded or square-cusped. Chelal finger only slightly longer than chelal palm (Table 1). Tiny microsetae proximal to *eb* and *esb* (4 or 5) present (Figs. 17 and 25). Four or five microsetae, distal to *eb* and *esb* developed (for abbreviations of setal names, see Beier, 1963). Pedipalpal femur in general longer than carapace (Table 1).

Trichobothriotaxy: *eb*, *esb*, *ib*, and *isb* on finger base; *it*, *et*, and *est* in proximal half of finger; *ist* slightly closer to *est* than to *isb* (or equidistant from these). Seta *sb* only slightly closer to *b* than to *st*, *st* closer to *t* than to *sb*. For trichobothrial pattern, see Figs. 17 and 25.

Tibia IV, basitarsus IV, and telotarsus IV each with a long tactile seta (Figs. 19 and 27; Table 1). For morphometric ratios and linear measurements, see Table 1.

Distribution. – Western Serbia, epigean, under stones, and in humus and leaf-litter. Probably endemic to Serbia and the Balkan Peninsula.

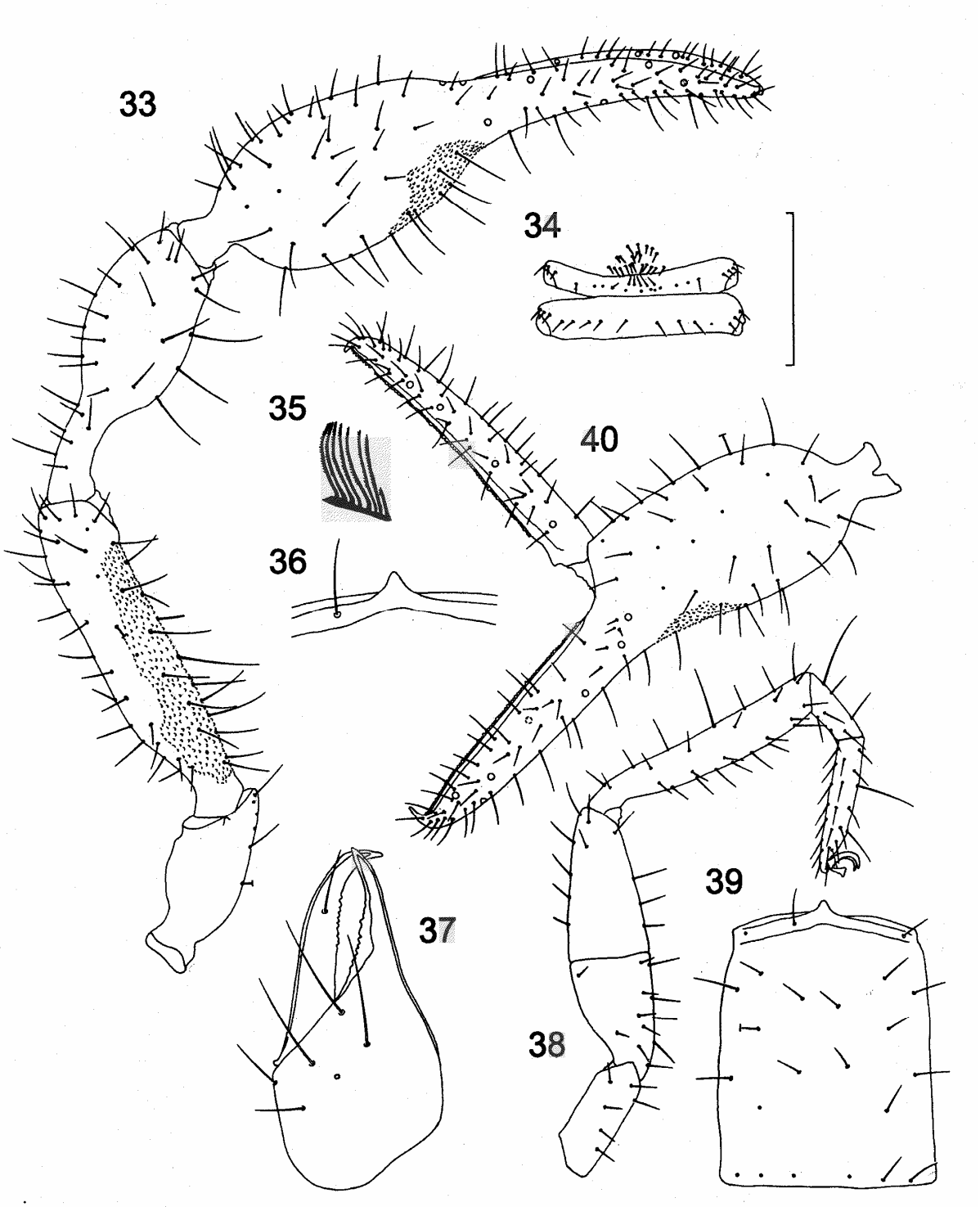
Remarks. – The present species is distinct from the phenetically close congener *R. tintilin* Ćurčić, 1993, in many important respects: body size (2.28 mm in the male of *R. krupanjensis* n . sp. vs. 2.84-3.58 mm in *R. tintilin*), in the pedipalpal length (3.37-3.85 mm in *krupanjensis* vs. 3.97-4.57 mm in *R. tintilin*), in the form of the epistome (apically blunt in *krupanjensis* vs. triangular i *tintilin*), in the form of the pedipalpal articles, in the cheliceral dentition, and the presence (in *krupanjensis*) vs. absence of small setae proximal to *eb* and *esb* (in *tintilin*).

RONCUS RADJI, NEW SPECIES

Material. – Holotype male, and paratype male, from the Lukića Pećina Cave, Stevanovići, Lipenović village, nr. Krupanj, western Serbia, 7 April 2008 and 24 October 2008, unknown collectors.

Etymology. – The town of Krupanj is the center of the Radjevina region, which was named after Radj, a great knight of Prince Lazar, who defended it from Hungarian and Ottoman conquerors. The new species is therefore named after this nobleman.

Description. – Epistome triangular and apically rounded (Figs. 36 and 39). Neither eyes nor eyespots developed (Fig. 39). Setal formulae: 4+6+8+4+22 and 3+6+8+6=23 (male). The basic pattern is probably 4+6+8+4=22 setae. Preocular microsetae not present (Fig. 39).



Figs. 33-40. *Roncus radji* n . sp., from Serbia. Holotype male: 33 – pedipalp, 34 – male genital area, 35 – flagellum, 36 – epistome, 37 – chelicerae, 38 – leg IV, 39 – carapace, 40 – pedipalpal chela. Scales = 0.50 mm (Figs. 33, 34, 38, 39 and 40) and 0.25 mm (Figs. 35, 36 and 37).

Abdominal tergites I-X smooth, uniseriate and entire. Number of setae on tergite I (males): 6, tergite II 7, tergite III 9-10, tergite IV 10, tergite V 10, tergite VI 10-11, tergite VII 10, tergite VIII 11, tergite IX 10-11, and tergite X 9.

Male genital area: sternite II with 20-21 setae in the form of an irregular patch; sternite III with 5 or 8 anterior and 11 or 12 posterior setae and 3 or 4 suprastigmatic microsetae along each of the stigma; sternite IV with 9 or 10 posterior setae and 3 small setae on either side. Female genital area: unknown. Sternites V-X setation: V – 13 or 14, VI – 13, VII – 13, VIII – 12 or 13, IX – 12 or 13, and X – 10 or 11. Twelfth abdominal segment with two pairs of small setae.

Cheliceral spinneret low and rounded (Fig. 37). Cheliceral palm with 6 setae, movable finger with 1 seta. Cheliceral teeth of unequal form and size (Fig. 37). Flagellum of 8 anteriorly pinnate blades (Fig. 35).

Manducatory process with 4 long setae. Pedipalpal articles elongate (Fig. 33); trochanter with one or two small exterior tubercles. Pedipalpal femur with distinct granulations: chelal palm granulated intero-laterally, pedipalpal tibia smooth (Fig. 33).

Fixed chelal finger with 79-81 teeth; distal teeth pointed and asymmetrical, followed by small, closely-set, and square-tapped or rounded teeth proximally. Movable chelal finger with 72-77 teeth; only distal teeth pointed and retroconical, other teeth square-cusped or rounded. Chelal fingers longer than chelal palm and considerably longer than carapace (Table 1).

Tiny microsetae proximal to *eb* and *esb* absent; chelal palm with 4 microsetae distal to these trichobothria (Fig. 40).

Trichobothriotaxy: *eb*, *esb*, *ib*, and *isb* on finger base, *it*, *et*, and *est* on proximal finger half; *ist* slightly closer to *isb* than to *est*. Seta *sb* equidistant from *b* and *st*, respectively, seta *st* closer to *b* than to *sb*, respectively. For trichobothrial ratios and linear measurements, see Fig. 40 and Table 1.

Leg: tibia, basitarsus and telotarsus each with a single tactile seta (Fig. 38). For morphometric ratios and linear measurements, see Table 1.

Distribution. –Western Serbia, cave-dwelling. Probably an endemic and relict species.

Remarks. – *R. radji* n. sp. is easily distinguished from *R. trojan* Ćurčić, 1993 (its phenetically most similar species), from southeastern Serbia, by the (male) body size (3.395-3.74 mm vs. 2.415-3.07), by the number of setae on sternite II (20-21 vs. 12-13), by the presence/absence of microsetae proximal to *eb* and *esb* (absent vs. present), by the number of teeth on the fixed (79-81 vs. 51-63) and movable chelal fingers (72-77 vs. 56-63), by the pedipalpal femurs length-to-breadth ratio (4.52-5.54 vs. 3.27-3.55), by the pedipalpal chela length-to-breadth ratio (4.125-4.285 vs. 3.27-3.705), etc.

The discovery of the described representatives of *Roncus* in Serbia (and Dalmatia) supports the fact that the taxonomy of this genus is still far from being complete (Ćurčić, 1991, 1992a, 1992b; Ćurčić, et al., 1992a, 2004). The variety of cave-dwelling species of *Roncus* described elsewhere by Ćurčić (1984, 1991) and by Ćurčić et al. (1981, 1988, 2004), offers further proof that this genus is presently subjected to intensive radiation or divergent differentiation into new species. Furthermore, the diversity of *Roncus* representatives in the Balkan regions bordering on Serbia (Ćurčić, 1984; Ćurčić and Beron, 1981; Ćurčić et al., 2004) compared to the same feature in other areas, points to the Balkan Peninsula as a center of origin and genesis of numerous forms of the genus. In addition, the occurrence of numerous *Roncus* species with extremely limited distribution areas demonstrates their endemic nature.

NOTE

With regard to a single diagnostic characteristic (presence/absence of microsetae proximal to *eb* and *esb*), it should be noted that this feature is present in *R. krupanjensis* n. sp. (as well as *R. pannonius* Ćurčić, Dimitrijevic and Karamata, 1992 in *R. trojan* Ćurčić, 1993, and in *R. lubricus* L. Koch, 1873. However, these

microsetae are missing in other epigean and cave species of the genus which inhabit the Balkan Peninsula (*R. onaemi* n. sp., *R. radjai* n. sp., *R. parablothroides* Hadži, 1937, etc). Therefore, it is possible that the presence or absence of this characteristic could be useful in distinguishing representatives of two species groups, which we have described as the „*Roncus lubricus*" (microsetae present) and „*Roncus parablothroides*" (microsetae absent), respectively. It seems that both groups are widespread in Europe (Ćurčić, 1992, 1992b); however, their precise taxonomic and biogeographic features are insufficiently known. Therefore, this problem remains one of the main goals for future research.

Acknowledgement – Support for fieldwork was received from the Serbian Ministry of Science and Technologies (Grant # 143053).

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