

On Two New Genera of Pseudoscorpions (Pseudoscorpiones: Chthoniidae) from the Northern Mediterranean

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Abstract: Pseudoscorpions, assigned to the new genera, *Neobalkanella* n. gen. and *Bituberoruncus* n. gen., which are distributed in the northeastern and northwestern Mediterranean, are described, along with an undetermined species of *Bituberoruncus*. Proofs for the existence of two new genera and a previously unknown species are presented. Ecological and available zoogeographic information on the taxa is given in brief. The presence of a new genus, *Neobalkanella* n. gen., previously reported from the Balkan Peninsula under the name of *Tyrannochthonius* Chamberlin, is confirmed, and the occurrence of another new genus and species, previously unknown from the Maritime Alps in France is proved. Illustrations, morphometric ratios and linear measurements of all new taxa are provided.

Key words: Pseudoscorpiones, Chthoniidae, Neobisiidae, *Neobalkanella* n. gen., *Bituberoruncus* n. gen., *Bituberoruncus nobilissimus* n. sp., endemism, Serbia, France, northern Mediterranean

Introduction

The Mediterranean is the most familiar and possibly best-known species inventory among the seas of the world. One indeed has the feeling that the high number of presumed endemics is not an objective fact, but rather a consequence of the intensive study of Mediterranean fauna undertaken since the XIX century (e.g. ČURČIĆ 1988, 1990, 2008; ČURČIĆ *et al.*, 2004, 2010a, b, c, d, e, f; 2011a, b, c, d, e, f; 2012a, b, c; 2013a, b; HADŽI, 1937).

Paleoendemics are taxa of a tropical stock, left behind from the Mesozoic or early Cenozoic Tethys and survived in isolation after the ancient distributional continuum was disrupted. They are *in situ* survivors of the Messinian Crisis and of the warm Pliocene Paleo-Mediterranean. The complete and long-lasting allopatry resulted in evident cases of species- and genus-level endemism.

DOV POR and DIMENTMAN (2006) considered a concept of “faunal elements” which circumscribed

“refugia” or “centers”. The present biogeographic patterns are defined by the high glacial periods in which the different faunal elements were confined in warmer climate refugia around the Mediterranean. These refugia served as centers of speciation, from where the specific faunal elements repeatedly spread-out during the interglacials. Dov Por and Dimentman’s zoogeographic analysis, especially this of the Palearctic and Mediterranean areas, is clearly based on extrapolations that result from the analysis of the distributional patterns of some arthropods.

In brief, Dov Por and Dimentman mentioned three main centers in the Mediterranean with their respective faunal elements: (1) the *Atlantomediterranean* fauna center of Spain, including re-colonized western Africa and southern England; (2) the *Adriatomediterranean* fauna centered in Italy that colonized central Europe; and (3) the *Pontomediterranean* fauna center in Anatolia and

the Balkans that colonized eastern Europe. There is also a *Mauretanian* center, located in North Africa and High Atlas in the middle and a *Syrian* center in the east, with faunal elements specific to the Fertile Crescent and eastern Anatolia. They also include the Atlantic islands of Macaronesia as a sixth, mainly relic, non-expansive center.

On the Balkan Peninsula, a new relic genus of pseudoscorpions has been recently discovered, while another new taxon at the generic level was found in the western Mediterranean (Map 1). These forms are *Neobalkanella psoglavi* (Ćurčić) that inhabits a cave in Serbia, and *Bituberoronus nobilissimus* n. gen., n. sp. that lives in leaf litter in the Maritime Alps, France. Both arachnids have been dissected, described, measured and properly diagnosed.

Setal designations follow BEIER (1963).

Systematic Part

Chthoniidae Daday, 1888

Neobalkanellini Ćurčić, new tribe

Synonym: *Troglochthoniini* Chamberlin, 1962 (Part.) (*Sensu* Judson, 2007)

Diagnosis – Chthoniinae with four eyes; no chemosensory setae extending along the dorsum of the chelal palm (Figs. 2 and 7); only coxae II each with 8-10 coxal spines, distal (middle) spines longest, spines robust, terminally incised and clavate; cheliceral spinneret absent or an extremely low tubercle (Figs. 3 and 6); trichobothria *ib* and *isb* slightly distad of the middle of the chelal palm (Figs. 2 and 7); sensilla of movable chelal finger absent; male genital opening V-shaped; body color: yellow-ochre; epistome quadrangular, terminally with numerous points (Figs. 1 and 5); a distinct carapacial suture anterior to posterior setal row (Figs. 1 and 5); trichobothria *eb* and *esb* at the same level; pedipalpal chelal palm ovate (dorsal view) and almost straight (dorsolaterally) or convex (ventrolaterally) (Figs. 2 and 7); carapace broader than longer; abdominal tergites I-IV with four setae each (Fig. 4), tergites V-X with six setae each; tactile seta of basitarsus IV on the middle of this podomere (Fig. 8), with no thick seta(e) on the median side of the chelal hand at the base of the fixed chelal finger (Figs. 2 and 7); intercoxal tubercle absent; flagellum 11-bladed, a few pinnules developed on each blade (of chthoniid facies); fixed and movable chelal fingers homodentate (Figs. 2 and 7).

Trichobothriotaxy as in Figs. 2, 7, and 8.

Type genus: *Neobalkanella* Ćurčić, new genus.

Other included genera: None.

Neobalkanella Ćurčić, New Genus

Synonym: *Tyrannochthonius* Chamberlin, 1929 (Part.)

Etymology – After Stara Planina Mts., its *terra typica*.

Diagnosis – Chthoniinae with four eyes or eyespots (Figs. 1 and 5); no chemosensory setae extending along the dorsum of the chelal palm (Figs. 2 and 7); only coxae II each with 8-10 coxal spines, terminally incised and clavate; cheliceral spinneret absent (Figs. 3 and 6); trichobothria *ib* and *isb* distad of the middle of the chelal palm; sensilla of movable chelal finger absent (Figs. 2 and 7); male genital opening V-shaped; epistome quadrangular, wider than longer, terminally with points (Figs. 1 and 5); a distinct carapacial groove anterior to posterior setal row (Figs. 1 and 5); trichobothria *eb* and *esb* at the same level; pedipalpal chela straight dorsally and convex ventrally; abdominal tergites I-IV (Fig. 4) with four setae each (two on each tergite side), tergites V-X with six setae along each tergite; basitarsus IV tactile seta on the middle of this podomere (Fig. 8); no thick setae on the median side of the chelal hand at the base of the fixed chelal finger (Fig. 2 and 7); intercoxal tubercle absent; flagellum 11-bladed, few pinnules developed distally on each blade (of chthoniid facies).

Type species: *Neobalkanella psoglavi* (Ćurčić, 1990).

Other species included: None.

Neobalkanella Psoglavi (Ćurčić, 1990), N. Comb.

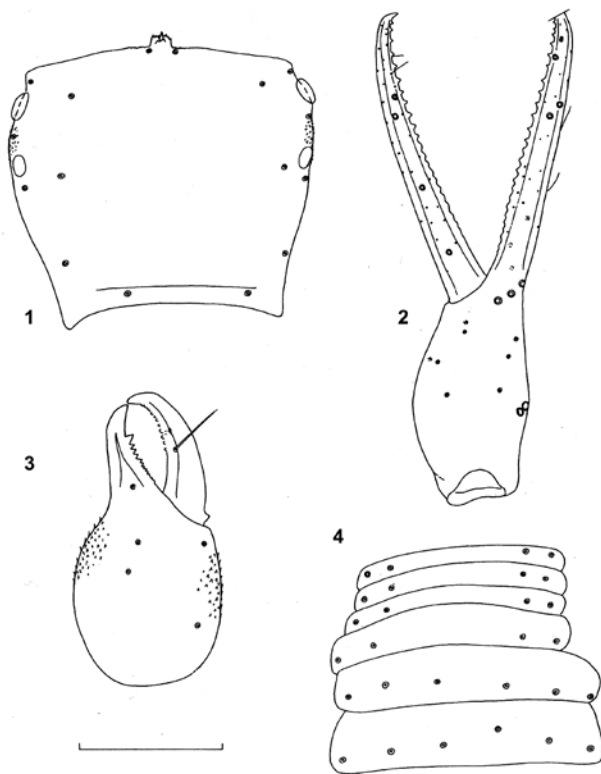
Synonyms: *Tyrannochthonius Psoglavi* Ćurčić, 1990:2

Tyrannochthonius Psoglavi Judson, 2007:58

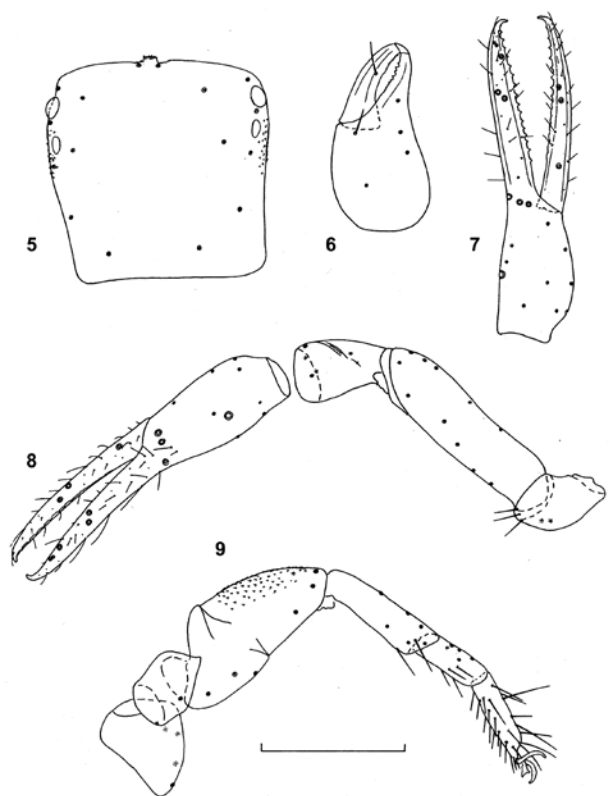
In 1979, the author of this study had the opportunity to collect a number of pseudoscorpions from Manastirska Pećina Cave I, v. Selačka, near Minićevo, eastern Serbia, which belong to the slopes of Stara Planina Mts. (ĆURČIĆ, 1990). Taxonomically, these specimens belonged to a new species that was provisionally placed in the genus *Tyrannochthonius* Chamberlin (ĆURČIĆ, 1990; JUDSON, 2007).

A precise description, illustrations and diagnostic remarks of *B. psoglavi* were then presented by ĆURČIĆ (1990).

Later, a reexamination of the type specimens of “*T.*” *psoglavi* yielded clear boundaries between the new species and other *Tyrannochthonius* (*sensu* Harvey, 1990; Judson, 2007) species, and revealed clear distinctions between species previously assigned to *Tyrannochthonius* from the Mediterranean area *sensu lato*. Since “*Tyrannochthonius*” comprises members of different origin, genesis and taxonomic status, it inevitably represents a heterogeneous genus. Therefore, it is necessary to confirm the taxonomic status of all the other species included in “*Tyrannochthonius*” and to verify their taxonomic



Figs. 1-4. *Neobalkanella psoglavi* (Ćurčić), holotype female from eastern Serbia; 1 – carapace, 2 – pedipalpal chela, 3 – chelicera, 4 – tergites I – IV. Without scale line.



Figs. 5-9. *Neobalkanella psoglavi* (Ćurčić), paratype tritonymph from eastern Serbia; 5 – carapace, 6 – chelicera, 7 – pedipalpal chela, 8 – pedipalp, 9 – leg IV. Without scale line.



Map 1. The distribution of *Neobalkanella psoglavi* (Ćurčić), and *Bituberoronus nobilissimus* n. gen., n. sp., in the Northern Mediterranean.

relationships. It is clear (Chamberlin, 1925, 1929, 1930, 1931, 1962; Harvey, 1990; Helversen, 1968; Hoff, 1959; Mahnert, 1974, 1979, 1986; Malcolm and Muchmore, 1985; Moyle, 1989; Muchmore, 1973, 1977, 1983, 1984, 1991, 1992, 1996) that a great number of so-called “genus *Tyrannochthonius*” species actually belong to a number of other, either known

or still undescribed species, genera or even tribes.

Neobisiidae Chamberlin, 1930

***Bituberoronus* Ćurčić, New Genus**

Etymology – The generic name is derived from two types of tubercles (smaller and larger) on the pedipalpal articles.

Material examined – A holotype female, two paratype tritonymphs and two paratype deutonymphs from leaf litter near the Pont de Demoiselles in the Maritime Alps, southeastern France close to the border with Monaco, 19 May 2010, collected by J.-M. Lemaire.

Diagnosis – Neobisiinae with two eyes (Figs. 1 and 5), cheliceral spinneret a low tubercle (Figs. 3 and 6). Epistome small, apically rounded or slightly triangular (Figs. 1 and 5). Four setae at the anterior carapacial margin; no preocular microsetae present. The anterior setae are followed by eight median, six intermedian and six posterior setae. Carapacial setae are smooth and acuminate. The holotype tergites (Fig. 4) and sternites each with a row of posterior setae. Tergites I – X with 6 – 8 – 10 – 11 – 10 – 11 – 9 – 11 – 11 – 9 setae, sternites II – X with 12 – 15 – 10 – 12 – 14 – 13 – 13 – 15 – 12 setae. Sternites III and IV each with three small suprastigmatic setae. Anal papilla with two pairs of small setae. Pleural membranes weakly granulated and longitudinally wrinkled. Pedipalpal articles (Figs. 2, 7, and 8) with two types of granulations (smaller on the pedipalpal chela and femur, and larger on the pedipalpal chela, tibia, and femur).

***Bituberoronus Nobilissimus* Ćurčić, New Species**

(Figs. 10-31, Table 1)

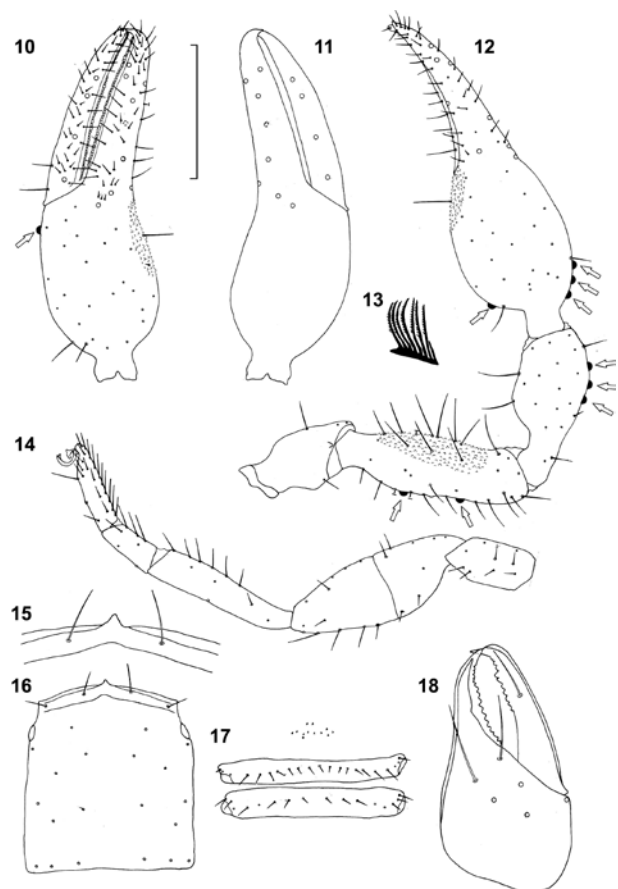
Etymology – The specific name comes from the Principality of Monaco.

Material examined – A holotype female, two paratype tritonymphs and two paratype deutonymphs from leaf litter near the Pont de Demoiselles in the Maritime Alps, southeastern France close to the border with Monaco, 19 May 2010, collected by J.-M. Lemaire.

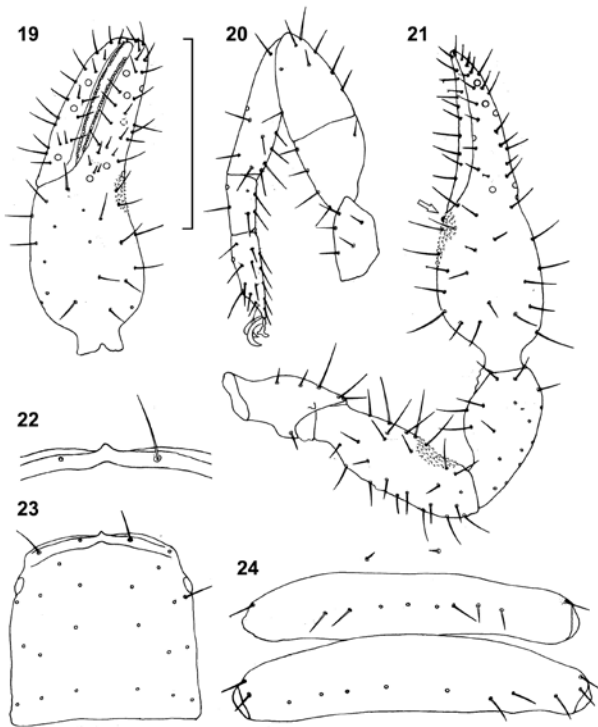
Diagnosis – **Female:** Carapace longer than broad (Fig. 16, Table 1). Anterior carapacial margin slightly convex; epistome small and triangular (Fig. 16). A pair of eyes present (Fig. 16). Carapace reticulate throughout. Setal carapacial formula: 4 + 6 + 2 + 6 + 6 = 24. No preocular setae are developed (Fig. 6). Abdominal tergites I – X and sternites III – X smooth, entire and uniseriate. Tergal setation: 6 – 8 – 10 – 11 – 10 – 11 – 9 – 11 – 11 – 9. Female genital area (Fig. 17): sternite II with 12 short and small setae, sternite III with 15 posterior setae and 3 suprastigmatic microsetae along each of the stigma, sternite IV with 10 posterior setae and 3 small suprastigmatic microsetae along each stigma (Fig. 17). Sternites V – X with 12 – 14 – 13 – 13 – 15 – 12 setae. Anal papilla with two pairs of small setae. Pleural membranes granulostrate. Male genital area: unknown.

Galea as a single conspicuous elevation on the movable finger margin (Fig. 18). Cheliceral palm with six setae, movable finger with one seta; galeal seta inserted basal to the largest tooth of the movable finger (Fig. 18). Fixed cheliceral finger with 15 close-set teeth, movable cheliceral finger with 11 distal teeth (proximal part of the blade tooth; Fig. 18). Flagellum of eight blades; seven pinnate distal blades of almost equal size and one small and smooth blade proximally (Fig. 13).

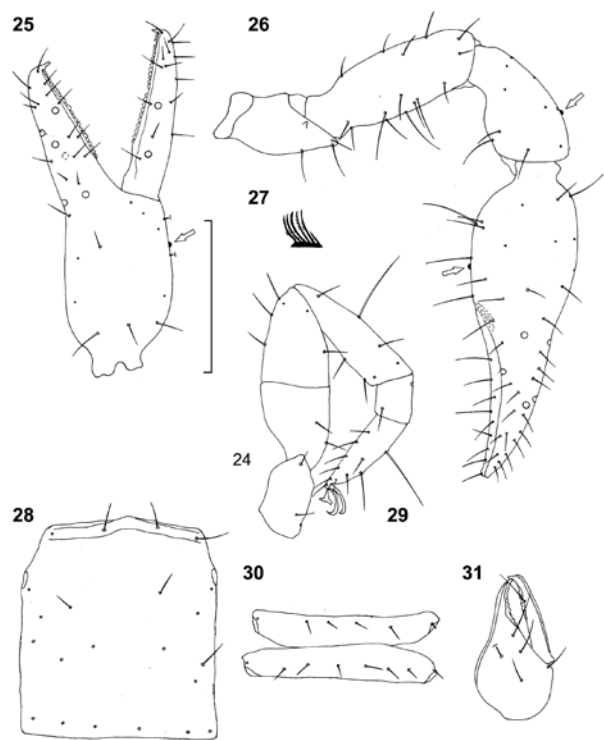
Manducatory process (apex of pedipalpal coxa) with three long and acuminate setae. Pedipalpal trochanter with a small tubercle (Fig. 12). Pedipalpal femur and chelal palm granulated interiorly and laterally (Fig. 12); femur, tibia and chelal palm with some additional, slightly larger tubercles, distributed irregularly over these podomeres (Fig. 12). Pedipalpal femur with a single exterior and lateral tubercle (Fig. 12). Chelal palm ovate (dorsal view), chelal fingers straight (lateral view). Fixed chelal finger with 52 or



Figs. 10-18. *Bituberoronus nobilissimus* n. gen., n. sp., holotype female from southeast France; 10 – pedipalpal chela, 11 – pedipalpal chela, 12 – pedipalp, 13 – flagellum, 14 – leg IV, 15 – epistome, 16 – carapace, 17 – female genital area, 18 – chelicera. Scale lines = 0.50 mm (Figs. 10-12, 14, 16, and 17) and 0.25 mm (Figs. 13, 15 and 18).



Figs. 19-24. *Bituberoroncus nobilissimus* n. gen., n. sp., paratype tritonymph from southeast France; 19 – pedipalpal chela, 20 – leg IV, 21 – pedipalp, 22 – epistome, 23 – carapace, 24 – sternites II – IV. Scale lines = 0.50 mm (Figs. 19-21, and 23) and 0.25 (Figs. 22 and 24).



Figs. 25-31. *Bituberoroncus nobilissimus* n. gen., n. sp., paratype deutonymph from southeast France; 25 – pedipalpal chela, 26 – pedipalp, 27 – flagellum, 28 – carapace, 29 – leg IV, 30 – sternites III and IV, 31 – chelicera. Scale lines = 0.50 mm (Figs. 25-27, 29, and 31) and 0.25 mm (Figs. 27, 28, and 31).

53 small teeth, movable chelal finger with 62 or 65 small and close-set teeth (Fig. 10). Chelal finger is slightly longer than chelal palm: pedipalpal femur longer than chelal finger (Table 1).

Trichobothriotaxy as in Fig. 10. Left pedipalpal chela with an additional supernumerary trichobothrium in the distal part of the fixed finger.

Coxa I: anterior and median rim with few chitinous points. Trochanteral foramen small. Pedal tactile setae: tibia IV, basitarsus IV, and telotarsus IV each with a single tactile seta (Fig. 14). Subterminal tarsal setae furcated, each branch with a few spinules.

Morphometric ratios and measurements as in Table 1.

Tritonymph: Cephalothoracic plate longer than broad (Fig. 23, Table 1). Carapace slightly convex anteriorly (Fig. 23), epistome small, triangular and apically blunt (Fig. 22). A single eye is carried on each carapacial side (Fig. 23). Preocular microsetae absent. Setal carapacial formula: $4 + 8 + 6 + 6 = 24$ and $4 + 6 + 6 + 6 = 22$. Carapace reticulate throughout.

Abdominal tergites I – X and sternites II – X entire, uniseriate and smooth. Tergal setation: 6 – 7 – 9 – 10 – 12 – 11 – 11 – 11 – 10 – 9 and 6 – 7 – 7 – 9 – 10 – 11 – 10 – 11 – 10 – 9. Sternite II with two

centrally and posteriorly located setae (Fig. 24), sternites III and IV each with eight posterior setae and one or two suprastigmal microsetae on either side (Fig. 24); sternites V – X with 12 – 11 – 13 – 13 – 13 – 12 and 12 – 12 – 13 – 12 – 12 – 11 setae. Anal papilla with two pairs of small setae. Pleural membrane granulostriate.

Cheliceral galea as an inconspicuous elevation of the movable finger margin. Cheliceral palm with five or six setae, movable finger with a single seta. Galeal seta inserted slightly basal to the larger teeth on the movable chelal finger. Fixed cheliceral finger with 10 or 11 close-set, apically rounded and irregularly sized teeth: movable cheliceral finger with five or seven small, rounded and apically blunt teeth. Flagellum of six pinnate blades of almost equal size and an additional seventh, smaller and smooth blade proximally.

Apex of pedipalpal coxa (manducatory process) with three long and acuminate setae. Pedipalpal trochanter with a small tubercle (Fig. 21). Chelal palm (Fig. 19) slenderly ovate (dorsal view), chelal fingers straight (lateral view).

Pedipalpal femur and chelal palm granulated interiorly and laterally (Fig. 21); femur, tibia and

Table 1. Linear measurements (in millimeters) and morphometric ratios in *Bituberoronus nobilissimus* n. gen., n. sp. from southeastern France. Abbreviations: F = female, TR = tritonymphs, DE = deutonymphs.

Character	B. nobilissimus		
	F	TR	DE
Body			
Length (1)	3.47	2.20 – 2.40	1.60 – 1.72
Cephalothorax			
Length (2)	0.70	0.51 – 0.54	0.37 – 0.39
Breadth (2a)	0.60	0.43	0.33 – 0.34
Ratio 2/2a	1.17	1.19 – 1.26	1.12 – 1.15
Abdomen			
Length	2.77	1.69 – 1.86	1.23 – 1.33
Chelicerae			
Length (3)	0.42	0.315 – 0.35	0.21 – 0.22
Breadth (4)	0.24	0.16 – 0.18	0.12
Length of movable finger (5)	0.33	0.20 – 0.21	0.15
Ratio 3/5	1.27	1.575 – 1.67	1.40 – 1.47
Ratio 3/4	1.75	1.94 – 1.97	1.75 – 1.83
Pedipalps			
Length with coxa (6)	3.68	2.41 – 2.62	1.545
Ratio 6/1	1.06	1.09 – 1.095	0.90 – 0.965
Length of coxa	0.57	0.42 – 0.44	0.26 – 0.275
Length of trochanter	0.45	0.305 – 0.33	0.19 – 0.20
Length of femur (7)	0.75	0.50 – 0.53	0.315 – 0.33
Breadth of femur (8)	0.22	0.15 – 0.16	0.11
Ratio 7/8	3.41	3.31 – 3.33	2.86 – 3.00
Ratio 7/2	1.07	0.98	0.81 – 0.89
Length of patella (tibia) (9)	0.60	0.38 – 0.41	0.22 – 0.23
Breadth of patella (tibia) (10)	0.26	0.18 – 0.19	0.12 – 0.13
Ratio 9/10	2.31	2.11 – 2.16	1.77 – 1.83
Length of chela (11)	1.31	0.805 – 0.91	0.535
Breadth of chela (12)	0.41	0.26 – 0.285	0.17 – 0.18
Ratio 11/12	3.195	3.10 – 3.19	2.97 – 3.15
Length of chelal palm (13)	0.62	0.39 – 0.44	0.275
Ratio 13/12	1.51	1.50 – 1.54	1.53 – 1.62
Length of chelal finger (14)	0.69	0.42 – 0.47	0.26
Ratio 14/13	1.11	1.07 – 1.08	0.945
Leg IV			
Total length	2.59	1.66 – 1.73	1.135 – 1.45
Length of coxa	0.39	0.20 – 0.22	0.18
Length of trochanter (15)	0.38	0.20 – 0.23	0.14 – 0.15
Breadth of trochanter (16)	0.14	0.11 – 0.12	0.08
Ratio 15/16	2.71	1.82 – 1.92	1.75 – 1.875
Length of femur + patella (17)	0.71	0.47 – 0.50	0.295 – 0.305
Breadth of femur + patella (18)	0.22	0.17 – 0.18	0.11 – 0.12
Ratio 17/18	3.23	2.76 – 2.78	2.54 – 2.68
Length of tibia (19)	0.56	0.39 – 0.41	0.23 – 0.24
Breadth of tibia (20)	0.12	0.09	0.07
Ratio 19/20	4.67	4.33 – 4.555	3.285 – 3.43
Length of metatarsus (21)	0.21	0.15	0.11
Breadth of metatarsus (22)	0.09	0.07	0.05
Ratio 21/22	2.33	2.14	2.20
Length of tarsus (23)	0.34	0.23 – 0.24	0.17
Breadth of tarsus (24)	0.08	0.07	0.05
Ratio 23/24	4.25	3.285 – 3.43	3.40
TS ratio – tibia IV	0.53	0.525 – 0.53	0.50 – 0.52
TS ratio – metatarsus IV	0.24	0.20	0.27
TS ratio – tarsus IV	0.33	0.54 – 0.565	0.29

chelal palm with some additional slightly greater and dispersed tubercles, distributed irregularly over these podomeres (Fig. 21). Pedipalpal femur with a tiny exterior and lateral tubercle. Fixed chelal finger with 40-45 close-set and small teeth, movable chelal finger with 45-49 teeth similar to those on the fixed finger. Chelal finger is only slightly longer than chelal palm: pedipalpal femur longer than chelal finger (Table 1).

Trichobothriotaxy as in Figs. 19 and 21.

Coxa I: anterior and median rim with few chitinous points. Trochanteral foramen small. Pedal tactile setae: tibia IV, basitarsus IV and telotarsus IV each with a single tactile seta (Fig. 20). Subterminal tarsal setae furcated, each branch with a few spinules.

Morphometric ratios and measurements as in Table 1.

Deutonymph: Cephalothorax slightly longer than broad (Fig. 28, Table 1). Carapace slightly convex anteriorly (Fig. 28). Epistome small and apically blunt (Fig. 28). A single eye is carried on each carapacial side. Preocular microsetae absent. Setal carapacial formulae: $4 + 6 + 6 + 6 = 22$ and $4 + 8 + 6 + 6 = 24$ setae. Carapace reticulate throughout.

Abdominal tergites I – X and sternites III – X entire, uniseriate and smooth. Tergal setation 6 – 6 – 7 – 7 – 6 – 7 – 7 – 7 – 6 – 6 and 6 – 6 – 7 – 7 – 7 – 7 – 7 – 6 – 7 – 6 setae. Sternite III with no setae (Fig. 30), sternites III – X with 4 – 6 – 8 – 8 – 8 – 8 – 9 – 8 and 4 – 6 – 8 – 8 – 8 – 8 – 8 – 8 setae. Sternites

III and IV with a single suprastigmal microsetae on either side (Fig. 30). Anal papilla with two pairs of small setae. Pleural membranes granulostriate.

Cheliceral galea as an inconspicuous elevation of the movable finger margin (Fig. 31). Cheliceral palm with five or six setae, movable finger with one seta (Fig. 31). Galeal seta inserted slightly basal to the larger tooth on the movable chelal finger. Flagellum of six or eight blades of almost equal size (Fig. 27).

Apex of pedipalpal coxa (manducatory process) with two or three long and acuminate setae. Pedipalpal trochanter with a tiny tubercle (Fig. 26). Chelal palm ovate, chelal fingers straight (Fig. 25). Pedipalpal chelal palm with tiny tubercles (Fig. 25), larger tubercles on pedipalpal podomeres absent (Fig. 26). Fixed chelal finger with 26 to 28 close-set and small teeth, movable chelal finger with 29 to 32 such teeth.

Trichobothriotaxy as in Figs. 25 and 26.

Coxa I: anterior and median rim with few chitinous points. Trochanteral foramen small. Pedal tactile setae: tarsus IV, basitarsus IV and telotarsus IV each with a single seta (Fig. 29). Subterminal tarsal setae furcate, each branch with a few spinules.

Morphometric ratios and measurements as in Table 1.

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