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The scorpions of Yunnan (China): updated identification key, new record and redescriptions of *Euscorpiops kubani* and *E. shidian* (Arachnida, Scorpiones)

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Abstract

We present an identification key to the scorpion species of Yunnan (China) with notes on the distribution and ecology. *Euscorpiops kubani* is recorded for the first time for China. The redescriptions of *Euscorpiops shidian* and *E. kubani* are provided. The number of known scorpion species from Yunnan is raised to nine.

Keywords

Buthidae, Euscorpiidae, new record, taxonomy, redescriptions, Yunnan, China

Introduction

Yunnan province located in the junction of world's two major biodiversity hotspots (21°8'32"–29°15'8"N, 97°31'39"–106°11'47"E), is the transition area from the high altitudes of Qinghai-Tibet plateau to low altitude peninsular Malaysia. Almost all of the terrestrial ecosystems can be found in Yunnan, including forests, shrubs, meadows, swamps and deserts (Chen et al. 2010). Because of the complex and varied terrains and landforms, the different areas can be divided into seven zones according to different climate types: North tropics, South Subtropical, Central Subtropical, North Subtropical, South Temperate, Central Temperate and Plateau climate zones.

The terrestrial diversity in Yunnan can meet the specific habitats demand of different species (Dong and Guo 2008). The scorpion biodiversity of the Yunnan is enormous compared to other provinces of China. Researchers erected six new species from the 1990s (Kovařík 1994, 2000; Qi et al. 2005; Di et al. 2010a, 2010b). The genus *Euscorpiops* Vachon, 1980 with its preference to humid habitats reaches its northern distribution limit in Yunnan, and the distribution of some species is restricted to this area.

There are nine species, belonging to two families: Buthidae: *Lychas* C.L. Koch, 1845, Euscorpiidae: *Euscorpiops* and *Scorpiops* Peters, 1861 have been recorded for this area. With seven species of *Euscorpiops* occur in Yunnan province more than a third of the total known species of this genus in the world (7/19); all them with similar coloration, morphology and close distribution.

Material and methods

Illustrations and measurements were produced using a Motic K-700L stereomicroscope with a drawing device and an ocular micrometer. The photos were taken with an Olympus C7070 camera. Measurements follow Sissom (1990), and are given in mm. Trichobothrial notations follow Vachon (1974) and morphological terminology mostly follows Hjelle (1990). Terminology of metasomal carination follows Vachon (1952), Prendini (2000) and Soleglad and Sissom (2001) for pedipalp chela carinae. Specimens are deposited in the Museum of Wuhan University, Wuhan, China (MWHU), and Biological specimens Herbarium of Dali College, Yunnan, China (BHDC). Other abbreviations of collections: FKCP: private collection of F. Kovařík, Prague, Czech Republic; MHBU: Museum of the College of Life Sciences, Hebei University, Baoding, China; MNHN: Muséum National d' Histoire Naturelle, Paris, France; NMPC: National Museum (Natural History), Prague, Czech Republic.

Taxonomy

Family Buthidae C.L. Koch, 1837
Genus *Lychas* C.L. Koch, 1845

Lychas mucronatus (Fabricius, 1798)
Figures 1–9

Scorpio mucronatus Fabricius 1798: 294.
Scorpio armillatus Gervais 1841: 284 (synonymized by Thorell 1888: 330).
Scorpio (*Androctonus*) *curvidigitatus* Gervais 1843: 129 (synonymized by Thorell 1893: 368).

Tityus varius C.L. Koch 1844 (synonymized by Thorell 1888: 330).
Isometrus chinensis Karsh 1879: 116 (synonymized by Kraepelin 1891: 81).
Isometrus atomarius Simon 1884: 363 (synonymized by Kraepelin 1891: 81).
Lychas baldasseronii Caporiaco 1947: 247 (synonymized by Kovařík 1997: 342).
Lychas mentaweius Roewer 1943: 212 (synonymized by Kovařík 1997: 342).
Lychas nucifer Basu 1964: 100 (synonymized by Kovařík 1997: 342).
Lychas mucronatus Pocock 1900: 36-37; Kovařík 1997: 341–344, Figs 10, 12, 29, 31, 80-82, 93, 98; Fet and Lowe 2000: 164, 165 [detailed reference list until 1998].

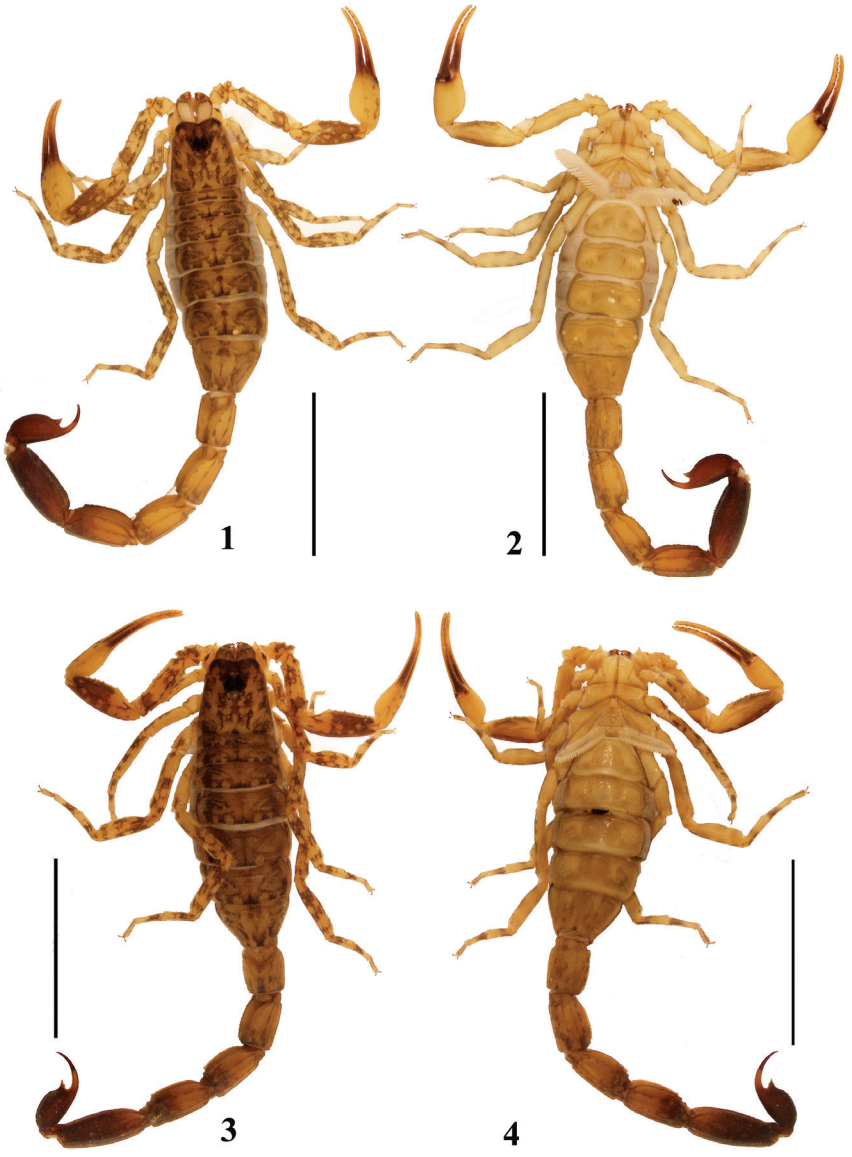
Type locality. India orientali, UZMD.

Type material. Lost.

Material examined. Shidian District, 17/VIII/2010, Dahe Jiang, Chaowu Yang and Zhiyong Di leg, 11 females, 3 males, 2 juveniles (MWHU, Ar.-MWHU-YNSD1010–15); Shidian District (24.42°N, 99.24°E), VIII/2008, Heng Xiao leg, 7 females, 7 males, 6 immatures (MWHU, Ar.-MWHU-YNSD0801–20); Longling District (24.47°N, 98.56°E), 18/VIII/2010, Wenxin Li, Hui Liu, Xiaohua He and Zizhong Yang leg, 14 females, 3 males, 4 juveniles (MWHU, Ar.-MWHU-YNLL1010–20); Gengma District, 6/VIII/2004, Zizhong Yang and Yuhua Yang leg, 2 males (BHDC, Ar.-BHDC-YNGM0401–02); Yun District, 21/VII/2003, Zizhong Yang and Benyong Mao leg, 2 males (BHDC, Ar.-BHDC-YNYX0301–02); Yongde District, 20/VII/2009, Benyong Mao leg, 1 female, 3 males (BHDC, Ar.-BHDC-YNYD0901–04); Mojiang District, Tongguan town, 22/XI/2010, Dongming Luo leg, 2 males, 5 females, 1 juvenile (MWHU, Ar.-MWHU -YNMJ1001–08).

Diagnosis. (Modified from Kovařík 1997). Total length about 40–65 mm in males and females (Figs 1–4). Male differs from female in having fingers of pedipalps proximally twisted (Fig. 5). Sixth cutting edge on movable and fixed fingers of pedipalps, usually with 3 external granules each (rarely 2 or 4 granules). First and second metasomal segments with 10 carinae, third and fourth segments with eight carinae. Ventral surface of seventh mesosomal segment with two carinae (not always discernible). Position and distribution of trichobothria on pedipalps as figures 5–9.

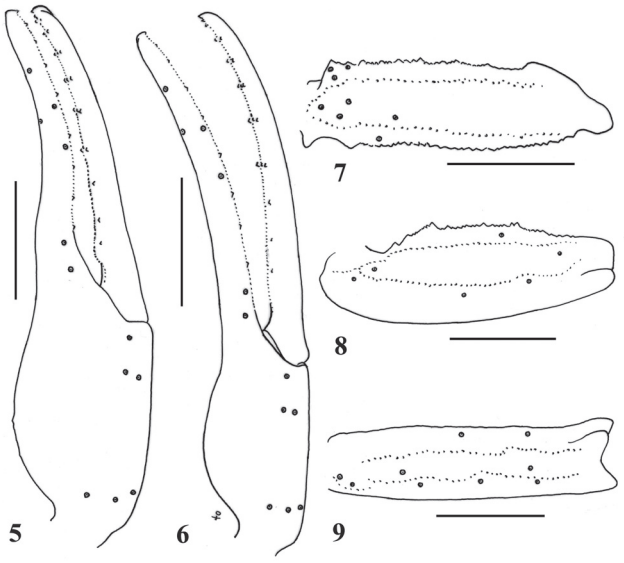
From its general morphology, *L. mucronatus* certainly related to *L. krali* Kovařík, 1995, described from Umphang River in Thailand. They have same important characters: second segment of metasoma with ten carinae, third metasomal segment with eight carinae; sixth cutting edge on movable fingers of pedipalps with two to four external granules; legs spotted. *L. mucronatus* can be distinguished from *L. krali* by the following characters: manus of pedipalps bright yellow with sparse, minute black spots, patella predominantly dark, compared with *L. krali*, in which the manus of pedipalps have the same color as patella and femur; pectinal teeth number 16–26, pectinal teeth 10–19 in *L. krali*; metasoma of approximately the same length in both sexes in *L. mucronatus*, whereas the metasoma much longer in males than in females in *L. krali* (Kovařík 1997: 360).



Figures 1–4. Habitus of *Lychas mucronatus*. **1–2** Male (Ar.-MWHU-YNSD1010), dorsal and ventral views **3–4** Female (Ar.-MWHU-YNSD1011), dorsal and ventral views. Scale bars: 12.0 mm.

Ecology. This species is common. We collected from mixed forest and buzzed canebrake. They are found in the bark, the gap of soil and under the stones.

Distribution. Cambodia, China (Guangxi, Hainan and Yunnan), India, Indonesia, Laos, Malaysia, Myanmar, Philippines, Thailand, and Vietnam (Kovařík 1997; Zhu, Qi and Song 2004).



Figures 5–9. 5, 7–9. *L. mucronatus*. Male (Ar.-MWHU-YNSD1010): **5** Chela, dorsal aspect **7** Femur dorsal aspect **8–9** Patella dorsal and external aspects. Scale bars: 2.0 mm. **6** *Lychas mucronatus*, female (Ar.-MWHU-YNSD1011). Chela, dorsal aspect. Scale bars: 2.0 mm.

Family Euscorpiidae Laurie, 1896
Subfamily Scorpiopinae Kraepelin, 1905
***Euscorpiops* Vachon, 1980**

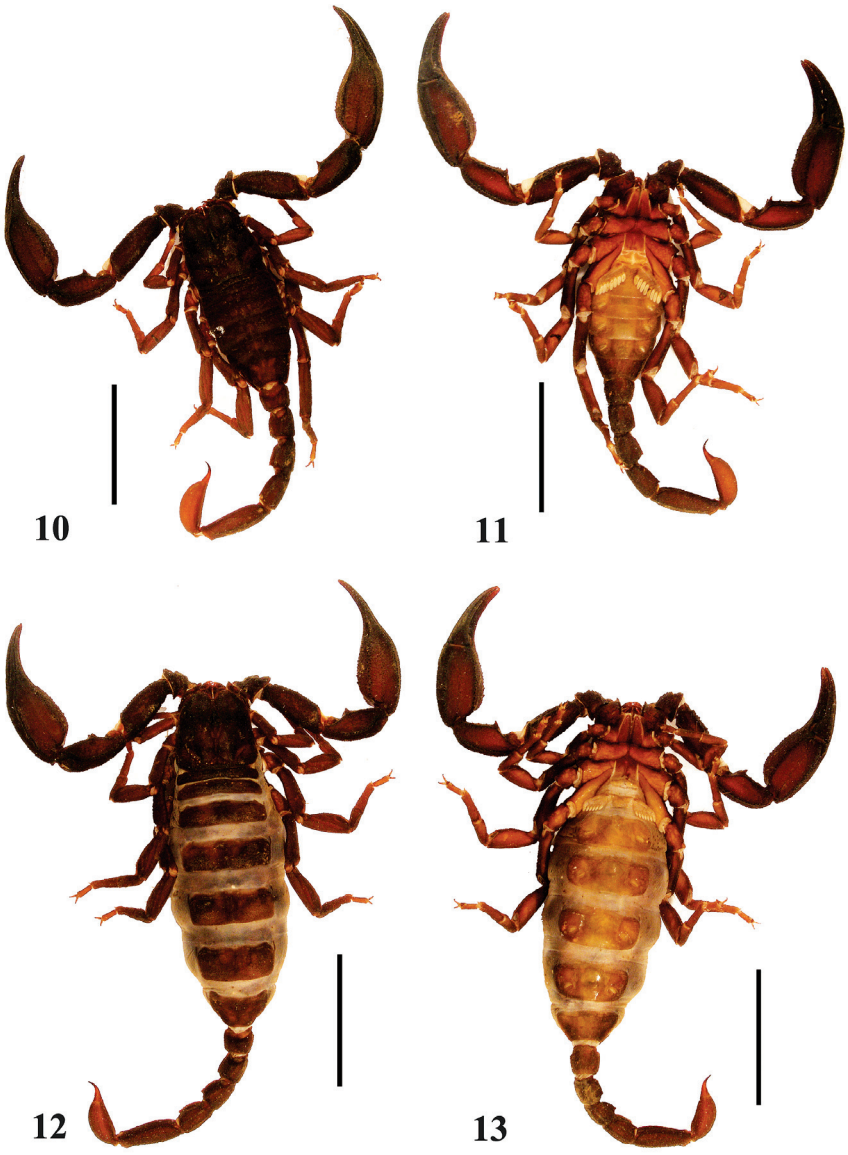
***Euscorpiops kubani* Kovařík, 2004, rec. n.**
Figures 10–28

Euscorpiops kubani Kovařík 2004: 13–18, Figs 1–6, tab. 1.
Euscorpiops kubani: Kovařík 2005: 1–10, Figs 1–6, tab. 1.

Type locality. Laos, prov. Phongsaly, Phongsaly env.

Type material. Holotype male, Laos, prov. Phongsaly, Phongsaly env., 21°41'2" N–102°06'8" E, 1500 m, Vt KubÆ leg, (deposited in the Moravian Museum, Brno, Czech Republic). Other type materials. Allotype female: Laos, prov. Phongsaly, Phongsaly env., 21°41'2" N–102°06'8" E, 1500 m, 28/V/20/VI/2003, leg. Vt KubÆ; (Moravian Museum, Brno, Czech Republic). 1 paratype male, Laos, prov. Phongsaly, Ban Sano Mai env., 21°21'N–102°03'E, ca 1150 m, 19. 26/V/2004, Vt KubÆ leg, (FKCP, followed Kovařík 2004).

Material examined. Menghai District (21.99°N,100.45°E), 21/VIII/2010, Wenxin Li, Xiaohua He, Hui Liu, Dahe Jiang and Zhiyong Di leg, 3 females, 3 males,



Figures 10–13. Habitus of *E. kubani*. **10–11** Male (Ar.-MWHU-YNMH1001), dorsal and ventral views **12–13** Female (Ar.-MWHU-YNMH1002), dorsal and ventral views. Scale bars: 12.0 mm.

3 female immatures, 2 male immatures (MWHU, Ar.-MWHU- YNMH 1001– 11); Menghai District, 21/VIII/2006, Bin Xu leg, 1 female immature (BHDC, Ar.-BH-DC- YNMH 0601–02).

Diagnosis. (Modified from Kovařík 2004) Adult 39–50 mm. Mainly color uniformly reddish-black. Pectinal teeth number 6–8. Sexual dimorphism expressed in

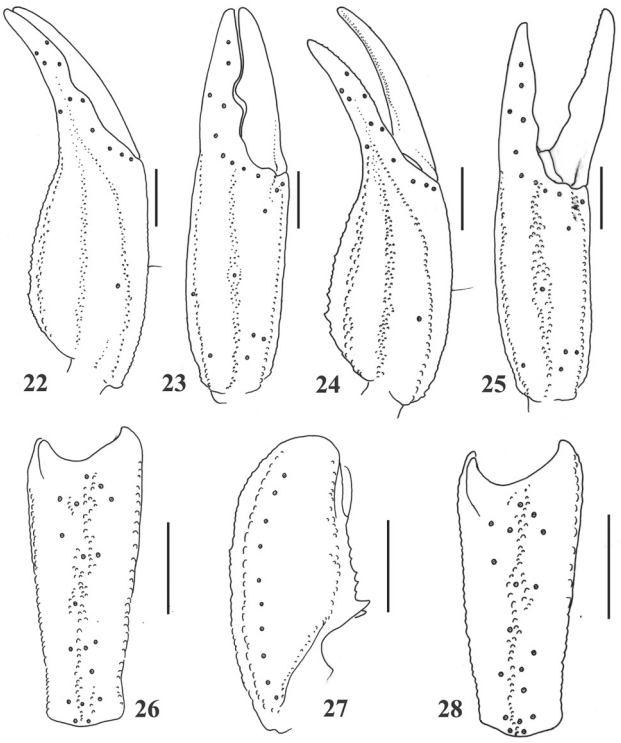
Figures 14–21. *Euscorpiops kubani*. **14–17** Male (Ar.-MWHU-YNMH1001). Chela dorsal, external, ventral and internal aspects **18–21** Female (Ar.-MWHU-YNMH1002). Chela dorsal, external, ventral and internal aspects. Scale bars: 6.0 mm.

shape of pedipalp fingers: in male flexed, in female nearly straight (slightly undulate). Pedipalp patella with 18 or rarely 19 external trichobothria (5 or 6 *eb*, 2 *esb*, 2 *em*, 4 *est*, 5 *et*) (Kovařík 2004), and 9 or 10 ventral trichobothria.

E. kubani is similar to *E. shidian* Qi, Zhu and Lourenço, 2005 in shape and color (Figs 10–13, 50–53): both are characterized by the presence of 18 trichobothria (*E. kubani*: mainly with 18) on the external surface of pedipalp patella, 6–8 pectinal teeth, chela with similar length/width ratio (Tab. 2). Both species can be separated by: male pedipalp chela fingers strongly scalloped in *E. kubani*, whereas in *E. shidian* males are slightly scalloped or straight, being the lobe and corresponding notch are reduced to absent; pectinal fulcra small, reduced or absent in *E. kubani*, but well developed in *E. shidian*.

Description (based on specimens: Ar.-MWHU-YNMH1001–02).

Coloration: Carapace dark red brown. Median and lateral ocular tubercles black. Tergites mostly dark red brown to dark brown. Metasoma segments dark red brown to dark brown. Vesicle red brown with a reddish aculeus. Chelicerae yellow brown



Figures 22–28. *Euscorpiops kubani*. **22–23** Male (Ar.-MWHU-YNMH1001): Chela dorsal and external aspects **26–27** Male (Ar.-MWHU-YNMH1001): Patella external and ventral aspects **24–25** Female (Ar.-MWHU-YNMH1002): Chela dorsal and external aspects **28** Female (Ar.-MWHU-YNMH1002): Patella external aspect. Scale bars: 2.0 mm.

with fingers dark red brown gradually lighter toward the tip. Pedipalp femur and patella dark red brown, chela manus and fingers red brown. Legs red brown with yellow brown tarsi. Tarsal ungues yellowish brown. Sternum, genital operculum and sternites pale brown. Pectines yellowish.

Morphology. *Prosoma*: Carapace with sparse, coarse granules; lateral furrow broad; anterior median furrow broad and moderately deep; posterior median furrow deep; margin behind lateral eyes with granules, other margins smooth. Median eyes situated anteriorly compared to center of carapace; three pairs of lateral ocelli, posterior smallest. Median ocular tubercle with granules and a pair of big median eyes and a median furrow. Lateral ocular tubercle with some granules around eyes.

Mesosoma: Tergites sparsely covered with coarse granules, posterior part of tergites with bigger granules; tergites II–VI with a median carina; tergite VII with two pairs of lateral carinae (with bigger granules). Pectinal teeth count 6–8, fulcra small reduced to absent. Genital operculum subtriangular. Sternites smooth and shiny; segment VII with 4 weak ventral carinae and few granules.

Metasoma: Tegument coarse. Segments II to V longer than wide; segments I to V with respectively 10-8-8-8-7 carinae, segments II–IV with a pair of vestigial lateral carinae; all dorsal carinae crenulate, slightly stronger distally; segment V carinae with smaller granules dorsally and larger serration ventrally. Vesicle with few setae and granules.

Pedipalps: Tegument coarse. Femur with external, dorsointernal, dorsoexternal, ventrointernal, ventroexternal and internal carinae granulated; tegument with scattered granules dorsally and smooth ventrally. Patella with dorsointernal, dorsoexternal, ventrointernal, ventroexternal and external carinae with big granules; two large spinoid granules present on the internal aspect; tegument with smooth granules dorsally and ventrally. Trichobothrial pattern C, neobothriotaxic (Vachon 1974); patella with 18 (rarely 19) external trichobothria (5 or 6 *eb*, 2 *esb*, 2 *em*, 4 *est*, 5 *et*) (Kovařík 2004), 10 or 9 ventral trichobothria (Fig. 27). Chela with length/width ratio: 2.7–3.0 in adult males and 2.7–2.9 in females (3.1 on male holotype, 3.2 on female paratype after Kovařík 2004). Chela with dorsal marginal, external secondary, and ventrointernal carinae granulated (Figs 14–21); ventrointernal carina with some big granules; tegument with granules forming reticulated pattern; male fingers scalloped with a pronounced lobe in the movable finger and a corresponding notch in fixed finger, lobe and corresponding notch reduced to absent in females (Figs 23, 25).

Chelicerae: Tegument smooth. Tibia smooth. Movable finger with 4 teeth on dorsal edge, 6–7 teeth (not constant) on ventral edge. Fixed finger with 3 teeth on dorsal edge.

Legs: Tegument coarsely granular dorsally, except basitarsi and telotarsi, smooth ventrally. Trochanters with few setae. Femur dorsal surface with few small granules, external surface with a granular carina, internal surface with two granular carinae. Patella internally with a dentate carina. Tibia with few setae and small granules, without spurs. Basitarsi with some spinules, few setae and 2 lateral pedal spurs. Tarsi ventrally with one row of short spinules and few setae. Tarsal ungues curved and hook-like.

Variation. Female and male paratypes: coloration and morphology are very similar to holotype (Kovařík 2004). Sexual dimorphism: adult males, with more pronounced lobes on the movable fingers of the chela, and a more pronounced notch in the fixed finger and bigger pectinal teeth than females. Measurements in table 1. Feature datasets in table 2.

Ecology. This species was collected from moist mixed forest and village. They are found in the shambles (brick or stones) and under the clod.

Distribution. China (Yunnan), Laos.

Euscorpiops puerensis **Di, Wu, Cao, Xiao & Li, 2010**

Figures 29–49

Euscorpiops puerensis Di et al. 2010: 49–61, Figs 1–34, tabs. 1–2.

Type locality. China, Yunnan, Puer.

Type materials, examined. Female holotype, China: Yunnan, Puer, X/2008, Heng Xiao leg, (Ar.-MWHU-YNPE0801); paratypes: 5 males and 4 females (including 2

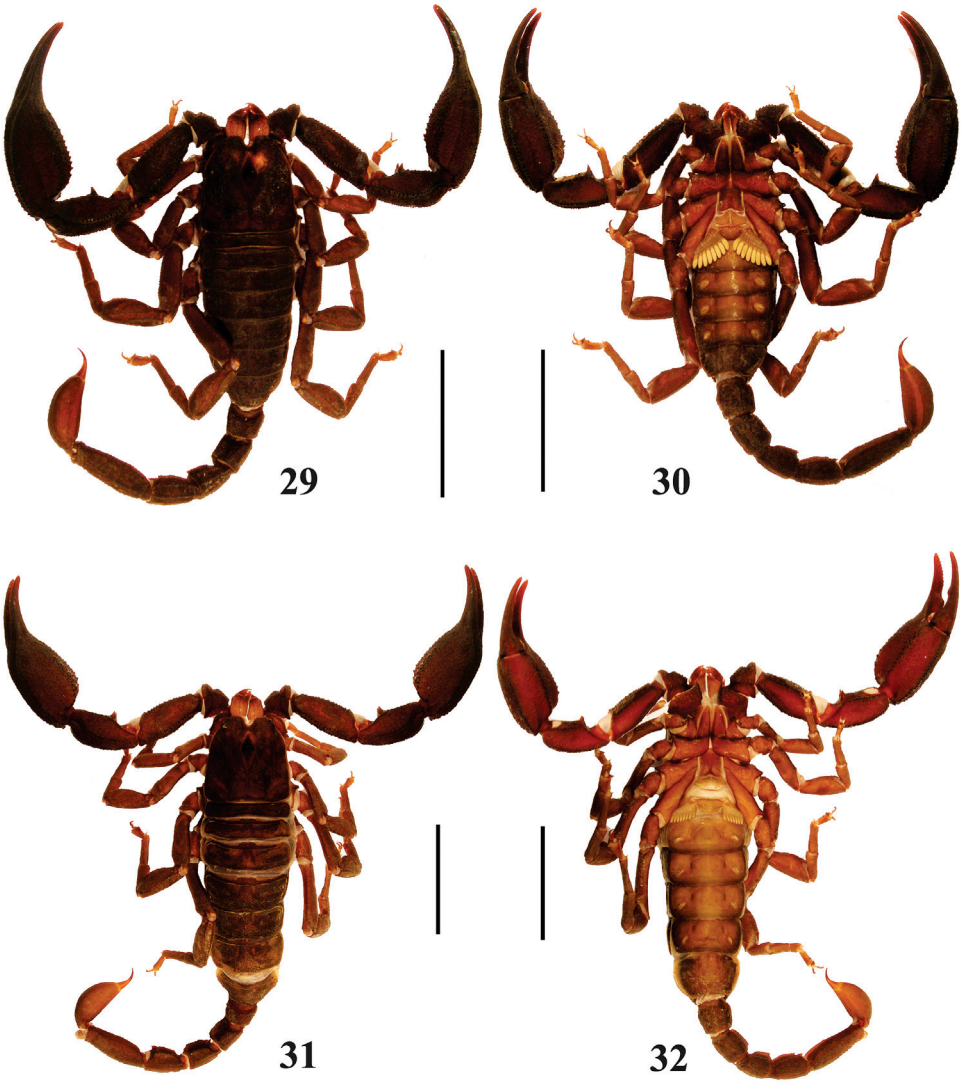
Table 1. Measurements (in mm) of *Euscorpiops kubani* (Ar.-MWHU-YNMH1001 and Ar.-MWHU – YNMH 1002), *E. shidian* (Ar.-BHDC-YNSD0401 and Ar.-MWHU-YNSD1001) and *E. xui* (Ar.-BHDC- YNML 0901 and Ar.-BHDC- YNML0902).

	E. kubani		*E. shidian*		*E. xui*	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
Total length:	47.0	48.0	52.4	54.8	56.3	57.5
Carapace:						
-Length	7.6	7.1	7.9	8.3	8.4	9.2
-Anterior width	4.5	4.5	4.9	4.7	5.0	5.3
-Posterior width	7.7	7.5	9.0	8.7	8.9	8.3
Mesosomal segments:						
-Length	11.5	15.5	17.1	18.0	18.1	19.2
Metasomal segment I:						
-Length	2.5	2.9	3.0	3.0	3.1	3.0
-Width	2.9	2.8	3.0	3.1	3.3	3.4
-Depth	2.4	2.2	2.3	2.6	2.6	2.7
Metasomal segment II:						
-Length	3.0	3.0	3. 1	3.3	3.5	3.3
-Width	2.6	2.5	2.7	2.6	3.0	3.1
-Depth	2.2	2.0	2.3	2.3	2.7	2.5
Metasomal segment III :						
-Length	3.5	3.2	3.5	3.7	3.8	3.7
-Width	2.5	2.3	2.5	2.5	2.7	2.9
-Depth	2.2	2.2	2.4	2.3	2.5	2.5
Metasomal segment IV:						
-Length	4.3	3.4	3.8	4.3	4.3	4.3
-Width	2.4	2.2	2.4	2.2	2.5	2.6
-Depth	2.2	2.3	2.4	2.3	2.4	2.5
Metasomal segment V:						
-Length	6.9	5.9	6.5	7.0	6.7	7.0
-Width	2.3	2.2	2.2	2.2	2.4	2.5
-Depth	2.2	2.0	2.3	2.2	2.4	2.4
Telson:						
-Length	7.8	6.8	7.6	7.4	8.4	7.9
-Width	2.5	2.2	2.4	2.2	2.6	2.2
-Depth	2.2	1.8	2.2	2.0	2.5	2.2
Pedipalp femur:						
-Length	7.9	6.4	8.9	8.6	10.4	8.7
-Width	3.0	2.6	3.3	3.1	3.2	3.5
-Depth	2.4	2.3	2.5	2.6	2.7	2.8
Pedipalp patella:						
-Length	7.1	6.2	7.6	7.4	9.1	7.9
-Width	3.6	3.3	4.1	4.0	4.4	4.8
-Depth	2.9	2.7	2.9	2.9	3.2	3.3
Chela:						
-Length	14.5	13.5	16.0	16.5	19.5	17.0
-Width (manus)	4.6	4.4	4.7	4.7	4.7	5.3
-Depth (manus)	3.8	3.4	3.6	3.6	4.0	4.1
Movable finger:						
-Length	7.7	7.0	8.2	8.9	8.8	8.8
Pectinal teeth (L/R)	8/8	7/6	8/8	8/8	8/8	7/7

Table 2. Feature datasets of specimens of *Euscorpiops kubani*, *E. shidian* and *E. xui***.** BL, body length; VTPP, ventral trichobothria of pedipalp patella (L/R); ETPP, external trichobothria of pedipalp patella (L/R); LWRC, length/width ratio of chela; PT, pectinal teeth; im, immature; HT, holotype; PT, paratype.

Species	Serial number	Sex	BL≈	VTPP	ETPP	PT	LWRC
E. kubani	HT(FKCP)	♂	39	10/10	19/19	8/8	3.1
	PT(FKCP)	♀	44	10/10	18/18	7/7	3.2
	Ar.-MWHU-YNMH1001	♂	47	10/10	18/18	8/8	3.2
	Ar.-MWHU-YNMH1002	♀	48	9/9	18/18	7/6	3.1
	Ar.-MWHU-YNMH1003	♂	48	10/10	18/18	8/8	3.1
	Ar.-MWHU-YNMH1004	♂	44	9/10	18/16[†]	6/7	2.9
	Ar.-MWHU-YNMH1005	♂im		10/10	18/18	7/7	
	Ar.-MWHU-YNMH1006	♂im		10/9	18/18	8/8	
	Ar.-MWHU-YNMH1007	♀	45	10/10	18/18	6/6	2.9
	Ar.-MWHU-YNMH1008	♀	44	9/10	18/18	7/6	2.7
	Ar.-MWHU-YNMH1009	♀im		9/10	18/18	7/6	
	Ar.-MWHU-YNMH1010	♀im		9/9	18/18	7/7	
	Ar.-MWHU-YNMH1011	♀im		10/10	18/18	6/6	
	Ar.-BHDC-YNMH0601	♀	45	9/10	17/17	6/6	2.7
	Ar.-BHDC-YNMH0601	♀im		11/11	18/18	6/6	
E. shidian	HT(MHBU)	♂	49	11/11	17/17[§]	7/7	1.6[#]
	PT(MHBU)	♂	60	11/11	17/17[§]	7/7	2.4[#]
	Ar.-BHDC-YNSD0401	♂	52	11/11	18/18	8/8	3.4
	Ar.-MWHU-YNSD1001	♀	55	10/11	18/18	8/8	3.5
	Ar.-MWHU-YNSD1002	♂	47	11/11	18/18	8/7	3.5
	Ar.-MWHU-YNSD1003	♂	50	11/11	18/18	8/8	3.3
	Ar.-MWHU-YNSD1004	♂im		11/11	18/18	8/8	
	Ar.-MWHU-YNSD1005	♀	50	12/12	18/18	6/6	3.2
	Ar.-MWHU-YNSD1006	♀	45	11/11	18/18	8/7	3.2
	Ar.-MWHU-YNSD1007	♀	45	11/11	18/18	6/7	3.5
	Ar.-MWHU-YNSD1008	♀	50	11/11	18/18	8/7	3.2
E. xui	HT(MHBU)	♀	66	10/10	19/19	7/7	3.6
	PT(MHBU)	♂	54	10/10	19/19	8/8	4.1
	Ar.-BHDC-YNML0901	♂	56	10/10	18/19	8/8	4.0
	Ar.-BHDC-YNML0902	♀	58	10/10	19/19	7/7	3.4

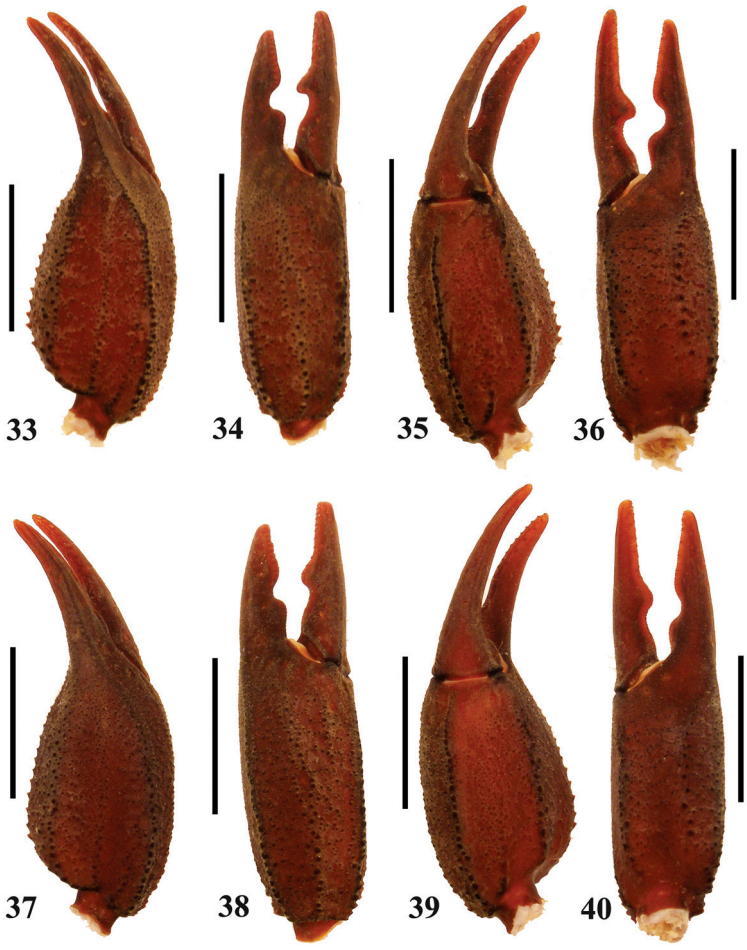
[†] It is visible that the right patella of pedipalp of this specimen (Ar.-MWHU-YNPMH1004) didn't developed well, in respect that with external trichobothria et_4 and est_2 absent (the position and terminology followed Kovařík 2000:157). [§] As these specimens came from the same village, it is very puzzling that with obvious external trichobothria difference. [#] Maybe there are different methods of measurement adopted by these authors lead to an enormous difference among length/width ratio of chela of type specimens and new material, however, it is obvious that they are with the same shape (Figs 50–61; Qi, Zhu and Lourenço 2005, Figs 78–83).



Figures 29–32. Habitus of *Euscorpiops puerensis*. **29–30** Male paratype (Ar.-MWHU-YNPE0805), dorsal and ventral views **31–32** Female holotype (Ar.-MWHU-YNPE0801), dorsal and ventral views. Scale bars: 12.0 mm.

male immatures and 1 female immature) (Ar.-MWHU-YNPE0802–06, Ar.-MWHU-YNPE0807–10), same data as holotype.

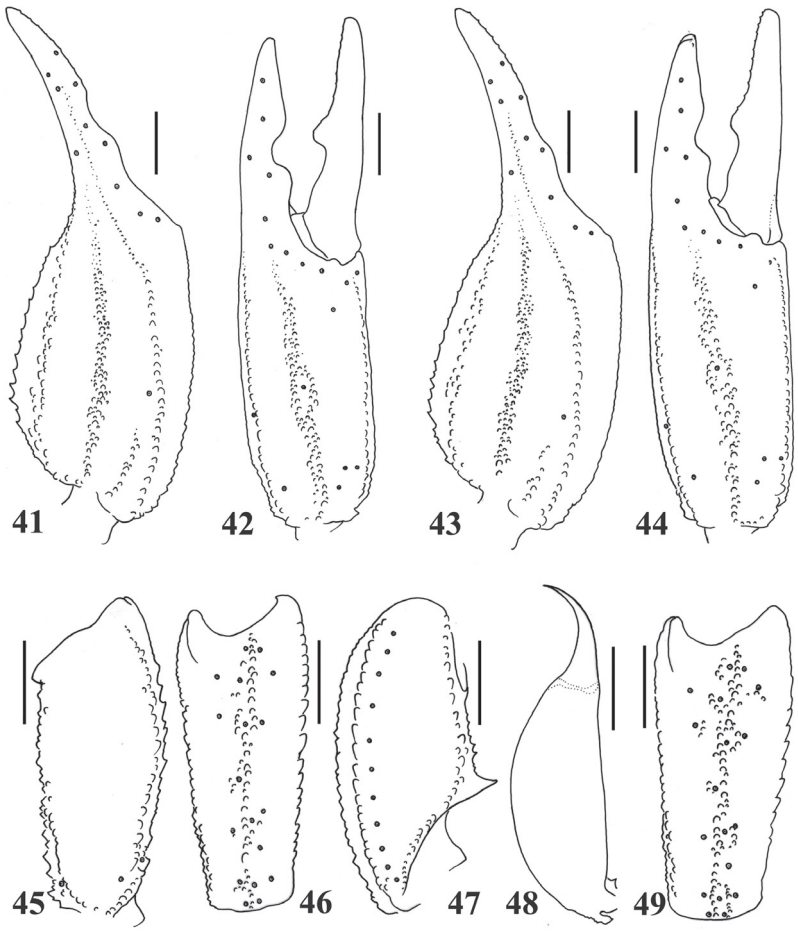
Diagnosis. *E. puerensis* differs from all other species in the genus on the basis of the following combination of characters: 18 external trichobothria (5 *eb*, 2 *esb*, 2 *em*, 4 *est*, 5 *et*), and 10 or 11 ventral trichobothria in the pedipalp patella (10 specimens); chela



Figures 33–40. *Euscorpiops puerensis*. **33–36** Male paratype (Ar.-MWHU-YNPE0805). Chela dorsal, external, ventral and internal aspects **37–40** Female holotype (Ar.-MWHU-YNPE0801). Chela dorsal, external, ventral and internal aspects. Scale bars: 6.0 mm.

with a length/width ratio average of 2.7 in males and females (5 males and 2 females); pedipalp chela fingers of adult females and males scalloped; pectinal teeth count 7–8; pectinal fulcra present.

E. puerensis appears to be closely related to *E. vachoni* Qi, Zhu and Lourenço, 2005: both are medium-sized scorpions characterized by the presence of 10 or 11 trichobothria on the ventral surface of pedipalp patella, a pronounced lobe on the movable finger and a corresponding notch on fixed finger of adult males, 7–8 pectinal teeth. The shape of the chela manus provides the most pronounced difference between them, in *E. puerensis* is flat dorsoventrally, whereas it is short, stout, and robust in *E. vachoni*. *E. puerensis* may be distinguished from *E. kubani* and *E. sejnai* Kovařík 2000



Figures 41–49. 41–42, 45–48 *Euscorpiops puerensis*. Male paratype (Ar.-MWHU-YNPE0805): **41–42** Chela dorsal and external aspects **45** Femur dorsal aspect **46–47** Patella external and ventral aspects **48** Telson, lateral aspect. Scale bars: 2.0 mm. **43–44, 49.** *E. puerensis*. Female holotype (Ar.-MWHU-YNPE0801): **43–44** Chela dorsal and external aspects **49** Patella external aspect. Scale bars: 2.0 mm.

by means of the following features: pedipalp chela fingers are distinctly scalloped on adult males and females in *E. puerensis*, whereas in *E. kubani* chela fingers are scalloped on male and nearly straight on female, and in *E. sejnai* male chela fingers are slightly scalloped (female unknown); 10–11 trichobothria on ventral surface of patella in *E. puerensis*, whereas there are 9 in *E. sejnai*, and 9–10 in *E. kubani* (11 rarely); chela with a length/width ratio average of 2.7 on males and females, whereas in *E. kubani* is higher than 2.7, and on *E. sejnai* is 2.75; 7–8 pectinal teeth, whereas there are 4–7 in *E. sejnai*, 6–8 in *E. kubani*; total length 48.8 to 60.0 mm in *E. puerensis*, whereas both *E. sejnai* and *E. kubani* are smaller than 48.0 mm (Kovařík 2000, 2004, 2005).

Description. See Di et al. (2010b).
Ecology. This species is found under the stones in mixed forest.
Distribution. China (Yunnan, just the type locality).

***Euscorpiops shidian* Qi, Zhu & Lourenço, 2005**
Figures 50–68

Euscorpiops shidian Qi et al. 2005: 18, 22–25, Figs 78–93.

Type locality. China, Yunnan Province, Shidian District.

Type material. Holotype, male, Yunnan Province, Shidian District, Jiucheng town (24.43°N, 99.09°E), 15/VI/2004, Yingda Zhang and Zizhong Yang leg, (MHBU); paratypes: 1 female (MNHN), 2 females (MHBU), same data as holotype.

Material examined. Shidian District, Jiucheng town (24.43°N, 99.09°E), 16/VIII/2010, Dahe Jiang and Zhiyong Di leg, 5 females, 2 males, 1 male immature, 1 juvenile (MWHU, Ar.-MWHU-YNSD1001–09); Shidian District, Jiucheng town(24.43°N, 99.09°E), 15/VI/2004, Yingda Zhang and Zizhong Yang leg, 1 male, 1 juvenile (BHDC, Ar.-BHDC-YNSD0401–02), same data as holotype.

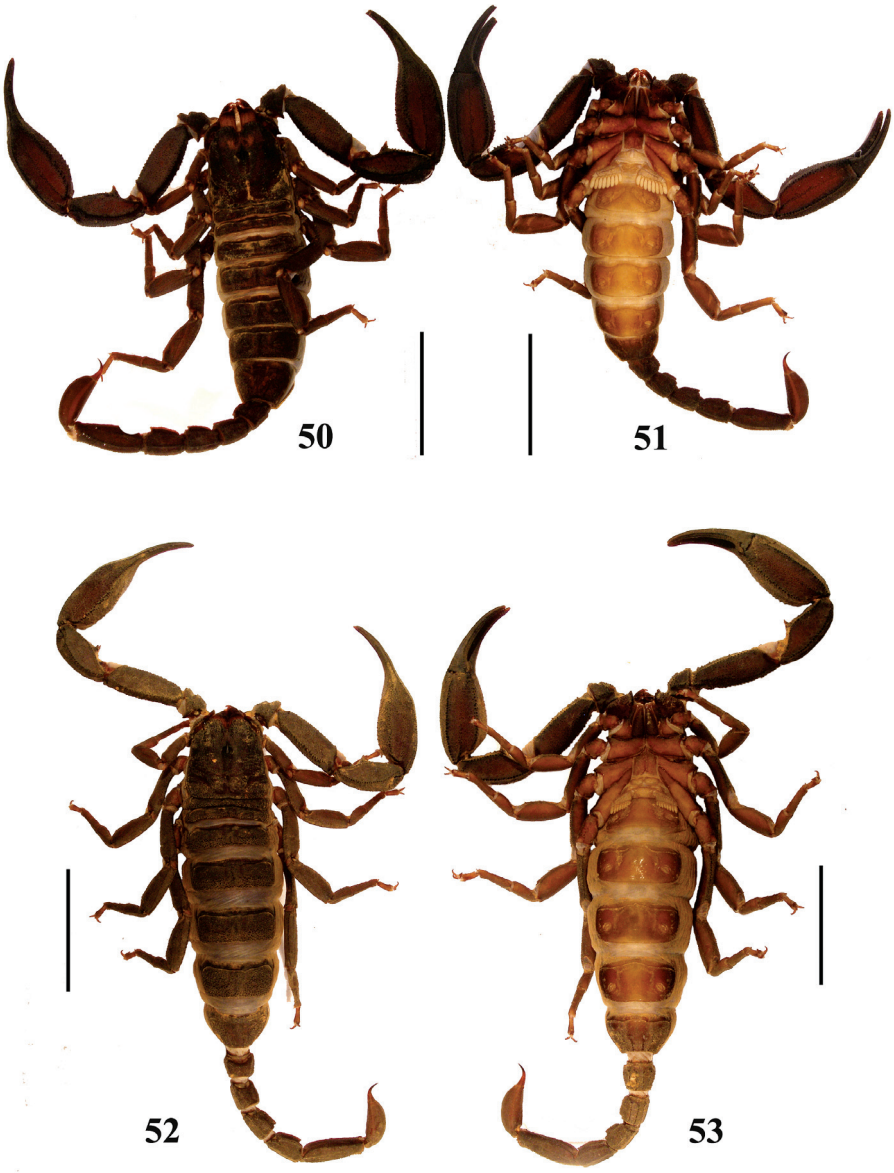
Diagnosis. *E. shidian* differs from all other species in the genus on the basis of the following combination of characters: pedipalp patella with 18 external (5 *eb*, 2 *esb*, 2 *em*, 4 *est*, 5 *et*), and 10–12 ventral trichobothria (rarely 10 or 12); chela with length/width ratio average of 3.3 (5 males and 5 females); inner surface of pedipalp chela fingers on adult females and males nearly straight; pectinal fulcra present (few and small).

E. shidian is morphologically most similar to *E. kubani*. Both species are characterized by the presence of 18 trichobothria (*E. kubani*: mainly with 18) on the external surface of pedipalp patella, 6–8 pectinal teeth, chela with similar length/width ratio (Tab. 2). They can be separated by: male pedipalp chela fingers slightly scalloped or straight in *E. shidian*, whereas in *E. kubani* males they are strongly scalloped; pectinal fulcra few but obvious in *E. shidian*, pectinal fulcra small reduced to absent in *E. kubani*.

E. shidian may be separated from *E. puerensis, E. vachoni and E. validus* Di, Cao, Wu and Li, 2010 on the basis of the following character: chela slender with a length/width ratio average of 3.3, whereas in *E. puerensis* chela with a length/width ratio average of 2.7, and in *E. vachoni* and *E. validus* chela smaller than 3.0; *E. shidian* may be separated from *E. yangi* Zhu, Zhang and Lourenço, 2007 and *E. xui* Sun and Zhu, 2010 by the following character: patella of pedipalp with 11 ventral trichobothria (rarely 10 and 12, Table 2), whereas on *E. yangi* with 9–10 (Zhu, Zhang and Lourenço 2007), on *E. xui* with 10 (4 specimens, Table 2); patella of pedipalp with 18 external trichobothria whereas on *E. xui* with 18–19.

Description (based on male (Ar.-BHDC-YNSD0401) and female (Ar.-MWHU-YNSD1001))**.**

Coloration: Carapace dark red black brown. Median and lateral ocular tubercles black. Tergites mostly dark red brown to dark brown. Metasoma segments dark red



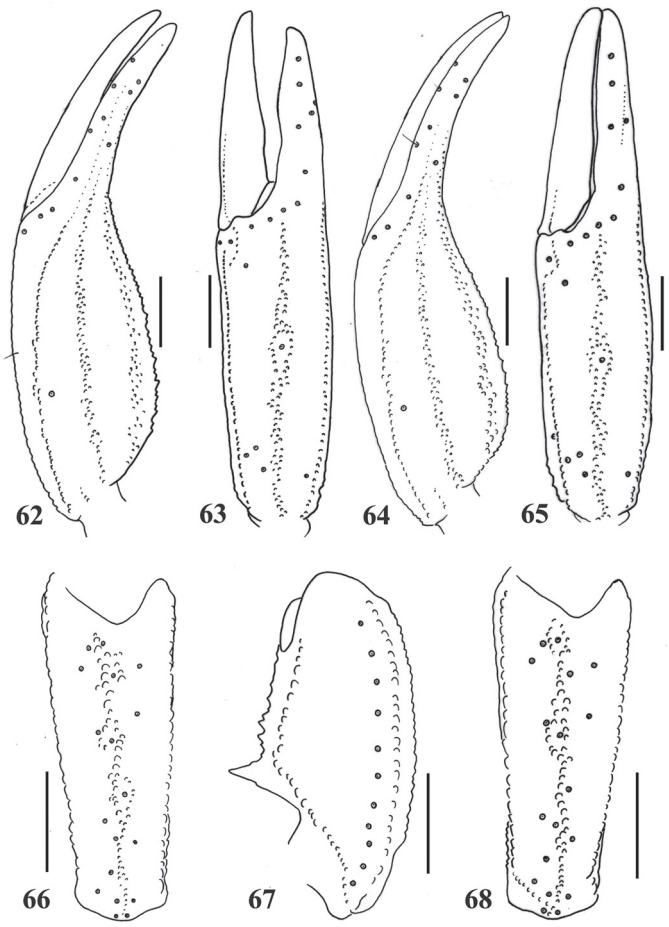
Figures 50–53. Habitus of *Euscorpiops shidian*. **50–51** Male (Ar.-BHDC-YNSD0401), dorsal and ventral views **52–53** Female (Ar.-MWHU-YNSD1001), dorsal and ventral views. Scale bars: 12.0 mm.

brown to dark brown; telson, vesicle brown, aculeus redish. Chelicerae yellow brown, fingers red brown gradually lighter toward the tip. Pedipalp femur and patella dark brown, chela manus and fingers dark red brown. Legs red brown with yellow brown tarsi. Tarsal ungues yellowish brown. Sternum, genital operculum and sternites brown. Pectines yellowish.

Figures 54–61. *Euscorpiops shidian* **54–57** Male (Ar.-BHDC-YNSD0401). Chela (left) dorsal, external, ventral and internal aspects **58–61** Female (Ar.-MWHU-YNSD1001). Chela (left) dorsal, external, ventral and internal aspects. Scale bars: 6.0 mm.

Morphology. *Prosoma*: Tegument coarse with fine and smooth granules. Carapace with sparse, fine granules; lateral furrow broad; anterior median furrow broad and moderately deep; posterior median furrow deep; margin behind lateral eyes with granules, other margins smooth. Median eyes situated anteriorly respect to the center of carapace; three pairs of lateral ocelli, posterior smallest. Median ocular tubercle coarse with granules and a pair of big median eyes and a median furrow. Lateral ocular tubercle with some granules around eyes.

Mesosoma: Tergites densely covered with fine granules, posterior part of tergites with bigger granules; tergite II to tergite VI with a median carina; tergite VII with two pairs of lateral carinae. Pectinal teeth count 6–8, fulcra small and obvious. Genital



Figures 62–68. 62–63, 66–67. *Euscorpiops shidian*. Male (Ar.-BHDC-YNSD0401): **62–63** Chela (left) dorsal and external aspects **66–67** Patella (left) external and ventral aspects. Scale bars: 2.0 mm **64–65, 68.** *E. shidian*. Female (Ar.-MWHU-YNSD1001) **64–65** Chela (left) dorsal and external aspects **68** Patella (left) external aspect. Scale bars: 2.0 mm.

operculum subtriangular. Sternites smooth; segment VII with four weak ventral carinae with granules.

Metasoma: Tegument coarse. Segments II to V longer than wide; segments I to V with respectively 10-8-8-8-7 carinae, segments II–IV with a pair of vestigial lateral carinae; dorsal carinae crenulated, slightly stronger distally; on segment V carinae with smaller granules dorsally and larger serration ventrally. Vesicle with sparse small granules, and few setae.

Pedipalps: Tegument coarse with fine and smooth granules. Femur with external, dorsointernal, dorsoexternal, ventrointernal, ventroexternal and internal carinae granulated;

tegument with scattered granules dorsally and smooth ventrally. Patella with dorsointernal, dorsoexternal, ventrointernal, ventroexternal and external carinae with big granules; two large spinoid granules present on the internal aspect; tegument with smooth granules dorsally and ventrally. Trichobothrial pattern C, neobothriotaxic (Vachon1974); patella with 18 external trichobothria (5*eb*, 2 *esb*, 2 *em*, 4 *est*, 5 *et*), 11 (rarely 10 and 12) ventral trichobothria (Fig. 67). Chela with a length/width ratio average of 3.3 on adult males and females. Chela with dorsal marginal, external secondary, and ventrointernal carinae granulated (Figs 54–61); ventrointernal carina with some big granules; tegument with small granules forming reticulated pattern; fingers nearly straight (Figs 63, 65).

Chelicerae: Tegument smooth. Tibiae smooth. Movable finger with 4 teeth on dorsal edge and 6–7 teeth (not constant) on ventral edge. Fixed finger with 3 teeth on dorsal edge.

Legs: Tegument coarse dorsally except basitarsi and telotarsi, smooth ventrally. Trochanters with few setae. Femur dorsal surface with some small granules, external surface with one granular carina, internal surface with two granular carinae. Patella internally with one dentate carina. Tibia with few setae and small granules, without spurs. Basitarsi with some spinules, few setae and two lateral pedal spurs. Tarsi ventrally with one row of short spinules and few setae. Tarsal ungues curved and hook-like.

Variation. Female and male paratypes: coloration and morphology are very similar to holotype (see Qi, Zhu and Lourenço 2005). Sexual dimorphism: the pectinal teeth of adult males are clearly bigger than those of adult females; this sexual dimorphism is common in *Euscorpiops* and *Scorpiops*. Measurements in table 1. Feature datasets in table 2.

Ecology. This species was collected from moist mixed forest and hamlets. They are found on the wall in the night and under stones in the day.

Distribution. China (Yunnan).

Euscorpiops vachoni Qi, Zhu & Lourenço, 2005

Figures 69–72

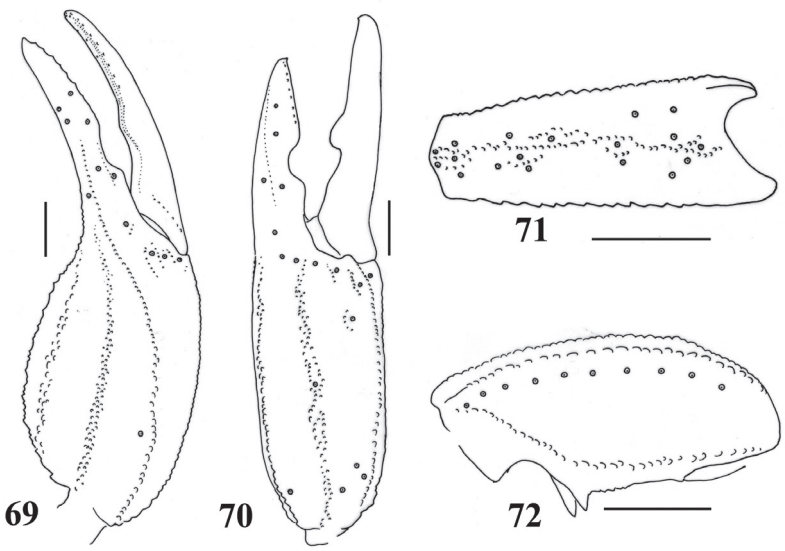
Euscorpiops vachoni Qi et al. 2005: 18–21, Figs 62–77.

Type locality. China, Yunnan Province, Mengla District.

Type material. Holotype male. Mengla district (21°29' N, 101°33' E), Yunnan Province, 2/VIII/2004, Zizhong Yang, Jing Li and Caixia Yuan leg, (MHBU); Paratypes: 1 female, same data as holotype (MHBU), 1 male, Tibet, Nyingchi district, 3/VIII/2003, Feng Zhang leg, (MNHN).

Material examined. Mengla District, 2/VIII/2004, Zizhong Yang, Jing Li and Caixia Yuan leg, 1 male immature, same data as holotype (BHDC, Ar.-BHDC-YNML0401).

Diagnosis. (Modified from Qi et al. 2005) *E. vachoni* differs from all other species of the genus on the basis of the following combination of characters: yellow brown



Figures 69–72. *Euscorpiops vachoni*. **69–70, 71** Holotype, male (MHBU, followed Qi, Zhu, and Lourenço 2005) **69–70** Chela dorsal and external aspects **71** Patella ventral aspect. Scale bars: 2.0 mm. **72** Male (immature, Ar.-BHDC-YNML1001). Patella external aspect. Scale bars: 2.0 mm.

color, 18 (17 in Qi et al. 2005) external trichobothria (5 *eb*, 2 *esb*, 2 *em*, 4 *est*, 5 *et*), and 10 ventral trichobothria in the pedipalp patella; adult chela manus stout and rounded (see Qi et al. 2005, Figs 63–66); pedipalp chela fingers on adult males scalloped; pectinal teeth: 7–8.

E. vachoni appears to be closely related to *E. puerensis*: both are medium-sized scorpions, characterized by the presence of 10 or 11 trichobothria on the ventral surface of pedipalp patella, a pronounced lobe on the movable finger and a corresponding notch on fixed finger of adult males, 7–8 pectinal teeth. The most pronounced difference between both species is: chela manus short, stout, and robust in *E. vachoni*, whereas it is flat dorsoventrally in *E. puerensis*.

E. vachoni may be separated from *E. shidian and E. yangi* on the basis of the following character: chela with a length/width ratio smaller than 3.0, whereas in *E. shidian* higher than 3.2, and in *E. yangi* 3.4 (males) and 3.3 (females). *E. vachoni* may be separated from *E. kubani* and *E. validus* by the following characters:yellow brown color in *E. vachoni*, compared with dark red brown in *E. kubani*, and dark brown inn *E. validus*; chela manus stout and rounded, whereas in *E. kubani* and *E. validus* flat. *E. vachoni* may be separated from *E. xui* by the following characters: patella of pedipalp with 18 external trichobothria whereas in *E. xui* with 18–19; chela with a length/width ratio smaller than 3.0, whereas in *E. xui* with a length/width ratio higher than 3.4.

Description. See Qi et al. (2005).

Ecology. This species is uncommon, type materials collected from moist mixed forest close to the border of China and Laos.

Distribution. China (Yunnan, just the type locality).

Notes. The immature male specimen checked bears 18/18 external trichobothria (5 *eb*, 2 *esb*, 2 *em*, 4 *est*, 5 *et*), and 10/10 ventral trichobothria in the pedipalp patella, 17 external trichobothria and 10 ventral trichobothria in the pedipalp patella on holotype (see Qi et al. 2005: 18).

Euscorpiops validus Di, Cao, Wu & Li, 2010

Figures 73–91

E. validus Di et al. 2010: 14–21, Figs 1–32, tabs. 1–2.

Type locality. China, Yunnan Province, Mengzi District.

Type material examed. Male holotype, China: Yunnan, Honghe Prefecture, 9/IX/2009, Junyun Huang leg (Ar.-MWHU-YNHH0901). Allotype female (Ar.-MWHU-YNHH0902); paratypes, 4 males, and 4 females (Ar.-MWHU-YNHH0903–06, Ar.-MWHU-YNHH0907–10), same data as holotype.

Diagnosis. Medium-sized scorpions, total length 50.0–59.8 mm. It can be distinguished from other species of *Euscorpiops* by having thicker chelas. It can be ditinguished from other *Euscopiops species* from Yunnan by the following features: pedipalp patella with 9 to 10 (rarely 11 or 8) ventral trichobothria; chela strong, length/width ratio: 2.9–3.2 (mean 3.0 in 3 males, and 3.1 in 4 females); pectinal fulcra present (obsolete in some females); chela fingers obviously curved; pectinal teeth: 7–8; pectinal fulcra present and small. *E. validus* can be ditinguished from related *Euscopiops* species by the following features: in *E. shidian* there are 11 (rarely 10 or 12) ventral trichobothria on pedipalp patella, chela length/width ratio higher than 3.2 in *E. shidian*, higher than 3.3 in *E.yangi* and higher than 3.4 in *E. xui*; chela fingers clearly curved in *E. validus*, whereas in *E. shidian* they are nearly straight, in *E. kubani* female nearly straight and in *E. yangi* they are slightly undulated in both sexes without sexual dimorphism; chela manus flat in *E. validus*, whereas in *E. vachoni* rounded.

Description. See Di et al. (2010a).

Ecology. This species is collected from moist mixed forest. They are found on the wall in the night and under stones in the day.

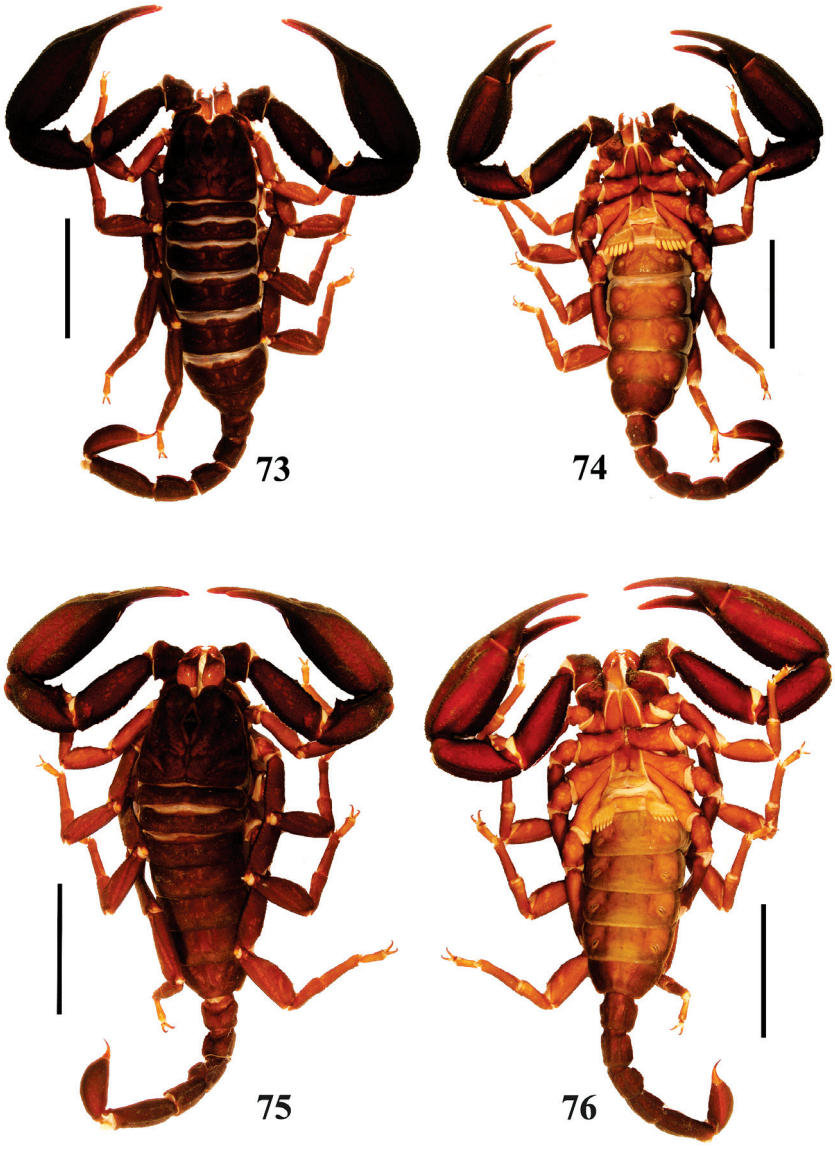
Distribution. China (Yunnan, just the type locality).

Euscorpiops xui Sun & Zhu, 2010

Figures 92–110

Euscorpiops xui Sun and Zhu 2010: 62–67, Figs 1–14, tab. 1.

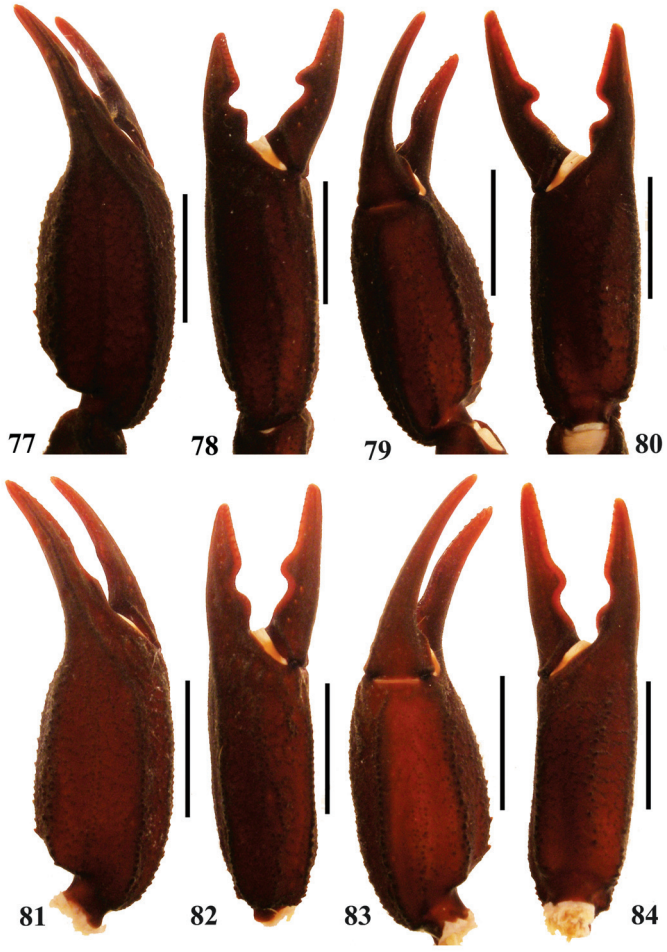
Type locality. China, Yunnan Province, Menglian District.



Figures 73–76. Habitus of *Euscorpiops validus*. **73–74** Male holotype (Ar.-MWHU-YNHH0901), dorsal and ventral views **75–76** Female allotype (Ar.-MWHU-YNHH0902), dorsal and ventral views. Scale bars: 12.0 mm.

Type material. Holotype female, China, Yunnan, Menglian District, Lafu Village, 22°08'N, 99°25'E, 15/VII/2009, Dr. Jishan Xu leg(MHBU); 1 female, 1 male, and 1 juvenile male paratypes, same data as holotype (MHBU).

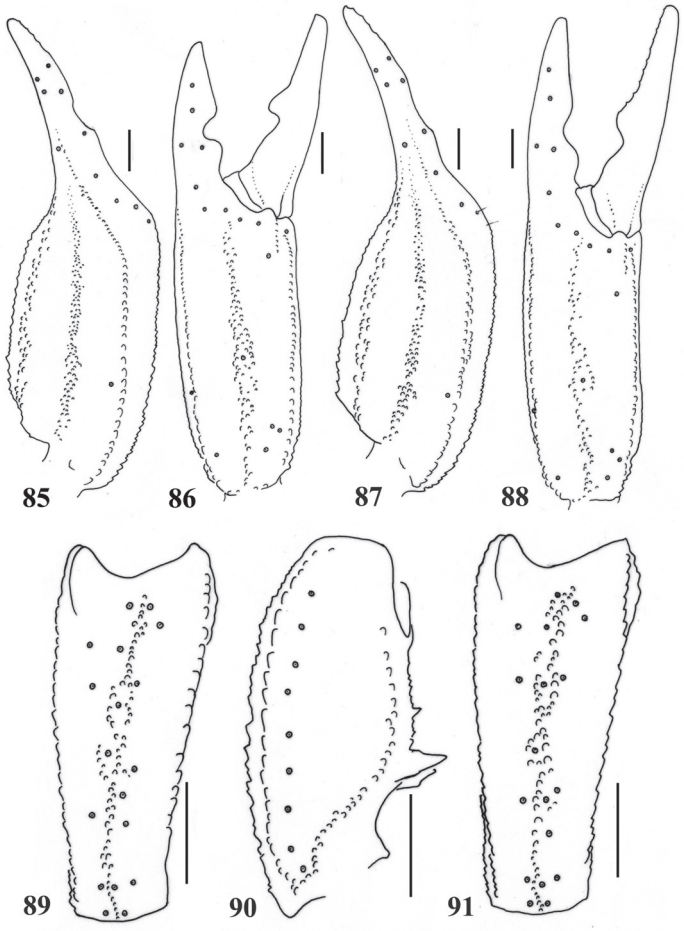
Material examined. Menglian County, 15/VII/2009, Lixiang Zhang leg, 1 male and 1 female. (BHDC).



Figures 77–84. *Euscorpiops validus*. **77–80** Male holotype (Ar.-MWHU-YNHH0901). Chela dorsal, external, ventral and internal aspects **81–84** Female allotype (Ar.-MWHU-YNHH0902). Chela dorsal, external, ventral and internal aspects. Scale bars: 6.0 mm.

Diagnosis (Modified from Sun and Zhu 2010)**.** total length about 54.0–66.0 mm (2 males and 2 females); color dark brownish-red; chela, length/width ratio about 3.5 in females (3.4 and 3.6 in 2 records) and about 4.0 in males (4.0 and 4.1 in 2 records); dentate margin with a slight lobe on movable finger and corresponding notch on fixed finger in both males and females; patella with 19 or 18 external trichobothria (5 *eb*, 2 *esb*, 2 *em*, 4 *est*, 5 or 6 *et* , fig. 108; 6 *eb*, 2 *esb*, 2 *em*, 4 *est*, 5 *et*, Sun and Zhu, 2010: fig. 3), and with 10 ventral trichobothria (4 specimens).

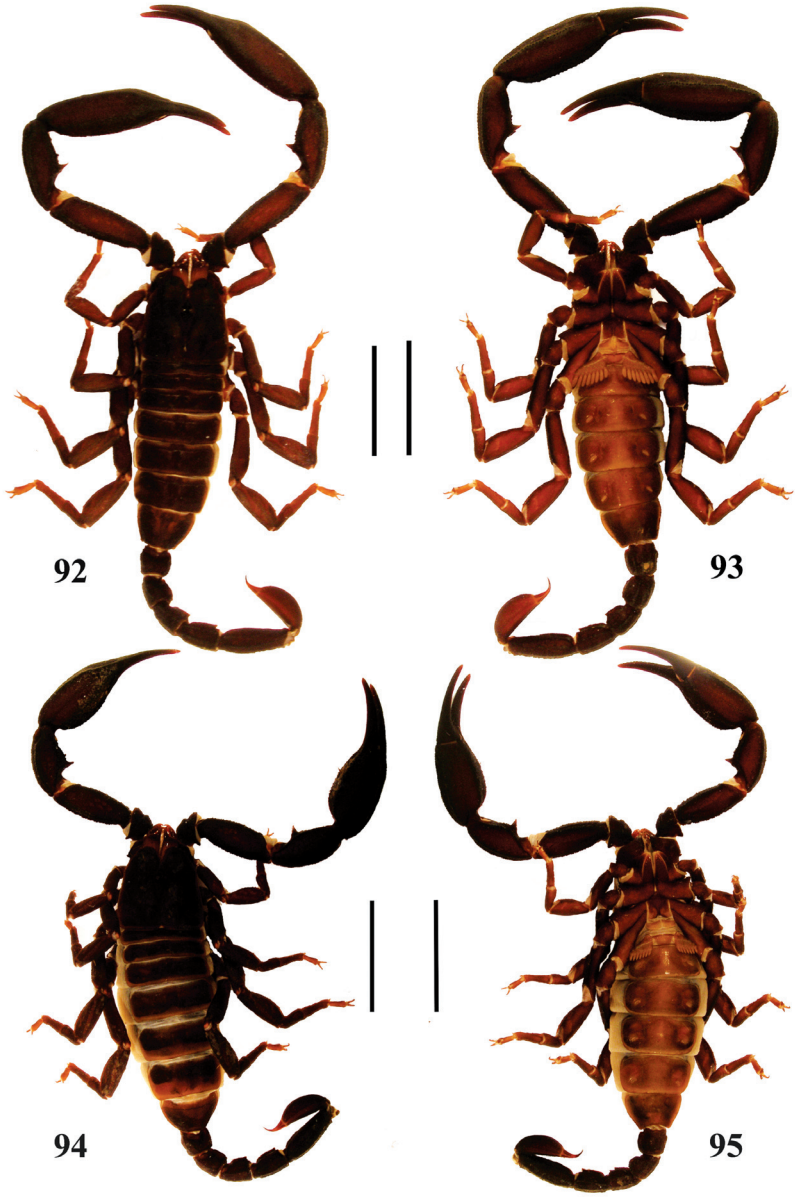
E. xui appears to be closely related to *E. kubani*, both can be distinguished by: male chela length/width ratio, about 4.0 in males and 3.5 in females, whereas it is about 3.1 in males and 2.9 in females in *E. kubani*; pedipalp fingers nearly straight (Figs



Figures 85–90. *Euscorpiops validus*. Male holotype (Ar.-MWHU-YNHH0901). **85–86** Chela dorsal and external aspects **89–90** Patella external and ventral aspects. Scale bars: 2.0 mm. **87–88, 91.** *Euscorpiops validus*. Female allotype (Ar.-MWHU-YNHH0902) **87–88** Chela dorsal and external aspects **91** Patella external aspect. Scale bars: 2.0 mm.

105, 107), while in *E. kubani* there is scalloped in males and nearly straight in females (Kovařík 2004; Sun and Zhu 2010).

E. xui can be distinguished from other related species of the genus *Euscorpiops* by the following features: patella of pedipalp with 10 ventral trichobothria, whereas in *E. shidian* with 11 (rarely 10 and 12); chela with a clear sexual dimorphism on length/width ratio: about 4.0 in males and 3.5 in females, compared with 2.7–3.2 in *E. kubani*, 2.9–3.2 in *E. validus*, and 2.6–2.8 in *E. puerensis*; patella of pedipalp with 18–19 (rarely 18) external trichobothria in *E. xui*, whereas 18 external trichobothria in *E. kubani*, *E. shidian*, *E. validus* and *E. yangi*; the coloration mainly dark brownish-red in *E. xui*, but yellow brown in *E. vachoni*.



Figures 92–95. Habitus of *Euscorpiops xui*. **92–93** Male (Ar.-BHDC-YNML0901), dorsal and ventral views **94–95** Female (Ar.-BHDC-YNML0902), dorsal and ventral views. Scale bars: 12.0 mm.

Description. See Sun and Zhu (2010).

Variation. Measurements in table 1. Feature datasets in table 2.

Ecology. This species is uncommon, collected from moist mixed forest close the villages.

Distribution. China (Yunnan).

Figures 96–103. *Euscorpiops xui*. **96–99** Male (Ar.-BHDC-YNML0901). Chela dorsal, external, ventral and internal aspects **100–103** Female (Ar.-BHDC-YNML0902). Chela dorsal, external, ventral and internal aspects. Scale bars: 6.0 mm.

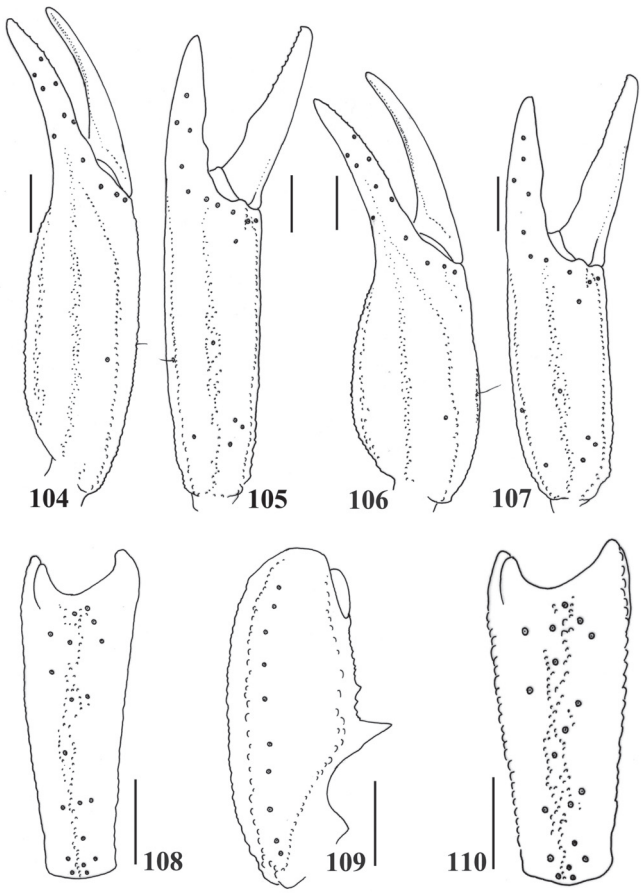
Euscorpiops yangi Zhu, Zhang & Lourenço, 2007

Figures 111–117

Euscorpiops yangi Zhu et al. 2007: 20–25, Figs 1–22, tab. 1.

Type locality. China, Yunnan Province, Maguan District.

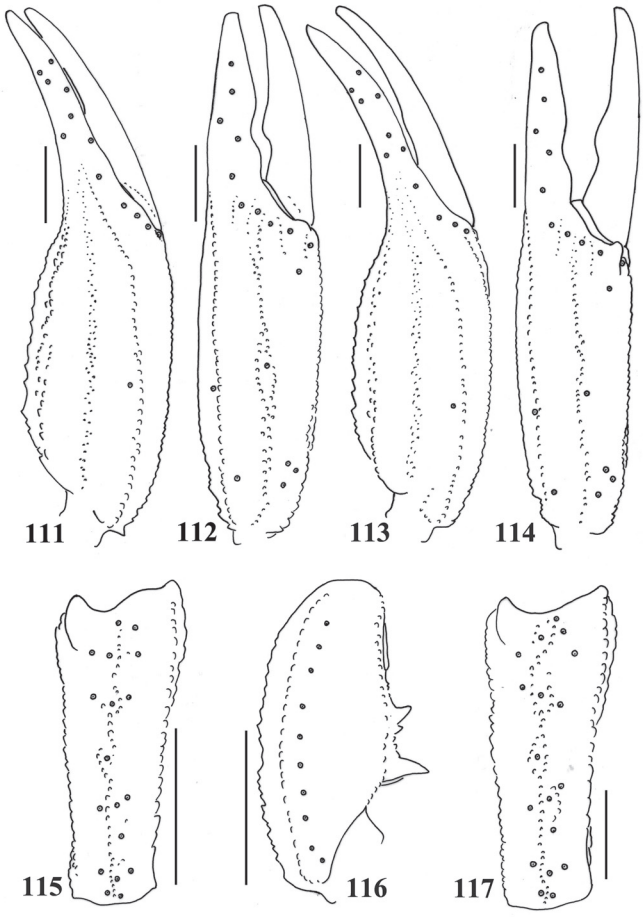
Type material. Male holotype, China, Yunnan Province, Maguan District, Gulingqing Town (23°00′N, 104°18′E), 20/VII/2006, Zizhong Yang and Yulong Wang leg, (Ar.-MHBU-0011); 3 males and 1 female paratypes, same data as holotype (1 male paratype in MNHN, the others in MHBU).



Figures 104–110. 104–105, 108–109. *Euscorpiops xui*. Male (Ar.-BHDC-YNML0901) **104–105** Chela dorsal and external aspects **108–109** Patella external and ventral aspects. Scale bars: 2.0 mm. **106–107, 110.** *E. xui*. Female (Ar.-BHDC-YNML0902) **106–107** Chela dorsal and external aspects **110** Patella external aspect. Scale bars: 2.0 mm.

Diagnosis. (Modified from Zhu et al. 2007) Medium-sized scorpion with total length 46.1 to 51.3 (4 males and 1 female); patella of pedipalp with 9 to 10 ventral trichobothria (Figs 115–117); chela narrow and elongated, the length/width ratio is 3.4 on males (4 specimens) and 3.3 on female (1 specimen), the chela length/carapace length ratio is equal or greater than 2.0; pedipalp fingers of males and females nearly straight (Figs 112, 114).

E. yangi can be distinguished from other related species of the genus *Euscorpiops* by the following features: patella of pedipalp with 9 to 10 ventral trichobothria, whereas



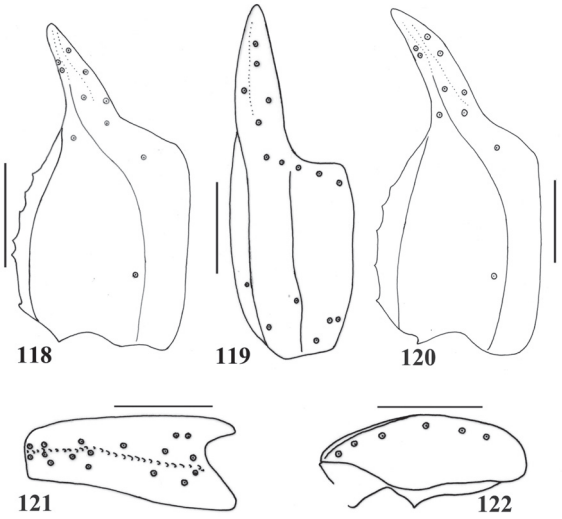
Figures 111–117. 111–112, 115–116. (followed Zhu, Zhang and Lourenço 2007). *Euscorpiops yangi*. Male holotype (Ar.-MHU-0011). **111–112** Chela dorsal and external aspects **115–116** Patella external and ventral aspects. Scale bars: 2.0 mm. **113–114, 117.** (followed Zhu, Zhang and Lourenço 2007). *E. yangi*, Female paratype **113–114** Chela dorsal and external aspects **117** Patella external aspect. Scale bars: 2.0 mm.

in *E. shidian* with 11 (rarely 10 or 12); chela narrow and elongated; the length/ width ratio is 3.4 in males and 3.3 in females, compared with 2.7–3.2 in *E. kubani*, 2.9–3.2 in *E. validus* , and 2.6–2.8 in *E. puerensis*. *E. yangi* can be ditinguished from *E. xui* by the following features: patella of pedipalp with 18 external trichobothria whereas in *E. xui* with 18–19; chela with length/width ratio 3.4 in males and 3.3 in females, whereas on *E. xui* with length/width ratio 4.0–4.1 in males (2 specimens) and 3.4–3.6 in females (2 specimens).

Description. See Zhu et al. (2007).

Ecology. This species is uncommon, found under stones.

Distribution. China (Yunnan).



Figures 118–122. *Scorpiops jendeki* (followed Kovařík 1994, 2000). Male holotype. **118–119** Chela dorsal and external aspects **121–122** Patella external and ventral aspecta. Scale bars: 2.0 mm. **120** *S. jendeki* (followed Kovařík 2000). Female. Chela dorsal aspect. Scale bars: 2.0 mm.

Genus *Scorpiops* Peters, 1861

Scorpiops jendeki Kovařík, 1994

Figures 118–122

Scorpiops hardwickii jendeki Kovařík 1994: 62, Figs 7–13, tab.1; Fet, 2000: 492.
Scorpiops jendeki: Kovařík 2000: 180, 182, Figs 59–60, tabs. 1–3.

Type locality. China, Yunnan, Gaoligongshan Nature Reserve 100 km west of Baoshan.

Type material. Holotype female: China, Yunnan, Gaoligongshan Nature Reserve 100 km west of Baoshan; 1 female paratype (NMPC), 4 females paratypes (FKCP), 14–21/VI/1993, E. Jendek and O. Sausa leg.

Diagnosis. (Taken from Kovařík 2000). Total length is 30–42.1 mm. Patella with 17 external trichobothria (5*eb*, 2 *esb*, 2 *em*, 4 *est*, 4 *et*) (Fig. 121) and 6–7 ventral trichobothria (6 specimens, Fig. 122). Pectinal teeth 4–5. Both males and females have fingers of pedipalps straight, without any flexure. The carapace bears very sparse large granules.

S. jendeki appears to be closely related to *S. hardwickei* (Gervais, 1843), both species have the same number of external and ventral trichobothria on the patella, and a similar length/width ratio of chela; however, in the latter the fingers of pedipalps are strongly flexed.

Figure 123. Map of China (Yunnan), showing the localities of the Scorpiones species. Map abbreviations: square, *S. jendeki*; ellipse, *E. kubani*; heart, *E. puerensis*; triangle, *E. shidian*; polygon, *E. vachoni*; pentagon, *E. validus*; rhombus, *E. xui*; circle, *E. yangi*; red diagonal, *L. mucronatus*.

Description. See Kovařík (1994, 2000).

Ecology. This species is uncommon, collected from moist mixed forest and in the bark or leavers and moss.

Distribution. China (Yunnan).

Key to species of Scorpiones from Yunnan (China)

1 Anterior margin of carapace retuse (Figs 1, 3), 5 pairs of lateral ocelli; telson with a subaculear tubercle ..... ***L. mucronatus* (Fabricius)**

– Anterior margin of carapace deeply depressed (see Di et al. 2010b, Fig. 6), 3 pairs of lateral ocelli; telson without subaculear tubercle **2**

2 Trichobothrium Eb_3 on the external surface of the chela located between trichobothria *Dt* and *Db*, pedipalp chela fingers straight; telson without annular ring ..... ***S. jendeki* Kovařík**

– Trichobothrium Eb_3 on the external surface of the chela located between trichobothria *Dt* and *Est*; telson with an annular ring at the juncture of the vesicle with aculeus (Fig. 48) **3**

3 Male pedipalp chela fingers strongly scalloped: with a pronounced lobe on the movable finger and a corresponding notch on fixed finger **4**

– Male pedipalp chela fingers slightly scalloped or straight: lobe and corresponding notch reduced or absent **7**

4 Chela manus stout and rounded ..... ***E. vachoni* Qi, Zhu and Lourenço**

– Chela manus flattened dorsoventrally **5**

5 Female pedipalp chela fingers nearly straight..... ***E. kubani* Kovařík**

– Female pedipalp chela fingers scalloped..... **6**

6 Chela length/width ratio: 2.9–3.2 (average 3.0 in males, 3.1 in females); pedipalp patella with 9 to 10 (rarely 11 or 8) ventral trichobothria; pectinal teeth 6–8 (rarely 8) ..... ***E. validus* Di, Cao, Wu and Li**

– Chela length/width ratio: 2.6–2.8 (average 2.7 on both sexes); pedipalp patella with 11 or 10 (rarely 10) ventral trichobothria; pectinal teeth count 7–8 ..... ***E. puerensis* Di, Wu, Cao, Xiao and Li**

7 Chela length/width ratio about 3.5 in females, about 4.0 in males; platella of pedipalp with 19 external trichobothria (rarely 18) ..... ***E. xui* Sun and Zhu**

– Chela length/width ratio 3.2–3.5 in both sexes; patella of pedipalp always with 18 external trichobothria **8**

8 Number of trichobothria on ventral surface of patella: 11 (rarely 10 or 12), pedipalp chela fingers nearly straight (Figs 57, 61) .... ***E. shidian* Qi, Zhu and Lourenço**

– Number of trichobothria on ventral surface of patella: 10 or 9, pedipalp chela fingers slightly undulated (Figs 112, 114) .... ***E. yangi* Zhu, Zhang and Lourenço**

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RESEARCH ARTICLE

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A synopsis of East-Mediterranean *Synaphris* Simon, 1894 (Araneae, Synaphridae) with a description of a new species from Israel

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Abstract

Three species of *Synaphris* occurring in the East Mediterranean – *S. orientalis* Marusik & Lehtinen, 2003, *S. lehtineni* Marusik, Gnelitsa & Kovblyuk, 2005 and *S. letourneuxi* (Simon, 1884) – are surveyed; and a new species – *S. wunderlichi* **sp. n.** – is described from southern Israel on the basis of males. The new species differs from other East- Mediterranean congeners by its smaller size, a smaller lamella with fewer ridges, and a thick palpal femur. Comparative figures are provided for all species from the East Mediterranean.

Keywords

Spiders, East Mediterranean, distribution

Introduction

Synaphridae Wunderlich, 1986 is a small family with three genera and 12 species known from the Mediterranean region (including adjacent territories: the Canary Islands and western Turkmenistan) and Madagascar (cf. Platnick 2011). The most

species-rich genus in the family is *Synaphris*, containing 10 species: eight from the Mediterranean (from the Canary Islands to western Turkmenistan) and two from Madagascar. Its type species, *S. letourneuxi* (Simon, 1884), was originally described in *Grammonota* Emerton, 1882, a linyphiid genus. A decade later after the species description a new genus was suggested for it (Simon 1894). This genus was later considered within the Theridiidae and Symphytognathidae, until Wunderlich (1986) placed it in a separate subfamily of Anapidae. The group was given family status by Marusik and Lehtinen (2003). Less than a decade ago, this family was known exclusively from the south-western Palaearctic. Recently, Miller (2007) reported this family from Madagascar and described two species of *Synaphris* and one new monotypic genus, *Africepheia* Miller, 2007. This finding suggests that the Synaphridae are more widespread than previously assumed and probably also occur in eastern Africa.

While studying material collected in Israel by pitfall traps we identified over two dozen specimens belonging to *Synaphris* and initially thought they might be *S. letourneuxi,* the species described from Egypt and known only from the male holotype. A detailed examination of our specimens, as well as their comparison with the literature and all the available material, has revealed them to belong to an unknown species. This study surveys all the species currently known from the East- Mediterranean region and describes a new species.

Material and methods

Digital photographs of general appearance and copulatory organs were taken using an Olympus SZX16 stereomicroscope with an Olympus E-520 camera and prepared using the CombineZP software. These photographs were taken in alcohol, in dishes with paraffin at the bottom. Different-sized hollows were made at the bottom to maintain the specimens in the desired position. Scanning electron photos were taken using the SEM JEOL JSM-5200 scanning microscope at the Zoological Museum, University of Turku. All measurements are in mm. Type material will be deposited at the Department of Zoology, Tel-Aviv University (TAU), the National Spider Collection at the Hebrew University, Jerusalem (HUJ), Göteborgs Naturhistoriska Museum (GNM) and the Zoological Museum, University of Moscow (ZMMU). The terminology follows Marusik and Lehtinen (2003). Only one abbreviation has been used on the figures: *La* – lamella. All measurements are in mm.

Taxonomic survey

To date, three species of *Synaphris* have been known from the East-Mediterranean region (east of 20°E) (cf. Platnick 2011). All of them are known from type localities only. A synopsis of these species including the new one is given below.

***Synaphris lehtineni* Marusik, Gnelitsa & Kovblyuk, 2005**
Figs 12, 15–16

S. l. Marusik et al. 2005: 125, f. 1–4, 6–14, 18–31 (♂♀).

Comments. This species was described on the basis of 30 specimens collected from a single Crimean locality (Marusik et al. 2005). After the species was described, repeated attempts to recollect it from the type locality have been unsuccessful (Kovblyuk pers. comm.). This may indicate that its population density can fluctuate significantly. Although not recollected from the type locality, it was found in one more locality on the south-eastern coast of the Crimean peninsula (Kovblyuk et al. 2008). Here we provide only comparative figures that enable its discrimination from other East-Mediterranean species. *S. lehtineni* is the northernmost species of the genus. All specimens were found under stones in the sub-Mediterranean *Quercus-Pistacia-Abies-Juniperus* forest, on small sheet-webs (Kovblyuk pers. comm.).

***Synaphris letourneuxi* (Simon, 1884)**
Figs 21–22

Grammonota l. Simon 1884: 599 (♂).
S. l.: Simon 1894: 589.
S. l.: Levi & Levi 1962: 64, f. 311 (♂).
S. l.: Brignoli 1970: 1407, f. 7–10 (♂).
S. l. Wunderlich 1980: 259, f. 15–16 (♂).
S. l.: Wunderlich 1987: 137, f. 363 (♂).

Comments. This is the type species of the genus. The species remains known from the male holotype only, collected in Aswan (=Assuan, Egypt). Although it has been redescribed several times, details of its male palp remain unknown. Neither lamella, nor the embolus basis, the course of the seminal duct or position of the cymbial furrow have been depicted or verbally described.

***Synaphris orientalis* Marusik & Lehtinen, 2003**
Figs 13, 17

S. o. Marusik & Lehtinen 2003: 150, f. 1–24 (♂).
S. o.: Marusik et al. 2005: 128, f. 5, 15–17, 32 (♂).

Comments. Like the type species, *S. orientalis* remains known from the male holotype only, collected in western Turkmenistan. Despite this, the species was studied by means of scanning electron microscope and properly described by Marusik and Lehtinen (2003).

***Synaphris wunderlichi* sp. n.**
urn:lsid:zoobank.org:act:90027054-25C3-43EB-9C22-462F3640BCD0
Figs 1–11, 14, 18–20

Material: Holotype ♂ (TAU) and paratypes 29♂♂ (HUJ, TAU, GTM & ZMMU) ISRAEL: Adulam 8 km SSW Beit-Shemesh, 31°39'N 34°57'E, 350–400 m, oak maquis (*Quercus calliprinos*), pitfall traps, 15.04.2003 (U. Columbus & T. Levanony).

Note. Although the species was numerous in pitfall traps, the second author (SZ) was unable to find any specimen by hand-picking or sifting the litter.

Etymology. The species name is a patronym in honour of our friend and colleague, the noted arachnologist Jörg Wunderlich (Germany), who erected the subfamily Synaphrinae.

Diagnosis. The new species can be separated from other East-Mediterranean species, *S. orientalis*, *S. lehtineni* and *S. letourneuxi*, by its smaller size (carapace < 0.5, in all other species longer than 0.5). In addition to size, the new species can be recognized by the relatively smaller lamella (cf. Figs 8, 12–13), with less developed ridges. Number of lamellar ridges in the new species (about 6) is approximately half that of its East-Mediterranean congeners. In addition, *S. wunderlichi* sp. n. has a relatively shorter and thicker palpal femur (cf. Figs 14–15, 17–19, 22). The new species is most similar in size to *S. dalmatensis* Wunderlich, 1980, but the Balkan species has relatively longer legs, and unlike other *Synaphris* species, it has tarsus I shorter than metatarsus I (0.24 and 0.21 respectively). The shape of the lamella in *S. dalmatensis* is unknown.

Description. Male. Total length 0.91–0.96. Carapace: 0.46 long, 0.41 wide, uniformly coloured light brown with three dorsal median setae as in other species. Abdomen oval, lighter than carapace, without pattern.

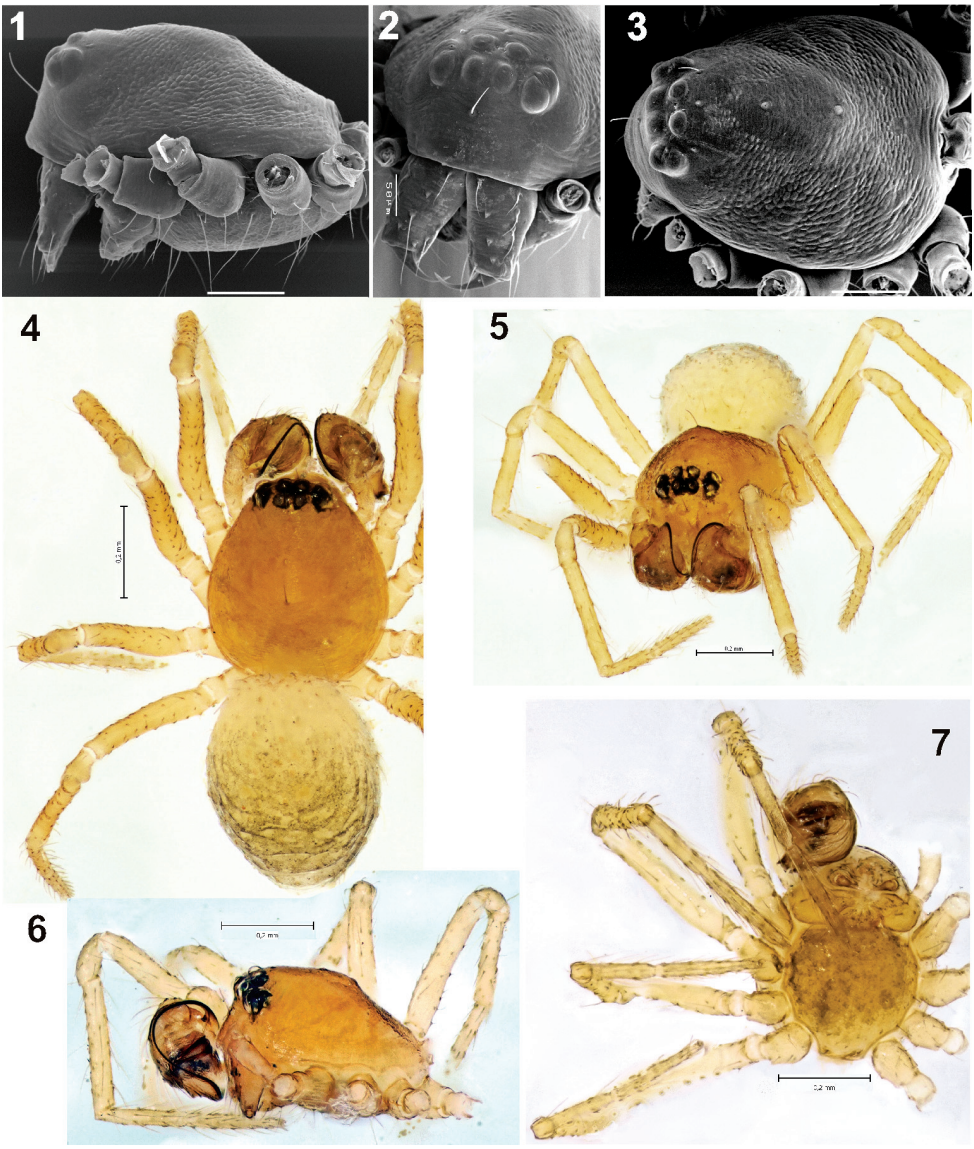
Leg joint measurements:

	Femur	Patella & Tibia	Metatarsus	Tarsus	Total
I	0.357	0.400	0.243	0.257	1.257
II	0.357	0.386	0.200	0.243	1.186
III	0.314	0.314	0.200	0.243	1.071
IV	0.386	0.371	0.214	0.257	1.228

The palp as in Figs 8–11, 14, 18–20. Femur short and thick; patella small; tibia wide, round and flat (Fig. 14); lamella lanceolate with six longitudinal ridges, lamella invisible in compound microscope in prolateral view, but can be found in terminal view (Fig. 20); seminal duct in the base of embolus is straight (Fig. 18).

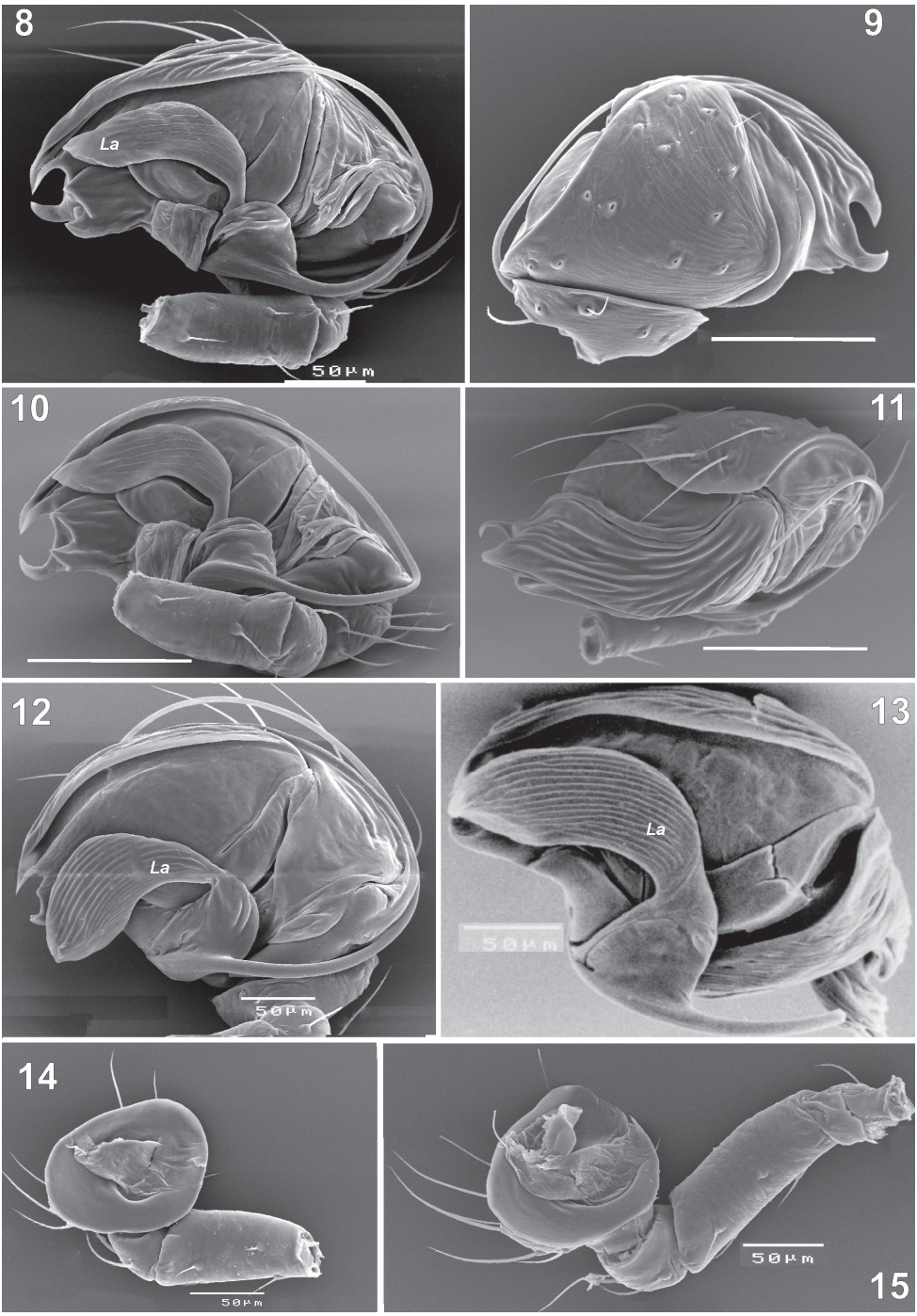
Distribution. Type locality only.

Comments. When we first examined these specimens from Israel, we thought that they might be conspecific with the generotype, *S. letourneuxi,* described and known from neighbouring Egypt. The type locality of *S. letourneuxi*, near Aswan

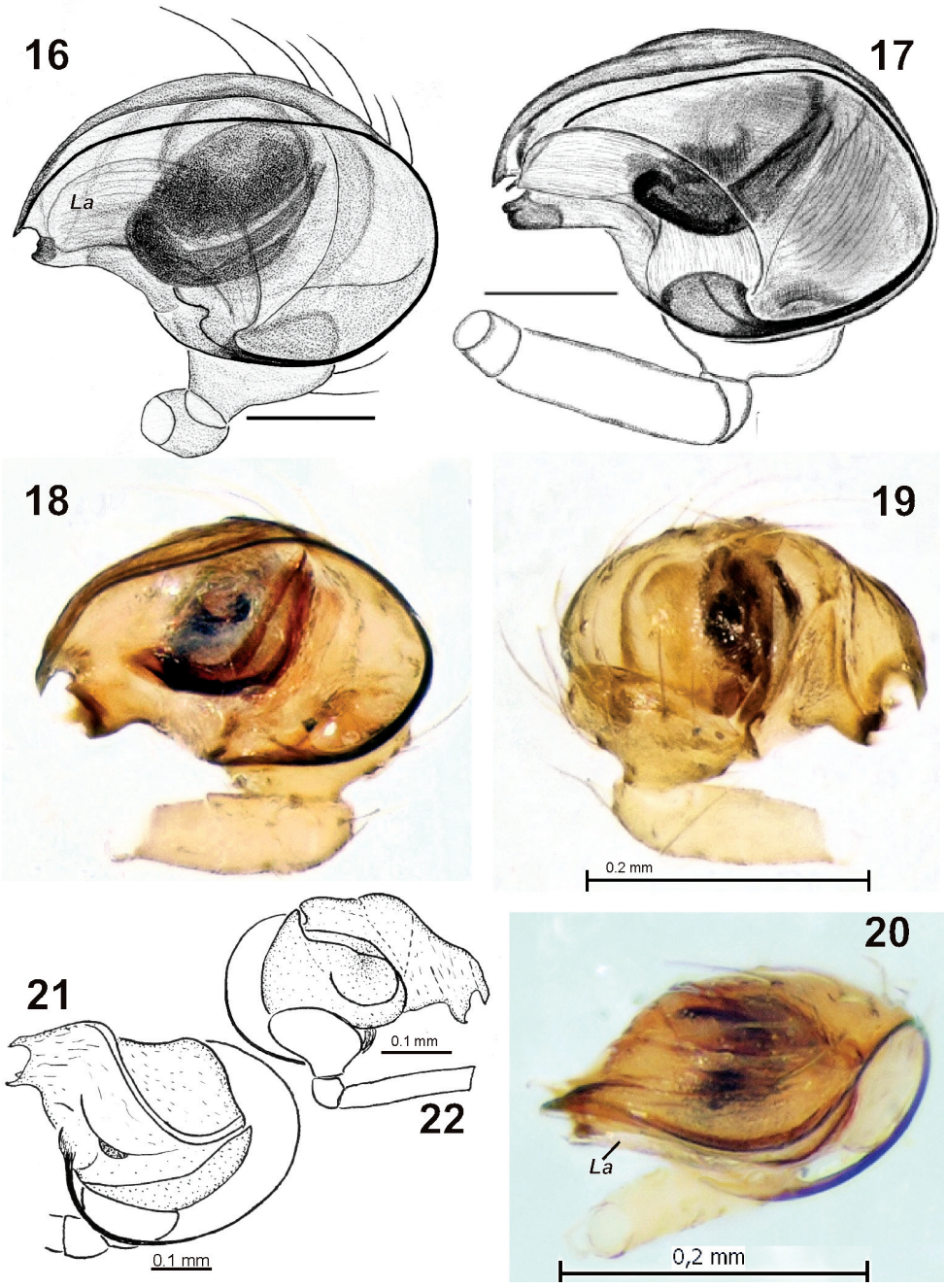


Figures 1–7. Prosoma and habitus of *Synaphris wunderlichi* sp. n. **1–3** prosoma with removed legs and palps, lateral, frontal and dorsal **4–5** habitus, dorsal and frontal **6–7** prosoma, lateral and ventral. Scale = 0.1 mm if not otherwise stated.

(=Assuan), is quite distant from southern Israel. The holotype of *S. letourneuxi* is 1.28 long, with carapace 0.53 long, distinctly larger than the new species. In addition to differences in the terminal part of the bulbus, *S. letourneuxi* has a thinner and relatively longer palpal femur (cf. Fig. 22). Unfortunately, the lamella in this species remains unknown, as in all other species described prior to its first observation in 2003.



Figures 8–15. Scanning electron microphotographs of the male palp of *Synaphris wunderlichi* sp. n. (**8–11, 14**), *S. lehtineni* (**12, 15**) and *S. orientalis* (**13**). **8, 12–13** prolateral **9** retrolateral **10** caudal **11** anterior **14–15** palp with removed bulbus showing femur-tibia, anterior. Scale = 0.1 mm if not otherwise stated.



Figures 16–22. Male palp of *Synaphris lehtineni* (**16**), *S. orientalis* (**17**), *S. wunderlichi* sp. n. (**18–20**) and *S. letourneuxi* (**21–22**). **16–18** prolateral **19, 22** retrolateral **20** anterior **21** retrolateral-anterior. Scale = 0.1 mm if not otherwise stated. **16–17** after Marusik et al. (2005); **21–22** after Wunderlich (1980).

Map 1. A map showing type localities and distribution of *Synaphris letourneuxi* (◆), *S. lehtineni* (✚), *S. wunderlichi* sp. n. (●) and *S. orientalis* (■).

Conclusions

All *Synaphris* species are very similar in general appearance and differ only in details of the terminal part of the bulbus and shape of the lamella; the latter is yet known only in *S. wunderlichi* sp. n. Females are known in a few species, making it impossible to provide an identification key for the entire genus, or even for the species occurring in the East Mediterranean. Nevertheless, the species living eastward of 20°E can be easily differentiated by their sizes (Table 1)

Interestingly, all the *Synaphris* species described from the Palaearctic Region, except for *S. lehtineni* known from two localities (see Map 1) are known from a single locality, whereas both species from Madagascar were found in several localities, even on the opposite sides of the island. The same holds true for *Cepheia longiseta* (Simon, 1881), which is known from at least seven separate localities, from south-west Portugal to Switzerland (Lopardo et al. 2007). In the Palaearctic Region all *Synaphris* species are allopatric, whereas in Madagascar there are four localities in which both *S. schlingeri* Miller, 2007 and *S. toliara* Miller, 2007 co-occur (see Miller 2007).

Table 1. Comparison of size of East Mediterranean *Synaphris* species.

	Total	Carapace length	Leg I	Femur I
S. wunderlichi sp. n.	0.91–0.96	0.46	1.26	0.36
S. orientalis	1.06	0.54	1.4	0.43
S. letourneuxi	1.28	0.53	1.56	0.47
S. lehtineni	0.96–1.09	0.52–0.54	1.29	0.38

Given that all the Palaearctic species have a very local distribution, it is likely that any new findings may represent a new species. We expect a true species diversity of *Synaphris* to be at least twofold its presently known one.

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Coulmannia rossensis sp. n. (Isopoda, Asellota, Paramunnidae) from the Ross Sea, Southern Ocean

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Abstract

A new species of *Coulmannia*, *C. rossensis*, is described from the Ross Sea, Antarctica. It is most similar to *C. ramosae* Castelló, 2004, but can easily be distinguished from this species by the males yielding a pair of granulate humps on the dorsum of the pereonites 1–6 and a single granulate hump on the pereonite 7 and the free pleonite. *Coulmannia rossensis* **sp. n.** is sexually dimorphic. The dorsal sculpture of the female bodies yield a single granulate hump on all the pereonites and free pleonite. The species of the genus *Coulmannia* are restricted to the Southern Ocean, and *C. rossensis* **sp. n.** is the fourth species included in it.

Keywords

Isopoda, *Coulmannia*, new species, taxonomy, Ross Sea, Southern Ocean

Introduction

Paramunnidae Vanhöffen, 1914 is a large family of asellote isopods; at present it includes 42 genera, many of them recently erected (see Just and Wilson 2004, 2006, 2007; Doti et al. 2009; Just 2009a, b; Shimomura 2009). This family has a worldwide

distribution, but with an overwhelming preponderance of species in temperate to cold water of the Southern Hemisphere (Wilson 1980; Just and Wilson 2004). In agreement with this observation, Choudhury and Brandt (2007) found Paramunnidae to be one of the most abundant and frequent families among the Isopoda collected in the Ross Sea with RV *Italica* in 2004. A preliminary study of this collection showed that many of the species found in this survey were new to science (Choudhury and Brandt 2009). Based on this material, a new paramunnid of the genus *Coulmannia* is described.

To date species in the genus *Coulmannia* have been exclusively reported from the Southern Ocean. Hodgson (1910) erected the genus *Coulmannia* to include two new species from the Ross Sea, viz.: *C. australis* Hodgson, 1910 from Coulman Island and *C. frigida* Hodgson, 1910 from McMurdo Sound. More recently, Castelló (2004a) described the third species of the genus, *C. ramosae* Castelló, 2004 from the South Shetland Islands. In the present paper *Coulmannia rossensis* sp. n. is described from the Ross Sea. The morphological differences of the four species belonging to this genus are discussed and presented in a table, an identification key is offered.

Material and methods

Specimens of *Coulmannia rossensis* sp. n. were collected during the 19th Antarctic expedition to the Ross Sea on board the RV *Italica*, in February 2004. Samples were taken along a latitudinal transect between Cape Adare and Terra Nova Bay with a modified Rauschert dredge (Lörz et al. 1999). The material was sieved using a 500 µm mesh and fixed in pre-cooled 96% ethanol for later DNA analysis.

For the taxonomic description some specimens were stained with Chlorazole Black E®, and their appendages were dissected and temporarily mounted in glycerine. Pencil drawings of the whole animal and dissected appendages were prepared using a Carl Zeiss (Axioskop 2) compound microscope equipped with a camera lucida. Digital illustrations were made with a Wacom tablet and the Adobe Illustrator program following Coleman (2003).

The length of the head, pereonites, free pleonite, and pleotelson were all estimated along the mid-dorsal line. The width of the head was measured between the tips of the eyestalks. Body length as well as lengths of the articles of the appendages were measured according to Hessler (1970).

The material examined of *Coulmannia rossensis* sp. n. is lodged at the Zoological Museum of Hamburg (ZMH). For comparison purposes, the type material of *C. ramosae* Castelló, 2004 (holotype male MZB 2003-1229A and paratype male MZB 2003-1229B) deposited in the Museum of Zoology, Barcelona (MZB) was also examined.

Taxonomy

Family Paramunnidae Vanhöffen, 1914

Genus *Coulmannia* Hodgson, 1910

Composition. *C. australis* Hodgson, 1910; *C. frigida* Hodgson, 1910; *C. ramosae* Castelló, 2004 and *C. rossensis* sp. n.

Key to species of *Coulmannia*

1 Lateral margins of all pereonites produced into 2 processes ..... ***C. australis* Hodgson, 1910**

– Lateral margins of at least one pereonite produced into a single process **2**

2 Lateral margins of pereonite 1 produced into a single process, remaining pereonites produced into 2 processes..... ***C. frigida* Hodgson, 1910**

– Lateral margin of pereonites 2–4 produced into a single process, remaining pereonites rounded **3**

3 Male: pereonites 1–6 with a pair of granulate humps mid-dorsally, pereonite 7 and free pleonite with a single granulate hump. Female: all pereonites and free pleonite with a single granulate hump ..... ***C. rossensis* sp. n.**

– Male: pereonites 1 and 2 with a pair of granulate humps mid-dorsally, remaining pereonites and free pleonite with a single granulate hump. Female: unknown ..... ***C. ramosae* Castelló, 2004**

***Coulmannia rossensis* sp. n.**
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Figs 1–4

Material examined. Ross Sea, RV *Italica*.

Holotype: Adult male 1.7 mm (ZMH 42000-718); station H out 2, 72°17.5'S, 170°29.4'E, 353 m depth, 11 Feb 2004.

Paratypes, same locality as holotype: 5 males (1.3–1.4 mm), 4 brooding females (1.6–1.7 mm), 2 females (1.2, 1.3 mm) and 2 juveniles (0.9, 1 mm); (ZMH 42000-719).

Additional material: Station H in 3, 72°17.0'S, 170°13.1'E, 316 m depth, 16 Feb 2004: 5 males, 2 brooding females, 1 female and 2 juveniles. Station H in 4, 72°17.1'S, 170°14.0'E, 196 m depth, 16 Feb 2004: 7 males, 3 females and 2 juveniles. Station H in 2, 72°16.9'S, 170°12.2'E, 391 m depth, 10 Feb 2004: 4 males and 1 female. Station SMN, 74°43.2'S, 164°13.1'E, 366 m depth, 20 Feb 2004: 2 males and 2 juveniles. Station H out 1, 72°15.7'S, 170°24.8'E, 458 m depth, 9 Feb 2004: 2 males, 1 female

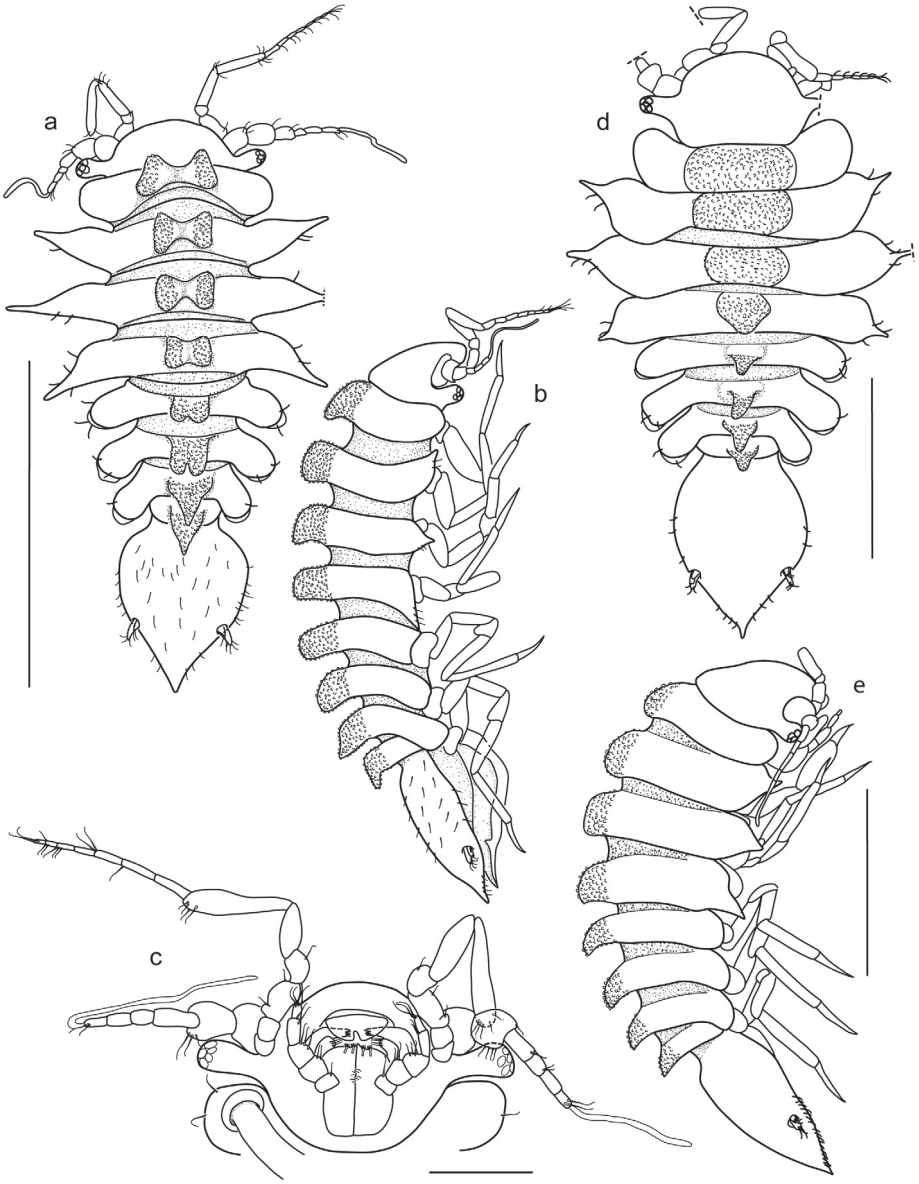

Figure 1. *Coulmannia rossensis* sp. n. Holotype male (ZMH–42000-718), **a** dorsal view **b** lateral view, **c** head in ventral view. Paratype female (ZMH–42000-719-a) **d** dorsal view. Paratype female (ZMH–42000-719-b) **e** lateral view. *Scale bars* 1 mm (a), 0.2 mm (c), 0.5 mm (d, e); a and b share the same scale.

and 2 juveniles. Station H out 4, 72°18.5'S, 170°26.8'E, 235 m depth, 12 Feb 2004: 4 males and 2 females. Station A 4, 71°18.4'S, 170°28.9'E, 230 m depth, 14 Feb 2004: 1 female. Station C 1, 73°24.5'S, 170°23.2'E, 474 m depth, 18 Feb 2004: 1 brooding female. Station C 2, 73°22.7'S, 170°06.9'E, 410 m depth, 18 Feb 2004: 2 males, 3 brooding females, 6 females and 3 juveniles.

Diagnosis. Males with dorsal sculpture formed by a pair of granulate humps on pereonites 1–6, and a single granulate hump on pereonite 7 and free pleonite. Females with single granulate hump on all pereonites and free pleonite; hump on pereonite 1 widest and shallowest, following humps gradually becoming narrower and higher towards distal end. Lateral margins of pereonites 1 and 5–7 rounded, those of pereonites 2–4 produced into single process. Coxae rounded, visible dorsally on pereonites 5–7 only.

Description of adult male (body description based on the holotype male, description of appendages based on a paratype male). Body (Fig. 1a, b) total length 1.7 mm; width 0.6 length, widest at pereonite 3. Cephalon width 1.9 length (Fig. 1c), anterior margin broadly rounded. Eyestalks prominent, width 0.6 length, with 5 ommatidia. Pereonites 1–6 with two granulate humps mid-dorsally, pereonite 7 and free pleonite with a single granulate hump each. Lateral margins of pereonites 1 and 5–7 rounded, those of pereonites 2–4 produced into a single process. Coxae rounded, visible in dorsal view on pereonites 5–7 only. Pleotelson and free pleonite together 1.7 as long as last 3 pereonites combined. Pleotelson oval, lateral margins smooth and convex, apex pointed. Uropods inserted at about 2/3 of pleotelson length in posterolateral indentations.

Antennula (Fig. 2a), articles 1–3 longer than wide; first article not extending beyond apex of eyestalk, with 1 penicillate and 4 simple setae; second article largest, with 4 penicillate and 5 simple setae; article 3 shorter than article 2, with 1 simple seta; article 4 shortest, with 1 penicillate seta, article 5 slightly longer than article 6, without setation; article 6 with 5 simple setae, 1 penicillate seta and 1 aesthetasc.

Antenna (Fig. 2b), article 1 broken off during dissection, without setation (see Fig. 1c); article 2 with 1 simple seta; article 3 shorter than article 5, with 5 simple setae; article 4 shortest, with 2 simple setae; article 5 with 3 simple setae; article 6 longest, with 5 penicillate and 5 simple setae; flagellum with 7 articles, each article with numerous simple setae.

Left mandible (Fig. 2c) stout, without palp; incisor process with 5 blunt cusps; spine row with 1 serrate and 2 simple setae; lacina mobilis 4-cusped; molar process cylindrical, transversely truncated, with lower margin of apex toothed. Right mandible (Fig. 2d) as left one, except for: spine row with 3 serrate and 1 simple setae; lacinia mobilis absent.

Maxillula (Fig. 2e), lateral lobe with 10 stout cuspidate setae distally and 1 simple seta near distal margin; medial lobe with 2 simple and 2 setulate setae distally.

Maxilla (Fig. 2f), lateral and medial lobes with 2 simple and 2 pectinate setae, distomedial margin with single acute projection finely setose; inner lobe with 5 simple, 2 pectinate and 2 setulate setae on distomedial margin, 4 simple slender setae on medial margin.

Figure 2. *Coulmannia rossensis* sp. n. Paratype male (ZMH–42000-719-c), **a** antennula **b** antenna **c** left mandible with detail of the incisor and molar processes **d** right mandible **e** maxillula **f** maxilla **g** maxilliped with detail of endite distal end (fan setae were omitted in the detail). *Scale bars* 0.1 mm (a–d, g), 0.05 mm (e, f); c and d share the same scale.

Maxilliped (Fig. 2g), endite reaching half-length of palp article 3, with 2 coupling hooks, distal margin with 4 setulate setae (see detail), ventral surface with 1 setulate and 2 fan setae, dorsal with 3 setulate setae; epipod ovate, width 0.5 length, reaching dorsal margin of palp article 2. Palp, article 1 with 1 tooth on lateral margin, relative lengths of articles 1.0:1.4:1.4:1.7:1.0.

Pereopod I (Fig. 3a) stoutest. Basis longest article, with 4 simple setae. Ischium with 4 simple setae. Merus with 1 robust and 1 simple setae distodorsally, ventral margin with 4 simple setae. Carpus triangular, length 0.88 ischium length, ventral margin with 2 robust and 4 simple setae and 2 cuticular combs, distodorsal margin with 1 simple seta. Propodus oval, ventral and dorsal margins with 4 simple setae each, anterior surface with 1 simple seta and cuticular combs. Dactylus with 4 simple setae near distal margin and 2 simple setae between unguis and ventral claw, unguis slightly longer than dactylus, ventral claw shorter than unguis, approximately 0.5 unguis length.

Pereopods II–VII (Figs 3b–f, 4a) subequal in shape and length. Meri distodorsally with 1 robust seta on pereopods II–IV and 2 robust setae on pereopods V–VII; distoventrally with 1 robust seta on pereopods III–VI and 2 robust setae on pereopod VII. Carpi and propodi with 1 distodorsal penicillate seta each; ventral margin with 4 robust setae and 3 robust setae, respectively. Ungues 1.6–1.9 dactyli length, ventral claws 0.35 ungues length.

Pleopod I (Fig. 4b, c), lateral lobes at level of 2/3 of its length, each lobe with 8 simple setae; ventral surface with 8 simple setae; distal margin with 8 simple setae.

Pleopod II (Fig. 4d), sympod lateral margin rounded and setose; endopod stylet-like, curved to the apex of the sympod, relative lengths endopod: sympod, 1.0:1.3; exopod distally concave, without setae.

Pleopod III (Fig. 4e), endopod width 0.6 length, with 3 plumose setae distally; exopod with 2 articles, distal one with 1 simple seta apically, extending beyond tips of endopod setae.

Pleopod IV (Fig. 4f), endopod width 0.54 length, exopod reaching half length of endopod.

Pleopod V (Fig. 4g) width 0.5 length.

Uropod (Fig. 4h) biramous; exopod 0.4 endopod length, distally with 2 simple setae (broken in the specimen drawn); endopod with 5 penicillate and 3 simple setae.

Description of adult female (Figs 1d, e; 4i). As male in body shape, except for: dorsal sculpture with a single granulate hump on all pereonites and free pleonite; hump on pereonite 1 widest and shallowest, following humps gradually becoming narrower and higher towards distal end. Operculum width 0.74 length, margins finely setose, ventral surface with 6 simple setae. Remaining appendages as those of the male.

Distribution. Only known from type locality (Fig. 5).

Etymology. The species name refers to the type locality, the Ross Sea.

Remarks. Because of the dorsal ornamentation and the lateral margins of the pereonites *Coulmannia rossensis* sp. n. is most similar to *C. ramosae* Castelló, 2004. The main differences between these two species are (characters found in *C. ramosae*

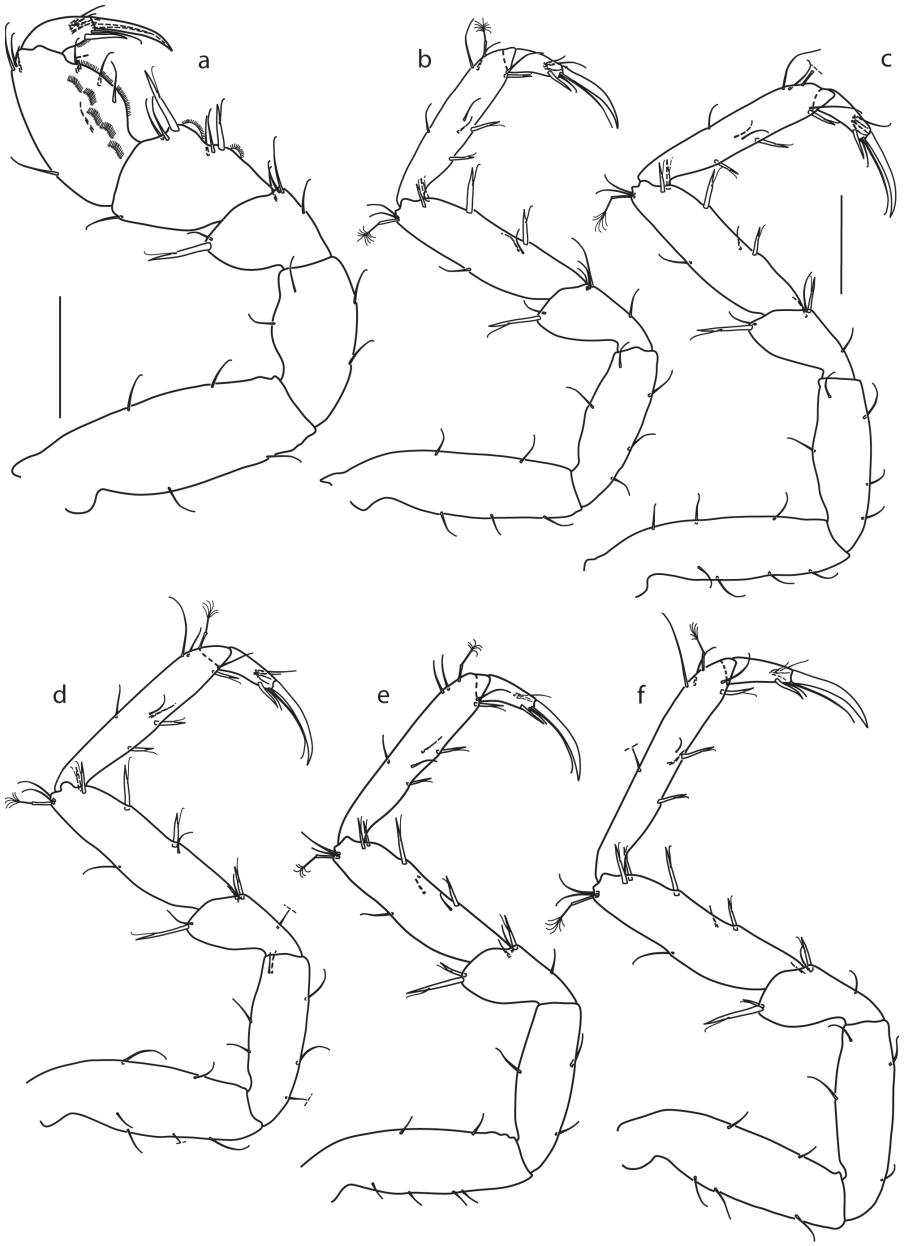

Figure 3. *Coulmannia rossensis* sp. n. Paratype male (ZMH–42000-719-c), **a** pereopod I **b** pereopod II **c** pereopod III **d** pereopod IV **e** pereopod V **f** pereopod VI. *Scale bars* 0.1 mm; b–f share the same scale.

in parentheses): two granulate humps on pereonites 1–6, single granulate hump on pereonite 7 and free pleonite (two granulate humps on pereonites 1 and 2, single granulate humps on remaining segments); pleotelson width 0.76 length (width 0.51

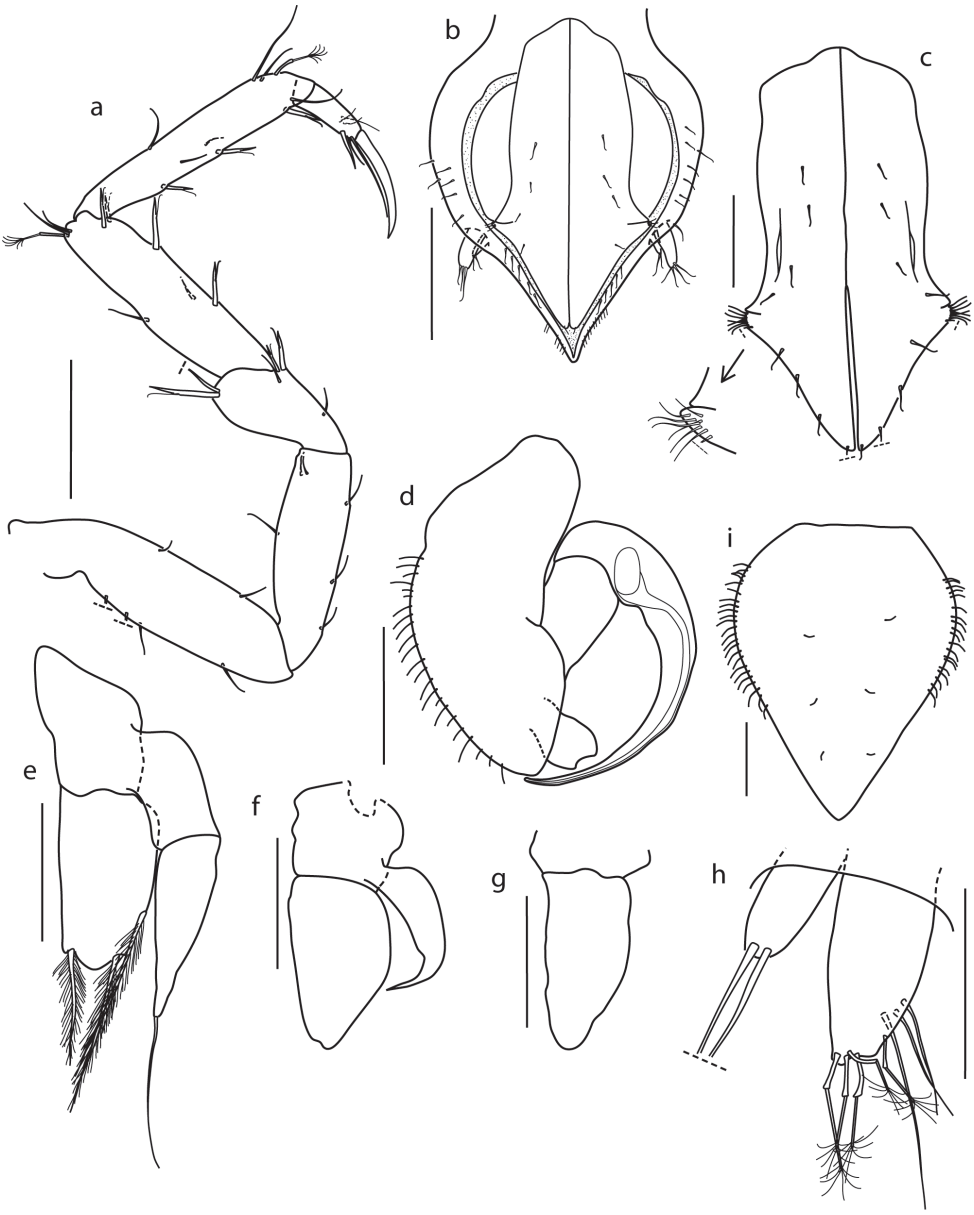

Figure 4. *Coulmannia rossensis* sp. n. Paratype male (ZMH–42000-719-c), **a** pereopod VII **b** pleotelson in ventral view **c** pleopod I **d** pleopod II **e** pleopod III **f** pleopod IV **g** pleopod V **h** uropod. Paratype female (ZMH–42000-719-a) **i** operculum. *Scale bars* 0.1 mm (a, c–g, i), 0.2 mm (b), 0.05 mm (h).

length, apex of pleotelson more produced); basis of pereopods with simple setae only (with simple and robust setae); propodi of pereopods II–IV with 3 robust setae (with 4 robust setae).

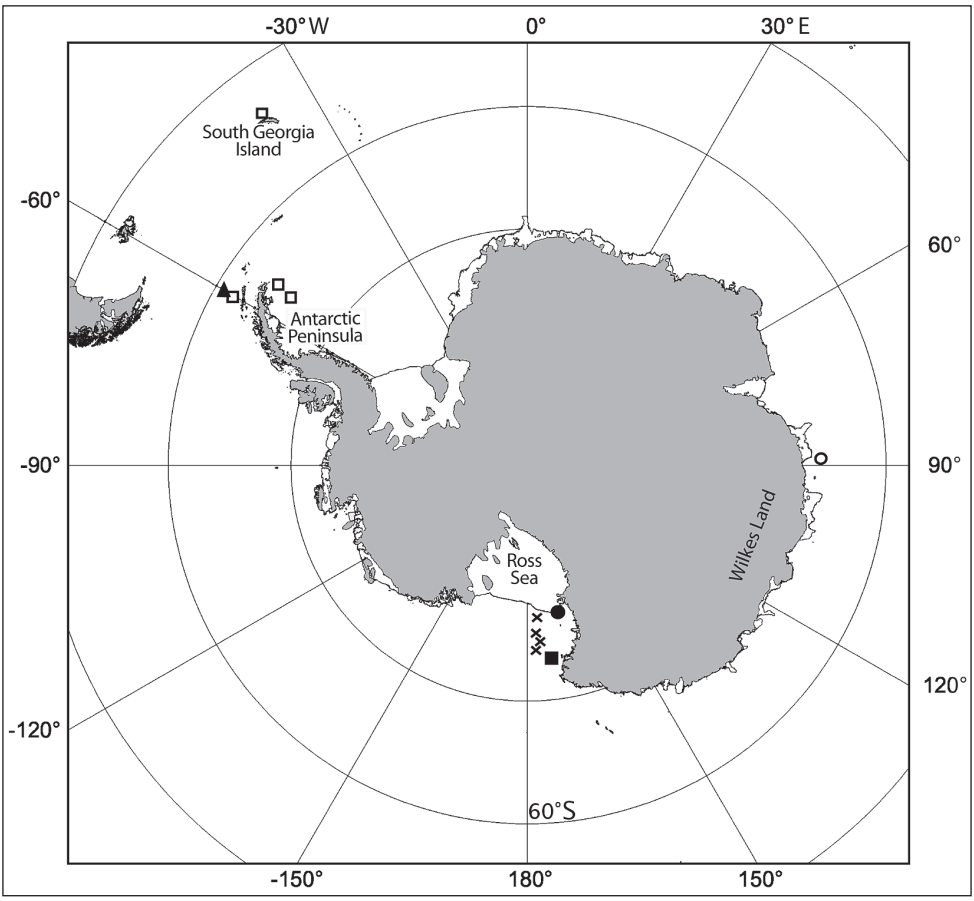

Figure 5. Geographic distribution of the *Coulmannia* species. *C. rossensis* sp. n. (cross); *C. ramosae* Castelló, 2004 (triangle); *C. australis* Hodgson, 1910 (square); *C. frigida* Hodgson, 1910 (circle). Full square and full circle stand for the type locality of the latter two species.

Discussion

At present, the genus *Coulmannia* Hodgson, 1910 contains four species, each one with a particular arrangement in the dorsal sculpture of the body and in the lateral margins of the pereonites (see Table 1). It is worth noticing that other genera of Paramunnidae, such as *Heterosignum* Gamô, 1976; *Meridiosignum* Just and Wilson, 2007; *Holodentata* Doti, Choudhury and Brandt, 2009; and *Pentaceration* Just, 2009 also include species with different dorsal sculptures and/or lateral margins arrays. The pereonites of *Coulmannia rossensis* sp. n. and *C. ramosae* Castelló, 2004 show lateral margins similar to those present in the species of the genus *Heterosignum*. This genus, however, differs from *Coulmannia* in having long and slender eyestalks, antenna with an elongate third article, and pleotelson with denticulate margins, anteriorly narrow and cylindrical.

Table 1. Character comparison of the species included in *Coulmannia* Hodgson, 1910. *Abbreviations*: **Prns.** = pereonites; **PI**= first pereopod; **RS** = robust setae. * This range includes the data from the specimens described by Hodgson (1910) and Nordenstam (1933).

	Lateral margins of pereonites	**Dorsal sculpture of pereonites and free pleonite**		**Coxae in dorsal view**	**PI, carpus ventral margin with**	**Body length (mm)**
C. australis Hodgson, 1910	Prns. 1–7 produced into two processes	One smooth conical hump on each segment (without sexual dimorphism; José Castelló, pers. comm.)		Not visible	2–5 RS*	5–9*
C. frigida Hodgson, 1910	Prn. 1 produced into a single process, prns. 2–7 produced into two processes	One smooth conical hump on each segment (sexual dimorphism unknown)		Not visible	Unknown	3.5
C. ramosae Castelló, 2004	Prns. 1 and 5–7 rounded, prns. 2–4 produced into a single process	Two granulate humps on prns. 1–2, single granulate hump on remaining segments (sexual dimorphism unknown)		Visible on prns. 5–7 only	2 RS	2.1
C. rossensis sp. n.	Prns. 1 and 5–7 rounded, prns. 2–4 produced into a single process	♂♂: two granulate humps on prns. 1–6, single granulate hump on remaining segments	♀♀: single granulate hump on all segments, hump on prn. 1 widest and shallowest	Visible on prns. 5–7 only	2 RS	0.9–1.7

Coulmannia rossensis sp. n. has a remarkable sexual dimorphism in the arrangement of the dorsal sculpture. Contrary, no sexual dimorphism was found in *C. australis* Hodgson, 1910 (José Castelló, pers. comm.). Regarding *C. frigida* Hodgson, 1910, both the original description and that presented by Vanhöffen (1914) were based on a single specimen, and none of these authors mentioned the sex of the specimens examined. Thus, sexual dimorphism in *C. frigida* remains unknown. Similarly, Castelló (2004a) had only two males when he described *C. ramose*; therefore, the sexual dimorphism in this species is also unknown.

The four species belonging to *Coulmannia* were found exclusively in the Southern Ocean, *Coulmannia australis* being the most widely distributed (Fig. 5). This species was originally described by Hodgson (1910) from a single specimen collected on Coulman Island, Ross Sea at 183–400 m depth. Afterward, Nordenstam (1933) reported *C. australis* from the Antarctic Peninsula at 360–400 m depth, and the South Georgia Island at 252–310 m depth, and more recently Castelló (2004b) recorded it from the South Shetland Islands at 89–220 m depth. Limited distributions have been reported for many asellote species (see Hessler 1970; Just and Wilson 2004). Besides lacking free-living larvae, paramunnid species display a reduced mobility; hence,

limited distributions are expected. *Coulmannia australis*, however, seems to have a circumpolar distribution. There are some minor differences between the specimens of *Coulmannia australis* described by Hodgson (1910) and Nordenstam (1933), mainly in the body length and in the number of robust setae on the ventral margin of carpus of first pereopod. The variation in the number of setae most probably is related to the body length: the specimen described by Hodgson (1910) is 5 mm long and has 2 or 3 robust setae on the carpus of pereopod I, whereas the specimen described by Nordenstam (1933) is 9 mm long and has 5 robust setae. A carefully examination of the type specimen of *C. australis* and those reported from other areas is required to corroborate this wide distribution.

Records from the remaining three species of *Coulmannia* are scarce: *C. frigida* was described by Hodgson (1910) from McMurdo Sound at 229 m depth, and later on reported from the Gauss Station, Wilkes Land at 385 m depth by Vanhöffen (1914); *C. ramosae* was found only in the South Shetland Island at 89–220 m depth by Castelló (2004a); and *C. rossensis* is herein reported from the Ross Sea at 196–474 m depth (Fig. 5).

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RESEARCH ARTICLE

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A new species of *Lithobius* (*Monotarsobius*) Verhoeff, 1905 (Lithobiomorpha, Lithobiidae) from China

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Abstract

The present paper deals with a new species of the genus *Lithobius* Leach, 1814, *L.* (*Monotarsobius*) *songi* sp. n. (Lithobiomorpha: Lithobiidae) recently discovered in Hebei Province, China. Morphologically it resembles *L.* (*M.*) *holstii* (Pocock, 1895) from China and Japan but could be well distinguished from latter by having a Tömösváry's organ slightly smaller than the adjoining ocelli, different leg plectrotaxy and tridentate claw of female gonopods. A key to the Chinese *Lithobius* (*Monotarsobius*) species is presented.

Keywords

new species, *Lithobius* (*Monotarsobius*) *songi* sp. n., Lithobiidae, Hebei, China

Introduction

The subgenus *Monotarsobius* Verhoeff, 1905 of genus *Lithobius* Leach, 1814 is characterized by the presence of fused tarsi of legs 1–13 and antennal articles fixed at 20 or thereabouts (Eason 1992). Presently, this subgenus comprises one hundred species known from Asia, Europe, and North Africa (Zapparoli 2006). Very little attention

has been paid to the study of Lithobiomorpha in China, with only 15 genera and 66 species having been recorded up to now (e.g. Takakuwa and Takashima 1949; Wang 1959, 1963; Zhang 1996; Ma et al. 2007a, b, 2008a, b). As regards the investigation of *Lithobius* (*Monotarsobius*) only 8 species have hitherto been recorded (cf. Trotzina 1895; Pocock 1895; Takakuwa 1940, 1941, 1942; Zalesskaja 1978; Wang and Mauriès 1996; Eason 1997; Chao 2005; Ma et al. 2009a, b). Takakuwa (1941) described *L.* (*M.*) *obtusus* and *L.* (*M.*) *ramulosus* from Taiwan and later on (Takakuwa 1940, 1942) recorded also *L.* (*M.*) *crassipes* and *L.* (*M.*) *holstii* from the island. Zalesskaja (1978) recorded two other species, *L.* (*M.*) *alticus* and *L.* (*M.*) *crassus* from Xinjiang Autonomous Region. Eason (1997) recorded *L.* (*M.*) *ferganensis* from Xinjiang Autonomous Region, while Ma et al. (2009b) described *L.* (*M.*) *subspinipes* from Hainan and Hebei provinces. After a study of recently collected material from Hebei Province, we came across a new species of *Lithobius* (*Monotarsobius*), which is described below.

Methods

All specimens were hand-collected under stones. The material was examined with the aid of a Motic-C microscope, made in China. Colour description is based on specimens in 75% ethanol, and body length is measured from anterior margin of the cephalic plate to posterior end of telson. Type specimens are preserved in 75% ethanol and deposited in the College of Life Sciences, Hebei University, Baoding, China; some nontype material is deposited in the Department of Life Sciences, Hengshgui University, Hengshui, China. Terminology for external anatomy follows Bonato et al. (2010).

The following abbreviations are used in the text and tables: T, TT = tergite, tergites; S, SS = sternite, sternites; C = coxa, t = trochanter, P = prefemur, F = femur, T = tibia, a = anterior, m = median, p = posterior.

Taxonomic part

Lithobiidae Newport, 1844

***Lithobius* (*Monotarsobius*) *songi* sp. n.**
urn:lsid:zoobank.org:act:9739FCCD-35E8-477E-AA81-22EA6B83F40A
Figs 1–6

Etymology: The specific name is a patronym in honor of the zoologist Dr. Daxiang Song, Academician at the Chinese Academy of Sciences.

Material examined: Holotype: female (Fig. 1), body length 6.9 mm, cephalic plate length 0.7 mm, breadth 0.7 mm; from Qingliangdian Town, Wuyi County, Hengshui City, Hebei Province, 37°06'N 115°08'E, 35 m, 6 May 2005, leg. H. Ma. **Paratypes:** 2 ♀♀, 1 ♂, same data as holotype.

Other material: 1 ♀♀, 3 ♂♂, Xiaowutai National Natural Reserve, Yu County, Zhangjiakou City, Hebei Province, 39°54'N 115°00'E, 1236 m, 21 August 2005, leg. Z. Zhang and H. Ma.

Diagnosis: A *Lithobius* (*Monotarsobius*) species with body length 5.9–6.9 mm, antennae composed of 19–21 articles, commonly 19+19; 6–7 ocelli on each side, commonly 6, arranged in 2 irregular rows; Tömösváry's organ moderately small, slightly smaller than adjoining ocelli; 2+2 coxosternal teeth; porodonts moderately slender and long, posterolateral to lateral tooth; posterior angles of all tergites without triangular projections; coxal pores 1222, oval to round; female gonopods with 2+2 moderately large, coniform spurs; terminal claw tridentate; male gonopods short and small, with 1–2 long setae on terminal segment.

Description: Body 5.9–6.9 mm long; cephalic plate 0.6–0.7 mm long, 0.6–0.7 mm wide. Colour: tergites and basal articles pale brown; transition to yellow brownish from the seventh or eighth articles onwards, the terminal article yellow brown; tergites pale chestnut; pleural region pale gray; SS pale orange; distal part of forcipules brown, the remaining part of forcipules, forcipular coxosternite and SS 14 and 15 pale yellow-brownish; all legs pale yellow-brownish, tarsi of all legs yellow-brown.

Antennae composed of 19+19–21+21 articles (Fig. 1), most often 19+19; basal article almost as long as wide, second one markedly longer than wide, succeeding articles gradually shortening; terminal article typically longer than wide, up to 2.3–2.9 times longer than wide. Antennal setation: abundant setae on antennal surface, but fewer setae on outer side and ventral and dorsal side in basal articles, gradual increase in density of setae to about fourth or fifth article, then more or less constant.

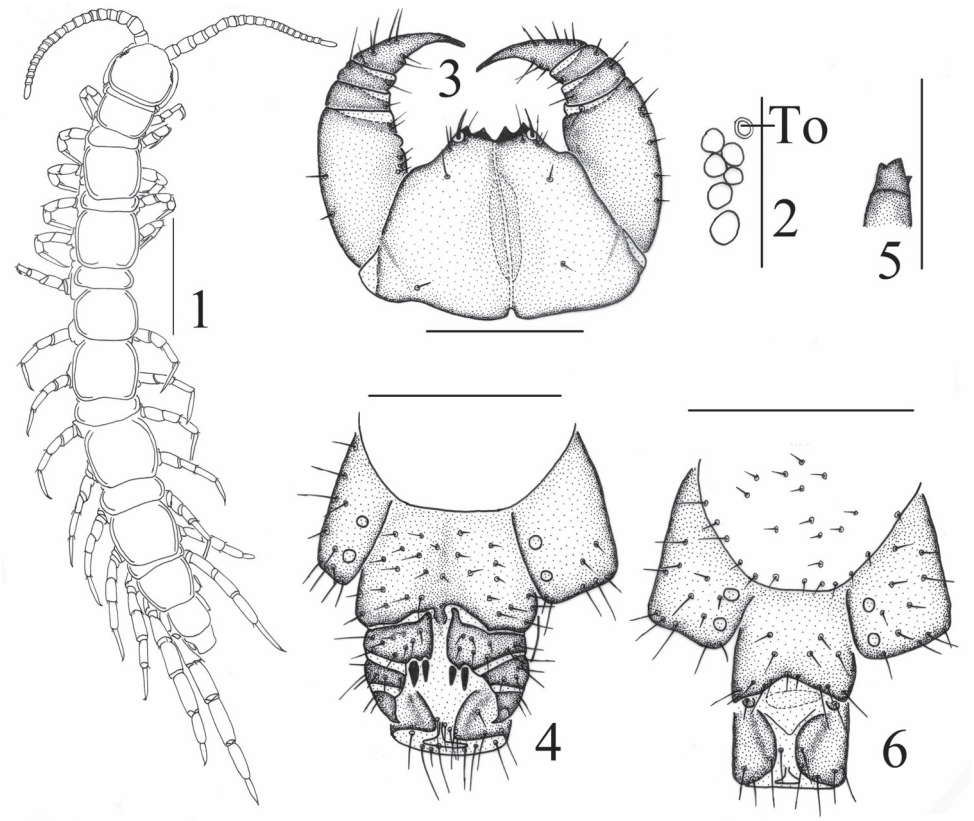
Cephalic plate smooth, convex, as long as broad, covered with sparse tiny setae; anterior part of the cephalic capsule with shallow median sulcus; pigment concentrated as close netlike veins, few short to long setae scattered along the marginal ridge; lateral marginal ridge continuous; posterior margin straight, without widening in middle part (Fig. 1).

Six–seven ocelli on each side of cephalic plate (Fig. 2), more often 6, arranged in 2 irregular rows; the terminal one larger, the ocelli near the dorsal slightly larger, the ocelli near the ventral slightly smaller; overhanging the lateral margin of the cephalic plate; ocelli gently bulging, translucent, usually darkly pigmented.

Tömösváry's organ moderately small (Fig. 2–To), nearly rounded, situated ventrad to anterolateral margin of cephalic pleurite, slightly smaller than the adjoining ocelli.

Coxosternite (Fig. 3) approximately trapezoidal, anterior margin moderately narrow with 2+2 comparatively sharp coxosternal teeth, median diastema relatively deep, V-shaped (Fig. 3); coxosternal shoulder lacking; porodonts lying posterolateral to the lateral tooth, comparely long and slender, without a bulge at the base. Moderately short to long setae sparsely scattered over the dental margin, comparatively long and thick near the dental margin.

All tergites moderately smooth, without wrinkles, backside slightly hunched, tiny setae scattered very sparsely over the surface; T 1 generally subrectangular, anteriorly broadened; T 1 slightly narrower than T 3 and the cephalic plate, the latter slightly



Figures 1–6. *L.* (*M.*) *songi* sp. n., **1–5** holotype, female: **1** habitus, dorsal view, scale 1 mm **2** ocelli and Tömösváry's organ (To), lateral view, scale 250 μm **3** forcipular coxosternite, ventral view, scale 500 μm **4** posterior segments and gonopods, ventral view, scale 500 μm **5** claw of gonopods, internal view, scale 250 μm **6** paratype, male: gonopods, ventral view, scale 250 μm.

wider than T3; lateral marginations of all tergites continuous, setae scattered sparsely along the lateral borders, more setae on anterior angles of tergites; posterior margin of TT 1, 3, 5, 7, 8, 10, 12 and 14 slightly concave; all tergites without posterior triangular projections (Fig. 1).

All sternites posterolaterally narrower than anterolaterally, generally trapeziform, moderately smooth, 2–4 moderately setae on anterior part of each sternite, 2–3 longer setae on posterior part of each sternite.

Legs strong, tarsus 1–2 articulation fused on legs 1–13, well-defined on legs 14 and 15; claw moderately long and curved ventrad in all legs; accessory spur on both anterior and posterior side of claw of legs 1–14, anterior accessory spur moderately long and thicker, forming a moderately large angle with the claw; posterior accessory spur short and slender, forming a comparatively small angle with the claw; no accessory claws on leg 15; short to moderately long setae scattered over the surface of legs 1–13, tarsi generally more setose, few setae on legs 14–15; legs 14 and 15

markedly thickened, the male more thicken than the female, tarsus 1 about 4.0–5.3 times longer than wide, tarsus 2 about 67%–81% length of tarsus on legs 15. Legs' plectrotaxy: as in Table 1.

Coxal pores arranged in a row, ovate to round, moderately small, 1222. Pore-field set in a slightly shallow groove, 8 short to moderately long setae scattered sparsely over the margin of shallow groove.

Female S 15 posterolaterally narrower than anterolaterally, generally trapeziform, straight posteromedially; short to long setae scattered very sparsely over its surface and lateral margins. The sternite of genital segment usually well sclerotised, wider than long, posterior border moderately deeply concave between condyles of gonopods, except for a small, median approximately rhombic bulge, distally lightly sclerotised; short to moderately long setae evenly scattered over the surface of genital sternite except for middle and anterior parts. Female gonopods: basal article moderately broad, bearing 8 moderately long setae, arranged in 3 irregular rows, and 2+2 small coniform spurs; inner spur slightly smaller and more anterior than the outer (Fig. 4); second article with 6 moderately long setae, arranged in 2 irregular rows; usually 3–4 moderately long setae on the surface of third article; terminal claw tridentate (Fig. 5), dorsal and ventral tooth about same in size.

Male S 15 posterolaterally narrower than anterolaterally, generally trapeziform, straight posteromedially; short to long setae scattered very sparsely over its surface and lateral margins. The sternite of genital segment usually well sclerotised, wider than long; comparatively long setae about evenly scattered on the ventral surface, slightly fewer near S15. Posterior margin of the sternite of the genital segment quite deeply concave between gonopods, no bulge medially; gonopods short and small, only a small hemispherical bulge, with 1–2 long setae on surface, terminal slightly sclerotised (Fig. 6).

Distribution: Known only from the Hebei Province (Hengshui and Zhangjiakou Cities), NE China.

Remarks: Having an eye composed of 6–7 ocelli and about 20 antennal articles, the new species resembles *L.* (*M.*) *holstii* (Pocock, 1895) from China and Japan (Takakuwa

Table 1. Legs' plectrotaxy of *L.* (*M.*) *songi* sp. n. Letters in brackets indicate variable spines.

legs	ventral					dorsal				
	C	t	P	F	T	C	t	P	F	T
1			p	a	m			p	ap	a
2			p	am	m			p	ap	ap
3–9				am	m				ap	ap
10				am	m				p	ap
11			(m)	am	m			p	p	p
12			mp	am	am			p	p	p
13		(m)	mp	(a)m(p)	m			mp	p	p
14		m	mp	m		m		mp		
15		m	mp	m		m		mp		

1941). However, it is well distinguished from the latter by having Tömösváry's organ slightly smaller than the adjoining ocelli, different leg plectrotaxy and tridentate claw of female gonopods (bidentate in *L.* (*M.*) *holstii*). It differs from *L.* (*M.*) *subspinipes* Ma et al., 2009 by having smaller Tömösváry's organ, different leg plectrotaxy and moderately setose legs (vs. only sparse setae in *L.* (*M.*) *subspinipes*).

Habitat preferences: The type series has been collected in a roadside of a mountain pine tree forest and under Chinese jujube trees in champaign environments.

Key to the Chinese species of *Lithobius* (*Monotarsobius*)

To assist in the identification of the Chinese species of *L.* (*Monotarsobius*), the following key is offered. This key emphasizes characters that can be examined without much dissection or high-magnification microscopy; moreover, these characters are specific to the taxa occurring in China.

1 Four ocelli on each side of cephalic plate, 17+17 antennal articles..... ***L.* (*M.*) *crassus* (Loksa, 1965)**

– Five or more ocelli on each side of cephalic plate, not less than 18+18 antennal articles..... **2**

2 Five ocelli on each side of cephalic plate..... ***L.* (*M.*) *alticus* (Loksa, 1965)**

– Six or more ocelli on each side of cephalic plate..... **3**

3 With spines on the second article of female gonopod..... **4**

– Without spines on the second article of female gonopod..... **5**

4 With two spines on the second article of female gonopod, six–ten ocelli on each side of cephalic plate, 1222–2222 coxal pores..... ***L.* (*M.*) *ferganensis* (Trotzina, 1894)**

– With three spines on the second article of female gonopod, eight–eleven ocelli on each side of cephalic plate, 2222–3443 coxal pores..... ***L.* (*M.*) *crassipes* L. Koch, 1862**

5 Terminal claw of female gonopod simple..... ***L.* (*M.*) *ramulosus* (Takakuwa, 1941)**

– Terminal claw of female gonopod bidentate or tridentate..... **6**

6 Terminal claw of female gonopod tridentate..... **7**

– Terminal claw of female gonopod bidentate..... **8**

7 Tömösváry's organ slightly smaller than adjoining ocellus; terminal ocellus largest..... ***L.* (*M.*) *songi* sp. n.**

– Tömösváry's organ slightly larger than adjoining ocellus or about same in size; terminal two ocelli largest..... ***L.* (*M.*) *subspinipes* Ma et al., 2009**

8 Tömösváry's organ larger than largest ocellus, antennae 20–25 articles..... ***L.* (*M.*) *holstii* (Pocock, 1895)**

– Tömösváry's organ about same size as the adjoining ocelli, antennae 19 articles..... ***L.* (*M.*) *obtusus* (Takakuwa, 1941)**

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Taxonomic study of the genus *Neurotettix* Matsumura (Hemiptera, Cicadellidae, Deltocephalinae) with a description of a new species from China

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Abstract

This paper treats all four known species of the genus *Neurotettix* Matsumura, 1914 (Hemiptera, Cicadellidae, Deltocephalinae), including one new species: *Neurotettix truncatus* **sp. n.** from China. A key is given to distinguish all species of the genus, and illustrations of genitalia are provided.

Keywords

Hemiptera, morphology, taxonomy, distribution

Introduction

The leafhopper genus *Neurotettix*, belonging to tribe Athysanini of subfamily Deltocephalinae (Hemiptera: Cicadellidae), was established by Matsumura (1914) for a single species, *Neurotettix horishanus* Matsumura from Taiwan. Later, Ishihara (1963)

redescribed and illustrated this genus. Cai and Shen (1999) described a second species, *Neurotettix bifurcatus*, from China, and recently, Shen et Dai (2002) described a third species, *Neurotettix flangenus*, from China. All the species of this genus are described from China.

Here we described and illustrated a new species from Guizhou Province, China. The type specimens of new species are deposited in the Institute of Entomology, Guizhou University, Guiyang, China (GUGC). The genus *Neurotettix* now contains four species. A key is given to separate all species.

Taxonomy

Neurotettix Matsumura

Neurotettix Matsumura 1914: 192; Esaki and Ito 1954: 128; Ishihara 1963: 223.

Type species: *Neurotettix horishanus* Matsumura, 1914

Description. Medium sized leafhoppers, body elongate, vertex triangular and produced. Head including eyes clearly narrower than pronotum. Eyes black, large. Ocelli located on anterior margin of vertex, near eyes. Face with dark, transverse streaks. Frontoclypeus long and narrow. Pronotum longer than vertex, its length of lateral carina 1/3 basal width of eye, anterior margin roundly protruded and posterior margin concave. Scutellum triangular, slightly shorter than pronotum, with transverse suture curved and depressed. Forewings with four apical cells and three subapical cells, apical cells short, anteapical cells with reticulate veins, clavus irregularly reticulated with many extra veins, appendix small.

Male pygofer side with about 10 stout setae, its ventro-posterior margin with a long appendage. Valve triangular. Subgenital plate with many setae in lateral margin. Aedeagus asymmetrical or symmetrical, base robust, aedeagal shaft slender or robust, with or without processes, gonopore apical or subapical. Connective nearly X-shaped. Style slender, elongate.

Diagnosis. *Neurotettix* may be distinguished from other Athysanini by the following combination of features: forewings with apical cells short, anteapical cells with reticulate veins, clavus irregularly reticulated with many extra veins; connective nearly X-shaped.

Distribution. Oriental Region and Palaearctic Region.

Disscussion. The aedeagus is asymmetrical in the type species in original description (Ishihara 1963). But, the aedeagus is symmetrical in the other two species (*Neurotettix bifurcatus* and *Neurotettix flangenus*) and the new species *Neurotettix truncatus* sp. n. According to the external characters and other male genitalia features, we confirmed the other two species and the new species belong to the genus *Neurotettix*.

Key to species (male) of *Neurotettix*

1 Aedeagal shaft short and robust (Figs 5, 6)..... ***N. flangenus* Shen & Dai**
– Aedeagal shaft long and slender **2**
2 Aedeagal with two paired apical processes (Figs 3, 4) .....
.....***N. bifurcatus* Cai & Shen**
– Aedeagal without paired apical process.....**3**
3 Gonopore subapical, about one-third from apex (Figs 1, 2) .....
..... ***N. horishanus* Matsumura**
– Gonopore at apex (Figs 10, 11).....***N. truncatus* Dai, Xing & Li, sp. n.**

***Neurotettix horishanus* Matsumura**
Figs 1–2

Neurotettix horishanus Matsumura 1914: 193; Ishihara 1963: 224.

Distribution: China (Taiwan).

***Neurotettix bifurcatus* Cai & Shen**
Figs 3–4

Neurotettix bifurcatus Cai and Shen 1999: 41–42.

Distribution: China (Henan).

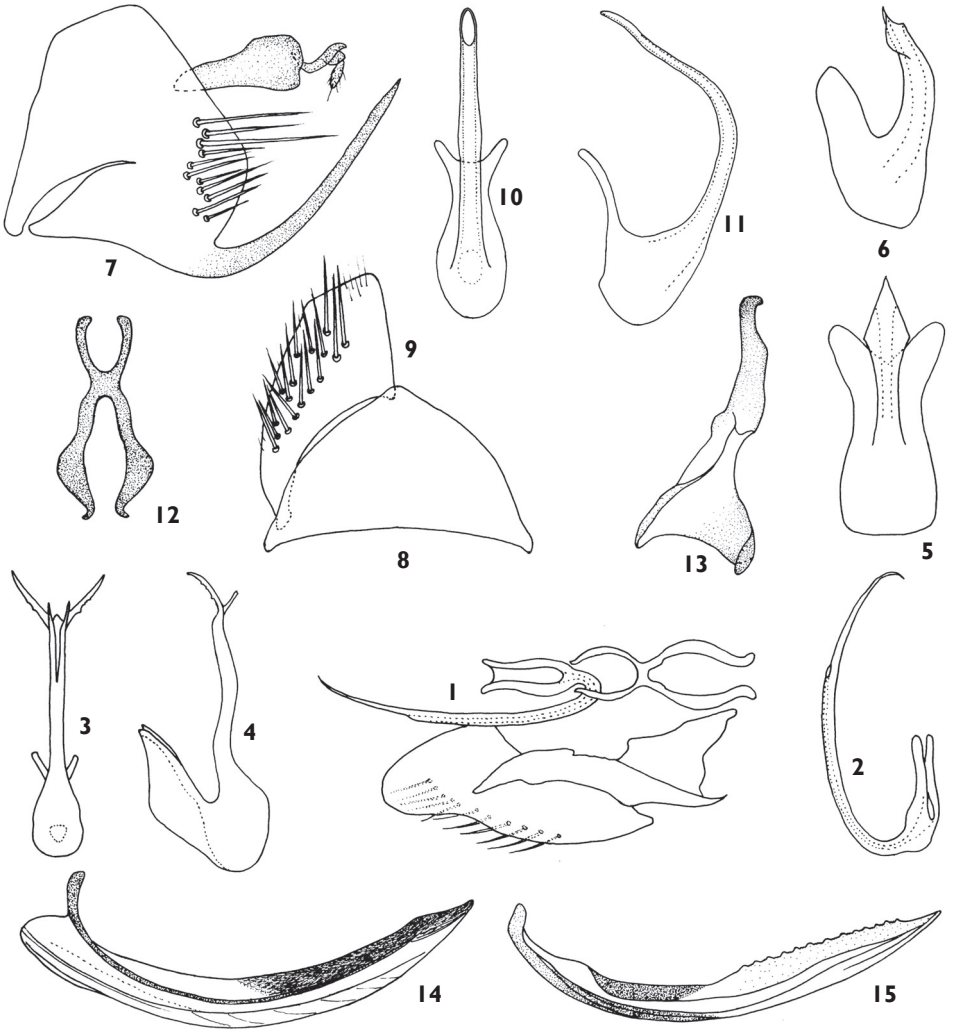
***Neurotettix flangenus* Shen & Dai**
Figs 5–6

Neurotettix flangenus Shen and Dai 2002: 89–91.

Distribution: China (Hunan).

***Neurotettix truncatus* Dai, Xing & Li, sp. n.**
urn:lsid:zoobank.org:act:41C31A94-D0A4-4E56-96CC-BBC3D49AB654
Figs 7–19

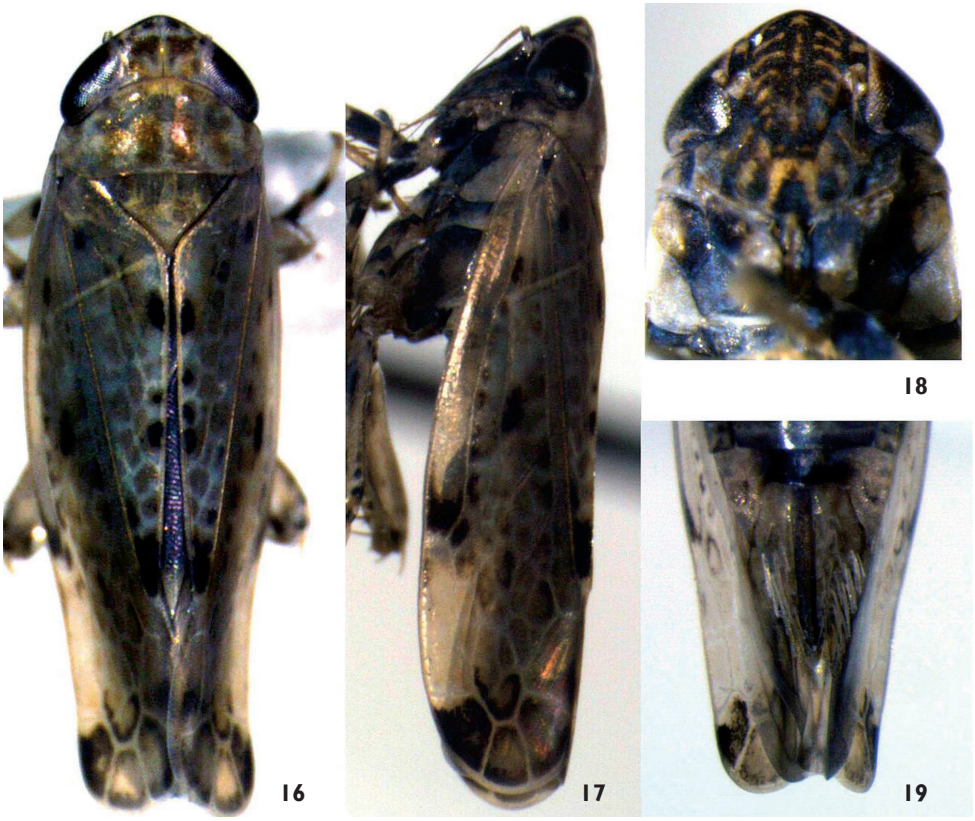
Description. Body yellow-brown, vertex with black spots along anterior margin, and with two irregular orange markings behind the spots, eyes dark-brown (Fig. 16). Face



Figures 1–15. *Neurotettix horishanus* Matsumura **1** Aedeagus, dorsal view **2** Aedeagus, lateral view (after Ishihara 1963) *Neurotettix bifurcatus* Cai & Shen **3** Aedeagus, ventral view **4** Aedeagus, lateral view (after Cai and Shen 1999) *Neurotettix flangenus* Shen & Dai **5** Aedeagus, ventral view **6** Aedeagus, lateral view (after Shen & Dai 2002) *Neurotettix truncatus* sp. n. **7** Male pygofer side, lateral view **8** Valve, ventral view **9** Subgenital plate, ventral view **10** Aedeagus, ventral view **11** Aedeagus, lateral view **12** Connective **13** Style, dorsal view **14** female 1st valvula, lateral view **15** female 2nd valvula, lateral view.

brown, transverse streaks and a longitudinal band yellow, anteclypeus yellow with apex dark-brown (Fig.18). Pronotum and scutellum yellowish-brown. Forewings yellowish-brown, with irregular fuscous markings, viens yellowish-white, apical part of forewings pale brown (Fig. 17). Female abdominal genital segment pale brown (Fig. 19).

External features as in generic description.



Figures 16–19. *Neurotettix truncatus* sp. n. **16** ♂, dorsal view **17** ♂, lateral view **18** ♂, face **19** ♀ abdominal sternum VII, ventral view.

Male genitalia. Pygofer side short, with eleven stout setae along dorso-caudal margin, its ventro-posterior margin with a long appendage (Fig. 7). Valve triangle (Fig. 8). Subgenital plate short and broad, with many setae in lateral margin, distally truncate, with 2 to 3 irregular rows of setae from lateral margin to middle of subgenital plate (Fig. 9). Aedeagus symmetrical, base robust, aedeagal shaft slender without processes, gonopore apical (Figs 10, 11). Connective nearly X-shaped, its arms longer than stem (Fig. 12). Style slender, elongate, with apex of apophysis curved laterally (Fig. 13).

Female seventh sternum concaved medially on posterior margin. First valvula of ovipositor sculpture irregularly (Fig. 14), second valvula with teeth, tapered toward apex in lateral view (Fig. 15).

Measurement. Length (including tegmen): ♂4.8–5.3mm,♀4.9–5.3mm.

Type Material. Holotype ♂, China: Guizhou Prov., Kuankuoshui, 16 August 2010, coll. Jichun Xing (GUGC). Paratypes: 1♂2♀♀, Guizhou Prov., Kuankuoshui, 12 August 2010, coll. Renhuai Dai (GUGC), 1♂1♀, China: Hubei Prov., Lichuan city, Pingba, 1 August 2010, coll. Junqiang Ni (GUGC).

Host. Bamboo.

Remarks. This species is similar to *Neurotettix horishanus* Matsumura, but can be distinguished from the latter by the symmetrical aedeagus and gonopore at apex, subgenital plate distally truncate and style apex curved.

Etymology. The new species name is derived from the Latin words "*truncatus*", indicating that the subgenital plate distally truncate.

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