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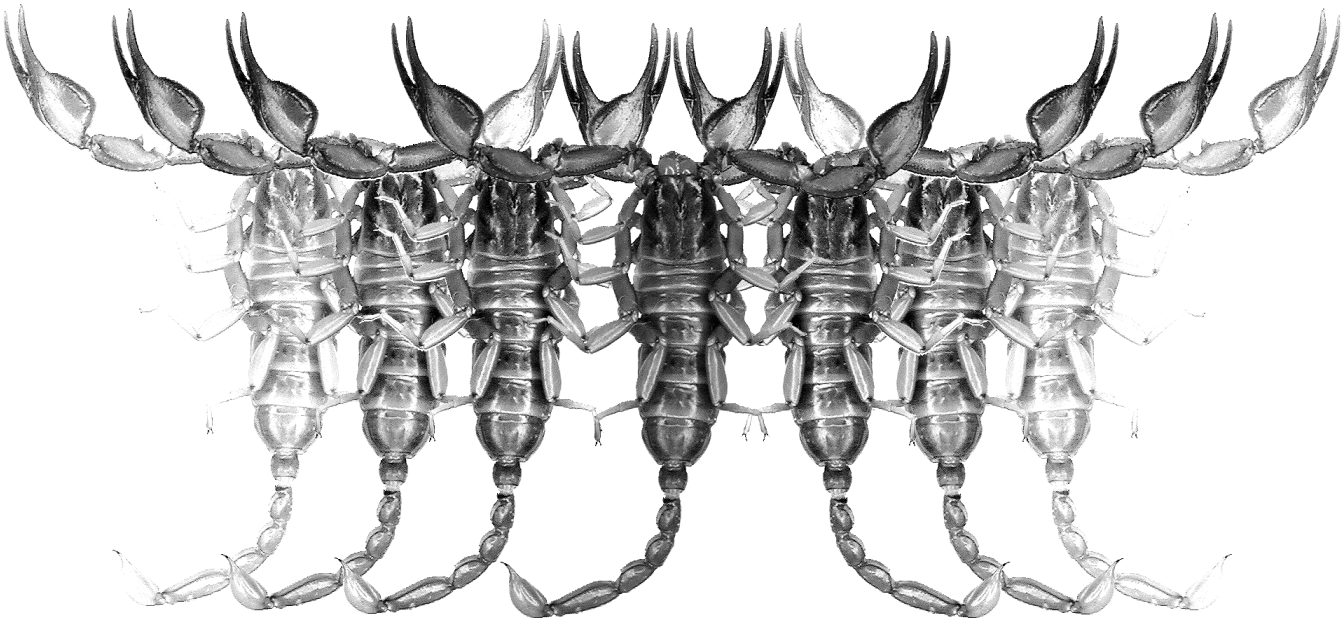

Scorpions 2011

John L. Cloudsley-Thompson 90th Birthday Commemorative Volume

The First Record of the Family Euscorpiidae (Arachnida: Scorpiones) from Central China, with a Key of Chinese Species of the Genus *Scorpiops*

Zhi-Yong Di, Ya-Wen He, Zhi-Jian Cao, Ying-Liang Wu & Wen-Xin Li

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Occasional Publications in Scorpiology

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The first record of the family Euscorpiidae (Arachnida: Scorpiones) from Central China, with a key of Chinese species of the genus *Scorpiops*

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Summary

The genus *Scorpiops* (Euscorpiidae) is recorded for the first time in Central China. Two immature specimens of a form belonging to *Scorpiops hardwickii* (Gervais, 1843) "complex" were collected from Huzhaoshan Mountains in Hubei Province. A discussion of Chinese species of genus *Scorpiops* is provided, as well as a key of *Scorpiops* from China.

Introduction

Di & Zhu (2009) published a detailed history of research on *Scorpiops*. Here, we retrace the history of study for species found in China. The first species of *Scorpiops* recorded from China was *S. tibetanus* Hirst, 1911. Kovařík (1994) found a new subspecies of *S. hardwickii* (Gervais, 1843) in Yunnan (China), and named it *S. hardwickii jendeki*. Several years later, Kovařík (2000) revised the family Scorpiopidae, which was soon downgraded to a subfamily of Euscorpiidae by Soleglad & Sissom (2001). In his revision, Kovařík (2000) described six new species including *S. margerisonae* Kovarik, 2000 from Xizang (Tibet, China). He also elevated *S. hardwickii jendeki* to species level. Zhu et al. (2004) published a checklist of scorpions from China, reporting five species after Fet (2000) and Kovařík (2000). Qi et al. (2005) described four new species of *Scorpiops*, and published a key for all Chinese species of Scorpiopinae. Recently, Di & Zhu (2009) described a new species of *Scorpiops*.

The genus *Scorpiops* comprises 25 species from South and Southeast Asia including India, Bhutan, Pakistan, Nepal, Bangladesh, Malaysia, Thailand, Vietnam, Laos, and China (Tikader & Bastawade, 1983; Kovařík, 1994, 2000, 2004, 2005; Zhu et al., 2005; Di & Zhu, 2009; Kovařík, 2009). So far, 11 species of *Scorpiops* have been recorded from China (Figure 23): *S. jendeki* Kovařík, 1994 (Yunnan); *S. atomatus* Zhu, Qi et Lourenço, 2005 (Xizang); *S. hardwickii* (Gervais, 1843) (Xizang); *S. langxian* Zhu, Qi et Lourenço, 2005 (Xizang); *S. leptochirus* Pocock, 1893 (Xizang); *S. lhasa* Di et Zhu, 2009 (Xizang); *S. luridus* Zhu, Qi et Lourenço, 2005 (Xizang); *S. petersii* Pocock, 1893 (Xizang); *S. tibetanus* Hirst, 1911 (Xizang); *S. margerisonae* Kovařík, 2000 (Xizang); *S. pococki* Zhu, Qi et Lourenço, 2005 (Xizang). However, the exact number of species is unclear since taxonomy and synonymy of some forms is under discussion. (Kovařík, 2000: 175) reduced the *Scorpiops hardwickii* "complex" to *S. hardwickii* and *S. tibetanus*; however, since more species were described later that could be closely related, Kovařík & Ahmed (2009) referred to an unresolved, widespread *S. hardwickii* "complex", which in their opinion, includes five species known from China (*S. atomatus*, *S. hardwickii*, *S. langxian, S. pococki*, and *S. tibetanus*).

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 notation follows Vachon (1974) and morphological terminology mostly follows Hjelle (1990). Terminology of carination follows Prendini (2000) for metasomal carinae, and Soleglad & Sissom (2001) for pedipalp chela carinae. Specimens are deposited in the Museum of Wuhan University, Wuhan, China (MWHU).

Systematics

Family **Euscorpiidae** Laurie, 1896
Subfamily **Scorpiopinae** Kraepelin, 1905
Genus ***Scorpiops*** Peters, 1861

Scorpiops Peters, 1861: 510; Kraepelin, 1899: 179 (in part); Pocock, 1900: 64 (in part); Vachon, 1980: 143

(in part); Tikader & Bastawade, 1983: 403 (in part); Lourenço, 1998: 246 (in part); Kovařík, 2000: 163–166 (in part); Fet, 2000: 491 (in part); Soleglad & Sissom, 2001: 93; Kovařík, 2005: 8; Qi, Zhu & Lourenço, 2005: 2; Di & Zhu, 2009: 40.

Type species: *Scorpiops hardwickii* (Gervais, 1843)

Diagnosis. Trichobothrium Eb_3 on the external aspect of pedipalp chela located basally to trichobothrium *Dt*. Annular ring at vesicle/aculeus juncture absent. Three pairs of lateral eyes. Pedipalp patella with 17–19 external trichobothria. Ventral aspect of patella with 6–18 trichobothria. Chela with 4 trichobothria on the ventral aspect of the manus.

Scorpiops sp.

[*hardwickii* (Gervais, 1843) "complex"]
Figures 1–18

Material examined: Female and male immature specimens, CHINA: Hubei Province, Jingzhou, Jingshan County, Huzhaoshan Mountains, 3 June 2007, Guanglin Xie leg. (MWHU, Ar.-MWHU-HBJS0701–02). These specimens were dry with two pinholes penetrating female's carapace and male's genital opercula; we placed them in 75% alcohol.

According to the revision of *Scorpiops* published by Kovařík (2000), and further considerations given by Kovařík & Ahmed (2009), forms belonging to *S. hardwickii* (Gervais, 1843) "complex", have 6–8 ventral trichobothria and 17 external trichobothria on the patella; pectinal teeth number 4–9; pectines without fulcra; chela manus length to width ratio is about 1; tegument coarse.

Scorpiops hardwickii "complex" can be distinguished from *S. jendeki* Kovařík, 1994, which is the most geographically close species of the genus in China, by the following features: (1) carapace with dense granules, while in *S. jendeki* it bears very sparse large granules; (2) the manus of pedipalps dorsally with coalescing large granules forming clear dorsoexternal carinae; in *S. jendeki*, irregular rows of granules form a loose dorsoexternal carinae; (3) chela fingers strongly curved, while they are straight in *S. jendeki*.

Description (based on an immature female specimen):

Coloration: Mostly yellow-brown to red-brown. Carapace dark brown, Median and lateral ocular tubercles black. Tergites mainly dark red-brown. Metasoma segments dark red brown with yellow brown stripes; vesicle red-brown with a yellowish aculeus. Chelicerae yellow-brown, with fingers red-brown and gradually lighter toward the tip. Pedipalp femur and patella dark brown; and the chela red-brown. Legs yellow brown. Claws yellowish brown. Sternum, genital operculum, venter and sternites brown. Pectines yellowish.

Morphology: Carapace coarse (Figure 1), with dense, minute granules; lateral furrow broad and flat; anterior median furrow broad and moderately deep; posterior median furrow deep; anterior margin smooth; posterior and lateral margins and other parts with dense, minute granules, anterior granules larger than the posterior ones. Median eyes situated anterior to the center of the carapace; three pairs of lateral eyes, the third smallest. Median ocular tubercle smooth with a pair of median eyes, which larger than the first two pairs of lateral eyes. Lateral ocular tubercle smooth with some granules (Figure 4).

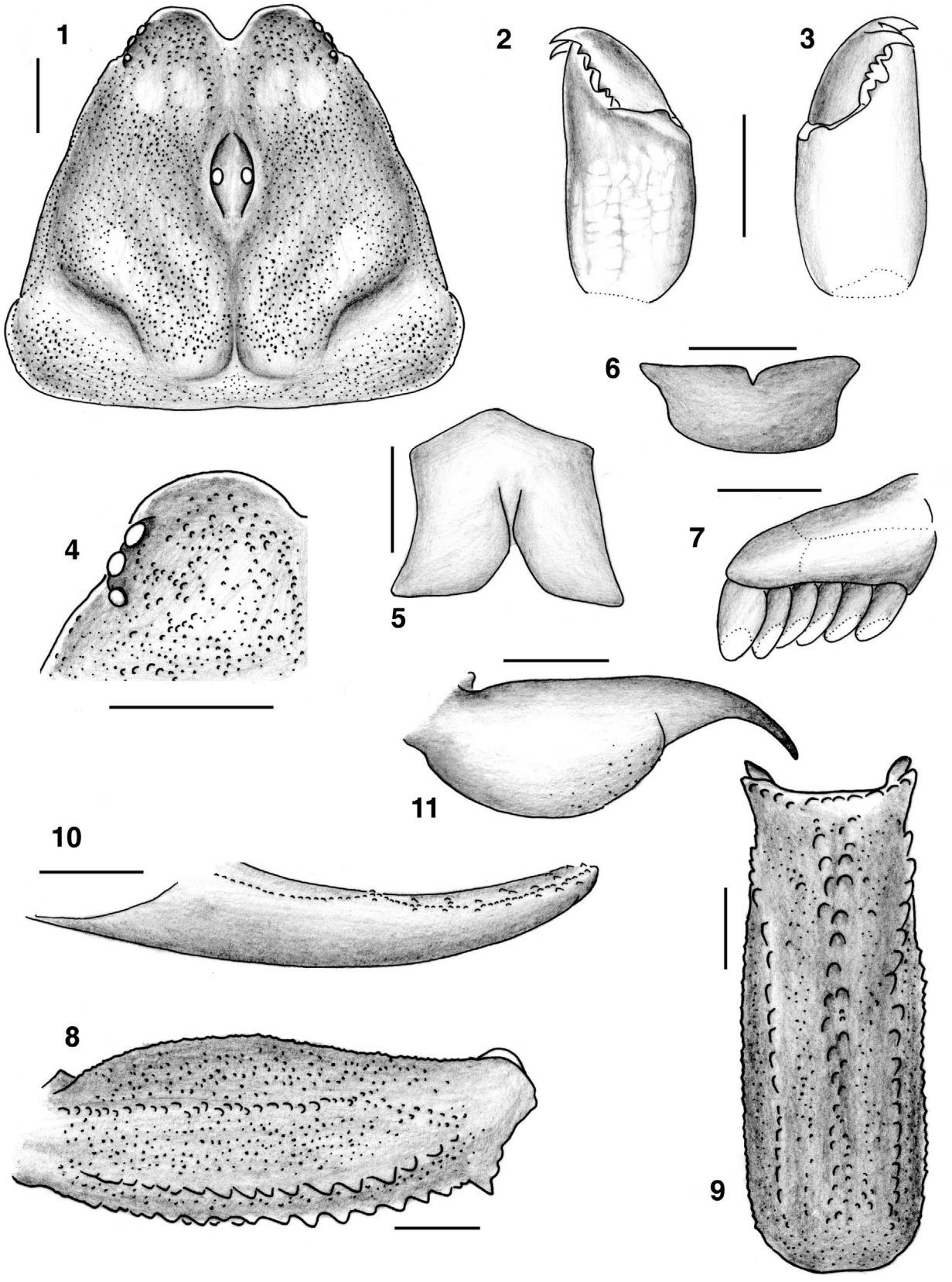
Mesosoma: Tergites are almost completely densely covered with fine granules, posterior part of tergites with some bigger ones; from tergite II to VI the trace of a median carina first appears and gradually becomes distinct; on tergite VII with a distinct carina and two pairs of lateral carinae. Pectinal tooth count 6/6, fulcra absent (Figure 7). Genital opercula subtriangular. Sternites smooth and shiny; segment VII ventrally with four weak carinae.

Metasoma: Segments II to V are longer than wide; segments I to V have 10-8-8-8-7 carinae, segments II–IV with a pair of vestigial lateral carinae; all dorsal carinae are dentate on segment I, and gradually become strongly serrated from II to IV; with tegument coarse and punctated; on segment V, carinae with smaller serration dorsally and larger serration ventrally. Vesicle smooth, with some sparse granules and few setae (Figure 11).

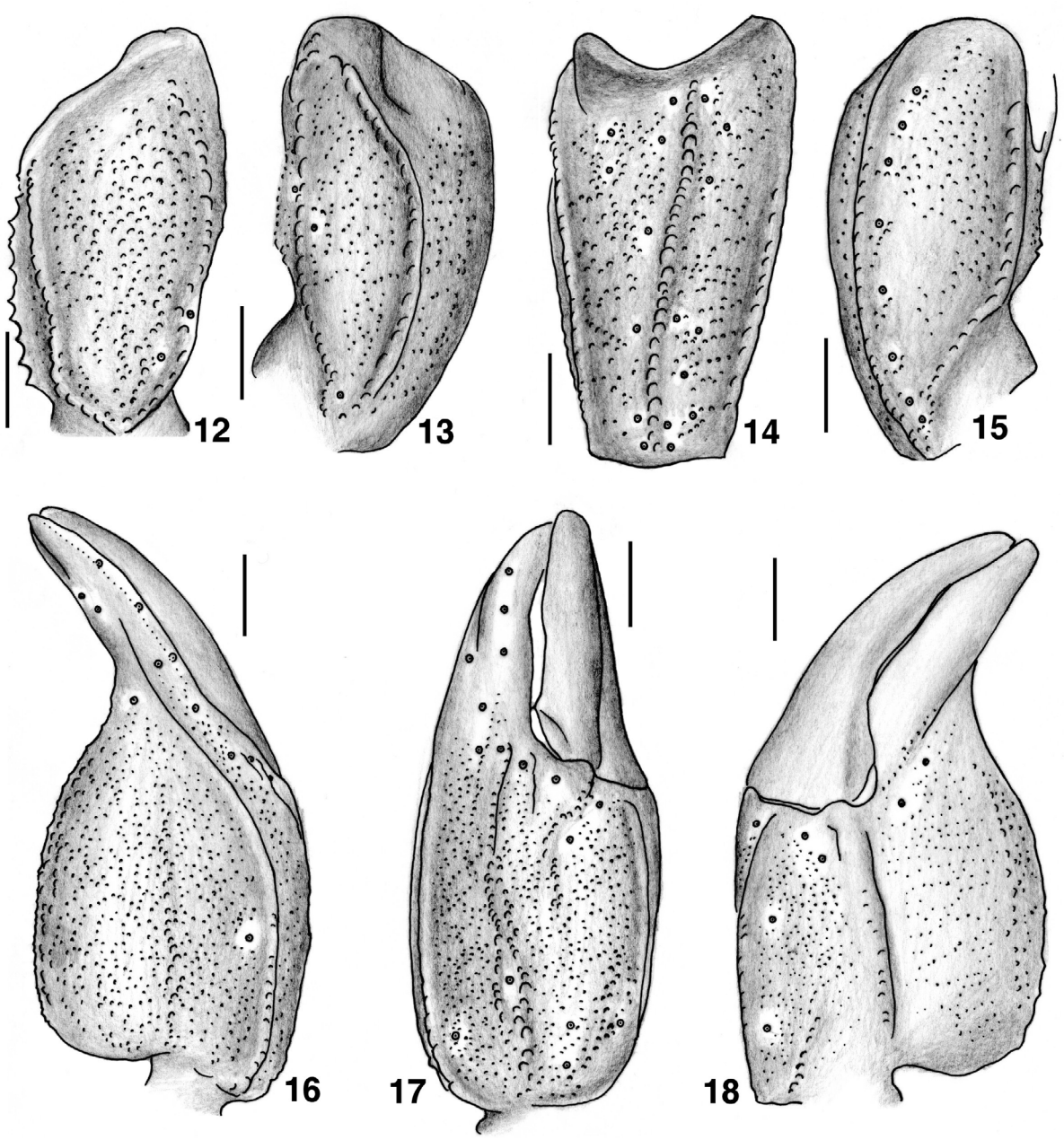
Pedipalps: Tegument coarse. Femur with external, dorsointernal, dorsoexternal, ventrointernal, ventroexternal carinae granulated and internal carinae crenulated. Patella with dorsointernal, dorsoexternal, ventrointernal, ventroexternal and external carinae with large, smooth granules; two small spinoid granules present on the internal aspect (Figure 15). Trichobothrial pattern C, neobothriotaxic (Vachon, 1974); patella with 17 external trichobothria (5 *eb*, 2 *esb*, 2 *em*, 4 *est*, 4 *et*) and 8 ventral trichobothria (Figure 15). Chela with 4 ventral trichobothria, with dorsal marginal, external secondary, and ventral internal carinae, all smooth (Figures 16–18); ventral internal carina only with a row of large granules. Fingers curved (Figure 10).

Chelicerae: Tibiae smooth, with reticulated pattern. Movable finger with 4 denticles on dorsal edge and 4 denticles on ventral edge. Fixed finger with 3 denticles on dorsal edge (Figures 2–3).

Legs: Tegument coarse except trochanter. Trochanter with few granules and setae. Femur dorsal surface densely granulose and ventrally smooth, internally with 2 granular carinae. Patella dorsally with scattered small granules, and dorsoexternal, dorsal and ventroexternal 3 granular carinae. Tibiae with few setae, without spurs. Basitarsus with more setae, and two lateral pedal spurs. Tarsus ventrally with row of spinules. Claws hooklike.



Figures 1–11: *Scorpiops* sp. (*hardwickii* "complex") from Hubei, female. **1.** Carapace. **2–3.** Chelicera, dorsal and ventral aspects. **4.** Lateral eyes. **5.** Sternum. **6.** Sternite (IX). **7.** Pectines. **8–9.** Metasomal segment V, lateral and ventral aspects.**10.** Dentate margin of movable finger, showing rows of granules. **11.** Telson, lateral aspect. Scale bars: 1.0 mm.



Figures 12–18: *Scorpiops* sp. (*hardwickii* "complex") from Hubei, female. **12.** Femur, dorsal aspect. **13–15.** Patella dorsal, external and ventral aspects. **16–18.** Chela, dorsal, external and ventral aspects. Scale bars: 1.0 mm.

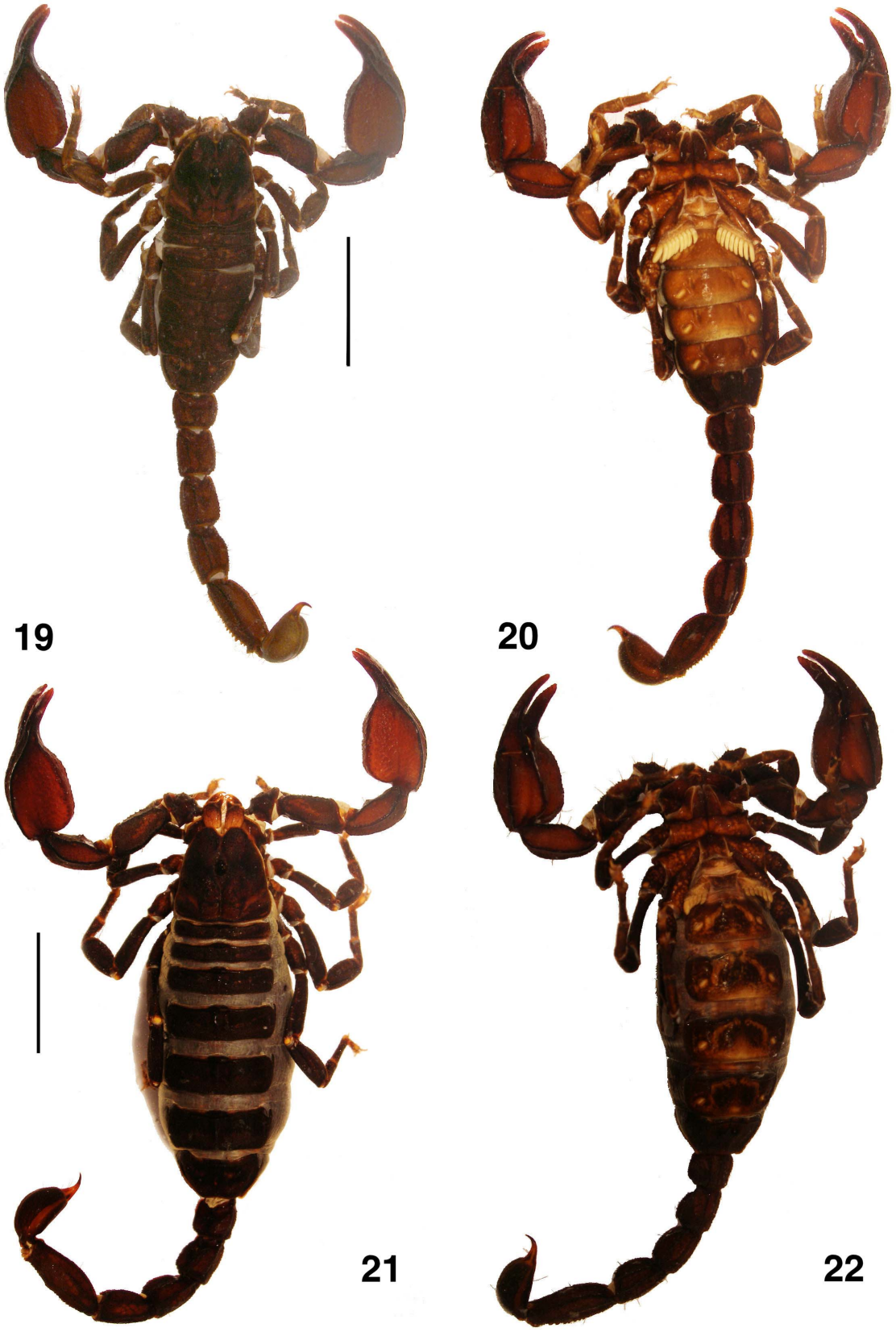
Variation. Female and male: coloration and morphology are very similar. Number (left/right) of ventral trichobothria on the pedipalp patellae: female with 8/8, male juvenile with 8/8. Number of pectinal teeth: female with 6/6, male juvenile with 8/7. Measurements are not provided as these specimens are immature.

Habitat: Found under stones on a hillside with many stones and ruderal vegetation.

Distribution: China (Hubei), see map in Fig. 23.

Discussion

Although the new record from Huzhaoshan Mountains is represented only by two immature specimens, it is surprising that the genus *Scorpiops* is found in Central China. The Chinese species of genus *Scorpiops* are mainly found in Tibet; *S. jendeki* is the only



Figures 19–22: *Scorpiops* sp. (*hardwickii* "complex") from Mainling District, Tibet (Xizang, China). **19–20.** Male, dorsal and ventral views. **21–22.** Female, dorsal and ventral views. Scale bars: 10.0 mm.

Some specimens of *S. hardwickii* (Gervais, 1843) "complex" from Tibet				
Localities	**Sex**	**Serial number**	**Pectinal teeth**	**Ventral trichobothria on patella**
Rega village, Mainling town, Mainling District, Nyingchi, Tibet	♂	Ar.-MWHU-XZM L0801	8/9	7/6*
	♂	Ar.-MWHU-XZM L0802	7/7	7/7
	juv. ♂	Ar.-MWHU-XZM L0803	7/8	7/7
	♀	Ar.-MWHU-XZM L0804	6/6	7/7
	♀	Ar.-MWHU-XZM L0805	5/5	7/7
	♀	Ar.-MWHU-XZM L0806	6/5	7/7
	♀	Ar.-MWHU-XZM L0807	6/6	7/6*
	♀	Ar.-MWHU-XZM L0808	6/6	7/7
	♀	Ar.-MWHU-XZM L0809	5/6	7/7
	♀	Ar.-MWHU-XZM L0810	6/5	7/7
	♀	Ar.-MWHU-XZM L0811	5/5	7/7
W. Kangtissu Shan, Tibet	♂	Ar.-MWHU-XZK T0701	6/6	7/7
	♀	Ar.-MWHU-XZK T0702	7/7	7/7
Huzhaoshan Mts, Hubei	♂	Ar.-MWHU-HBJ S0701	6/6	8/8
	♀	Ar.-MWHU-HBJ S0702	8/7	8/8

* The right patella of pedipalp of these specimens is underdeveloped.

Table 1: Pectinal teeth and ventral trichobothria on patella of *Scorpiops hardwickii* "complex" from Tibet compared to Hubei specimens.

species found in Yunnan (Figure 23). The locality in Hubei, however, is very far from all other known localities.

Kovařík & Ahmed (2009: 10) provided a list of taxa of *S. hardwickii* (Gervais, 1843) "complex", which contained 12 species, widely distributed in Asia, including China. Our new locality increases its range even further; this disjunct distribution remains to be explained.

Huzhaoshan Mountains (112°49'13"–112°57'35"E, 31°00'15"–31°07'38"N) are a southern range of the Dahongshan Mountains, covered with abundant forests. This locality in Hubei is far from the known localities of any forms belonging to *S. hardwickii* (Gervais, 1843) "complex". The closest such locality (of *Scorpiops langxian*) (Baishuwang Park in Nyingchi County), is about 1775 km away.

Our observations suggest that *Scorpiops atomatus* Qi, Zhu et Lourenço, 2005 should be excluded from *S. hardwickii* "complex". The reasons are as follows: (1) pectinal tooth count is 9–11 in *S. atomatus*, and 4–8 in *S. hardwickii* (Kovařík, 2000: 178); (2) ventral trichobothria on patella number is 9 in *S. atomatus*, and 6–8 in *S. hardwickii* (Kovařík, 2000: 176); (3) fulcra are present in *S. atomatus* but absent in *S. hardwickii*. In addition, *S. atomatus* has clearly thinner chela than *S. pococki* and *S. langxian*.

We also suggest that *Scorpiops tibetanus* Hirst, 1911 should be excluded from *S. hardwickii* "complex" until further study. Hirst (1911) did not provide a detailed description except a brief comparison with *S. austerus* Hirst, 1911 (synonymized with *S. hardwickii* by Tikader & Bastawade, 1983: 418) and *S. crassimanus* Pocock,

1899 (synonymized with *S. hardwickii* by Kovařík, 2000: 175). Kovařík (2000) examined the holotype (male) of *S. tibetanus* and recorded some important information. Ventral trichobothria on patella in *S. tibetanus* number 7–10 (usually 9, in one young out of 37 specimens, 7 on one side; Kovařík, 2000: 196). At the same time, this number is 6–8 in *S. hardwickii* "complex". Pectinal tooth number is 5–11 (usually 7–11) in *S. tibetanus*, and 4–9 in *S. hardwickii* (usually 5–7). These features suggest that *S. tibetanus* could be different from *S. hardwickii* "complex".

In summary, the taxa of *S. hardwickii* "complex" (Figures 19–22) have the following features: (1) color red brown to dark brown; (2) total length about 45–80 mm in adults; (3) fingers of pedipalps very strongly flexed (curved) in males, slightly flexed (undulated) in females; (4) ventral trichobothria on patella number 6–8; (5) pectinal teeth number 4–9; (6) length/width ratio of chela about 1.8–2.1; (7) fulcra absent; (8) patella with two small spinoid granules on the internal aspect.

The key of Kovařík & Ahmed (2009) did not distinguish *S. lhasa* Di et Zhu, 2009 and *S. pachmarhicus* Bastawade, 1992. Here, we add this information from literature: pectinal tooth count was 9–11 in *S. lhasa* (two females and two males, one juvenile female and one juvenile male: Di & Zhu, 2009: 47), and 6–7 in *S. pachmarhicus* (three females and one male: Bastawade, 1992, 102). Other discriminating features should be researched by examin- ing original specimens.

Finally, we must note that while the pectinal tooth count is an important character in the genus *Scorpiops*, it varies within a species. For example, in *S. margerisonae* the holotype (male) has 12–13 pectinal teeth (Kovařík, 2000), but after examining ten specimens (six adult males, three adult females and one immature female), Di & Zhu (2010) found that the variation range was 8–13 (rarely 12 and 13). In Table 1, we provide the data for the number of pectinal teeth and ventral patellar trichobothria for some specimens belonging to *S. hardwickii* "complex" from Tibet.

Key to species of *Scorpiops* from China

1. Fingers of pedipalps are straight or only slightly flexed in both sexes ……..…… **2**
- Fingers of pedipalps are flexed (curved) in both sexes .....…..……..... **3**
2. Ventral trichobothria on patella number 6 (7 rarely), total length 30–42.1mm, pectinal teeth number 4–5, chela length to width ratio about 2.2 ..... *S. jendeki*
- Ventral trichobothria on patella number 7, total length 40–58 mm, pectinal teeth number 7–9, chela length to width ratio about 3.3–3.5 ……..…….*S. leptochirus*
3. Male chela length to width ratio about 1.8–2.2; the manus with same or very similar length and width, fingers of pedipalps are very strongly flexed in the male. Ventral trichobothria on patella number 6–8 ..... *S. hardwickii* "complex" (including *S. hardwickii, S. langxian* and *S. pococki*)
- Manus length to width ratio visibly higher than 1 ….. **4**
4. Total length more than 65 mm ……..…… **5**
- Total length less than 65 mm ……..…….... **6**
5. Mostly yellowish to yellow in adults, ventral patella of pedipalps with 9 trichobothria ...……..... *S. luridus*
- Mostly red brown in adults, ventral patella of pedipalps with 7 (rarely 6 or 8) trichobothria …….. *S. petersii*
6. Dorsally flat manus of pedipalps and chela of both sexes with length/width ratio: 2.1–2.2 (mean about 2.1 in males and 2.2 in females), total length 40.0–50.0 mm in adults ...……..... *S. margerisonae*
- Dorsally round manus of pedipalps or at least the chela of one sex with length to width ratio higher than 2.2 or total length higher than 50 mm ....…….....….....**7**
7. Total length more than 40 mm .....….…..**8**
- Total length less than 50 mm, chela strong, with length/width ratio: 2.0 in male and 2.5 in female ……..… …….. *S. tibetanus*
8. Chela of pedipalp length to width ratio about 2.6–3.0, dorsal surface of chela of pedipalp coarse …. *S. lhasa*
- Chela of pedipalp length to width ratio lower than 2.5, dorsal surface of chela of pedipalp smooth with luster ……..…….....*S. atomatus*

Acknowledgments

We are most grateful to Dr. John L. Cloudsley-Thompson, since the scientists like him worked hard to give birth to scorpiology and to ensure this new field continues to be further developed. We appreciate all of the predecessors and mentors who studied scorpions as their remarkable works guided us to know, to love, and to research scorpions, and to choose scorpiology to be our lifelong career with a keen interest. We are most delighted to celebrate Dr. John Cloudsley-Thompson's 90th birthday. At the same time, we wish all of the scorpiologists a long, healthy, and joyful life, and wish that scorpiology will be carried forward unceasingly.

We are grateful to Dr. Guang-Lin Xie for collecting the specimens. Thanks also are due to Mr. Jan Ove Rein for providing references. Sincere appreciation goes to Professor Victor Fet who provided valuable advices, in particular, for linguistic improvement. This work was supported by grants from the National Natural Sciences Foundation of China (No. 30530140 & No. 31071942) to Wen-Xin Li, the Basic Project of Ministry of Science and Technology of China (No. 2007FY210800) to Wen-Xin Li, and the 973 program (No. 2010CB529800) to Ying-Liang Wu.

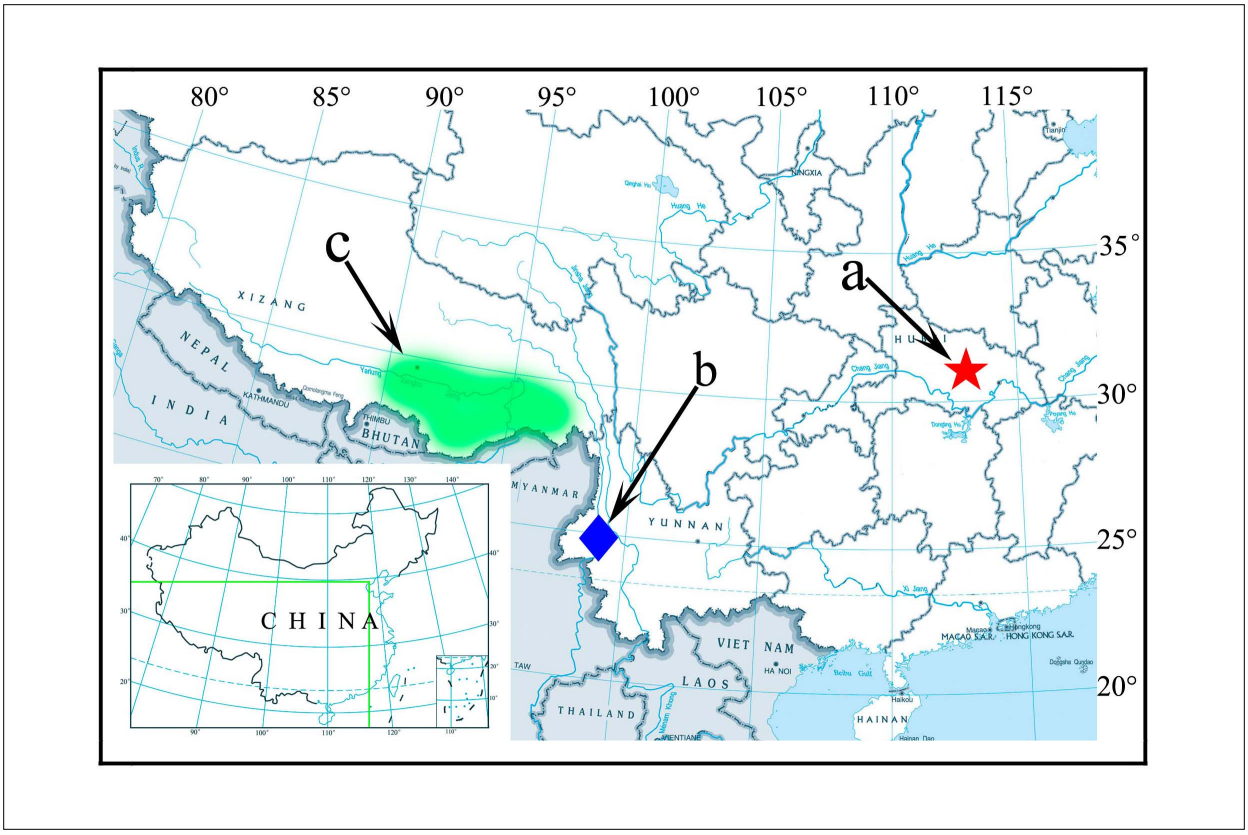


Figure 23: Map of China, showing the localities of *Scorpiops* species. **a** (star), *S.* sp. (*hardwickii* "complex") from Hubei (Huzhaoshan Mountains). **b** (rhombus), *S. jendeki* from Yunnan (Gaoligongshan Mountains); **c** (green part), the area rich in *Scorpiops* (Xizang).

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