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

Zhiyong Di, Yawen He, Yingliang Wu, Zhijian Cao, Hui Liu, Dahe Jiang, Wenxin Li

College of Life Sciences, Wuhan University, Wuhan 430072, China

Corresponding author: Wenxin Li (liwxlab@whu.edu.cn)

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, Wexin 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-YNFD0901–04); Mojian 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).
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).
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.-BHDC- 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
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
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. Prosome:** 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.

**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.
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 |
|         | ♂ | 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 | ♂ | 47 | 9/9 | 18/18 | 8/8 | 3.1 |
|         | Ar.-MWHU-YNMH1006 | ♂ | 10/9 | 18/18 | 7/7 | 2.7 |
|         | 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 | ♂ | 9/10 | 18/18 | 7/6 | 2.7 |
|         | Ar.-MWHU-YNMH1010 | ♂ | 9/10 | 18/18 | 7/7 | 2.7 |
|         | Ar.-MWHU-YNMH1011 | ♂ | 10/10 | 18/18 | 6/6 | 2.7 |
|         | Ar.-BHDC-YNMH0601 | ♂ | 11/11 | 18/18 | 6/6 | 2.7 |
| *E. shidian* | HT(MHBU) | ♂ | 49 | 11/11 | 17/17§ | 7/7 | 1.6§ |
|         | ♂ | 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 | ♂ | 11/11 | 18/18 | 8/8 | 3.3 |
|         | 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 |
|         | ♂ | 54 | 10/10 | 19/19 | 8/8 | 4.1 |
|         | Ar.-BHDC-YNML0901 | ♂ | 56 | 10/10 | 19/19 | 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 develop well, in respect that with external trichobothria *et*4 and *et*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).
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

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**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.
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 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.
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).

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**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 or 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.
**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 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.
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 dorsointer-
nal, dorsoexternal, ventrointernal, ventroexternal and external carinae with big granules;
two large spinoid granules present on the internal aspect; tegument with smooth gran-
ules dorsally and ventrally. Trichobothrial pattern C, neobothriotaxic (Vachon1974); pa-
tella with 18 external trichobothria (5eb, 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 dor-
sal 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. Tro-
chanters with few setae. Femur dorsal surface with some small granules, external sur-
face with one granular carina, internal surface with two granular carinae. Patella inter-
nally 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 unguis 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); Para-
types: 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
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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 examined.** 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 distinguished from other *Euscorpiops* 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 fulcrum present and small. *E. validus* can be distinguished from related *Euscorpiops* 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.
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 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.
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
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 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).
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).
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).
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
Euscorpiops yangi can be distinguished 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).
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 (5eb, 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. hardwickii* (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.
**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* 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*, 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

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