

# A new cave-dwelling species of *Bisetocreagris* Ćurčić (Arachnida, Pseudoscorpiones: Neobisiidae) from Yunnan Province, China

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A new pseudoscorpion species, *Bisetocreagris xiaoensis* Li & Liu, **sp. n.**, is described and illustrated from specimens collected in caves in Yanjin County, Yunnan Province, China. An identification key is provided to all known cave-dwelling representatives of the genus *Bisetocreagris* in the world.

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## 1. Introduction

The pseudoscorpion subfamily Microcreagrinae Balzan belongs to the family Neobisiidae Chamberlin. It is divided into 32 genera with only three genera, *Bisetocreagris* Ćurčić, 1983, *Microcreagris* Balzan, 1892 and *Stenohya* Beier, 1967 having been reported from China (Harvey 2013, Mahnert & Li 2016).

The genus *Bisetocreagris*, with *Microcreagris annamensi* Beier, 1951 (by original designation) (Harvey 2013) as the type species, is characterized by the terminal exterior and interior trichobothria situating near the tip of the distal finger, the sub-terminal exterior trichobothria being isolated in the distal half of the fixed finger, the interior basal, interior sub-basal and interior sub-terminal trichobothria being grouped closely together at the finger base, the exterior basal and

exterior sub-basal trichobothria being located on the lateral distal side of the hand, thus five trichobothria are grouped basally (Mahnert & Li 2016).

At present, the genus *Bisetocreagris* contains 35 species and 1 subspecies and is widely distributed in Afghanistan, China, India, Japan, Kyrgyzstan, Mongolia, Nepal, Philippines, Pakistan, Russia, Tajikistan, Thailand, Uzbekistan and Vietnam (Harvey 2013, Mahnert & Li 2016, Guo & Zhang 2017). So far, 21 species have been reported from China (Table 1, including also the new species described here). Of the species that have been described, most live in leaf litter of forests. However, nine species, the so-called cavernicolous species or troglobites and including the new one described here, are found in China only in few caves currently.

During the identification of pseudoscorpion

Table 1. Reported 21 species and a new species of *Bisetocreagris* from China.

Species	Distribution	References
<i>B. annamensis</i> (Beier, 1951)	Xishuangbanna County, Yunnan Province	Schawaller 1995, Harvey 2013
<i>B. baozinensis</i> Mahnert & Li, 2016	Gulin County, Sichuan Province	Mahnert & Li 2016
<i>B. cavernarum</i> Mahnert & Li, 2016	Beibei County, Chongqing Province	Mahnert & Li 2016
<i>B. cheni</i> Jia, Zhao & Zhu, 2010	Tonglu County, Zhejiang Province	Harvey 2013, Guo & Zhang 2017
<i>B. chinacavernicola</i> (Schawaller, 1995)	Huaying County, Sichuan Province	Mahnert & Li 2016
<i>B. chuanensis</i> Mahnert & Li, 2016	Xinhua County, Guizhou Province	Mahnert & Li 2016
<i>B. indochinensis</i> (Redikorzev, 1938)	Xishuangbanna County, Yunnan Province	Schawaller 1995, Harvey 2013
<i>B. juanxuae</i> Mahnert & Li, 2016	Xinwen County, Sichuan Province	Mahnert & Li 2016
<i>B. kaznakovi</i> (Redikorzev, 1918)	Rivière Tshok-tshio and Monts Amnenkor, Xizang Autonomous Region	Redikorzev 1918, Guo & Zhang 2017
<i>B. kwantungensis</i> (Beier, 1967)	Tsin Leong San, Guangdong Province	Beier 1967, Harvey 2013
<i>B. lampra</i> (Chamberlin, 1930)	Wuyishan County, Fujian Province	Schawaller 1995, Harvey 2013
<i>B. martii</i> (Mahnert, 2003)	Zhenxiong County, Yunnan Province	Mahnert & Li 2016
<i>B. nankingensis</i> Curčić, 1983	Nanjing County, Jiangsu Province	Schawaller 1995, Harvey 2013
<i>B. orientalis</i> (Chamberlin, 1930)	Linan County, Zhejiang Province	Harvey 2013
<i>B. parva</i> Guo & Zhang, 2017	Tonglu County, Zhejiang Province	Guo & Zhang 2017
<i>B. scaurum</i> (Mahnert, 2003)	Zhenxiong County, Yunnan Province	Mahnert & Li 2016
<i>B. silvestrii</i> (Chamberlin, 1930)	Emei County, Sichuan Province; Huaxi County, Guizhou Province; Henshan County, Hunan Province; Linan County, Zhejiang Province	Schawaller 1995, Harvey 2013
<i>B. thailandica</i> Schawaller, 1994	Xishuangbanna County, Yunnan Province	Schawaller 1995, Harvey 2013
<i>B. titanium</i> (Mahnert, 2003)	Zhenxiong County, Yunnan Province	Mahnert & Li 2016
<i>B. ussuriensis</i> (Redikorzev, 1934)	Changbai County, Jilin Province	Schawaller 1995, Harvey 2013
<i>B. xiaoensis</i> Li & Liu, <b>sp. n.</b>	Laiyuan County, Hebei Province	This article
<i>B. yangae</i> Guo & Zhang, 2017	Yanjin County, Yunnan Province	Guo & Zhang 2017
	Huangshan County, Anhui Province	

specimens collected from Yunnan Province in 2017, a new cavernicolous species of *Bisetocreagris* was found, which is described here.

## 2. Materials and methods

The new species was collected by hand from a cave under rocks where the place is very humid. The specimens were conserved in 75% ethanol. They were cleared in acid lactic for 12–24 h at room temperature and returned after washing in distilled water to alcohol after examination. The specimens were analyzed with a Leica M205C stereomicroscope and Olympus BX51 general optical microscope.

The measurements are given in mm. Proportions and measurements of pedipalps and cara-

pace correspond to length/breadth, those of legs to length/depth. The term “rallum” (for flagellum) is adopted following Judson (2007). The terminology of trichobothria follows Chamberlin (1931) and Harvey (1992), the measurements follow Chamberlin (1931).

The type specimens of the new species as well as all the specimens of the other studied species are deposited in the collections of the Museum of Southwest University (MSWU), Chongqing City, China.

The following abbreviations are used in the text for the trichobothria: *b* = basal, *eb* = exterior basal, *esb* = exterior subbasal, *ib* = interior basal, *sb* = sub-basal, *isb* = interior sub-basal, *t* = terminal, *et* = exterior terminal, *it* = interior terminal, *st* = sub-terminal, *ist* = interior sub-terminal, *est* = exterior sub-terminal.

### 3. Taxonomy

Family Neobisiidae Chamberlin, 1930  
 Subfamily Microcreagrinae Balzan, 1892  
 Genus *Bisetocreagris* Čurčić, 1983

#### 3.1. Material of *Bisetocreagris* species examined

- B. martii* (Mahnert, 2003): 1♂ and 2♀, Yunnan Province, Zhenxiong County, Wude town, Xiao Guo Quan cave, 27°29.712' N, 104°44.678' E, 1,301 m, 9.IV.2017, Yun-Chun Li leg.
- B. titanium* (Mahnert, 2003): 2♀, Yunnan Province, Zhenxiong County, Wude town, Xiao Guo Quan cave, 27°29.712' N, 104°44.678' E, 1,301 m, 9.IV.2017, Yun-Chun Li leg.
- B. baozinensis* Mahnert & Li, 2016: 5♂ and 6♀, Sichuan province, Gulin County, Yuhua town, Bao Zi cave, 28.01458° N, 106.05209° E, 954 m, 22.IV.2014, Yun-Chun Li & Yu-Cheng Lin leg.
- B. juanxuae* Mahnert & Li, 2016: 7♂ and 13♀, Sichuan province, Xingwen County, Shihai town, Dao cave, 28.18900° N, 105.12118° E, 840 m, 17.X.2015, Yun-Chun Li leg.; 5♂ and 9♀, Sichuan province, Xingwen County, Shihai town, Tian Yang cave, 28.19094° N, 105.13734° E, 835 m, 18.X.2015, Yun-Chun Li leg.
- B. cavernarum* Mahnert & Li, 2016: 3♂ and 5♀, Chongqing, Beibei, Jindaoxia town, Er Long cave, 30.05539° N, 106.62385° E, 776 m, 8.X.2015, Yun-Chun Li leg.
- B. chuanensis* Mahnert & Li, 2016: 2♂ and 1♀, Guizhou province, Jinsha County, Xinhua town, Chuan cave, 27°23.797' N, 106°06.104' E, 1,387 m, 2.X.2015, Yun-Chun Li leg.

#### 3.2. Description of *Bisetocreagris xiaoensis* Li & Liu, sp. n. (Figs 1–3)

*Type material.* Holotype: ♂, China, Yunnan Province, Yanjin County, Dousha town, Xiao cave, 28°02.405' N, 104°06.845' E, 708 m, 11.IV.2017,

Yun-Chun Li leg. Paratypes: 7♂ and 10♀, same data as holotype.

*Diagnosis.* Troglolobiont habitus. Carapace with 2 indistinct lense (anterior) eyes; carapace with 6 setae on posterior margin, tergite I with 7 setae; chelicera with teeth of movable finger on thickened lamella, rallum with 7–8 blades, the distal one with expanded base. The new species is most similar to *B. scaurum* (Mahnert, 2003), but can be distinguished (new species vs. *B. scaurum*) from the pinnate setae of cheliceral rallum (8 vs. 9), chaetotaxy of tergites I (7 vs. 6) and fixed finger of pedipalps (163–171 vs. 105).

*Description.* Male (Fig. 3a). Colouration: Carapace, pedipalps and chelicera brown, tergites darker, legs slightly yellowish.

Carapace: With 2 (anterior) eyes with indistinct lense, about 3.0–3.5 diameters of the anterior margin; Anterior margin of carapace distinctly narrow (Fig. 1a), 1.21–1.25 longer than broad, epistome a distinct triangle, with sharpened apices; chaetotaxy 6:9–10:4–5:6 (25–27), anterolateral setae much shorter than others.

Tergal chaetotaxy: 7:6:6:6:6:7:8:8:9:9:6–8 (2 tactile setae):4. Sternite III with anteromedian groove flanked by one small seta on each side, with 19–20 long setae (5 medial discal setae)+4–6 suprastigmal setae. IV–XII: 16–17:19–20:18:18:16:16:13–14:3–4 (2 lateral tactile setae):4. Manducatory process rounded, with 5 (4–5 on right side) marginal setae. Pedipalpal coxa with 6–7 setae, two lyrifissures, coxa I 10–11, II 6–7, III 4–5, IV 11–12. Genital operculum of male (Fig. 2h) with 39–48 setae, lateral marginal setae longer than middle ones.

Cheliceral palm (Fig. 2e): 6–7 long, with thin setae, ventrobasal seta shorter than others, palm with moderate hispid granulation dorsally. Fixed cheliceral finger with 13–14 teeth, distal tooth larger than the others; movable finger on the left with 1 (in the middle)–2 setae (in the middle and near distal 1/3), on the right only with 1 setae (Fig. 2f), with 11–12 teeth, the medial ones on thickened lamella. Galea (Fig. 2e–f): a short slender transparent rod on left chelicera. Serrula exterior with about 39–43 and serrula interior with 32–36 blades. Rallum composed of 7–8 blades (Fig. 10), distal one separated and with expanded base, proximal one short.

Pedipalps (Fig. 2a–d): Longer and slenderer

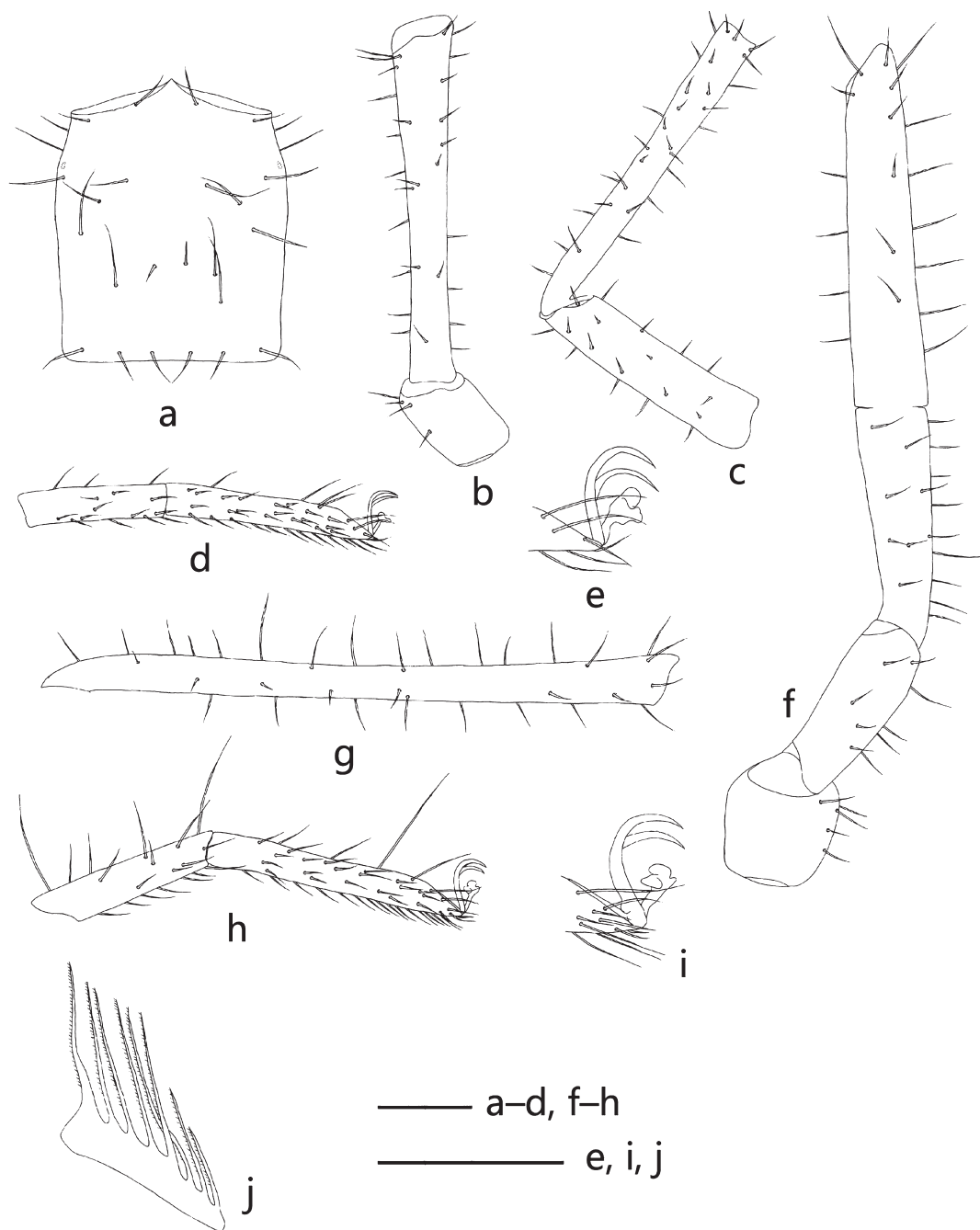


Fig. 1. *Bisetocreagris xiaoensis* sp. n., male holotype and paratype. – a. Carapace. – b–d. Left leg I, lateral view. – e. Apotele of left leg I, lateral view. – f–h. Right leg IV, lateral view. – i. Apotele of left leg IV, lateral view. – j. Right rallum. Scale lines 0.2 mm.

than in known species living in forests in leaf litter i.e. outside of caves, trochanter 2.81–3.40 times longer than broad, distal femur slightly enlarged, 6.92–7.61 times longer than broad, patella

7.84–10.36 times longer than broad, femur 0.93–0.98 times longer than patella, chela with pedicel 8.10–8.78 times longer than broad, hand with pedicel 3.71–3.96 times longer than broad; mov-

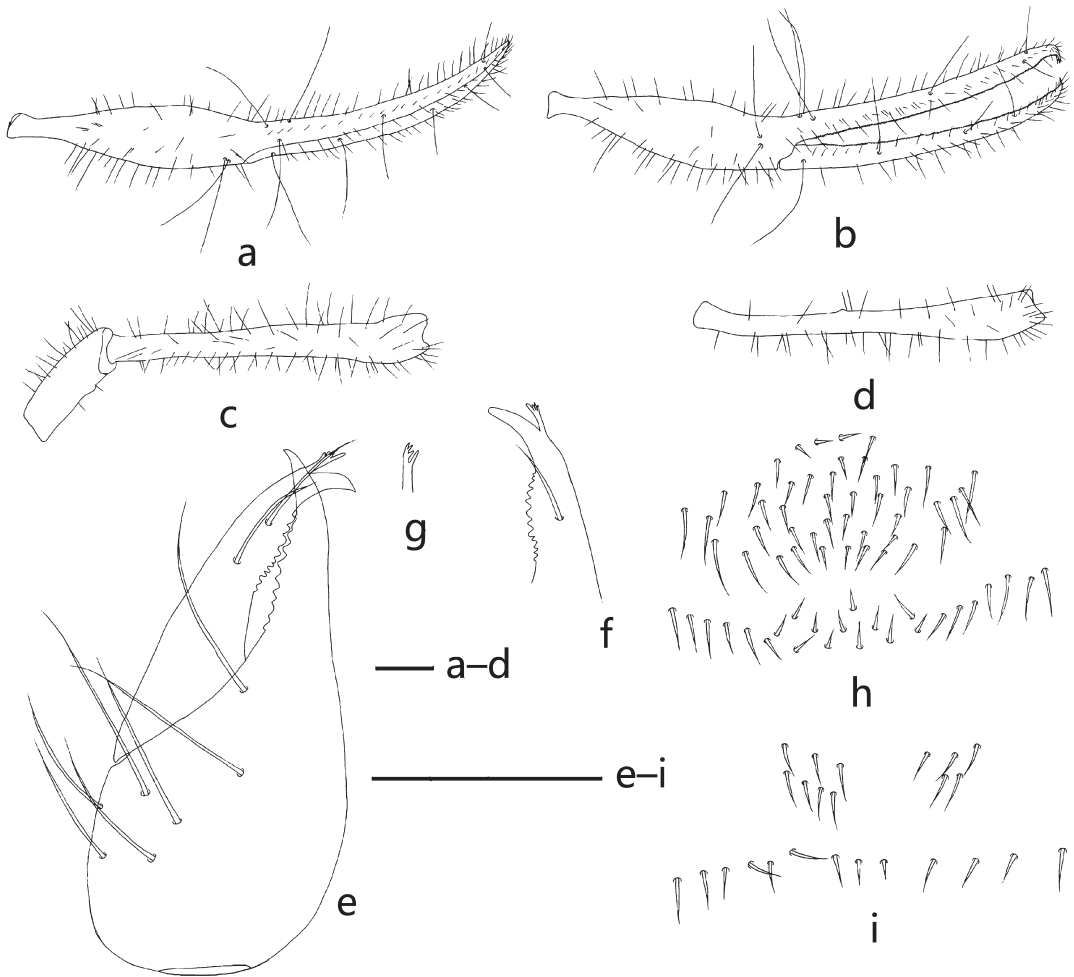


Fig. 2. *Bisetocreagris xiaoensis* sp. n., male holotype (a–f, h), female (g, i). – a–b. Chela, antiaxial and dorsal view. – c–d. Pedipalp from trochanter to patella, antiaxial view. – e. Left chelicera. – f. Tip of movable finger of right chelicera, dorsal view. – g. Female left cheliceral galea, dorsal view. – h–i. Male and female genital area. Scale lines 0.2 mm.

able finger 1.14–1.23 longer than hand (with pedicel) length. Fixed finger with 163–171 small, cusped teeth, movable finger with 173–182 teeth, rounded in basal fifth of finger; venom duct in fixed finger, very short; 12 trichobothria (8+4), *et-it* at same level near finger tip, *est* slightly distal of finger middle, *eb-esb* on distal lateral hand side, *sb* on movable finger distinctly nearer to *b* than to *st*, *st* nearer to *t* than to *sb*.

Legs (Fig. 1b–i): Typical, elongate. Fine granulation present on anterodorsal faces of femora I, IV and patella IV. Leg I: femur 6.81–8.64 times longer than deep and 1.37–1.55 times longer than patella, patella 5.41–6.17 times lon-

ger than deep, tibia 8.31–12.44 times longer, basitarsus 4.05–5.92 times longer, telotarsus 6.00–6.67 times longer than deep, telotarsus 1.27–1.39 longer than basitarsus; leg IV: femur+patella 7.09–8.26 times longer than deep, femur shorter than patella, tibia 12.73–18.32 times longer than deep, basitarsus 3.91–5.40 times longer, with two tactile setae (basally, TS= 0.26–0.29; distally, TS= 0.29–0.31), telotarsus 7.76–7.85 times longer than deep, with a tactile setae near middle (TS= 0.41–0.43).

Measurements (in mm) (holotype and paratypes): Body length 5.25–5.42; carapace (length/breadth) 1.44–1.46/1.16–1.17. Pedipalps: tro-

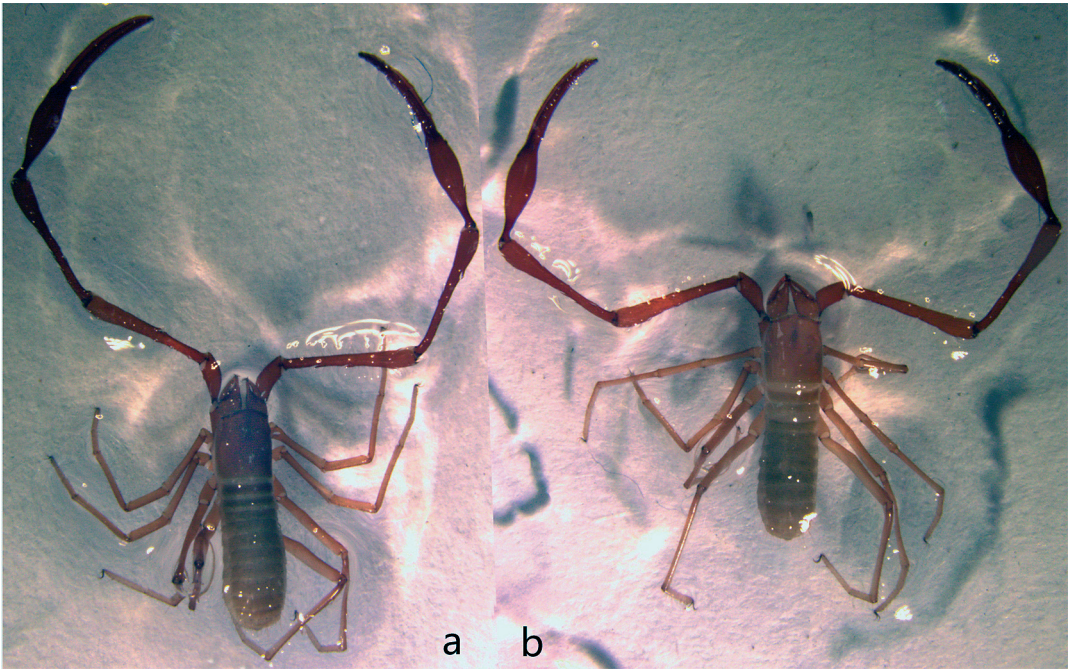


Fig. 3. Habitus of *Bisetocreagris xiaoensis* sp. n. – a. Male holotype (length 5.42 mm). – b. Paratype female (length 5.31 mm).

chanter 1.19–1.20/0.35–0.37, femur 2.75–2.80/0.34–0.37, patella 2.74–3.00/0.26–0.38, hand with pedicel 1.96–2.08/0.50–0.56, length of finger 2.42–2.48, length of chela 4.39–4.56/0.50–0.56. Leg I: femur 1.32–1.35/0.16–0.17, patella 0.91–0.99/0.16–0.17, tibia 1.29–1.31/0.10–0.14, basitarsus 0.54–0.59/0.09–0.10, telotarsus 0.68–0.80/0.08–0.09; leg IV: femur+patella 1.78–1.83/0.26–0.27, tibia 2.01–2.29/0.13–0.16, basitarsus 0.52–0.78/0.13–0.14, telotarsus 1.01–1.08/0.13–0.14.

Female (paratypes). Tergal chaetotaxy: 7:6:6:6:7:7:9:9:9:9:8 (2 tactile setae):4. Sternite III with an anteromedian groove, with one tiny seta on each margin, 21–22 long setae (1–2 medial discal setae)+3–4 suprastigmal setae. IV–XII, 17–18:14:17–18:17:16:15–16:14:8 (2 lateral tactile setae):4. Manducatory process with 6 (5–6 on right side) marginal setae. Pedipalpal coxa with 7–8 setae. Genital operculum with 6/6–7 medial marginal setae (Fig. 2i). Cheliceral galea (Fig. 2g): a short slender transparent rod on left chelicera, divided in 2 main branches. Cheliceral rallum composed of 8 blades, distal one separated

and with slightly expanded base. Measurements: Body length 5.31–6.53; carapace (length/breadth) 1.55–1.58/1.23–1.24. Pedipalps: trochanter 1.29–1.34/0.40–0.41, femur 2.71–2.93/0.37–0.39, patella 2.98–3.02/0.42–0.43, hand with pedicel 2.17–2.23/0.62–0.63, length of finger 2.47–2.62, length of chela 4.70–4.80/0.62–0.63. Leg I: femur 1.22–1.32/0.14–0.20, patella 0.97–1.06/0.16–0.18, tibia 0.99–1.41/0.11–0.13, basitarsus 0.46–0.66/0.11–0.13, telotarsus 0.71–0.96/0.11–0.12; leg IV: femur+patella 1.98–2.27/0.25–0.29, tibia 1.89–2.03/0.15–0.18, basitarsus 0.49–0.64/0.14–0.15, telotarsus 0.76–1.14/0.13–0.14.

*Distribution.* Yunnan Province, China.

*Etymology.* Latinized adjective, derived from the name of the *locus typicus*, Xiao cave.

*Remarks.* Checking all specimens of this new species revealed that only one chelicera of one male has two setae in its left movable finger, while other chelicera only has one seta. Beyond that difference, they have the same characteristics as other specimens. We believe that this is an unstable character.

#### 4. Key to the known cave-dwelling species of the genus *Bisetocreagris*

1. Carapace with eyes 2
  - Carapace without eyes or eyespots 7
2. Carapace only with 2 (anterior) eyes with indistinct lense 3
  - Carapace with 4 small eyes or eyespots 6
3. Eight setae on posterior margin of carapace; slender and shorter pedipalps, femur 4.4 times as long as broad (length 1.70 mm), patella 3.1 times as long as broad (length 1.53 mm)
  - B. chuanensis* Mahnert & Li, 2016
  - Either more or less than 8 setae on posterior margin of carapace; both pedipalpal femur (length 2.04–4.65 mm) and patella (length 2.06–4.99 mm) more than 4.7 times as long as broad 4
4. Carapace with 31 setae, 10 or 12 setae on posterior margin; pedipalpal femur length 4.65 mm, patella length 4.99 mm; genital operculum of male with about 80 short and thickened setae
  - B. juanxuae* Mahnert & Li, 2016
  - Either more or less than 31 setae of carapace; both pedipalpal femur and patella shorter than 4.5 mm; genital operculum of male with less than 80 setae 5
5. Cheliceral rallum with 10 pinnate setae, finger of both pedipalps with about 120 equal and closely situated teeth
  - B. chinacavernicola* (Schawaller, 1995)
  - Cheliceral rallum with 7–8 pinnate setae, fixed finger of pedipalps with 163–171 small, cusped teeth, movable finger with 173–175 teeth *B. xiaoensis* sp. n. Li & Liu
6. Anterior eyes with indistinct lense, posterior eyes indistinct and difficult to observe; distal pedipalps of dorsal and medial hand with fine granules; femur 5.8 times (length 1.92–2.10 mm), patella 4.3–4.7 times (length 1.78–2.01 mm) longer than broad
  - B. cavernarum* Mahnert & Li, 2016
  - Four small eyes very distinct; trochanter of pedipalps with small dorsal hump, femur indistinctly granulate medially, femur 4.25 times (length 1.58 mm), patella 2.7 times

(length 1.35 mm) longer than broad

*B. martii* (Mahnert, 2003)

7. 13 cheliceral rallum setae
  - B. titanium* (Mahnert, 2003)
  - Less than 13 cheliceral rallum setae 8
8. Carapace with 4 anterior and 6 posterior setae; tergites I–X with 6 setae, XI with 6 (of which 2 tactile) setae
  - B. scaurum* (Mahnert, 2003)
  - Carapace with 6 anterior and 7 posterior setae; tergites I–X with 7–9 (rarely 6 or 10), XI with 7 (of which 2 tactile) setae *B. baozinensis* Mahnert & Li, 2016

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