

Two new species of the genus *Parobisium* Chamberlin, 1930 from China (Pseudoscorpiones: Neobisiidae)

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Two new *Parobisium* species belonging to the family Neobisiidae are described from China: *Parobisium wangae* **sp. n.** from Sichuan and Shaanxi Provinces and *Parobisium xiaowutaicum* **sp. n.** from Hebei Province. Detailed diagnoses, descriptions and illustrations of the two new species are presented. A key to the Palearctic *Parobisium* species and a distribution map of the new species are provided.

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1. Introduction

The pseudoscorpion genus *Parobisium* was established by Chamberlin (1930) as a subgenus of *Neobisium* Chamberlin, 1930, and later elevated by Chamberlin and Malcolm (1960) to generic rank. *Parobisium* can be distinguished from *Neobisium* by the arrangement of trichobothria on the fixed chelal finger: in *Neobisium* the trichobothria are arranged in a distal group of four (*et*, *est*, *it* and *ist*), and a basal group of four (*esb*, *eb*, *isb* and *ib*), while the arrangement of trichobothria in *Parobisium* includes three (*et*, *est* and *it*) in the distal group and five (*ist*, *esb*, *eb*, *isb* and *ib*) in the basal group (Chamberlin, 1962).

Parobisium species mainly occur in leaf litter or in caves, and are found in East Asia and North America. Harvey (2013) recorded 16 *Parobisium* species in the world, but three Chinese species, *P. martii* Mahnert, 2003, *P. scaurum* Mahnert, 2003 and *P. titanium* Mahnert, 2003 were transferred to *Bisetocreagris* Čurčić, 1983 by Mahnert and Li

(2016). At present, *Parobisium* includes 13 species, of which six species have been reported from the Palearctic region: *P. flexifemoratum* (Chamberlin, 1930), *P. imperfectum* (Chamberlin, 1930), *P. magnum* (Chamberlin, 1930), *P. anagamidense* (Morikawa, 1957), *P. longipalpus* Hong, 1996 and *P. robustiellum* Hong, 1996 from Japan and South Korea.

During examination of pseudoscorpion specimens collected by sieving leaf litter from Sichuan, Shaanxi and Hebei Provinces, China, two *Parobisium* species were found to be previously unnamed. They are described and illustrated here as *P. wangae* **sp. n.** and *P. xiaowutaicum* **sp. n.**

2. Materials and methods

All specimens are preserved in 85% alcohol, and were examined and illustrated using a Leica 205A stereomicroscope with a drawing tube, which



Fig. 1. *Parobisium wangae* sp. n. – a. Holotype male, dorsal view. – b. Paratype female, dorsal view.

was also used for the measurements. Detailed examination was carried out with an Olympus BX53 general optical microscope. Temporary slide mounts were made in glycerol. All measurements are given in mm. The specimens are deposited in the Museum of Hebei University (MHBHU), Baoding, China.

Terminology of trichobothria follows Chamberlin (1931) and Harvey (1992). The term “rallum” (for flagellum) is adopted following Judson (2007). The following abbreviations are used in the text for the trichobothria: *b* = basal, *sb* = sub-basal, *st* = sub-terminal, *t* = terminal, *ib* = interior basal, *isb* = interior sub-basal, *ist* = interior sub-terminal, *it* = interior terminal, *eb* = exterior basal, *esb* = exterior sub-basal, *est* = exterior sub-terminal, *et* = exterior terminal.

3. Descriptions of new species

3.1. *Parobisium wangae* sp. n. (Figs 1–3)

Type material. Holotype male (Ps.-MHBHU-SC13051401), China: Sichuan Province, Nanjiang County, Guangwu Mountain (32°40'N, 106°48'E), alt. 1,070 m, 14.V.2013, Dong Wang leg. Paratypes: three males and seven females (Ps.-MHBHU- SC13051402–11), same data as for

holotype; one male and one female (Ps.-MHBHU-SHX15080201–02), China: Shaanxi Province, Zhenping County, Hualong Mountain (31°59'N, 109°22'E), alt. 1,870 m, 2.VIII.2015, Xiangbo Guo leg.

Diagnosis. *Parobisium wangae* sp. n. is characterized by the following combination of characters: carapace with 4 well-developed eyes; rallum consisting of 8 blades; male pedipalpal femur 3.60–3.65 (female 3.41–3.81), patella 1.89–2.16 (female 2.06–2.08), chela (without pedicel) 2.90–3.25 (female 2.51–2.66) times longer than wide; male fixed chelal finger with 66–74 (female 54–59) rounded teeth, movable finger with 57–67 (female 50–58) rounded teeth.

Description. Male (Fig. 1a). Colour mostly reddish brown, legs yellowish.

Carapace (Figs 2a, 3a). Smooth, 1.03–1.10 times longer than broad, with a total of 24–28 setae, including 4 on anterior margin and 8 on posterior margin; 4 eyes, well developed; epistome small, triangular.

Chelicera (Figs 2b, 3b). Palm with 6–7 setae, movable finger with one sub-medial seta; fixed finger with 6–8 teeth; movable finger with 10–11 teeth; serrula exterior with 28–30 lamellae; serrula interior with 25–28 lamellae. Galea (Fig. 2c) replaced by a small rounded transparent spinneret. Rallum (Fig. 2d) consisting of 8 blades,

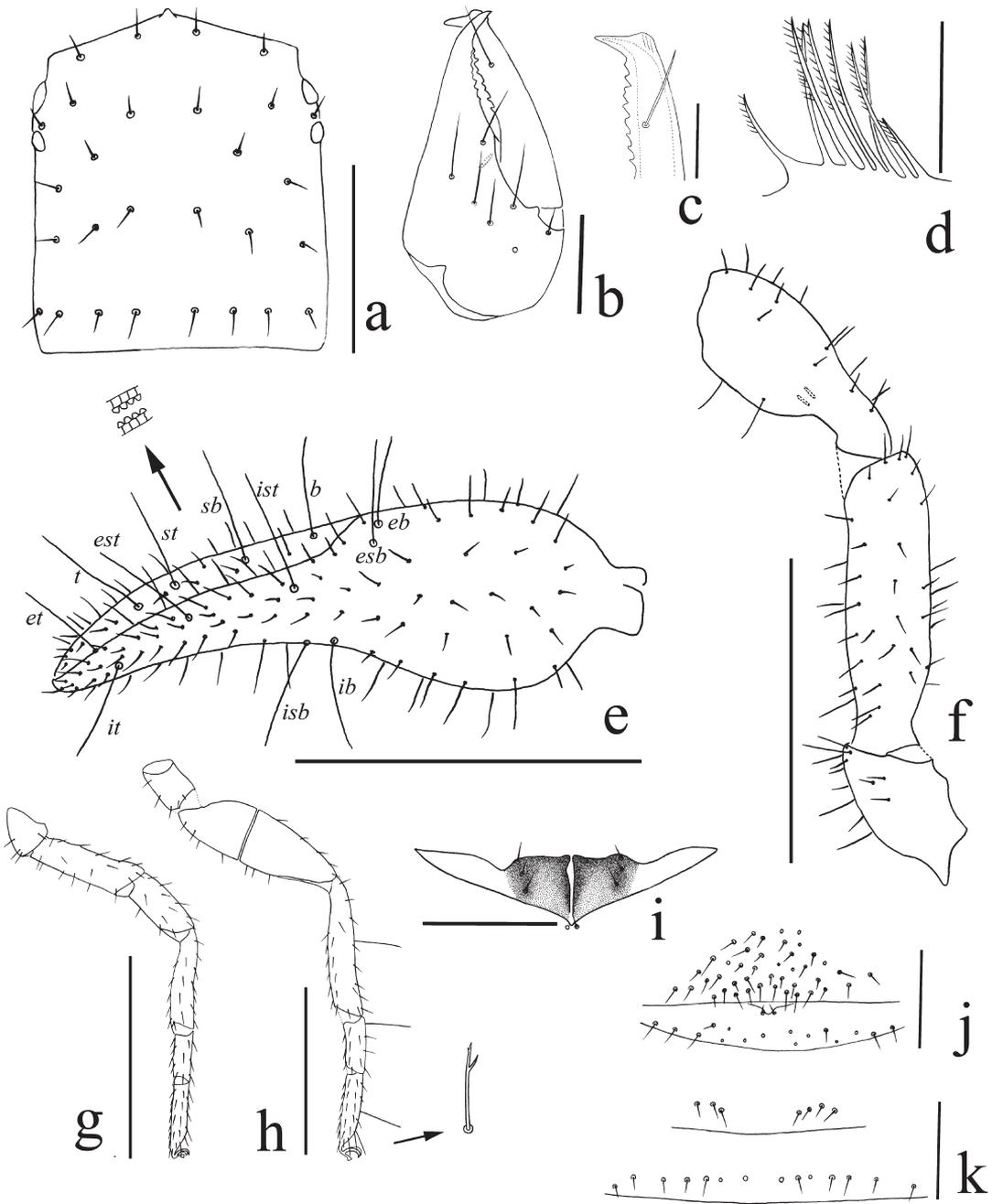


Fig. 2. *Parobisium wangae* sp. n. holotype male (a–i), female (k). – a. Carapace, dorsal view. – b. Right chelicera, dorsal view. – c. Movable finger of chelicerae, showing galea. – d. Rallum. – e. Right chelal, lateral view, showing trichobothriotaxy and teeth. – f. Right pedipalp, dorsal view (trochanter, femur and patella). – g. Right leg I, lateral view. – h. Right leg IV, lateral view. – i. Internal piece of male genital operculum. – j. Genital area of male. – k. Genital area of female. Scale bars: 0.1 mm (c, d), 0.2 mm (b, i–k), 0.5 mm (a), 1 mm (e–h).

all with anteriorly-directed spinules, the basal-most blade shortest.

Pedipalps (Figs 2e–f, 3c, d). Apex of coxa

rounded, with 5 setae. Femur, patella and chela smooth; chelal fingers a little longer than hand. Trochanter 1.69–1.81, femur 3.60–3.65, pa-

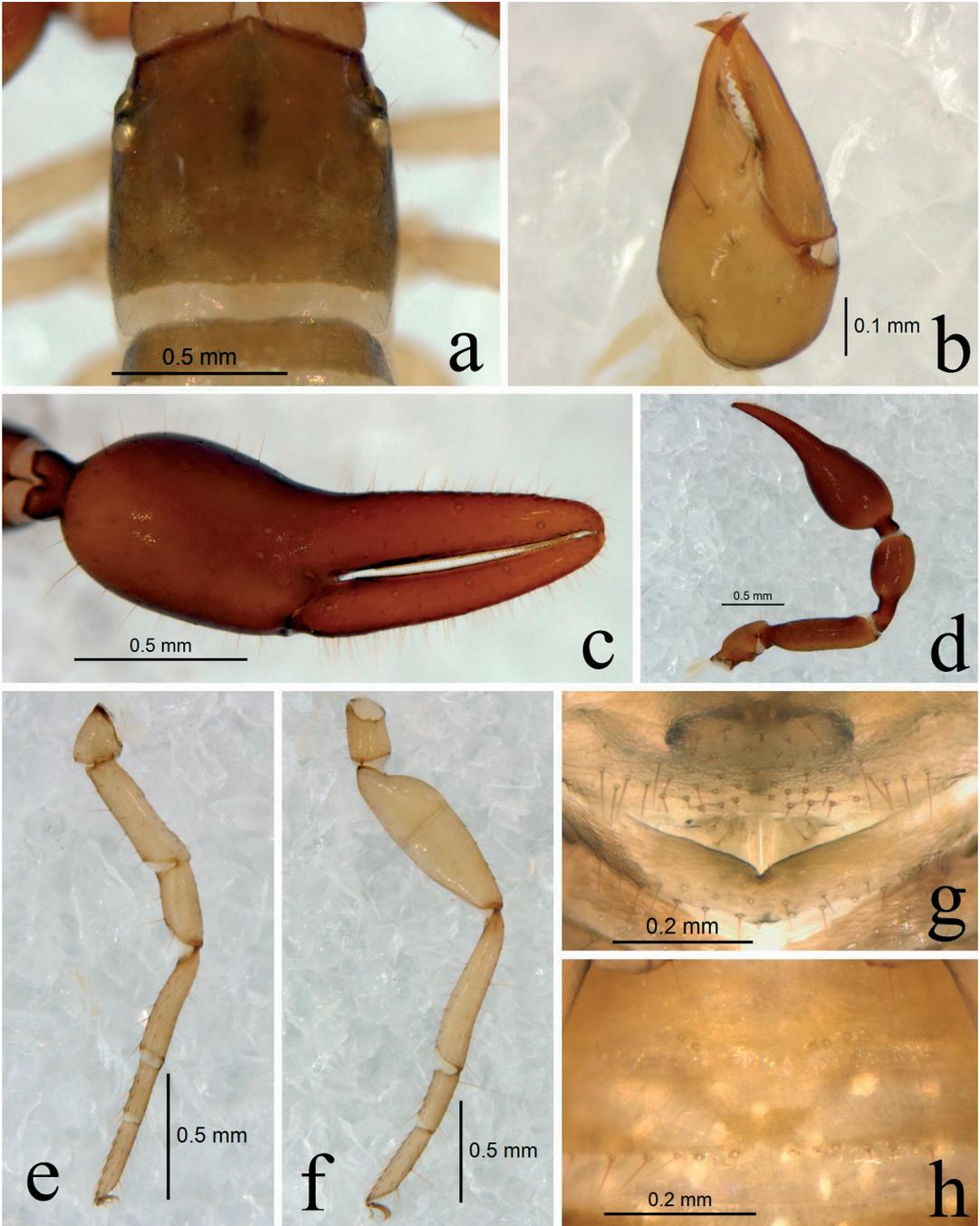


Fig. 3. *Parobisium wangae* sp. n. holotype male (a–g), female (h). – a. Carapace, dorsal view. – b. Right chelicera, dorsal view. – c. Right chela, lateral view. – d. Right pedipalp, dorsal view. – e. Right leg I, lateral view. – f. Right leg IV, lateral view. – g. Genital area of male. – h. Genital area of female.

tella 1.89–2.16, chela (with pedicel) 3.13–3.52, chela (without pedicel) 2.90–3.25 times longer than wide, movable finger 1.09–1.31 times longer than hand (without pedicel). Fixed chelal fin-

ger with 8 trichobothria, movable finger with 4, *eb* and *esb* on lateral margin of hand; *ib*, *isb* and *ist* on basal half, *et* and *it* on distal half, *est* almost on the middle of fixed finger; *t* and *st* near the middle

of movable finger, *sb* and *b* on basal half. Venom apparatus present only in fixed chelal finger, short. Fixed chelal finger with 66–74 rounded teeth, movable finger with 57–67 rounded teeth.

Abdomen. Pleural membrane granulated. Tergal chaetotaxy: 10–12: 11–14: 12: 12–14: 13–14: 12–13: 12–13: 12–13: 12: 12–13: 8–10; sternal chaetotaxy (IV–XI): 10: 17–18: 16–17: 15–17: 16–20: 17–18: 12–16: 10–13; stigmata with 5–6 setae around; anal cone with 2 dorsal and 2 ventral setae. Male genital area (Figs 2j, 3g): sternite II with 39–45 scattered setae; sternite III with 2 small setae which occur each on either side of the anteromedian groove, and followed by 16–19 intermediary and posterior setae. Internally, the genital operculum with 3 setae on each side (Fig. 2i).

Legs. Leg I (Figs 2g, 3e) and Leg IV (Figs 2h, 3f) typical. Tibia IV with one sub-medial tactile seta (TS=0.44–0.47), basitarsus IV with one basal tactile seta (TS=0.13–0.18), telotarsus IV with one sub-medial tactile seta (TS=0.43–0.46). Subterminal tarsal seta bifurcate; arolium not divided, shorter than the slender and simple claws.

Female (Fig. 1b). As in holotype except where noted.

Chelicera. Fixed finger with 6–7 teeth; movable finger with 9–11 teeth; serrula exterior with 34–37 lamellae; serrula interior with 25–28 lamellae.

Pedipalps. Trochanter 1.56–1.66, femur 3.41–3.81, patella 2.06–2.08, chela (with pedicel) 2.73–2.80, chela (without pedicel) 2.51–2.66 times longer than wide, movable finger 1.10–1.13 times longer than hand (without pedicel). Fixed chelal finger with 54–59 teeth, movable finger with 50–58 teeth, which both rounded and almost of equal size.

Abdomen. Tergal chaetotaxy: 9–11: 11–12: 12–13: 12–15: 12–14: 12–13: 12–13: 11–14: 11–13: 10–12: 9–10. Chaetotaxy of sternites (IV–XI): 9–10: 14–17: 15–17: 15–17: 14–17: 12–16: 13–15: 8–10. Female genital area (Figs 2k, 3h): sternite II with 3–4 setae on each side; sternite III with a row of 13–14 setae on the posterior margin.

Measurements (length×breadth or depth in mm, ratios in parentheses). Male (holotype and paratypes). Body length 3.18–3.79. Carapace 0.80–0.85×0.77–0.78 (1.03–1.10). Chelicera 0.49–0.56×0.28–0.32 (1.75), movable finger

length 0.34–0.43. Palpal trochanter 0.44–0.49×0.26–0.27 (1.69–1.81), femur 0.90–0.95×0.25–0.26 (3.60–3.65), patella 0.68–0.69×0.32–0.36 (1.89–2.16), chela (with pedicel) 1.55–1.63×0.44–0.52 (3.13–3.52), chela (without pedicel) 1.43–1.51×0.44–0.52 (2.90–3.25), hand length (without pedicel) 0.70–0.75, movable finger length 0.76–0.94 (1.09–1.31×hand). Leg I: trochanter 0.20–0.23×0.16–0.18 (1.25–1.28), femur 0.46–0.51×0.16–0.17 (2.88–3.00), patella 0.30–0.34×0.14–0.15 (2.14–2.27), tibia 0.40–0.45×0.10–0.11 (4.00–4.09), basitarsus 0.21×0.08 (2.63), telotarsus 0.31–0.35×0.07 (4.43–5.00). Leg IV: trochanter 0.27–0.31×0.21–0.23 (1.29–1.35), femur + patella 0.87–0.91×0.26–0.27 (3.35–3.37), tibia 0.73–0.77×0.14–0.16 (4.81–5.21), basitarsus 0.31–0.33×0.09–0.11 (3.00–3.44), telotarsus 0.42–0.46×0.09–0.10 (4.60–4.67).

Female (paratypes). Body length 3.43–4.27. Carapace 0.78–0.84×0.82–0.88 (0.95). Chelicera: 0.57–0.59×0.32–0.33 (1.78–1.79), movable finger length 0.42–0.45. Palpal trochanter 0.48–0.50×0.29–0.32 (1.56–1.66), femur 0.92–0.99×0.26–0.27 (3.41–3.81), patella 0.74–0.77×0.36–0.37 (2.06–2.08), chela (with pedicel) 1.61–1.65×0.59 (2.73–2.80), chela (without pedicel) 1.48–1.57×0.59 (2.51–2.66), hand length (without pedicel) 0.75–0.78, movable finger length 0.85–0.86 (1.10–1.13×hand). Leg I: trochanter 0.22–0.23×0.18 (1.22–1.28), femur 0.47–0.48×0.16–0.17 (2.76–3.00), patella 0.32–0.33×0.15–0.16 (2.06–2.13), tibia 0.41–0.44×0.11 (3.73–4.00), basitarsus 0.19–0.25×0.08–0.09 (2.38–2.78), telotarsus 0.32–0.33×0.07–0.08 (4.00–4.71). Leg IV: trochanter 0.31–0.33×0.22–0.23 (1.41–1.43), femur + patella 0.87–0.88×0.26–0.27 (3.26–3.35), tibia 0.65–0.72×0.15 (4.33–4.80), basitarsus 0.29–0.30×0.10 (2.90–3.00), telotarsus 0.41–0.42×0.09 (4.56–4.67).

Distribution. This species has been found in Sichuan and Shaanxi Provinces, China (Fig. 7).

Etymology. The specific name is a patronym in honour of Ms. Dong Wang, who collected some of the specimens.

Remarks. The other species of the genus of comparable size and with four eyes are *P. imperfectum* from Japan, *P. vanceleavei* (Hoff, 1961) and *P. utahense* Muchmore, 1968 from the

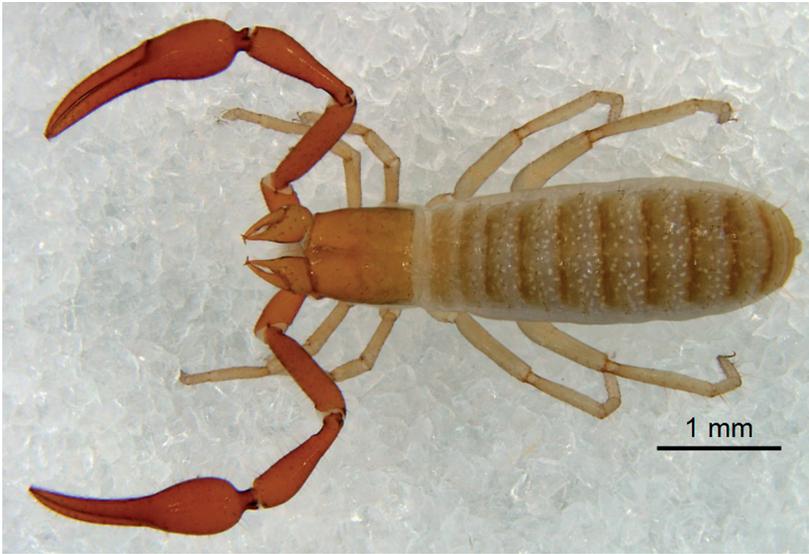


Fig. 4. *Parobisium xiaowutaicum* sp. n. – Holotype female, dorsal view.

United States. *Parobisium wangae* sp. n. can be distinguished from these species by: carapace with 8 setae on posterior margin (8–10 in *P. utahense*; 10–12 in *P. vancleavei*); pedipalpal femur 3.60–3.65, patella 1.89–2.16 times longer than wide (femur 4.20–4.40, patella 2.80–2.90 times longer than wide in *P. utahense*; femur 3.91–4.12, patella 2.51–2.70 times longer than wide in *P. vancleavei*); pedipalpal femur smooth (in *P. imperfectum* femur weakly granulate along its anterior margin); chelal movable finger with 57–67 teeth (86 in *P. imperfectum*).

3.2. *Parobisium xiaowutaicum* sp. n. (Figs 4–6)

Type material. Holotype female (Ps.-MHBH-13081301), China: Hebei Province, Zhangjiakou City, Xiaowutai Mountain (40°01'N, 115°03'E), alt. 1,250 m, 13.VIII.2013, Jie Yang leg. Paratype: female (Ps.-MHBH-1407-3101), same locality as holotype, 31.VII.2014, Guangxin Han leg.

Diagnosis. This new species can be easily distinguished from the other members of the genus *Parobisium* by the following combination of characters: carapace with no eyes/eyespot; pedipalpal trochanter 2.04, femur 4.65, patella 3.14, chela (with pedicel) 4.04, chela (without pedicel) 3.76 times longer than wide.

Description. Female (Fig. 4). Colour mostly yellow; pedipalps, carapace and chelicerae darker.

Carapace (Figs 5a, 6a). Smooth, 1.06 times longer than broad, with a total of 26 setae, including 4 on anterior margin and 8 on posterior margin; eyes/eyespot absent; epistome rounded.

Chelicera (Figs 5b, 6b). Palm with 7 setae, movable finger with one sub-medial seta; fixed finger with 11 teeth; movable finger with 8 teeth; serrula exterior with 28 lamellae; serrula interior with 26 lamellae. Galea (Fig. 5c) replaced by a small rounded transparent spinneret. Rallum (Fig. 5d) consisting of 8 blades, distalmost blade slightly widened at base and with spinules both anteriorly and posteriorly, while other blades with anteriorly-directed spinules, the basalmost blade shortest.

Pedipalps (Figs 5e–f, 6c, d). Apex of coxa rounded, with 5 setae. Femur, patella and chela smooth; chelal fingers longer than hand. Trochanter 2.04, femur 4.65, patella 3.14, chela (with pedicel) 4.04, chela (without pedicel) 3.76 times longer than wide, movable finger 1.48 times longer than hand (without pedicel). Fixed chelal finger with 8 trichobothria, movable finger with 4, *eb* and *esb* on lateral margin of hand; *ib*, *isb* and *ist* on basal half, *et* and *it* on distal half, *est* closer to *et* than to *ist*; *t* and *st* near the middle of movable finger, *sb* and *b* on basal half. Venom apparatus present only in fixed chelal finger, short.

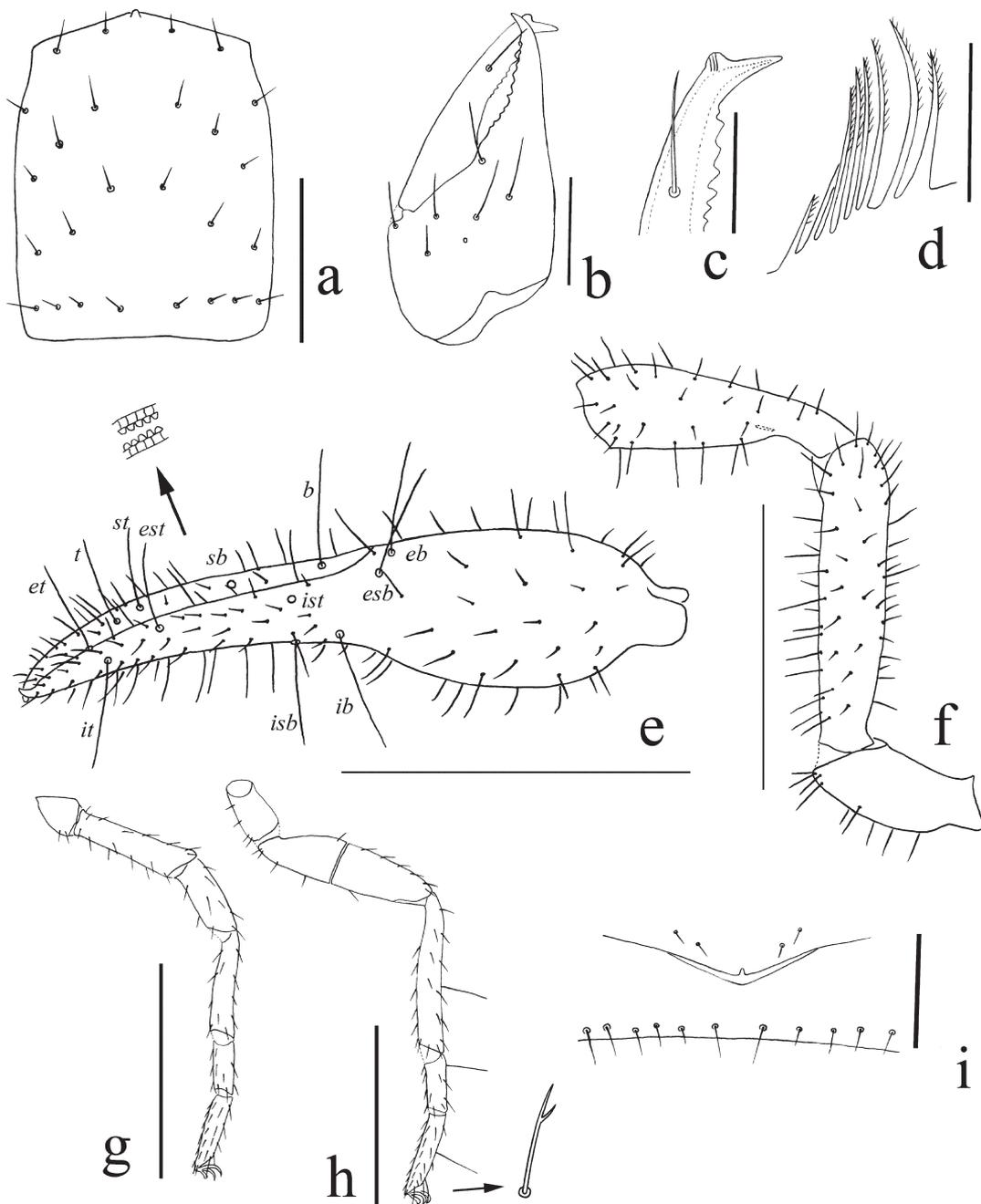


Fig. 5. *Parobisium xiaowutaicum* sp. n. holotype female. – a. Carapace, dorsal view. – b. Left chelicera, dorsal view. – c. Movable finger of chelicerae, showing galea. – d. Rallum. – e. Right chela, lateral view, showing trichobothriotaxy and teeth. – f. Right pedipalp, dorsal view (trochanter, femur and patella). – g. Right leg I, lateral view. – h. Right leg IV, lateral view. – i. Genital area of female. Scale bars: 0.1 mm (c, d), 0.2 mm (b, i), 0.5 mm (a), 1 mm (e–h).

Fixed chelal finger with 73 rounded teeth, movable finger with 75 rounded teeth.

Abdomen. Pleural membrane granulated.

Tergal chaetotaxy: 8: 11: 13: 12: 13: 13: 14: 13: 11: 11: 7; sternal chaetotaxy (IV–XI): 10: 17: 18: 14: 16: 15: 13: 8; stigmata with 6 setae around;

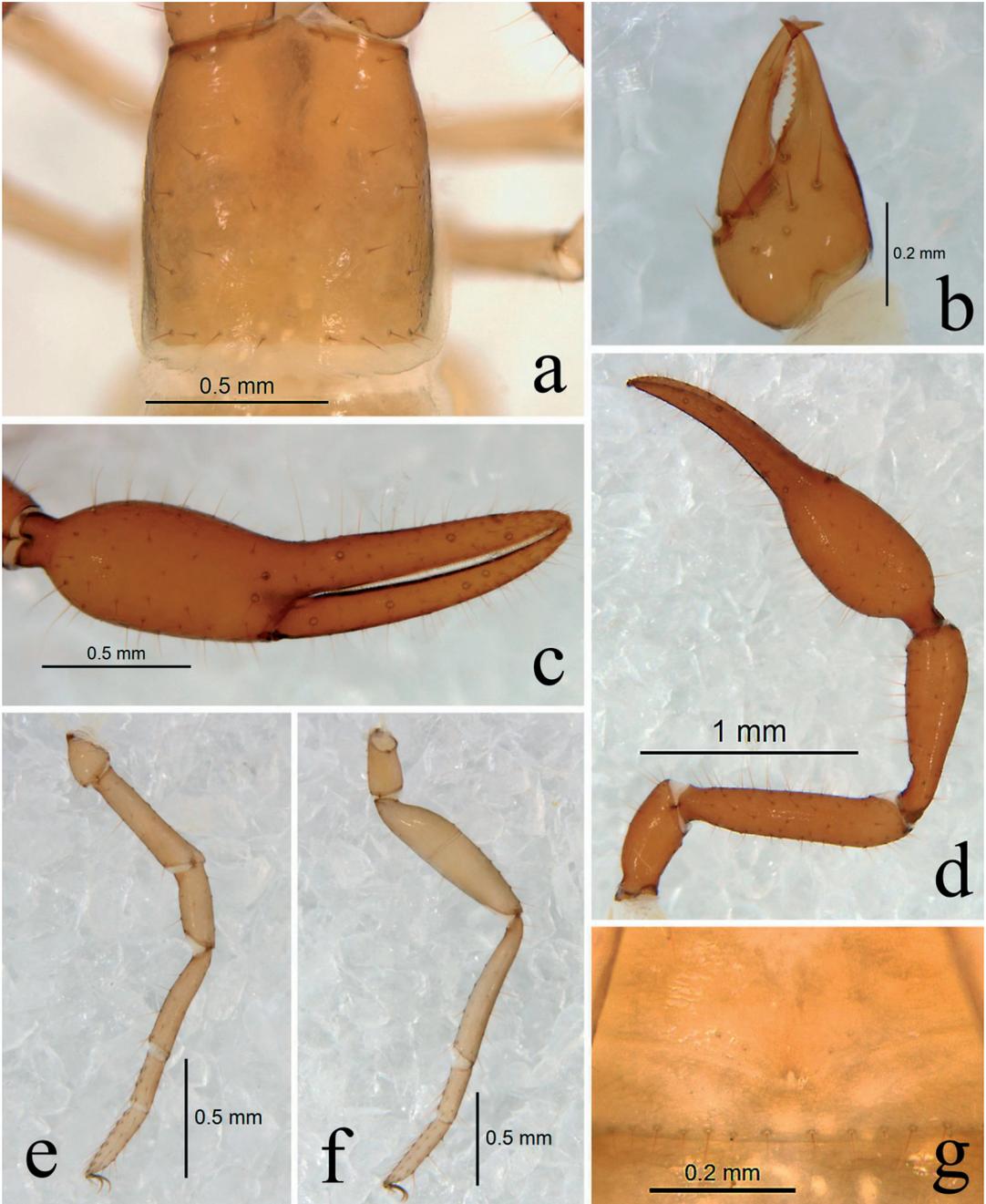


Fig. 6. *Parobisium xiaowutaicum* sp. n. holotype female. – a. Carapace, dorsal view. – b. Left chelicera, dorsal view. – c. Right chela, lateral view. – d. Right pedipalp, dorsal view. – e. Right leg I, lateral view. – f. Right leg IV, lateral view. – g. Genital area of female.

anal cone with 2 dorsal and 2 ventral setae. Female genital area (Figs 5i, 6g): sternite II with 2 setae on each side; sternite III with a row of 12 setae on the posterior margin.

Legs. Leg I (Figs 5g, 6e) and Leg IV (Figs 5h, 6f) typical. Tibia IV with one sub-medial tactile seta (TS=0.62), basitarsus IV with one basal tactile seta (TS=0.17), telotarsus IV with one sub-

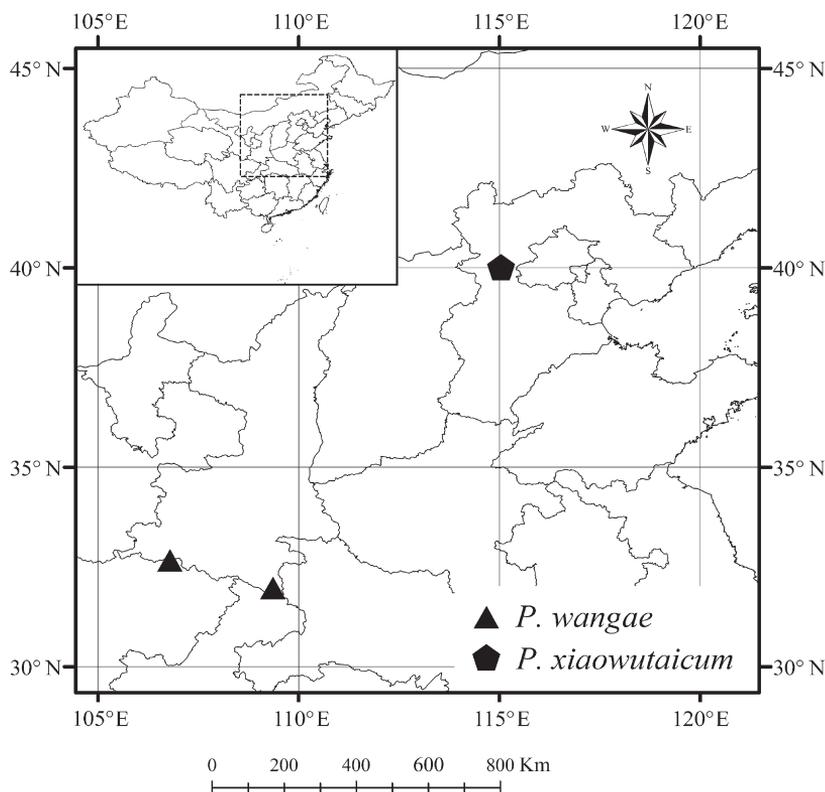


Fig. 7. Distribution map of the new *Parobisium* species.

medial tactile seta (TS=0.58). Subterminal tarsal seta bifurcate; arolium not divided, shorter than the slender and simple claws.

Measurements (length×breadth or depth in mm, ratios in parentheses). Female (holotype). Body length 3.74. Carapace 0.84×0.79 (1.06). Chelicera 0.56×0.31 (1.81), movable finger length 0.41. Palpal trochanter 0.51×0.25 (2.04), femur 1.07×0.23 (4.65), patella 0.91×0.29 (3.14), chela (with pedicel) 1.82×0.45 (4.04), chela (without pedicel) 1.69×0.45 (3.76), hand length (without pedicel) 0.73, movable finger length 1.08 (1.48×hand). Leg I: trochanter 0.22×0.17 (1.29), femur 0.52×0.15 (3.46), patella 0.33×0.13 (2.54), tibia 0.45×0.11 (4.09), basitarsus 0.23×0.09 (2.56), telotarsus 0.35×0.09 (3.89). Leg IV: trochanter 0.39×0.19 (2.05), femur + patella 0.96×0.25 (3.84), tibia 0.76×0.13 (5.85), basitarsus 0.29×0.11 (2.64), telotarsus 0.45×0.11 (4.09).

Distribution. This species has been found only in Hebei Province, China (Fig. 7).

Etymology. The specific name refers to the type locality.

Remarks. *Parobisium xiaowutaicum* **sp. n.** was collected from leaf litter in a conifer-broadleaf forest, but its carapace lacks eyes/eyespot, similar to some troglobitic species of *Parobisium* that have adapted for life in caves. The only other species of the genus without eyes/eyespot from the Palaearctic is *P. flexifemoratum* (*P. flexifemoratum* has four very weakly differentiated eyespot in some cases). *Parobisium xiaowutaicum* **sp. n.** can be easily separated from it by pedipalpal morphology and size.

4. Key to Palaearctic *Parobisium* species

- | | | |
|---|--|---|
| 1 | Four eyes | 2 |
| | Eyes/eyespot absent; or four very weak eyespot present | 7 |
| 2 | Pedipalpal patella 2.90–3.30, chela 3.50–4.20 times longer than wide | |
| | <i>Parobisium longipalpm</i> | |
| | Pedipalpal patella less than 2.90, chela less than 3.50 times longer than wide | 3 |

- 3 Pedipalpal femur more than 4.00 times as long as wide *Parobisium anagamidense*
Pedipalpal femur less than 3.90 times as long as wide 4
- 4 Pedipalpal femur smooth 5
Pedipalpal femur weakly granulate along its anterior margin 6
- 5 Rallum consisting of 6–7 blades
Parobisium robustiellum
Rallum consisting of 8 blades
Parobisium wangae sp. n.
- 6 Cheliceral palm with 6 setae
Parobisium imperfectum
Cheliceral palm with 7 setae
Parobisium magnum
- 7 Pedipalps robust, femur 2.60–2.70, patella 2.00 times longer than wide; moveable chelal finger with 54–56 teeth
Parobisium flexifemoratum
Pedipalps slender, femur 4.65, patella 3.14 times longer than wide; moveable chelal finger with 75 teeth
Parobisium xiaowutaicum sp. n.

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