Lithobius (Ezembius) tetraspinus, a new species of centipede from northwest China (Lithobiomorpha, Lithobiidae)

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Abstract
Lithobius (Ezembius) tetraspinus sp. n. (Lithobiomorpha: Lithobiidae), recently discovered from Hami City, Xinjiang Autonomous Region, NW China, is described. Morphologically this species resembles L. (E.) sibiricus, Gersfeldt, 1858, but is distinguishable by a different coxal pore formula, absence of accessory spurs on leg 15, morphology of the second article of the female gonopod, and legs 14 plectrotaxy. A table of the main morphological characters of Chinese Lithobius (Ezembius) species is presented.

Keywords
Chilopoda, Lithobius (Ezembius), NW China, Xinjiang Autonomous Region

Introduction

The centipede subgenus Lithobius (Ezembius) Chamberlin, 1919 accommodates a group of 58 species/subspecies mostly known from Asia, with little extension into north-western North America. Known species colonize a wide range of habitats, from arctic and sub-arctic to tropical and sub-tropical forests, to steppe and overgrazed stony areas of central Asia, to Himalayan montane forests, from sea shore up to 5500 m (Himalayas) (Zapparoli and Edgecombe 2011). Although the subgenus was formally proposed as new
and described in 1923 (Chamberlin 1923), according to Jeekel (2005) its name had been already validated in 1919 (Chamberlin 1919). *Ezembius* is characterized by antennae with ca 20 articles; ocelli 1+4–1+20; forcipular coxosternal teeth usually 2+2; porodonts generally setiform, sometimes stout. Tergites are generally without posterior triangular projections; tarsal articulation of legs 1–13 is distinct. Female gonopods are with uni-, bi- or tridentate claw, and 2+2–3+3 (rarely 4+4) spurs (Zapparoli and Edgecombe 2011).

The myriapod fauna of China is still poorly known and very little attention has been paid to the study of Lithobiomorpha, with only 74 species/subspecies hitherto known from the country (Ma et al. 2014a, b, 2015; Minelli et al. 2016; Pei et al. 2014, 2015, 2016; Qin et al. 2014). Xinjiang Autonomous Region is among the poorly studied regions of China with only eight species at present registered from its territory (Ma et al. 2014 b; Pei et al. 2015, 2016). Altogether, 18 species of *Lithobius* (*Ezembius*) have been recorded from China, only three of them from Xinjiang Autonomous Region. Here with a new species recently found in Balikun County is described.

**Materials and methods**

All specimens were hand-collected under leaf litter or stones. The material was examined with the aid of a Motic-C microscope (Xiamen, China). The colour description is based on specimens in 75% ethanol, and the body length is measured from the anterior margin of the cephalic plate to the posterior margin of the postpedal tergite. Type specimens are preserved in 75% ethanol and deposited in the School of Life Sciences, Hengshui University, Hengshui, China (HUSLS). The terminology of the external anatomy follows Bonato et al. (2010). The following abbreviations are used throughout:

- **T, TT** tergite, tergites;
- **S, SS** sternite, sternites;
- **C** coxa,
- **Tr** trochanter,
- **P** prefemur,
- **F** femur,
- **Ti** tibia,
- **a** anterior,
- **m** median,
- **p** posterior.

**Taxonomic part**

*Lithobiidae* Newport, 1844

*Lithobius* (*Ezembius*) *tetraspinus* sp. n.

http://zoobank.org/846D108B-D41F-4C20-9161-DA2137A17977

Figs 1–7

**Material examined. Holotype:** ♂ (Fig. 1), body length 11.7 mm, cephalic plate 1.10 mm long, 1.17 mm broad, Balikun County, Hami City, Xinjiang Autonomous
Region, 43°06′N, 93°00′E, 968 m, a.s.l., 25 July 2006, leg. H. Ma, F. Zhang, S. Liu (HUSLS). **Paratypes:** 8 ♀ ♂, 1 ♂, same data as holotype (HUSLS).

**Etymology.** The specific name refers to the second article of the female gonopods with four short, robust spines lying dorsally on the posterior part of the external margin.

**Diagnosis.** A *Lithobius* (*Ezembius*) species with body length 9.6–13.3 mm, antennae composed of 19–22 articles, commonly 20+20; 8–10 ocelli on each side, arranged in 3 irregular rows, posterior two ocelli comparatively large; Tömösváry’s organ small, subequal in size to the adjoining ocelli; 2+2 coxosternal teeth; porodonts moderately thick, postero-lateral to the lateralmost tooth; posterior angles of all tergites without triangular projections; coxal pores 2–5, oval to round; female gonopods commonly with 3+3 moderately large, coniform spurs; second article of female gonopods with four short, robust spines lying dorsally on the posterior part of the external margin; gonopods with a simple terminal article; male gonopods short and small, with 1–2 long setae on the terminal segment.

**Description.** Body length 9.6–13.3 mm, cephalic plate 1.03–1.24 mm long, 1.06–1.31 mm wide.

**Colour:** basal antennal articles chocolate, distal articles gradually lighter, distalmost article yellow-brown. Tergites yellow-brown, TT 1 and 14 more darker. Cephalic plate and T 15 chocolate. Pleural region pale grey. Sternites pale yellow-brown. Distal part of forcipules red-brown, with basal and proximal parts of forcipules and forcipular coxosternite and sternite 15 yellow-brown. Legs 1–13 pale yellow-brown with greyish hue, legs 14 and 15 red-brown, tarsi of legs yellow-brown.

**Antennae:** 19–22 articles, commonly 20+20 (Fig. 1), only one specimen 20+25 articles; basal article longer than wide, second article markedly longer than wide, with following articles gradually shortening distally. Distalmost article 2.0–2.4 times as long as wide. Abundant setae on antennal surface, gradual increase in density of setae basally to distally to approx. 3–4th article.

**Cephalic plate** smooth, convex, tiny setae emerging from pores scattered sparsely over the entire surface. Frontal marginal ridge of head with shallow anterior median furrow. Setae of various lengths scattered along the marginal ridge of the cephalic plate. Lateral marginal ridge discontinuous. Posterior margin continuous, straight (Fig. 1).

Eight to ten oval to rounded **ocelli** on each side (Fig. 2), arranged in three irregular rows; posterior two ocelli large; ocelli adjacent to the Tömösváry organ slightly small. Seriate ocelli domed, translucent, usually darkly pigmented.

**Tömösváry organ** at antero-lateral margin of the cephalic plate, moderately smaller, subequal in size to the adjacent ocelli (Fig. 2-To).

**Coxosternite** subtrapezoidal (Fig. 3), anterior margin narrow, lateral margins of the coxosternite slightly longer than medial margins. Median diastema moderately deep, V-shaped; anterior margin with 2+2 subtriangular slightly acute teeth. Porodont thick and strong, just postero-lateral and separated from the lateral tooth, hardly bulged at base (Fig. 3). Scattered short setae on the ventral side of coxosternite, longer setae near the dental margin, more longer setae near the porodont. Forcipules and forcipular coxosternite without obvious special modifications.
Figures 1–7. *Lithobius (Ezembius) tetraspinus* sp. n., 1–3 and 7 paratype, male: 1 habitus, dorsal view, scale bar 1 mm 2 ocelli and Tömösváry’s organ (To), lateral view, scale bar 250 μm 3 forcipular segment, ventral view, scale bar 500 μm; 4–6 holotype, female: posterior segments and gonopods, ventral view, scale bar 500 μm 5 posterior segments and gonopods, ventral view, scale bar 500 μm 6 posterior part of the external margin of second article of gonopods, ventral view, scale bar 250 μm 7 terminal claw of right gonopod, dorsal view, scale bar 250 μm.

All tergites smooth, without wrinkles, dorsum slightly convex, tiny setae emerging from pores scattered sparsely over the entire surface, near the margin with few long setae; T 1 narrower posterolaterally than anterolaterally, generally trapezoidal, narrower than the cephalic plate and T 3, cephalic plate slightly wider than T 3. Lateral marginal ridges of all tergites continuous. Posterior marginal ridges of TT 1 and 3 slightly concave, continuous, posterior marginal ridges of TT 5, 8, 10, 12 and 14 shallow concave, discontinuous. Posterior angles of tergites generally rounded, without triangular projections. Miniscule setae scattered sparsely over the surface, more numerous setae on anterior and posterior angles of each tergite, with 2–4 long setae on anterior angles and 2–3 long setae on posterior angles of each tergite.
Sternites smooth, trapezoidal, posterior side narrower than anterior. Setae emerging from sparsely scattered pores on the surface, a pair of approximate symmetrically arranged long setae on both anterior part and posterior part of each sternite. The setae obviously increase in number on S 15, scattered evenly over the surface.

Legs robust, tarsal articulation ill-defined on legs 1–13, well defined on legs 14–15. All legs with fairly long curved claws. Legs 1–14 with anterior and posterior accessory spurs; anterior accessory spurs moderately long and slender, forming a moderately small angle with the claw, posterior accessory spurs slightly more robust, forming a comparatively large angle with the claw. Dense glandular pore on the surface of prefemur, femur, tibia, and tarsi of legs 14 and 15. Leg pair 15 lacking accessory spurs. Long setae sparsely scattered over the surface of prefemur, femur, tibia, and tarsi of legs 1–13; more setae on the tarsal surface, many thicker setae scattered evenly over the tarsal surface, setae arranged in one row on the ventral surface of tarsi of legs 1–13, with setae significantly reduced on legs 14 and 15, no thicker setae and setae arranged in one row on the ventral surface of tarsi present. Legs 14 and 15 slightly thicker than the anterior pairs in the female, tarsus 1 3.7–4.7 times as long as wide in legs 15. Legs 15 significantly thicker and stronger than the anterior pairs in the male, with a central longitudinal discontinuous shallow groove on the dorsal of femur, and a black vertical line at the bottom; tarsus 1 3.8–4.3 times as long as wide in legs 15. Leg plectrotaxy as in table 1.

Coxal pores 2–5, round or slightly oval, variable in sizes, arranged in a row; usually 4555, 4554, rarely 3454, 3455, 3343 in females and 2332, 2333 in males. Coxal pore field set in a relatively shallow groove, the coxal pore-field fringe with prominence. Prominence with short to moderately long setae sparsely scattered over the surface.

Male. S 15 posterior margin narrower than anterior, posteromedially slightly convex, sparsely covered with long setae, more than the anterior; sternite of genital segment obviously smaller than the female, usually well sclerotized; posterior margin deeply concave between the gonopods, without medial bulge. Long setae scattered on the ventral surface of the genital segment, fewer setae near S 15, fringed with longer setae along the posterior margin. Gonopods short, appearing as a small hemispherical bulge, with 1–2 long setae, apically slightly sclerotized (Fig. 7).

Table 1. Leg plectrotaxy of L. (E.) tetraspinus sp. n.

| Legs | Ventral | Dorsal |
|------|---------|--------|
|      | C | Tr | P | F | Ti | C | Tr | P | F | Ti |
| 1    | p | am | m |   |    | p | ap | a |
| 2    | mp | amp | m |   | (a)p | ap | ap |
| 3    | mp | amp | am |   | (a)p | ap | ap |
| 4–10 | mp | amp | am |   | ap | ap | ap |
| 11   | mp | amp | am |   | amp | ap | ap |
| 12   | amp | amp | am | m | amp | p | ap |
| 13   | amp | amp | am | m | amp | p | p |
| 14   | m | amp | am | a | m | amp | p | p |
| 15   | m | amp | am | a | m | amp | p | p |

Letters in brackets indicate variable spines.
Table 2-1. The main morphological characters of the known Chinese species of subgenus *Lithobius* (*Ezembius*) Chamberlin, 1919.

| Characters                        | *anabilineatus* | *anasulcifemoralis* | *bidens* | *bilineatus* | *chekianus* | *gantoensis* | *giganteus* | *insolitus* | *irregularis* |
|-----------------------------------|-----------------|--------------------|----------|--------------|-------------|--------------|-------------|-------------|---------------|
| Sources                           | Ma et al., 2015 | Ma, et al. 2013    | Takakuwa, 1939 | Pei et al., 2014 | Chamberlin & Wang, 1952 | Takakuwa & Takashima, 1949 | Eason, 1986 | Eason, 1993 | Takakuwa & Takashima, 1949 |
| Distribution                      | China S (Guangxi) | China S (Guangxi) | China S (Taiwan) | China S (Guangxi) | China S (Zhengjiang and Taiwan) | China NW (Shanxi) | China N (Inner Mongolia Autonomous region) | China S (Hongkong) | China W (Shanxi) |
| Body length (mm)                  | 11.9–12.1       | 10.1–12.3          | 15.0     | 9.0–9.1      | 16.0         | 9.0          | 15.0–50.0   | 10.0–11.5   | 12.0          |
| Number of antennal articles       | 23+23 articles in female, unknown in male | 19+19–24+24, commonly 20+20 | 20–21 | two specimens with 20+21, one specimen with 20+23 | 20+20 | 20–23 | 20+20 | 18+18–19+19 | 20+20 |
| Number, arrangement and shape of the ocelli | 5 – 6, in 2 rows | 6, in 3 rows | 7 | 5–6, in 2 rows | 5, in 3 rows | 6 | 6–10, in 2–3 rows | 6–8, in 2 rows | 7, in 2 rows |
| Posterior ocellus                 | round, large    | oval to round, large | comparatively large | oval to rounded | oval to round, comparatively large | oval to round, comparatively large | oval to round, comparatively large | round, comparatively large |
| Seriate ocelli                    | subequal, all ocelli domed, translucent, usually darkly pigmented. | the one near ventral margin moderately small, others almost equal | not reported | subequal, all ocelli domed, translucent, usually darkly pigmented | not reported | comparatively large | not reported | not reported | subequal |
| Tomosváry’s organ                 | round, smaller than the adjoining ocelli | moderately large, rounded, slightly larger than the adjoining ocelli | at most same size as one ocellus | slightly larger than the adjoining ocelli | not reported | subequal in size to the adjoining medium large ocelli | slightly smaller than the adjoining ocelli | slightly smaller than the adjoining ocelli | same size as largest ocellus |
| Number and arrangement of coxosternal teeth | 2+2, triangular | 2+2, moderately blunt | 2+2 | 2+2, slightly triangular | 2+2 | 2+2, approximately sharp small | 2+2 | 2+2, approximately sharp small | 2+2, small |
| Characters | anabilineatus | anasulcifemoralis | bidens | bilineatus | chekianus | gantoensis | giganteus | insolitus | irregularis |
|------------|--------------|------------------|--------|-----------|-----------|------------|-----------|----------|------------|
| Porodont   | slender, lying posterolateral to the lateral most tooth, their basal moderately bulged | moderately long | thick and long, lying posterolateral to the lateral most tooth | not reported | not reported | not reported | slender, lying posterolateral to the lateral tooth, their basal slightly bulged | long, their basal slightly bulged |
| Tergites   | smooth, backside slightly hunched | smooth | not reported | smooth, slightly hunched behind | not reported | smooth, without wrinkles | smooth, with slightly wrinkles | T1 smooth, other with wrinkles | smooth |
| Number of coxal pores | 3–5, female 4454, 3554; male 4443, 4453 | 3–6, usually 4663, 5654, 5553, 5563 and 5565 | 5(6)555 | usually females 4554, 5565; males 4553, 4454 | 6655 or 7665 | 3333 | 3333, 4554, 4555, 4556, 5565 or 5566 | 3–6, male 3443; female 4454, 4555, 5555, 5556, 5565 | 3–10, female 3–6 in 12\textsuperscript{th} leg, 4–6 in 13\textsuperscript{th} leg, 7–10 in 14\textsuperscript{th} and 15\textsuperscript{th} leg |
| Shape of coxal pores | round or slightly ovate | round or slightly ovate | round | ovate | not reported | round | round | round | round |
| Tarsus 1–tarsus 2 articulation on legs 1–13 | not well-defined | not well-defined | well-defined | not well-defined | not reported | not reported | well-defined | not defined | well-defined |
| Male 14\textsuperscript{th} leg | markedly thicker and stronger than other legs | not reported | distinctly thick and strong | not reported | not reported | distinct thick and strong | not reported |
| Male 15\textsuperscript{th} leg | markedly thicker and stronger than other legs | not reported | distinctly thick and strong | not reported | not reported | distinctly thick and strong, with dark zones on dorsal of tibia | not reported |
| Dorsal sulci on male 14\textsuperscript{th} legs | absent | absent | not reported | with two, shallow longitudinal sulci | not reported | not reported | absent | not reported |
| Characters                                      | anabilineatus | anasulcifemoralis | bidens       | bilineatus                           | chekianus | gantoensis | giganteus | insolitus | irregularis |
|------------------------------------------------|---------------|-------------------|--------------|--------------------------------------|-----------|------------|-----------|-----------|-------------|
| Dorsal sulci on male 15th legs                  | two distinct, shallow, dorsal sulci on the femur and tibia | with a distinct, shallow, dorsal sulci on the tibia | not reported | with two, shallow longitudinal sulci | not reported | not reported | not reported | absent    | not reported |
| DaC spine on 14th-15th legs                     |               | on 14th-15th legs | absent | on 4th-15th legs | on 14th-15th legs | absent | on 12th-15th legs (on 11th and 12th legs sometimes present) | absent | on 13th-15th legs |
| 14th accessory spur                             | absent | not reported | anterior accessory spur absent | present | present | present | not reported | not reported |           |
| 15th accessory spur                             | absent | absent | not reported | anterior accessory spur absent | present | present | absent | absent | not reported |
| Number and shape of spurs on female gonopods    | 2+2 moderately small, blunt, coniform spurs, inner spur slightly smaller than the outer | 2+2 moderately blunt, with conical spurs, inner spur slightly smaller | 3+3 or 4+4, sharp | 2+2 moderately small, blunt, coniform spurs, inner spur slightly smaller than the outer one | not reported | 1+1, conical spurs | 2+2 | 3+3, coniform spurs | 2+2 or 2+3, moderately small, blunt, coniform spurs |
| Dorsal side of the second article of female gonopods | with one spine lying dorsally on its external margin | no striking features | not reported | with three short, robust setae lying dorsally on its external margin | not reported | not reported | with eight spines in two irregular rows lying dorsally on its external margin | not reported | not reported |
| Apical claw of female gonopods (and lateral denticles) | simple, there a small subtriangular teeth in the inner | apical claw dimidiate | simple, there a small sharply teeth in the inner | apical claw bipartite, and its inner aspect broader | not reported | simple | simple | simple | simple and broad |
| Male gonopods                                   | short and small bulge, with one to two long setae, apically slightly sclerotised | with a small bulge, without setae and apically less sclerotised | hemispherical, with two long setae | short and small bulge, having a long seta, apically slightly sclerotised | not reported | not reported | not reported | not reported | not reported |
Table 2-2. Range and main morphological characters of the known Chinese species of subgenus *Lithobius* (*Ezembius*) Chamberlin, 1919.

| Characters | *laevidentata* | *lineatus* | *mandschreiensis* | *multispinipes* | *parvicornis* | *rhysus* | *sulcipes* | *sulcifemoralis* | *zhui* | *tetrospinus* |
|------------|---------------|------------|-------------------|-----------------|--------------|---------|-----------|----------------|-------|-------------|
| Sources    | Pei et al., 2015 | Takakuwa, 1939 | Takakuwa, 1940 | Pei et al., 2016 | Zapparoli, 1991 | Attems, 1934 | Attems, 1927 | Takakuwa & Takashima, 1949 | Pei et al., 2011 | This paper   |
| Distribution | China NW (Xinjiang Uygur) | China S (Taiwan) | China NW (Xinjiang Uygur) | China S (Taiwan) | China S (Taiwan) | China S (Taiwan) | China W (Shanxi) | China NW (Xinjiang Uygur) | China NW (Xinjiang Uygur) |
| Body length (mm) | 9.6–13.3 | 18.0 | 22.0–23.0 | 11.6–22.6 | 16.0 | 15.0 | Not reported | 12.0 | 8.1–15.0 | 9.6–13.3 |
| Number of antennal articles | 19+19–21+21 | 19+19–21+21 | 20–28 | commonly 20–20, (three specimens with 20+21, one specimen with 20+26 of 134 specimens) | 20+20, 21+21 | 20+20 in female, 20+21 in male | 19–22 | 20+20 | 20–24, commonly 20 | 19–22, commonly 20 |
| Number, arrangement and shape of the ocelli | 8–10, in 3 rows | 8–11, in 3 rows | 9–13, in 3 rows | 8, in 3 rows | 3–4, in 1 or 2 rows | 8, in 4 rows | 7, in 2 rows | 6 | 10–13, in 3–4 rows | 8–10, in 3 rows |
| Posterior ocellus | posterior two ocelli bigger than the seriate ocelli | comparatively small | comparatively large | two ocelli large, oval to rounded | comparatively large | comparatively large | comparatively large | all ocelli same size | comparatively large | two ocelli comparatively large |
| Seriate ocelli | not reported | same size of wath | the two near ventral margin moderately small, others almost equal | not reported | not reported | not reported | same size of wath | dorsal ones moderately large, those near ventral margin of ocellar field moderately small, others of moderate size | the adjoining Tömösváry organ slightly small |
| Characters                          |  *laevidentata* |  *lineatus* |  *maudschiensis* |  *multispinipes* |  *parvicornis* |  *rhysus* |  *sulcipes* |  *sulcifemoralis* |  *zhui* |  *tetraspinus* |
|------------------------------------|----------------|-------------|-----------------|-----------------|---------------|-----------|------------|-----------------|--------|---------------|
| Tömösváry’s organ                  | subequal in size to the adjoining ocelli | same size as the adjoining ocelli | larger than the adjoining ocelli | slightly smaller than the adjoining ocelli | not reported | not reported | not reported | same size as ocelli | slightly larger than the adjoining ocelli | subequal in size to the adjoining ocelli |
| Number and arrangement of coxosternal teeth | 2+2, approximately blunt | 2+2, comparatively large | 2+2, small and sharp | 3+3, slightly triangular | 2+2 | 2+2 | 2+2, small and sharp | 2+2 moderately small and pointed | 2+2 subtriangular slightly acute |
| Porodont                           | thick and long, lying posterolateral to the most lateral teeth | long and strong | lying posterolateral to the lateral most tooth | thick and long, lying posterolateral to the lateral most tooth | lying posterolateral to the most lateral teeth | not obvious | not reported | slender and long | moderately thick in basal, moderately pointed, just posterolateral to the lateral tooth | Porodonts thick and strong, just posterolateral and separated from the lateral tooth, |
| Tergites                           | smooth, without wrinkles, backside slightly hunched | smooth | smooth, without wrinkles and slightly hunched behind | smooth, without wrinkles | With shallow wrinkles | Smooth, posterior angles slightly triangular in T14 | not reported | smooth, without wrinkles, backside slightly hunched | smooth, without wrinkles, dorsalum slightly convex | |
| Number of coxal pores              | 2–5, female commonly 4555, 4554, sometime 3454, 3455, 3343, male commonly 2332, 2333, sometime 3444, 3333 | 6–7, usually 66(7)6 | 776(7)5(6) | 3–5, 4555, 5555, 4444, 4455 (females) and 4444, 3344 (males) | 3334 | 6554 | 4554 | 5555 | 2–4, 3444, 3443, 3333 in female, and 3443, 2343, 2433, 2333 in male, | usually 4555, 4554, rarely 3454, 3455, 3343 in females and usually 2332, rarely 3444, 3333 in males |
| Shape of coxal pores               | round or slightly ovate | round to ovate | round to ovate | not reported | round | round | round | round or slightly ovate | round or slightly oval | round or slightly oval |
| Tarsus 1–tarsus 2 articulation on legs 1–13 | not well-defined | well-defined | well-defined | not reported | not reported | well-defined | well-defined | well-defined | well-defined | ill-defined |
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| Characters | laevidentata | lineatus | mandschreiensis | multispinipes | parvicornis | rhysus | sulcipes | sulcifemoralis | zhu | tetraspinus |
|------------|--------------|----------|-----------------|---------------|-------------|--------|----------|----------------|----|------------|
| Male 14th leg | remarkably thicker and stronger than 1–13 legs. | not reported | not reported | thick and strong | not reported | not reported | femur and tibia thicker | moderately thicker and stronger | significantly thicker and stronger |
| Male 15th leg | markedly thicker and stronger than in 1–13 legs | not reported | not reported | thick and strong | not reported | femur and tibia thicker | thick and strong | thicker and stronger, with a circular protuberance on distal end of tibia | significantly thicker and stronger |
| Dorsal sulci on male 14th legs | absent | absent | not reported | absent | not reported | present on the femur | present on the femur and tibia | absent | absent |
| Dorsal sulci on male 15th legs | with a distinct, shallow, dorsal sulci on the tibia | not reported | not reported | absent | not reported | present on the femur and tibia | present on the femur and tibia | absent | present on the femur |
| DaC spine | on 12th–15th legs | on 14th–15th legs | on 2th–15th legs | on 11th–15th legs, 9th–10th sometimes present | not reported | on 15th legs present | on 15th legs present | on 13th–15th legs, 12th sometimes present | on 12th–15th legs |
| 14th accessory spur | present | present | not reported | present | not reported | not reported | not reported | present | present |
| 15th accessory spur | anterior absent | present | not reported | absent | not reported | absent | not reported | absent | absent |
| Number and shape of spurs on female gonopods | 3+4, or 4+4 small, blunt, coniform spurs, commonly with 3+3, inner spur smaller than the outer one | 3+3 moderately sharp, slender conical spurs | 3+3, same size | 2+2, blunt, coniform spurs, with inner spur smaller than the outer one | 2+2 | 2+2, slender | 2+2, thick spurs | 2fl 2 moderately long, coniform spurs, inner spur slightly smaller and more anterior than outer | 3+3, few 3+4, only one 4+4 coniform spurs |
| Characters                                                                 | laevidentata                             | lineatus                              | manschreiensis                        | multispinipes                          | parvicornis                           | rhysus                                | sulcipes                              | sulcifemoralis                        | zhui                                  | tetraspinus                           |
|---------------------------------------------------------------------------|------------------------------------------|---------------------------------------|---------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|---------------------------------------|---------------------------------------|----------------------------------------|
| dorsal side of the second article of female gonopods                      | with three long setae lying dorsally on its anterior external margin | not reported                          | not reported                          | with 3–4 long setae and 5–6 spines lying dorsally on its external margin | not reported                          | not reported                          | not reported                          | not reported                          | not reported                          | three spurs arranged in one irregular row on the dorsal terminal part |
| Apical claw of female gonopods (and lateral denticles)                    | simple and broad                         | simple                                | simple                                | simple                                  | simple                                 | simple                                 | dimidiate                              | simple                                | simple                                | broad, and tridentate                  |
| Male gonopods                                                             | small bulge, with one to two long setae apically slightly sclerotised | hemispherical bulge, without setae    | hemispherical bulge, having a long seta, and apically slightly sclerotised | not reported                           | not reported                           | not reported                           | not reported                           | not reported                           | small bulge, with 1–2 long setae on surface, and terminal slightly sclerotised | small hemispherical bulge, with 1–2 long setae |

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**Female.** S 15 anterior margin broader than posterior, generally trapezoidal, posteromedially slightly convex. Short to long setae sparsely scattered on S 15 surface. Surface of the lateral sternal margin of genital segment well chitinized, posterior margin of genital sternite deeply concave between condyles of gonopods, except for a small, median linguliform bulge. Relatively long setae scattered over ventral surface of the genital segment, few setae near S 15. Gonopods: first article fairly broad, bearing 23–30 short to moderately long setae, arranged in four irregular rows; with 3+3, few 3+4, only one 4+4 moderately long and slender, coniform spurs, inner spur slightly smaller than the outer (Fig. 4); second article with 8–12 long setae, arranged in three irregular rows, with three long setae and four short, robust spines lying dorsally on the posterior part of the external margin; third article with 4–6 long posteroventral setae, and two short, robust spines lying dorsally on the posterior part of the external margin (Fig. 5). Third article of female gonopods with a simple apical claw with a very small subtriangular blunt denticle on the inner margin (Fig. 6).

**Remarks.** The new species with 2+2 coxosternal teeth, 9–10 ocelli on each side of head, female gonopods with 3–4 moderately large, coniform spurs, and leg pair 15 lacking accessory spurs, is morphologically similar to *Lithobius (Ezembius) sibiricus* Gerstfeldt, 1858 from Mongolia and Russia, but is readily distinguished by having coxal pores arranged in a 2–5-formula in contrast to *L. (E.) sibiricus* with a coxal pore formula 5–8; the second article of the female gonopods with four short, robust spines lying dorsally on the posterior part of the external margin versus with eight short, robust spines lying dorsally on the posterior part of the external margin; lacking accessory spurs on legs 15\textsuperscript{th} versus having small accessory spurs on legs 15\textsuperscript{th}; moreover, leg 14 plectrotaxy is distinctly different, 10311 (dorsal) and 01321 (ventral) compared to 10311 (dorsal) and 01332 (ventral).

**Habitat.** The specimens were collected in a *Larix* forest at 950–1000 m alt. It inhabits moderately moist habitats under roadside stones and litter of the forest floor.

To assist in the identification of the Chinese species of *Lithobius (Ezembius)*, the range and main morphological characters of the known species of the subgenus in the area is presented (table 2). These characters are specific only to adults of the taxa occurring in China.

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References

Attems C (1927) Neue Chilopoden. Zoologischer Anzeiger 72: 291–305.
Attems C (1934) Einige neue Geophiliden und Lithobiiden des Hamburger Museums. Zoologischer Anzeiger 107: 310–317.
Bonato L, Edgecombe GD, Lewis JGE, Minelli A, Pereira LA, Shelley RM, Zapparoli M (2010) A common terminology for the external anatomy of centipedes (Chilopoda). ZooKeys 69: 17–51. https://doi.org/10.3897/zookeys.69.737
Chamberlin RV (1919) The Chilopoda collected by the Canadian Arctic Expedition, 1913–1918. In: Report of the Canadian Arctic Expedition, 1913–1918, Volume III: Insects. Part H: Spiders, Mites and Myriapods, 15–22.
Chamberlin RV (1923) Chilopods of the Pribilof Islands. North American Fauna 46: 240–244.
Chamberlin RV, Wang YX (1952) Some records and descriptions of Chilopods from Japan and other oriental areas. Proceeding of the Biological Society of Washington 65: 177–188.
Eason EH (1993) Descriptions of four new species of Lithobius from the oriental region and a redescriptions of Australobius palnis (Eason 1973) from Sri Lanka (Chilopoda: Lithobiomorpha) – Bollettino del Museo Civico di Storia Naturale di Verona 17: 181–199.
Eason EH (1986) On the synonymy of Lithobius giganteus Sselianoff 1881 and the taxonomic status of Porobius Attems 1926 (Chilopoda) – Annalen des Naturhistorischen Museums, Wien 87 B: 181–192.
Jeekel CAW (2005) Nomenclator generum et familiarum Chilopodorum: a list of the genus and family-group names in the class Chilopoda from the 10th edition of Linnaeus, 1758, to the end of 1957. Myriapod Memoranda Supplement 1: 1–130.
Ma HQ, Pei SJ, Hou XJ, Zhu TG (2014a) Lithobius (Monotarsobius) zhangi sp. n., a new species from Eastern China (Chilopoda, Lithobiomorpha, Lithobiidae). ZooKeys 459: 1–10. https://doi.org/10.3897/zookeys.459.8169
Ma HQ, Pei SJ, Hou XJ, Zhu TG, Gai YH (2015) Lithobius (Ezembius) anabilineatus sp. nov., a new species (Lithobiomorpha: Lithobiidae) from Eastern China. Oriental Insects 49(3–4): 256–263. https://doi.org/10.1080/00305316.2015.1081647
Ma HQ, Pei SJ, Hou XJ, Zhu TG, Wu DY, Gai YH (2014b) An annotated checklist of Lithobiomorpha of China. Zootaxa 3847(3): 333–358. https://doi.org/10.11646/zootaxa.3847.3.2
Ma HQ, Pei SJ, Wu DY, Gai YH (2013) A new lithobiid centipede of Lithobius (Ezembius) (Lithobiomorpha) from China, Oriental Insects 47(1): 1–6. https://doi.org/10.1080/00305316.2012.753763
Minelli A, Pereira LA, Shelley RM, Stoev P, Zapparoli M (2016) ChiloBase 2.0. A World Catalogue of Centipedes (Chilopoda). http://chilobase.biologia.unipd.it
Pei SJ, Lu YM, Liu HP; Hou XJ, Ma HQ, Zapparoli M (2016) Lithobius (Ezembius) multispinipes n. sp. a new species of centipede from North West China (Lithobiomorpha: Lithobiidae). Zootaxa 4169(2): 390–400. https://doi.org/10.11646/zootaxa.4169.2.12
Pei SJ, Ma HQ, Zhu TG, Gai YH (2014) A new species of Lithobius (Ezembius) Chamberlin (Lithobiomorpha: Lithobiidae) from China. Oriental Insects 48(1–2): 102–107. https://doi.org/10.1080/00305316.2014.959787
Pei SJ, Ma HQ, Hou XJ, Zhu TG, Gai YH (2015) *Lithobius* (*Ezembius*) *laevidentata* sp. n., a new species (Chilopoda: Lithobiomorpha: Lithobiidae) from the Northwest region of China. *Biologia* 70(8): 1113–1117.

Qin W, Lin GH, Zhao XX, Li B, Xie JX, Ma HQ, Su JP, Zhang TZ (2014) A new species of *Australobius* (Lithobiomorpha: Lithobiidae) from the Qinghai-Tibet Plateau, China. *Biologia* 69(11): 1601–1605. https://doi.org/10.2478/s11756-014-0459-4

Takakuwa Y (1939) Über Japanische *Lithobius*-Arten - *Transactions of the Sapporo Natural History Society* 16: 28–37.

Takakuwa Y (1940) Class Chilopoda, Epimorpha, Lithobiomorpha. *Fauna Nipponica* Vol. 9 Fas. 8 No. (3). Sanseido Book Store, Tokyo, 104 pp.

Takakuwa Y, Takashima H (1949) Myriapods collected in Shansi, North China. *Acta Arachnologica* 11: 51–69. https://doi.org/10.2476/asjaa.11.51

Wang YM (1955) Serica 1b. A preliminary report on the Myriapoda and Arachnida of Lan Yu Islets (Botel Tobago) China - *Quarterly Journal of the Taiwan Museum* 8: 195–201.

Zapparoli M, Edgecombe G (2011) Lithobiomorpha. In: Minelli A (Ed.) Treatise on Zoology. Anatomy, Taxonomy, Biology. The Myriapoda, Volume 1. Jordaan Luchtmans, Brill, 538 pp.

Zapparoli M (1991) Note su alcune specie di chilopodi della regione palestinese. *Fragmenta Entomologica* 23: 15–33.