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Research article

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Two new species of the genus *Trilacuna* (Araneae: Oonopidae) from Jinyun Mountain of Chongqing, China

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Abstract. Two new species of the genus *Trilacuna* Tong & Li, 2007, *T. jinyun* Tong, Zhang & Li, sp. nov. (♂♀) and *T. jiuchi* Tong, Zhang & Li sp. nov. (♂♀), are described from Chongqing, China. Photos of the habitus and copulatory organs are provided.

Keywords. Biodiversity, goblin spider, morphology, taxonomy.

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Introduction

The family Oonopidae is a diverse group of spiders with 1872 extant described species in 114 genera. Oonopids are small (1–3 mm), two-clawed, ecribellate spiders that can be abundant in leaf litter, under bark of trees, in forest canopies and in subterranean habitats (Saaristo 2001; Tong 2013). *Trilacuna* Tong & Li, 2007 is a larger genus of the family. Currently, a total of 35 species have been reported. All the species

are known from Asia and occur in Iran and from the Korean Peninsula south to Sumatra (Li 2020; WSC 2020).

In China the genus is represented by 13 species, of which only three are known in Chongqing Municipality, China, i.e., *T. angularis* Tong & Li, 2007, *T. simianshan* Tong & Li, 2018 and *T. songyuae* Tong & Li, 2018 (Tong & Li 2007; Tong *et al.* 2018, 2019; Liu *et al.* 2019; Huang *et al.* 2020). In this paper two new *Trilacuna* species, *T. jinyun* Tong, Zhang & Li sp. nov. and *T. jiuchi* Tong, Zhang & Li sp. nov., collected from Chongqing, are described and illustrated.

Material and methods

The specimens were examined using a Leica M205C stereo microscope. Details were studied under an Olympus BX51 compound microscope. Photos were made with a Canon EOS 750D zoom digital camera (18 megapixels) mounted on an Olympus BX51 compound microscope. Vulvae were cleared in lactic acid. For scanning electron microscopy (SEM), specimens were air-dried, sputter coated using IXRF SYSTEMS and imaged with a Hitachi TM3030 SEM. Photos were stacked using Helicon Focus 7.6.1 and processed using Adobe Photoshop ver. 21.1.2. All measurements were taken using an Olympus BX51 compound microscope and are in millimeters. Measurements of palps are given as follows: total length (femur + patella + tibia + tarsus).

The following abbreviations are used in the text and figures:

ab	=	anterior branch
ALE	=	anterior lateral eyes
ap	=	apodeme
as	=	anterior sclerite
bp	=	basal protrusion
cp	=	circular projection
db	=	dorsal branch
ehb	=	elevated hair base
flp	=	flag like protrusion
fls	=	fork like sclerite
lb	=	lateral branch
ldi	=	labium deep incision
mb	=	median branch
pe	=	posterior extension
PME	=	posterior median eyes
PLE	=	posterior lateral eyes
psp	=	posterior spiracle
rls	=	nine-teeth-rake like sclerite
rss	=	rectangular shaped structure
sar	=	sclerotized, recurved arches
sdb	=	strongly curved distal branch
sls	=	slender line-like structure
tba	=	transverse bars
tsc	=	transverse sclerite
vb	=	ventral branch
wss	=	worm-shaped structure

All material studied is deposited at the Shenyang Normal University, Shenyang, China (SYNU) and Southwest University, Chongqing, China (SWUC).

Results

Class Arachnida Cuvier, 1812
Order Araneae Clerck, 1757
Family Oonopidae Simon, 1890
Genus *Trilacuna* Tong & Li, 2007

Trilacuna Tong & Li, 2007: 333.

Type species

Trilacuna rastrum Tong & Li, 2007.

Differential diagnosis

See Tong *et al.* (2020).

Trilacuna jinyun Tong, Zhang & Li sp. nov.

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Figs 1–3, 4A–B, E–F, 8

Differential diagnosis

This new species is similar to *Trilacuna simianshan* Tong & Li, 2018, but males can be distinguished by the large flag like protrusion and the broad dorsal branch of embolus system (Fig. 2E, F, H), and females by the rectangular shaped structure of endogyne (Fig. 4F). Males of *T. simianshan* have a rectangular projection and narrow dorsal branch of embolus system, and females have a cone-shaped structure of endogyne (Tong *et al.* 2018: figs 3a–f, 5i).

Etymology

The specific name is a noun in apposition and refers to the type locality.

Material examined

Holotype

CHINA • ♂; Chongqing Municipality, Beibei District, Jinyun Mountain, Caijiagou; 12 Oct. 2008; Zhisheng Zhang *et al.* leg.; SYNU-291.

Paratypes

CHINA • 4 ♀♀; same collection data as for holotype; SYNU-292 to 295 • 1 ♂; Jinyun Mountain, Canal Protection Station; 4 Dec. 2010; Zhong Li and Zongxu Li leg.; SWUC-T-OO-01-1 • 3 ♀♀; Jinyun Mountain; 12 Apr. 2010; Luyu Wang leg.; SWUC-T-OO-01-2 to 4.

Description

Male (holotype)

BODY. Yellow; habitus as in Fig. 1A–C; body length 2.39. Carapace (Fig. 1D, F–G): 1.23 long, 0.97 wide; sides granulate; lateral margin rebordered.

EYES (Fig. 1A, G). Well developed, arranged in a compact group; ALE, PME and PLE subequal; ALE–PLE separated by less than ALE radius, PME touching each other; posterior row recurved from above, procurved from front.

CLYPEUS (Fig. 1G). Sinuous in frontal view, ALE separated from edge of carapace by about 1.8 times their diameter.

MOUTHPARTS (Fig. 1E, G). Chelicerae straight; labium rectangular, anterior margin deeply incised; endites slender, distally strongly curved branched.

STERNUM (Fig. 1E). With radial furrows between coxae I–II, II–III, III–IV; surface medially strongly rugose.

ABDOMEN (Fig. 1A–C). Abdomen 1.30 long, 0.92 wide; booklung covers ovoid, surface smooth; dorsal scutum not fused to epigastric scutum; apodemes present, posterior spiracles connected by a shallow groove; sperm pore oval, situated between anterior spiracles.

LEG SPINATION (all spines longer than segment width). Legs I–II: tibia: v2-2-2-2-0, metatarsus: v2-2-0.

PALP (Figs 2, 4A–B). Orange; 0.67 long (0.21, 0.12, 0.17, 0.17); femur greatly swollen (width/length = 0.67); bulb oval, tapering apically; embolus system (Fig. 2C–H) with a broad dorsal branch (db), a very

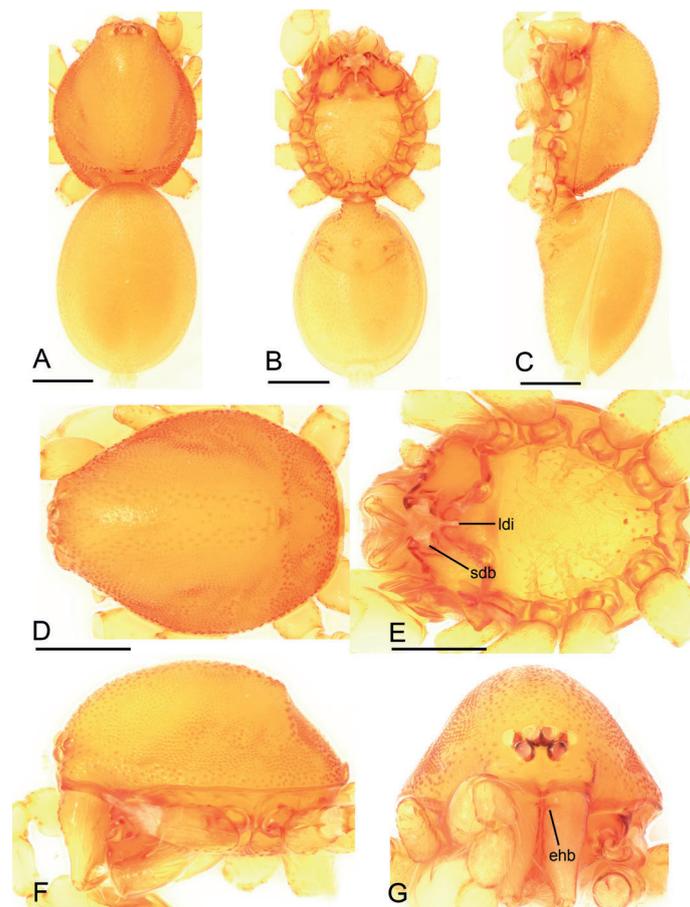


Fig. 1. *Trilacuna jinyun* Tong, Zhang & Li sp. nov., holotype, ♂ (SYNU-291). **A–C.** Habitus in dorsal, ventral, and lateral views. **D–G.** Prosoma in dorsal, ventral, lateral, and anterior views. Abbreviations: ehb = elevated hair base; ldi = labium deep incision; sdb = strongly curved distal branch. Scale bars: 0.4 mm.

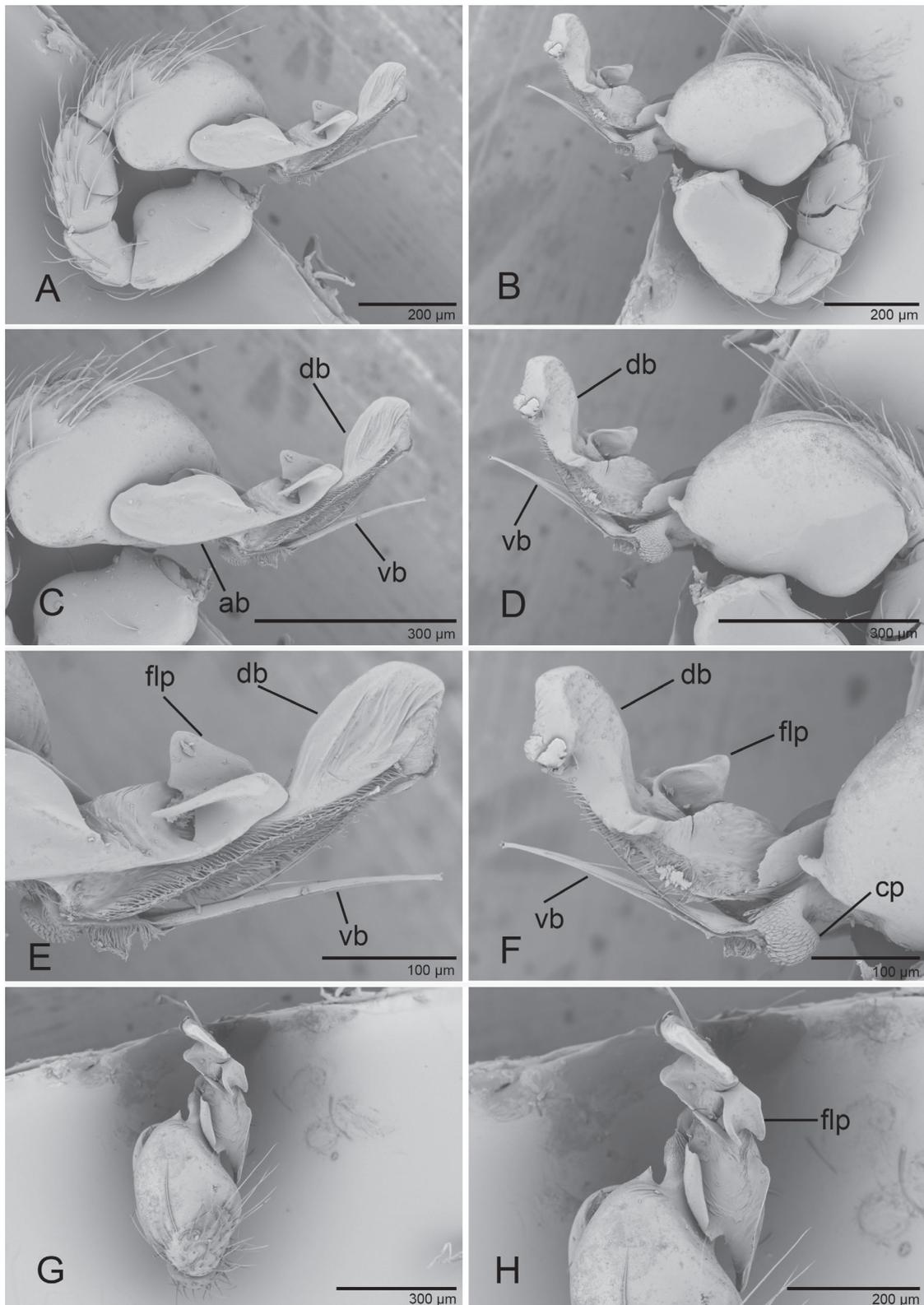


Fig. 2. *Trilacuna jinyun* Tong, Zhang & Li sp. nov., left male palp, SEM, holotype, ♂ (SYNU-291). A–B, G. Prolateral, retrolateral, and dorsal views. C–D. Palpal bulb in prolateral and retrolateral views. E–F, H. Distal part of palpal bulb in prolateral, retrolateral, and dorsal views. Abbreviations: ab = anterior branch; cp = circular projection; db = dorsal branch; flp = flag like protrusion; vb = ventral branch.

narrow thread-like ventral branch (vb), and a broad anterior branch (ab) in prolateral view, a flag like protrusion (fp) in dorsal view, and a circular projection (cp) in retrolateral view.

Female (SYNU-292)

Same as male except as noted; slightly larger than male. Body: length 2.44; habitus as in Fig. 3A–C. Carapace: 1.02 long, 0.89 wide. Endites: unmodified. Abdomen: 1.53 long, 0.98 wide. Epigaster

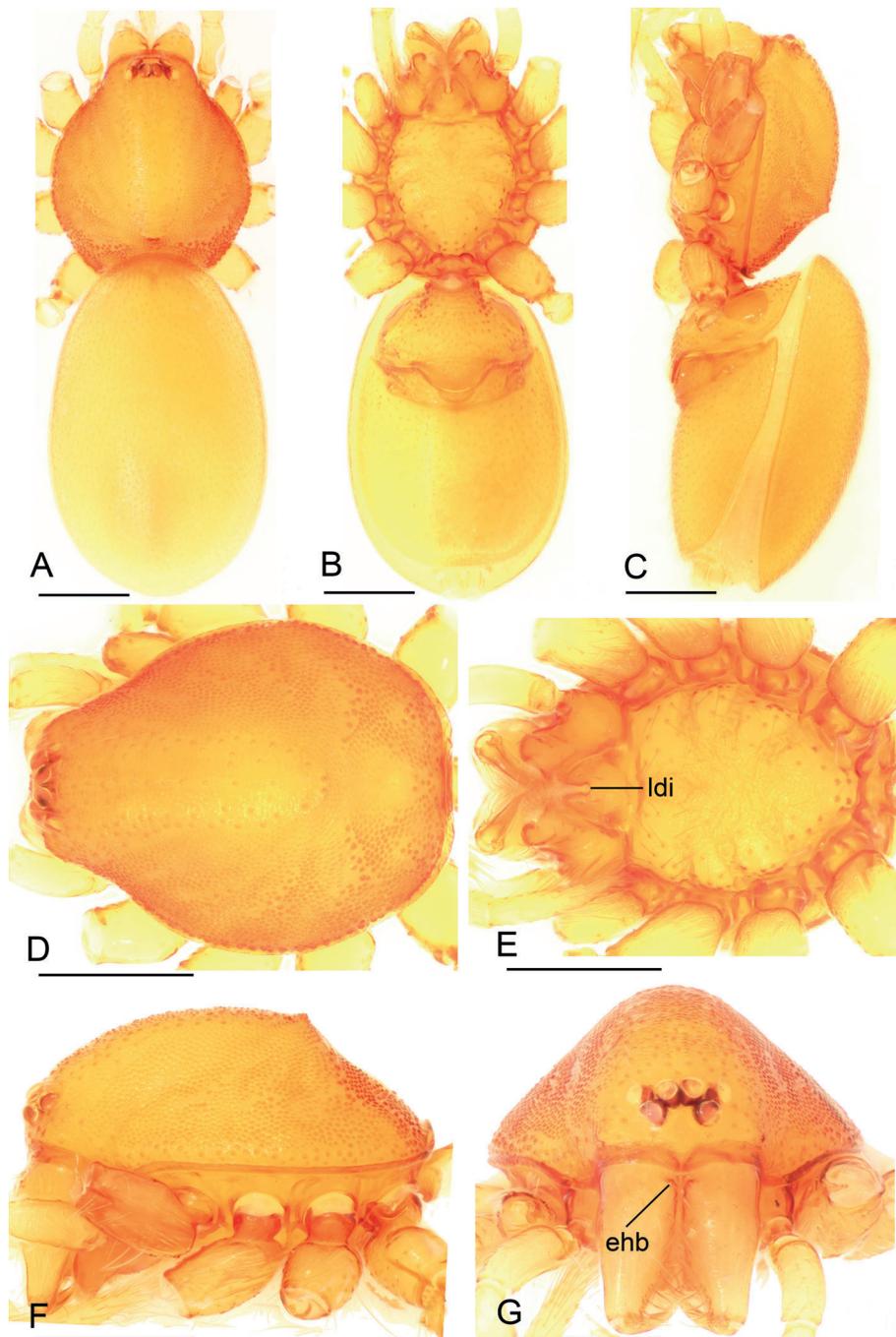


Fig. 3. *Trilacuna jinyun* Tong, Zhang & Li sp. nov., paratype, ♀ (SYNU-292). **A–C.** Habitus in dorsal, ventral, and lateral views. **D–G.** Prosoma in dorsal, ventral, lateral, and anterior views. Abbreviations: ehb = elevated hair base; ldi = labium deep incision. Scale bars: 0.4 mm.

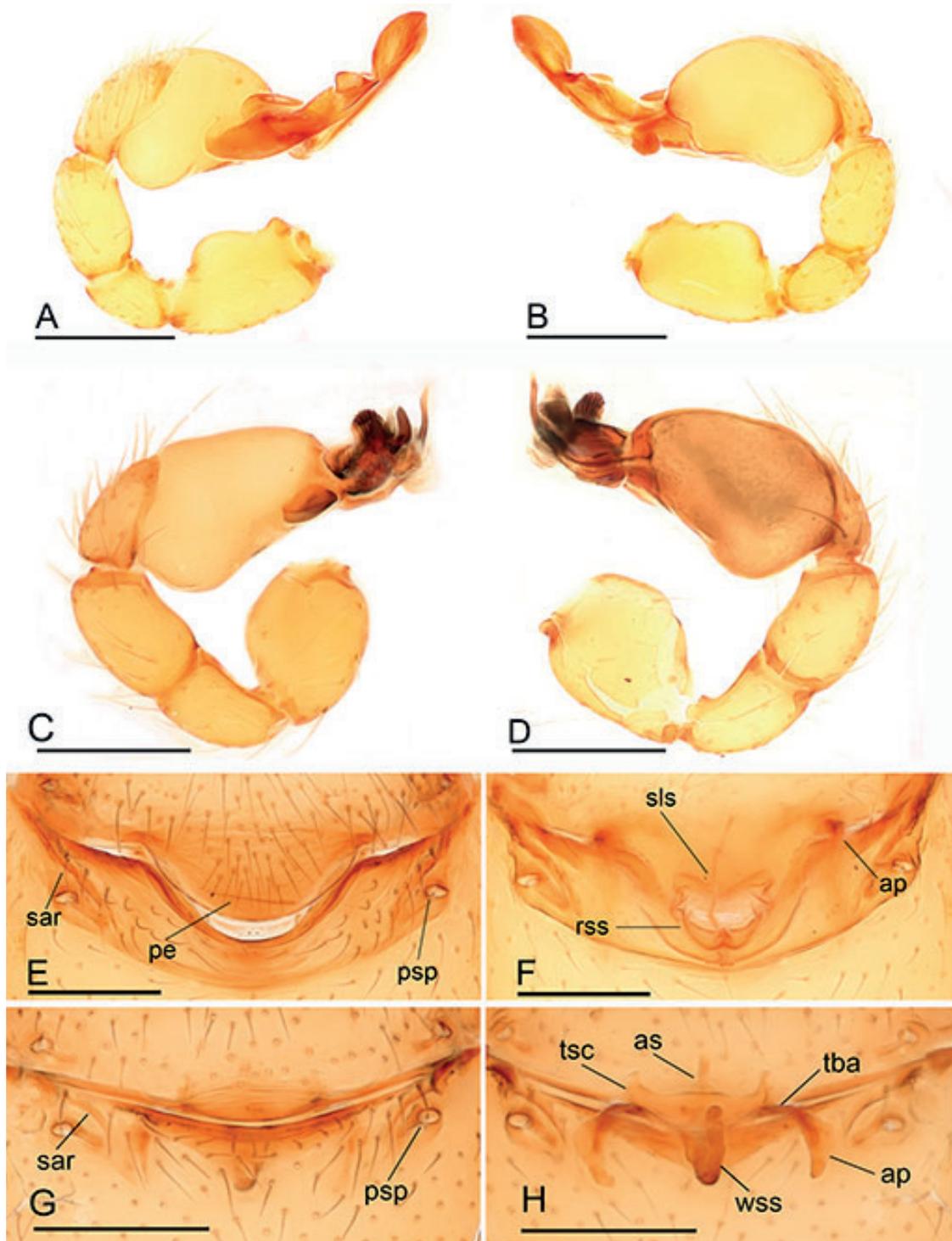


Fig. 4. A–B. *Trilacuna jinyun* Tong, Zhang & Li sp. nov., holotype, ♂ (SYNU-291). C–D. *T. jiuchi* Tong, Zhang & Li, sp. nov., holotype, ♂ (SYNU-300). E–F. *T. jinyun* sp. nov., paratype, ♀ (SYNU-292). G–H. *T. jiuchi* sp. nov., paratype, ♀ (SYNU-303). A, C. Left palp, prolateral view. B, D. Left palp, retrolateral view. E, G. Epigaster, ventral view. F, H. Endogyne, dorsal view. Abbreviations: ap = apodeme; as = anterior sclerite; pe = posterior extension; psp = posterior spiracle; rss = rectangular shaped structure; sar = sclerotized, recurved arches; sls = slender line-like structure; tba = transverse bars; tsc = transverse sclerite; wss = worm-shaped structure. Scale bars: 0.2 mm.

(Figs 3B, 4E): middle part of posterior margin of epigastric scutum (pe) much extended posteriorly, with sclerotized recurved arches (sar) between posterior spiracles (psp). Endogyne (Fig. 4F): with a rectangular shaped structure (rss), at the posterior end of the rectangular shaped structure is a slender line-like structure (sls) extending anteriorly; with two lateral apodemes (ap).

Distribution

China (Chongqing) (Fig. 8).

Trilacuna jiuchi Tong, Zhang & Li sp. nov.

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Figs 4C–D, G–H, 5–8

Differential diagnosis

Males of this new species are similar to the males of *Trilacuna angularis* Tong & Li, 2007 and *T. rastrum* Tong & Li, 2007, but can be distinguished by the nine-teeth-rake like sclerite and the fork like sclerite of the embolus system (Fig. 6E–H). Males of *T. angularis* and *T. rastrum* both have a four-teeth-rake like sclerite but lack the fork like sclerite (Tong & Li 2007: figs 5–10, 15–18). Females of this new species are similar to the females of *Trilacuna rastrum* Tong & Li, 2007, but can be separated by the worm-shaped structure of the endogyne, which is not present in *T. rastrum* (Tong & Li 2007: fig. 6).

Etymology

The specific name is derived from the Chinese pinyin, 'jiuchi', which means 'nine teeth', referring to the nine-teeth-rake like sclerite of the male embolus system.

Material examined

Holotype

CHINA • ♂; Chongqing Municipality, Beibei District, Jinyun Mountain, Caijiagou; 29°50'19.368" N, 106°21'47.142" E; 15 Oct. 2014; Yanfeng Tong and Songyu Lv leg.; SYNU-300.

Paratypes

CHINA • 2 ♂, 3 ♀♀; same collection data as for holotype; SYNU-301 to 305 • 2 ♂, 4 ♀♀; Jinyun Mountain, Baiyunguan Temple; 20 Mar. 2010; Zongxu Li, Luyu Wang, Hupeng Wang and Kaiyi Xu leg.; SYNU-306 to 311 • 2 ♂, 26 ♀♀; Jinyun Mountain; 7 Jun. 2011; Zhisheng Zhang, Zhong Li and Luyu Wang leg.; SWUC-T-OO-02-1 to 28 • 2 ♂, 15 ♀♀; Jinyun Mountain; 10 Apr. 2010; Zongxu Li, Luyu Wang and Kaiyi Xu leg.; SYNU-340 to 356.

Other material

CHINA • 2 ♂, 1 ♀; Jinyun Mountain, Caijiagou; 12 Dec. 2010; Zhisheng Zhang *et al.* leg.; SYNU-357 to 359 • 3 ♀♀; Jinyun Mountain, Canal Protection Station; 4 Dec. 2010; Zhong Li and Zongxu Li leg.; SYNU-360 to 362 • 1 ♂, 1 ♀; Jinyun Mountain; 16 Oct. 2011; Zongxu Li, Zhong Li, Luyu Wang, Dong Wang and Mingxin Liu leg.; SYNU-363 to 364 • 1 ♀; Jinyun Mountain, Canal Protection Station; 11 May 2008; Zhisheng Zhang leg.; SYNU-365 • 1 ♀; Jinyun Mountain, Jinyun Village, bamboo forest; 28 Jun. 2009; Luyu Wang and Hupeng Wang leg.; SYNU-366 • 1 ♀; Jinyun Mountain, Caijiagou; 12 Dec. 2010; Zhisheng Zhang leg.; SYNU-367 • 1 ♀; Jinyun Mountain; 3 Nov. 2011; Luyu Wang and Mingxin Liu leg.; SYNU-368.

Description

Male (holotype)

BODY. Yellow; habitus as in Fig. 5A–C; body length 1.70.

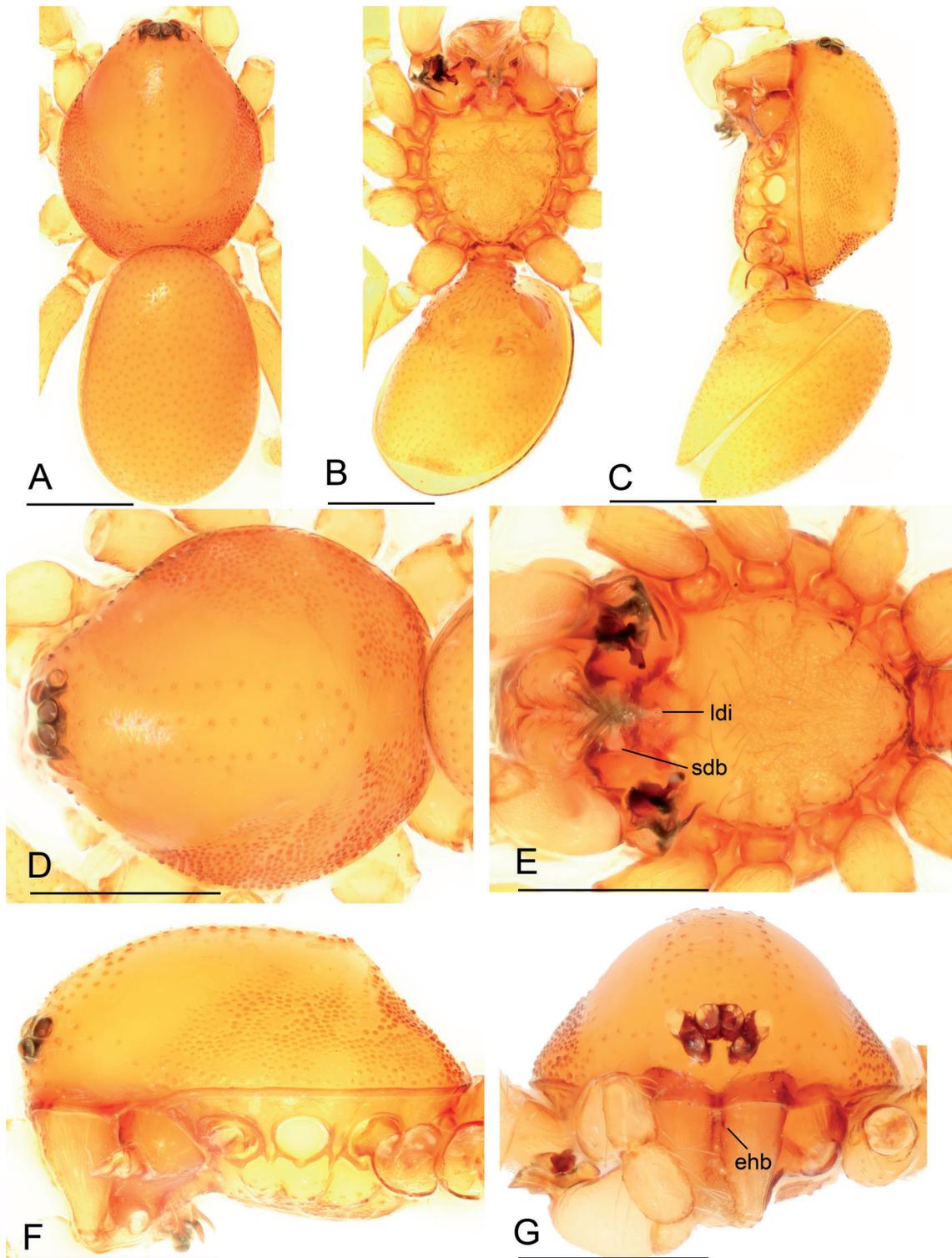


Fig. 5. *Trilacuna jiuchi* Tong, Zhang & Li sp. nov., holotype, ♂ (SYNU-300). **A–C.** Habitus in dorsal, ventral, and lateral views. **D–G.** Prosoma in dorsal, ventral, lateral, and anterior views. Abbreviations: ehb = elevated hair base; ldi = labium deep incision; sdb = strongly curved distal branch. Scale bars: 0.4 mm.

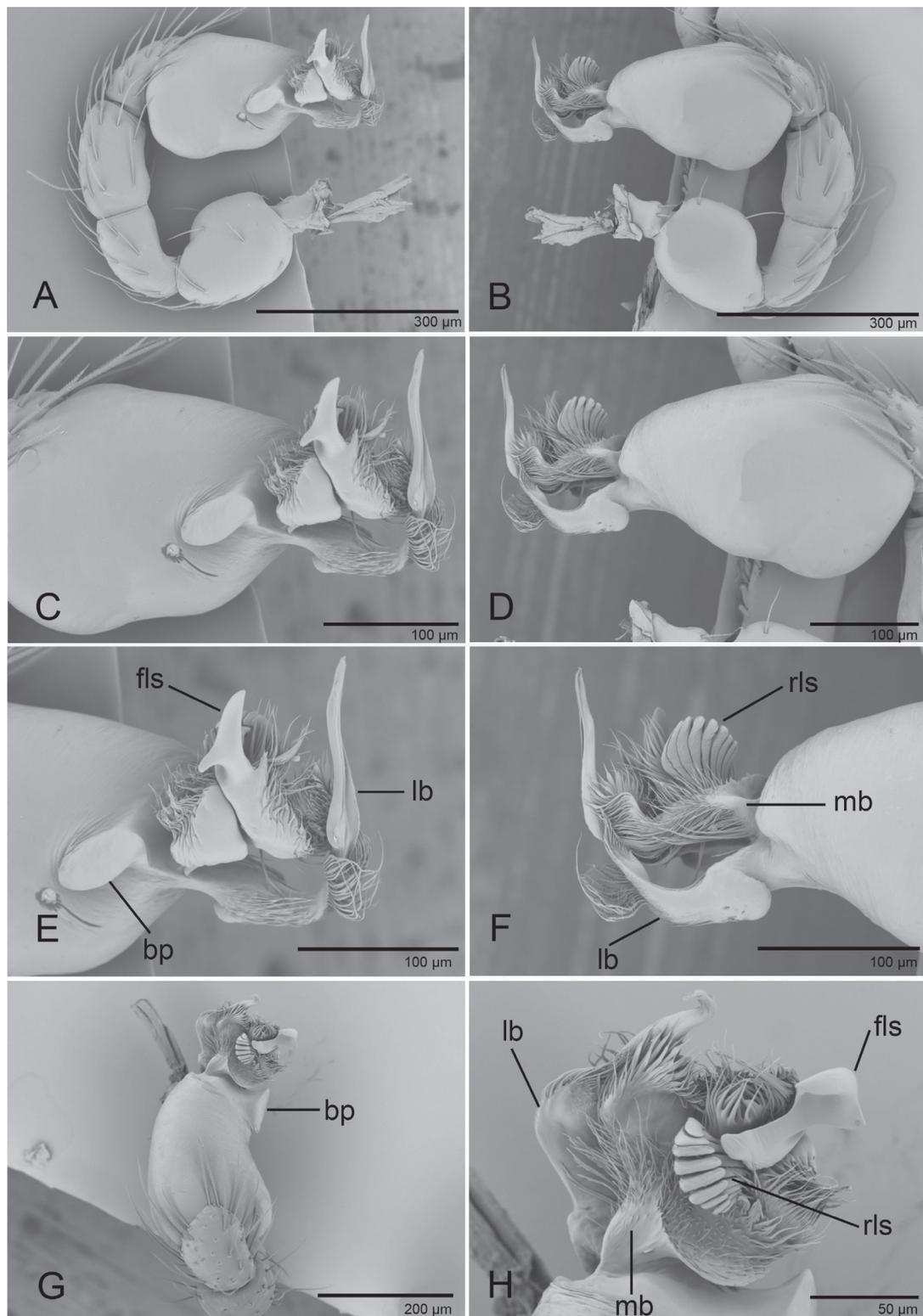


Fig. 6. *Trilacuna jiuchi* Tong, Zhang & Li sp. nov., left male palp, SEM, holotype, ♂ (SYNU-300). A–B, G. Prolateral, retrolateral, and dorsal views. C–D. Palpal bulb in prolateral and retrolateral views. E–F, H. Distal part of palpal bulb in prolateral, retrolateral, and dorsal views. Abbreviations: bp = basal protrusion; fls = fork like sclerite; lb = lateral branch; mb = median branch; rls = nine-teeth-rake like sclerite.

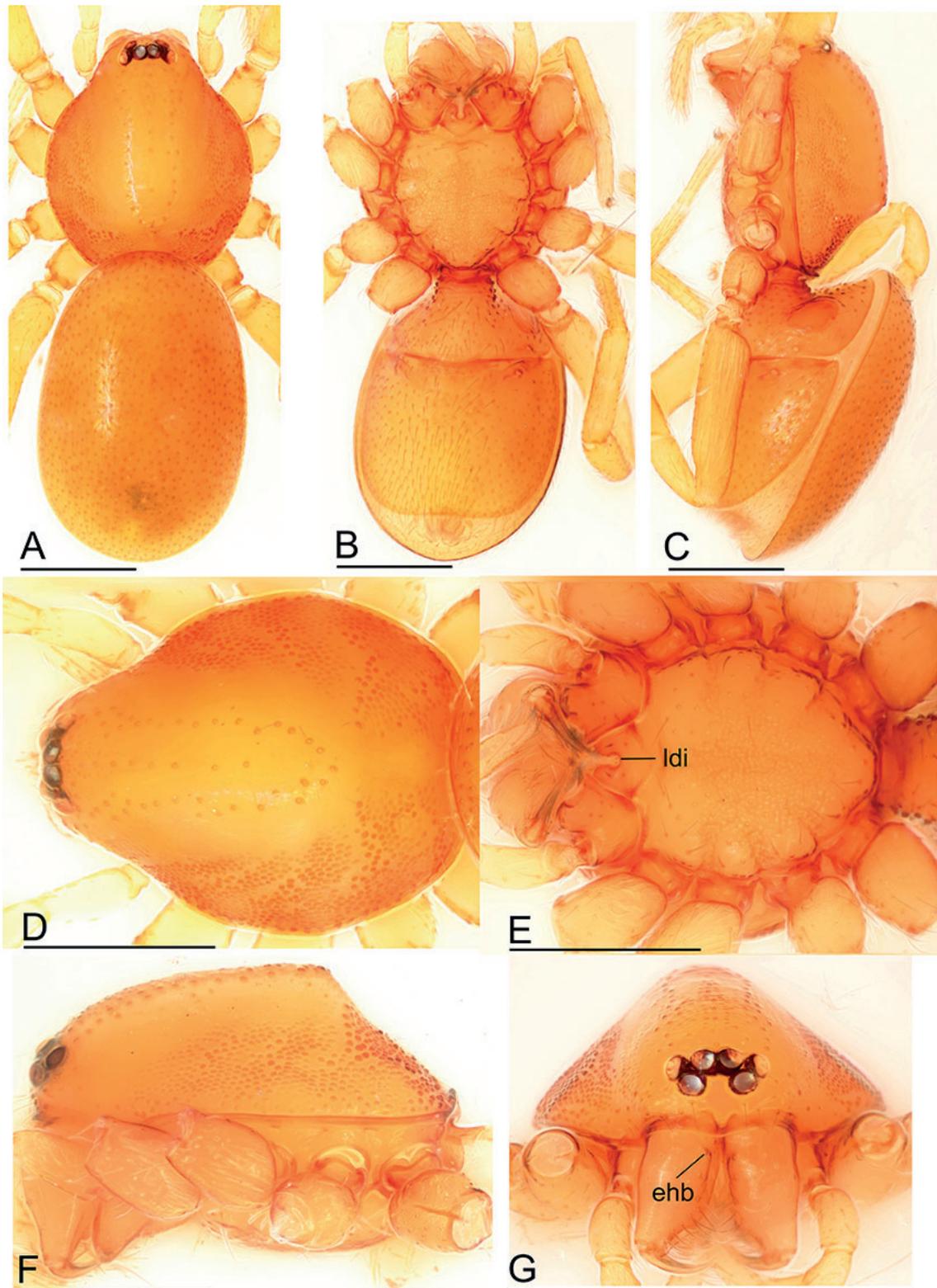


Fig. 7. *Trilacuna jiuchi* Tong, Zhang & Li sp. nov., paratype, ♀ (SYNU-303). **A–C.** Habitus in dorsal, ventral, and lateral views. **D–G.** Prosoma in dorsal, ventral, lateral, and anterior views. Abbreviations: ehb = elevated hair base; ldi = labium deep incision. Scale bars: 0.4 mm.

CARAPACE (Fig. 5D, F–G). 0.86 long, 0.73 wide; sides granulate; lateral margin rebordered.

EYES (Fig. 5D, G). Well developed, arranged in a compact group; ALE largest, PLE smallest; ALE–PLE separated by less than ALE radius, PME touching each other; posterior row recurved from above, procurved from front.

CLYPEUS (Fig. 5G). Nearly straight in frontal view, ALE separated from edge of carapace by about 1.3 times their diameter.

MOUTHPARTS (Fig. 5E, G). Chelicerae straight; labium rectangular, anterior margin deeply incised; endites slender, distally strongly curved branched.

STERNUM (Fig. 5E). With radial furrows between coxae I–II, II–III, III–IV; surface reticulated.

ABDOMEN (Fig. 5A–C). 0.91 long, 0.64 wide; booklung covers ovoid, surface smooth; apodemes present, posterior spiracles not connected; sperm pore oval, situated between anterior spiracles.

LEG SPINATION (all spines longer than segment width). Legs I–II: tibia: v2-2-2-2-0, metatarsus: v2-2-0.

PALP (Figs 6, 4C–D). Orange; 0.64 long (0.18, 0.15, 0.17, 0.14); femur strongly elongated (width/length = 0.81); bulb oval shaped, tapering apically; embolus system (Fig. 6E–F, H) with a protrusion on

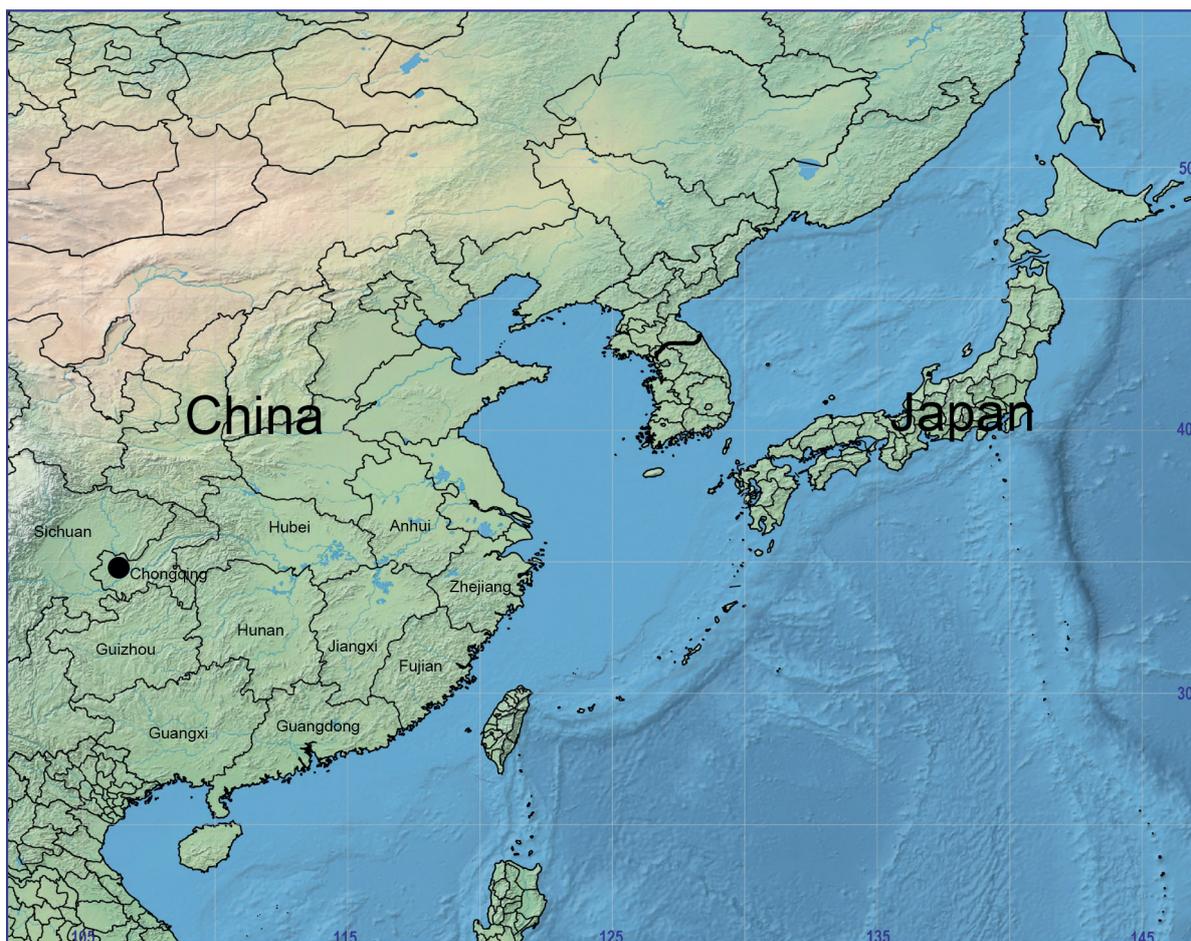


Fig. 8. The type locality of the two new species, Jinyun Mountain, Chongqing.

base (bp) and a fork like sclerite (fls) in prolateral view, a broad median branch (mb) and a nine-teeth-rake like sclerite (rls) in dorsal view, and a lateral long curved branch (lb) in retrolateral view.

Female (SYNU-303)

Same as male except as noted; slightly larger than male. Body: length 2.05; habitus as in Fig. 7A–C. Carapace: 0.91 long, 0.72 wide. Endites: unmodified. Abdomen: 1.22 long, 0.82 wide. Epigaster (Figs 4G, 7B): sclerotized recurved arches (sar) between posterior spiracles (psp) visible. Endogyne (Fig. 4H): with broad, transverse sclerite (tsc), a very long, nearly worm-shaped structure (wss) and an anterior sclerite (as), stick-shaped; transverse bar (tba) with two lateral apodemes (ap).

Distribution

China (Chongqing) (Fig. 8).

Discussion

Trilacuna was originally diagnosed by the enlarged male palpal femora, the very complicated embolus system, the branched endites and the notched labium (Tong & Li 2007). These characters were later recognized as shared by a more inclusive group: the “*Dysderoides* complex”, that includes *Bannana* Tong & Li, 2015, *Dysderoides* Fage, 1946, *Himalayana* Grismado, 2014, and *Trilacuna* (Grismado *et al.* 2014; Tong & Li 2015). Males of *Trilacuna* differ from those of the other genera of the “*Dysderoides* complex” by usually lacking the furrow connecting the posterior tracheal spiracles, and females differ by having a long postepigastric scutum covering almost the whole ventral abdomen (Tong *et al.* 2020).

However, as already discussed by Grismado *et al.* (2014) and Malek-Hosseini *et al.* (2015), some species, i.e., *T. aenobarba* (Brignoli, 1978), *T. bangla* Grismado & Ramírez, 2014, *T. hazara* Grismado & Ramírez, 2014, *T. jinyun* sp. nov., *T. qarzi* Malek Hosseini & Grismado, 2015 and *T. simianshan* Tong & Li, 2018, have a shallow groove connecting the tracheal spiracles in males; *T. diabolica* Kranz-Baltensperger, 2011 and *T. werni* Eichenberger, 2011 have a well-developed furrow connecting the spiracles in males (Eichenberger & Kranz-Baltensperger 2011), indicating a variability of this trait.

Also worth mentioning are *T. jinyun* sp. nov. and *T. simianshan*. Both species have two very long branches on the embolus system (Figs 2C–D, 4A–B; Tong *et al.* 2018: fig. 2c–d), which make them quite different from all other species of *Trilacuna*. However, the enlarged male palpal femora and somatic features like the deeply incised labium and the branched endites make the placement in the genus *Trilacuna* reasonable.

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