

ORIGINAL ARTICLE

Five new genera of the subfamily Psilodercinae (Araneae: Ochyroceratidae) from Southeast Asia

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Abstract Five new genera of the spider family Ochyroceratidae with remarkable palpal and epigynal characters are described: *Luzonacera* Li & Li, **gen. nov.**, *Qiongocera* Li & Li, **gen. nov.**, *Relictocera* Li & Li, **gen. nov.**, *Sinoderces* Li & Li, **gen. nov.**, and *Thaidercera* Li & Li, **gen. nov.** Six new species are described based on specimens collected in China, Philippines, Vietnam, and Thailand: *Luzonacera chang* Li & Li, **sp. nov.**, *Luzonacera duan* Li & Li, **sp. nov.**, *Qiongocera hongjunensis* Li & Li, **sp. nov.**, *Relictocera qiyi* Li & Li, **sp. nov.**, *Sinoderces nawanensis* Li & Li, **sp. nov.**, and *Thaidercera jian* Li & Li, **sp. nov.** In addition, two *Psilodercera* species are transferred to other genera: *Sinoderces exilis* (Wang & Li, 2013) **comb. nov.** and *Thaidercera vulgaris* (Deeleman-Reinhold, 1995) **comb. nov.** All type specimens are deposited in the Institute of Zoology, Chinese Academy of Sciences (IZCAS) in Beijing.

Key words Haplogynae, spider, taxonomy, diagnosis, COI.

1 Introduction

The pantropical spider family Ochyroceratidae Fage, 1912 currently contains 15 genera and 191 species (World Spider Catalog, 2017). Ochyroceratids are found in forests where they construct small webs in warm, wet, cryptozoic habitats such as leaf litter and under stones (Deeleman-Reinhold, 1995). Ochyroceratids are also common in caves in Southeast Asia.

Based on characters of the respiratory system, cheliceral teeth, carapace shape, and genital organs Ochyroceratidae is divided into three subfamilies: Theotiminae, Psilodercinae, and Ochyroceratinae (Deeleman-Reinhold, 1995). Although Wunderlich (2008, 2012, 2015) raised Psilodercinae to family level, that arrangement has not been accepted (Selden & Penney, 2010; Wang & Li, 2013; Li *et al.*, 2014; Dupérré, 2015; World Spider Catalog, 2017). To date, Psilodercinae is composed of five genera: *Psilodercera* Simon, 1892, *Althepus* Thorell, 1898, *Merizocera* Fage, 1912, *Leclercera* Deeleman-Reinhold, 1995, and *Flexicrurum* Tong & Li, 2007. Among these, *Psilodercera* is the most heterogeneous and appears to be polyphyletic (Wunderlich, 2012): this genus has been divided into nine species groups based on genitalic characters (Deeleman-Reinhold, 1995).

The purpose of our paper is to improve our knowledge of psilodercine taxonomy. Here we describe six new species and five new psilodercine genera based on specimens from Southeast Asia. These new genera show unique characters that clearly distinguish them from all currently known genera of Ochyroceratidae.

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2 Materials and methods

2.1 Sample

All specimens were collected in China, Philippines, Thailand, or Vietnam (Fig. 15) and preserved in 95% ethanol. All type specimens are deposited in the Institute of Zoology, Chinese Academy of Sciences (IZCAS) in Beijing, China.

2.2 Morphological examination

Specimens were examined and measured using a Leica M205 C stereomicroscope. Morphological details were studied with an Olympus BX41 compound microscope. Photos were taken with an Olympus C7070 wide zoom digital camera (7.1 megapixels) mounted on an Olympus SZX12 stereomicroscope. Figure images were montaged using Helicon Focus 6.6.1 image stacking software. The map was generated using ArcView GIS 3.3. All measurements are in millimeters (mm). Leg measurements are shown as total length (femur, patella, tibia, metatarsus, and tarsus). Leg segments were measured from the retrolateral side. Carapace length was measured from anterior eye row to carapace posterior margin. Terminology follows that of Deeleman-Reinhold (1995), Tong & Li (2007), and Li *et al.* (2014).

Abbreviations used in figures are as follows:

Somatic morphology:

PR—clypeal projection;

Male genitalic morphology:

CO—conductor;

EM—embolus;

LA—laminal apophysis on bulb;

CP—cymbial protrusion;

Female genitalic morphology:

SP—spermathecal;

GL—genitalic lobe.

2.3 PCR and DNA sequencing

The extraction of genomic DNA from legs and thoracic tissue followed Zhang & Li (2014). Primer sets for the PCR and cycle sequencing reactions used for cytochrome c oxidase subunit I (COI) in this study were shown in Folmer *et al.* (1994). Amplifications were conducted in a 25 μ L volume reaction with initial denaturing of 60 s at 94°C, five cycles of 45 s at 94°C, 45 s at 45°C, 30 s at 72°C, then 33 cycles of 45 s at 94°C, 45 s at 48°C, 30 s at 72°C, followed by a final 5 min extension at 72°C. All sequences were analyzed using BLAST. DNA sequences newly obtained in this study were deposited in GenBank; accession numbers are provided in Table 1.

Table 1. The accession numbers for each species in this paper.

Species name	Length (bp)	GenBank No.
<i>Luzonacera chang</i> Li & Li, sp. nov.	651	MF624268
<i>Luzonacera duan</i> Li & Li, sp. nov.	451	MF624267
<i>Qiongocera hongjunensis</i> Li & Li, sp. nov.	651	MF624264
<i>Relictocera qiyi</i> Li & Li, sp. nov.	651	MF624270
<i>Sinoderces nawanensis</i> Li & Li, sp. nov.	651	MF624266
<i>Sinoderces exilis</i> (Wang & Li, 2013), comb. nov.	651	MF624265
<i>Thaiderces jian</i> Li & Li, sp. nov.	651	MF624269

2.4 COI genetic diversity calculation

The seven COI sequences (651 bp) obtained in this study were aligned using MAFFT version 7 (<http://mafft.cbrc.jp/alignment/server/>). MEGA7.0.16 (Kumar *et al.*, 2016) was used for subsequent manual adjustment of the sequences and calculation of pairwise comparisons of uncorrected K2P-distances.

3 Systematics

Family Ochyroceratidae Fage, 1912

Key to the genera of the subfamily Psilodercinae (males only).

1. Cheliceral promargin with 1–2 large teeth and a lamina; maxillae mesodistally rounded..... 2
Cheliceral promargin with a dentoid lamina; maxillae mesodistally acuminate..... 4
2. Thoracic fovea a deep groove extending to posterior margin of carapace; cymbium with lateral protrusion bearing lanceolate apophysis and three slightly curved serrated bristles distally; bulb with embolus and conductor widely separated basally
..... *Althepus* Thorell
Fovea short or a simple depression; cymbium lacking lateral protrusion and lanceolate apophysis; bulb with conductor present or absent, if present embolus and conductor not widely separated basally 3
3. Palp with retrolateral protrusion on tibia or cymbium; conductor present *Leclercera* Deeleman-Reinhold
Palp without retrolateral protrusion on tibia or cymbium; conductor absent..... *Luzonacera* Li & Li, gen. nov.
4. Cymbium without apical protrusion..... 5
Cymbium with apical protrusion..... 6
5. Embolus long; conductor present or absent, if present then separated basally from embolus; cheliceral retromargin with one small tooth *Sinodercera* Li & Li, gen. nov.
Embolus short; conductor absent; cheliceral retromargin with two transparent small teeth..... *Thaidercera* Li & Li, gen. nov.
6. Clypeus medially with trifurcate projection; conductor present; cheliceral retromargin with two small teeth.....
..... *Relictocera* Li & Li, gen. nov.
Clypeus medially with horn-shaped projection or unmodified; conductor present or absent; cheliceral retromargin with one or two small teeth 7
7. Palpal tibia deflected prolaterally; bulb with complex conductor 8
Palpal tibia not deflected prolaterally; conductor otherwise..... 9
8. Embolus slender; abdomen oriented nearly perpendicular to thorax; cheliceral retromargin with two small teeth.....
..... *Flexicrurum* Tong & Li
Embolus short; abdomen oriented in line with thorax; cheliceral retromargin with one small tooth ... *Qiongocera* Li & Li, gen. nov.
9. Conductor present or absent, if present then embolus and conductor not separated basally *Psilodercera* Simon
Conductor present or absent, if present then separated basally from embolus *Merizocera* Fage

3.1 Genus *Luzonacera* Li & Li, gen. nov.

Type species: *Luzonacera chang* Li & Li, sp. nov.

Eymology. The genus name is a combination of “*Luzon*” (refers to Luzon, the Philippine Island) with the typical ending among genus names within this family. Gender is feminine.

Diagnosis. The new genus is distinguished (together with *Leclercera* and *Althepus*) from all other genera of Ochyroceratidae by the large size, the presence of a denticle on the cheliceral promargin and the rounded maxillae. It is distinguished from *Leclercera* and *Althepus* by the absence of a retrolateral protrusion on the tibia or cymbium of the male palp and by the absence of a conductor.

Description. Cheliceral promargin with lamina and one denticle, retromargin with two denticles; male with swollen palpal tibia, cymbium with distal protrusion, palp lacking retrolateral tibial or cymbial apophysis, bulb pyriform, central part remarkably constricted, spiral whip-like embolus extending subapically, conductor lacking; female with two pairs of elongate, distally swollen spermathecae.

Distribution. Philippines (Rizal Province).

Species composition. *Luzonacera chang* Li & Li, sp. nov., *Luzonacera duan* Li & Li, sp. nov.

Luzonacera chang Li & Li, sp. nov. (Figs 1–2, 15)

Material examined. Holotype male, Philippines, Rizal Province, Antipolo City, San Jose Village, Mystical Cave (large cave with a bird colony, 14°36.353'N, 121°12.521'E; elev. 212 m), 04 June 2015, leg. F. Ballarin & Y. Li. Paratypes. 1 male, 2 females, same data as holotype (IZCAS).

Eymology. The species name is a noun in apposition derived from the Chinese pinyin “cháng” (“long”) and refers to the long embolus.

Diagnosis. Specimens of the two species of *Luzonacera* are very similar but can be distinguished as follows. The carapace in both sexes of *L. chang* Li & Li, sp. nov. has a medial rounded brown area (*versus* three longitudinal bands in



Figure 1. *Luzonacera chang* Li & Li, **sp. nov.**, male holotype. A. Palp, ventral view. B. Palpal bulb, prolateral view. C. Palp, prolateral view. D. Palp, retrolateral view. Scale bars: B–D=0.1 mm.

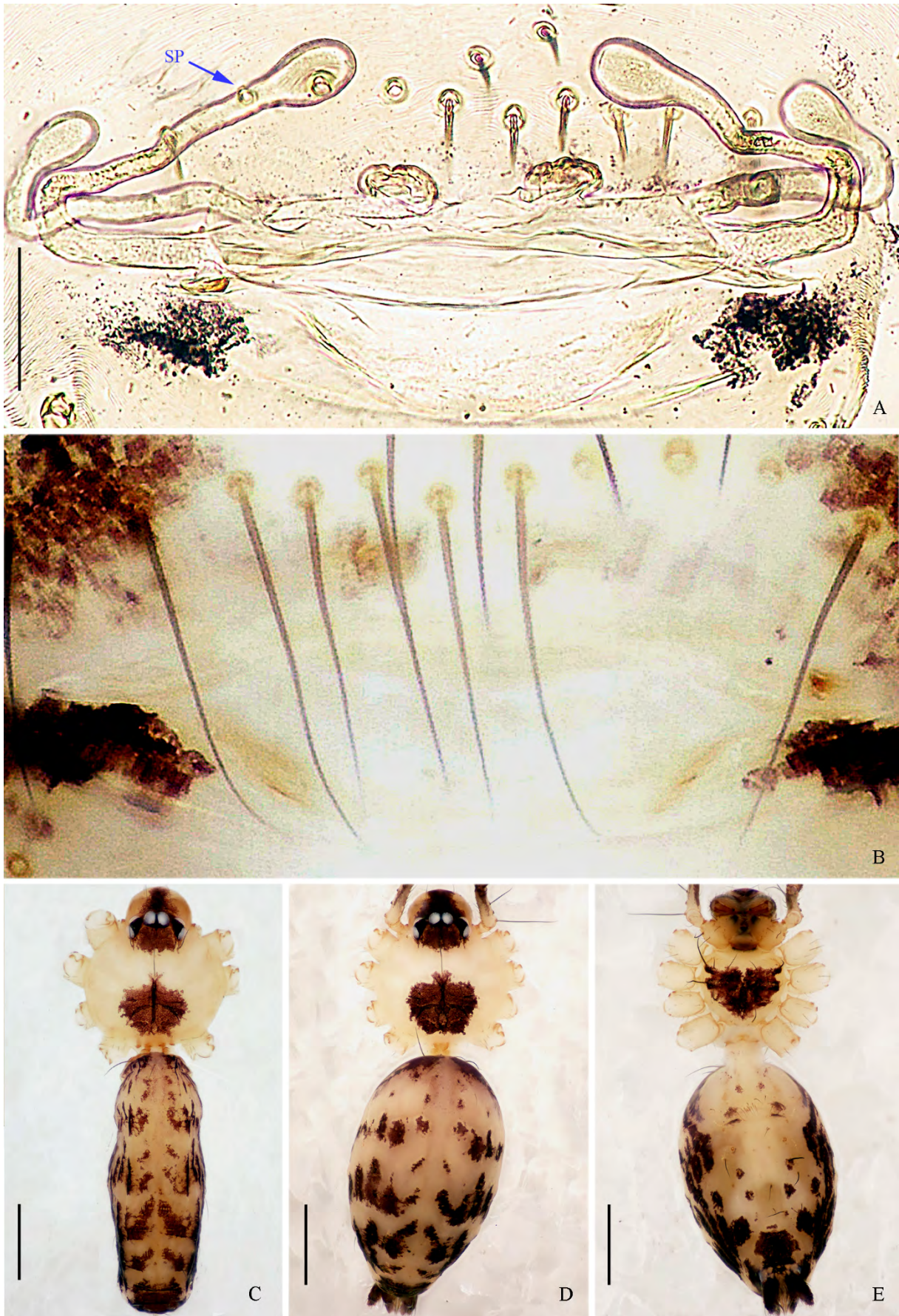


Figure 2. *Luzonacera chang* Li & Li, **sp. nov.**, male holotype and female paratype. A. Spermathecae, dorsal view. B. Female epigyne, ventral view. C. Male habitus, dorsal view. D. Female habitus, dorsal view. E. Female habitus, ventral view. Scale bars: A=0.05 mm; C–E=0.5 mm.

both sexes of *L. duan* Li & Li, **sp. nov.**). The male of this species is easily recognized by the long spiral embolus (*versus* shorter in *L. duan* Li & Li, **sp. nov.**) and the relatively light constriction of the central part of the bulb (*versus* constriction more pronounced in *L. duan* Li & Li, **sp. nov.**). The female is diagnosed by the two pairs of curved, elongate, distally swollen spermathecae (*versus* curves of spermathecae relatively more twisted in *L. duan* Li & Li, **sp. nov.**).

Description. Male (holotype). Total length 2.72; carapace 0.85 long, 0.92 wide; abdomen 1.70 long, 0.66 wide. Carapace round, pale yellow, with rounded brown patch medially and triangular brown patch posterior to ocular area (Fig. 2C). Fovea shallow, dark brown. Anterior margin of thoracic region distinctly elevated. Chelicerae brown with lamina, promargin with one tooth, retromargin with two small teeth, posterior surface of fang with 25 small denticles. Clypeus slanting, brown with two pale rounded areas laterally. Labium slanting, yellow. Sternum yellow, with large brown spots medially. Abdomen elongate, with complex patterns dorsally and ventrally. Legs brown; measurements: I 15.75 (4.00, 0.30, 4.10, 4.75, 2.60), II 10.97 (3.03, 0.33, 3.13, 3.40, 1.08), III 7.27 (2.13, 0.35, 2.04, 1.92, 0.83), IV 11.69 (3.44, 0.32, 3.36, 3.52, 1.05). Palp (Figs 1A–D): tibia remarkably swollen, cymbium with distal protrusion; bulb yellow, pyriform; conductor absent; embolus a slender spiral extending subapically from bulb.

Female (paratype). Similar to male in coloration and general features but slightly larger (Figs 2D–E). Measurements: total length 3.00; carapace 0.86 long, 0.88 wide; abdomen 1.90 long, 1.02 wide. Leg measurements: I - (3.72, 0.19, -, -, -), II 9.25 (2.56, 0.26, 2.80, 2.60, 1.03), III 9.92 (2.81, 0.28, 2.94, 3.06, 0.83), IV 6.24 (1.48, 0.31, 1.84, 1.80, 0.81). Vulva with two pairs of elongate, curved spermathecae with distal ends swollen (Fig. 2A).

Distribution. Known only from the type locality (Fig. 15).

Luzonacera duan Li & Li, **sp. nov.** (Figs 3–4, 15)

Material examined. Holotype male, Philippines, Luzon Island, Kalinga Province, Tabuk City, Pasil Area, Road to Lubuagan Village, rainforest on a steep slope, in humid litter (17°22.490'N, 121°10.864'E; elev. 915 m), 02 June 2015, leg. F. Ballarin & Y. Li. Paratypes. 2 females, same data as holotype (IZCAS).

Etymology. The species name is a noun in apposition derived from the Chinese pinyin "duǎn" ("short") and refers to the relatively short embolus.

Diagnosis. Both sexes of the two species of *Luzonacera* **gen. nov.** are very similar; distinguishing them is discussed under *L. chang* Li & Li, **sp. nov.**

Description. Male (holotype). Total length 3.48; carapace 0.95 long, 0.98 wide; abdomen 2.10 long, 0.69 wide. Carapace round, pink, with three longitudinal brown bands of which middle three times wider than laterals (Fig. 4C). Fovea shallow, brown. Anterior margin of thoracic region distinctly elevated. Chelicerae brown with lamina, promargin with one tooth, retromargin with two small teeth, posterior surface of fang with 22 small denticles. Clypeus slanting, brown with two pale rounded areas laterally. Labium slanting, brown. Sternum yellow, with complex patterns. Abdomen elongate, with complex patterns dorsally and ventrally. Legs brown, with white annulation; measurements: I 15.10 (4.50, 0.40, 4.20, 4.70, 1.30), II 11.48 (3.28, 0.38, 3.20, 3.52, 1.10), III 7.63 (2.25, 0.34, 2.18, 1.96, 0.90), IV 12.15 (3.68, 0.38, 3.44, 3.52, 1.13). Palp (Figs 3A–D): tibia remarkably swollen; cymbium with distal protrusion; bulb light yellow, pyriform; conductor lacking, embolus a relatively short spiral extending subapically from bulb.

Female. Similar to male in coloration and general features but slightly smaller (Figs 4D–E). Measurements: total length 2.97; carapace 0.88 long, 0.88 wide; abdomen 1.70 long, 1.14 wide. Leg measurements: I - (3.32, 0.32, 3.40, 3.60, -), II missing, III 6.29 (1.76, 0.31, 1.78, 1.62, 0.82), IV 8.22 (2.72, 0.34, 2.72, 1.62, 0.82). Vulva with two pairs of elongate, distally swollen spermathecae (Fig. 4A).

Distribution. Known only from the type locality (Fig. 15).

3.2 Genus *Qiongocera* Li & Li, **gen. nov.**

Type species: *Qiongocera hongjunensis* Li & Li, **sp. nov.**

Etymology. The genus name is a combination of "Qiong" (refers to Hainan Province, China) with the typical ending among genus names within this family. Gender is feminine.

Diagnosis. The new genus is distinguished (together with *Flexicrurum*) from all other genera by the inner turned tibia of the male palp and the complex conductor of the genital bulb. It is distinguished from *Flexicrurum* by the presence of one tooth on the cheliceral retromargin and the short embolus of the genital bulb.

Description. Cheliceral promargin with lamina, retromargin with one denticle; male with palpal tibia strongly deflected prolaterally (Fig. 6C), cymbium with distal protrusion, bulb pyriform with complex conductor; female with single pair of enlarged spermathecae (Fig. 6A).

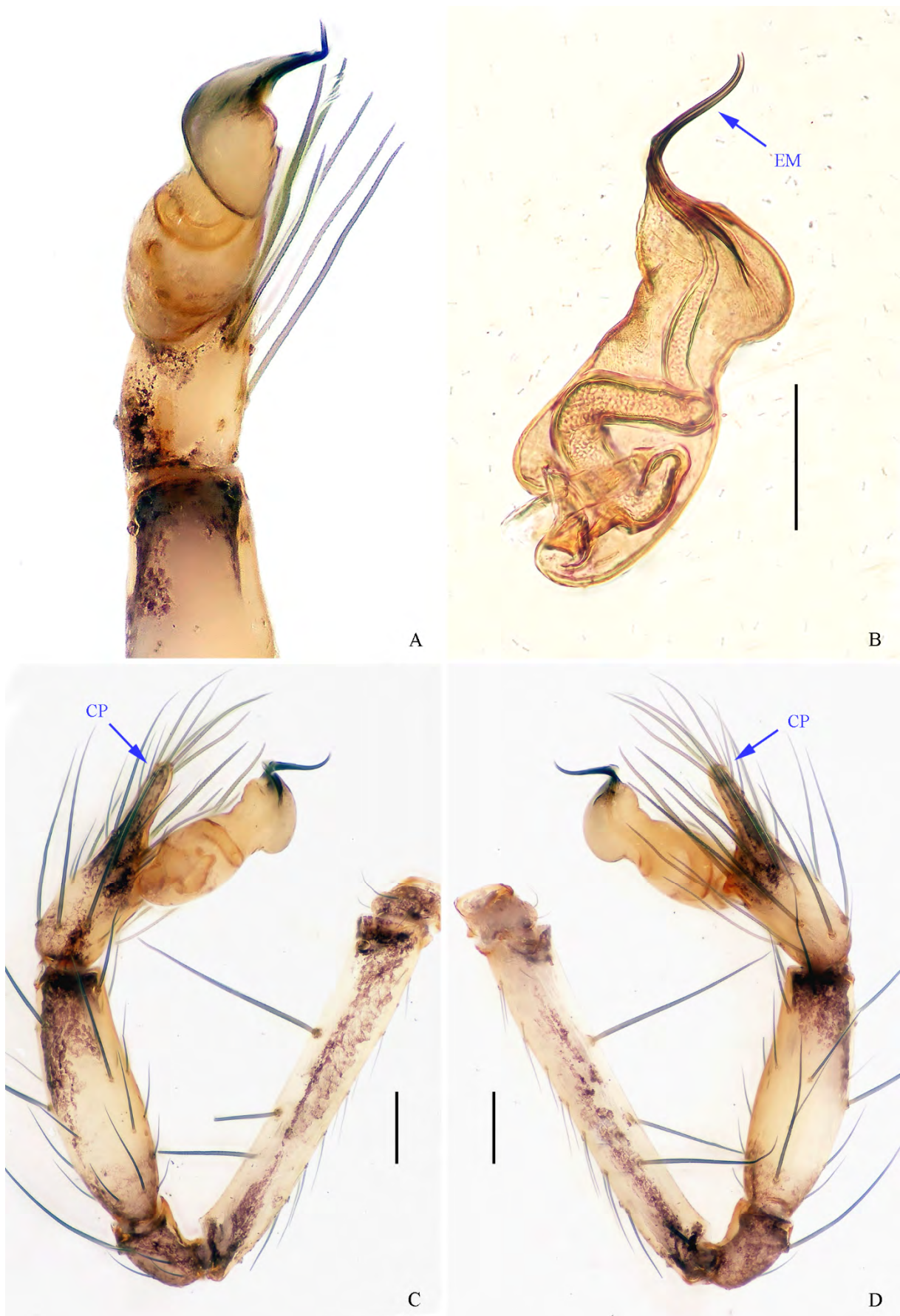


Figure 3. *Luzonacera duan* Li & Li, **sp. nov.**, male holotype. A. Palp, ventral view. B. Palpal bulb, prolateral view. C. Palp, prolateral view. D. Palp, retrolateral view. Scale bars: B–D=0.1 mm.

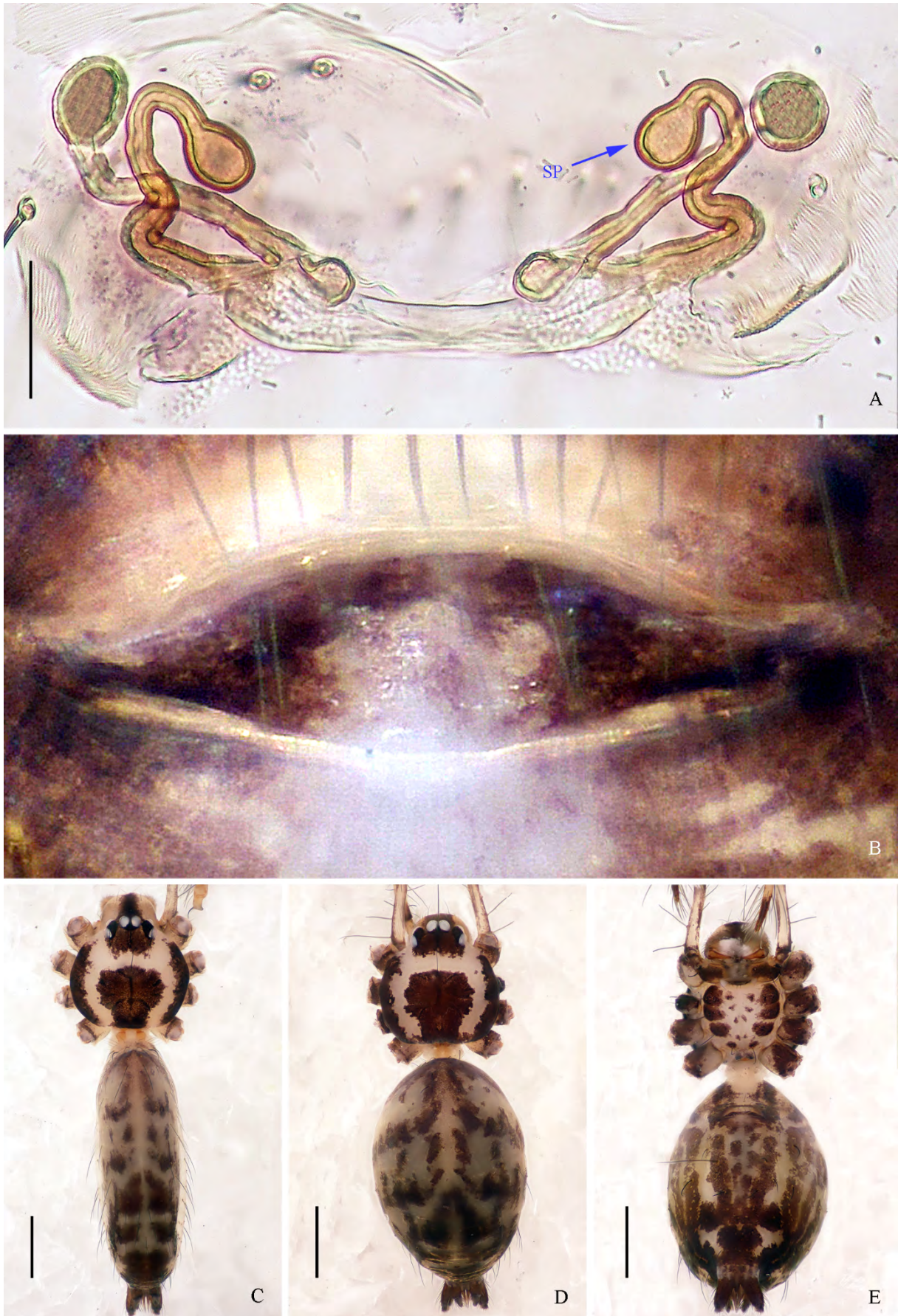


Figure 4. *Luzonacera duan* Li & Li, **sp. nov.**, male holotype and female paratype. A. Spermathecae, dorsal view. B. Female epigyne, ventral view. C. Male habitus, dorsal view. D. Female habitus, dorsal view. E. Female habitus, ventral view. Scale bars: A=0.05 mm; C–E=0.5 mm.

Distribution. China (Hainan Province).

Species composition. *Qiongocera hongjunensis* Li & Li, **sp. nov.**

***Qiongocera hongjunensis* Li & Li, sp. nov.** (Figs 5–6, 15)

Material examined. Holotype male, China, Hainan Province, Wanning City, Liulian Mountain, Hongjun Cave (18°57.925'N, 110°25.316'E; elev. 290 m), 03 July 2014, leg. F. Li & X. Wang. Paratype. 1 female, same data as holotype (IZCAS).

Etymology. The species name is an adjective referring to the type locality.

Diagnosis. This species is easily recognized by the complex conductor and short embolus of the male palp and the single pair of enormous spermathecae in the female.

Description. Male (holotype). Total length 2.08; carapace 0.71 long, 0.80 wide; abdomen 1.19 long, 0.56 wide. Carapace round, yellow, with three longitudinal brown bands of which middle band twice as wide as laterals (Fig. 6C). Fovea shallow, dark brown. Anterior margin of thoracic region distinctly elevated. Chelicerae yellow. Cheliceral promargin with lamina and no teeth, retromargin with one small tooth, posterior surface of fang with 19 small denticles. Clypeus slanting, brown, with two pale rounded areas basally. Labium slanting, brown. Sternum brown. Abdomen elongate with complex patterns dorsally and ventrally. Legs brown; measurements: I missing, II missing, III 7.02 (2.10, 0.27, 2.10, 1.86, 0.69), IV 10.07 (3.13, 0.27, 3.28, 2.97, 1.05). Palp (Figs 5A–D): femur slender, patella angled ventrally, tibia strongly deflected prolaterally, cymbium with single protrusion; bulb yellow, pyriform, ending with a laminal, acuminate apophysis (Fig. 5B); conductor flat and short, arising distally on bulb, divided into two unequal parts; embolus dark, short, arising distally from bulb adjacent to base of conductor.

Female. Similar to male in coloration and general features but slightly smaller (Figs 6D–E). Measurements: total length 1.84; carapace 0.6 long, 0.75 wide; abdomen 1.26 long, 0.76 wide. Leg measurements: I 8.82 (2.50, 0.28, 2.62, 2.42, 1.00), II 6.29 (1.74, 0.28, 1.90, 1.74, 0.63), III 5.33 (1.55, 0.27, 1.47, 1.41, 0.63), IV 8.02 (2.25, 0.27, 2.28, 2.23, 0.99). Vulva with one pair of enormous spermathecae (Fig. 6A).

Distribution. Known only from the type locality (Fig. 15).

3.3 Genus *Relictocera* Li & Li, gen. nov.

Type species: *Relictocera qiyi* Li & Li, **sp. nov.**

Etymology. The genus name is an arbitrary combination of letters. Gender is feminine.

Diagnosis. The new genus is distinguished from all other genera of the family by the trifurcate projection on the male clypeus and the distinctly slender apical protrusion on the male cymbium.

Description. Cheliceral promargin with dentoid lamina, retromargin with one denticle; male with short cymbium with single distinctly slender protrusion distally, clypeus with trifurcate projection medially (Figs 8C–D), bulb oval with conductor present; female with external pair of translucent lobes laterally on genitalic area (Fig. 8B), vulva with single pair of slender elongate spermathecae (Fig. 8A).

Distribution. Vietnam (Thua Thien Hue Province).

Species composition. *Relictocera qiyi* Li & Li, **sp. nov.**

***Relictocera qiyi* Li & Li, sp. nov.** (Figs 7–8, 15)

Material examined. Holotype male, Vietnam, Thua Thien Hue Province, Bach Ma National Park, Da Dung Village (16°13.203'N, 107°52.944'E; elev. 69 m), 26 August 2015, leg. Q. Zhao, Y. Li & Z. Chen. Paratypes. 1 male, 2 females, same data as holotype (IZCAS).

Etymology. The species name is a noun in apposition derived from the Chinese pinyin "qíyì" ("strange") and refers to the unique trifurcate projection on the male clypeus.

Diagnosis. The male of this species is easily recognized by the distinctly slender elongate cymbial protrusion, the bifurcate conductor, and the flat embolus. The female is diagnosed by the single pair of slender elongate spermathecae.

Description. Male (holotype). Total length 2.63; carapace 0.65 long, 0.76 wide; abdomen 1.36 long, 0.56 wide. Carapace round, yellow, with three longitudinal brown bands of which middle band 3–4 times wider than laterals (Fig. 8C). Fovea shallow, dark brown. Anterior margin of thoracic region distinctly elevated. Chelicerae light yellow. Cheliceral promargin with dentoid lamina and no teeth, retromargin with one small denticle, posterior surface of fang with 19 small denticles. Clypeus light yellow, slanting with trifurcate projection medially and two horn-like projections basally (Figs 8C–

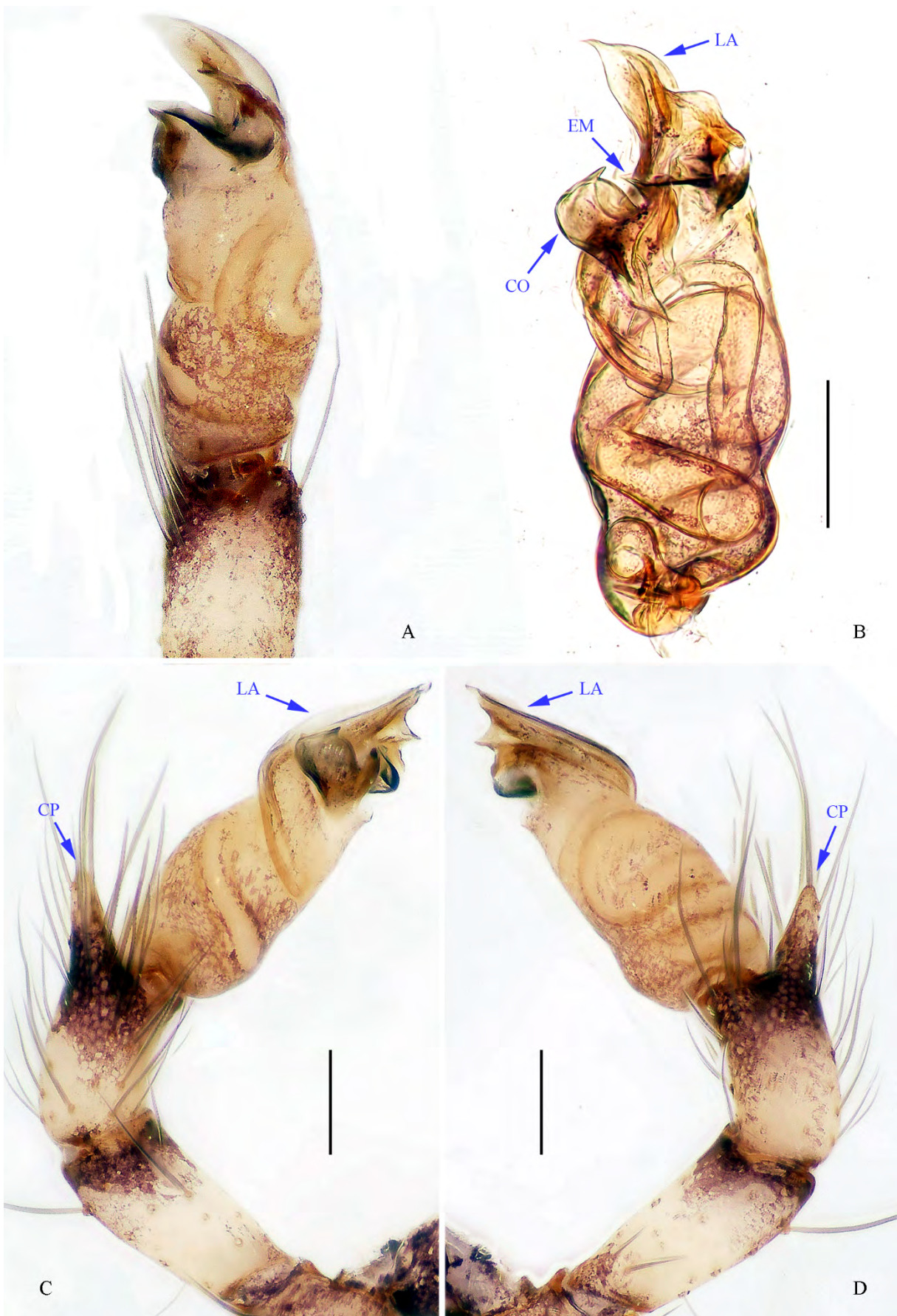


Figure 5. *Qiongocera hongjunensis* Li & Li, **sp. nov.**, male holotype. A. Palp, ventral view. B. Palpal bulb, prolateral view. C. Palp, prolateral view. D. Palp, retrolateral view. Scale bars: B–D=0.1 mm.

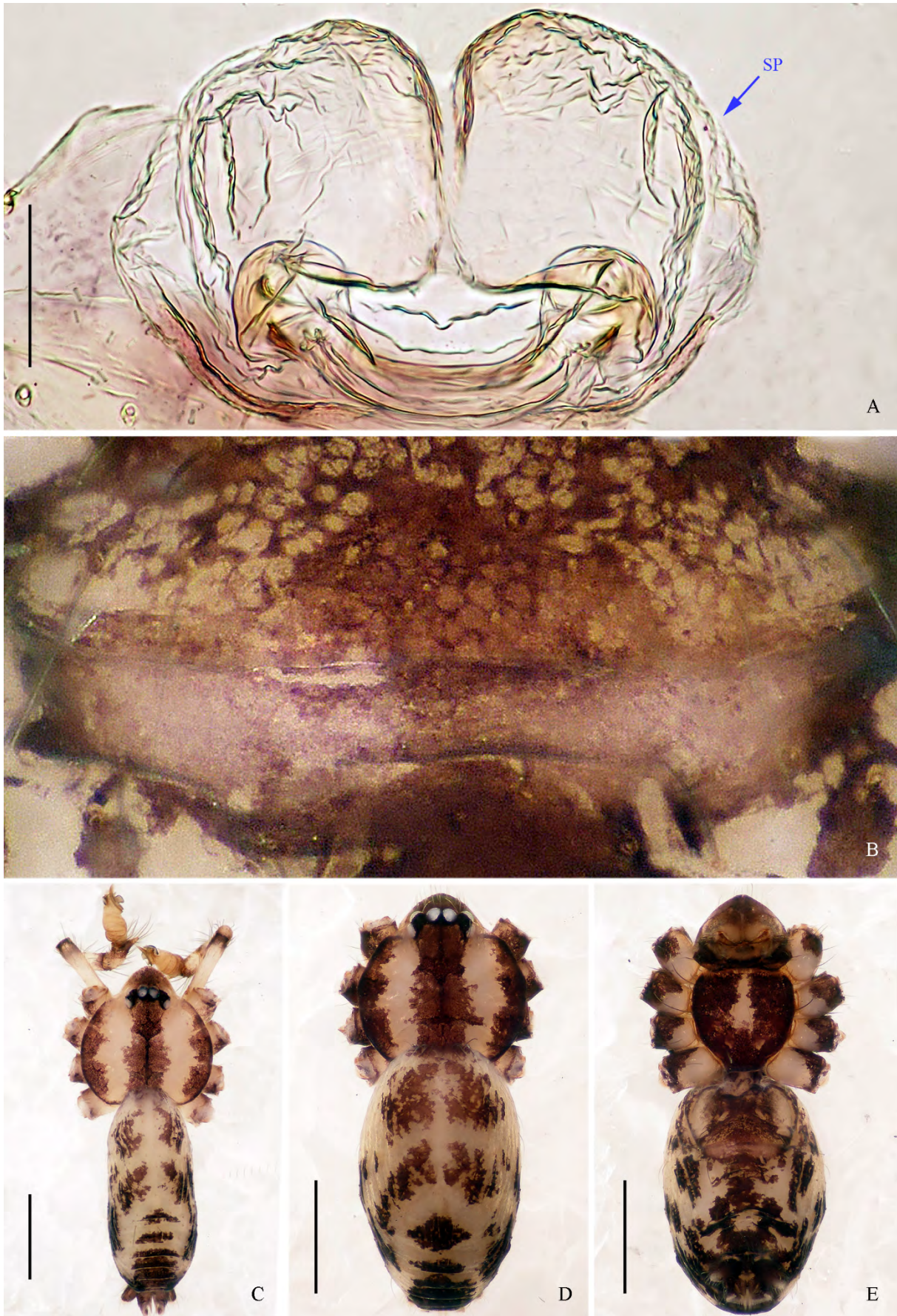


Figure 6. *Qiongocera hongjunensis* Li & Li, **sp. nov.**, male holotype and female paratype. A. Spermathecae, dorsal view. B. Female epigyne, ventral view. C. Male habitus, dorsal view. D. Female habitus, dorsal view. E. Female habitus, ventral view. Scale bars: A = 0.1 mm; C–E = 0.5 mm.



Figure 7. *Relictocera qiya* Li & Li, **sp. nov.**, male holotype. A. Palp, ventral view. B. Palpal bulb, prolateral view. C. Palp, prolateral view. D. Palp, retrolateral view. Scale bars: B–D=0.1 mm.

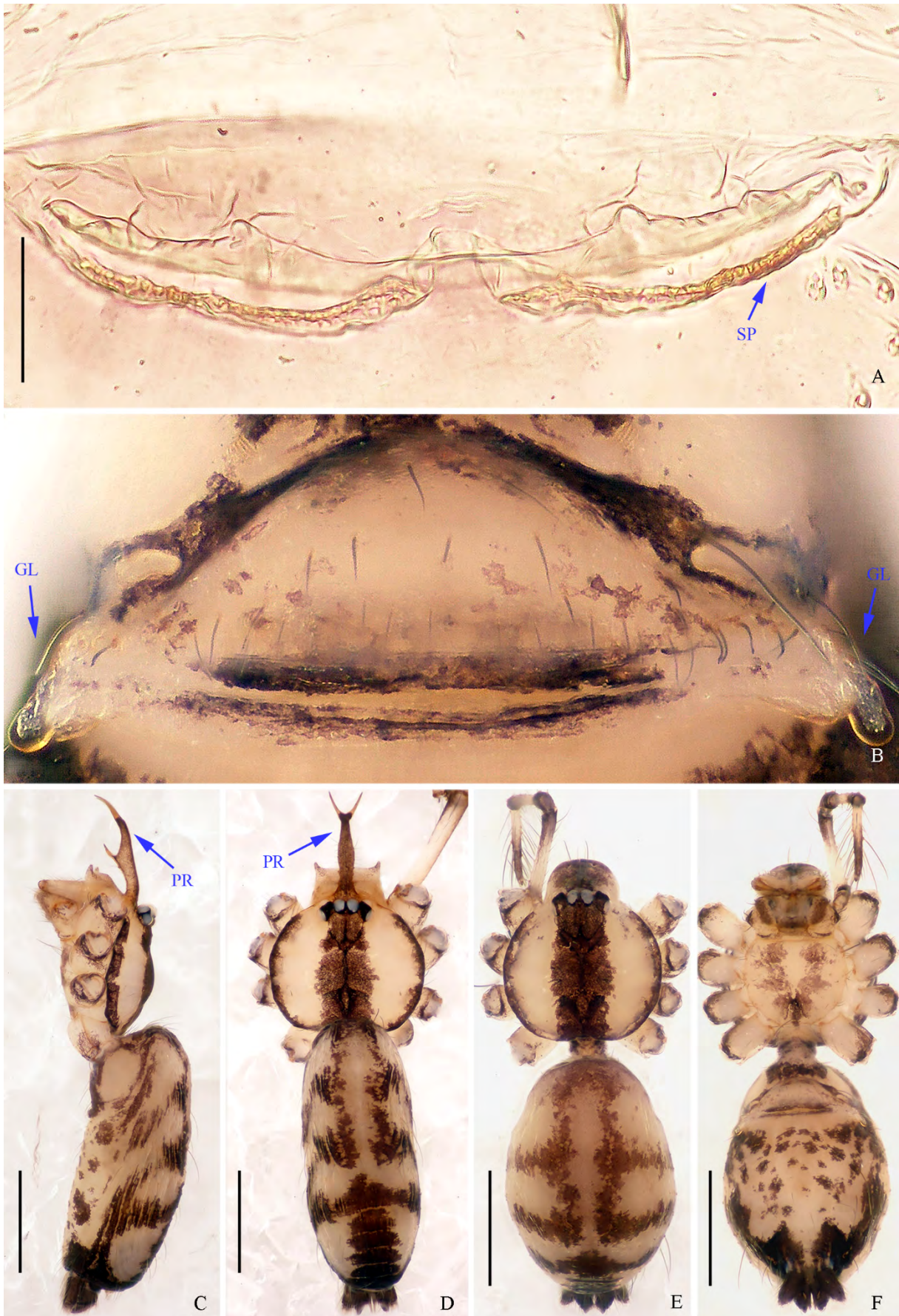


Figure 8. *Relictocera qiyi* Li & Li, **sp. nov.**, male holotype and female paratype. A. Spermathecae, dorsal view. B. Female epigyne, ventral view. C. Male habitus, retrolateral view. D. Male habitus, dorsal view. E. Female habitus, dorsal view. F. Female habitus, ventral view. Scale bars: A=0.05 mm; C–F=0.5 mm.

D). Labium yellow, slanting. Sternum yellow, with a pair of irregular brown bands. Abdomen elongate, yellow, with brown bands dorsally and ventrally. Legs brown, femur and tibia each with white annulation; measurements: I 13.12 (3.60, 0.28, 3.88, 4.30, 1.06), II 8.85 (2.50, 0.27, 2.49, 2.78, 0.81), III 6.99 (2.00, 0.27, 2.05, 2.02, 0.65), IV 6.83 (1.98, 0.28, 1.88, 2.02, 0.67). Palp (Figs 7A–D): tibia and cymbium slender; tibia distinctly more than twice as long as cymbium; cymbium with slender apical protrusion nearly as long as cymbium; bulb yellow, oval; embolus flattened, conductor bifurcate, embolus and conductor both arising distally from bulb but separated basally.

Female. Similar to male in coloration and general features, but slightly smaller and lacking trifurcate clypeal projection. Measurements: total length 2.10; carapace 0.63 long, 0.70 wide; abdomen 1.34 long, 0.76 wide. Leg measurements: I 10.56 (2.75, 0.25, 3.06, 3.44, 1.06), II 6.77 (1.82, 0.25, 1.92, 2.00, 0.78), III 5.14 (1.40, 0.23, 1.41, 1.48, 0.62), IV 8.39 (2.25, 0.25, 2.40, 2.61, 0.88). External genitalic area with pair of translucent lobes laterally (Fig. 8B). Vulva with pair of slender elongate spermathecae (Fig. 8A).

Distribution. Known only from the type locality (Fig. 15).

3.4 Genus *Sinoderces* Li & Li, **gen. nov.**

Type species: *Sinoderces nawanensis* Li & Li, **sp. nov.**

Etymology. The genus name is a combination of “Sino” (refers to Chinese) with the second part of “*Psiloderces*”. Gender is masculine.

Diagnosis. The new genus is distinguished (together with *Thaiderces*) from all other genera by the absence of an apical protrusion on the male cymbium. It is distinguished from *Thaiderces* by the presence of one tooth on the cheliceral retromargin and the long embolus of the genital bulb.

Description. Cheliceral promargin with lamina, retromargin with one tooth or denticle; genital bulb with long embolus, conductor present or absent, if present then embolus and conductor separated basally; female with two pairs of elongate, curved spermathecae (Fig. 10A).

Distribution. China (Guangxi Zhuang Autonomous Region)

Species composition. *Sinoderces nawanensis* Li & Li, **sp. nov.**, *Sinoderces exilis* (Wang & Li, 2013) **comb. nov.**

Sinoderces exilis (Wang & Li, 2013) **comb. nov.**

Psiloderces exilis Wang & Li, 2013: 49, Figs 9A–D, 10A–C, 11A–B, 12A–D.

Material examined. 1 male, 2 females, China, Guangxi Zhuang Autonomous Region, Chongzuo City, Fuwei County, Dongmen Town, Ziyao Village, Yinhe Cave (22°32.939'N, 107°79.210'E; elev. 154 m), 13 July 2011, leg. X. Wang (IZCAS).

Diagnosis. The dark, hook-like conductor and shorter embolus diagnose the male of this species. Females of the two species of *Sinoderces* Li & Li, **gen. nov.** are very similar; the differences are discussed under *S. nawanensis* Li & Li, **sp. nov.**

Description. See Wang & Li (2013).

Comments. This species is transferred to *Sinoderces* Li & Li, **gen. nov.** because it possesses the somatic characters that diagnose the genus.

Distribution. China (Guangxi Zhuang Autonomous Region)

Sinoderces nawanensis Li & Li, **sp. nov.** (Figs 9–10, 15)

Material examined. Holotype male, China, Guangxi Zhuang Autonomous Region, Nanning City, Longan County, Nanxu Town, Nawan Village, cave without name (23°12.528'N, 107°35.020'E; elev. 113 m), 13 May 2015, leg. F. Li & Z. Chen. Paratypes. 1 male, 2 females, same data as holotype (IZCAS).

Etymology. The species name is an adjective referring to the type locality.

Diagnosis. The male of this species is easily recognized by the sickle-shaped embolus (Figs 9A–D). Females of the two species of *Sinoderces* Li & Li, **sp. nov.** are very similar but can be distinguished as follows. The female of this species is diagnosed by the elongate, curved spermathecae which narrow distally (Fig. 10A) (*versus* spermathecae of same width throughout their length in *S. exilis*).

Description. Male (holotype). Total length 2.02; carapace 0.70 long, 0.75 wide; abdomen 1.13 long, 0.63 wide. Carapace round, yellow with some brown bands of differing width (Fig. 10C). Fovea shallow. Chelicerae yellow. Cheliceral promargin with distinct lamina and no teeth, retromargin with one small tooth, posterior surface of fang with 12 small denticles. Clypeus slanting, brown. Labium slanting, brown, triangular. Sternum brown. Abdomen elongate with complex patterns dorsally and ventrally. Legs brown, measurements: I missing, II missing, III 5.09 (1.48, 0.23, 1.52, 1.17, 0.69), IV 7.46 (2.10, 0.26, 2.30,

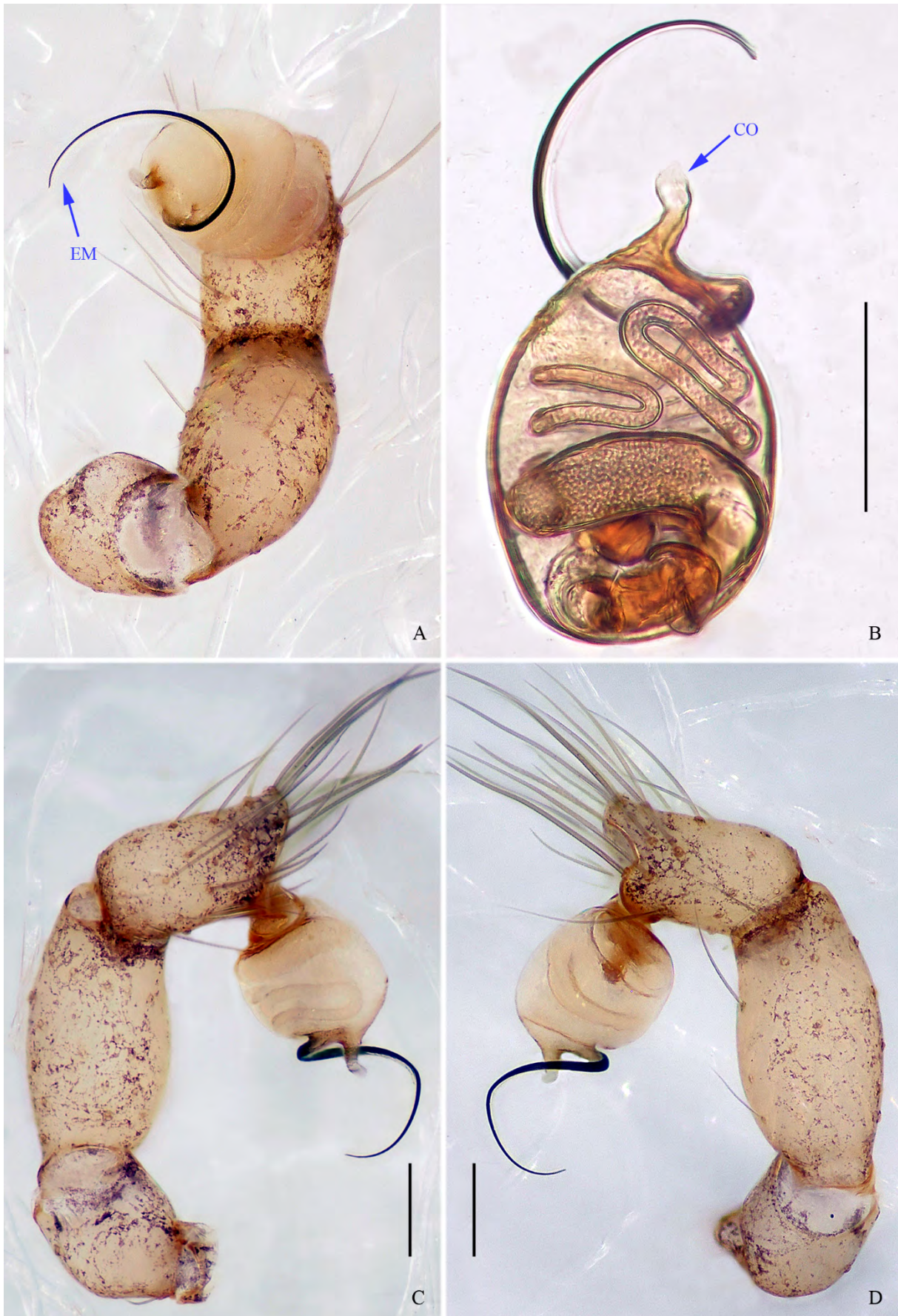


Figure 9. *Sinoderces nawanensis* Li & Li, **sp. nov.**, male holotype. A. Palp, ventral view. B. Palpal bulb, prolateral view. C. Palp, prolateral view. D. Palp, retrolateral view. Scale bars: B–D=0.1 mm.

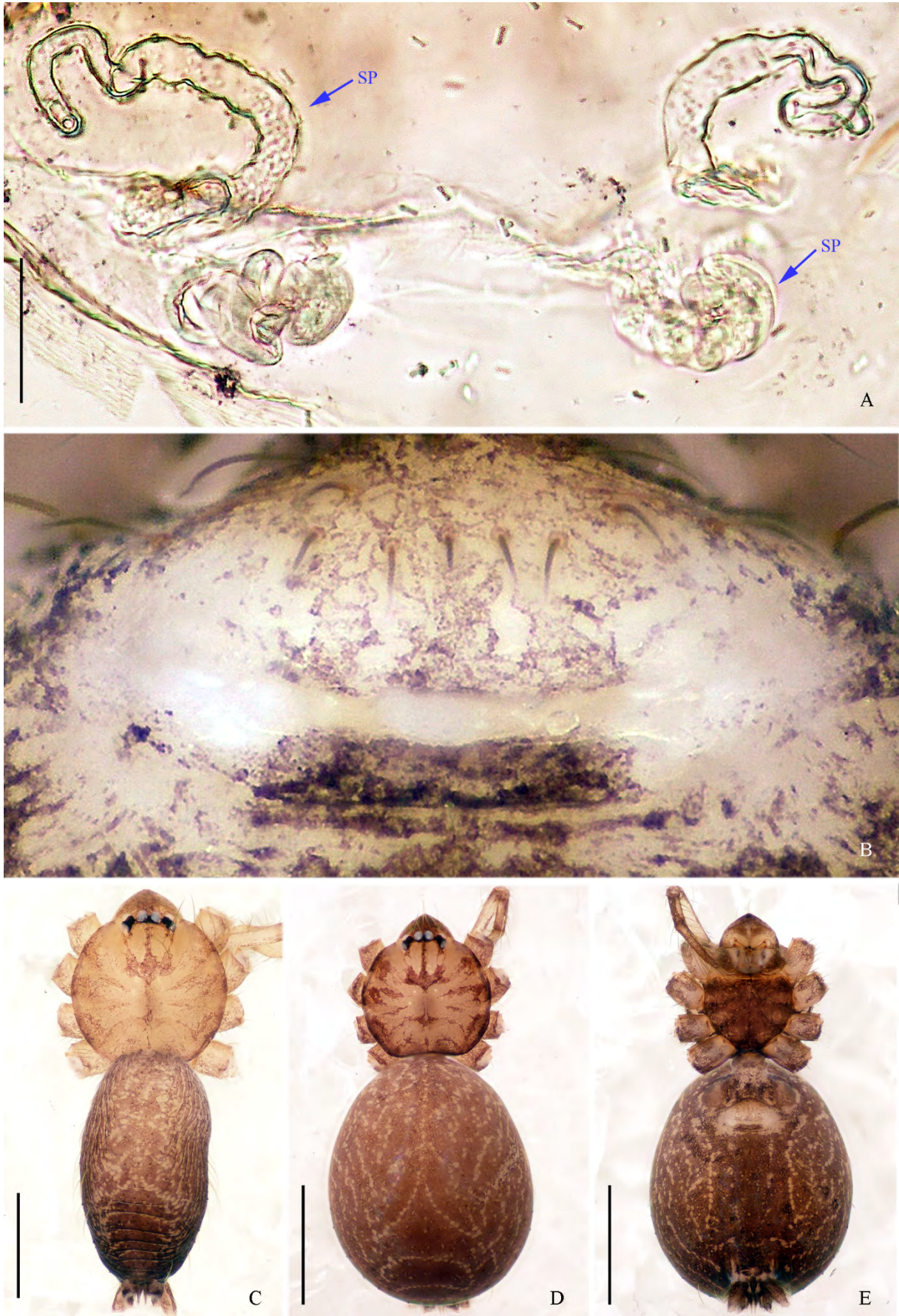


Figure 10. *Sinoderces nawanensis* Li & Li, **sp. nov.**, male holotype and female paratype. A. Spermataecae, dorsal view. B. Female epigyne, ventral view. C. Male habitus, dorsal view. D. Female habitus, dorsal view. E. Female habitus, ventral view. Scale bars: A = 0.05 mm; C–E = 0.5 mm.

1.80, 1.00). Palp (Figs 9A–D): tibia swollen, cymbium with numerous long macrosetae distally; bulb yellow, oval; conductor small, lamina-like; embolus slender, sickle-shaped; conductor and embolus separated basally, arising from bulb distally.

Female. Similar to male in coloration and general features, but slightly larger (Figs 10D–E). Measurements: total length 2.23; carapace 0.65 long, 0.55 wide; abdomen 1.58 long, 1.11 wide. Leg measurements: I 6.31 (1.75, 0.28, 1.88, 1.50, 0.90), II missing, III 4.04 (1.10, 0.23, 1.22, 0.94, 0.55), IV 5.65 (1.41, 0.25, 1.80, 1.33, 0.86). Vulva with two pairs of transparent, distinctly curved, duct-like spermathecae, narrowing distally (Fig. 10A).

Distribution. Known only from the type locality (Fig. 15).

3.5 Genus *Thaiderces* Li & Li, gen. nov.

Type species: *Thaiderces jian* Li & Li, sp. nov.

Etymology. The genus name is a combination of “Thai” (refers to Thailand) with the second part of “*Psiloderces*”. Gender is masculine.

Diagnosis. The new genus is distinguished (together with *Sinoderces*) from all other genera by the absence of an apical protrusion on the male cymbium. It is distinguished from *Sinoderces* by having two teeth on the cheliceral retromargin and the narrow, curved, needle-like tip of embolus.

Description. Cheliceral promargin with dentoid lamina; retromargin with two denticles; male with simple, unmodified cymbium, conductor lacking, embolus arising apically from the bulb, tip of embolus very narrow, curved, needle-like; female with two pairs of spermathecae, one pair longer than the other.

Distribution. Thailand (Yala Province).

Species composition. *Thaiderces jian* Li & Li, sp. nov., *Thaiderces vulgaris* (Deeleman-Reinhold, 1995) **comb. nov.**

Thaiderces jian Li & Li, sp. nov. (Figs 11–12, 15)

Material examined. Holotype male, Thailand, Yala Province, Than To District, evergreen forest in front of Krasaeng Cave entrance (6°10.868'N, 101°11.605'E; elev. 155 m), 10 October 2015, leg. Q. Zhao, G. Zhou & Z. Chen. Paratype. 1 female, same data as holotype (IZCAS).

Etymology. The species name is a noun in apposition derived from the Chinese pinyin “jian” (“simple”) and refers to the simple structure of the male palp.

Diagnosis. The males of the two species of *Thaiderces* Li & Li, **gen. nov.** are very similar but can be distinguished as follows. The embolus of this species is relatively slender basally and the needle-like tip is smoothly curved (Figs 11A–D) (*versus* relatively thick basally and with a slightly sinuous tip in *T. vulgaris*). The female of this species is easily distinguished by the relative length of the pairs of spermathecae: the medial spermathecae are elongate, the lateral spermathecae are greatly reduced (Fig. 12A).

Description. Male (holotype). Total length 1.41; carapace 0.52 long, 0.51 wide; abdomen 0.75 long, 0.44 wide. Carapace round, brown, with two yellow longitudinal bands (Fig. 12C). Fovea shallow, brown. Anterior margin of thoracic region distinctly elevated. Chelicerae yellow with brown spots. Cheliceral promargin with dentoid lamina and no teeth, retromargin with two small teeth, posterior surface of fang with 15 small denticles. Clypeus slanting, pale brown. Labium slanting, brown. Sternum mostly brown with some small yellow areas. Abdomen elongate, light brown, with some yellow patterns dorsally and ventrally. Legs pale brown; measurements: I 5.58 (1.48, 0.20, 1.60, 1.50, 0.80), II 4.54 (1.25, 0.20, 1.25, 1.19, 0.65), III 3.60 (1.00, 0.20, 0.99, 0.94, 0.47), IV 5.31 (1.41, 0.21, 1.53, 1.41, 0.75). Palp (Figs 11A–D): cymbium simple, unmodified; bulb pale yellow, oval; conductor lacking; embolus arising subapically from bulb, with relatively slender base and smoothly curved, needle-like tip.

Female. Similar to male in coloration and general features but slightly larger (Figs 12D–E). Measurements: total length 1.60; carapace 0.61 long, 0.54 wide; abdomen 1.05 long, 0.71 wide. Leg measurements: I missing, II - (1.03, 0.22, 1.17, 1.64, -), III 3.02 (0.80, 0.20, 0.79, 0.82, 0.41), IV missing. Vulva with elongate medial spermathecae and very short lateral spermathecae (Fig. 12A).

Distribution. Known only from the type locality (Fig. 15).

Thaiderces vulgaris (Deeleman-Reinhold, 1995) **comb. nov.** (Figs 13–14, 15)

Psiloderces vulgaris Deeleman-Reinhold, 1995: 18, f. 29–32.

Material examined. 1 male, 1 female, Thailand, Nakhon Nayok Province, Muang District Forest near Lah Rak waterfall (14°17.472'N, 101°14.888'E; elev. 82 m), 13 November 2014, leg. Q. Zhao.

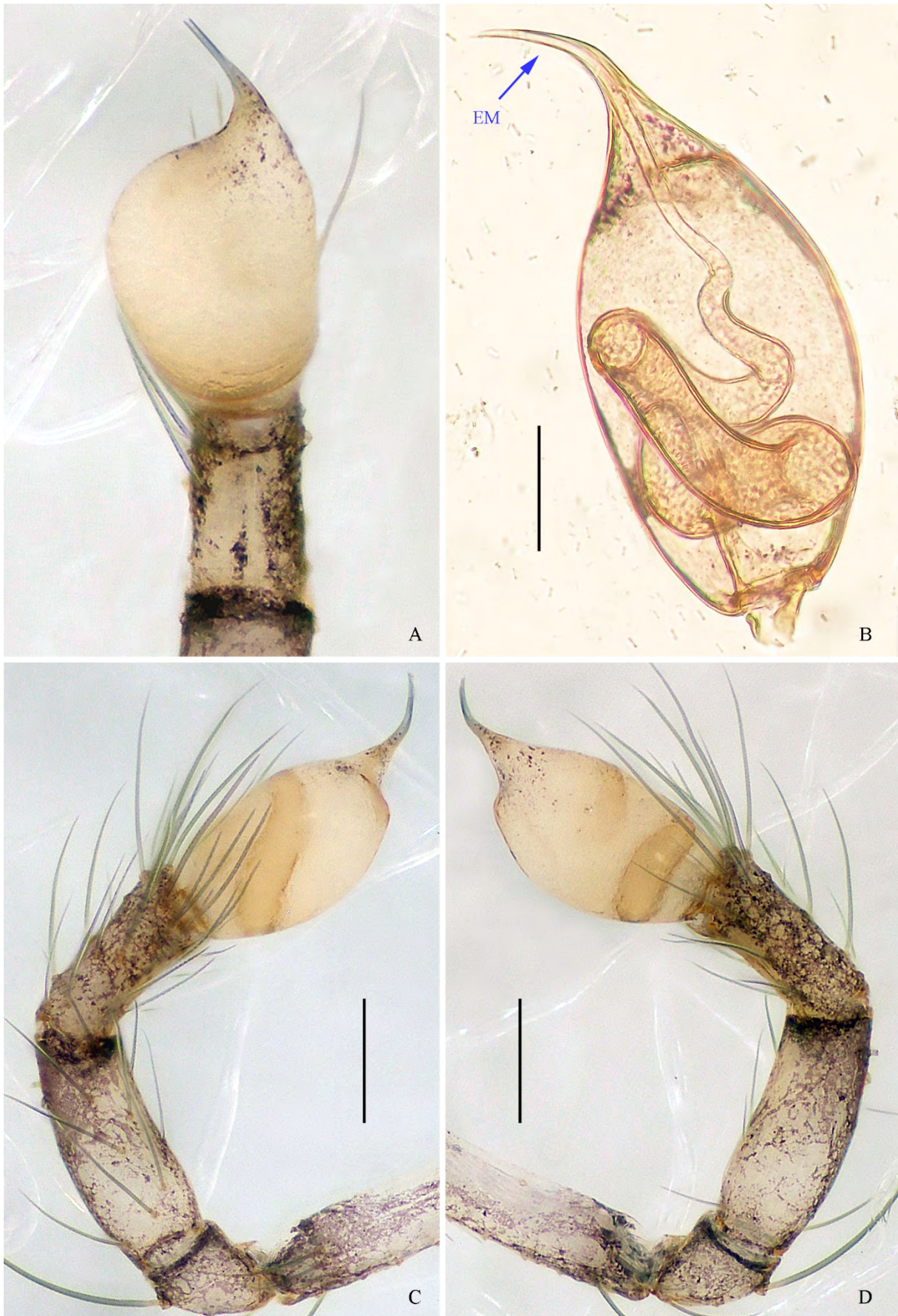


Figure 11. *Thaiderces jian* Li & Li, **sp. nov.**, male holotype. A. Palp, ventral view. B. Palpal bulb, prolateral view. C. Palp, prolateral view. D. Palp, retrolateral view. Scale bars: B=0.05 mm; C–D=0.1 mm.

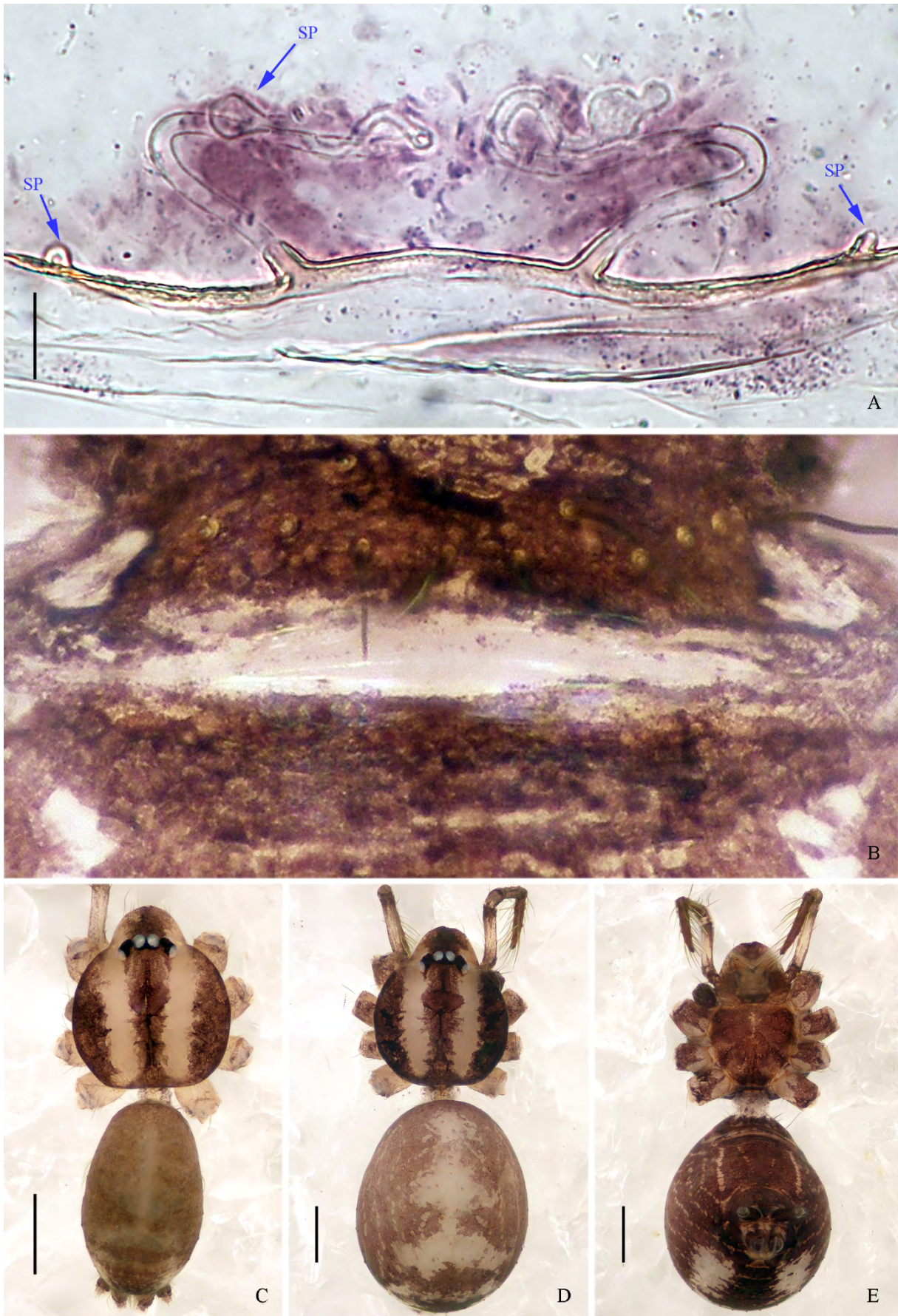


Figure 12. *Thaiderces jian* Li & Li, **sp. nov.**, male holotype and female paratype. A. Spermathecae, dorsal view. B. Female epigyne, ventral view. C. Male habitus, dorsal view. D. Female habitus, dorsal view. E. Female habitus, ventral view. Scale bars: A=0.02 mm; C–E=0.5 mm.

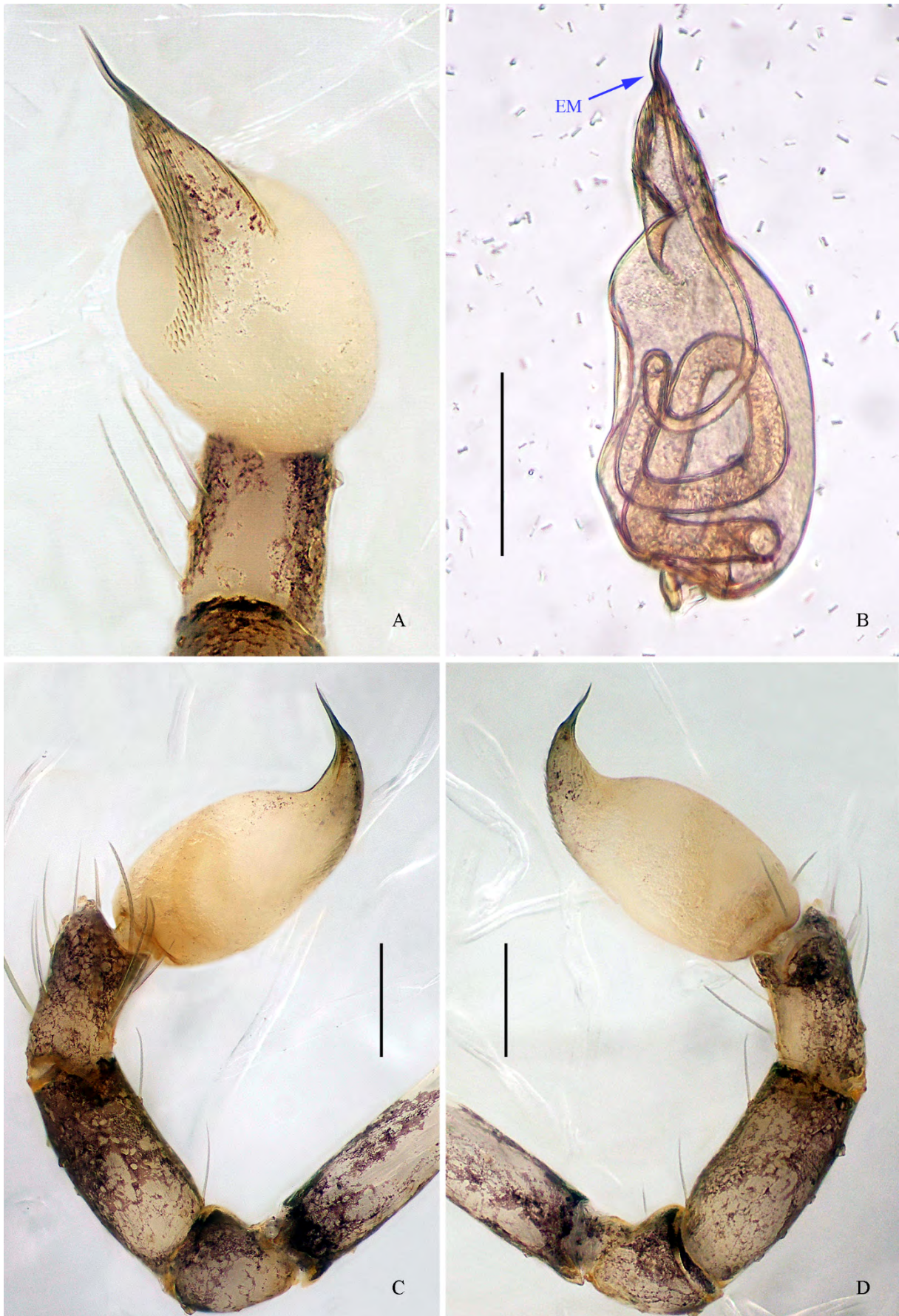


Figure 13. *Thaiderces vulgaris* (Deeleman-Reinhold, 1995) **comb. nov.**, male holotype. A. Palp, ventral view. B. Palpal bulb, prolateral view. C. Palp, prolateral view. D. Palp, retrolateral view. Scale bars: B–D=0.1 mm.

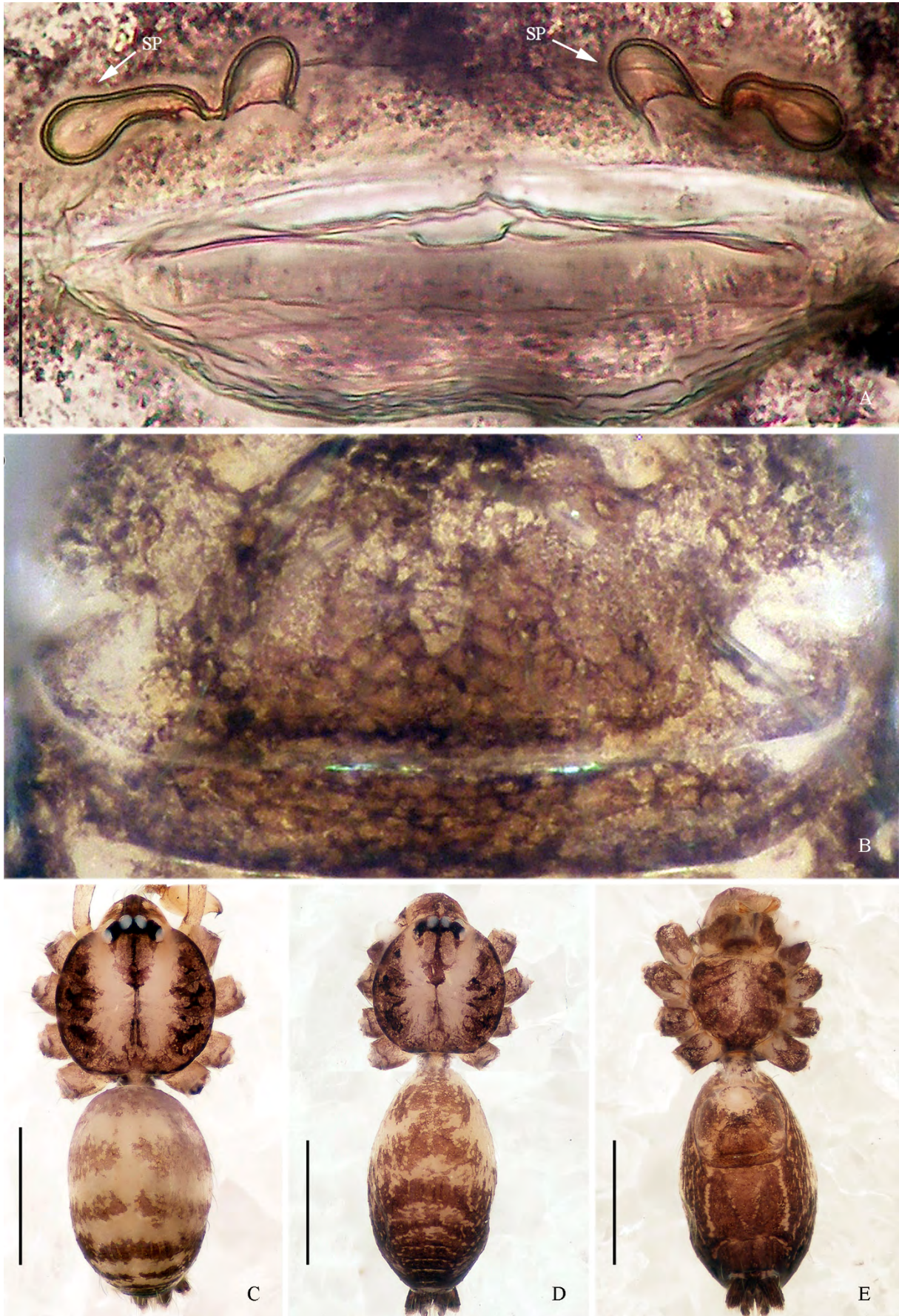


Figure 14. *Thaiderces vulgaris* (Deeleman-Reinhold, 1995) **comb. nov.**, male holotype and female paratype. A. Spermathecae, dorsal view. B. Female epigyne, ventral view. C. Male habitus, dorsal view. D. Female habitus, dorsal view. E. Female habitus, ventral view. Scale bars: A=0.05 mm; C–E=0.5 mm.

Diagnosis. The males of the two species of *Thaiderces* Li & Li, **gen. nov.** are very similar; distinguishing them is discussed under *T. jian* Li & Li, **sp. nov.** The female of this species is easily distinguished by the two pairs of relatively short spermathecae with the lateral pair longer than the medial pair (Fig. 14A).

Description. Described by Deeleman-Reinhold (1995).

Comments. This species is transferred to *Thaiderces* Li & Li, **gen. nov.** because it possesses the somatic characters that diagnose the genus.

Distribution. Thailand (Nakhon Nayok Province).

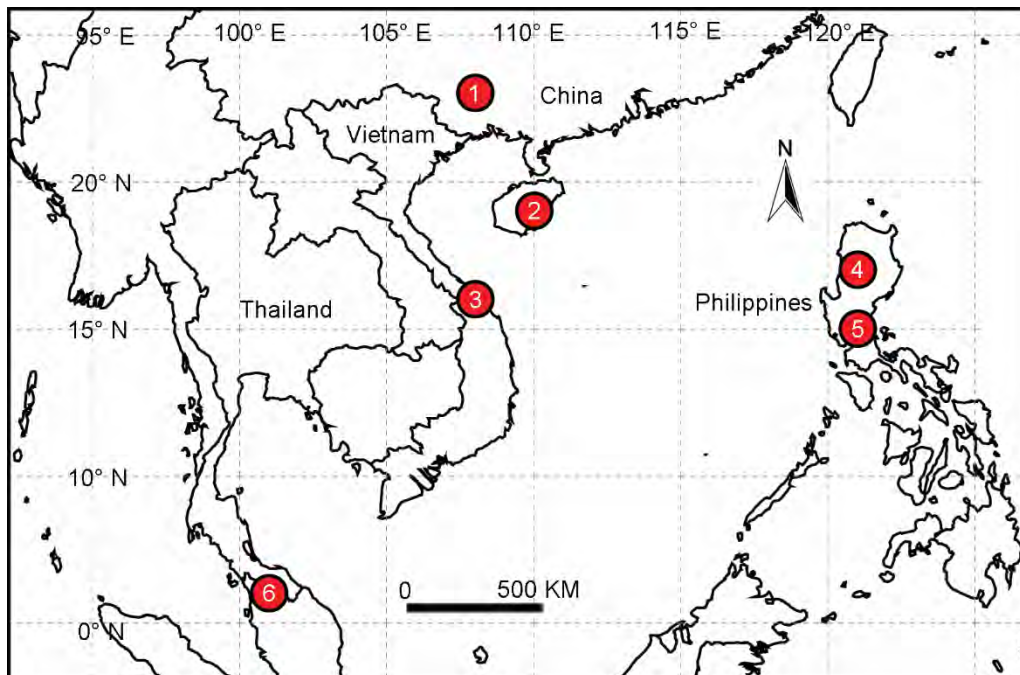


Figure 15. Known distribution of six new ochyroceratids from Southeast Asia. 1. *Sinoderces nawanensis* Li & Li, **sp. nov.** 2. *Qiongocera hongjunensis* Li & Li, **sp. nov.** 3. *Relictocera qi yi* Li & Li, **sp. nov.** 4. *Luzonacera duan* Li & Li, **sp. nov.** 5. *Luzonacera chang* Li & Li, **sp. nov.** 6. *Thaiderces jian* Li & Li, **sp. nov.**

4 Sequences and COI genetic distances

In total seven COI sequences (651 bp) were determined. Based on the 651 bp aligned sequences, the COI uncorrected K2P-distance between *Luzonacera chang* Li & Li, **sp. nov.** and *Luzonacera duan* Li & Li, **sp. nov.** is 10.5%, and between *Sinoderces nawanensis* Li & Li, **sp. nov.** and *Sinoderces exilis* (Wang & Li, 2013), **comb. nov.** is 8.7%. In addition, the average K2P-distance between the five genera (*Luzonacera* Li & Li, **gen. nov.**, *Qiongocera* Li & Li, **gen. nov.**, *Relictocera* Li & Li, **gen. nov.**, *Sinoderces* Li & Li, **gen. nov.**, and *Thaiderces* Li & Li, **gen. nov.**) is 20.8%.

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References

Deeleman-Reinhold, C.L. 1995. The Ochyroceratidae of the Indo-Pacific region (Araneae). *The Raffles Bulletin of Zoology*, Supplement,

2: 1–103.

- Dupérré, N. 2015. Descriptions of twelve new species of *Ochyroceratids* (Araneae, Ochyroceratidae) from mainland Ecuador. *Zootaxa*, 3956(4): 451–475.
- Folmer, O., Black, M., Hoeh, W., Lutz, R., Vrijenhoek, R. 1994. DNA primers for amplification of mitochondrial cytochrome c oxidase subunit I from diverse metazoan invertebrates. *Molecular Marine Biology and Biotechnology*, 3: 294–299.
- Kumar, S., Stecher, G., Tamura, K. 2016. MEGA7: Molecular Evolutionary Genetics Analysis version 7.0 for bigger datasets. *Molecular Biology and Evolution*, 33(7): 1870–1874.
- Li, F., Li, S., Jäger, P. 2014. Six new species of the spider family Ochyroceratidae Fage, 1912 (Arachnida: Araneae) from Southeast Asia. *Zootaxa*, 3768(2): 119–138.
- Selden, P., Penney, D. 2010. Fossil spiders. *Biological Reviews*, 85: 171–206.
- Tong, Y., Li, S. 2007. First records of the family Ochyroceratidae (Arachnida: Araneae) from China, with descriptions of a new genus and eight new species. *The Raffles Bulletin of Zoology*, 55: 63–76.
- Valdez-Mondragón, A. 2017. On the poorly known haplogynae spiders of the genus *Ochyrocera* Simon (Araneae, Ochyroceratidae) from Mexico: description of two new species with an updated identification key for Mexican species. *Zootaxa*, 4226(2): 194–204.
- Wang, C., Li, S. 2013. Four new species of the subfamily Psilodercinae (Araneae: Ochyroceratidae) from southwest China. *Zootaxa*, 3718: 39–57.
- World Spider Catalog. 2017. Natural History Museum Bern. version 18.0. Available from <http://wsc.nmbe.ch> (accessed 22 May 2017).
- Wunderlich, J. 2008. The dominance of ancient spider families of the Araneae: Haplogyne in the Cretaceous, and the late diversification of advanced ecribellate spiders of the Entelegynae after the Cretaceous-tertiary boundary extinction events, with descriptions of new families. *Beiträge zur Araneologie*, 5: 524–675.
- Wunderlich, J. 2012. On the fossil spider (Araneae) fauna in Cretaceous ambers, with descriptions of new taxa from Burmese (Burma) and Jordan, and on the relationships of the superfamily Leptonetoidea. *Beiträge zur Araneologie*, 7: 157–232.
- Wunderlich, J. 2015. On the evolution and the classification of spiders the Mesozoic spider and descriptions of new Cretaceous taxa mainly in amber from Burmese (Burma) (Arachnida: Araneae) faunas. *Beiträge zur Araneologie*, 9: 21–408.
- Zhang, Y., Li, S. 2014. A spider species complex revealed high cryptic diversity in South China caves. *Molecular Phylogenetics and Evolution*, 79: 353–35.