

## ORIGINAL ARTICLE

# Three new species of the spider genus *Chorizopes* O. Pickard-Cambridge, 1871 (Araneae: Araneidae) from China

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**Abstract** Three new *Chorizopes* species are diagnosed and described based on specimens collected in China, namely *C. jianfengensis* **sp. nov.** (♂♀), *C. liae* **sp. nov.** (♂♀) and *C. yinae* **sp. nov.** (♂♀). Distributional data, detailed morphological characteristics, and illustrations of habitus and genital organs are provided.

**Key words** Taxonomy, morphology, orb-weaver spider, South China.

## 1 Introduction

The genus *Chorizopes* was established by O. Pickard-Cambridge in 1871 based on the type species, *C. frontalis* O. Pickard-Cambridge, 1871, known from Sri Lanka, and currently contains 26 species distributed in Asia and Madagascar (WSC, 2020). All of these species were described as new originally, except for *C. calciope* which was transferred from *Araneus* Clerck, 1757, and most of them were sporadically described and have very limited ranges: 23 species are regional endemics and known from a single country, while *C. khanjanus* Tikader, 1965 is from two countries and *C. frontalis* and *C. nipponicus* Yaginuma, 1963 are from three countries. The genus is rather poorly studied as it has never been revised and more than half of its species (15) are known only from single-sex: 14 from females and one from male. Due to lacking diagnostic illustrations, three species cannot be confidently identified. To date, the genus shows the highest diversity in India (12 species present while 10 endemics), followed by China (10 species while eight endemics).

While examining the specimens of *Chorizopes* from Yunnan, Guizhou and Hainan of China, three new species were recognized as new to science. The present paper is to describe them.

## 2 Materials and methods

Specimens were mainly collected by beating shrubs. All specimens were preserved in 75% ethanol and are deposited in the museum of Tongren University (TRU).

The specimens were examined with an Olympus SZ51 stereomicroscope. After dissecting from the body, epigyne was cleared in trypsin enzyme solution before examination and photography. Left male palps were used for description and illustration. Photos of copulatory organs were taken with a Kuy Nice CCD mounted on an Olympus BX51 compound microscope. Compound focus images were generated using Helicon Focus 6.7.1 software®. The terminology and methods of description and illustration followed Mi *et al.* (2016).

All measurements are given in millimeters. Leg measurements are given as total length (femur, patella + tibia,

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metatarsus, tarsus). The abbreviations used in the text and figures as follow.

Eyes:

ALE—anterior lateral eye;

AME—anterior median eye;

MOA—median ocular area;

PLE—posterior lateral eye;

PME—posterior median eye.

Copulatory organs:

C—conductor;

CD—copulatory duct;

CO—copulatory opening;

E—embolus;

FD—fertilization duct;

MA—median apophysis;

PC—paracymbium;

S—spermathecae;

SC—scape;

TA—terminal apophysis;

TgA—tegulum apophysis.

### 3 Taxonomy

Family Araneidae Clerck, 1757

#### Genus *Chorizopes* O. Pickard-Cambridge, 1871

*Chorizopes* O. Pickard-Cambridge, 1871: 738.

Type species: *Chorizopes frontalis* O. Pickard-Cambridge, 1871.

#### *Chorizopes jianfengensis* sp. nov. (Figs 1–2, 7A–B, 8A)

Type material. Holotype. ♂ (TRU-Araneidae-021), China: Hainan Province, Ledong County, Jianfeng Township, Jianfengling National Nature Reserve, Tianchi (18°44'27.00"N, 108°57'29.57"E; elev. 856 m), 11 April 2019, Cheng Wang, Yuanfa Yang leg. Paratypes. 1 ♀ (TRU-Araneidae-022), the same data as holotype; 2 ♂ (TRU-Araneidae-023–024), Yulingu (18°44'47.39"N, 108°55'45.70"E; elev. 634 m), 13 April 2019, Cheng Wang, Yuanfa Yang leg.

Etymology. The species name is derived from the name of the type locality; adjective.

Diagnosis. The male of this new species can be distinguished from all known congeneric species by having a short median apophysis not extending beyond bulb margin in prolateral view (Figs 1A, 7A) and by the shape of the terminal apophysis. The female of this new species is similar to that of *C. nipponicus* Yaginuma, 1963 in the shape of habitus and the form of copulatory ducts, but can be distinguished from the latter by: 1) the spermathecae touching each other medially in dorsal view (Figs 1F, 8A), vs. well separated in *C. nipponicus* (Yaginuma, 1963, fig. 7); 2) the copulatory ducts about one-third the spermathecal diameter (Figs 1F, 8A), vs. less than one-fifth the spermathecal diameter in *C. nipponicus* (Yaginuma, 1963, fig. 7).

Description. Male (TRU-Araneidae-021). Total length 2.95. Carapace length 1.49, width 1.05; abdomen length 1.67, width 1.26. Eye sizes and interdistances: AME 0.13, ALE 0.07, PME 0.09, PLE 0.09, AME–AME 0.21, AME–ALE 0.65, PME–PME 0.27, PME–PLE 0.68, MOA length 0.34 with anterior width 0.34 and posterior width 0.40. Leg measurements: I 3.39 (0.98 + 1.09 + 0.83 + 0.49), II 3.48 (1.02 + 1.17 + 0.80 + 0.49), III 2.24 (0.66 + 0.73 + 0.44 + 0.41), IV 3.44 (0.94 + 1.22 + 0.78 + 0.50). Carapace (Figs 2A, 2C) red-brown, paler medially, re-curved at anterior margin and elevated in cephalic region, covered with sparse brown hairs. Chelicerae (Fig. 1C) brown, with six promarginal teeth. Sternum triangular, yellow-brown. Gnathocoxae and labium yellow-brown. Legs yellow-brown with dark grey annuli. Abdomen (Figs 2A, 2C) oval, with a pair of lateral tubercles and two vertically arranged caudal tubercles, dorsum yellow to brown, with pairs of anterior yellow spots and a pair of median white spots, covered with sparse brown and white hairs; venter pale brown, darker medially, with a pair of longitudinal lateral bands covered by white dots. Spinnerets yellow.

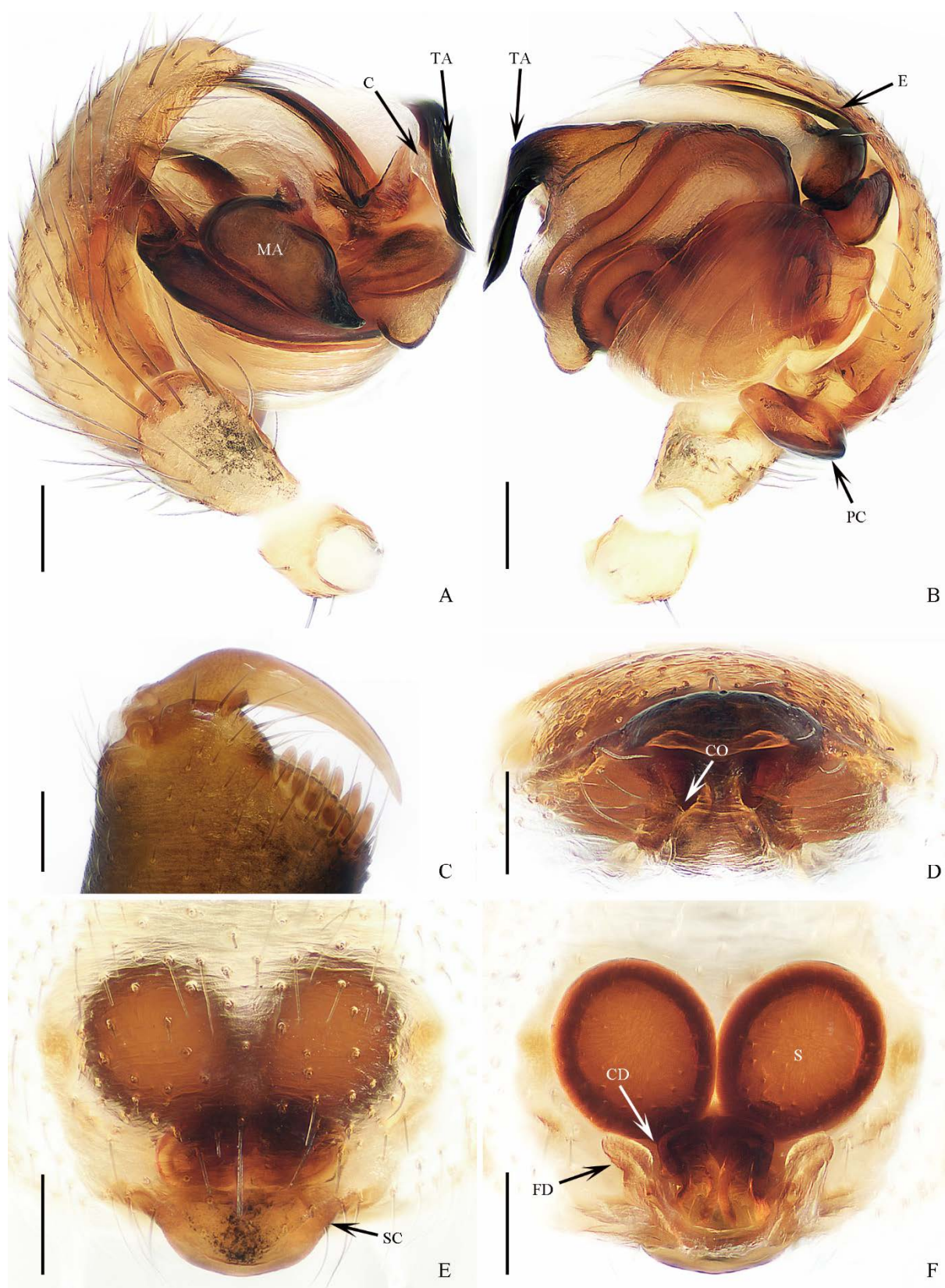


Figure 1. *Chorizopes jianfengensis* sp. nov. A–C. Male, holotype. A. Left palp, prolateral view; B. *ditto*, retrolateral view; C. left chelicerae, prolateral view. D–F. Female, paratype. D. Epigyne, posterior view; E. *ditto*, ventral view; F. vulva, dorsal view. Abbreviations: C—conductor; CD—copulatory duct; CO—copulatory opening; E—embolus; FD—fertilization duct; MA—median apophysis; PC—paracymbium; S—spermathecae; SC—scape; TA—terminal apophysis. Scale bars = 0.1 mm.





Figure 2. *Chorizopes jianfengensis* sp. nov. A. Male habitus, dorsal view, holotype. B. Female habitus, dorsal view, paratype. C. Male habitus, lateral view, holotype. D. Female habitus, lateral view, paratype. Scale bars=0.5 mm.

Palp (Figs 1A–B, 7A–B). Patellar pale, with a dorsal bristle; cymbium hairy; paracymbium flattened; bulb almost spherical, with an acute process near conductor (see gray arrow in Fig. 7A); median apophysis long-elliptical anterior-medially, and acutely narrowed and sclerotized posteriorly, with a slightly pointed tip directed towards position of 4 o'clock in prolateral view; terminal apophysis strongly sclerotized and curved at base, enveloped median-posteriorly and pointed apically; embolus slender, originated from 2 o'clock position of bulb in retrolateral view; conductor membranous, lamelliform, terminally overlapped with terminal apophysis in prolateral view.

Female (TRU-Araneidae-022). Total length 3.19. Carapace length 1.65, width 1.36; abdomen length 1.83, width 1.47. Eye sizes and interdistances: AME 0.12, ALE 0.07, PME 0.09, PLE 0.08, AME–AME 0.24, AME–ALE 0.69, PME–PME 0.29, PME–PLE 0.76, MOA length 0.37 with anterior width 0.37 and posterior width 0.43. Leg measurements: I 3.61 (1.05 + 1.22 + 0.83 + 0.51), II 3.68 (1.10 + 1.24 + 0.83 + 0.51), III 2.61 (0.85 + 0.83 + 0.49 + 0.44), IV 3.81 (1.15 + 1.32 + 0.81 + 0.53). Habitus (Figs 2B, 2D) similar to male except anterior edge of carapace straight, cephalic region paler and dorsum of abdomen darker.

Epigyne (Figs 1D–F, 8A) slightly longer than wide, with a labiate posterior scape slightly wider than long; copulatory openings posteriorly situated, separated from each other; copulatory ducts thick, ascending before strongly twisted medially, and then extending as re-curved arcs to connect with posterior edge of spermathecae; spermathecae spherical and touching each other medially; fertilization ducts elongated, originating from base of copulatory ducts, curved and hook-shaped posteriorly.

Distribution. China (Hainan) (Fig. 9).

#### *Chorizopes liae* sp. nov. (Figs 3–4, 7C–D, 8B)

Type material. Holotype. ♂ (TRU-Araneidae-025), China: Yunnan Province, Ruili City, Ruili botanical garden (24°47'00"N, 97°56'58.00"E; elev. 1142 m), 22–25 August 2018, Feng'e Li leg. Paratypes. 1♂2♀ (TRU-Araneidae-026–028), the same data as holotype.

Etymology. The specific name is a patronym after Feng'e Li, the collector of the new species; name in genitive case.

Diagnosis. The new species is similar to *C. longus* Mi, Wang & Peng, 2016 by its copulatory organs, but can be distinguished from the latter by: 1) the median apophysis almost as long as width (Figs 3A, 7C), *vs.* about three times longer than width in *C. longus* (Mi *et al.*, 2016, fig. 17); 2) the bulb having a lamellar process near the base of median apophysis in retrolateral view (see red arrow in Fig. 3A and gray arrow in Fig. 7C), *vs.* having a spur near the base of median apophysis in *C. longus* (Mi *et al.*, 2016, fig. 17). Females of these two species are very similar and almost indistinguishable, but they differ in the shape of spermathecae, pyriform in *C. liae* sp. nov. (Figs 3F, 8B), but spherical in *C. longus* (Mi *et al.*, 2016, fig. 20).

Description. Male (TRU-Araneidae-025). Total length 3.38. Carapace length 1.65, width 1.17; abdomen length 2.00, width 1.27. Eye sizes and interdistances: AME 0.12, ALE 0.08, PME 0.08, PLE 0.09, AME–AME 0.20, AME–ALE 0.61, PME–PME 0.30, PME–PLE 0.63, MOA length 0.32 with anterior width 0.32 and posterior width 0.40. Leg measurements: I 4.17 (1.29 + 1.36 + 1.01 + 0.51), II 4.26 (1.32 + 1.44 + 0.99 + 0.51), III 2.50 (0.73 + 0.85 + 0.51 + 0.41), IV 3.95 (1.22 + 1.39 + 0.85 + 0.49). Carapace (Figs 4A, 4C) yellow-brown anteriorly and dark-brown posteriorly, re-curved at anterior margin and elevated in cephalic region, bearing short brown hairs. Chelicerae (Fig. 3C) red-brown, with eight promarginal teeth. Sternum triangular, yellow-brown. Gnathocoxae and labium yellow-brown basally, and gray terminally. Legs pale yellow to yellow, with dark grey annuli. Abdomen (Figs 4A, 4C) oval, with a pair of lateral tubercles and two vertically arranged caudal tubercles, dorsum pale-brown, darker laterally, with a pair of white spots followed by a pair of indistinct white stripes medially, and pairs of pale-brown spots laterally, covered with short hairs; venter pale brown, darker medially, with a pair of longitudinal lateral bands covered by white dots. Spinnerets yellow, hairy.

Palp (Figs 3A–B, 7C–D). Patella yellow, with a dorsal bristle; paracymbium red-brown, flattened; median apophysis well developed, broadening anterior-medially, with a knob process at prolateral edge, and two little cuspidal apophyses terminally; bulb having a lamellar structure near base of median apophysis; conductor membranous, lamelliform; embolus slender, partly covered by terminal apophysis; terminal apophysis well-developed, strongly curved terminally touching with conductor apically.

Female (TRU-Araneidae-026). Total length 4.38. Carapace length 1.86, width 1.48; abdomen length 2.62, width 1.69. Eye sizes and interdistances: AME 0.12, ALE 0.07, PME 0.8, PLE 0.08, AME–AME 0.24, AME–ALE 0.70, PME–PME 0.30, PME–PLE 0.77, MOA length 0.34 with anterior width 0.34 and posterior width 0.39. Leg measurements: I 4.05 (1.17 + 1.39 + 1.00 + 0.49), II 4.25 (1.29 + 1.44 + 1.01 + 0.51), III 2.64 (0.80 + 0.85 + 0.58 + 0.41), IV 4.30 (1.34 + 1.49 + 0.98 + 0.49). Habitus (Figs 4B, 4D) as in male except for anterior edge of carapace being straight and darker.



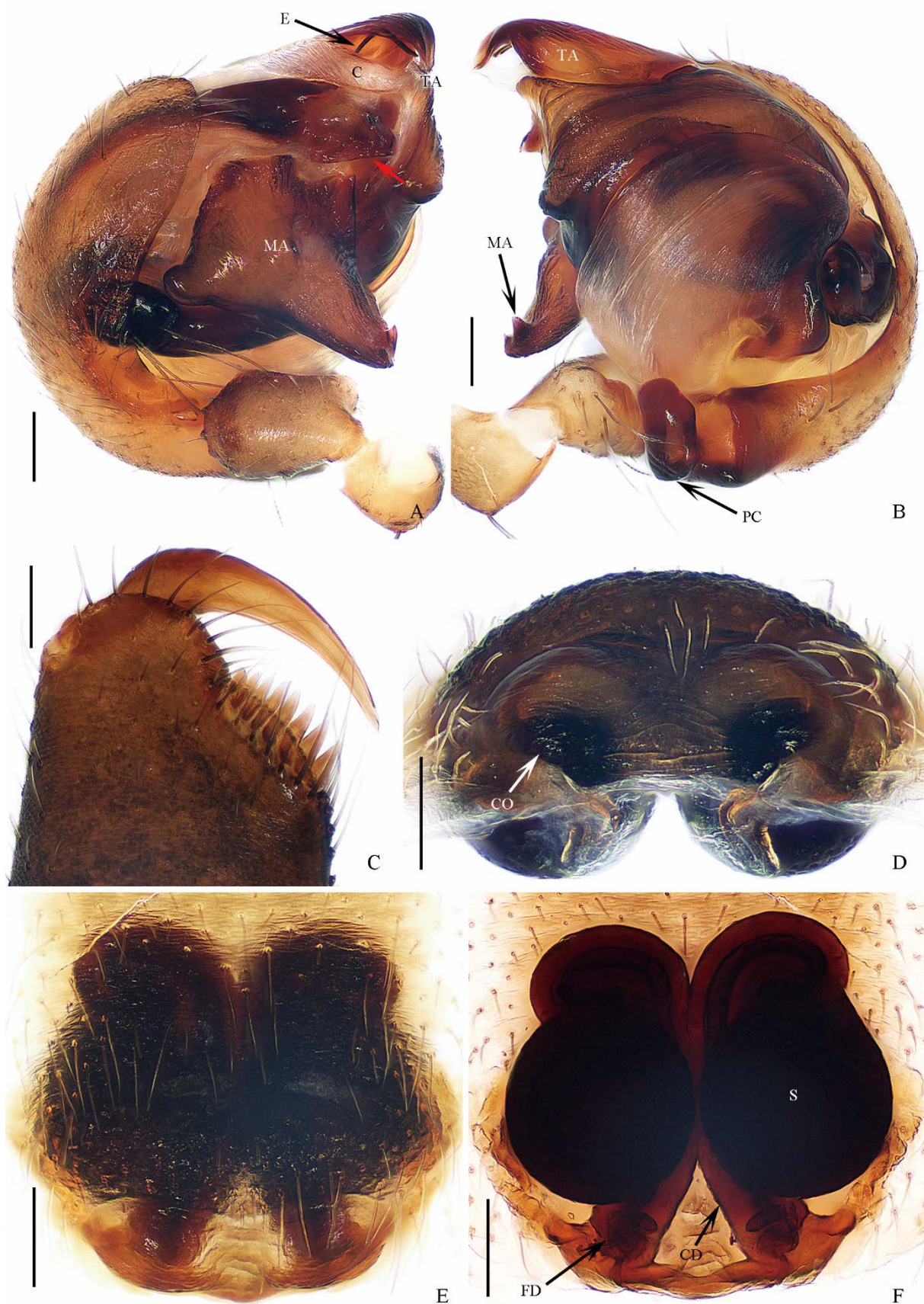


Figure 3. *Chorizopes liae* sp. nov. A–C. Male, holotype. A. Left palp, prolateral view; B. ditto, retrolateral view; C. left chelicerae, prolateral view. D–F. Female, paratype. D. Epigyne, posterior view; E. ditto, ventral view; F. vulva, dorsal view. Abbreviations: C—conductor; CD—copulatory duct; CO—copulatory opening; E—embolus; FD—fertilization duct; MA—median apophysis; PC—paracymbium; S—spermathecae; SC—scape; TA—terminal apophysis. Scale bars = 0.1 mm.





Figure 4. *Chorizopes liae* sp. nov. A. Male habitus, dorsal view, holotype. B. Female habitus, dorsal view, paratype. C. Male habitus, lateral view, holotype. D. Female habitus, lateral view, paratype. Scale bars = 0.5 mm.



Epigyne (Figs 3D–F, 8B) slightly longer than wide, copulatory openings posteriorly located, arciform, separated from each other by 1/3 width of epigyne; copulatory ducts long and thick, ascending anteriorly and then coiled a half-circle continuing spiral a circle to connect with anterior edge of spermathecae; fertilization ducts posteriorly located, elongated, sinusoid.

Distribution. China (Yunnan) (Fig. 9).

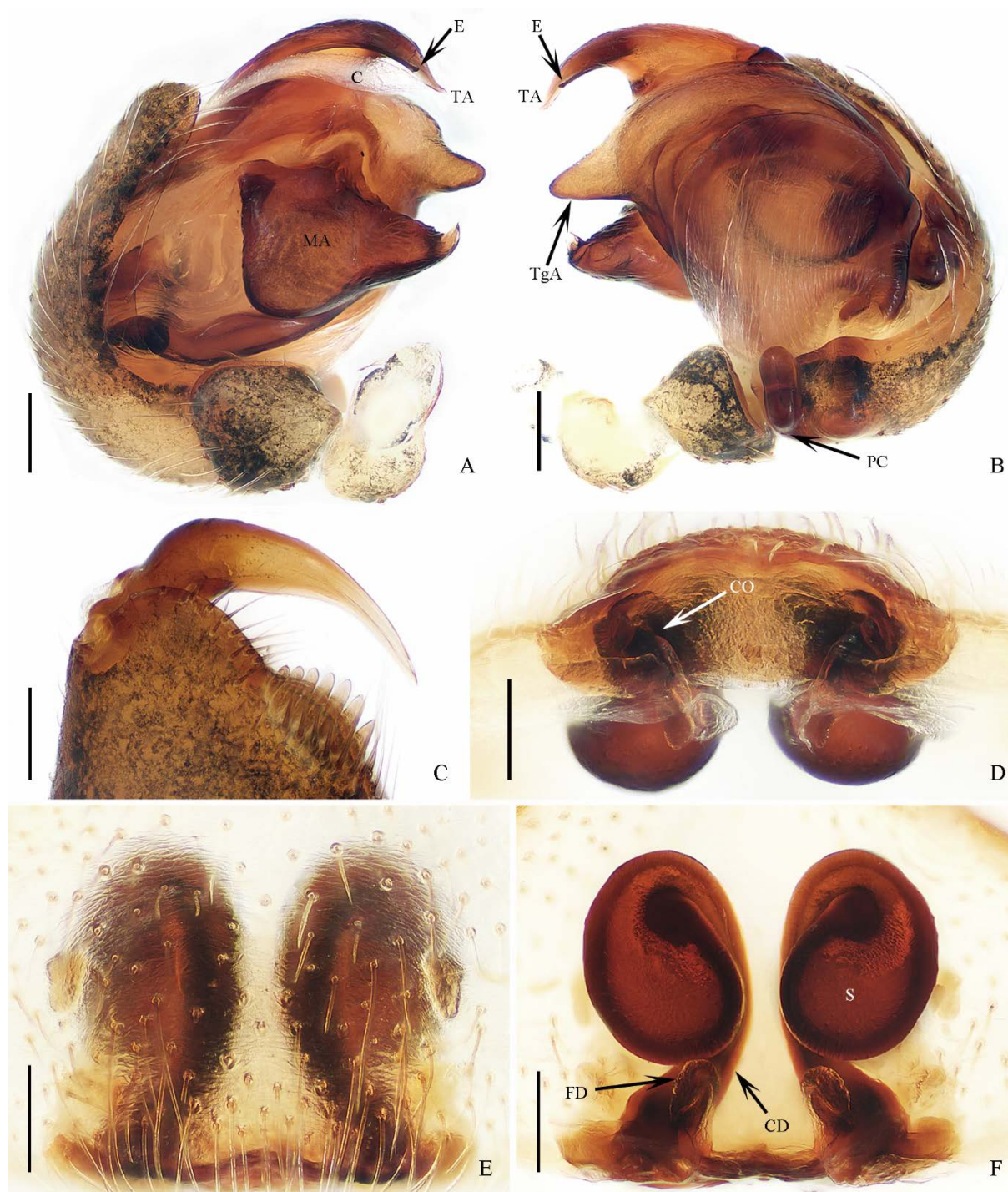


Figure 5. *Chorizopes yinae* sp. nov. A–C. Male, holotype. A. Left palp, prolateral view; B. *ditto*, retrolateral view; C. left chelicerae, prolateral view. D–F. Female, paratype. D. Epigyne, posterior view; E. *ditto*, ventral view; F. vulva, dorsal view. Abbreviations: C—conductor; CD—copulatory duct; CO—copulatory opening; E—embolus; FD—fertilization duct; MA—median apophysis; PC—paracymbium; S—spermathecae; SC—scape; TA—terminal apophysis; TgA—tegulum apophysis. Scale bars=0.1 mm.





Figure 6. *Chorizopes yinae* sp. nov. A. Male habitus, dorsal view, holotype. B. Female habitus, dorsal view, paratype. C. Male habitus, lateral view, holotype. D. Female habitus, lateral view, paratype. Scale bars=0.5 mm.

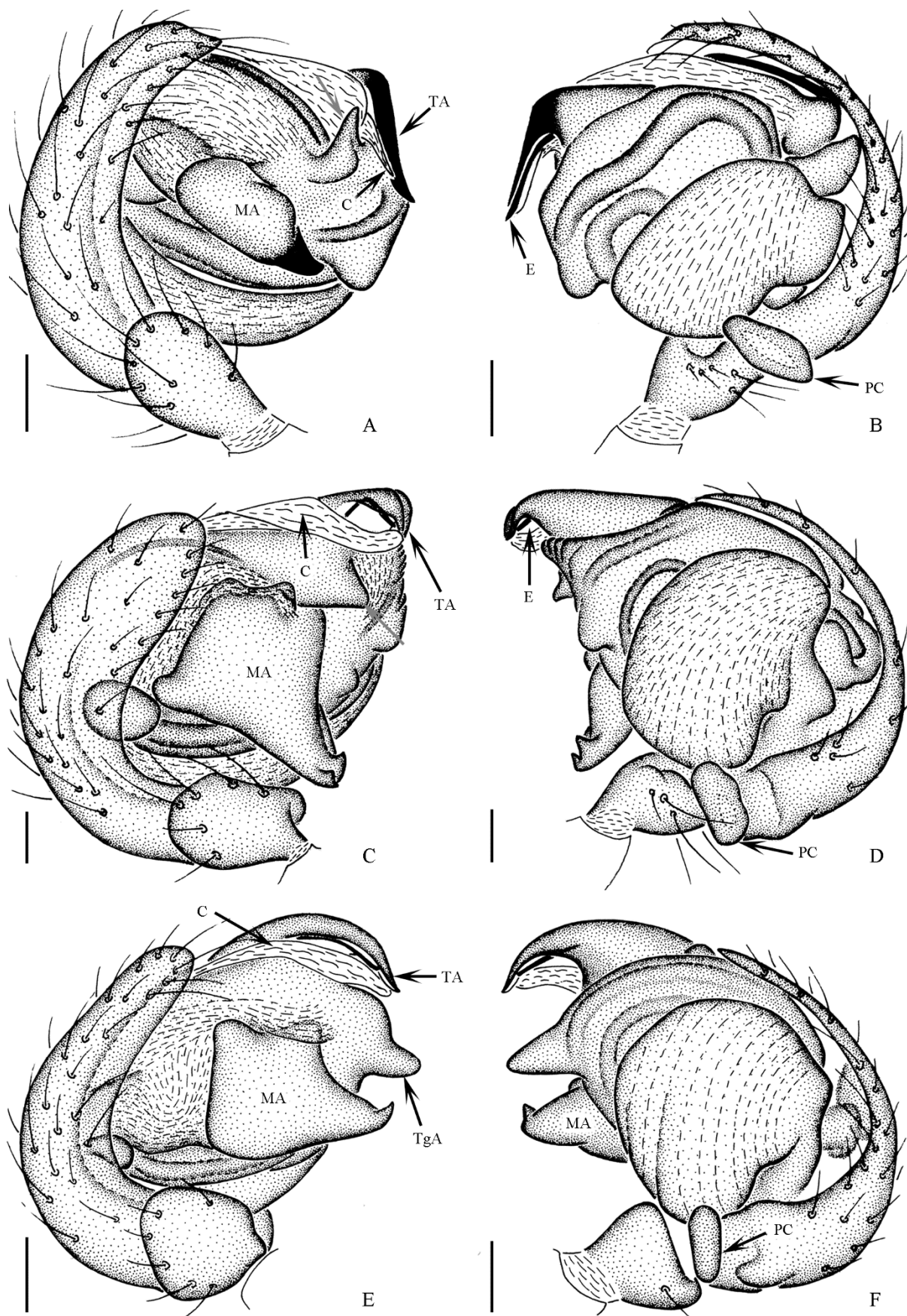


Figure 7. Male palp of *Chorizopes* spp. A–B. *C. jianfengensis* sp. nov. C–D. *C. liae* sp. nov. E–F. *C. yinae* sp. nov. A, C, E. Prolateral view. B, D, F. Retrolateral view. Scale bars = 0.1 mm.



***Chorizopes yinae* sp. nov.** (Figs 5–6, 7E–F, 8C)

Type material. Holotype. ♂ (TRU-Araneidae-029), China: Guizhou Province, Tongren City, Wenbi Park (27°43' 15.85"N, 109°10'1.94"E; elev. 460 m), 7 June 2013, Xiaoqi Mi, Mingyong Liao, Zhaolin Liao leg. Paratype. 1♀ (TRU-Araneidae-030), China: Guizhou Province, Shibing County, Chengguan Township (27°2'52.08"N, 108°8'21.95"E; elev. 618 m), 28 July 2015, Cheng Wang, Mingyong Liao, Xing Kuang leg.

Etymology. The specific name is a patronymic in honor of prof. Changmin Yin for her contribution to the taxonomy of Chinese spiders; name in genitive case.

Diagnosis. This new species is similar to *C. tumens* Yin, Wang, Xie & Peng, 1990 by the general shape of habitus and copulatory organs, but can be distinguished from the latter by: 1) the median apophysis away from cymbial margin in prolateral view (Figs 5A, 7E), vs. touching to the cymbial margin in *C. tumens* (Yin *et al.*, 1990, fig. 146); 2) the tegulum apophysis well-developed, as long as median apophysis in retrolateral view (Figs 5B, 7F), vs. indistinct in *C. tumens* (Yin *et al.*, 1990, fig. 147); 3) the terminal of copulatory ducts smooth in dorsal view (Figs 5F, 8C), vs. with tubercular processes in *C. tumens* (Yin *et al.*, 1990, fig. 145).

Description. Male (TRU-Araneidae-029). Total length 2.69. Carapace length 1.62, width 1.04; abdomen length 1.27, width 0.96. Eye sizes and interdistances: AME 0.10, ALE 0.07, PME 0.08, PLE 0.08, AME–AME 0.23, AME–ALE 0.61,

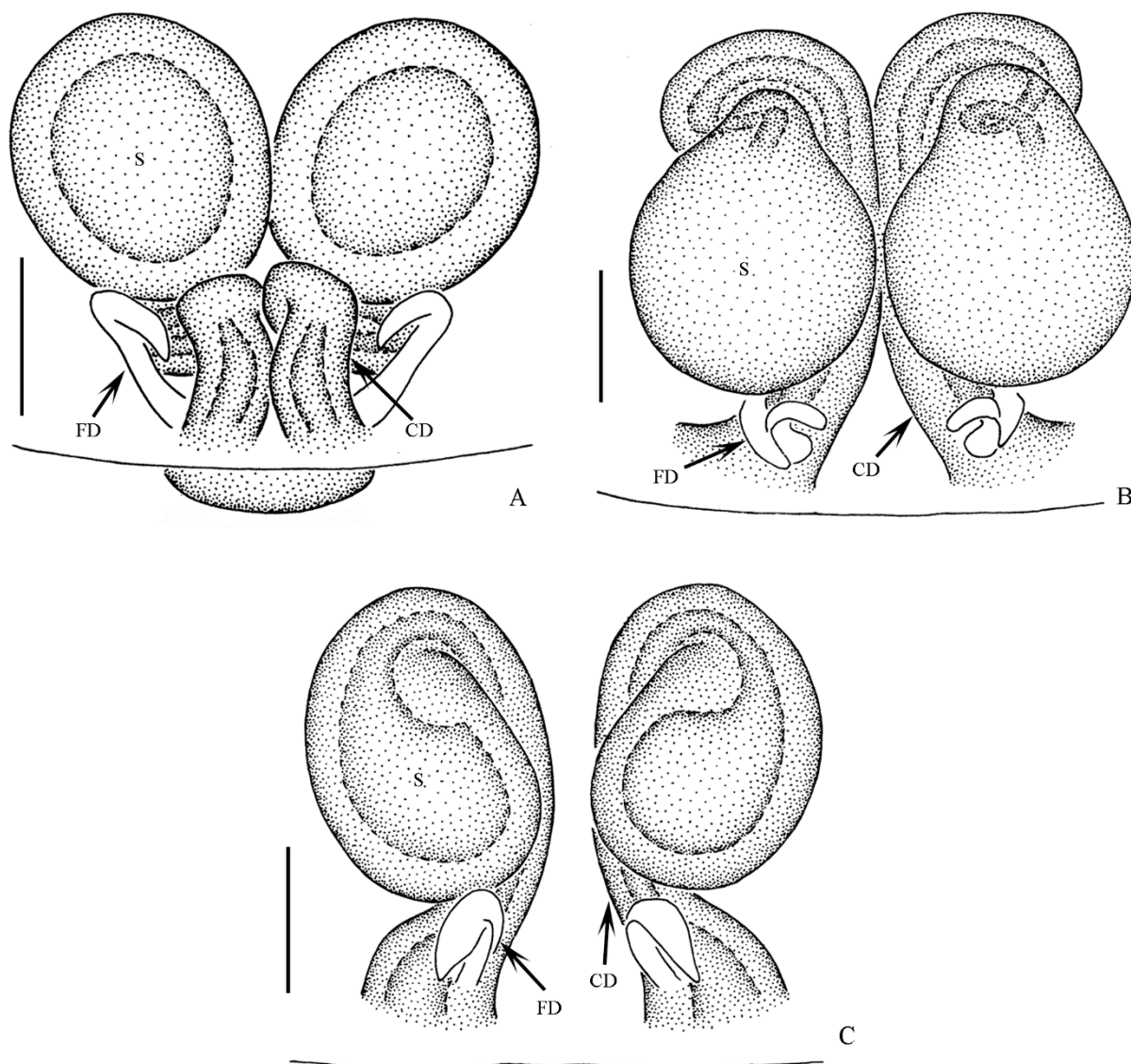


Figure 8. Dorsal view of vulvas of *Chorizopes* spp. A. *C. jianfengensis* sp. nov. B. *C. liae* sp. nov. C. *C. yinae* sp. nov. Scale bars = 0.1 mm.

PME–PME 0.27, PME–PLE 0.67, MOA length 0.29 with anterior width 0.29 and posterior width 0.35. Leg measurements: I 3.16 (0.90 + 1.07 + 0.70 + 0.49), II 3.14 (0.93 + 1.02 + 0.70 + 0.49), III 2.37 (0.68 + 0.78 + 0.52 + 0.39), IV 3.26 (1.02 + 1.10 + 0.68 + 0.46). Carapace (Figs 6A, 6C) red-brown, with a longitudinal brown band extending from anterior margin to terminal of cephalic region and irregular dark radial stripes, re-curved at anterior margin and elevated in cephalic region, covered with white thin hairs, dense laterally. Chelicerae (Fig. 5C) red-brown, with seven promarginal teeth. Sternum triangular, yellow-brown. Gnathocoxae and labium yellow-brown to gray. Legs pale yellow, with dark grey annuli. Abdomen (Figs 6A, 6C) oval, with a pair of lateral tubercles and two vertically arranged caudal tubercles, dorsal brown, with yellow spots laterally and a longitudinal white band almost extending over whole surface, covered with brown thin hairs; venter with a black longitudinal band, rest pale with white spots. Spinnerets yellow.

Palp (Figs 5A–B, 7E–F). Patellar pale brown, with a dorsal bristle; paracymbium flattened; bulb with a tegulum apophysis located between median apophysis and terminal apophysis; median apophysis flattened, with an acute projection directed anteriorly in prolateral view; terminal apophysis long, curved medially, tapered to a slightly pointed tip; embolus slender, distally enveloped by terminal apophysis in prolateral view; conductor narrow, lamelliform, almost equal to length of terminal apophysis in prolateral view.

Female (TRU-Araneidae-030). Total length 3.96. Carapace length 1.92, width 1.52; abdomen length 2.45, width 1.85. Eye sizes and interdistances: AME 0.10, ALE 0.07, PME 0.08, PLE 0.08, AME–AME 0.24, AME–ALE 0.79, PME–PME 0.35, PME–PLE 0.85, MOA length 0.37 with anterior width 0.37 and posterior width 0.43. Leg measurements: I 3.58 (1.00 + 1.22 + 0.85 + 0.51), II 3.53 (0.98 + 1.22 + 0.80 + 0.53), III 2.66 (0.78 + 0.90 + 0.54 + 0.44), IV 3.92 (1.20 + 1.36 + 0.85 + 0.51). Habitus (Figs 6B, 6D) similar to male except for anterior margin of carapace being almost straight and darker.

Epigyne (Figs 5D–F, 8C) almost as long as wide, copulatory openings posteriorly located, slit-shaped, separated from each other by more than half epigynal width; copulatory ducts broadening basally, ascending and then strongly curved 180° to connect with anterior edge of spermathecae; spermathecae elliptic, separated from each other by less than half of its diameter; fertilization ducts posteriorly located, near copulatory openings, elongated, curved medially.

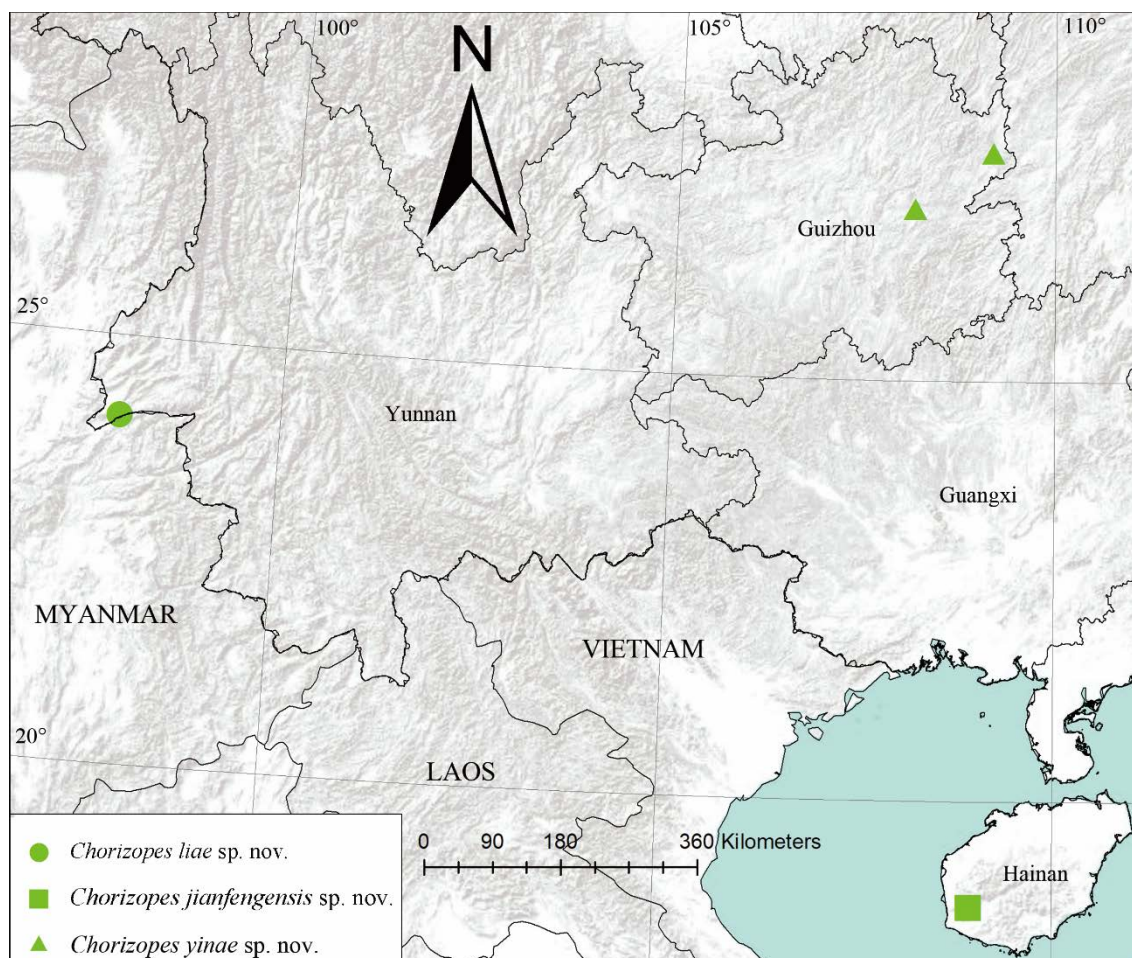


Figure 9. Distributions of the three new *Chorizopes* species.



Distribution. China (Guizhou) (Fig. 9).

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