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# *Yunguirius*, a new genus of Coelotinae (Araneae, Agelenidae) spiders from southwest China

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## Abstract

A new genus of the subfamily Coelotinae F. O. Pickard-Cambridge, 1893, *Yunguirius* Li, Zhao & Li gen. n. is distributed, including two new species and three new combinations (all ex-*Draconarius* Ovtchinnikov, 1999) from southwest China: *Y. duoge* Li, Zhao & Li sp. n. (♀), *Y. xiangding* Li, Zhao & Li sp. n. (♀), *Y. ornatus* (Wang, Yin, Peng & Xie, 1990) comb. n. (♂♀) (the type species of *Yunguirius* gen. n.), *Y. subterebratus* (Zhang, Zhu & Wang, 2017) comb. n. (♀) and *Y. terebratus* (Peng & Wang, 1997) comb. n. (♂♀). The molecular topologies supported *Yunguirius* gen. n. as a monophyletic group, with sister groups of *Sinodraconarius* clade, as: *Yunguirius* gen. n. + (*Hengconarius* + (*Nuconarius* + *Sinodraconarius*)).

## Keywords

Asia, *Draconarius*, new species, phylogeny, taxonomy

## Introduction

Coelotinae F. O. Pickard-Cambridge 1898, a subfamily of Agelenidae C. L. Koch, 1837 is distributed worldwide, acrosss Asia, Europe, and North America and represented by 794 species in 37 genera (WSC 2023). In the past decade, with concerted efforts of arachnologists, this subfamily has a basic and relatively stable framework both in morphology and molecular phylogeny between the known genera (Chen et al. 2015, 2016; Li et al. 2018a, 2018b, 2018c, 2019a, 2019b; Zhao and Li 2016, 2017; Okumura 2017, 2020; Okumura and Zhao 2022). We, therefore, focused our work on the paraphyletic *Draconarius* based on Zhao and Li (2017) and Zhu et al. (2017).

The genus *Draconarius* Ovtchinnikov, 1999 is exceptionally plentiful, especially in the species richness (274 valid species) and morphological diversity. Some studies show that *Draconarius* is not monophyletic (Li et al. 2018c; Zhao and Li 2017; Zhao et al. 2020). Therefore, the taxonomy of the genus needs to be reviewed, as do many *Draconarius* species. *Draconarius* species are mainly distributed from the Pamir Mountains to the Himalayas (Li et

al. 2018c). The type species *D. venustus* Ovtchinnikov, 1999 is from Tajikistan. Thus, the known *Draconarius* species distributed in the Yunnan-Guizhou Plateau to the east (Yin et al. 2012; Zhu et al. 2017) need to be further taxonomic studies. There are 25 species have recently been transferred to other genera, such as *Nuconarius* Zhao & S. Li, 2018: *N. capitulates* (Wang, 2003) and *N. pseudocapitulatus* (Wang, 2003); *Hengconarius* Zhao & S. Li, 2018: *H. exilis* (Zhang, Zhu & Wang, 2005), *H. falcatus* (Xu & Li, 2006), *H. incertus* (Wang, 2003), *H. latusincertus* (Wang, Griswold & Miller, 2010) and *H. pseudobrunneus* (Wang, 2003); *Sinodraconarius* Zhao & S. Li, 2018: *S. patellabifidus* (Wang, 2003), and *Troglocoelotes* Zhao & S. Li, 2019: *T. proximus* (Chen, Zhu & Kim, 2008), *T. tortus* (Chen, Zhu & Kim, 2008) and *T. yosiiianus* (Nishikawa, 1999).

Recently, while examining specimens collected from southwest China and comparing them with known species in the literatures, we suspected they should belong to a new genus, and the three *Draconarius* species *D. ornatus* (Wang, Yin, Peng & Xie, 1990), *D. terebratus* (Peng & Wang, 1997) and *D. subterebratus* Zhang, Zhu & Wang, 2017 needed to be reviewed. Therefore, morphological and phylogenetic studies were carried out on these closely related species.

## Material and methods

**Sampling and morphological examination.** All specimens studied in this paper were collected from southwest China. Specimens were examined with a LEICA M205C stereomicroscope. Photos were taken with an Olympus C7070 wide zoom digital camera (7.1 megapixels) mounted either on an Olympus SZX12 dissecting microscope or on an Olympus BX51 compound microscope. Images from multiple focal ranges were combined using Helicon Focus (Version 6.80) photo stacking software. The epigyne and male palp were dissected from the body for examination. The epigyne was treated in a warm 10% potassium hydroxide (KOH) solution. Images of the left male palp are presented. Measurements were obtained with a LEICA M205C stereomicroscope and are given in millimetres. Eye diameters were measured as the maximum distance in either dorsal or frontal views. Leg measurements are given as this: total length (femur, patella, tibia, metatarsus, tarsus). Terminology follows Wang et al. (1990), Peng and Wang (1997), and Zhu et al. (2017). References to figures in the cited papers are listed in lowercase (fig. or figs); figures from this paper are noted with an initial capital (Fig. or Figs). **HNNU** Hunan Normal University; **IZCAS** Institute of Zoology, Chinese Academy of Sciences; **MHBU** Museum of Hebei University. Abbreviations used in the text and figures are as follows:

<b>A</b>	atrium;	<b>CF</b>	cymbial furrow;
<b>ALE</b>	anterior lateral eye;	<b>CO</b>	copulatory opening;
<b>ALE-PLE</b>	distance between ALE and PLE;	<b>E</b>	embolus;
<b>AME</b>	anterior median eye;	<b>EB</b>	embolic base;
<b>AME-ALE</b>	distance between AME and ALE;	<b>F</b>	fold;
<b>AME-AME</b>	distance between AME and AME;	<b>FD</b>	fertilization duct;
<b>AME-PME</b>	distance between AME and PME;	<b>H</b>	hood;
<b>C</b>	conductor;	<b>LTA</b>	lateral tibial apophysis;
<b>CD</b>	copulatory duct;	<b>MA</b>	median apophysis;

<b>MS</b>	median septum;	<b>PME-PME</b>	distance between PME and PME;
<b>PA</b>	patellar apophysis;	<b>RTA</b>	retrolateral tibial apophysis;
<b>PES</b>	posterior epigynal sclerite;	<b>S</b>	spermatheca;
<b>PLE</b>	posterior lateral eye;	<b>SB</b>	spermathecal base;
<b>PME</b>	posterior median eye;	<b>SH</b>	spermathecal head;
<b>PME-PLE</b>	distance between PME and PLE;	<b>St</b>	stalk.

**Laboratory protocols and Phylogenetic analyses.** DNA barcodes were obtained for de limiting the species. A partial fragment of the mitochondrial cytochrome oxidase subunit I (*COI*) gene was amplified and sequenced using the primers: LCO1490-oono (5'-CWA CAAAYCATARRGATA-TTGG-3') and HCO2198-zz (5'-TAAACTTCCAGGTGACCAA AAAATCA-3'). Extraction, amplification and sequencing methods followed Zhao and Li (2017) and Zhao et al. (2020). The dataset consisted of 73 available sequences (Supple mentary Table S1), including 69 species in 32 known genera of Coelotinae (with 26 typ e species from different genera) as the ingroup, and three species of Ageleninae and on e species of Amaurobiidae as the outgroup, which were published recently (Zhao and Li 2017; Zhao et al. 2020; Okumura and Zhao 2022), and four novel sequences (Table 1).

Phylogenetic relationships were inferred using both maximum likelihood (ML) and Bayesian inference (BI). First, the best-fit partitioning schemes and models for the ML and BI analyses were selected using PartitionFinder v2.1.1 (Lanfear et al. 2012). ML analysis was conducted in RAXML v8.0.0 (Stamatakis 2006) using the substitution model GTRCAT for all partitions (partitioned by genes). A rapid bootstrap of 1000 replicate ML inferences was performed to determine the best-scoring ML tree and nodal support. ML analysis was also conducted in IQ-TREE (Nguyen et al. 2015) by using the ModelFinder function (-m MFP+MERGE) to select the best-fit model for each partition, and the option “-bb 1,000” to estimate the nodal support values. BI analyses were conducted in MrBayes v3.2.2 (Ronquist and Huelsenbeck 2003) with posterior distributions estimated by Markov chain Monte Carlo (MCMC) sampling. The corresponding model for each partition was selected. Two simultaneous runs with four MCMC chains were performed for 10 million generations to ensure that the average standard deviation of split frequency was below 0.01 and to get a well-supported consensus tree.

**Table 1.** Voucher specimen information

Species	Voucher code	GenBank accession number	Sequence length	Collection localities
<i>Y. ornatus</i> <b>comb. n.</b>	IZCAS-Ar44406 (YX055)	OQ243292	771bp	Kunming City, Yunnan Province, China
<i>Y. ornatus</i> <b>comb. n.</b>	IZCAS-Ar44407 (YX366)	OQ243293	798bp	Yuxi City, Yunnan Province, China
<i>Y. duoge</i> <b>sp. n.</b>	IZCAS-Ar44401 (YX066)	OQ243294	780bp	Kunming City, Yunnan Province, China
<i>Y. xiangding</i> <b>sp. n.</b>	IZCAS-Ar44408 (CL048)	KY778892	1194bp	Luzhou City, Sichuan Province, China

**Results and discussion**

By examining specimens collected from southwest China, we found two species with particular external genital morphology could not be placed into existing genera. They have morphological commonalities with the three *Draconarius* species mentioned in the

introduction, *D. ornatus*, *D. terebratus*, and *D. subterebratus* (Wang 2003; Zhu et al. 2017). The epigyne of these five species are all lacking epigynal teeth, with a large atrium centrally. As for the vulva, the CD is broad, anteriorly extended and bending, and SH is elongated. The males also show similar homology characteristics, such as thick E beginning at the 7 o'clock position, and short CF with a length less than half of cymbium, although only two males out of five species have been described so far. All species are closely related to each other by the comprehensive characteristics mentioned above and differ from the type species *D. venustus* Ovtchinnikov, 1999 and *venustus* group of *Draconarius* that have a pair of triangular epigynal teeth commonly (Wang 2003; Li et al. 2019c). Therefore, we establish a new genus, *Yunguirius* gen. n., and moved the three *Draconarius* species to the new genus.

Our different phylogenetic analyses infer similar tree topologies (Fig. 1) and highly supported that the new genus *Yunguirius* is a monophyletic group (ML bootstrap = 100 and 95; BI posterior probability = 1.00). Although the relationships within the genus are unclear (two species missing molecular data), the other three species are indeed genetically closely related. The genus is sister to the *Sinodraconarius* clade (*Hengconarius* + (*Nuconarius* + *Sinodraconarius*)) and genetically distant to the genus *Draconarius*. The close relationship between *Yunguirius* gen. n. and *Sinodraconarius* clade also can be confirmed by having common morphological features such as bifurcated conductors and epigynal teeth absent, which obviously differ from *Draconarius*. Geographically, species of *Yunguirius* gen. n. are narrowly distributed in southwest China (Fig. 5). Zoogeographic studies suggest that the genus-level distribution of coelotine spiders is regional, and the divergence and formation of these monophyletic genera are closely related to geological and climatic events in Eurasia (Zhao and Li 2017; Zhao et al. 2022). From the above results, including morphological differences from the *Sinodraconarius* clade and *Draconarius*, it becomes clear that the new genus *Yunguirius* is valid.

## Taxonomy

### Family Agelenidae C.L. Koch, 1837

### Subfamily Coelotinae F.O. Pickard-Cambridge, 1893

### Genus *Yunguirius* Li, Zhao & Li, gen. n.

Figs. 2–5

**Type species.** *Coelotes ornatus* Wang, Yin, Peng & Xie, 1990, from Kunming, Yunnan, China (designated herein).

**Etymology.** The generic name is derived from the pinyin word “Yungui”, referring to Yunnan-Guizhou Plateau where the genus is distributed, and “-rius” refers to the genus as part of its sister groups of genera: *Nuconarius*, *Hengconarius*, and *Sinodraconarius*. The gender is masculine.

**Diagnosis.** The morphological characteristics of *Yunguirius* gen. n. resemble those of *Nuconarius*, *Hengconarius* and *Sinodraconarius*, which are distributed in southeastern China, but differ from *Draconarius* by CF short, with the length less than the half of cymbium (fig. 3

in Zhang 1993; fig. 31 in Peng and Wang 1997), E thick, C with two branches (figs. 1–3 in Zhang 1993; figs. 30, 31 in Peng and Wang 1997) of males, and epigyne with posterior sclerite, epigynal teeth absent, atrium with sclerotic margin (Figs. 2A, 3A, 4A) of females. The new genus can be distinguished from the genera *Nuconarius*, *Hengconarius* and *Sinodraconarius* by habitus, and detailed structures of male palp and epigyne by the following characters: 1) carapace tonneau-shaped, first half wide, and abdomen beloid (Figs. 2C, 3C, 4C); 2) the bifurcate C of male palp, the upper branch large and wide with groove, while the lower one long with the length over the up one (fig. 2 in Zhang 1993; fig. 252D in Zhu et al. 2017); 3) atrium gigantic, in the centre of epigyne and occupying over or equal to 1/2 of the epigyne (Figs. 2A, 3A, 4A), epigyne dark and sclerotic, with lateral folds that located between atrium lateral margin and epigynal hood (Figs. 2A, 3A, 4A), CD and SH concomitant, along the contour of atrium (Figs. 2B, 3B, 4B), spermatheca located posteriorly, with very long SH, which is wrapped in CD (Figs. 2B, 3B, 4B).

**Description.** Small to very large sized spiders, with total lengths from 6.00 to 21.80. Carapace brown to black, tonneau-shaped, longer or equal to abdomen, with longitudinal fovea and dark radial grooves; chelicerae black, with three promarginal and two retromarginal teeth; endites and labium brown to dark brown, anterior white with black hairs; sternum brownish to brown, longer than wide. Abdomen grey-green to dark grey, nearly oval, narrow to wide, with four to six dark chevron-like markings or grey-black speckles, or unpatterned. Leg formula  $4 > 1 > 2 > 3$  or  $1 > 4 > 2 > 3$ . Male palp: PA finger-like, RTA large, LTA small, MA spoon-like; C large, with two branches; E thick, beginning at 7 o'clock position, with swollen base; CF short, with the length less than half of cymbium. Female epigyne: PES various; atrium gigantic, wide to narrow, with osteosclerotic lateral margin, the inside being white osteone, the outside having brownish markings and seal brown F; CD membranous, beginning posteriorly, extending to anterior, opening anteriorly; spermatheca brown, SB swollen, SH long and line-like, extending anteriorly, opposite end swollen, lamellar or connected with St.

**Distribution.** Guizhou, Hunan, Sichuan and Yunnan, China (Fig. 5)

### ***Yunguirius duoge* Li, Zhao & Li sp. n.**

Figs. 2, 5

**Type material.** **Holotype** ♀ (IZCAS-Ar44401): China: Yunnan Province: Kunming City: Panlong District, Duoge Village, Laohuanglong Cave, N25.4254°, E102.9259°, elevation: 2731±3m, 4.XII.2014, Y. Li and Z. Chen leg. **Paratypes:** 4♀♀ (IZCAS-Ar44402–Ar44405): China: Yunnan Province: Kunming City: Panlong District, Duoge Village, Huanglong Cave, N25.4285°, E102.9244°, elevation: 2337±3m, 8.XII.2019, Z. Chen leg.

**Etymology.** The new species is named after the type locality Duoge Village; noun in apposition.

**Diagnosis.** *Yunguirius duoge* sp. n. resembles *Y. terebratus* (Peng & Wang, 1997) comb. n. by having rectangular PES, subround atrium and dumbbell shaped spermatheca at its first half. However, *Y. duoge* sp. n. can be distinguished from *Y. terebratus* by the following characters: 1) posterior margin of epigyne narrow and pointed in the middle (Fig. 2A) in *Y. duoge* sp. n., but flat in *Y. terebratus* (fig. 28 in Peng and Wang 1997); 2) epigynal folds



banded (Fig. 2A) in *Y. duoge* sp. n., but dentiform in *Y. terebratus* (fig. 28 in Peng and Wang 1997); 3) CD close to each other anteriorly (Fig. 2B) in *Y. duoge* sp. n., but lapped in *Y. terebratus* (fig. 29 in Peng and Wang 1997); 4) and St extending laterally (Fig. 2B) in *Y. duoge* sp. n., but anteriorly in *Y. terebratus* (fig. 29 in Peng and Wang 1997).

**Description. Female** (holotype) (Fig. 2). Total length 13.27. Carapace 6.04 long, 3.66 wide. Abdomen 7.23 long, 4.86 wide. Eye sizes and interdistances: AME: 0.13, ALE: 0.17, PME: 0.15, PLE: 0.15; AME-AME: 0.09; AME-ALE: 0.13; AME-PME: 0.04; ALE-PLE: 0.03; PME-PME: 0.07; PME-PLE: 0.18. Leg measurements: I: 13.75 (4.08, 1.62, 3.30, 2.73, 2.02); II: 12.40 (3.55, 1.56, 2.82, 2.48, 1.99); III: 9.25 (3.04, 1.08, 1.98, 1.54, 1.61); IV: 14.26 (4.06, 1.92, 3.72, 2.84, 1.72). Leg formula  $4 > 1 > 2 > 3$ . Carapace brown, anterior and lateral black; fovea and radial grooves dark; chelicerae black, with three promarginal and two retromarginal teeth; endites and labium dark brown, anterior white with thin hairs; sternum brownish, lateral brown, about 1.4 times longer than wide. Abdomen grey, nearly oval, narrow to wide, with five dark chevron-like markings and several grey-black speckles. Female epigyne (Fig. 2A, B): PES rectangular, atrium gigantic, wide to narrow, with wide lateral margin, inside osteone like a sweat heart, outside markings brown, F slender and banded, approximate to 6 times longer than wide; CO located anteriorly; CD narrow to wide; spermatheca dumbbell shaped at first half, SH wrapped in CD and symmetric each other; FD long, about 5 times longer than wide, with bent end.

**Male.** Unknown.

**Distribution.** Yunnan Province, China (Fig. 5).

***Yunguirius ornatus* (Wang, Yin, Peng & Xie, 1990) comb. n.**

Figs. 3, 5

*Coelotes ornatus* Wang, Yin, Peng & Xie, 1990: in Wang, Yin, Peng and Xie, 1990: 199, figs. 53–54; Zhang, 1993: 47, figs. 1–3; Song, Zhu and Chen, 1999: 377, fig. 221O–P.

*Draconarius ornatus* (Wang, Yin, Peng & Xie, 1990): in Wang, 2003: 541, figs. 46A–C, 96C; Wang and Jäger, 2008: 2285, fig. 22; Wang, Griswold and Miller, 2010: 77, figs. 316–321; Zhu, Wang and Zhang, 2017: 329, fig. 200A–E.

**Type material. Holotype** ♀ (HNNU, not examined): China: Yunnan Province: Kunming City: Xishan District, Xishan Mountain, 25.X.1987, J. Wang leg. **Paratypes:** 15♀♀ (HNNU, not examined): same data as the holotype.

**Material examined.** 1♀ (IZCAS-Ar44406): China: Yunnan Province: Kunming City: Xishan District, Xishan Mountain, National Forest Park, Longmen, N24.9511°, E102.6385°, elevation: 2437m, 5.XII.2014, Y. Li and Z. Chen leg.; 1♀ (IZCAS-Ar44407): China: Yunnan Province: Yuxi City: Xinping county, Mopanshan Mountain, National Forest Park, N23.9448°, E101.9660°, elevation: 2269±3m, 19.III.2019, Z. Chen leg.

**Diagnosis.** *Yunguirius ornatus* (Wang, Yin, Peng & Xie, 1990) comb. n. can be distinguished from other species of this genus by the following characters: 1) atrium inverted trapezoid (Fig. 3A; fig. 53 in Wang et al. 1990) in *Y. ornatus*, but sweat-heart (fig. 245A in Zhu et al. 2017) in *Y. subterebratus* and (Fig. 4A) and *Y. xiangding* sp. n., or subround (Fig. 2A) in *Y. duoge* sp. n. and (fig. 28 in Peng and Wang 1997) and *Y. terebratus*; 2) MS present

(Fig. 3A; fig. 53 in Wang et al. 1990) in *Y. ornatus*; 3) CO away from each other and the midline (Fig. 3A; fig. 53 in Wang et al. 1990) in *Y. ornatus*, but close to each other and the midline in *Y. subterebratus* (fig. 245A in Zhu et al. 2017) and (Fig. 4A) in *Y. xiangding* sp. n.; 4) PA long, extending beyond the patella to the middle of the tibia (fig. 3 in Zhang 1993) in *Y. ornatus*, but extending to the quarter of the tibia (fig. 31 in Peng and Wang 1997) in *Y. terebratus*; 5) LTA small, about 1/4 the size of RTA (fig. 3 in Zhang 1993) in *Y. ornatus*, but about 1/3 (fig. 31 in Peng and Wang 1997) in *Y. terebratus*.

**Description. Female** (IZCAS-Ar44406) (Fig. 3). Total length 21.44. Carapace 10.54 long, 5.32 wide. Abdomen 10.90 long, 7.35 wide. Eye sizes and interdistances: AME: 0.15, ALE: 0.16, PME: 0.16, PLE: 0.17; AME-AME: 0.09; AME-ALE: 0.17; AME-PME: 0.08; ALE-PLE: 0.06; PME-PME: 0.09; PME-PLE: 0.28. Leg measurements: I: 21.73 (6.60, 2.62, 5.39, 4.17, 2.95); II: 18.09 (5.69, 2.21, 3.91, 3.49, 2.79); III: 14.08 (4.69, 2.14, 2.69, 2.69, 1.87); IV: 18.66 (6.06, 2.63, 4.39, 3.28, 2.30). Leg formula  $1 > 4 > 2 > 3$ . Sternum about 1.5 times longer than wide. Female epigyne (Fig. 3A, B): PES rectangular, atrium with white margin, outside markings brownish, fold like a bell jar, approximate to 2 times larger than hood; CO located anteriorly, away from each other, close to the lateral margin of atrium; CD semiluculent; spermatheca lamellar at first half, SH extends with and beyond CD; FD long and bent, about 4 times longer than wide. For diagnosis and more detail see Wang et al. (1990).

**Male.** See Zhang (1993).

**Distribution.** Yunnan Province, China (Fig. 5).

### ***Yunguius subterebratus* (Zhang, Zhu & Wang, 2017) comb. n.**

*Draconarius subterebratus* (Zhang, Zhu & Wang, 2017): in Zhu, Wang and Zhang 2017: 379, fig. 245A–B.

**Type material. Holotype** ♀ (MHB, not examined): China: Guizhou Province: Zunyi City: Daozhen County, Dashahegou Nature Reserve, Xieshiyan Cave to Dashahe River, 18.VIII.2004, Z. Zhang leg. **Paratypes:** 3♀♀ (MHB, not examined): same data as the holotype.

**Diagnosis.** *Yunguius subterebratus* (Zhang, Zhu & Wang, 2017) comb. n. can be distinguished from other species of this genus by the following characters: 1) atrium sweat-heart (fig. 245A in Zhu et al. 2017) in *Y. subterebratus*, but inverted trapezoid (Fig. 3A; fig. 53 in Wang et al. 1990) in *Y. ornatus* or subround (Fig. 2A) in *Y. duoge* sp. n. and (fig. 28 in Peng and Wang 1997) and *Y. terebratus*; 2) PES longer than wide, like a waist drum (fig. 245A in Zhu et al. 2017) in *Y. subterebratus*, but like a vase (Fig. 4A) in *Y. xiangding* sp. n., or rectangular (Fig. 2A, 3A; fig. 53 in Wang et al. 1990; fig. 28 in Peng and Wang 1997) in others.

**Description. Female:** See Zhu, Wang and Zhang (2017).

**Male.** Unknown.

**Distribution.** Guizhou Province, China (Fig. 5).

### ***Yunguius terebratus* (Peng & Wang, 1997) comb. n.**

*Coelotes terebratus* Peng & Wang, 1997: in Peng and Wang 1997: 330, figs. 27–31; Song, Zhu and



Chen 1999: 378, figs. 225M–N, 227E, 228H.

*Draconarius terebratus* (Peng & Wang, 1997): in Wang 2003: 551, figs. 63A–E, 96G–H; Yin et al. 2012: 1015, fig. 525a–f; Zhu, Wang and Zhang 2017: 387, fig. 252A–E; Jiang, Chen and Zhang 2018: 77, figs. 12A–B, 26K.

**Type material. Holotype** ♀ (HNNU, not examined): China: Hunan Province: Zhangjiajie City: Sangzhi County, Tianpingshan Mountain, 16.X.1986, J. Wang leg. **Paratypes**: 1♂ (HNNU, not examined): same data as the holotype.

**Diagnosis.** *Yunguirius terebratus* (Peng & Wang, 1997) comb. n. can be distinguished from other species of this genus by the following characters: 1) atrium subround (fig. 28 in Peng and Wang 1997; fig. 252A in Zhu et al. 2017) in *Y. terebratus*, but inverted trapezoid (Fig. 3A; fig. 53 in Wang et al. 1990) in *Y. ornatus*, or sweat-heart (fig. 245A in Zhu et al. 2017) in *Y. subterebratus* and (Fig. 4A) *Y. xiangding* sp. n. 2) PES rectangular (fig. 28 in Peng and Wang 1997; fig. 252A in Zhu et al. 2017), but like a waist drum (fig. 245A in Zhu et al. 2017) in *Y. subterebratus* or like a vase (Fig. 4A) in *Y. xiangding* sp. n.; 3) EB with a round apophysis (fig. 31 in Peng and Wang 1997; fig. 252E in Zhu et al. 2017), while nearly its end with a dentiform apophysis (fig. 30 in Peng and Wang 1997; fig. 252C in Zhu et al. 2017) in *Y. terebratus*, but absent in *Y. ornatus*; 4) lower branch of conductor falcate, and bent to ventrally, longer than the upper one (fig. 252D in Zhu et al. 2017) in *Y. terebratus*, but lamellar, fluted, and pointed to posteriorly, shorter than upper one (fig. 2 in Zhang 1993; fig. 200D in Zhu et al. 2017) in *Y. ornatus*.

**Description. Female:** (fig. 27 in Peng and Wang 1997). Carapace gourd shaped, longer than abdomen. Abdomen oblong. Female epigyne (figs. 28, 29 in Peng and Wang 1997; fig. 252A, B in Zhu et al. 2017): epigynal teeth absent, PES rectangular, fold triangular, hood large, approximate to 2 times larger than fold; SH long, twisted and sigmoid in the middle. For diagnosis and more detail see Peng and Wang (1997) and Zhu et al. (2017).

**Male.** See Peng and Wang (1997) and Zhu et al. (2017).

**Distribution.** Hunan Province, China (Fig. 5).

### *Yunguirius xiangding* Li, Zhao & Li sp. n.

Figs. 4–5

**Type material. Holotype** ♀ (IZCAS-Ar44408): China: Sichuan Province: Luzhou City: Gulin County, Shiping Township, Xiangdoing Village, huaer Cave, N28.0294°, E106.0073°, elevation: 641m, 22.IV.2014, Y. Lin, H. Zhao, Y. Li, J. Wu and F. Li leg.

**Etymology.** The new species is named after the type locality Xiangding Village; noun in apposition.

**Diagnosis.** *Yunguirius xiangding* sp. n. resembles *Y. subterebratus* (Zhang, Zhu & Wang, 2017) comb. n. by having sweat-heart atrium, asymmetric CD, with narrow in the middle, arch-shaped St, fists on both sides, unilateral end of SH exposed. However, *Y. xiangding* sp. n. can be distinguished from *Y. subterebratus* by the following characters: 1) crevice breaking at lateral margin of atrium, below its hoods (Fig. 4A) in *Y. xiangding* sp. n., but at anterior margin of atrium, above its hoods in *Y. subterebratus* (fig. 245A in Zhu et al. 2017); 2) in the middle of anterior margin of atrium raised (Fig. 4A) in *Y. xiangding* sp. n., but concave in *Y.*

*subterebratus* (fig. 245A in Zhu et al. 2017); 3) PES like a vase (Fig. 4A) in *Y. xiangding* sp. n., but like a waist drum in *Y. subterebratus* (fig. 245A in Zhu et al. 2017); 4) and St extending laterally (Fig. 4B) in *Y. xiangding* sp. n., but anteriorly in *Y. subterebratus* (fig. 245B in Zhu et al. 2017).

**Description. Female** (holotype) (Fig. 4). Total length 13.29. Carapace 6.21 long, 4.22 wide. Abdomen 7.08 long, 5.02 wide. Eye sizes and interdistances: AME: 0.14, ALE: 0.17, PME: 0.15, PLE: 0.16; AME-AME: 0.08; AME-ALE: 0.12; AME-PME: 0.06; ALE-PLE: 0.05; PME-PME: 0.07; PME-PLE: 0.22. Legs lost. Carapace dark brown, anterior black; fovea and radial grooves dark; chelicerae black, with three promarginal and two retromarginal teeth; endites and labium dark brown to black, anterior white with several hairs; sternum brownish, lateral brown, about 1.2 times longer than wide. Abdomen grey-green, nearly oval, narrow to wide, with four dark chevron-like markings and several grey-black speckles. Female epigyne (Fig. 4A, B): PES like a vase, atrium sweat-heart, wide to narrow, with sclerotic lateral margin, inside osteone inverted triangle, outside markings brownish, F brown, like a ridge, close to the deep hood; CO small, located anteriorly, nearly the midline, and symmetric; CD beloid, and then swollen; first half of spermatheca dumbbell shaped, SH wrapped in CD fully, with unilateral end exposed; FD about 3.5 times longer than wide, pointed to laterally.

**Male.** Unknown.

**Distribution.** Sichuan Province, China (Fig. 5).

## Acknowledgements

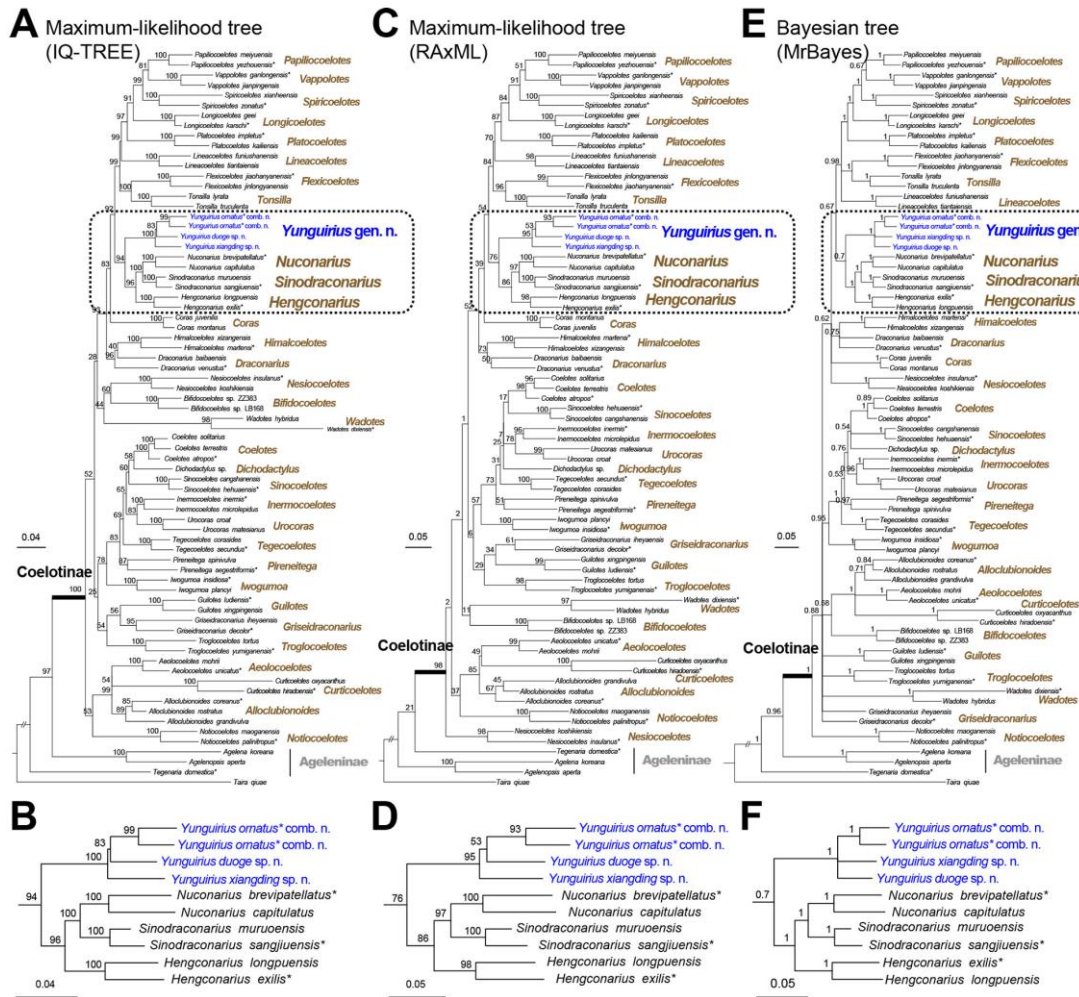
Danni Sherwood (UK) checked English. Xiaoqing Zhang helped lab work and illustrations. This study was supported by the National Natural Sciences Foundation of China (NSFC-32170447) and the program of Youth Innovation Promotion Association of Chinese Academy of Sciences (No. 2019087).

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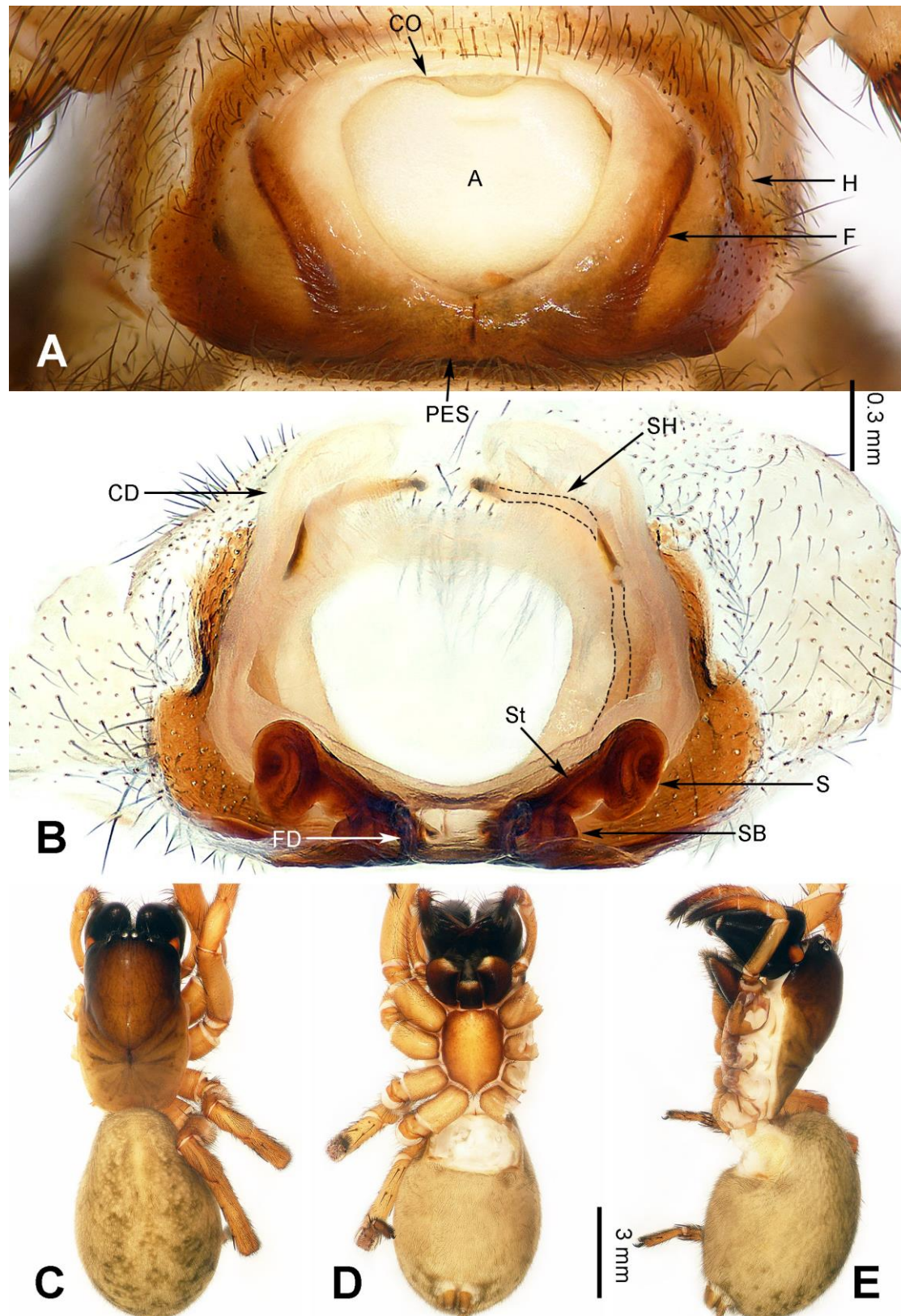
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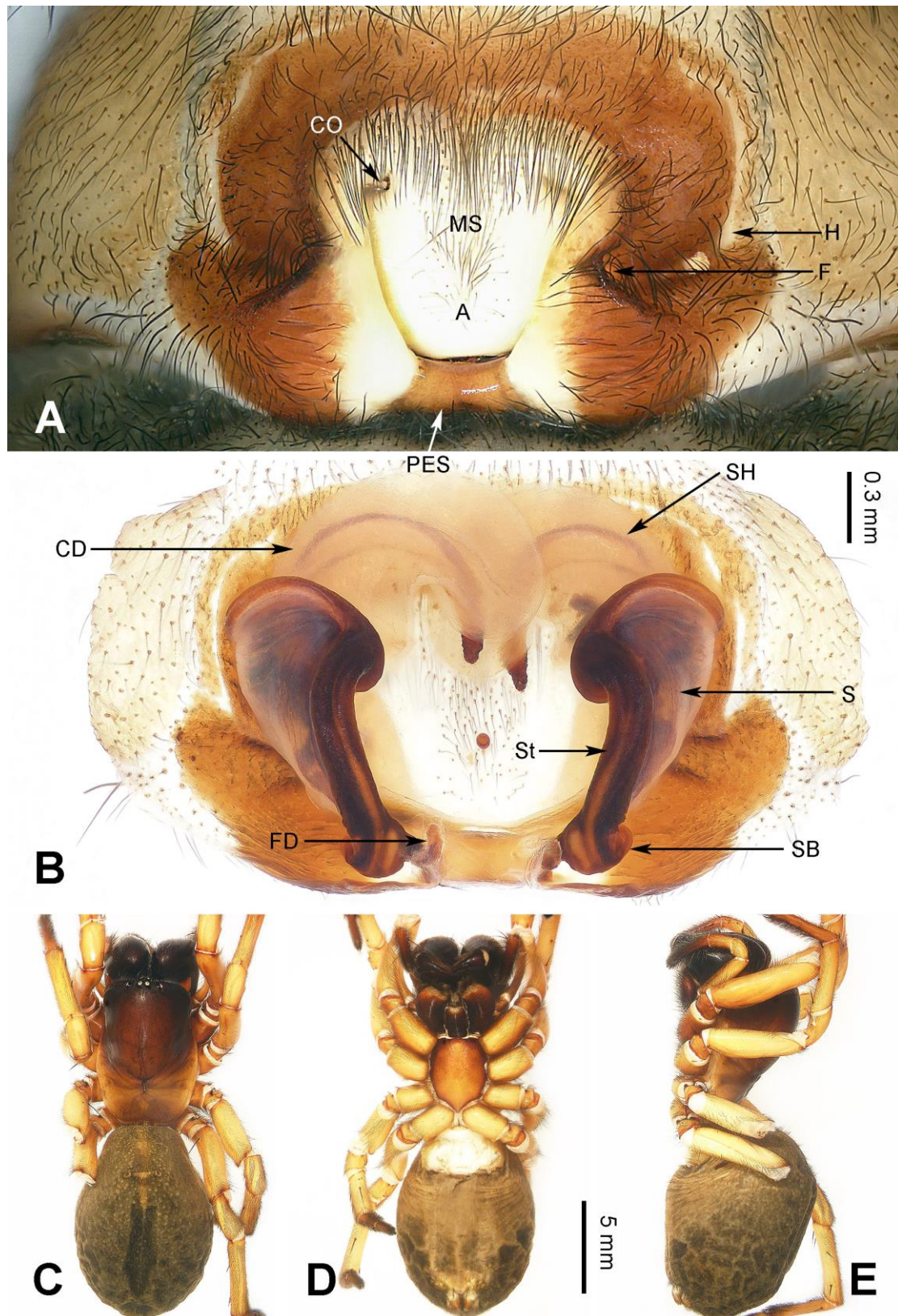
**Figure 1.** Phylogenetic trees. **A** and **B** Maximum Likelihood (ML) trees obtained by using IQ-TREE; **C** and **D** ML trees obtained by using RAxml; **E** and **F** Bayes trees obtained by using MrBayes. Support values for major nodes are shown. Scale bar corresponds to the expected number of substitutions per site. Asterisks indicate the type species of each genus.





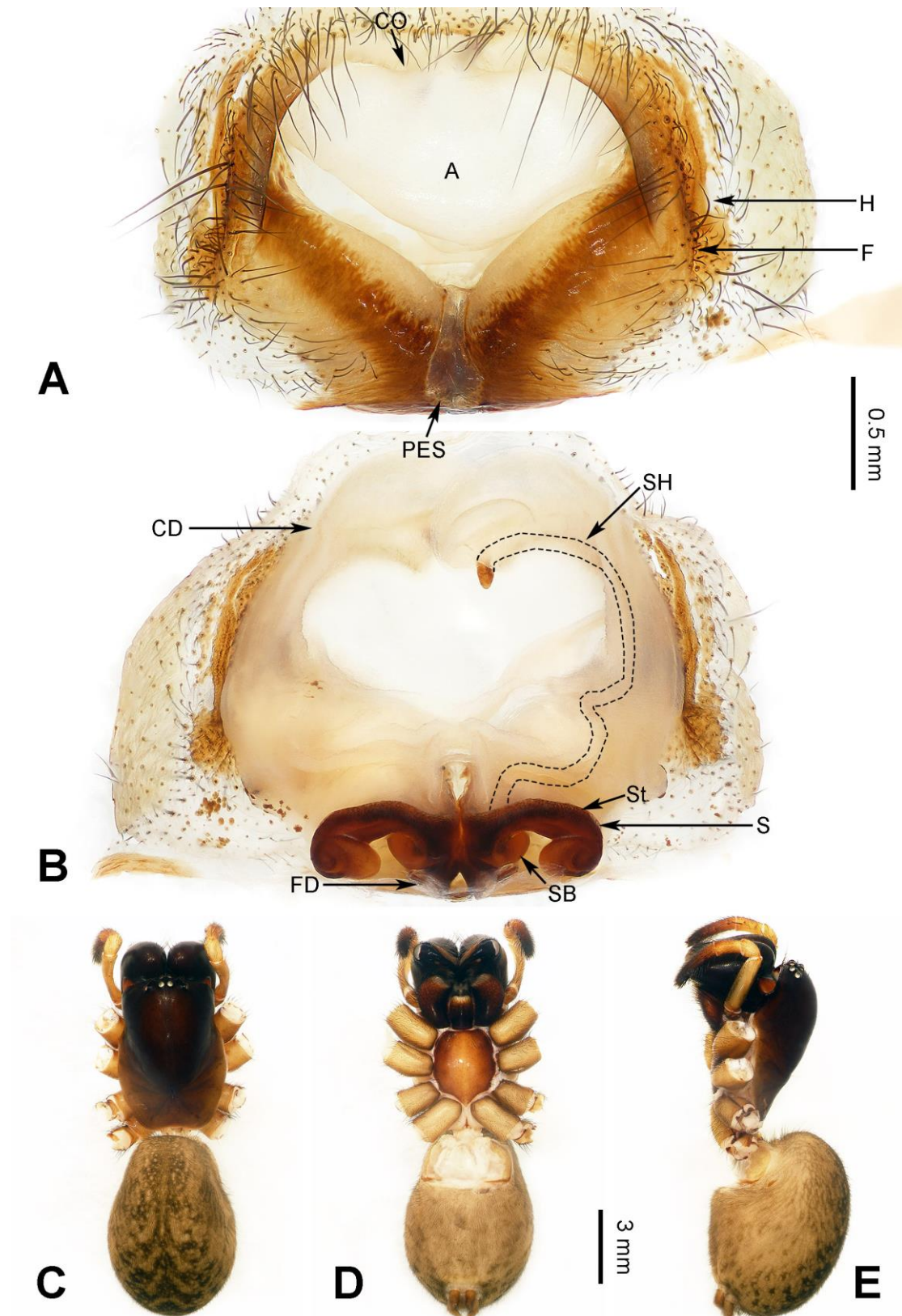
**Figure 2.** Epigyne and habitus of *Yunguirius duoge* sp. n. **A** Epigyne, ventral **B** Vulva, dorsal **C** Female habitus, dorsal **D** Female habitus, ventral **E** Female habitus, lateral. Scale bar equal for C–E.



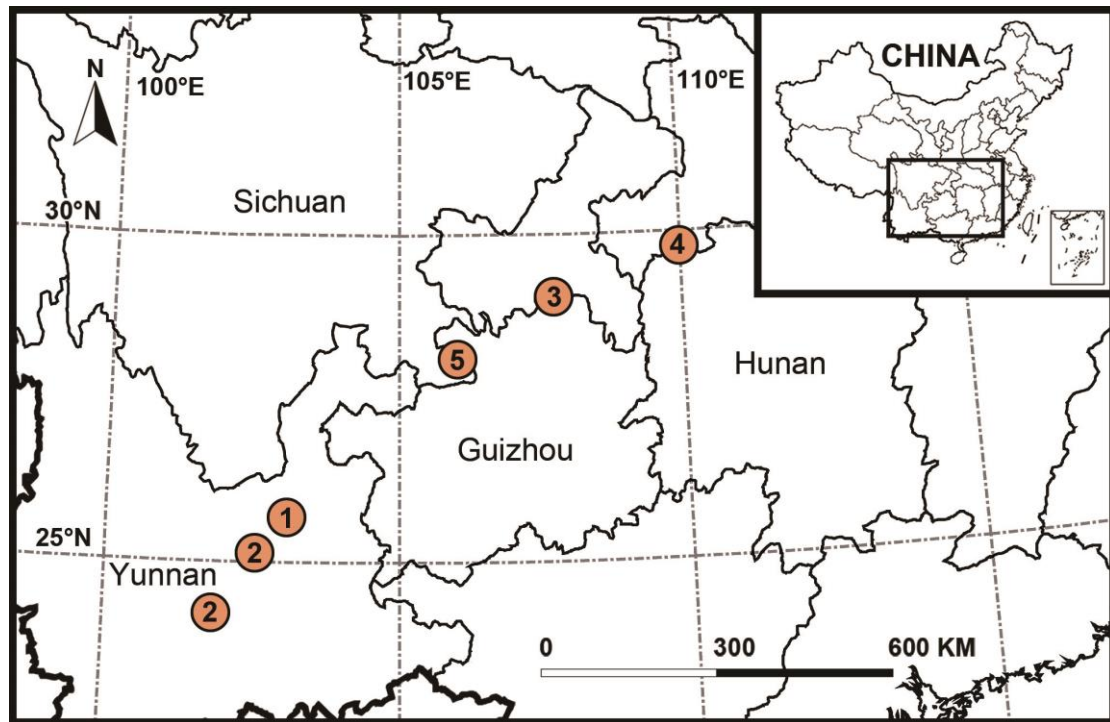


**Figure 3.** Epigyne and habitus of *Yunguirius ornatus* (Wang, Yin, Peng & Xie, 1990) **comb. n.** A Epigyne, ventral B Vulva, dorsal C Female habitus, dorsal D Female habitus, ventral E Female habitus, lateral. Scale bar equal for C–E.





**Figure 4.** Epigyne and habitus of *Yunguirius xiangding* sp. n. **A** Epigyne, ventral **B** Vulva, dorsal **C** Female habitus, dorsal **D** Female habitus, ventral **E** Female habitus, lateral. Scale bar equal for C–E.



**Figure 5.** Localities of *Yunguirius* species in China. **1** *Y. duoge* sp. n. **2** *Y. ornatus* **3** *Y. subterebratus* **4** *Y. terebratus* **5** *Y. xiangding* sp. n.