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First record of *Gelotia* Thorell, 1890 (Araneae: Salticidae) from Vietnam with description of a new species

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Abstract. A novel species of the spartaeine genus *Gelotia* Thorell, 1890, *G. onoi*, new species is described from the Central Highlands of Vietnam. Additionally, two species, *G. liuae* Wang & Li, 2020 and *G. zhengi* Cao & Li, 2016 are also recorded from Vietnam for the first time. Detailed descriptions, illustrations of the copulatory organs, somatic features, and DNA barcodes for the species are provided.

Key words. DNA barcoding, jumping spiders, Southeast Asia, Spartaeinae

INTRODUCTION

Despite being the second-largest subfamily of the jumping spiders, Spartaeinae Wanless, 1984 has received limited attention in Vietnam. Currently, only nine species belonging to five genera (including *Brettus*, *Cyrba*, *Neobrettus*, *Portia*, and *Spartaeus*) have been reported in the country (Metzner, 2024; World Spider Catalog, 2024).

The spartaeine genus *Gelotia* Thorell, 1890 is mainly distributed in East and Southeast Asia, New Guinea, and Australia (World Spider Catalog, 2024). China, the country immediately to the north of Vietnam, has reported three species of the genus (Cao et al., 2016; Wang & Li, 2020). However, the genus has not been recorded from Vietnam until now.

Based on a collection of jumping spiders assembled by the first author from various localities in Vietnam, three species of the genus *Gelotia* Thorell, 1890 are reported from the country. Among these, a new species, *G. onoi* is described herein, though only from the female specimen. Additionally, two species, *G. liuae* Wang & Li, 2020 and *G. zhengi* Cao & Li, 2016, previously known only from China (Cao et al., 2016; Wang & Li, 2020), are herein reported in Vietnam, and the opposite sexes are confirmed by DNA barcoding. Hence, this marks the first recorded occurrence of the genus *Gelotia* Thorell, 1890, in Vietnam, with three species.

MATERIAL AND METHODS

Specimens were collected by beating trays. The specimens were examined with a Leica M205C stereo microscope. Photos were taken using Jenoptik ProgRes CF Scan 12.5MP camera and Jenoptik ProgRes Capture Pro 2.10.0.1 software. The male palp and the female epigyne were examined and illustrated after dissection. The epigyne was cleared in a 10% KOH solution at room temperature for about 12 hours. Photos were stacked using the Helicon Focus 7.0.2 Pro software and then modified using Adobe Photoshop CS2 9.0. All measurements are given in millimeters (mm). Leg segment lengths are given as follows: femur + patella + tibia + metatarsus + tarsus (total length). The studied specimens have been deposited in the Vietnam National Museum of Nature (VNMN), Hanoi, Vietnam.

Abbreviations used throughout the paper are as follows: ALE, anterior lateral eye; AME, anterior median eye; CD, copulatory duct; CO, copulatory opening; DTA, dorsal tibial apophysis; E, embolus; F, fold; FD, fertilisation duct; Fm, femur; Mt, metatarsus; PCO, prolateral cymbial outgrowth; PLE, posterior lateral eye; PME, posterior median eye; Pt, patella; PTA, prolateral tibial apophysis; RPA, retrolateral patellar apophysis; RTA, retrolateral tibial apophysis; S, spermatheca; SM, spermophore; Tb, tibia; VTA, ventral tibial apophysis; W, window. The number and position of spines on legs: d, dorsal; pr, prolateral; rt, retrolateral; v, ventral.

The GeneJET Genomic DNA Purification Kit (Thermo Scientific, Lithuania) was used to extract genomic DNA from two legs of the specimens, following the manufacturer's instructions. A partial fragment of approximately 680 bp

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Table 1. Specimens used in the present study.

	Species	Sex	GenBank accession numbers	Collection localities
1	*Gelotia onoi*, new species	Female	PP515282	Dak Lak Prov., Vietnam
2	*Gelotia zhengi*	Male	PP515285	Dong Nai Prov., Vietnam
3	*Gelotia zhengi*	Female	PP515286	Dak Lak Prov., Vietnam
4	*Gelotia liuae*	Male	PP515283	Quang Binh Prov., Vietnam
5	*Gelotia liuae*	Female	PP515284	Dak Lak Prov., Vietnam
6	*Gelotia liuae*[*]	Male	KM033210	Guangxi Prov., China
7	*Gelotia syringopalpis*[*]	Unknown	KM033212	Guangxi Prov., China

([*]) downloaded from GenBank.

Table 2. Pairwise distances in K2P model.

	Species	1	2	3	4	5	6	7
1	*Gelotia onoi*, new species							
2	*Gelotia zhengi*	0.1226						
3	*Gelotia zhengi*	0.1361	0.0225					
4	*Gelotia liuae*	0.0601	0.1363	0.1227				
5	*Gelotia liuae*	0.0601	0.1363	0.1227	0.0024			
6	*Gelotia liuae*[*]	0.0658	0.1396	0.1259	0.0122	0.0097		
7	*Gelotia syringopalpis*[*]	0.1005	0.1426	0.1496	0.1078	0.1045	0.1015	

of the mitochondrial cytochrome c oxidase subunit I (COI) gene was successfully amplified using the universal primer pairs LCO1490/HCO2198 (Folmer et al., 1994). Sequencing chromatograms were examined for quality and sequences edited using the software FinchTV version 1.4.0 (Geospiza Inc.). All sequences were translated into amino acids to check for stop codons by using software MEGA version 11.0.13 (Tamura et al., 2021). Finally, the sequences were verified using BLAST (https://www.ncbi.nlm.nih.gov) and deposited in GenBank (Table 1). The COI sequences for four species of the genus *Gelotia* as in Table 1 were aligned using MUSCLE (Edgar, 2004) built in the software MEGA version 11.0.13, under default parameters. Genetic distance was calculated using Kimura's two parameter (K2P) model using the the same software.

RESULTS

DNA analysis. The genetic analysis utilising a COI dataset consisting of 418 bp from four species of the genus *Gelotia* from Vietnam and China is summarised in Table 2. Interspecific genetic distance in the K2P model among *Gelotia* species ranged from 6.01% to 14.96%. The highest interspecies genetic distance was observed between the female of *G. zhengi* from Vietnam and *G. syringopalpis* from China (14.96%) while the lowest interspecies pairwise value was found between *G. onoi*, new species and *G. liuae* (6.01%). Intraspecies genetic distance for the species *G. liuae* ranged from 0.24% to 1.22%. The genetic distance between the male and female of *G. zhengi* collected from two different localities in Vietnam (approximately 266km apart) was calculated at 2.25%. Intraspecies genetic distance for two species *G. liuae* and *G. zhengi* in the present study still falls within the estimated species delimitation threshold for spiders from India (ranging from 2.6% to 3.7%) (Tyagi et al., 2019), suggesting they are conspecific.

TAXONOMY

Family Salticidae Blackwall, 1841

Genus *Gelotia* Thorell, 1890

Type species. *Gelotia frenata* Thorell, 1890.

Distribution. Singapore, China, Malaysia, Indonesia, India, Sri Lanka, Papua New Guinea, Australia, and Vietnam (new record).

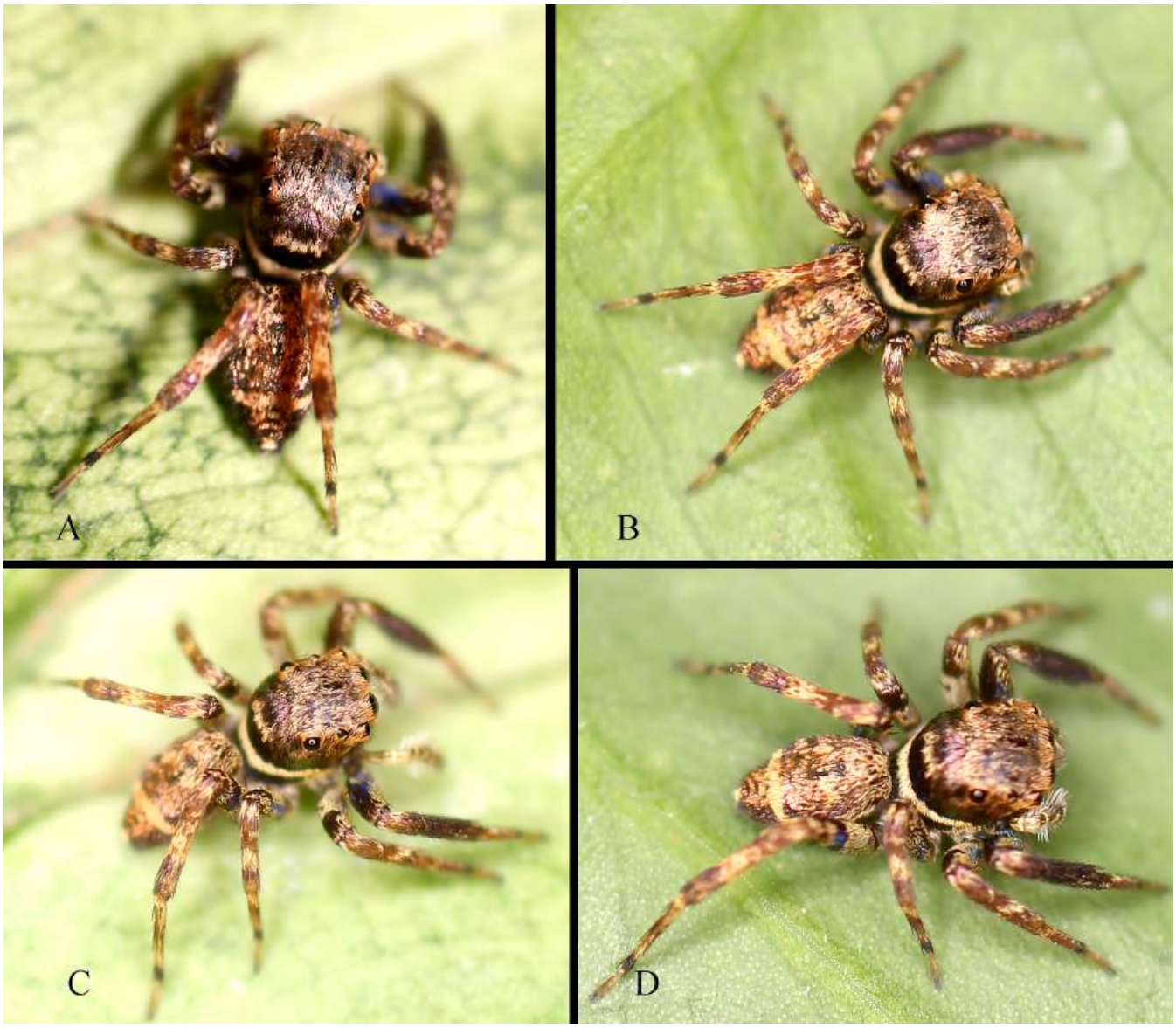

Fig. 1. Habitus of *Gelotia onoi*, new species (female, holotype) in life. A, B, habitus, dorsal view; C, D, habitus, dorso-lateral view.

***Gelotia onoi*, new species**
(Figs. 1–2)

Material examined. Holotype: female (VNMN-ARA-SAL-480), VIETNAM, Dak Lak Prov., Buon Don Dist., Yok Don National Park, 12.9462°N, 107.7294°E, 140m a.s.l., 4 February 2024, coll. Q.D. Hoang.

Etymology. This specific epithet is given to honour Dr. Hirotsugu Ono (Japan), who has made great contributions to improving knowledge of the spider fauna in Vietnam.

Diagnosis. The female of *Gelotia onoi*, new species (Figs. 1–2) resembles those of the type species, *G. frenata* Thorell, 1890 and *G. liuae* Wang & Li, 2020 in having the epigyne with a fold and rounded window, but differs from two latter species by the following characteristics: the epigynal window located in the near middle in the new species (Fig. 2C) while anterior in both *G. frenata* (fig. 5 in Prószyński, 1969) and *G. liuae* (cf. Fig. 4C and fig. 8A in Wang & Li, 2020), copulatory duct significantly longer than the length of spermathecae (Fig. 2D) (shorter in other species), spermathecae almost rounded, relatively very small (Fig. 2D) in comparision with *G. frenata* and *G. liuae* as well as all other members of the genus *Gelotia* (see comparative illustrations in Metzner, 2024).

Description. Female holotype. Measurements: Total length 4.63; carapace length 2.31, width 1.72; abdomen length 2.32, width 1.34; clypeus height 0.08. Carapace brown, clothed with dense iridescent setae, lateral sides dark with yellowish belt (Figs. 1A–D, Fig. 2A); fovea longitudinal. Anterior eyes surrounded by yellow-orange orbital setae (Fig. 2B). Clypeus dark brown, narrowest medially with some long setae (Fig. 2B). Sternum yellowish brown, with darker margin and sparse long setae. Endites and labium brownish yellow. Chelicerae brownish yellow (Fig. 2B); promargin with three teeth, and five retromarginal teeth. Abdomen brown, covered with dense iridescent setae and with a large transverse stripes in posterior half of dorsum (Figs. 1A–D, Fig. 2A); venter brownish yellow. Lateral sides of abdomen dark brown covered with yellow setae. Spinnerets

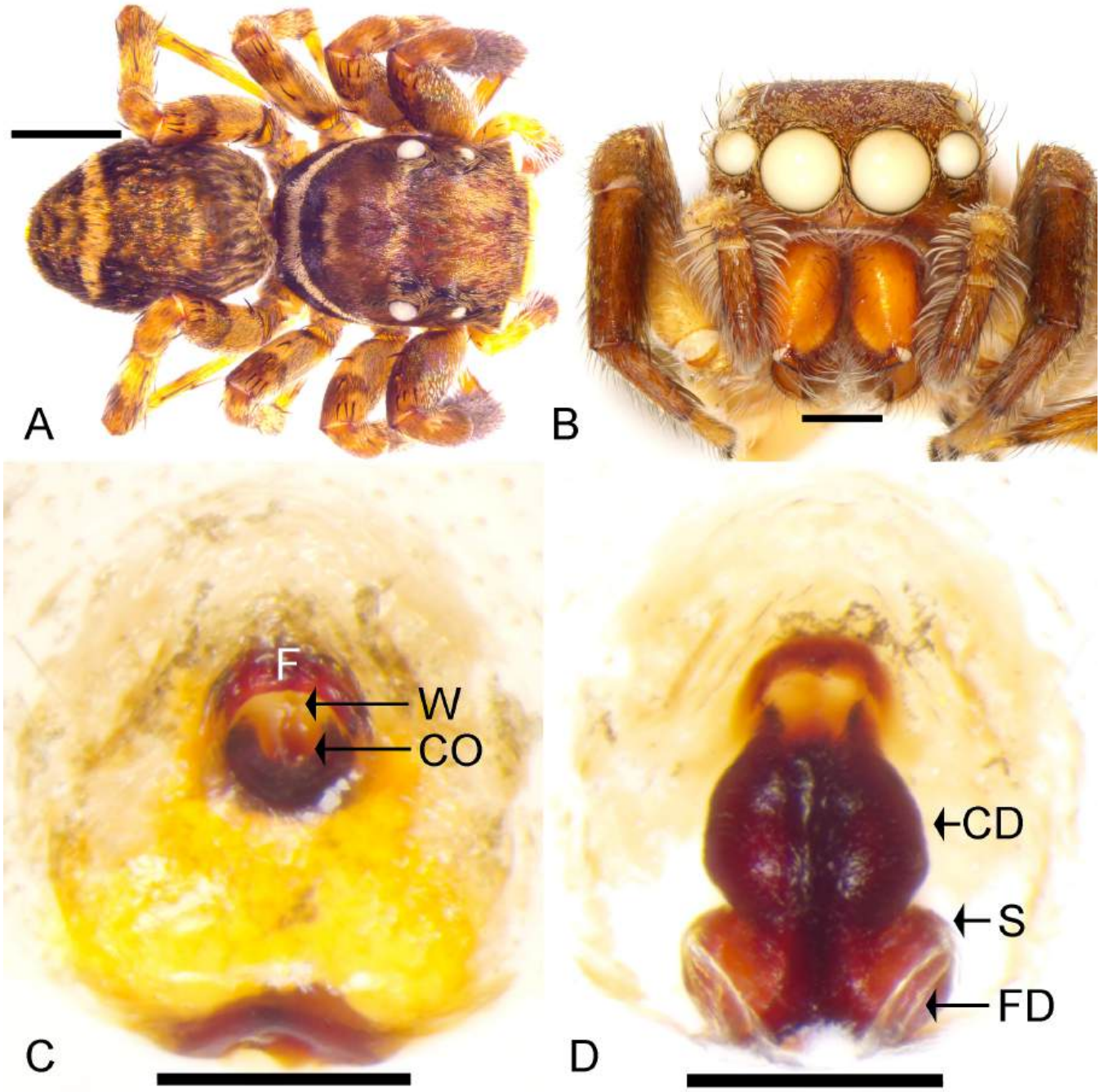

Fig. 2. Female of *Gelotia onoi*, new species (holotype). A, habitus, dorsal view; B, carapace, anterior view; C, epigyne, ventral view; D, epigyne, dorsal view. Scale bars: A, 1 mm, B, 0.5 mm, C, D, 0.2 mm.

very short, dark brown. Legs brown, covered with densely pale setae (Fig. 2A). Width of eye rows: anterior eye row 1.67; posterior medial eye row 1.53; posterior lateral eye row 1.64. Distance between ALE-PME 0.51; ALE-PLE 1.09. Diameter of eyes: AME 0.56; ALE 0.32; PME 0.18; PLE 0.29. Length of leg segments: I 1.46 + 0.82 + 1.12 + 0.95 + 0.52 (4.87); II 1.36 + 0.75 + 0.92 + 0.89 + 0.49 (4.41); III 1.29 + 0.63 + 0.91 + 0.99 + 0.43 (4.25); IV 1.73 + 0.74 + 1.40 + 1.62 + 0.48 (5.97). Leg formula IV–I–II–III. Leg spination: I: Fm d 1–1–4; Pt pr 1; Tb v 2–2–2ap, pt 1–1; Mt v 2–2. II: Fm d 1–1–4; Pt pr 1, rt 1; Tb v 1–2–2ap, pt 1–1; Mt v 2–2. III: Fm d 1–1–4; Pt pr 1, rt 1; Tb d 1–1, pt 0–1–1ap, v 1–0–2ap, rt 0–1–1ap; Mt d 1–2–2ap, v 0–2–2ap., and IV: Fm d 1–1–4; Pt pr 1, rt 1; Tb d 1–1, pt 1–1, rt 1–1; Mt d 2–2–2ap, rt 1ap, v 1–0–2ap, pr 1ap.

Epigyne (Fig. 2C–D): longer than wide, the fold of epigyne wider than the window, and the rim of epigynal window almost rounded (Fig. 2C). Copulatory ducts fused, long, widest medially (Fig. 2D). Spermathecae fused, rounded and significantly shorter than copulatory ducts (Fig. 2D).

Male: Unknown.

Distribution. Known only from the type locality.

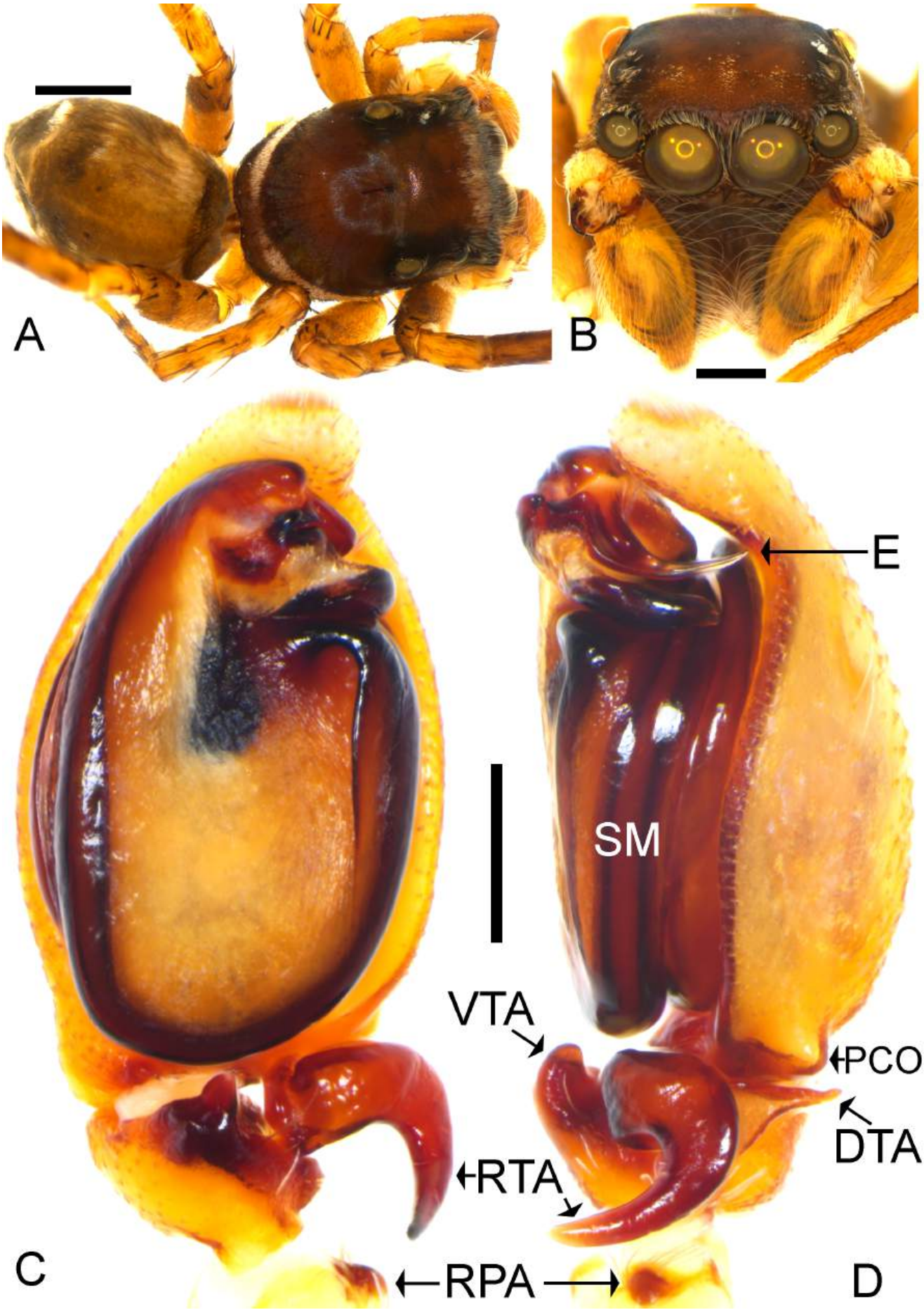

Fig. 3. Male of *Gelotia liuae* Wang & Li, 2020. A, habitus, dorsal view; B, carapace, anterior view; C, palp, ventral view; D, palp, retrolateral view. Scale bars: A, 1 mm, B, 0.5 mm, C, D, 0.3 mm.

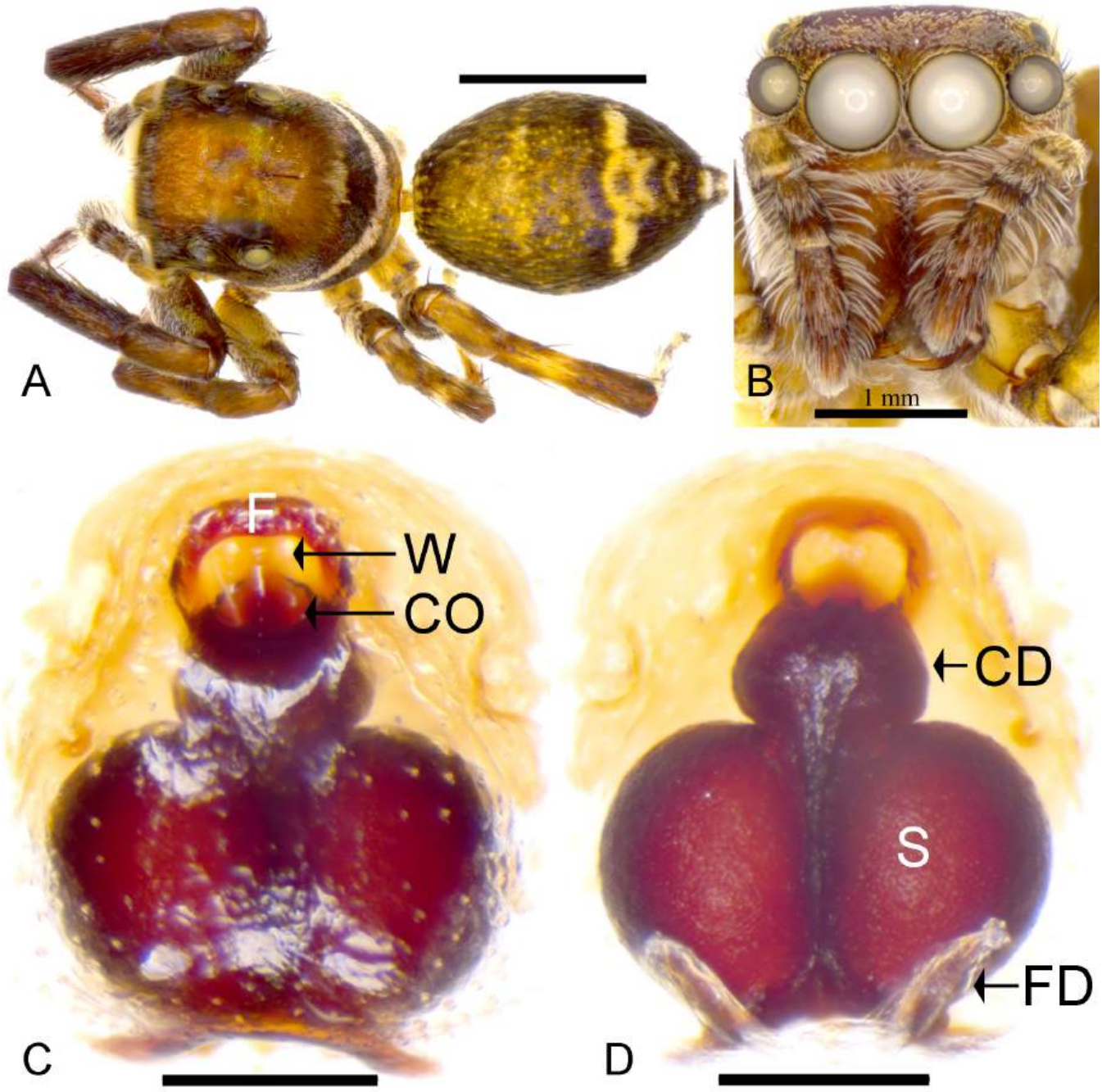

Fig. 4. Female of *Gelotia liuae* Wang & Li, 2020. A, habitus, dorsal view; B, carapace, anterior view; C, epigyne, ventral view; D, epigyne, dorsal view. Scale bars: A, 2 mm, B, 1 mm, C, D, 0.2 mm.

***Gelotia liuae* Wang & Li, 2020**
(Figs. 3–4)

Gelotia sp. Maddison et al., 2014: 68, fig. 7 (male).
Gelotia liuae Wang & Li, 2020: 38, figs. 7A–D, 8A–F, 17D, 18D, 19D (male, female).

Material examined. Male (VNMN-ARA-SAL-230), VIETNAM, Quang Binh Prov., Bo Trach District, near Phong Nha cave (17.6141°N, 106.3041°E), 46m a.s.l., 18 May 2020, coll. Q.D. Hoang; Female (VNMN-ARA-SAL-331), VIETNAM, Bac Giang Prov., Son Dong District, Tay Yen Tu Nature Reserve (21.1810°N, 106.7228°E), 202m a.s.l., 9 July 2022, Coll. Q.D. Hoang.

Description. Well-described by Wang & Li (2020). Habitus and copulatory organs from Vietnamese specimens as in Figs. 3–4.

Variation. The specimens from Vietnam were collected from at least two different localities (a male from central Vietnam and a female from northern Vietnam). They show some differences with the original description by Wang & Li (2020): male with RTA slightly thicker and more bent than the holotype (Figs. 3C–D and fig. 7A–B in Wang & Li, 2020), DTA almost pointed (Fig. 3D) rather than blunt (fig. 7A–B in Wang & Li, 2020), and embolus more curved than in the holotype (Fig. 3D, and fig. 7B–D in Wang & Li, 2020); the female from Vietnam shows a different epigyne,

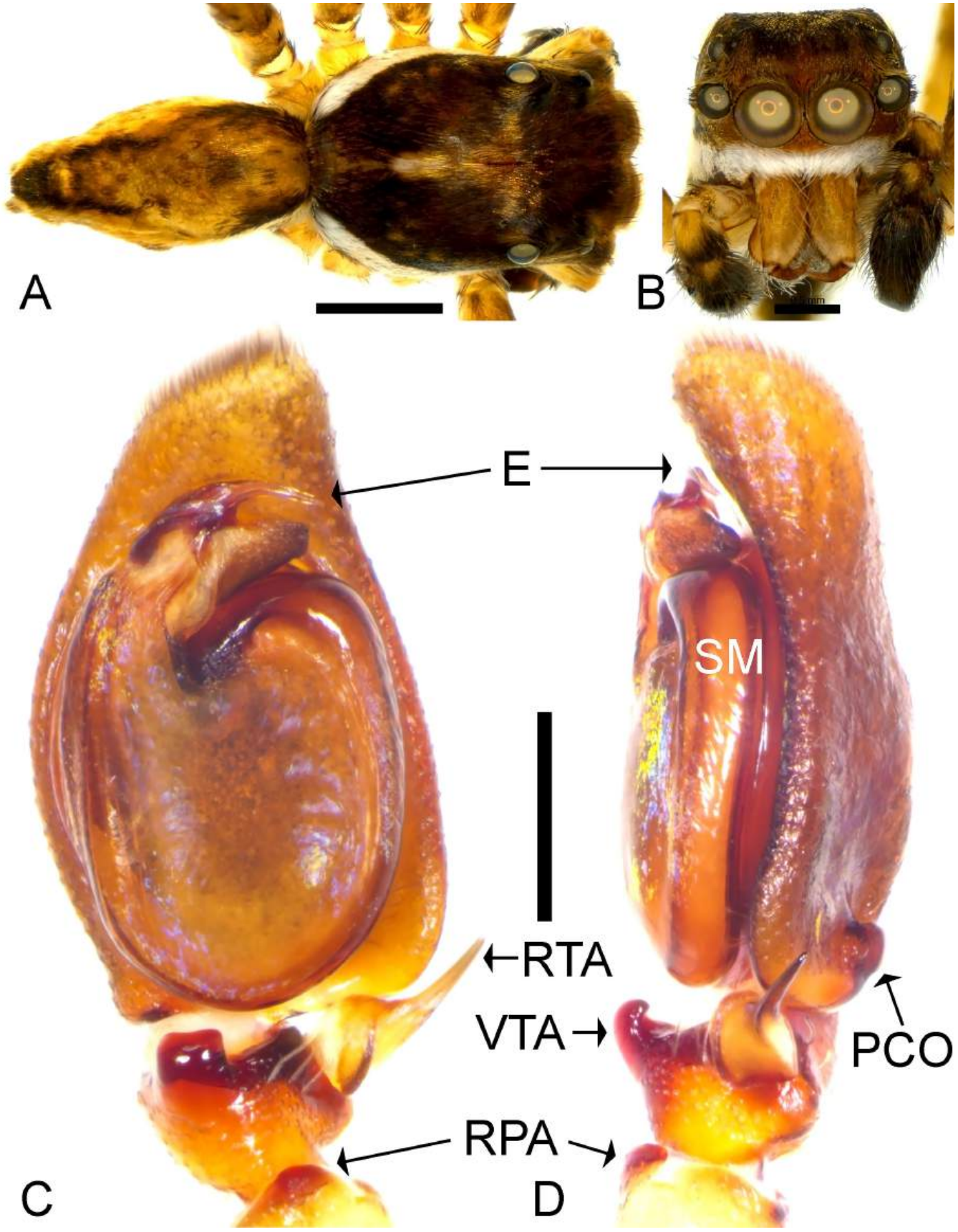

Fig. 5. Male of *Gelotia zhengi* Cao & Li, 2016. A, habitus, dorsal view; B, carapace, anterior view; C, palp, ventral view; D, palp, retrolateral view. Scale bars: A, 1 mm, B, 0.5 mm, C, D, 0.3 mm.

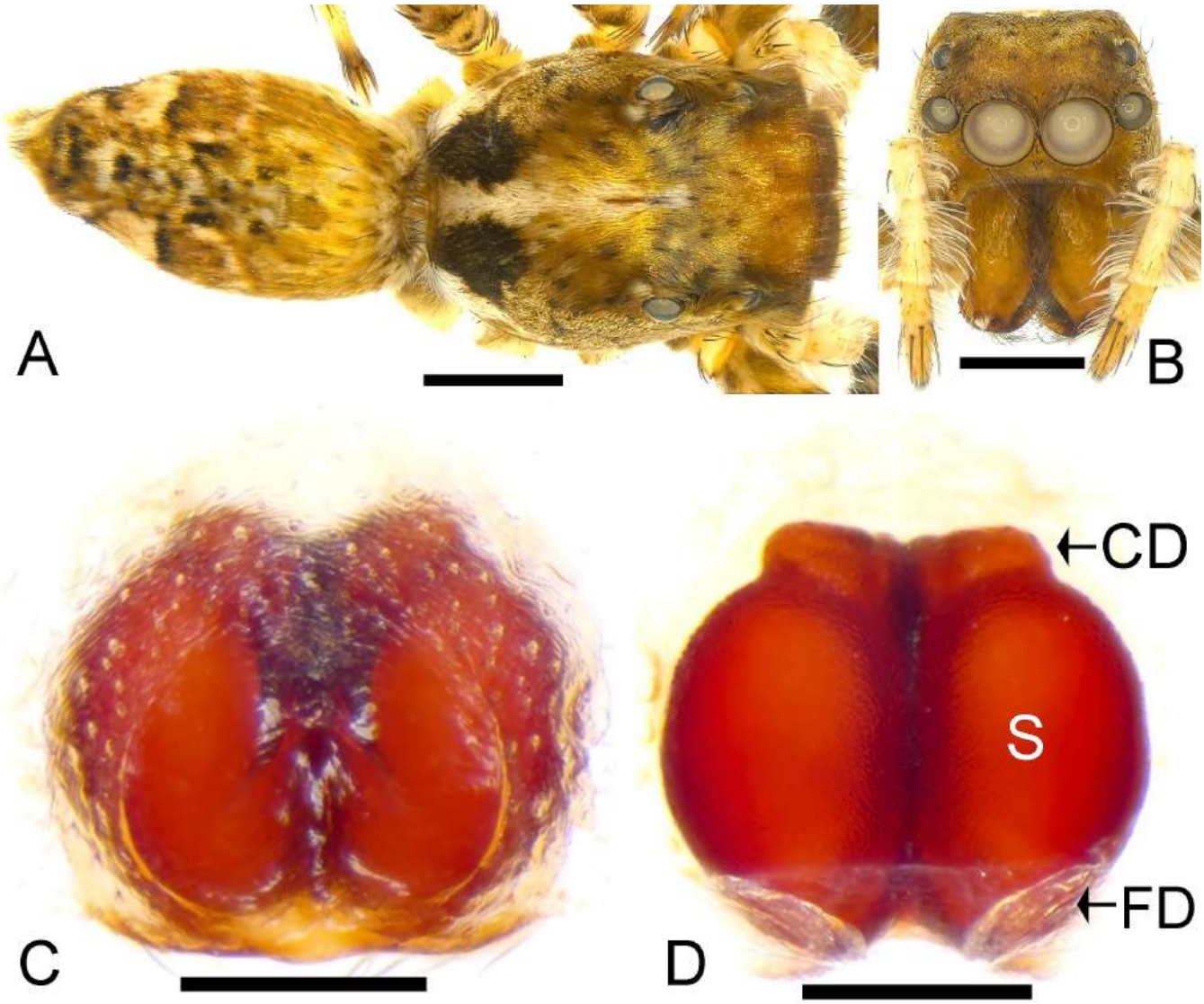

Fig. 6. Female of *Gelotia zhengi* Cao & Li, 2016. A, habitus, dorsal view; B, carapace, anterior view; C, epigyne, ventral view; D, epigyne, dorsal view. Scale bars: A, B, 1 mm, C, D, 0.2 mm.

the fossa fused with rim of window (Fig. 4C) vs. wider than the window in the paratype (fig. 8A in Wang & Li, 2020), copulatory ducts about half length of spermathecae (Fig. 4D) while near 2/3 in the paratype (fig. 8B in Wang & Li, 2020), spermathecae symmetrical (Fig. 4D) vs. obliquely at an angle of about 45 degrees in the illustrations (fig. 8B in Wang & Li, 2020). Despite the minor differences between the specimens from China and Vietnam and their genetic distance, these are insufficient to divide them into two separate species. Thus, we consider them conspecific in the present study.

Distribution. China (Yunnan, Guangxi Prov.) and Vietnam (Quang Binh, Bac Giang Prov.).

Gelotia zhengi Cao & Li, 2016
(Figs. 5–6)

Gelotia zhengi Cao & Li, in Cao, Li & Żabka, 2016: 78, figs. 24A–D, 25A–B (males); Wang & Li, 2020: 41, figs. 9A–D, 10A–G, 17G, 18G, 19G (male, females).

Marterial examined. Male (VNMN-ARA-SAL-117), female (VNMN-ARA-SAL-95), VIETNAM, Dong Nai Prov., Tan Phu Dist., (11.4063°N, 107.4370°E), 121m a.s.l., 21 November 2021, coll. Q.D. Hoang. Male (VNMN-ARA-SAL-226), VIETNAM, Dak Lak Prov., Krong Bong District, Chu Yang Sin National Park (12.2686°N, 108.2305°E), 893m a.s.l., 14 May 2022, coll. Q.D. Hoang.

Description. For both sexes, see Cao et al. (2016) and Wang & Li (2020). Habitus and copulatory organs from Vietnamese specimens as illustrated in Figs. 5–6.

Variation. There are slight differences with the illustration of the female by Wang & Li (2020), as the copulatory ducts are slightly wider and longer than those of the specimens from China (Fig. 6D and fig. 10C in Wang & Li, 2020). The male is perfectly matched to the illustrations by Cao et al. (2016) and Wang & Li (2020).

Distribution. China (Yunnan Prov.) and Vietnam (Dong Nai, Dak Lak Prov.). The species is probably found in

Malaysia, as indicated by two Facebook posts (https://www.facebook.com/photo/?fbid=10158373523431441&set=a.10150395133571441, Nicky Bay; https://www.facebook.com/photo/?fbid=10219423322027121&set=gm.625020444714442, Paul Ng). The conformation of the RTA observed in the posts closely resembles the illustrations of *Gelotia zhengi*, but further examination of the specimens is needed to confirm this.

DISCUSSION

Both male and female specimens of two species, *Gelotia liuae* and *G. zhengi* were collected from various localities in Vietnam. They exhibit variations in morphology compared to their original descriptions (see preceding section). However, the male (VNMN-ARA-SAL-230) and female (VNMN-ARA-SAL-331) specimens from Vietnam as well as a specimen from China of the species *G. liuae* have a low genetic distance ranging from 0.24% to 1.22%, indicating that they are conspecific. Similarly, the male (VNMN-ARA-SAL-226) and female (VNMN-ARA-SAL-95) specimens of the species *G. zhengi* show a larger genetic distance (2.25%), but remained below the estimated delimitation threshold for the Indian spiders (Tyagi et al., 2019), suggesting they belong to the same species. In the present study, the closest species to *G. onoi*, new species, in terms of genetic distance is *G. liuae* with genetic distance ranging from 6.01% to 6.58%. *G. onoi*, new species is clearly distinguished from congeners by both morphological and COI data. Although the species *Gelotia liuae* and *G. zhengi* show variations in both morphology and DNA (COI) in the study, we consider them to only be intraspecific variations due to biogeographical differences. Therefore, we confirm the presence of three species of the genus *Gelotia* Thorell, 1890 in Vietnam, including *G. onoi*, new species, *G. zhengi*, and *G. liuae*.

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