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(ARANEAE: TETRAGNATHIDAE)**

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Tetragnathid spiders from Sri Lanka: description of two new species (Araneae: Tetragnathidae)

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ABSTRACT

Recent collecting in Sri Lanka has revealed a rich native tetragnathid spider fauna with several new species. In this paper, I describe two new, endemic, species, namely *Leucauge rubromaculata* **sp. nov.** and *Glenognatha dubiosa* **sp. nov.** from the Sabaragamuwa, Western and North Western Provinces. *Leucauge rubromaculata* **sp. nov.** can be separated from all known species of *Leucauge* of Sri Lanka by its smaller body size, oval abdomen, and presence of two large silver guanine patches anterior and posterior to the spinnerets. *Glenognatha dubiosa* **sp. nov.** is similar to *G. dentata* (Zhu & Wen, 1978), but can be separated from it by having a serrated embolus. Furthermore, *G. dubiosa* **sp. nov.** can be separated from all known species of *Glenognatha* Simon, 1887 by the serrated tip of the conductor. This species constitutes the first record of *Glenognatha* from Sri Lanka. Finally, *Leucauge lamperti* Strand, 1907 is considered as *nomen dubium*.

Keywords: Araneae, biodiversity, new species, taxonomy

INTRODUCTION

Spiders of the orb-weaving spider family Tetragnathidae have a worldwide distribution, and are particularly diverse in tropical and subtropical ecosystems. Tetragnathids usually build typical orb webs either along bodies of water, within the forest vegetation, or inside caves (Alvarez-Padilla *et al.* 2009; Dimitrov & Hormiga 2010; Alvarez-Padilla & Benjamin 2011). A total of 987 species of tetragnathids have been described to date (World Spider Catalog 2024). However, this probably constitutes only 50% of the true diversity of this ecologically and behaviourally diverse family (Alvarez-Padilla *et al.*, 2009). Twenty-four Tetragnathidae species belonging to 8 genera, *Atelidea* Simon, 1895 (1), *Dolichognatha* O. Pickard-Cambridge, 1869 (4), *Leucauge* White, 1841 (5), *Tetragnatha* Latreille, 1804 (11), and *Tylorida* Simon, 1894 (3) are known from Sri Lanka (World Spider Catalog 2024). Out of these 24 species, only *Atelidea spinosa* Simon, 1895 and *Dolichognatha quinquemucronata* (Simon, 1895) have been studied recently (Alvarez-Padilla & Benjamin 2011; Dimitrov *et al.* 2010).

The genus *Glenognatha* Simon, 1887 currently has 34 nominal species distributed on the African continent, Indo-Malaya, Nearctic, Neotropics, Oceania, and Palearctic regions (Cabra-García & Brescovit, 2016; World Spider Catalog, 2024). It has three representatives in India: *Glenognatha dentata* (Zhu & Wen, 1978), *G. ganeshi* (Bodkhe, Manthen & Tanikawa, 2014), and *G. paullula* Sankaran, Caleb & Sebastian, 2020 (Sankaran *et al.* 2020, World Spider Catalog, 2024). However, *Glenognatha* has not been previously reported from Sri Lanka (Benjamin *et al.*, 2012; World Spider Catalog,

2024). The genus *Leucauge* is represented by five species: *Leucauge celebesiana* (Walckenaer, 1841), *L. decorata* (Blackwall, 1864), *L. ditissima* (Thorell, 1887), *L. granulata* (Walckenaer 1841) and *L. lamperti* Strand, 1907. Except for the last species, the others are quite widespread and well-known. In this contribution, I describe two new species, one each of the genera *Leucauge* and *Glenognatha*, and discuss the taxonomic status of *L. lamperti*.

MATERIALS AND METHODS

Digital images were taken with a Nikon DXM1200F camera. Images were edited using an AutoMontage software package (Helicon Focus ver. 6, Helicon soft Ltd). Left-hand side structures are depicted unless otherwise stated. Setae are usually not depicted in final palp drawings. All measurements are given in millimeters and were made with a stereo microscope equipped with a 10x ocular and an ocular micrometre scale. An Amray 1810 Scanning Electron Microscope (SEM), housed at the Smithsonian Institution's National Museum of Natural History SEM facility, was used to study and photograph select morphological features. Photographed parts were cleaned ultrasonically for 1–3 min and dehydrated with 100% ethanol (transferred from 70% ethanol to absolute ethanol and left overnight), then critical point dried. After critical point drying, the specimens were glued to rounded aluminium rivets using an acetone solution of polyvinyl resin (Paraloid B72) and then Au/Pd coated for examination in the SEM. Female genitalia were excised with sharpened needles. Abdominal tissue was digested with SIGMA Pancreatin LP 1750 enzyme complex (Alvarez-Padilla & Hormiga, 2008), in a solution of sodium borate prepared following methods described in Dingerkus & Uhler (1977). The specimen was then transferred to methyl salicylate (Holm, 1979) and temporarily mounted as described in Grandjean (1949) and Coddington (1983) for examination and illustration under microscope. Illustrations were scanned and edited with Adobe Photoshop CS2. Plate layout was done with Adobe Illustrator CS2. The species descriptions generally follow the format of Alvarez-Padilla & Benjamin (2011). The studied specimens are deposited in ZFMK.

Abbreviations used in the text and figures: AC = aciniform gland spigot(s); ALE = anterior lateral eye; ALS = anterior lateral spinneret; AME = anterior median eye; C = conductor;

CB = cymbium; CD = copulatory duct; CO = copulatory opening;

CY = cylindrical gland spigot(s); E = embolus; F = fundus; FD = fertilization duct; MAP = major ampullate gland spigot; mAP = minor ampullate gland spigot; P = paracymbium; PI = piriform gland spigot(s); PLE = posterior lateral eye; PLS = posterior lateral spinneret; PME = posterior median eye; S = spermatheca; ST = subtegulum; T = tegulum; ZFMK = Zoologisches Forschungsmuseum Alexander Koenig, Bonn.

RESULTS

Taxonomy

Class Arachnida Cuvier, 1812

Order Araneae Clerck, 1757

Family Tetragnathidae Menge, 1866

Genus *Leucauge* White, 1841

Leucauge rubromaculata* sp. nov. (Figs. 1A–F, 2A–F, 3A–B, 4A–F, 5A–D)*LSID** urn:lsid:zoobank.org:act:F97CE392-5233-431F-B8A5-29CC9311B56E**Type material:** Holotype: Male from SRI LANKA: Sabaragamuwa Province: Ratnapura District, Gilimale forest reserve, 11 Feb. 2007, Suresh Benjamin & Ziyad Jaleel (ZFMK Ar8769).**Paratypes:** 1 male and 3 females, same data as holotype (ZFMK Ar8770).**Other material examined:** SRI LANKA: Western Province: 1 female, Kalutara district, Ingiriya, Bodinagala forest reserve, 10 Feb. 2007, Suresh Benjamin & Ziyad Jaleel (ZFMK Ar8771).**Etymology:** The specific name refers to the conspicuous red spots of the abdomen.**Diagnosis:** The new species can be separated from all known species of *Leucauge* of Sri Lanka by the total body size of about 5 to 6.5 mm (vs. 10–20 mm in *Leucauge celebesiana*, *L. decorata*, *L. ditissima*, and *L. granulate*), the oval abdomen (vs. elongated and cylindrical, extending caudally beyond spinnerets in the aforementioned three species) and by the two large silver guanine patches [these patches are red in colour in live spiders (Figs. 1C–F, 2A, 2C)], anterior and posterior to the spinnerets (Figs 1C–F, 2A, 2C; absent in the aforementioned three species). This diagnosis applies to both males and females.**Description:** Male (holotype). Total length: 5.0; prosoma length: 3.0, width: 2.1. Leg I: femur 3.0, patella 1.0, tibia 3.5, metatarsus 4.0, tarsus 2.0. Leg formula 1243. Prosoma yellow/green, laterals darker. Opisthosoma round, as long as wide (0.8 long, 0.8 wide, 0.6 high), dorsally and with a large silver patch towards spinnerets (red *in vivo*) and randomly distributed smaller silver patches (silver *in vivo*), ventrally with a large silver patch (red *in vivo*). Chelicerae anterior margin with a single tooth, posterior cheliceral margin not visible. Chelicerae not larger than that of female. Epiandrous plate with clear anterior and posterior margins, fusules, 10 in number, lined in a single row (Fig 5A). AME diameter 0.08. ALE 0.06. PME 0.06. PLE 0.05. Clypeus height 0.5 times AME diameters. AME separation 0.7 times AME diameters. AME-ALE separation 0.7 times AME diameter. PME separation 0.8 times PME diameter. PME-PLE separation 0.8 times PME diameters. Cymbio dorso-basal process, found in most *Leucauge* and related genera, absent (Figs 3A–B). Leg IV with two parallel rows of ramified trichobothria extended more than half the femur length. Paracymbium thumb-shaped, slightly broader at the distal end (Figs 3A–B). Conductor hook-shaped with a terminal curve that supports the embolic tip. Embolus base encircles the conductor, embolus broad (Figs. 3A–B). Sperm duct coiled, width considerably enlarged towards fundus.

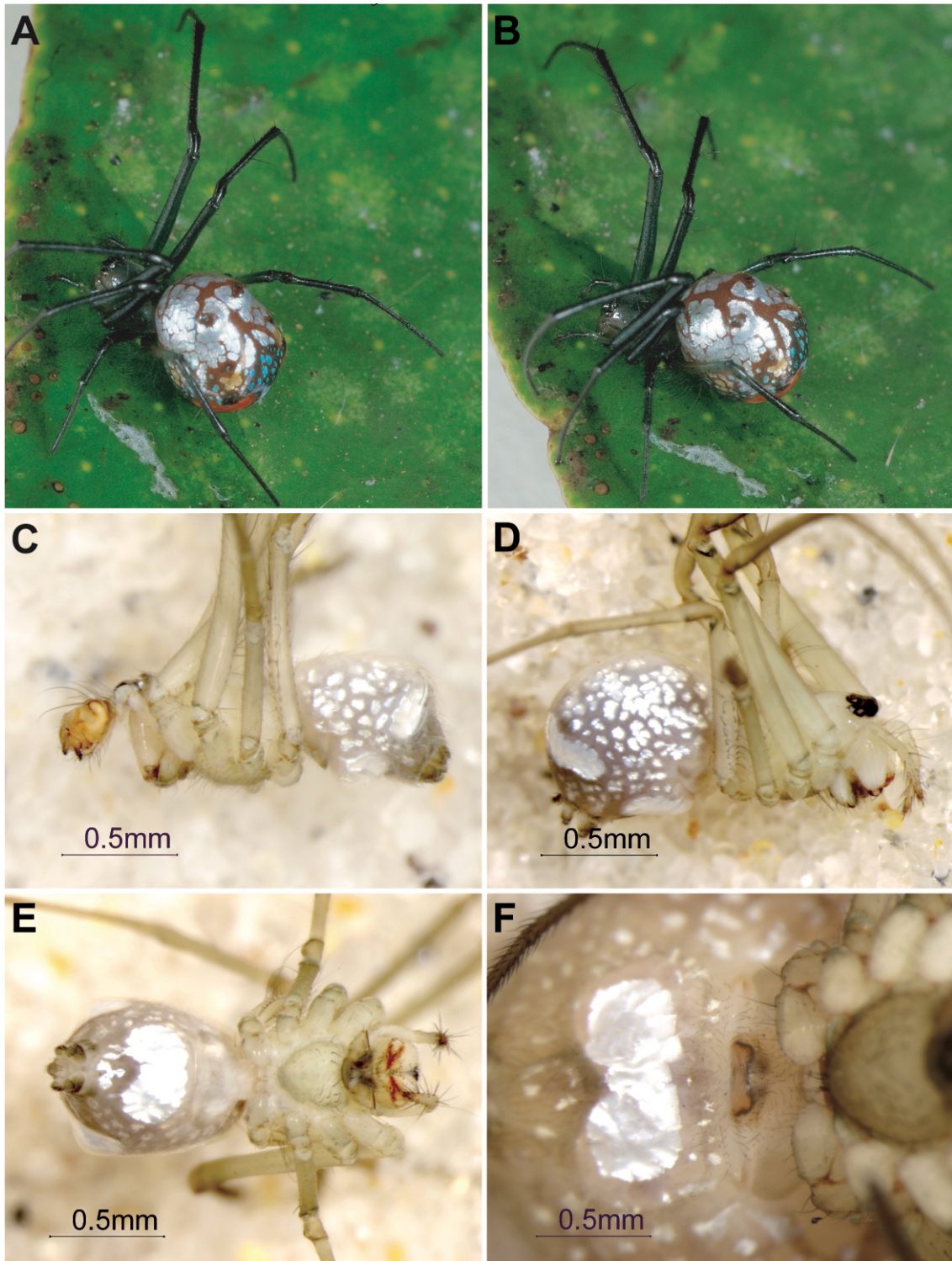


Figure 1. Photographs of *Leucauge rubromaculata* sp. nov. A B D–F female paratype (A B dorsal, D lateral, E F ventral); C male holotype, lateral view.

Female: Total length: 6.1; prosoma length: 3.0, width: 3.0. Leg I: femur 3.1, patella 1.0, tibia 3.5, metatarsus 3.0, tarsus 1.5. Leg formula 1243. In general, similar to male. Chelicerae anterior margin with two teeth, posterior cheliceral margin not visible. Abdomen oval 1.2 long, 0.8 wide, 1.1 high, Ocular area lower than the carapace margin (Figs. 5B–C). AME diameter 0.08. ALE 0.06. PME 0.06. PLE 0.05. Clypeus height 0.5

times AME diameters. AME separation 0.5 times AME diameter. AME-ALE separation 0.5 times AME diameter. PME separation 1.0 times PME diameter. PME-PLE Figure 3.

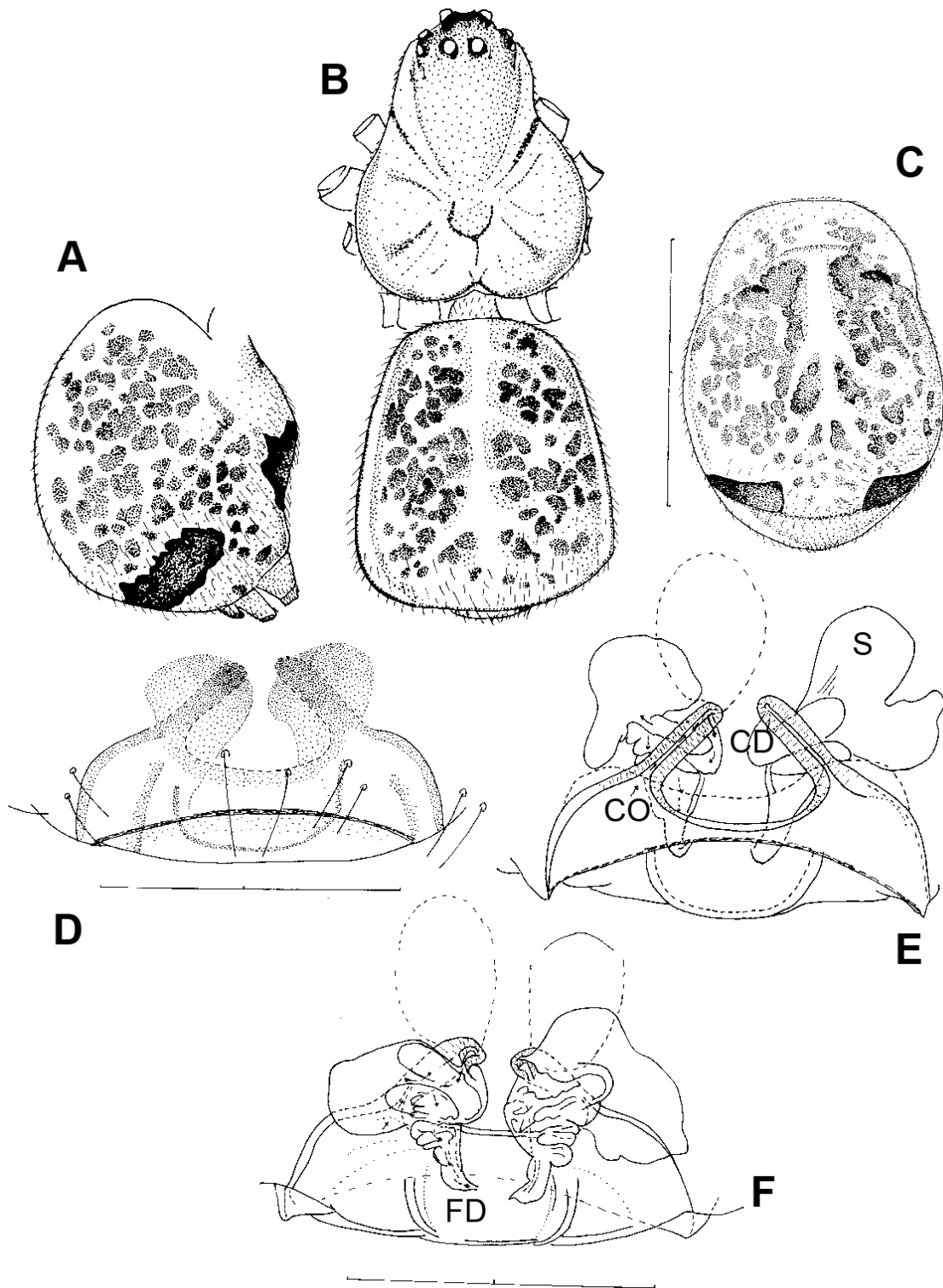


Figure 2. *Leucauge rubromaculata* sp. nov., non-type female (not preserved). A Opisthosoma lateral view; B habitus, dorsal view; C, Opisthosoma dorsal view; D, Epigynum, ventral view; E vulva, ventral view; F ditto, dorsal view. Scale bars = 0.2 mm (D, E, F), 2.0 mm (A, B, C).

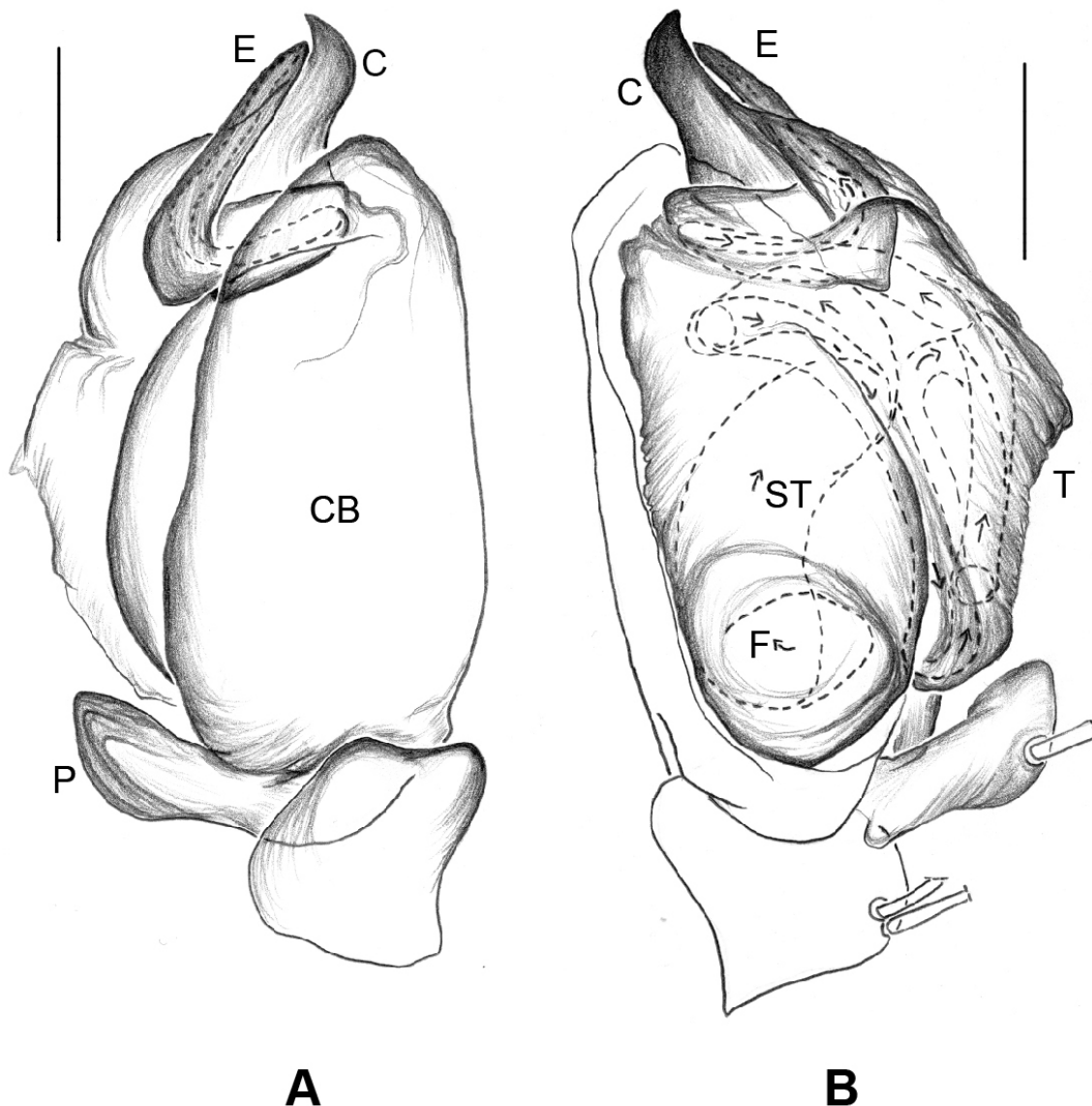


Figure 3. *Leucauge rubromaculata* sp. nov., male holotype. left male palp (A prolateral, B retrolateral). Scale bars = 0.2 mm.

separation 0.7 times PME diameter. Spinnerets as in Figs 6A–D. Leg IV with two parallel rows of ramified trichobothria extended more than half the femur length (Figs 4E, F). Epigyne flat, with an anterior sclerotised arch forming an oblong atrium, longer than wide (Figs 1F, 2D–F). The copulatory ducts begin at the lateral margins of the atrium and lead to membranous spermatheca. The walls of the copulatory ducts gradually thicken towards the spermatheca (Figs 1F, 2D–F). Fertilization ducts coiled and well-sclerotised. Accessory glands not observed.

Natural History: This species appears to be restricted to relatively undisturbed natural forest in the wet zone of Sri Lanka. The spiders hang upside down from the centre of their horizontal orb webs. Females are found throughout the year, whereas adult males are found only in a short period of about a few weeks during the months of February and March. They are not found particularly close to water bodies as is common in most *Leucauge*.

Distribution: Known only from the type locality.

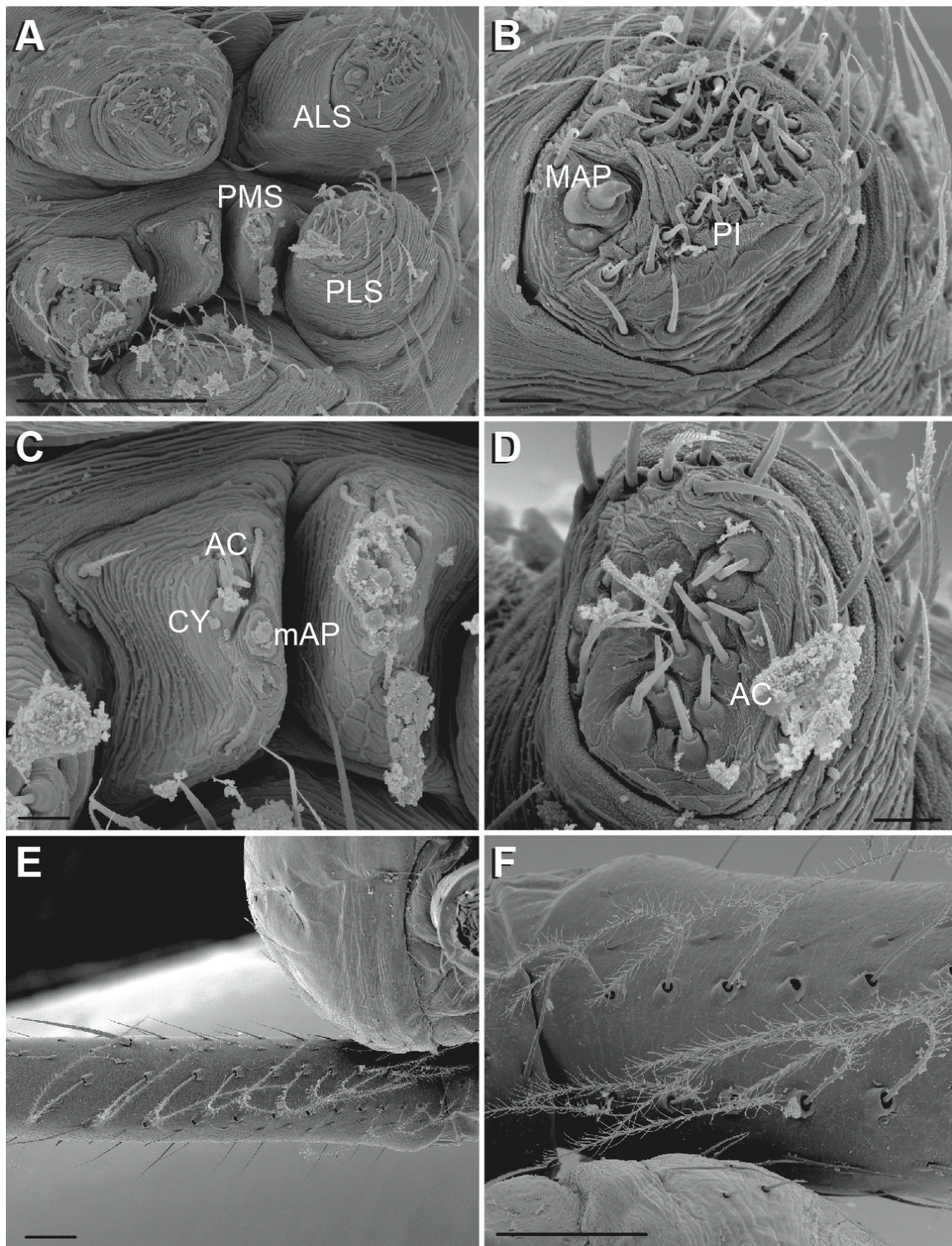


Figure 4. Scanning electron micrographs of *Leucauge rubromaculata* sp. nov., non-type female (not preserved). A spinnerets; B ALS; C PMS; D PLS; E F trichobothria, leg 4. Scale bars = 10 μ m (B, C, D), 100 μ m (A, E, F).

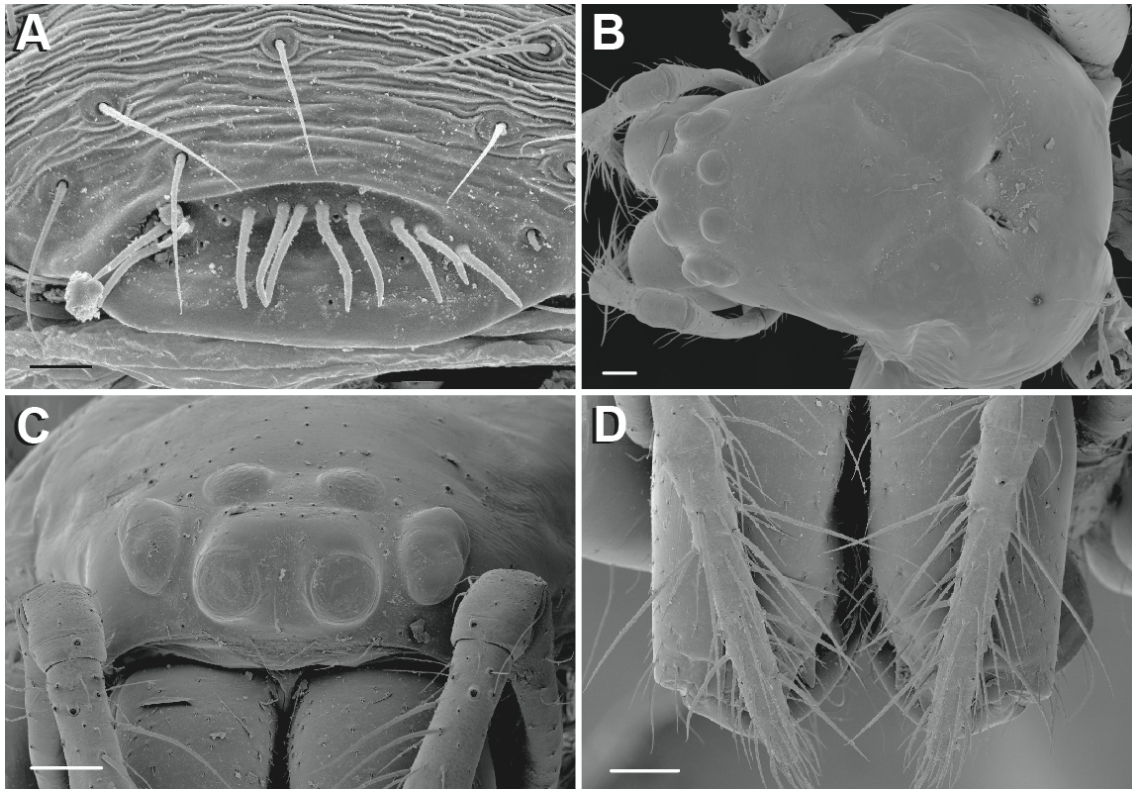


Figure 5. Scanning electron micrographs of *Leucauge rubromaculata* sp. nov., A male (not preserved), B–D female (not preserved). A epiandrous fusules; B prosoma, dorsal view; C D ditto, front view. Scale bars = 10 μ m (A), 100 μ m (B–D).

Genus *Glenognatha* Simon, 1887

***Glenognatha dubiosa* sp. nov. (Figs. 6A–C)**

LSID urn:lsid:zoobank.org:act:00CF72E0-9F3D-4F9D-9891-0774DABA65BC

Type material: Holotype: Male from SRI LANKA: North Western Province: Kurunegala District, ca 300m 1–28 Feb. 2007, hand collecting, leg. Ziyad Jaleel. (ZFMK Ar8772).

Etymology: The specific name refers to the unusual morphological characteristics and the serendipitous discovery of the holotype.

Diagnosis: *Glenognatha dubiosa* sp. nov. is similar to *G. dentata* Zhu & Wen, 1978, by the serrated retrolateral margin of the conductor (Cabra-García & Brescovit, 2016: fig. 43g) but can be separated from it by the serrated embolus tip (Fig. 6A, B, vs. smooth (not serrated) in *G. dentata* (Cabra-García & Brescovit, 2016: fig. 43h xxx). Further, the new species can be easily distinguished from all other *Glenognatha* species by the prominent tooth-like projections (serrations) on the distal retrolateral margin of the conductor and embolus (arrow in Fig. 6B). Separated from all known species of *Tetragnatha* and *Leucauge* of Sri Lanka by the oval (almost rounded) opisthosoma and the serrated tip of the conductor.

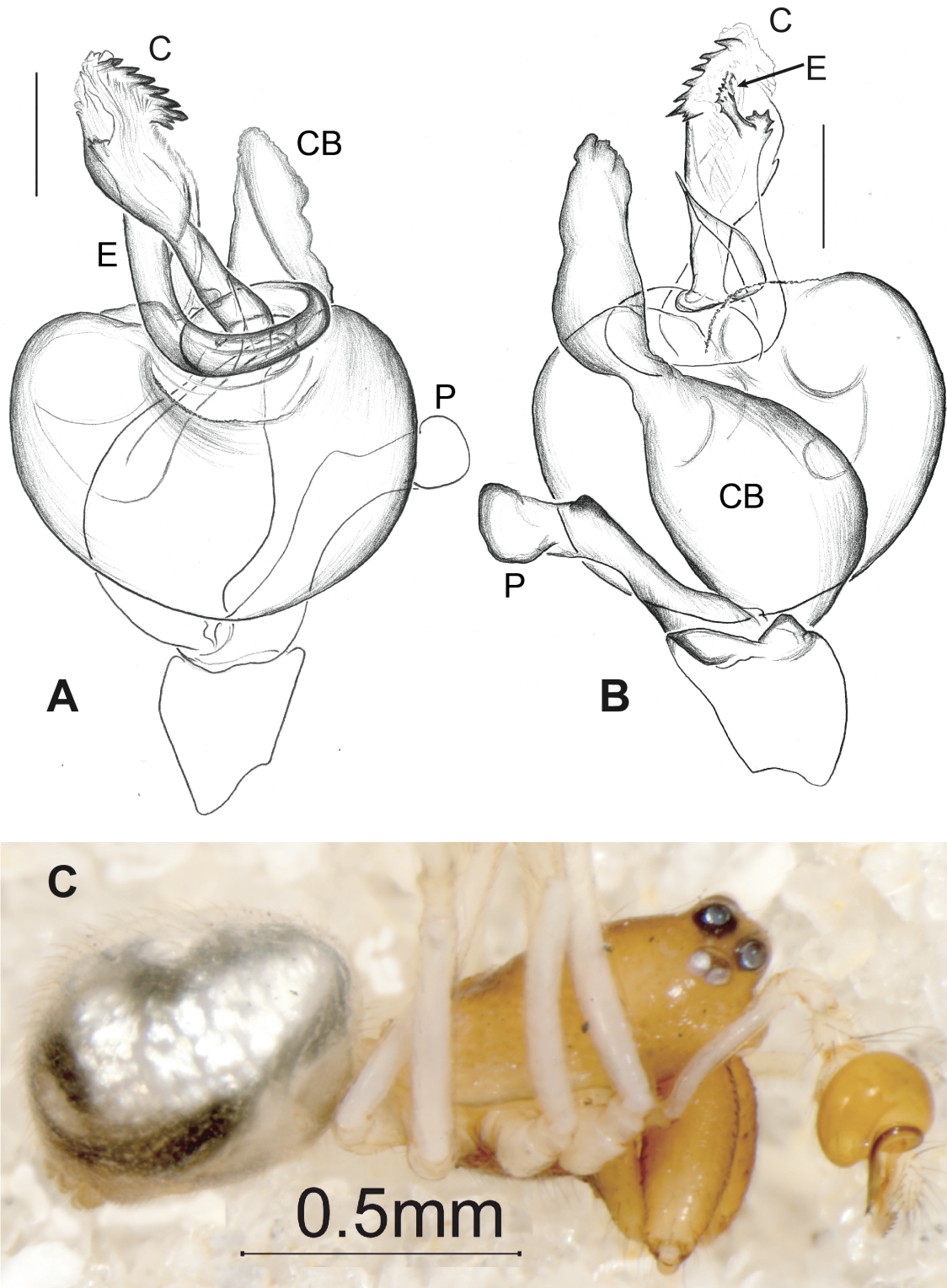


Figure 6. *Glenognatha dubiosa* sp. nov., male holotype. A left male palp, ventral view; B ditto, dorsal view; C habitus, lateral view. The arrow points to the serrated embolus. Scale bars = 0.2 mm (A, B), 0.5 mm (C).

Description: Male (holotype). Total length: 5.0; prosoma length: 3.0, width: 2.1. Leg I: femur 3.0, patella 1.0, tibia 3.5, metatarsus 4.0, tarsus 2.0. Prosoma oval, longer than wide. Opisthosoma oval, longer than wide. Leg formula 1243. Prosoma dark yellow,

without markings. Opisthosoma oval, slightly long as wide (0.4 long, 0.3 wide, 0.3 high), dorsolaterally with two large silver patches (Fig 6C). Laterally with black markings as in Fig 6C. Chelicerae anterior margin with two teeth and posterior margin with 3 teeth in two groups. Chelicerae divergent (Fig 6C). AME diameter 0.08. ALE 0.06. PME 0.08. PLE 0.05. Clypeus height 3.5 times AME diameters. AME separation 1.0 times AME diameters. AME-ALE separation 1.5 times AME diameter. PME separation 1.1 times PME diameter. PME-PLE separation 2.0 times PME diameters. Leg IV lack any form elongated trichobothria. Paracymbium elongated with a constriction approximately at the centre, slightly broader at the distal end (Figs 6A–B). Conductor filiform, terminally broadened with serrated margins. Base weakly sclerotised, terminal end membranous. Embolus base encircles the conductor, tip is surrounded by the conductor (Figs 6A–B). Sperm duct coiled, diameter width considerably enlarged towards the fundus.

Female: Unknown.

Natural History: Unknown.

Distribution: Known only from the type locality.

Taxonomic status of *Leucauge lamperti* Strand, 1907

Leucauge lamperti* Strand, 1907 *nomen dubium

Leucauge lamperti Strand, 1907: 157, fig. 8.

Type material: Lost.

Remarks: The spiders described by Strand (1907) were deposited in the Staatliches Museum für Naturkunde, Stuttgart. This collection was destroyed during the World War Two (W. Schawaller, in litt.). As this study was published in the journal “Abhandlungen der Naturforschenden Gesellschaft zu Goerlitz”, I also looked for the material at the Staatlichees Museum für Naturkunde, Goerlitz. According to A. Christian (in litt.) no spiders described by Embrik Strand were deposited there. Thus, the holotype can be safely considered lost. The description of *Leucauge lamperti* was based on a subadult male specimen. Strand provided a single illustration (Strand, 1907: 157, fig. 8). The description and figure might refer to any of the common species of the genus *Leucauge* known from Sri Lanka and do not render the species recognisable. Thus, I declare this name a *nomen dubium*.

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