

A new genus of railroad-worm beetles from the Atlantic Rainforest from Brazil (Coleoptera: Phengodidae, Mastinocerinae)

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Abstract. Here we describe a new genus, *Cleidella* gen. nov., and two new species, *C. picea* sp. nov. and *C. silveirai* sp. nov., all from Rio de Janeiro State, Brazil. The new genus is characterized by the interantennal distance subequal to scape length, antenna with 11 antennomeres, IV to X with two long symmetrical branches; mandibles long, projected and not crossed, pointed forward obliquely from head; maxillary palpi 4-segmented, last segment digitiform; labial palpi 2-segmented; posterior tentorial pit consisting of a single small fossa; elytron surpassing from the fourth to fifth abdominal segment, 3.3-3.9× longer than wide; first tarsomere of protarsus with a ventral comb as long as the tarsomere length; wing with radial cell closed and transverse, vein r4 interrupted; aedeagus with paramere symmetrical, apex unevenly round, toothed inward, with short and scarce bristles. We provide a key to Mastinocerinae genera with 11 antennomeres, as well as illustrations for the diagnostic features for this new genus and a key to its species.

Key-Words. Mountains; Morphology; Neotropical; Taxonomy.

INTRODUCTION

The American Phengodidae LeConte, 1861 are composed of 295 species and 37 genera from southern Canada to northern Chile-Argentina, being more specious in the Neotropical region (Costa & Zaragoza-Caballero, 2010; Zaragoza-Caballero & Hernández, 2014; Constantin, 2014, 2016; Roza *et al.*, 2017, 2018; Roza & Mermudes, 2019; Vega-Badillo & Zaragoza-Caballero, 2019; Vega-Badillo *et al.*, 2020). In Brazil, 59 species and 15 genera are recorded (Roza *et al.*, 2017, 2018; Roza & Mermudes, 2019; Quintino, 2019). Recent studies of the Brazilian fauna have uncovered several new taxa in the family (*e.g.*, Roza *et al.*, 2017, 2018; Roza & Mermudes, 2019), especially in the Atlantic Rainforest. This biome is one of the 25 hotspots of biodiversity on the planet, among the five higher rates of endemism (Myers *et al.*, 2000). However, it is the eighth threatened-most biome of the world (Fisher & Christopher, 2007), with only 11-12% of its original forest cover remaining (Ribeiro *et al.*, 2009; Fundação SOS Mata Atlântica & INPE, 2014).

The taxonomy of Phengodidae is not well resolved. Although keys to identification of the American genera exist (Zaragoza-Caballero &

Hernández, 2014; Constantin, 2014; Roza *et al.*, 2017, 2018; Roza & Mermudes, 2019), only *Zarhipis* LeConte, 1881 was revised (Linsdale, 1964). Redescriptions, illustrations and a key to some species of *Phengodes* Illiger, 1807 from the USA (Wittmer, 1975) and *Distremocephalus* Wittmer, 1976 from Mexico (Zaragoza, 1986) also exist. Besides that, most of genera are impossible to be identified at species level.

Currently, the group has three subfamilies in the Americas: Phengodinae LeConte, 1881, Mastinocerinae Leng, 1920 and Penicillophorinae Paulus, 1973. No phylogenetic analysis was ever conducted in order to test the monophyly of any genus in the family, and some of them may prove not to be natural groups. The internal relation of the family is unresolved, as the subfamilies were shown to be para- or polyphyletic, presenting the need for an updated classification through future phylogenetic analyses (Zaragoza-Caballero & Zurita-García, 2015). Additionally, the Middle East Cydistinae (two genera and seven species), previously an Elateroidea *incertae sedis*, were recently found to be the sister group of the American Phengodidae, based on molecular data, and included in the group as a subfamily (Kundrata *et al.*, 2019).

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Mastinocerinae Leng, 1920 is presently composed of 28 genera in the entire American continent (Zaragoza-Caballero & Hernández, 2014; Roza *et al.*, 2017, 2018; Roza & Mermudes, 2019; Vega-Badillo *et al.*, 2020). The group is morphologically diverse and badly defined, with no genera ever revised and several new taxa waiting to be described. Inside the variation in their morphology, the genera in Mastinocerinae may present antennae with 10 antennomeres (two genera), 11 antennomeres (four genera) or 12 antennomeres (22 genera). The four genera with 11 antennomeres are: *Euryognathus* Wittmer, 1976, *Euryopa* Gorham, 1881, *Stenuryopa* Wittmer, 1986 and *Microphrixothrix* Roza & Mermudes, 2019. Here, we describe a new genus, the fifth with 11 antennomeres, and two new species. One species is from the Serra dos Órgãos, on the Serra do Mar Mountain range, and the other from the previous location, and also Ilha Grande, Angra dos Reis. Both localities are in the Atlantic Rainforest of Rio de Janeiro State, Brazil. We also present a key to the genera of Mastinocerinae with 11 antennomeres, and to the species of the new genus.

MATERIAL AND METHODS

Study areas

The Parque Nacional da Serra dos Órgãos (PARNASO) is located at the Serra do Mar mountain range, in the Atlantic Rainforest of Southeastern Brazil. It includes in totality an area of 20,030 ha, with altitudes from 200 to 2,263 m, nested at the borders of four municipalities in the Rio de Janeiro State: Guapimirim, Magé, Petrópolis and Teresópolis (ICMBIO, 2008). Its phytophysognomies include: lower montane forest (below 800 m), montane forest (600 to 1,500 m), high-montane forest (1,500 to 2,000 m) and the “Campos de altitude” (CA) or “Brazilian Páramos” (starting at 2,000 m) (Rizzini, 1954; Veloso *et al.*, 1991; Safford, 1999). Its climate varies from hot and rainy summers to humid winters, when temperatures near freezing are found at the mountaintops (Flinte *et al.*, 2009).

The Parque Estadual da Ilha Grande (PEIG) protects an area of 12,072 ha at Ilha Grande, a continental island in the Angra dos Reis municipality, Rio de Janeiro State. The PEIG ranges elevations from sea level to 1,031 m, of which Pico da Pedra da Água (1,031 m) and Pico do Papagaio (959 m) stand out as the highest peaks. Its climate is rainy during all year, with the higher rates in the summer and lower in winter, with enough pluviosity to cause landslides on densely forested areas during summer. The park includes the following vegetation types: Dense Ombrophilous Forest, the Restinga and the Mangrove (INEA, 2010).

Collection, dissection and terminology

All specimens were collected by Malaise traps and preserved in 90% alcohol.

Specimens are deposited at Coleção Entomológica Prof. José Alfredo Pinheiro Dutra, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil (DZRJ) and Museu de Zoologia, Universidade de São Paulo, São Paulo, Brazil (MZSP). Terminology follows Costa *et al.* (1999), Costa & Zaragoza-Caballero (2010) and Zaragoza-Caballero & Zurita-García (2015). For hind wings, we follow Kukulová-Peck & Lawrence (1993). Specimens with the abdomen dissected have their terminalia preserved in alcohol. Photographs and measurements were taken with a Leica DFC450 and Application Suite CV3 multifocus software. The photographs were edited using Adobe Photoshop and the figure plates were designed with Adobe Illustrator (Adobe Systems). Total length was given by the sum of head, thorax and abdominal lengths, because extracting only overall body size could be misleading due to pronotal and head declination. Specimens were cleaned with ultrasonic sound for scanning electron microscopy (SEM), which was made with a Carl Zeiss, FEG Sigma 300 VP. We generated the distributional maps using the software Quantum GIS 2.14.3 (QGIS Development Team, 2016).

RESULTS

Systematics Phengodidae Mastinocerinae

Key to Mastinocerinae genera with 11 antennomeres

Adapted from Zaragoza-Caballero & Hernández (2014), with modifications on couplet 5 and the addition of two new couplets:

4. 11 antennomeres..... 5
5. Interantennal distance bigger than scape length..... 6
- 5'. Interantennal distance subequal to slightly smaller than scape length 6b
6. Antennal flabellae cylindrical; ventral combs on the first and second tarsomeres of protarsus and first tarsomere of mesotarsus
.....*Microphrixothrix* Roza & Mermudes, 2019
- 6'. Antennal flabellae lanceolated; ventral combs on the first tarsomeres of pro- and mesotarsus 6a
- 6a. Antennal flabellae from antennomeres IV-X; mandibles without an inner tooth *Euryopa* Gorham, 1881
- 6a'. Antennal flabellae from antennomeres IV-VIII, IX-X inflate and without flabellae; mandibles with an inner tooth *Euryognathus* Wittmer, 1976
- 6b. All tarsomeres without ventral combs *Stenuryopa* Wittmer, 1986
- 6b'. First protarsomere with a ventral comb *Cleidella* gen. nov.

Cleidella gen. nov.

Type species: *Cleidella picea* sp. nov.

Diagnosis: Body overall small, around 4 mm long (Figs. 1A-B); interantennal distance subequal to scape length (Figs. 1E, 2A); antenna with 11 antennomeres, IV-X with two long symmetrical branches, 2 to 8x the size of

the respective antennomere (Fig. 1D); mandibles long, projected and not crossed, pointed forward obliquely from head (Fig. 1C); maxillary palpi 4-segmented, last segment digitiform; labial palpi 2-segmented (Fig. 1F); posterior tentorial pit consisting of a single small fossa (Figs. 1F, 2B-C); pronotum narrower than humeral distance (Fig. 1A); elytron surpassing from the fourth to fifth abdominal segment, 3.3-3.9× longer than wide, slightly convergent posteriorly and slightly thickened apically (Figs. 1A, 4A); first tarsomere of protarsus with ventral comb as long as the tarsomere length (Fig. 3B);

claws simple, without any teeth (Fig. 3A); wing with radial cell closed and transverse, vein r4 interrupted (Fig. 4B); aedeagus with parameres symmetrical, apex unciform, toothed inward, with short and scarce bristles (Figs. 5C-H).

Description, male: Length: 3.2-4.7 mm.

Head (Figs. 1C-F, 2): Head wider than long, with posterior margin posteriorly convergent, usually partially covered by pronotum, slightly wider than pronotum; an-

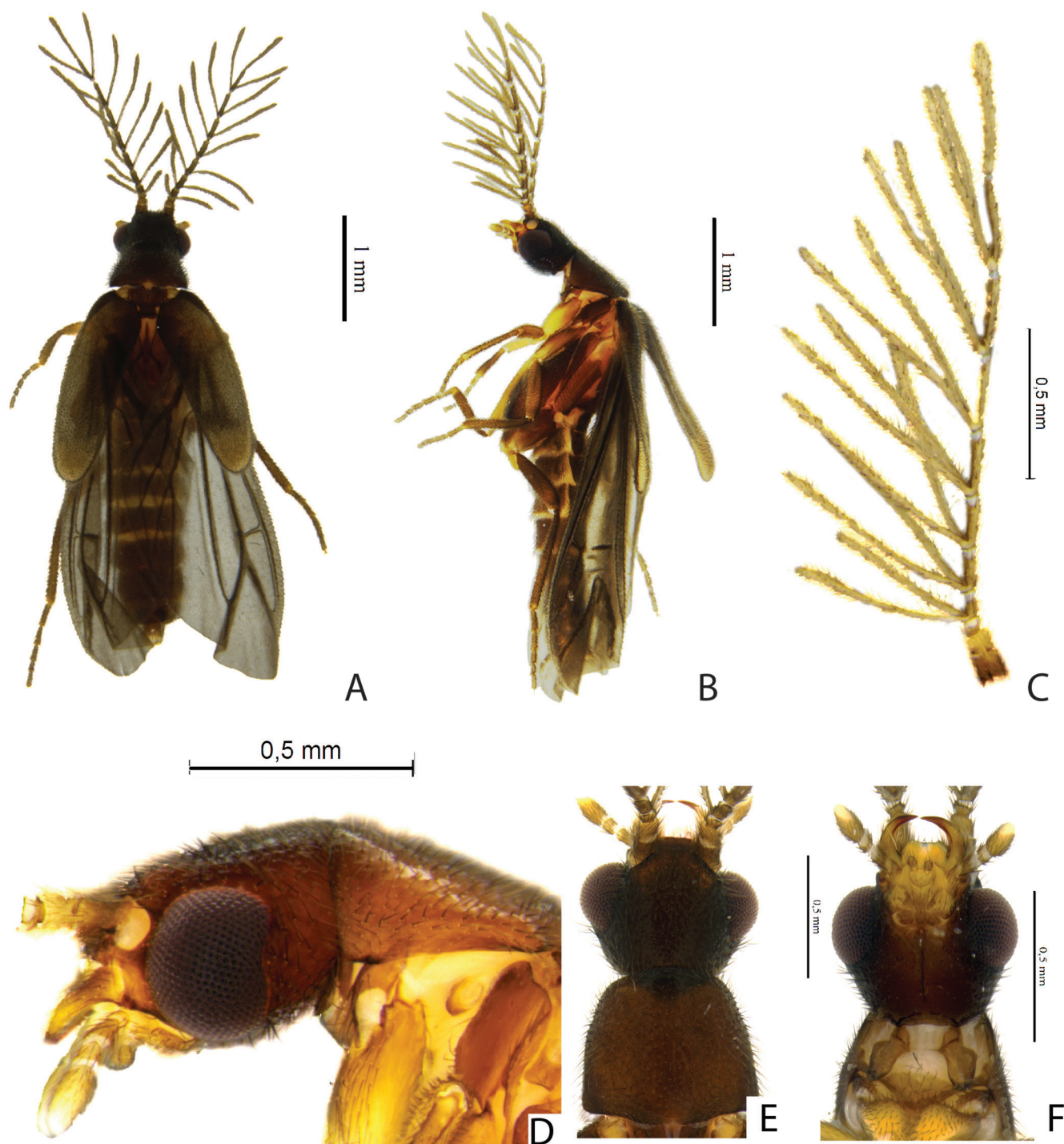


Figure 1. *Cleidella picea* gen. nov. et sp. nov., holotype male: (A) habitus, dorsal; (B) habitus, lateral; (C) head and pronotum, lateral; (D) antenna, lateral; (E) head and pronotum, dorsal; (F) head and prosternum, ventral.

tenna longer than elytron; 11 antennomeres, IV-X each with two long, symmetrical branches, 2 to 8× longer than antennomere (Fig. 1D); eyes medium to large size,

covering from ½ to almost totally of head length in lateral view, finely faceted, laterally projected in dorsal view (Fig. 1E), posterior margin variable in lateral view; frons

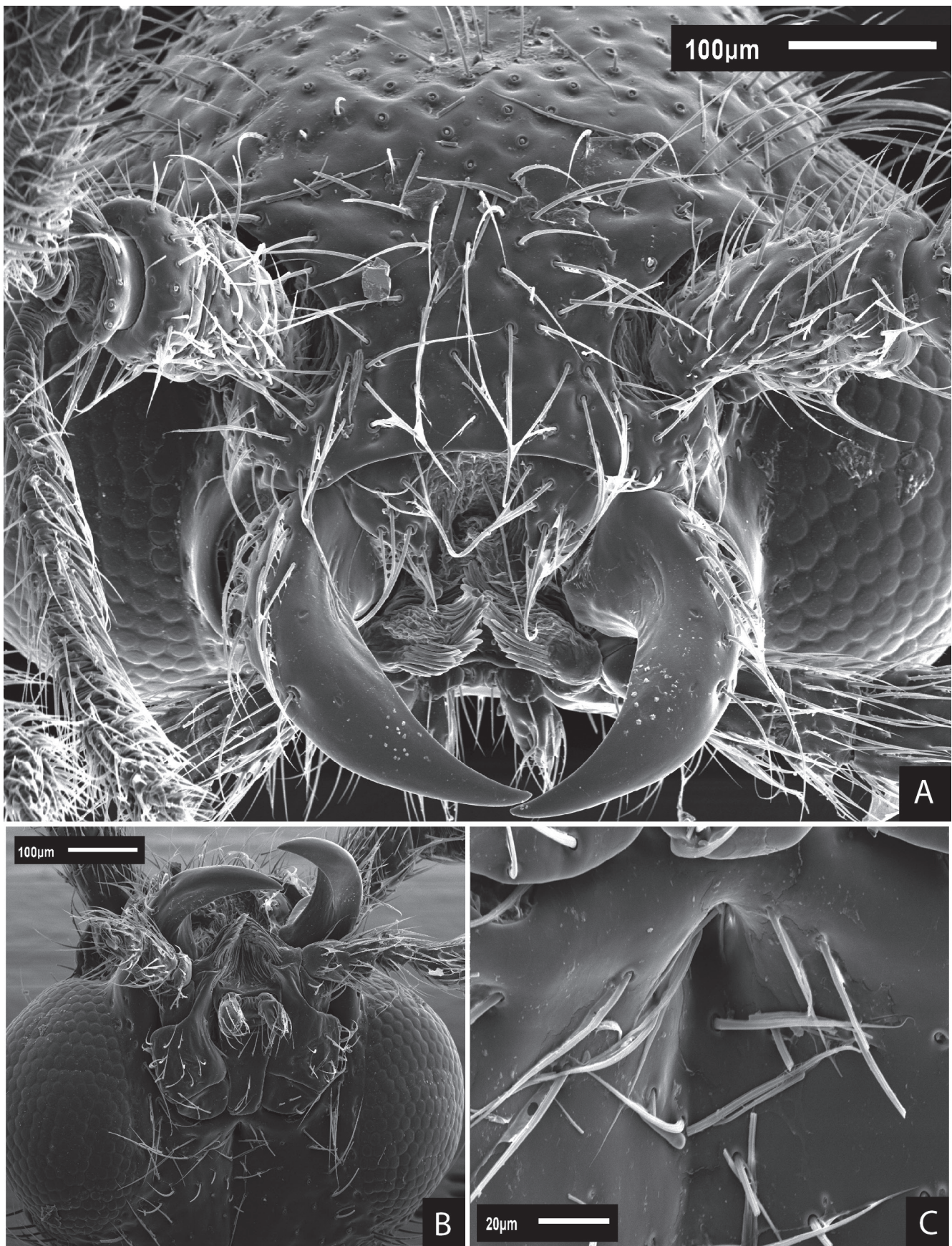


Figure 2. *Cleidella picea* gen. nov. et sp. nov., male, scanning electron micrographs: (A) head, frontal; (B) head, ventral; (C) tentorial pit, close.

slightly convex between eyes, with a declivity between antennae until reaches labrum, interantennal space sub-equal to antennomere I length, clypeus fused to frons;

labrum large, clearly separated from frontoclypeus, membranous, bilobate and swollen, with a pair of irregular latero-proximal slightly sclerotized pieces (Fig. 2A), as

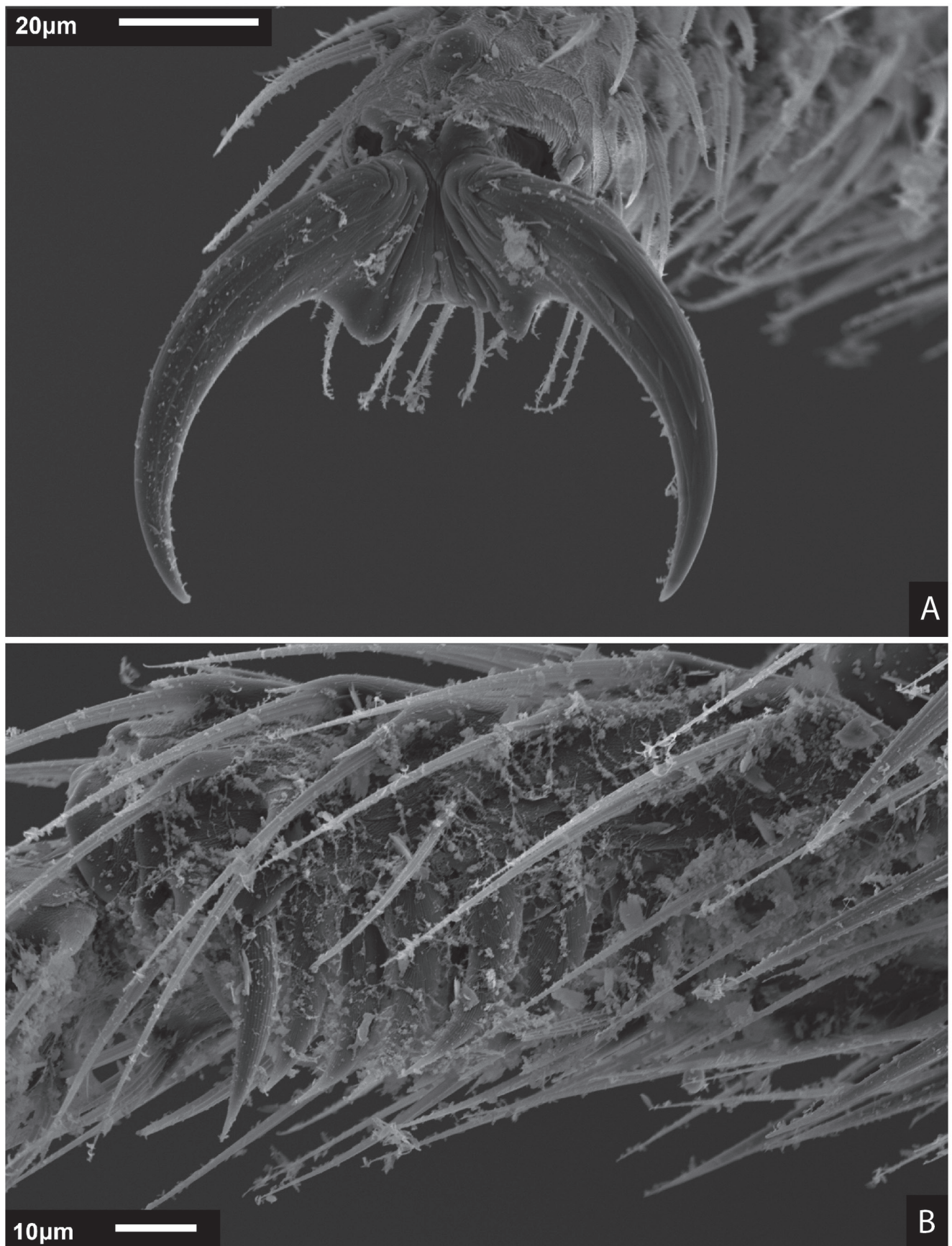


Figure 3. *Cleidella picea* gen. nov. et sp. nov., male, scanning electron micrographs: (A) protarsus, claw, frontal; (B) protarsus, protarsomere I, comb, ventral, close.

wide as long; mandibles long and thin, projected and not crossed, pointed forward obliquely from head; maxillary palpi 4-segmented, palpomere II 2× longer than III, III as long as I, IV digitiform, 3× longer than III, coarsely punctate on anterior half, finely punctate on posterior half, cardo semitriangular, 1.5× wider than long; labial palpi 2-segmented, short, segment II 2× longer than I, not covered by mandibles, last palpomere digitiform; one gular suture, tentorial pit with single fossa (Figs. 2B-C, 2F), apodeme indistinct.

Thorax (Figs. 1E-F, 3-4): Pronotum trapezoidal, wider than long, anterior angles dorsally concave, lateral margins dorsally convergent from posterior to anterior angles, laterally curved down in anterior angles (Fig. 1E); elytron surpassing the fourth abdominal segment, 3.3-4× longer than wide, wider in anterior half, slightly convergent posteriorly, subparallel, apex slightly swollen (Figs. 1A, 4A); hind wings with radial cell closed, elongated and transversal, r4 interrupted both in the radial cell and RP, r3 vestigial, RP reaching half of MP1+2 length, medial field containing five main veins: MP3, MP4, CuA2 and AA3+4; AA1+2, CuA1 and CuA3+4 absent, AA well marked to vestigial and cubitoanal cell open or closed, anal lobe well developed, AP3+4 long, J absent (Fig. 4B); legs increasing in length, first tarsomere of protarsus with ventral comb as long as the tarsomere (Fig. 3B), first and second tarsomeres of protarsus subequal in length, third tarsomere longer, first, second and third tarsomeres of meso- and metatarsus increasing in length, fourth tarsomere of all legs with ½ of the fifth length, claws without any teeth (Fig. 3A).

Abdomen (Fig. 5): Tergite IX transversal, divided in the middle, anterior margin curved inward, posterior margin nearly straight; tergite X short, conical, lateral margins

subparallel (Fig. 5A); sternite IX short and quadrangular, curved inward in posterior margin (Fig. 5B); aedeagus with basal piece entirely sclerotized, ribbon-like; median lobe cylindrical, strongly curved at base, rounded and constricted apically, with many tiny glandular openings; flagellum encircled around median lobe at rest; about 1.5× longer than median lobe length; parameres parallel, symmetrical, narrowing slightly after middle towards apex, which is unciform, toothed inward, with short and scarce bristles separated by a distance at least twice the setae length (Figs. 5C-H).

Female and immature stages: Unknown.

Etymology: Singular genitive, feminine. The name is in honor of the entomologist Cleide Costa, in the commemoration of her 80th birthday. Professor Costa is a great researcher who greatly contributed to the knowledge of bioluminescent beetles, including phengodids, with a large focus on morphology and natural history.

Biology and distribution: *Cleidella* gen. nov. is only known from the Serra dos Órgãos, from 700 to 1,800 m of altitude, and in Ilha Grande, around 700 m of altitude, both in Rio de Janeiro State, Brazil. It is known to occur from spring to summer. No live specimens were observed to date, so there is no data regarding their habits.

Remarks: There are four described genera in Mastinocerinae with 11 antennomeres: *Euryognathus*, distributed in Venezuela, Paraguay and Argentina, *Euryopa*, distributed from Guatemala to Argentina, *Steneuryopa*, known from Costa Rica, and *Microphrixothrix*, known from Brazil. *Cleidella* gen. nov. can be easily separated from *Microphrixothrix* by the interantennal distance subequal to scape length (bigger in *Microphrixothrix*) and

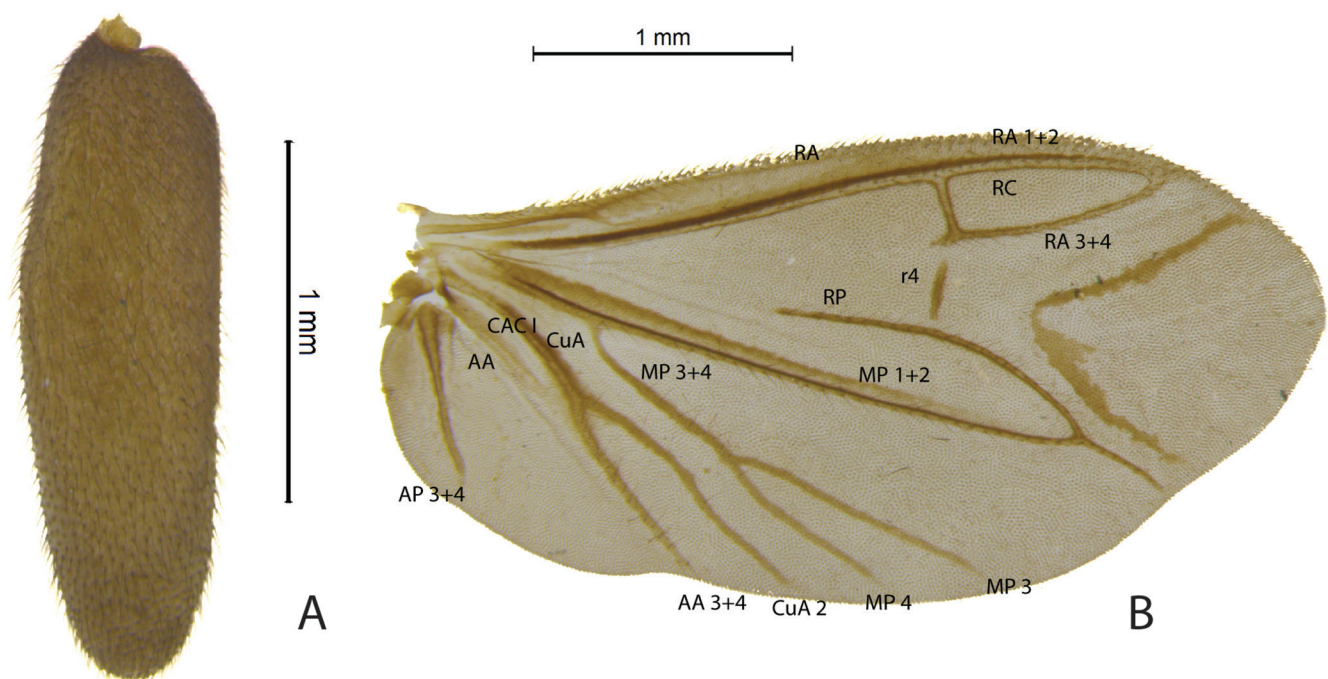


Figure 4. *Cleidella picea* gen. nov. et sp. nov., male: (A) elytron, dorsal; (B) hind wing, dorsal

the first tarsomere of protarsus with a ventral comb (first and second tarsomeres of protarsus and first tarsomere of mesotarsus with a ventral comb in *Microphrixothrix*).

It can be separated from the other three genera by the radial cell closed (open in all others). It also differs from *Euryognathus* by the cylindrical flabellae from antenno-

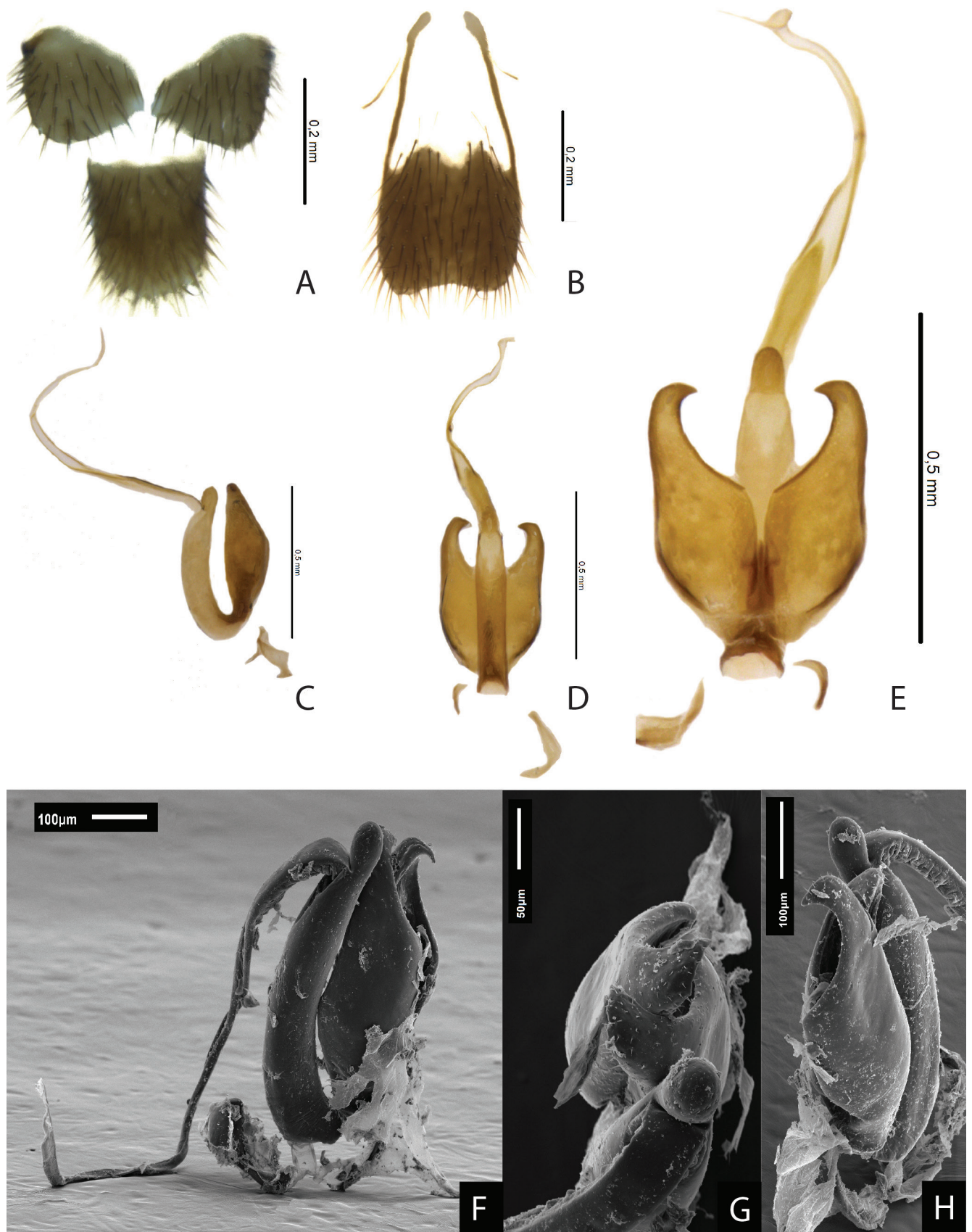


Figure 5. *Cleidella picea* gen. nov. et sp. nov., male: (A) Tergites IX and X, dorsal; (B) Sternite IX, ventral; (C) aedeagus, lateral; (D) aedeagus, ventral; (E) aedeagus, dorsal; Scanning electron micrographs: (F) aedeagus, lateral (G) aedeagus, frontal; (H) aedeagus, dorsolateral.

meres IV-X (lanceolated from IV-VIII, IX-X inflate and without flabellae in *Euryognathus*), mandibles without teeth (toothed in *Euryognathus*), first tarsomere of protarsus

with a ventral comb (first tarsomere of pro- and mesotarsus with a ventral comb in *Euryognathus*) and MP3 and MP4 present (absent in *Euryognathus*); from *Euryopa* by

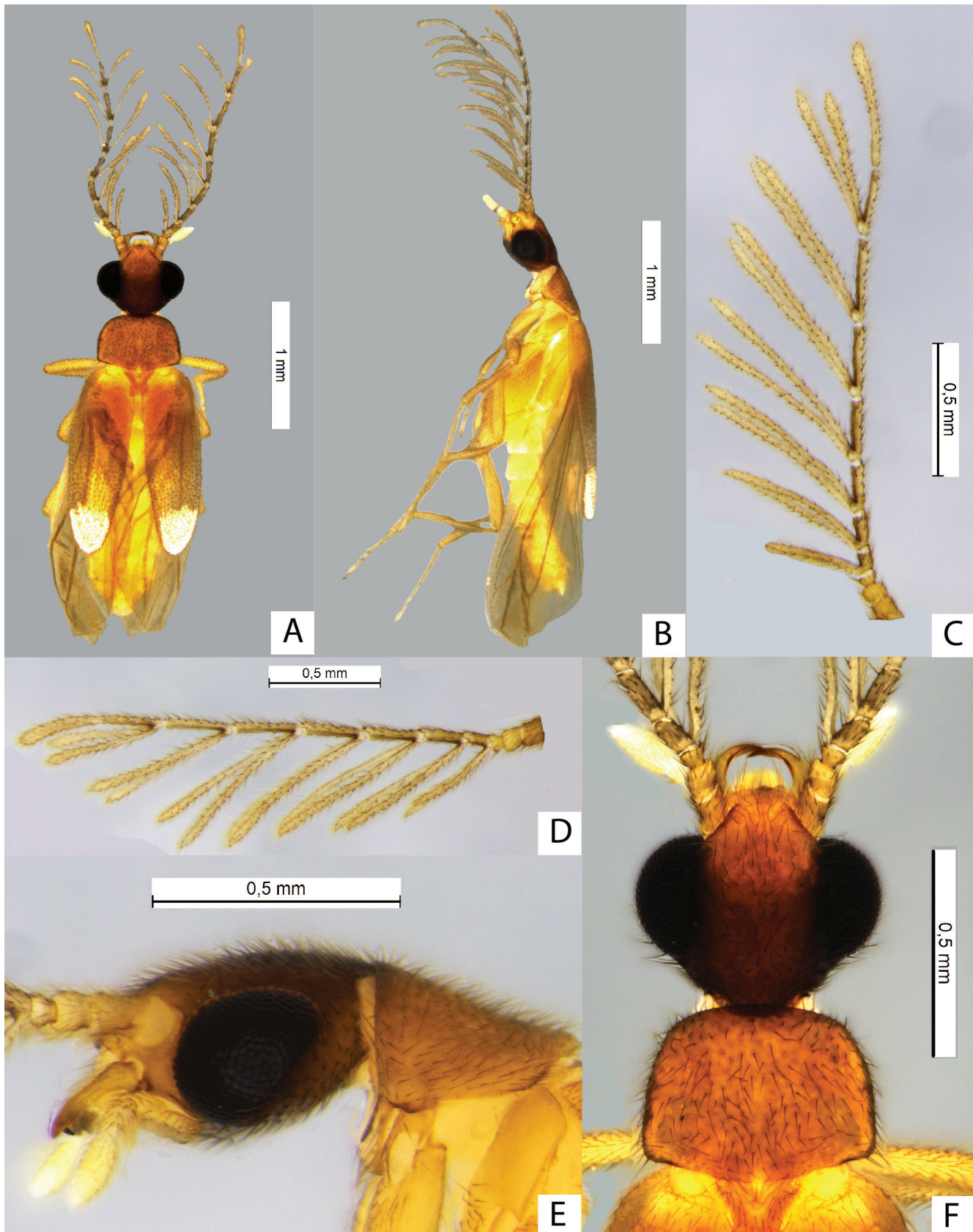


Figure 6. *Cleidella silveirai* gen. nov. et sp. nov., holotype male: (A) habitus, dorsal; (B) habitus, lateral; (C) antenna, specimen from Teresópolis; (D) antenna, specimen from Ilha Grande; (E) head and pronotum, lateral; (F) head and pronotum, dorsal.

the cylindrical flabellae (lanceolated in *Euryopa*) and first tarsomere of protarsus with a ventral comb (the first tarsomere of pro- and mesotarsus with a ventral comb in *Euryopa*); and from *Steneuryopa* by the interantennal distance bigger than scape length (smaller in *Steneuryopa*), first tarsomere of protarsus with a ventral comb (without comb in *Steneuryopa*) and MP4 simple (bifurcated in *Steneuryopa*).

Key to the species of *Cleidella* gen. nov.

- 1. Body overall dark brown; eyes, in lateral view, with posterior margin vertical and slightly reniform (Fig. 1C); pronotum 1.1× wider than long (Fig. 1E)..... *C. picea* sp. nov.
- 1'. Body overall yellowish light-brown; eyes, in lateral view, with posterior margin strongly obliquely projected (Fig. 6E); pronotum 1.4× wider than long (Fig. 6F)..... *C. silveirai* sp. nov.

***Cleidella picea* sp. nov.**
(Figs. 1-5)

Type material: HOLOTYPE (♂, DZRJ): BRAZIL. *Rio de Janeiro*: Teresópolis. Parque Nacional da Serra dos Órgãos. PVE Pt. 12A, 22°27'18,2"S, 43°00'58,9"W, 1,812 m, IX.2015, R. Monteiro col. PARATYPES: *Rio de Janeiro*: Teresópolis. Parque Nacional da Serra dos Órgãos. PVE Pt. 9A, 22°26'55,1"S, 43°00'16,4"W, 1,246 m, II.2015 (1 ♂,

DZRJ); PVE Pt. 9B, 22°26'57.8"S, 43°0'13.7"W, 1,236 m, II.2015, R. Monteiro col. (2 ♂, DZRJ).

Diagnosis: Eyes occupying nearly half of head width, in lateral view, posterior margin vertical, slightly reniform (Fig. 1C). Pronotum 1.1× wider than long, anterior margin curved, posterior margin slightly curved (Fig. 1E). Body overall dark brown, with head and pronotum from black to dark brown, and mandibles, palpi and internal margin of pro- and mesocoxae and femora brown to light brown (Figs. 1A-B).

Description, male

Measurements (n = 4): Total length: 4.2-4.7 mm (aver. 4.4 mm). Head length: 0.57-0.65 mm (aver. 0.6 mm). Head width: 0.74-0.76 mm (aver. 0.75 mm). Pronotum length: 0.62-0.65 mm (aver. 0.64 mm). Pronotum maximum width: 0.71-0.76 (aver. 0.73 mm). Elytron length: 1.80-1.85 mm (aver. 1.82 mm). Elytron maximum width: 0.52-0.57 mm (aver. 0.54 mm).

Morphology: Head wider than long, integument glossy, finely punctate, interocular distance occupying slightly more than half of head width in dorsal view (Fig. 1E); eyes occupying nearly half of head width, in lateral view, posterior margin vertical, slightly reniform (Fig. 1C); antennomere IV 2× longer than III, progressively longer from IV to X, XI cylindrical, 1.5× longer than X; IV-X each with two

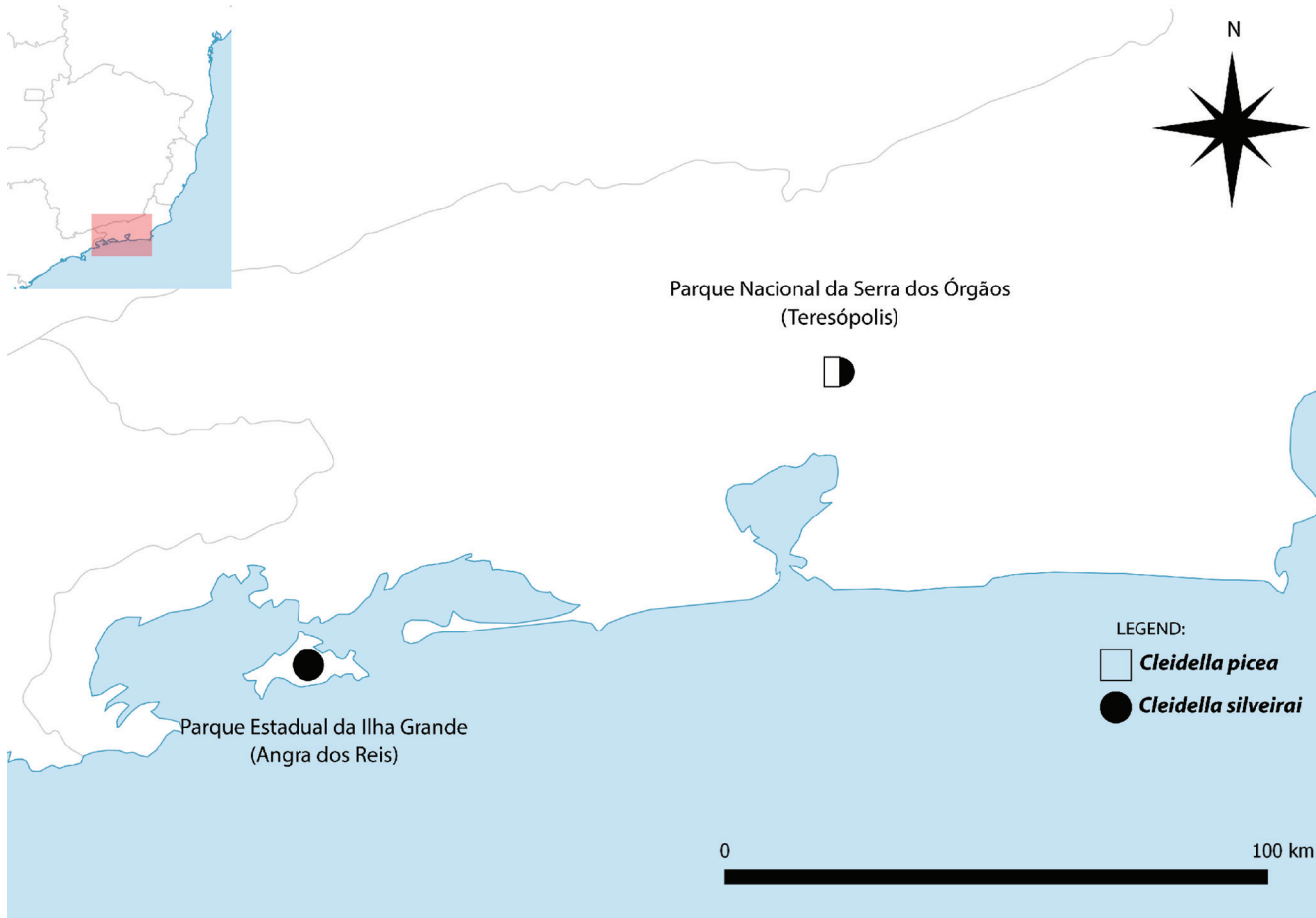


Figure 7. Distribution of *Cleidella* gen. nov. species.

long, symmetrical branches, 2 to 8× longer than antennomere (Fig. 1D). Pronotum 1.1× wider than long, integument glossy, finely punctate, anterior margin curved, lateral margins convergent in anterior half, dorsally parallel in posterior half, posterior margin slightly curved (Fig. 1F). Elytron heavily setigerous punctate, 3.1-3.5× longer than wide (Fig. 4A), reaching anterior margin of fourth abdominal segment (Fig. 1B). Tergite IX transversal, twice wider than long in the middle line; tergite X slightly longer than wide (Fig. 5A); sternite IX twice longer than wide when including membranous area, inner curved in the posterior margin (Fig. 5B). Aedeagus: basal piece entirely sclerotized, ribbon-like; median lobe cylindrical, strongly curved at base, rounded and constricted apically, with many tiny glandular openings; flagellum encircled around median lobe at rest; about 1.5× longer than median lobe length; parameres parallel, symmetrical, narrowing slightly past the middle towards the apex, which is unciform, toothed inward, with short and scarce bristles separated by a distance at least twice the seta length (Figs. 5C-H).

Coloration: Body overall dark brown, with head and pronotum from black to dark brown, and mandibles, palpi and internal margin of pro and mesocoxae and femora brown to light brown.

Females and immatures: Unknown.

Etymology: The specific name is a Latin adjective for "pitch-black" and refers to the dark overall color of the specimens' integument.

Biology and distribution: *Cleidella picea* sp. nov. occurs on the Spring and Summer of the southern hemisphere. It inhabits altitudinal areas of the Serra dos Órgãos, in the Serra do Mar mountain range, around 1,250-1,800 m, in a vegetation type of montane and high-montane forest.

Remarks: This species can be easily distinguished from *Cleidella silveirai* sp. nov. by the eyes, in lateral view, with posterior margin vertical, slightly reniform (strongly obliquely projected in *P. silveirai* sp. nov.); pronotum slightly wider than long (distinctly wider than long in *P. silveirai* sp. nov.); and the body overall dark brown, with head and pronotum from black to dark brown, and mandibles, palpi and internal margin of pro and mesocoxae and femora brown to light brown (body overall light brown, head brown, palpi, thoracic sterna, legs, tergites and sternites pale yellow in *P. silveirai* sp. nov.).

***Cleidella silveirai* sp. nov.**
(Fig. 6)

Type material: HOLOTYPE (♂, DZRJ): BRAZIL. *Rio de Janeiro*: Teresópolis. Parque Nacional da Serra dos Órgãos. PVE Pt. 5B, 22°28'37.6"S, 42°59'45.5"W, 691 m, IX.2015, R. Monteiro col. PARATYPES: *Rio de Janeiro*: Teresópolis. Parque Nacional da Serra dos Órgãos. Same

data as holotype, XII.2014 (1 ♂, DZRJ, 1 ♂, MZSP); PVE Pt. 8A, 22°27'11,3"S, 42°59'33,9"W, 1,071 m, XI.2015, R. Monteiro col. (1 ♂, DZRJ); Angra dos Reis. Parque Estadual da Ilha Grande. IG 2A, 23°09'12.4"S, 44°11'24.1"W, 720 m, XI.2017, (1 ♂, DZRJ), I.2018 (1 ♂, DZRJ), Silveira, Campello, Vaz & Queiroz col.

Diagnosis: Eyes, in lateral view, strongly obliquely projected (Fig. 6E). Pronotum 1.4× wider than long, anterior and posterior margins slightly curved to nearly straight (Fig. 6F). Body overall light brown, head brown, palpi, thoracic sterna, legs, tergites and sternites pale yellow (Figs. 6A-B).

Description, male

Measurements (n = 6): Total length: 3.2-3.6 mm (aver. 3.4 mm). Head length: 0.47-0.53 mm (aver. 0.5 mm). Head width: 0.62-0.67 mm (aver. 0.64 mm). Pronotum length: 0.42-0.44 mm (aver. 0.43 mm). Pronotum maximum width: 0.59-0.63 (aver. 0.6 mm). Elytron length: 1.55-1.6 mm (aver. 1.57 mm). Elytron maximum width: 0.39-0.48 mm (aver. 0.44 mm).

Morphology: Head wider than long, integument glossy, finely punctate, frons slightly concave between antennal insertions, interocular distance occupying half of head in dorsal view (Fig. 6F); eyes occupying $\frac{3}{4}$ of head width, in lateral view, posterior margin strongly obliquely projected (Fig. 6E); antennomere IV 1.5-2× longer than III, progressively longer from IV to VIII, IX and X progressively shorter, XI cylindrical, 1.5-2× longer than X; IV-X with two symmetrical branches, 2 to 4× longer than antennomere (Fig. 6C-D). Pronotum 1.4× wider than long, integument glossy, finely punctate, anterior margin slightly curved, lateral margins weakly convergent, posterior margin slightly curved (Fig. 6F). Elytron heavily setigerous punctate, around 3.5× longer than wide (Fig. 6A), reaching posterior margin of fourth abdominal segment (Figs. 6A-B). Tergites IX and X, sternite IX and aedeagus shows no morphological variation in relation to *C. picea* sp. nov.

Coloration: Body overall light brown, head brown, palpi, sternum, legs, tergites and sternites pale yellow.

Females and immatures: Unknown.

Etymology: Patronymic. The name *silveirai* is given in honor of Luiz Felipe Lima da Silveira, a fellow coleopterist graduated from Universidade Federal do Rio de Janeiro, currently an assistant professor at the Western Carolina University, USA. Luiz is a Lampyridae specialist which also has interest in other soft-body Elateroid beetles, encouraging the first author to start the studies with Phengodidae. He has also collected extensively in areas of Rio de Janeiro state with Malaise traps.

Biology and distribution: *Cleidella silveirai* sp. nov. occurs on the Spring and Summer of the southern hemi-

sphere. It inhabits altitudinal areas of the Serra dos Órgãos, in the Serra do Mar mountain range, around 700-1,100 m, in a vegetation type of montane forest, and altitudinal areas of Ilha Grande, around 700 m, in a vegetation type of dense ombrophilous forest.

Remarks: This species can be easily distinguished from *Cleidella picea* sp. nov. by eyes, in lateral view, strongly obliquely projected (with posterior margin vertical, slightly reniform in *C. picea* sp. nov.); pronotum distinctly wider than long (slightly wider than long in *C. picea* sp. nov.); and the body overall light brown, head brown, palpi, thoracic sterna, legs, tergites and sternites pale yellow (body overall dark brown, with head and pronotum from black to dark brown, and mandibles, palpi and internal margin of pro and mesocoxae and femora brown to light brown in *C. picea* sp. nov.).

Two distinct populations of *Cleidella silveirai* sp. nov. were found, around 100 km apart from each other. The specimens from Ilha Grande have smaller flabellae in the antennae (2 to 3× the antennomere length) and the antennomere XI 1.5× the antennomere X length, while the specimens from the Serra dos Órgãos have longer flabellae in the antennae (3 to 4× the antennomere length) and the antennomere XI 2× the antennomere X length. However, as this was the only difference found between the populations, they were considered as a single species.

DISCUSSION

With a few exceptions, like in *Phengodes* or *Zarhipis*, most phengodid species have very narrow geographic ranges (Costa *et al.*, 1999; Zaragoza-Caballero & Pérez-Hernández, 2014). Some features that might converge in explaining their restricted ranges include: soft body, apparently semelparous lifestyle (Tiemann, 1967) and poor flying ability. Together, these features render them sensitive to temperature and humidity variation at the microclimate scale, and subject to wind forces (see Viviani & Bechara, 1997; Costa & Zaragoza-Caballero, 2010). Moreover, all known phengodid females are apterous and larviform, which facilitate even more allopatric speciation events due to vicariance, a common phenomenon in beetle lineages with soft-bodies and larviform females (see Bocak *et al.*, 2008).

The Atlantic Rainforest presents a complex system of mountain chains with altitudinal gradients of temperature, humidity, and vegetation cover. This variation from the surrounding lowlands towards mountaintops may drive local adaptation and ecological speciation, originating endemic taxa (reviewed in Hodkinson, 2005). These conditions may be especially influential on the evolutionary history and speciation of railroad-worms. This pattern of endemism has been observed in other soft-bodied elateroid beetles, such as lampyrids (*e.g.*, Silveira *et al.*, 2016) and phengodids (*e.g.*, Roza *et al.*, 2017).

The here-described new genus presents an interesting pattern of distribution, with two apparently isolat-

ed populations of *Cleidella silveirai* sp. nov. around 100 km apart from each other. A similar pattern was found in two species of *Akamboja* Roza, Quintino, Mermudes & Silveira (Roza *et al.*, 2017, 2018). When compared with widespread species in other genera of Phengodidae (*e.g.*, *Zarhipis*, *Phrixothrix* Olivier, 1909 and *Stenophrixothrix* Wittmer, 1963), both *Cleidella* gen. nov. and *Akamboja* stand out by their very short body length (<5 mm), which could prevent long distance dispersal. This isolation, however, could be a sampling bias (Roza *et al.*, 2018), as most of rail-road worm species have their distribution only superficially known. Nonetheless, these aforementioned species are particularly interesting for phylogeographic studies, and future studies on genetic diversity and structuring may reveal the history behind such disjunct distribution.

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