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### Research article

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## The Sertão Leaf Katydid – a new genus of Pterochrozinae Walker, 1870 (Insecta, Orthoptera) from the Caatinga in Northeastern Brazil

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**Abstract.** Pterochrozinae are katydids endemic to the Neotropics, commonly known as peacock or leaf katydids. Several areas in the Neotropical are poorly sampled for leaf katydids, and there are few experts working with this group. Most of Pterochrozinae diversity occurs in rainforests, while only a single genus occurs in the savannic Cerrado, and no Pterochrozinae is known for the Caatinga, a semi-arid biome. Here, we present a new Pterochrozinae genus and species, *Metallacantha aculeata* Engelking, Ghirotto, Fianco, Sobral, Silva-Neto & Mendes gen. and sp. nov., from the Caatinga. The new genus can be distinguished from all other Pterochrozinae by its robust body, enlarged legs, large and flat hind tibial spines, and extremely shortened hind wings. We describe the new genus and species based on three adult females, three adult males, and one nymph from different areas in the Southern Sertanejo Depression of the Caatinga biome, Brazil, also presenting notes on its biology, acoustics, and behavior. Furthermore, we present discussions on the relationship of some Pterochrozinae genera.

**Keywords.** New species, taxonomy, peacock-katydid, South American dry diagonal, Brazilian fauna.

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## Introduction

The order Orthoptera Olivier, 1789 includes grasshoppers, katydids, crickets, and related insects. With slightly less than 30 000 extant species, it is the most diverse order among the polyneopteran insect lineages (Cigliano *et al.* 2024). Some representatives are reclusive, others are generally camouflaged with coloration and shape matching their environment, while there are lineages that developed a more thorough camouflage, possessing a very realistic leaf appearance, such as several Tettigoniidae Krauss, 1902 (Mugleston *et al.* 2016). Tettigoniidae representatives are commonly named katydids, which are represented by 8370 described species composing more than one-fourth of the diversity of Orthoptera. There are 22 subfamilies, of which more than half developed a variety of leaf-like wings to perfect camouflage (Gwynne 2001; Cigliano *et al.* 2024), with at least fifteen independent origins (Mugleston *et al.* 2016).

One of the lineages that most perfected their wings to resemble leaves is the Pterochrozinae Walker, 1870 (Braun 2015), with broad wings that significantly cover and surpass the abdomen. The Pterochrozinae are endemic to the Neotropics and are commonly known as peacock-katydids (for species bearing wing eyespots), “sauterelles-feuilles” (in French), or leaf-katydids. Several species also bear colorful eyespots in their hindwings that are displayed upon threat, which is the reason behind the former common name. Currently, 97 species in 14 genera are known (Cigliano *et al.* 2024). Few species of Pterochrozinae have been described in the last years, and certainly more species await discovery as few experts work with this group (Braun 2015; Cigliano *et al.* 2024). For example, the last species described for Brazil, a megadiverse country, dates back 45 years. Even though this group comprises such well-camouflaged representatives, there are two short-winged genera with shortened wings that do not surpass the end of the abdomen: *Asbolomma* Beier, 1962 (including only one species) and *Tanusiella* Enderlein, 1917 (including two species), both endemic to Brazil, the first occurring in the Cerrado and *Tanusiella* in the Atlantic Forest. Few species are described for the Chaco domain in the more southern areas of South America, and no species of leaf katydid was ever recorded for the Caatinga in Brazil, a xeric shrubland biome or short forest suffering from very dry seasons. Here, we present a mesopterous katydid from this environment, describing a new genus and species of Pterochrozinae from northeast Brazil, the first occurring in the xeric Caatinga and representing the third genus of short-winged Pterochrozinae. The new genus shows remarkable morphological characteristics, apparently adaptations to live in the harsh, dry Caatinga.

## Material and methods

In 2023, S.M. Martins photographed a *Metallacantha aculeata* Engelking, Ghirotto, Fianco, Sobral, Silva-Neto & Mendes gen. et sp. nov. in his hometown and submitted it to the online platform iNaturalist. Upon observing the record and noticing its uniqueness, V.M. Ghirotto, P.W. Engelking, and M. Fianco contacted SMM, who arranged the collection of a specimen. The specimen was confirmed to belong to a new genus of Pterochrozinae, a conclusion which R. Sobral, A.M. da Silva-Neto, and D.M. de Mello Mendes also reached simultaneously, with another specimen at hand that they had collected, and both groups were unaware of each other. RS, ASN, and DMM then also reached out to SMM after seeing the record on iNaturalist, so both groups became aware of each other’s work. After discussions, we respectfully decided to merge the studies, thereby enhancing the significance of the material and promoting collaboration among researchers of orthopteroid insects in Brazil. Shortly afterward, PWE and MF also collected more specimens at the Serra da Jibóia, municipality of Santa Teresinha, Bahia State, Brazil.

## Taxonomy

Specimens are housed in the Coleção Entomológica Pe. Jesus Santiago Moure, Universidade Federal do Paraná, Curitiba, Brazil (DZUP), Instituto Nacional de Pesquisas da Amazônia, Manaus, Brazil (INPA) and Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil (MZUSP). We analyzed pictures and illustrations of type material of the type species and other species of all Pterochrozinae genera available in the Orthoptera Species File (Cigliano *et al.* 2024) and from original descriptions. We further examined voucher specimens from eleven Pterochrozinae genera housed at MZUSP and Academy of Natural Sciences of Philadelphia (ANSP): *Celidophylla* Saussure & Pictet, 1898; *Cycloptera* Serville, 1838; *Paracycloptera* Vignon, 1926; *Porphyromma* Redtenbacher, 1895 (in Brunner von Wattenwyl 1895); *Pseudotanusia* Vignon, 1923; *Pterochroza* Serville, 1831; *Rhodopteryx* Pictet, 1888; *Roxelana* Kirby, 1906; *Tanusia* Stål, 1874; *Tanusiella*; and *Typophyllum* Serville, 1838. Unpublished observations in the wild of live leaf-katydid by the authors observed in several areas across the southeast and northeast regions of Brazil were also considered for discussion and are cited as personal observations.

Specimens were examined using a Nikon SMZ460 stereomicroscope. Images of body parts were taken with a Nikon D90 with a 100 mm lens. Scanning electron microscopy (SEM) images were obtained using a VEGA3 TESCAN equipment at the Electronic Microscopy Center of the Universidade Federal do Paraná; a tibial spine was removed, passed through gold metallization, and scanned in vacuum mode. Digital illustrations were made using Adobe Illustrator CS6 and Adobe Photoshop CS6. The map was elaborated on using Simplemappr (Shorthouse 2010). Venation nomenclature follows Ingrisich *et al.* (2016) and Desutter-Grandcolas *et al.* (2017).

In the description, we use “anterior” to refer to surfaces located and/or facing anteriorly, and “posterior” to refer to surfaces located and/or facing posteriorly, including appendices such as legs. In the literature, the terms “inner” and “outer” have been used to refer to lateral surfaces of legs, but we adopt the terms “anterior” and “posterior” to avoid confusion with leg position, for example, the second leg can be both pointing towards anterior (making the anterior face to be the inner face) or towards posterior (making the anterior face to be the outer face). Independently of the leg’s position, the anterior or posterior lateral surfaces are always recognizable, as these surfaces are contiguous with the coxae that have two sides, one permanently facing anteriorly and one permanently facing posteriorly. Similarly, we use the terms “procurved” to refer to a curvature bent towards the posterior portion, “recurved” to a curvature bent towards the anterior portion, “upcurved” to a curvature bent and pointing upwards and “downcurved” to a curvature bent and pointing downwards.

## Bioacoustics

After collection, live specimens from Santa Teresinha were taken to the laboratory to obtain sound recordings. Males and females were individualized in order to record the calling songs; additionally, upon handling, adults of both sexes also produced defensive/aggressive sounds, which are also described. Individuals were conditioned in a foam box to avoid reverberation; the recordings were made using a Tascam® DR 22WL recorder at night; the room temperature and humidity were measured manually with a thermohydrometer. Sampling frequencies of 40, 80, and 220 Hz were tested, and 40 Hz were sampled in the final recordings. Only calling songs at 23–24°C and 75% of humidity were considered for analysis. We used the terminology proposed by Ragge & Reynolds (1998): (I) calling song: a sound produced by an isolated male; (II) defensive/aggressive song: a sound produced by an individual when threatened; (III) syllable: a sound produced during the opening and closing of the tegmina; (IV) echeme: a set of first-order syllables; (V) echeme sequence: a first-order assemblage of echemes. Sounds were analyzed in the software Raven Pro 64 ver. 1.5.0 (Cornell Lab of Ornithology 2014), measuring temporal and physical parameters – amplitude, duration, period, mute interval, dominant frequency, and bandwidth 90% (power under or above the peak frequency). We obtained spectrograms and oscillograms in RStudio ver. 4.3.1 (RStudio Team 2015) with the packages TuneR ver. 1.0 (Ligges *et al.* 2013) and Seewave (Sueur *et al.* 2008).

## Results

Class Insecta Linnaeus, 1758  
Order Orthoptera Olivier, 1789  
Family Tettigoniidae Krauss, 1902  
Subfamily Pterochrozinae Walker, 1870

***Metallacantha*** Engelking, Ghirotto, Fianco, Sobral, Silva-Neto & Mendes gen. nov.  
urn:lsid:zoobank.org:act:88E46209-AE25-45A7-BD2F-5C1E0CAA6078  
Figs 1–21, table 1

### Type species

*Metallacantha aculeata* Engelking, Ghirotto, Fianco, Sobral, Silva-Neto & Mendes gen. et sp. nov. by present designation.

### Species included

*Metallacantha aculeata* Engelking, Ghirotto, Fianco, Sobral, Silva-Neto & Mendes gen. et sp. nov.

### Diagnosis

The new genus can be differentiated in both sexes from all other known Pterochrozinae by the broad pronotum that is wider than long; the very reduced hind wings not extending more than two tergites in length; the very robust, large legs in relation to the body (the whole third leg being 1.9–2.1× longer than the body); the large, widened and dorsoventrally flattened spines on hind tibiae; the conical spines on the dorsal surface of hind femora. For females, the wide and short subgenital plate that is wider than long also readily differs the new genus from the females of all other Pterochrozinae.

Furthermore, other characteristics that can help differentiate the new genus, but are not exclusive of it, are the short tegmina that do not or barely surpass the end of the abdomen (shared with *Asbolomma* and *Tanusiella*); a white band running through the lateral region of the head, the middle of the eyes, the lateral edge of the pronotum, lateral region of the thorax, and dorsal edge of the tegmina (shared with *Paracycloptera*); the unspotted hind wing (shared with *Celidophylla*, *Cycloptera*, *Mimetica*, *Paracycloptera*, *Typophyllum*, and *Roxelana*); hind femora with two ventral rows of conical spines (*Metallacantha* gen. nov. presents rows both in the dorsal and ventral surfaces of the hind femora, while other genera, such as *Paracycloptera*, bear only ventral rows); fore wings with R and M veins not conjoined in lateral view, running parallel and very closely apart, side by side (shared with several other genera such as *Paracycloptera*).

### Etymology

Taken in reference to the large and wide spines with a metallic iridescent shine present on the metatibiae that readily distinguishes the new genus from other Pterochrozinae genera. The name is derived from the Latin words “metallicus” (= metallic) and “acanthus” (= spines). The gender is feminine.

### Description

**COLORATION** (Figs 17–19). Generally green, with a lateral whitish stripe.

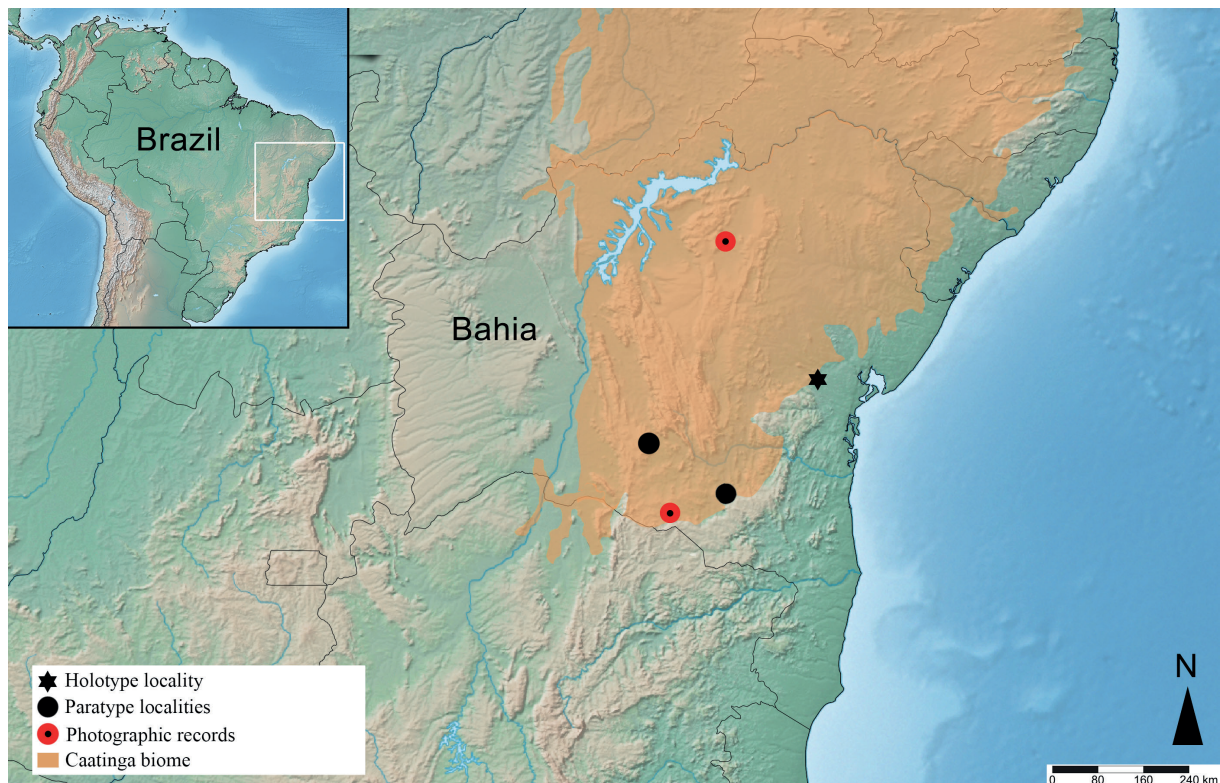
**HEAD** (Fig 11). Fastigium of vertex laterally flattened, eyes globular. Frons, clypeus, and genae slightly rugose. Frons straight, junction with genae divided by a vertical and straight keel, in frontal view. Antennae around 5–6× longer than anterior femur.

**THORAX** (Figs 2–3A, 5–6A, 10, 11B–C, 12, 15A, C–E). Robust, slightly tapering from the posterior area towards the anterior margin. Pronotal disc (Figs 3A, 11B, 15C) anteriorly and laterally gently round, metazona moderately elevated; pronotum slightly tapering towards anterior region. Basisterna bearing two spines paramedial each, gradually increasing in size from pro to metabasisternum (Figs 5C, 12B, 15E).

WINGS (Figs 2, 6, 10, 12A, C, 16). Distally acuminate with apex round and gently inwardly curved in the anterior edge; posterior margin suboval, anterior margin slightly sinuous near apex. Bearing relatively small, irregularly shaped cells. Vein C weak. Veins Sc and R strong, extending towards the tip; both parallel and very close to each other. Vein M contiguous with MP, strong and curved, and MA weaker and sinuous. Membranous wing hyaline, triangular, reduced, unspotted. Male stridulatory area (Fig. 3B–E). Triangular, file with delicate stridulatory teeth similar to a zipper strip, with up to hundreds of wide, sharp, and minute teeth; mirror elliptical to almost round, asymmetric at the sides; scraper straight and sharp.

LEGS (Figs 2, 5, 7A, 10, 13, 15A, F–H). Robust and large in relation to the body, with hind legs around twice the length of the body. Tympanum shown as a narrow slit. All femora bearing rows of conical or triangular porrect spines, two dorsally and two ventrally. Pro- and meta-tibiae bearing few spines. Hind legs very thick. Metatibiae extremely thorny (Fig. 13A–E). Dorsally with an anterior row of seven slightly porrect, large, laterally flattened, widened triangular spines with blackish and iridescent ventral surfaces – the proximal three very large, the central one medium to small, and the distal three small and narrower, close to each other and near apex. Dorsally, with a further posterior row of around seven spines, the first four large, somewhat triangular, thorny, thin, long, and slightly sinuous. Ventrally with single row of several spines on the anterior edge, all except the last thin, long, and inwardly curving, those near apexes slightly porrect; first three smaller, gradually increasing in size towards distal portion; the largest spines are those near the center of the tibiae.

ABDOMEN (Figs 4, 7B, 14, 15I–K). Large, wide. Tergum X with posterior margin expanded and rounded. Subgenital plate wide, with posterior margin round in the male and indented in the female. Cerci conical, somewhat widened, strongly tapering. Male styli absent. Female ovipositor laterally flattened, long, curved, apex widened in lateral and finely serrated in dorsal and ventral edges.



**Fig. 1.** Distribution map for *Metallacantha aculeata* Engelking, Ghirotto, Fianco, Sobral, Silva-Neto & Mendes gen. et sp. nov. in Bahia, Brazil.

### Distribution (Fig. 1)

This genus is most likely endemic to the southeast portion of the xeric Caatinga biome and contact areas, known so far from some scattered areas in Bahia state, Brazil. Specimens were only found in one of the southern subregions of the Caatinga, the Southern Sertanejo Depression. Photographic records from iNaturalist were also used to complement the information on its distribution.

*Metallacantha aculeata* Engelking, Ghirotto, Fianco, Sobral, Silva-Neto & Mendes gen. et sp. nov.  
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Figs 1–21, table 1

### Diagnosis

As for the genus.

### Etymology

From Latin *aculeata*, meaning “spiny” in reference to the many distinct spines of this katydid, especially the enlarged ones on its hind legs.

### Type material

#### Holotype

BRAZIL – Bahia • ♂ (Figs 2–4, 17); Santa Teresinha, Pedra Branca district; 12°50′41.6″ S, 39°29′28.6″ W; 10 Jul. 2024; P.W. Engelking and M. Fianco leg.; DZUP.

#### Paratypes (7 specimens)

BRAZIL – Bahia • 1 ♀ (Figs 10–14); Vitória da Conquista, near urban area; 14°53′47.6″ S, 40°51′55.5″ W; 13 Feb. 2023; S.P. Silva leg.; MZUSP • 1 ♂ (Figs 5–9); Caetité, Complexo Uranífero de Lagoa Real; 8–16 Jan. 2000; J.L. Nessimian and D.F. Baptista leg.; MNRJ • 1 ♀ (Figs 15–16); Santa Teresinha, Pedra Branca district; 12°50′ S, 39°30′ W; 430 m; 9 Feb. 2001; Jonas leg.; INPA • 1 ♂, 1 ♀; Santa Teresinha, Pedra Branca district; 12°50′41.6″ S, 39°29′28.6″ W; 10 Jul. 2024; P.W. Engelking and M. Fianco leg.; MZUSP • 1 ♀, 1 ♂ nymph (nymph in Fig. 19); same data as for preceding; DZUP.

### Description

#### Male (Figs 2–9, 17, 20–21)

COLORATION (Fig. 17). Description based on live specimens. General coloration light and dark green. Antennae, cerci, fore and mid tibiae terracotta pink. Palpi white. Eyes light brown. Two parallel stripes run from behind the eyes, passing through the lateral margins of the pronotum and on the thorax, right above the coxae I–III, ending right before the end of the coxae of hind legs. Superior stripe whitish and slightly wider, and the inferior stripe dark salmon to purplish, narrower, and matching the color of the ventral area of thorax and abdomen. Legs with green femora and hind tibia and light brown tarsi.

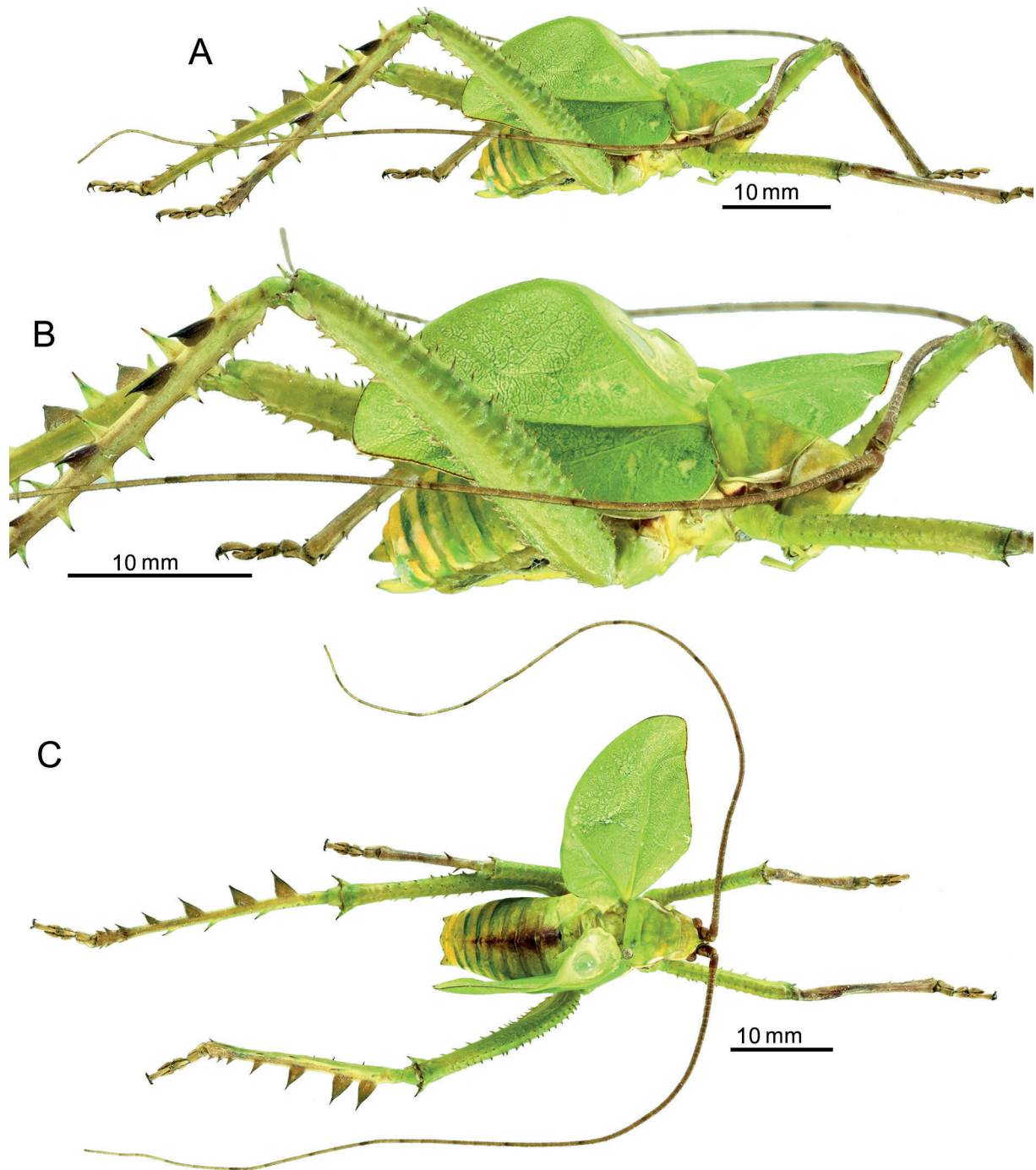
HEAD. Fastigium of vertex laterally flattened, with medial furrow (Figs 3A, 5B). Antennal orbit sclerites elevated, with bilobate apex, visible in dorsal and frontal view (Fig. 3A); eyes globular (Fig. 3A). Frons, clypeus, and genae slightly rugose. Frons straight, junction with genae divided by a vertical and straight keel, in frontal view. Clypeus quadrangular, labrum large and rounded, 1.3× longer than clypeus in frontal view. Scapus cylindrical and slightly tapering towards apex; pedicellus cylindrical, 0.65× shorter and narrower than scapus; antennal segments short, wide, with several short bristles gradually shorter towards the apex, making a velvet aspect; antennae length 7.1–7.6 cm, at least 5.8× longer than anterior femur. Lateral region of the head bearing a whitish band also running from behind the eyes and continuous with the inferior margin of lateral lobe. Withish region between inferior frons and superior clypeus. Pronotal disc anteriorly and laterally gently round, smooth, and posteriorly straight with a smooth medial projection in dorsal view (Fig. 2B); metazona moderately elevated, posterior margin elevated and with curved sides in lateral

**Table 1.** Measurements of 2 females (from MZUSP, average) and 3 males (holotype and MZUSP and MNRJ paratypes, range) of *Metallacantha aculeata*.

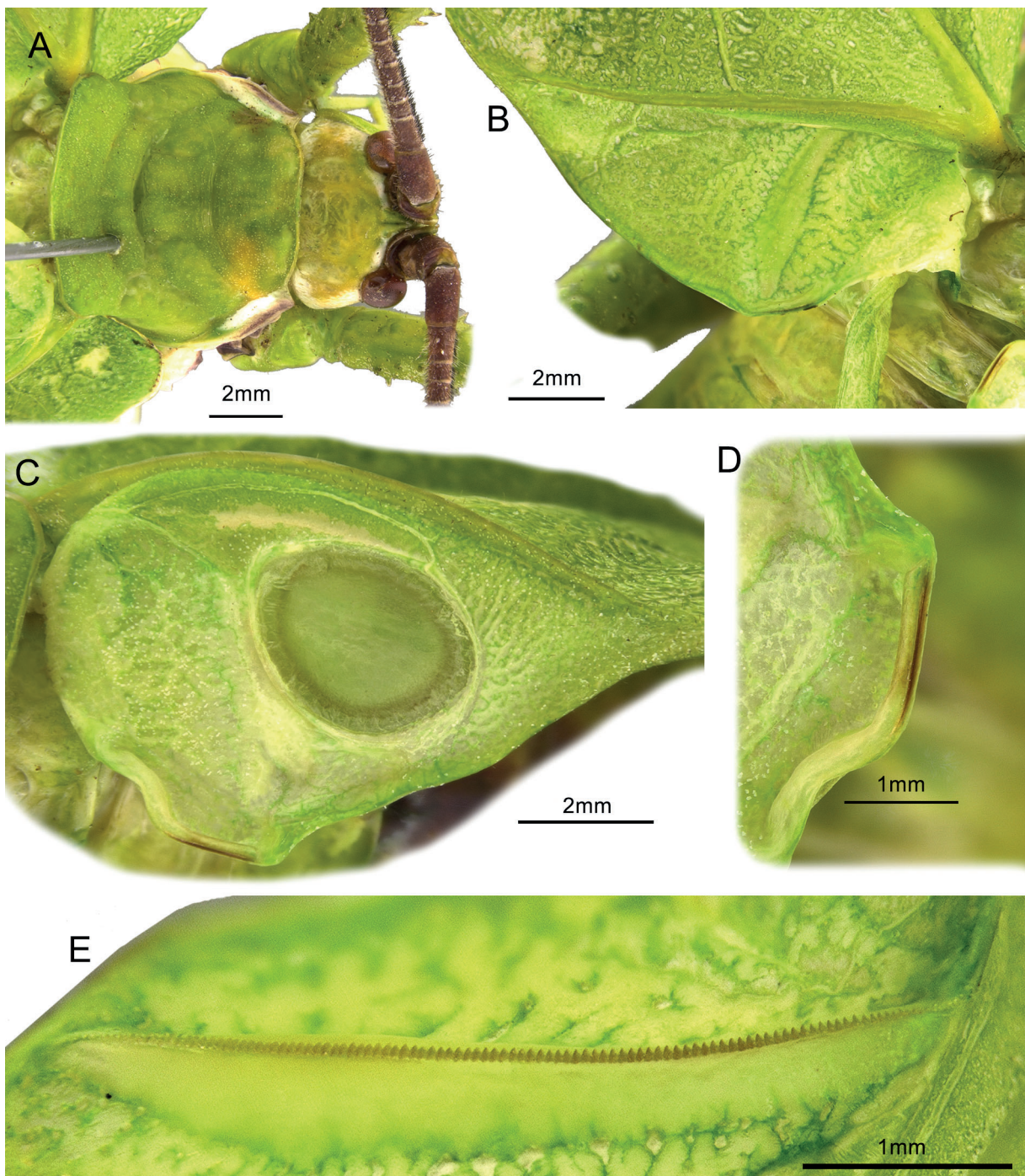
Measurement (length)	♀ (mm)	♂ (mm)
Total body length	60.5	31.2–32.3
Body length (excluding ovipositor)	45.3	-
Maximum tegmen length	35.4	21.3–23
Tegmen height	22.6	14.2–14.7
Frontal width	8.8	4.3–5.4
Pronotum dorsal length at midline	10.7	6.3–7.2
Length of the forefemur	21.4	13.4–14.2
Length of the midfemur	19.3	12.3–13
Length of the hindfemur	41.5	25.6–26.5
Length of the foretibia	24.1	15.4–16.2
Length of the midtibia	23.6	13.7–14.3
Length of the hindtibia	48.4	27.3–31.3
Length of the cercus	1.7	1.5–1.6
Length of the ovipositor	18–20	-
Length of the subgenital plate	1.7	3.2–3.4
Width of subgenital plate	7.3	5–5.4

view (Fig. 5B). Pronotal disc  $1.1\times$  as wide as long anteriorly and  $0.7\times$  as wide as long posteriorly. Pronotal disc with lateral margins slightly elevated, with a whitish band running along the entire lateral edge. Pronotum, in dorsal view, slightly tapering towards the anterior portion in a slightly trapezoidal aspect. In lateral view, dorsolateral suture slender, straight, and further bearing a longitudinal suture dorsomedially (Fig. 2B). In dorsal and lateral views, furcal suture dorsomedially united and straight; laterally with bifurcated ramification anteriorly and posteriorly (Fig. 2B). Dorsolateral suture and furcal suture concolorous with pronotal disc (Fig. 2B). Probasisternum bearing two spines (Fig. 5B). Mesobasisternum subrectangular, anteriorly straight to slightly curving towards posterior portion, laterally slightly inwardly curved, posteriorly emarginate; bearing two posterocentral triangular acute projections (Fig. 5C). Metabasisternum elliptical, anteriorly straight to slightly curving and tapering towards posterior portion, posteriorly emarginated, and bearing two posterocentral triangular acute projections oriented hindward (Fig. 5B–C). Spines from pro to metabasisternum gradually increasing in size (Fig. 5B–C).

WINGS. Tegmina distally acuminate with apex round and gently inwardly curved in the anterior edge; posterior margin suboval, anterior margin slightly sinuous near apex (Fig. 6). Tegmina showing numerous irregularly shaped, relatively small cells. Vein C weak, poorly curved, and bifurcated. Veins Sc and R parallel, very close to each other, almost straight at basal two-thirds; both strong and located on the medial region of tegmina, extending towards the tip. Vein Sc with two main bifurcations reaching margin of tegmina. Vein R with a single bifurcation near the apex that also bifurcated before contacting the margin. Vein M contiguous with MP strong and curved, MA weaker, sinuous, and bifurcated near the apex, one bifurcation merging with R and other with tegminal margin (Figs 2C, 6; see also the similar



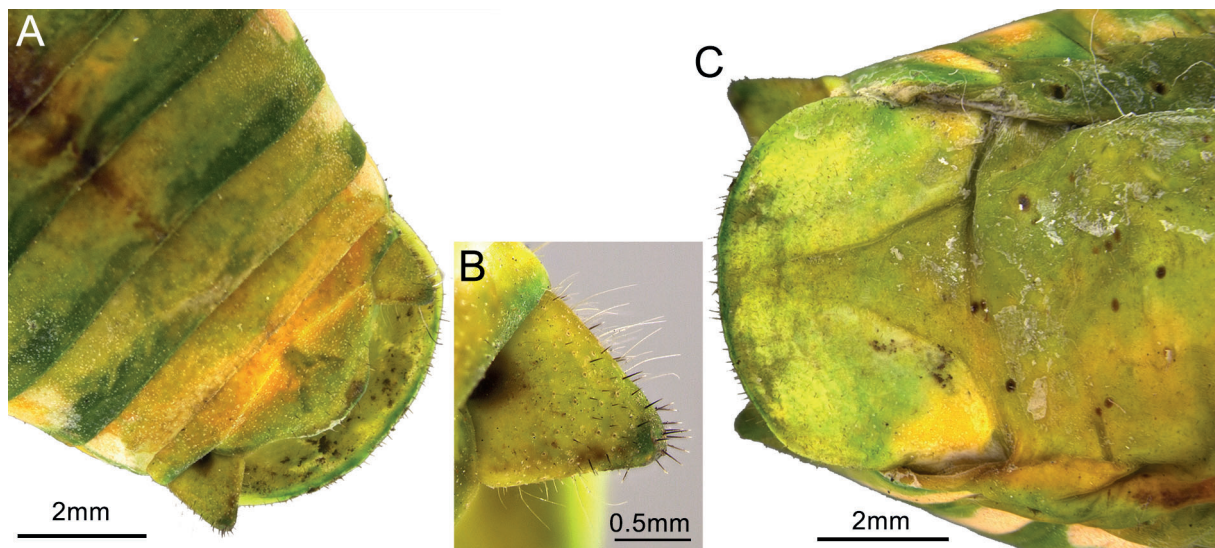
**Fig. 2.** Holotype ♂ of *Metallacantha aculeata* Engelking, Ghirotto, Fianco, Sobral, Silva-Neto & Mendes gen. et sp. nov. (DZUP), from Santa Teresinha, Bahia, Brazil. **A.** Habitus in lateral view. **B.** Body in lateral view. **C.** Habitus in dorsal view.



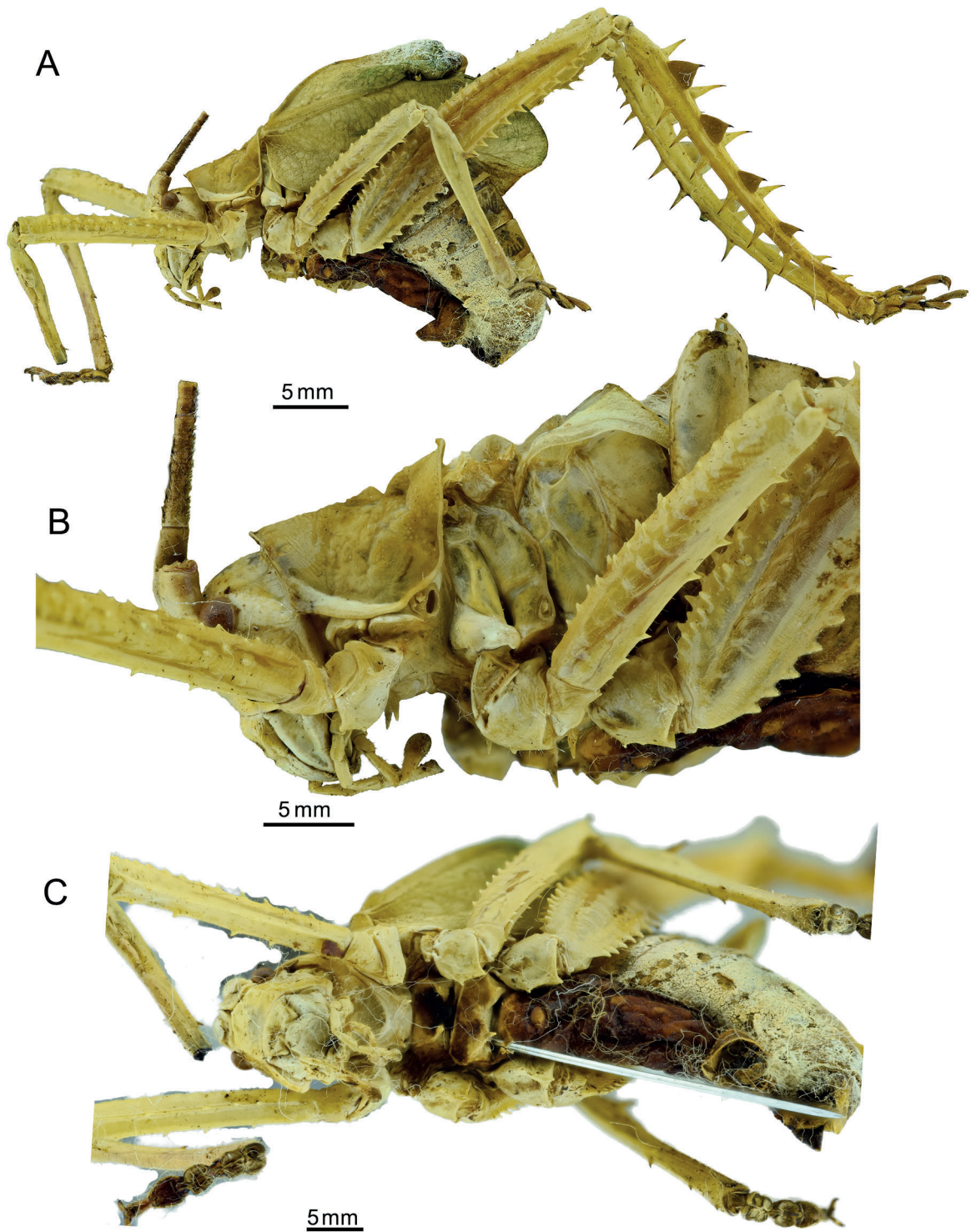
**Fig. 3.** Thorax and wings of the holotype ♂ of *Metallacantha aculeata* Engelking, Ghirotto, Fianco, Sobral, Silva-Neto & Mendes gen. et sp. nov. (DZUP), from Santa Teresinha, Bahia, Brazil. **A.** Head and pronotum in dorsal view. **B–E.** Stridulatory area of tegmen. **B.** Left stridulatory area in dorsal view. **C.** Right stridulatory area in dorsal view. **D.** Scraper of the right stridulatory area in dorsal view. **E.** File of left stridulatory area in ventral view.

female tegmina in Figs 12A, 16A). Stridulatory area triangular,  $0.7\times$  as large as pronotum (Figs 2B–E, 6); A1 sinuous, tapering towards the lateral region, file with delicate stridulatory teeth covering less than 10% of A1 width in the medial region similar to a zipper strip, with 87–105 wide, sharp and minute teeth (Fig. 2E); mirror elliptical to almost round, asymmetric at the sides with left anterior edge shorter than right anterior edge, and bearing an obtuse angle in the right lateral edge post-medially; scraper straight and sharp (Figs 2C–E, 6). Membranous wing hyaline, triangular, reduced, unspotted, and with simplified venation, extending to two to three tergites (Fig. 6A).

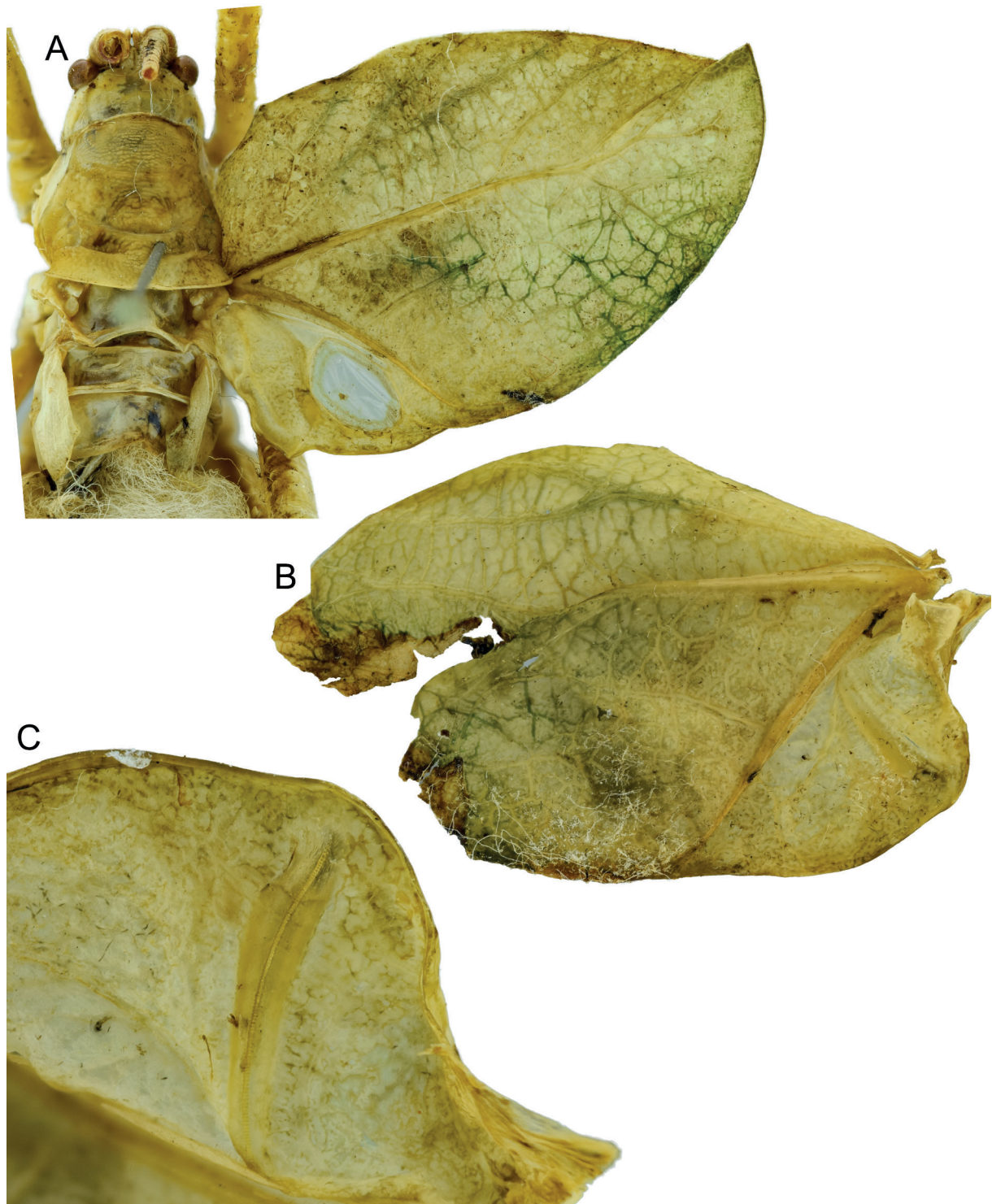
LEGS. Robust and large in relation to the body (Fig. 2), hind legs almost twice the length of the body (Figs 2, 5A). Fore femur almost straight, mid femur very slightly downcurved (Fig. 2). Tympanum present. All femora bearing rows of conical or triangular porrect spines, two dorsally and two ventrally – spines of the dorsal surfaces gradually shorter and becoming rounded, similar to mounds near the apex. Profemora with 6 spines on each ventral row and 11–12 on each dorsal row. Mesofemora with 7–8 spines on each ventral row and 11 on each dorsal row. Lateral carinae of all femora projected apically, forming triangular sharp spines. Pro and mesotibiae with basal third dorsoventrally widened, protibiae bearing tympanum at that widening, shown as a narrow slit (Figs 2, 5). Protibiae basally very slightly curved on the dorsal surface, dorsally without spines, ventrally, on apical half, with two sparse rows of thin, sharp, and porrect spines, two to three on each row. Mesotibiae slightly procurved, dorsally with a pair of large, almost straight, thin, and sharp spines on basal two-fifths, in one of the mid legs with a further single smaller spine more apically, pre-medially, located near posterior edge; ventrally with two rows with three spines similar to those of protibiae. Hind leg very thick. Metafemora slightly downcurved and very slightly recurved. Metafemora dorsally with two rows of slightly porrect conical spines stopping slightly before the apex, anterior row with 19–26 spines, posterior row with 19–22 spines; often with extra spines between rows near the apex (Figs 2, 5). Metafemora ventrally with two rows of slightly porrect spines, anterior row with 18–19 more triangular spines, posterior with 7–9 smaller spines distributed only on distal two-thirds (Figs 2, 5). Metatibiae slightly downcurved and extremely thorny (Figs 2, 5A, 7A). Dorsally with an outer row of 7 slightly porrect, large, laterally flattened, and widened triangular spines



**Fig. 4.** Last tergites, cerci, and subgenital plate of the holotype ♂ of *Metallacantha aculeata* Engelking, Ghirotto, Fianco, Sobral, Silva-Neto & Mendes gen. et sp. nov. (DZUP), from Santa Teresinha, Bahia, Brazil. **A.** Last terga in dorsal view (mirrored). **B.** Detail of right cercus in dorsal view. **C.** Subgenital plate in ventral view.



**Fig. 5.** Paratype ♂ of *Metallacantha aculeata* Engelking, Ghirotto, Fianco, Sobral, Silva-Neto & Mendes gen. et sp. nov. (MNRJ) from Caetit , Bahia, Brazil. **A.** Habitus in lateral view. **B.** Head and thorax in lateral view. **C.** Body in ventral view.



**Fig. 6.** Tegmina of paratype ♂ of *Metallacantha aculeata* Engelking, Ghirotto, Fianco, Sobral, Silva-Neto & Mendes gen. et sp. nov. (MNRJ) from Caetité, Bahia, Brazil. **A.** Right tegmen in dorsolateral view. **B.** Left tegmen in dorsolateral view. **C.** File of left stridulatory area in ventral view. Image not to scale.

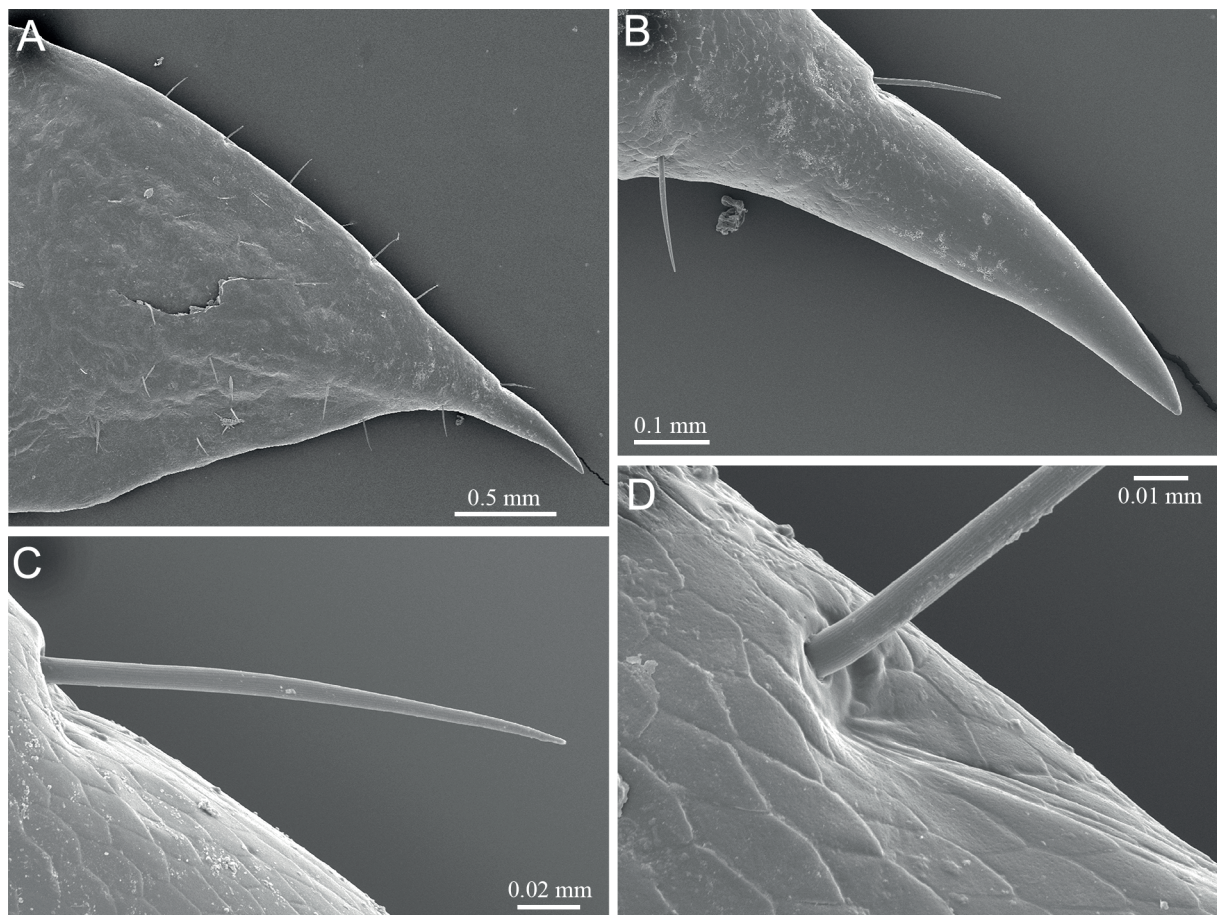


**Fig. 7.** Paratype ♂ of *Metallacantha aculeata* Engelking, Ghirotto, Fianco, Sobral, Silva-Neto & Mendes gen. et sp. nov. (MNRJ) from Caetité, Bahia, Brazil. **A.** Left leg III in lateral view. **B.** Last tergites in ventral view. Image not to scale.

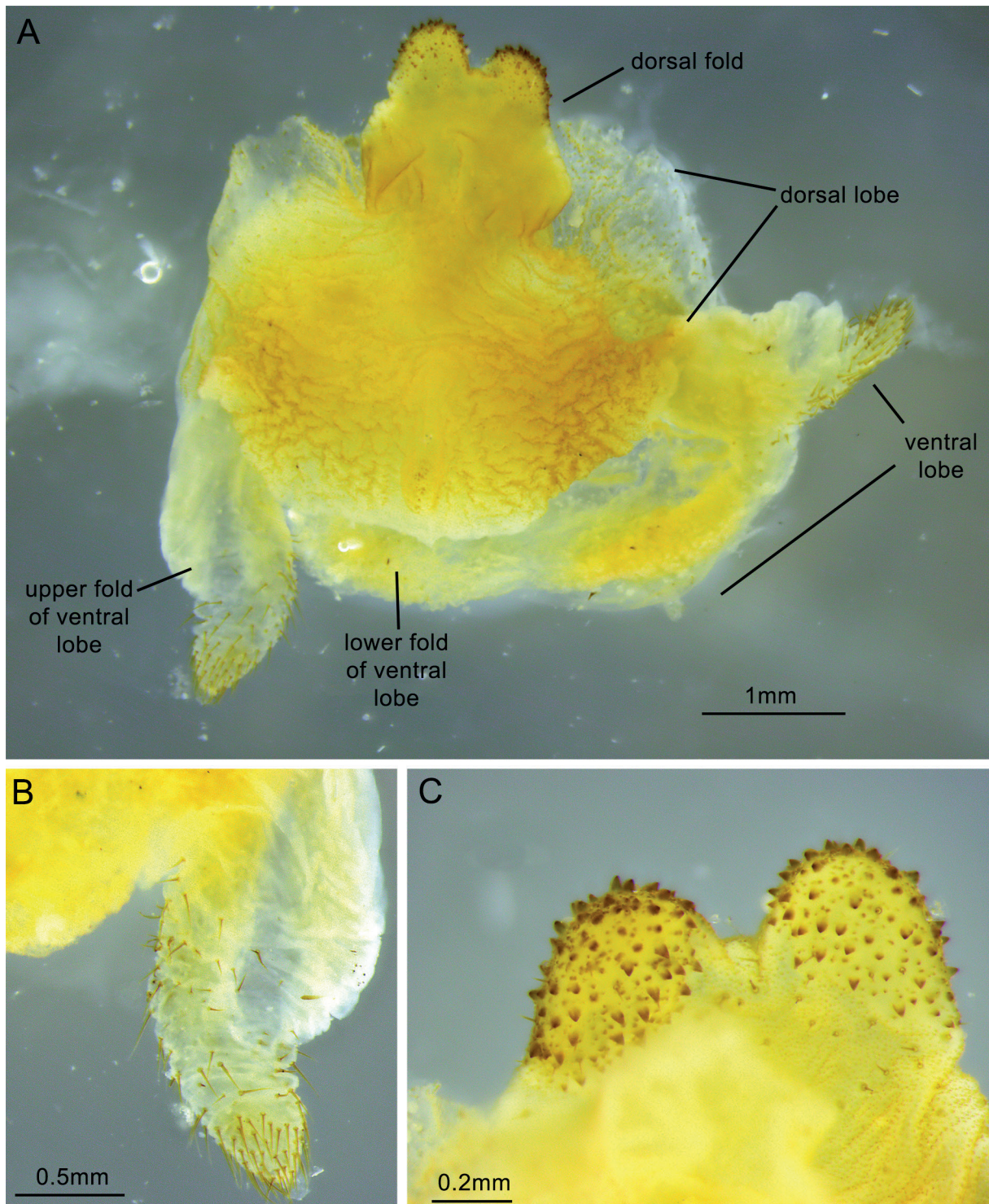
with blackish and iridescent outer surfaces – the proximal three very large, the central one medium to small, and the distal three small and narrower, close to each other and near apex (Figs 2, 5A, 7A). Dorsally with a further posterior row of 7–8 spines, the first four large, somewhat triangular, thorny, thin, long, and slightly sinuous (occasionally some are smaller), with some setae on the dorsal and medial region, apex quite smooth and pointed (Figs 2, 5A, 7A); the last four (or five in rows with eight spines) slightly porrect; the last three (or four in rows with eight spines) close to each other and near apex, pairing with those of the anterior row (Figs 2, 5A, 7A). Ventrally with a single row of 12–13 spines on the anterior edge, all except the last thin, long and inwardly curving, those near apexes slightly porrect; first three smaller, gradually increasing in size towards posterior portion; the largest spines are those near the center of the tibiae; penultimate and antepenultimate spines smaller, decreasing in size towards posterior; last spine very porrect, straight, small, and conical, paired by a single spine on the posterior edge (Figs 2, 5A, 7A).

**ABDOMEN.** Large, wide. Tergum X with posterior margin expanded and rounded (Fig. 4A). Subgenital plate rounded, anterior margin with a V-shaped depression, posterior margin slightly concave (Fig. 4C, 7B); lateral flange, styliform processes, and styli absent; cerci conical, at base 1.2× as wide as long (Fig. 4).

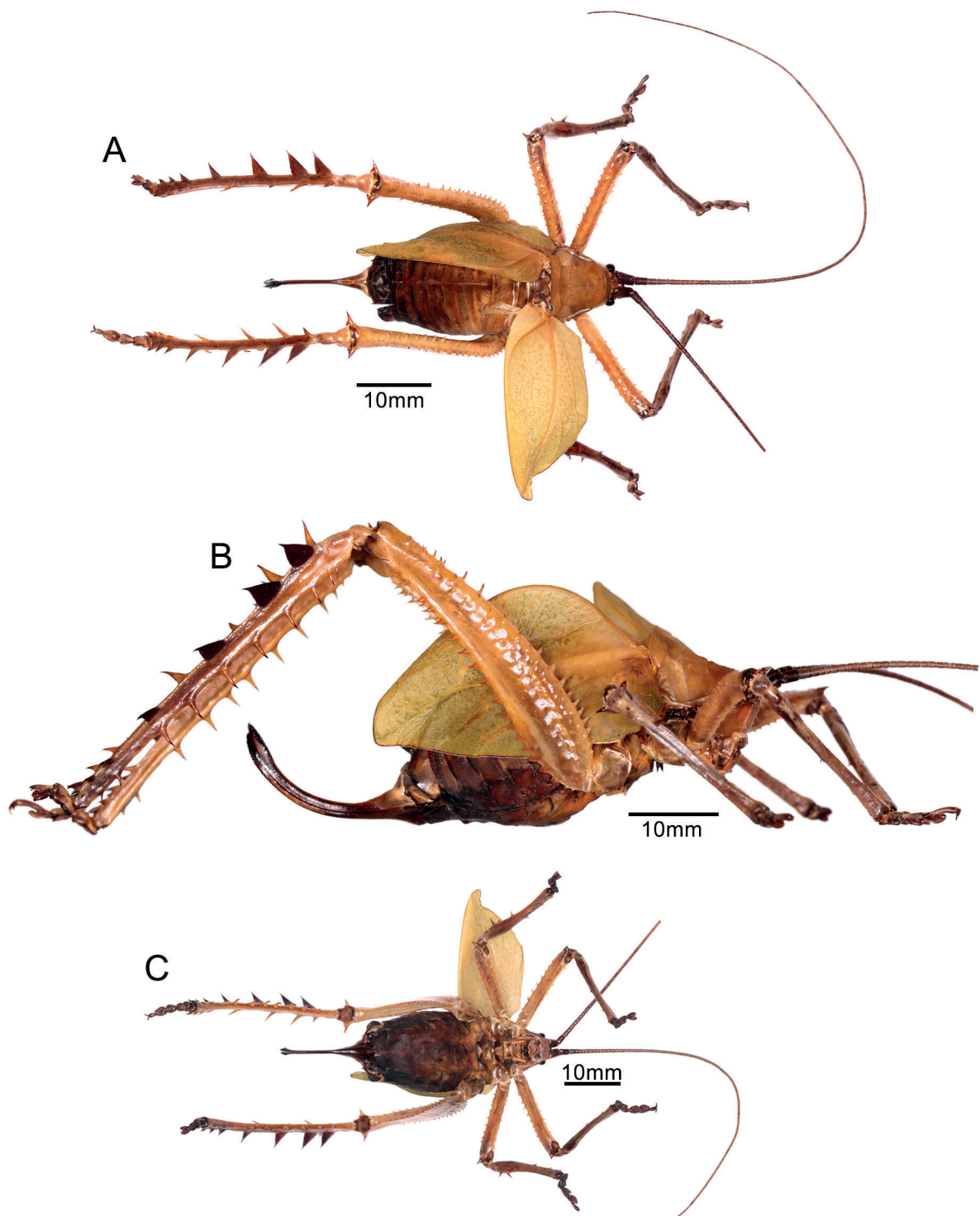
**GENITALIA** (Fig. 9). Membranous, dorsal lobe without titillator's sclerites, composed of a slightly sclerotized round central lobe of rough surface more basally (Fig. 9A). Dorsal fold as an apical projection



**Fig. 8.** SEM images of a tibial spine of *Metallacantha aculeata* Engelking, Ghirotto, Fianco, Sobral, Silva-Neto & Mendes gen. et sp. nov. (paratype ♂, MNRJ) from Caetité, Bahia, Brazil. **A.** Tibial spine in medial view. **B.** Close-up of the apex. **C.** Close-up of a dorsal seta. **D.** Close-up of a seta insertion in the dorsomedial region.



**Fig. 9.** Genitalia of paratype ♂ of *Metallacantha aculeata* Engelking, Ghirotto, Fianco, Sobral, Silva-Neto & Mendes gen. et sp. nov. (MNRJ) from Caetit , Bahia, Brazil, treated with KOH. **A.** Dorsal view. **B.** Upper fold of ventral lobe in ventral view. **C.** Dorsal fold in ventral view.



**Fig. 10.** Paratype ♀ of *Metallacantha aculeata* Engelking, Ghirrotto, Fianco, Sobral, Silva-Neto & Mendes gen. et sp. nov., from Vitória da Conquista, Bahia, Brazil (MZUSP), habitus. **A.** Dorsal view. **B.** Lateral view (mirrored). **C.** Ventral view.



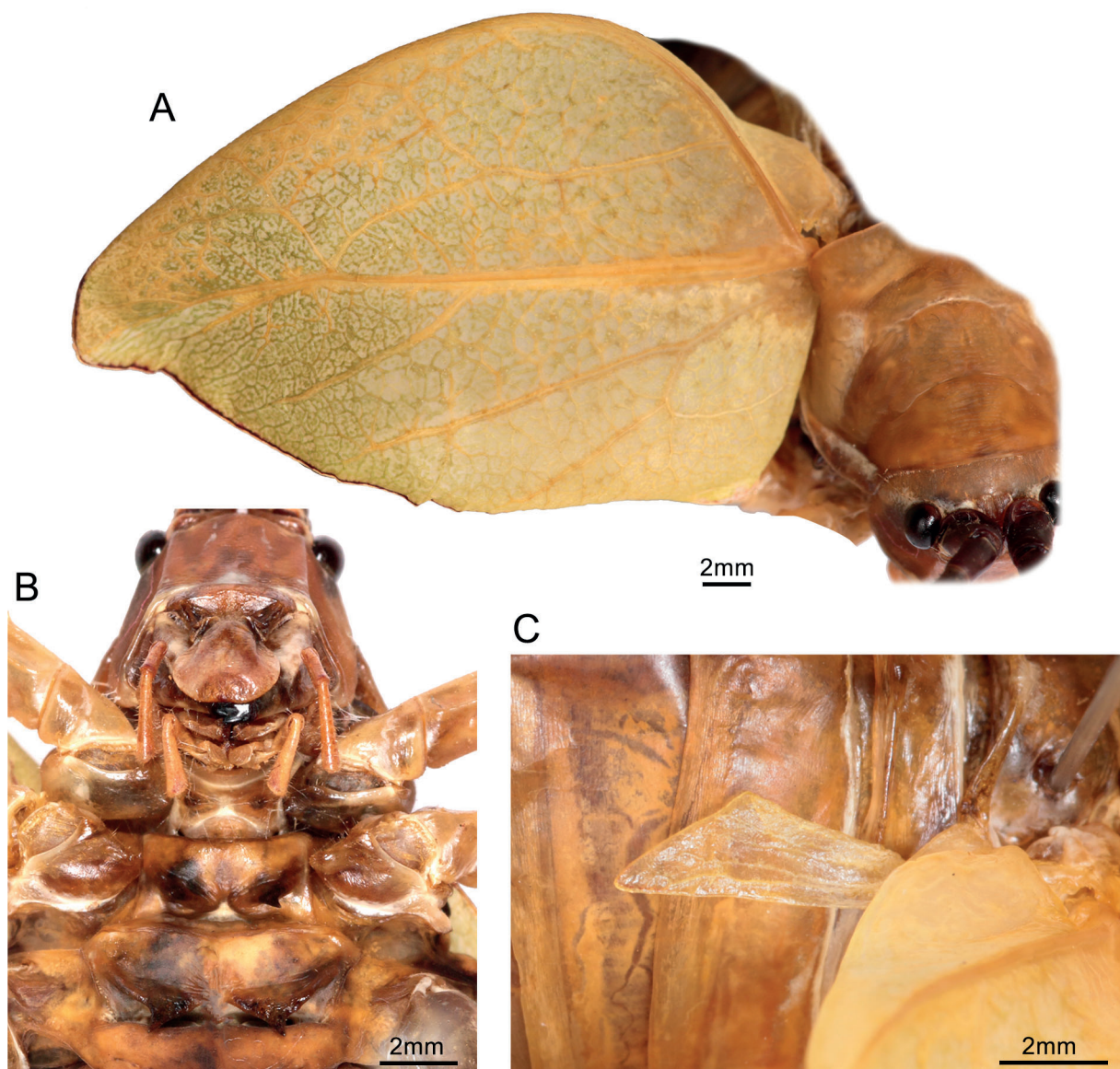
**Fig. 11.** Head and pronotum of paratype ♀ of *Metallacantha aculeata* Engelking, Ghirrotto, Fianco, Sobral, Silva-Neto & Mendes gen. et sp. nov., from Vitória da Conquista, Bahia, Brazil (MZUSP). **A.** Head in frontal view. **B.** Head and pronotum in dorsal view. **C.** Head and pronotum in lateral view.

of 0.6x the length of the central lobe, basally with a central sulcus, apically further bifurcated into two short round lobes at the apex, those bearing several small dark sclerotized spines (Fig. 9C). Ventral lobe composed of symmetric upper and lower folds. Upper folds long, more than half the length of the genitalia, very similar to a cercus in which they are somewhat cylindrical, with a tapering apex and a widened base, further bearing several bristles from around half the length up to the apex (Fig. 9B). Lower folds as two wide and round lobes (Fig. 9A).

**Female** (Figs 10–16, 18)

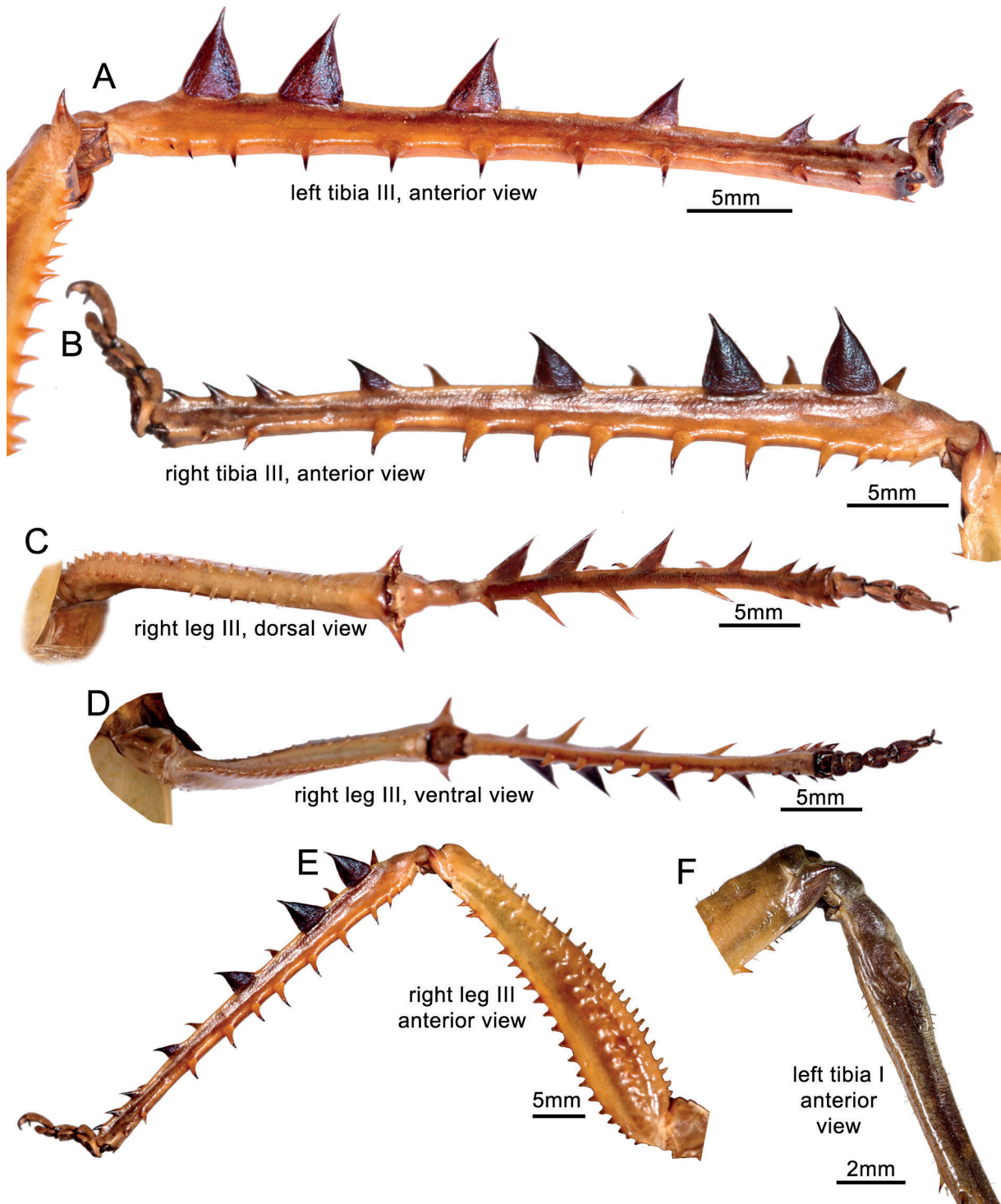
**COLORATION** (Fig. 18). Similar to the male, tegmina with or without a subquadrate dark brown spot on the anterior edge, below the main veins; ovipositor dark brown with blackish spots.

**HEAD.** Similar to the male, except: eyes slightly smaller; scapus and pedicellus slightly longer (Fig. 11); antennae total length 9.5 cm, at least 5.8× longer than anterior femur (Fig. 10).



**Fig. 12.** Thorax and wings of paratype ♀ of *Metallacantha aculeata* Engelking, Ghirotto, Fianco, Sobral, Silva-Neto & Mendes gen. et sp. nov., from Vitória da Conquista, Bahia, Brazil (MZUSP). **A.** Right tegmen in dorsolateral view. **B.** Thorax in ventral view. **C.** Right hind wing in dorsoanterior view.

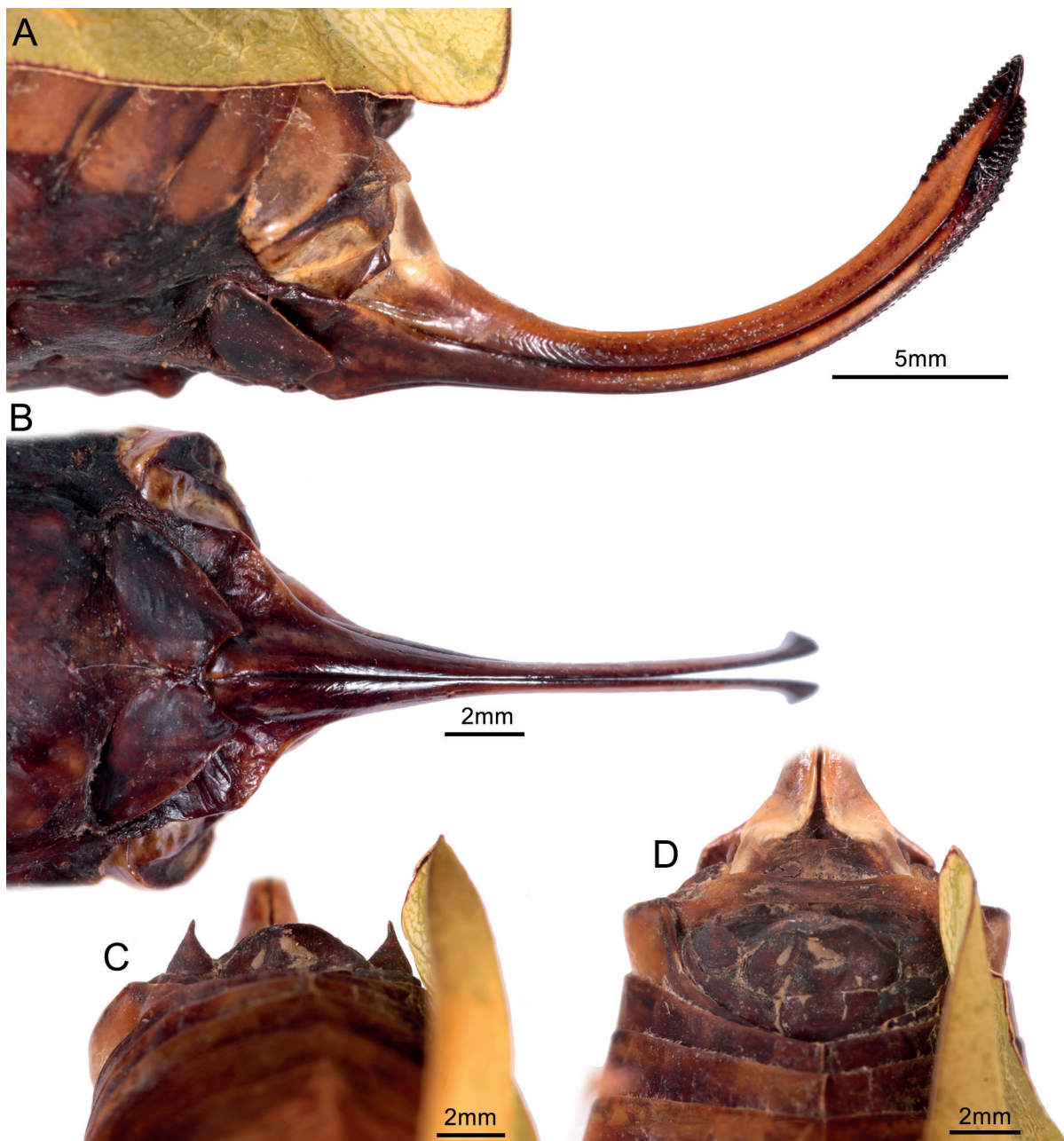
THORAX. Similar to the male, except wider. Pronotum significantly tapering towards anterior portion, trapezoidal in shape (Figs 10, 11B–C). Pronotal disc  $1.1\times$  wider than long; thoracic sternites wider due to a thicker thorax than that of males (Figs 10, 12B).



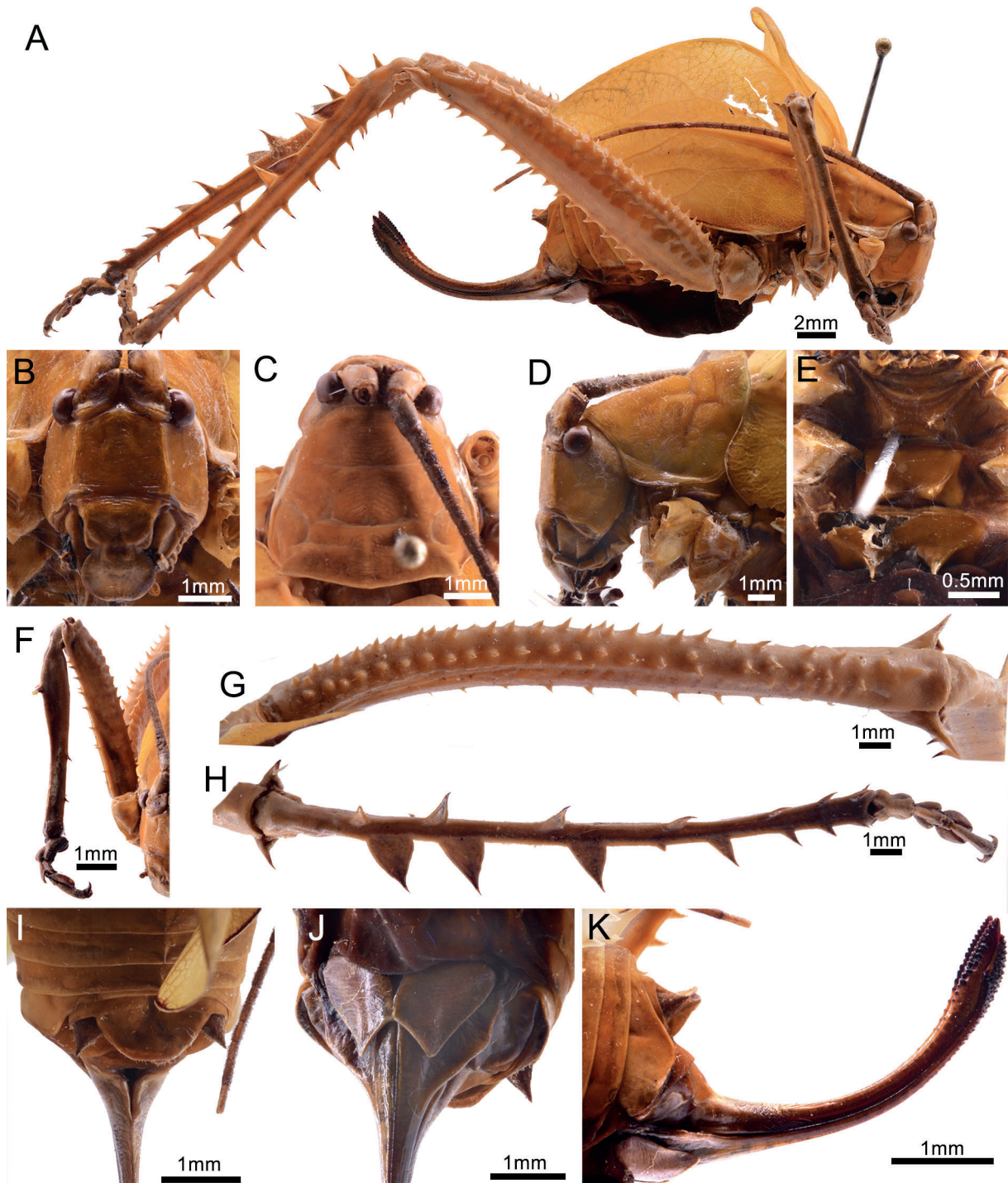
**Fig. 13.** Legs of paratype ♀ of *Metallacantha aculeata* Engelking, Ghiorotto, Fianco, Sobral, Silva-Neto & Mendes gen. et sp. nov., from Vitória da Conquista, Bahia, Brazil (MZUSP). A–B. Right tibia III. C–E. Right leg. F. Left tibia I. Legs views are indicated in the figure.

WINGS. Tegmina of females in the same shape as those of males (Figs 12A, 16A). Tegmina with cells smaller and veins more sinuous than those of males (Figs 12A, 16A). Tegmina with no modifications to sound production. Hind wings slightly smaller in comparison to those of males (but because the abdomen in females is much wider) and covering the same tergites as in males (Figs 12C, 16B).

LEGS. Similar to those of the male, except: hind legs 2× longer than body length (excluding ovipositor). Profemora with 6–7 spines on each ventral row and 9–10 on each dorsal row (Fig. 10). Mesofemora with



**Fig. 14.** Terminalia of paratype ♀ of *Metallacantha aculeata* Engelking, Ghirotto, Fianco, Sobral, Silva-Neto & Mendes gen. et sp. nov., from Vitória da Conquista, Bahia, Brazil (MZUSP). **A.** Ovipositor in lateral view. **B.** Ovipositor and subgenital plate in ventral view. **C–D.** Last tergites and cerci in dorsoanterior (C) and dorsal (D) views.



**Fig. 15.** Paratype ♀ of *Metallacantha aculeata* Engelking, Ghirotto, Fianco, Sobral, Silva-Neto & Mendes gen. et sp. nov. (INPA), from Santa Teresinha, Bahia, Brazil. **A.** Habitus in lateral view. **B.** Head in frontal view. **C.** Head and pronotum in dorsal view. **D.** Head and pronotum in lateral view. **E.** Thorax in ventral view. **F.** Right leg II in anterior view. **G.** Left femur III in dorsal view. **H.** Left tibia III in dorsal view. **I.** Last tergites in dorsal view. **J.** Subgenital plate in ventral view. **K.** Ovipositor in lateral view.

7–8 spines on each ventral row, and 12–13 on dorsal rows (Fig. 10). Protibiae ventrally on apical half with sparse rows of thin, sharp porrect spines, three on each row (Fig. 10). Mesotibiae dorsally with a pair of large, almost straight, thin, and sharp spines on basal two-eighths (Fig. 10).

A



B

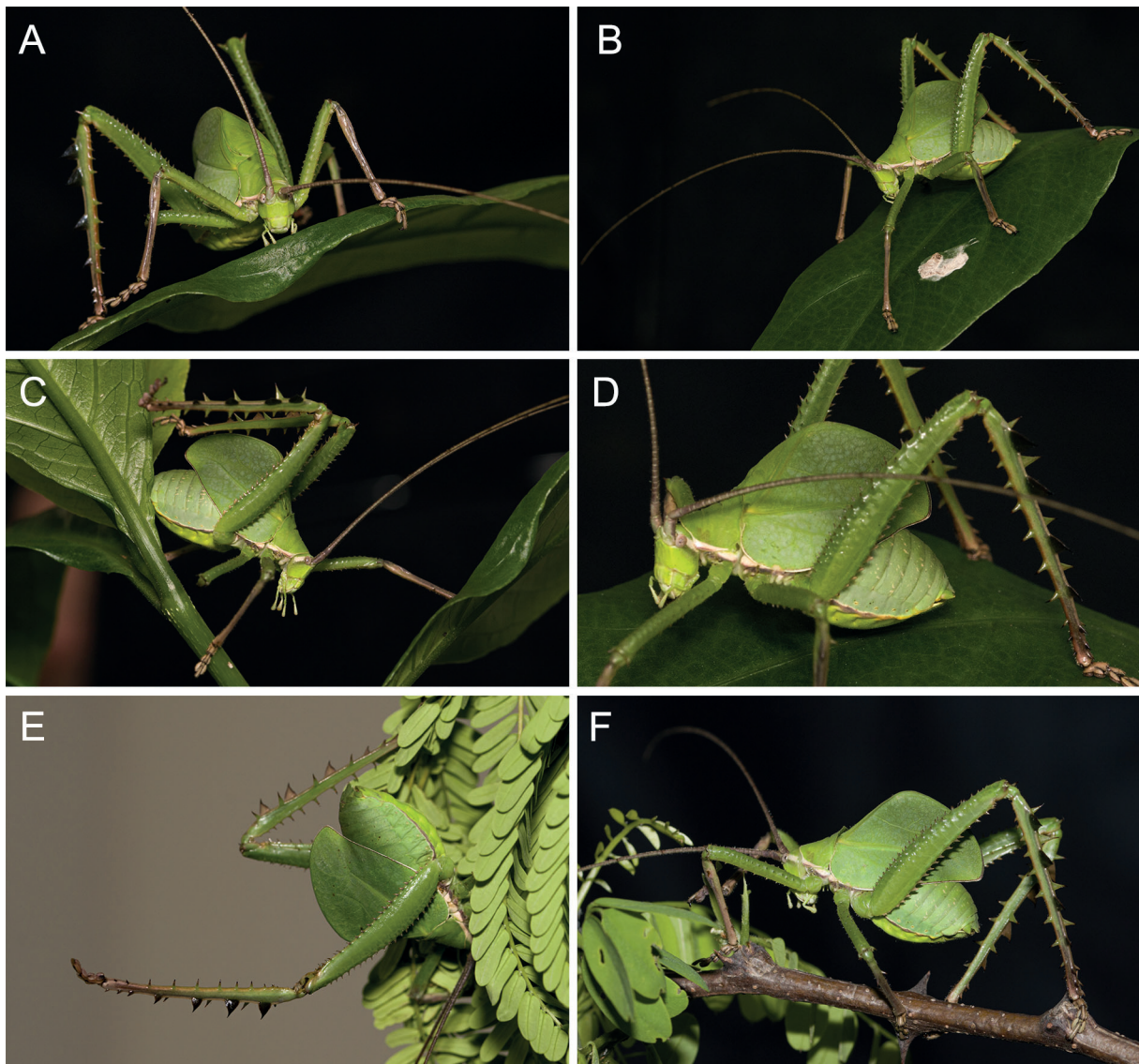


**Fig. 16.** Wings of paratype ♀ of *Metallacantha aculeata* Engelking, Ghirotto, Fianco, Sobral, Silva-Neto & Mendes gen. et sp. nov. (INPA), from Santa Teresinha, Bahia, Brazil. **A.** Left tegmen in dorsolateral view. **B.** Left hind wing in lateral view. Image not to scale.

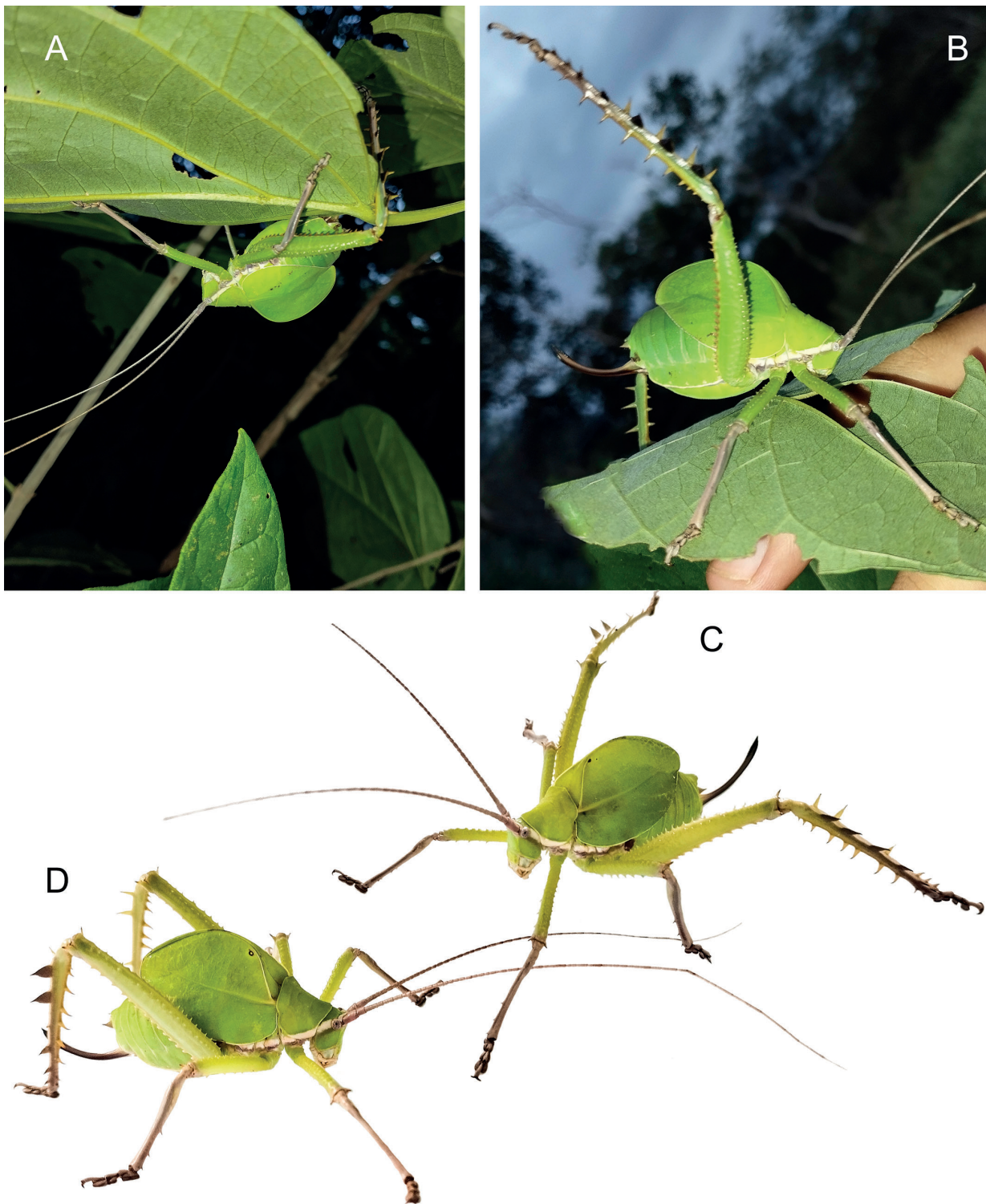
**ABDOMEN.** Large, wide, like the thorax, overall thicker than that of male (Fig. 10). Tergum X with posterior margin expanded and rounded (Figs 14, 15I–K). Cerci conical, short, strongly tapering to an acuminate apex (Figs 14, 15I–K). Subgenital plate trapezoidal, wider than long, and strongly indented into two triangular edges (Figs 14B, 15J). Ovipositor laterally flattened, long, curved, and with apex widened in lateral view; apex finely serrate, with several short and round projections dorsally, ventrally, and slightly laterodorsally and lateroventrally (Fig. 14A–E).

**Nymph (Fig. 19)**

Nymphs are fairly similar to adults, with several spines on their legs, including the characteristic widened iridescent metallic spines of foretibiae (Fig. 19A). Dorsally, the body is keeled mainly at the posterior areas of the thorax and the abdomen, making the mid-length of the katydid being projected, with tergum I as its highest point. Laterally, the abdomen also forms a keel on each side. The white lateral line is present, similar to that of adults, extending through all thorax, and, in addition, specimens bear



**Fig. 17.** Live holotype ♂ of *Metallacantha aculeata* Engelking, Ghirrotto, Fianco, Sobral, Silva-Neto & Mendes gen. et sp. nov. (DZUP), from Santa Teresinha, Bahia, Brazil. **A–D, F.** Different positions. **E.** Male raising hind leg after being handled. Image not to scale.



**Fig. 18.** Live ♀ of *Metallacantha aculeata* Engelking, Ghirotto, Fianco, Sobral, Silva-Neto & Mendes gen. et sp. nov. from Anagé, Bahia, Brazil (not deposited). **A.** In situ, when found. **B.** Female raising hind leg after being handled. **C–D.** Habitus of the same female. Image not to scale.

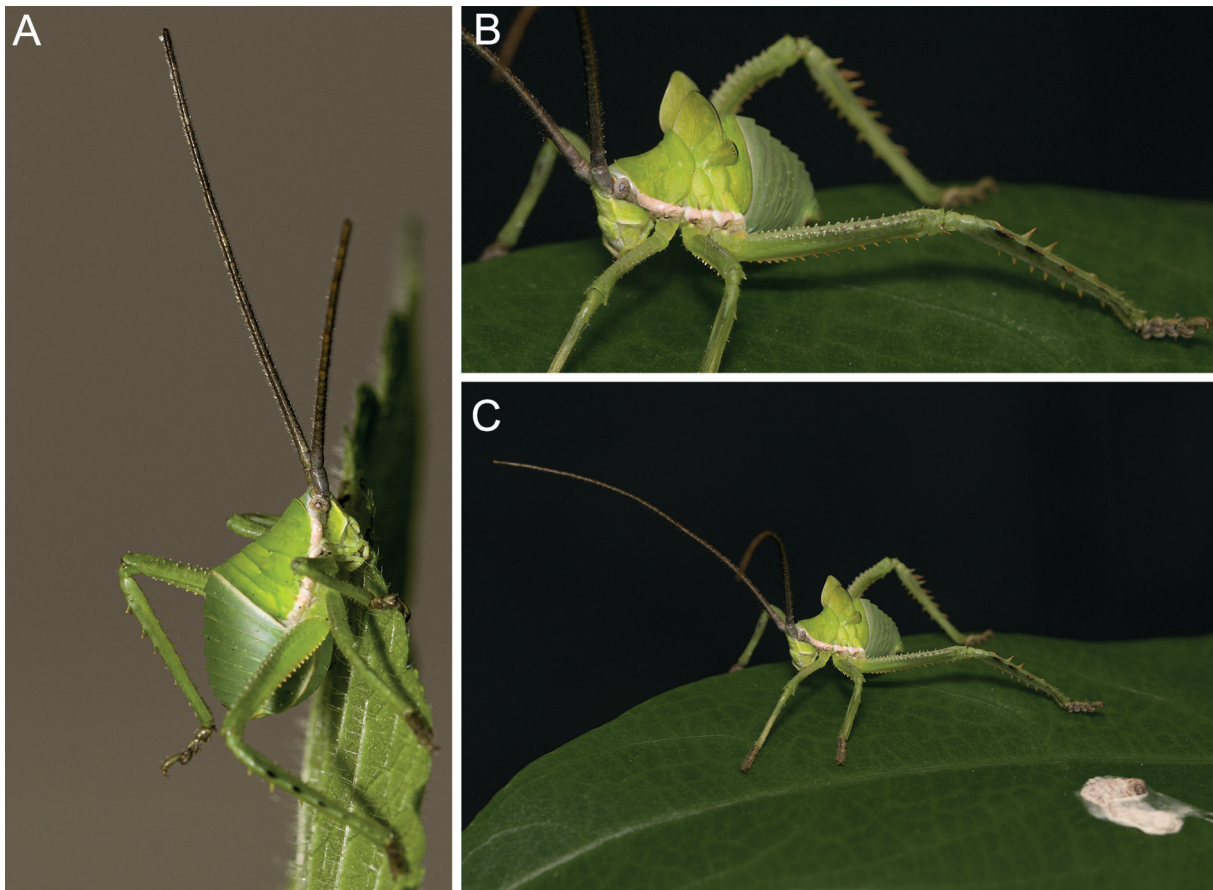
further white lines at the anterior edge of tergum I bordering the thorax and on the lateral abdominal keels (Fig. 19A). In mid to later instars, nymphs exhibit raised wingbuds pointing upward, as in other Pterochrozinae (Fig. 19B–C).

#### Distribution (Fig. 1)

Known only from the State of Bahia in Brazil, in the municipalities of Anagé, Caetit , Santa Teresinha, and Vit ria da Conquista. Photographic records from iNaturalist show the species further occurring in Conde ba and Orol ndia, also in Bahia.

#### Biological aspects

Specimens of *Metallacantha aculeata* gen. et sp. nov. were found resting atop or under bushes from 50–210 cm above the ground, foraging and calling at night (Fig. 17A). In Santa Teresinha, specimens were found on or near *Lantana* L. (Verbenaceae) plants. Their green color matches with the color of the leaves, showing some camouflage despite their large body size. When handled, the individuals presented a warning display, raising their hind legs, ready to strike and push with the tibial spines if touched (Figs 17B, 18E). Both sexes of *Metallacantha aculeata* gen. et sp. nov. produced strong hissing sounds when disturbed, males by tegminal stridulation and females probably by also scraping their tegmina. Specimens from Santa Teresinha were reared briefly in captivity and ate leaves and flowers of different species of *Lantana*.

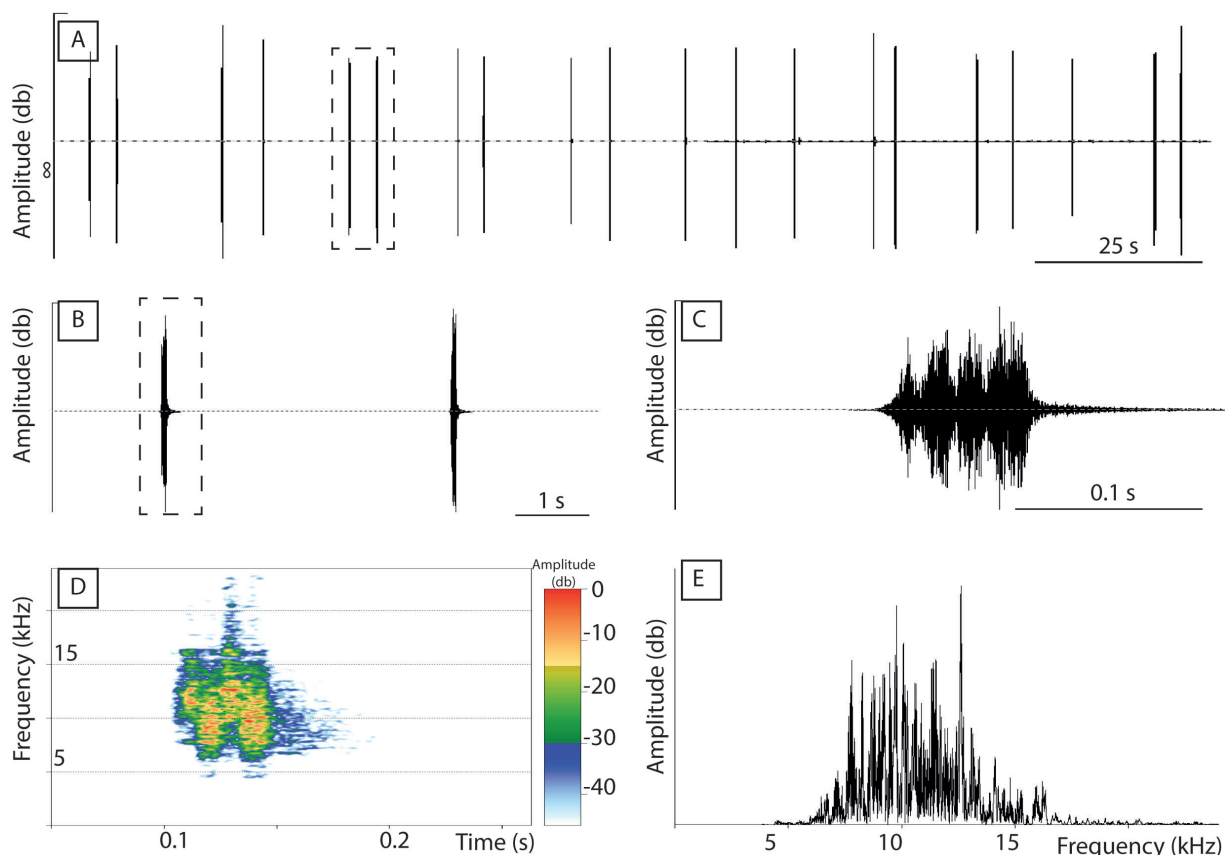


**Fig. 19.** Live paratype ♂ nymph of *Metallacantha aculeata* Engelking, Ghirrotto, Fianco, Sobral, Silva-Neto & Mendes gen. et sp. nov. (DZUP), from Santa Teresinha, Bahia, Brazil. **A.** In an earlier instar, when found. **B–C.** One instar later, after rearing in captivity. Image not to scale.

### Bioacoustics

**CALLING SONGS** (Fig. 20): Male calling songs were perfectly audible at distances of around 5 m in the field at night. Only calling songs at 23–24°C and 75% humidity were considered for analysis during nighttime. In the calling songs, males produce echemes of  $4.2 \pm 0.8$  s (3.1–6.18 s), with a regular intensity (Fig. 20A–C). The echemes are constituted by two single syllables, each one lasting  $9.6 \pm 0.9$  ms (7.5–12.5 ms) with a mute interval of  $4 \pm 0.8$  s (2.9–5.96 s) (Fig. 20B–C). Echemes are separated by a mute interval of  $15.75 \pm 5.9$  s (36.5–11.2 s) (Fig. 20A). Syllables are emitted with a dominant frequency of  $10.5 \pm 1.8$  kHz (7.7–13.3 kHz), the lowest frequencies were about  $4.3 \pm 0.4$  kHz (3.3–5.2 kHz) and the highest frequencies at  $20.3 \pm 1.5$  kHz (18.1–26.3 kHz), with a bandwidth of 90% of  $5.7 \pm 0.2$  kHz (5.4–6.2 kHz) (Fig. 20D–E).

**AGGRESSIVE SONGS** (Fig. 21). The aggressive songs of males are sonorously similar to their calling songs but more vigorous, whereas females make a lower-pitched hissing sound, which is also made by scraping, probably with the wings. Males emit echeme sequences of about  $0.6 \pm 0.04$  s (0.3–0.8 s) of duration, composed by  $16 \pm 2$  echemes (5–22 echemes) (Fig. 21A–B). Each echeme is composed of two syllables, each one lasting  $2.5 \pm 0.5$  ms (3.9–1.5 ms), and echemes with a duration of  $7.1 \pm 3.1$  ms (10–4 ms), with a mute interval of  $2 \pm 0.6$  ms (1.2–3 ms) between syllables and  $5.2 \pm 1.5$  ms (3.4–6.3 ms) between echemes (Fig. 21B–C). Peak frequency was different between the first and second syllable, of about  $12.3 \pm 1$  kHz (10–13 kHz) in the first syllable and  $8.9 \pm 0.7$  kHz (7.4–9.9 kHz); the bandwidth of 90% was almost equal between the first and the second syllable,  $4.4 \pm 0.7$  kHz (2.7–6.1 kHz) in the first syllable and  $4.5 \pm 0.4$  kHz



**Fig. 20.** Calling song of paratype ♂ of *Metallacantha aculeata* Engelking, Ghirotto, Fianco, Sobral, Silva-Neto & Mendes gen. et sp. nov. (DZUP), from Santa Teresinha, Bahia, Brazil. **A–C.** Oscillogram of an echeme sequence (A), an echeme (B), and a syllable (C). **D.** Sonogram of a syllable. **E.** Linear spectrogram of a syllable.

(3.4–5.4 kHz) in the second one (Fig. 21C–D). In the same behavior, females emit syllables that do not form echemes, and each syllable has a duration of  $41 \pm 4$  ms (33–44 ms); the peak frequency was  $3.8 \pm 1.3$  kHz (1.2–5.8 kHz), with a bandwidth of  $5.4 \pm 0.5$  kHz (4.1–5.8 kHz) (Fig. 21G–H).

## Discussion

### Relationships of short-winged Pterochrozinae

Most genera belonging to the Pterochrozinae are relatively taxonomically relatively well-defined, but the relationship among them remains unexplored (Mugleston *et al.* 2018). There is a lack of a reliable phylogenetic hypothesis for this lineage, and therefore, we mostly assume relationships based on external morphology. *Metallacantha* gen. nov. shares most similarities with *Paracycloptera*, such as the general color pattern in green with a lateral white band running from the eye to at least the anterior edge of the tegmina, the unspotted hind wing, the relatively large legs, a robust body, the rows of conspicuous spines on metafemora and metatibiae, the broad pronotal disc and the enlarged, and wider-than-long subgenital plate of the female. Representatives of *Paracycloptera* are one of the most voluminous and robust Pterochrozinae, with some individuals reaching 7.05 cm of body length, and are only recorded in the Atlantic Forest that borders the Caatinga in Northeast Brazil. *Metallacantha* gen. nov. is also recorded for areas with influences of the Atlantic Forest, near contact areas between this forest and the Caatinga, as in Santa Teresinha, Bahia. Thus, we hypothesize *Paracycloptera* to be the sister taxon of *Metallacantha* gen. nov. The general wing venation pattern of *Metallacantha* gen. nov. is different from most Pterochrozinae, as is also the case in *Tanusiella* (authors pers. obs.), indicating that wing reduction might be a cause for changing venation pattern. For Pterochrozinae, the R and Sc veins are either running one atop the other, with Sc concealed below R, or side by side, very close to the other, and, like *Paracycloptera*, these veins on *Metallacantha* gen. nov. are in the latter form. Furthermore, the venation pattern of *Tanusiella* and *Asbolomma* are more reticulate (with more numerous and smaller cells) with straighter veins differing from those of *Metallacantha* gen. nov., which bears more sinuous veins and ample cells. *Tanusiella* presents the shortest wings for all Pterochrozinae, reaching around the mid-length of the abdomen. In contrast, in *Asbolomma*, the wings cover most of the abdomen. In *Asbolomma* the general venation pattern, the color patterns on the tegmina, and the composition of the eyespots of the hindwings indicate a possible close relationship to *Pseudotanusia*. *Asbolomma* and *Tanusiella* are also more similar to other leaf-katydids in being slender, with less robust body and legs, having less conspicuous and fewer spines on the hind leg and spotted hind wings, presenting eye spots typical for several Pterochrozinae. This strongly suggests that the new genus is not closely related to *Tanusiella* or *Asbolomma*. Wing reduction likely arose more than once in different pterochrozine lineages, as not all short-winged genera appear to be closely related.

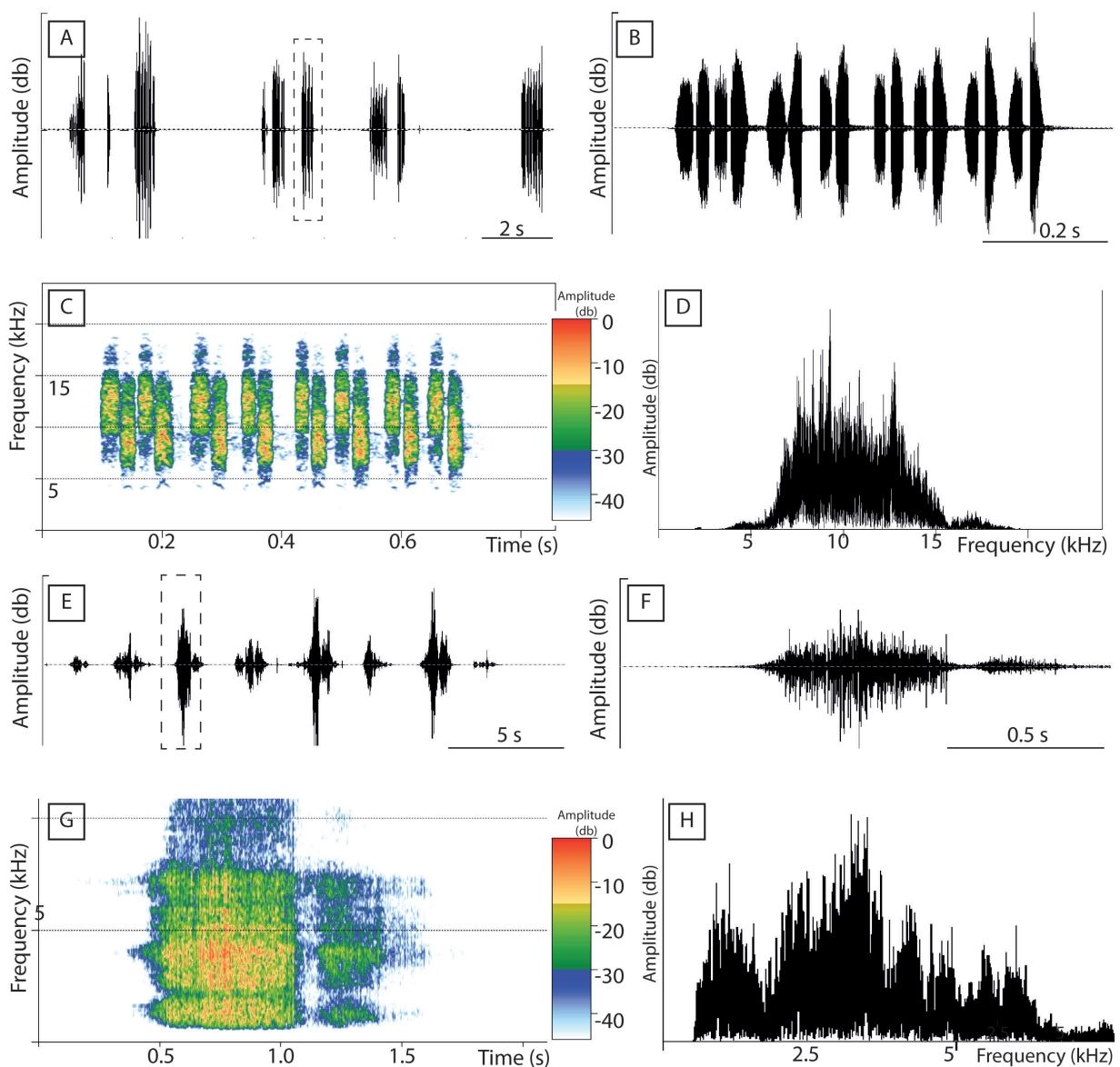
### Reduction of wings in Pterochrozinae

Although they typically lack the ability to fly and primarily use their wings for camouflage and deimatic displays, most Pterochrozinae representatives possess elongated wings. *Tanusiella* inhabits montane forests in the Atlantic Forest biome in Brazil, which form more restricted environments compared to surrounding lowland rainforests. *Asbolomma* is likely exclusive to savannic environments and open vegetations of the heterogeneous Cerrado domain, being one of the few Pterochrozinae known from the Cerrado. *Metallacantha* gen. nov. is the first known to occur in the xeric shrubland Caatinga. All other Pterochrozinae, however, inhabit typical humid tropical or equatorial forests in the Amazon or the Atlantic Forests (Cigliano *et al.* 2024). The evolution of short wings in katydids can be related to limitations in dispersal (Grzywacz *et al.* 2018). Researchers discuss three possible explanations for this phenomenon: (I) habitat stability, which discourages dispersal events; (II) habitat isolation, which limits or makes flight risky or too costly, such as in caves, mountains, or island environments (Roff 1998); and (III) scenarios where, even in unfavorable conditions, dispersal events are too risky or costly to be outweighed (Roff 1998). Braun

(2011) linked altitude to the loss or shortening of wings in katydids, showing that this trait is predominant at higher altitudes. The harsh environmental conditions of the Caatinga may have led to this specialization in *Metallacantha*, similar to what may have occurred to *Tanusiella* in mountainous areas or *Asbolomma* in the drier and more open savannic formations. Future research on the systematics and biogeography of the leaf-katydids would be essential to treat the hypotheses raised here.

### Camouflage in short-winged Pterochrozinae

Both *Tanusiella* and *Asbolomma* seem to have kept their excellence in visual camouflage. For example, we have struggled to find well-camouflaged *Tanusiella* in their environment within moss or leaf litter



**Fig. 21.** Aggressive song of paratype ♂ (A–D) and paratype ♀ (E–H) of *Metallacantha aculeata* Engelking, Ghirotto, Fianco, Sobral, Silva-Neto & Mendes gen. et sp. nov. (DZUP), from Santa Teresinha, Bahia, Brazil. **A–B, E.** Oscillogram of the aggressive song. **C.** Sonogram of an echeme. **D.** Linear spectrogram of an echeme. **F.** Oscillogram of a syllable. **G.** Sonogram of a syllable. **H.** Linear spectrogram of a syllable.

in montane forests (authors pers. obs.). Furthermore, *Asbolomma*, with its body and wings, still has the shape of a leaf, which is not easily revealed by its thin legs (P. Sisnando, pers. comm., 2024). *Metallacantha* gen. nov., however, lacks sophisticated camouflage details and is only generally colored green, with its bulky legs making it easier to distinguish the insect, at least for human eyes. There is a possibility that *Metallacantha* gen. nov. could be less affected by the fine selection by a high predation pressure that likely shaped the richly detailed camouflage of most Pterochrozinae (Braun 2015). Alternatively, it is possible that the thorny, thick legs provide a good enough camouflage setting in the thorny, shrubby Caatinga full of thick and spiny branches.

### Defensive behavior

Many Pterochrozinae show deimatic behavior, such as opening and exhibiting their colorful eyespots on the hindwings while moving laterally and jumping forward (authors pers. obs.). *Metallacantha aculeata* gen. et sp. nov., on the other hand, is the only member of this lineage known to show defensive behavior using tibial spines and also the only known so far to produce hissing sounds.

### Male genitalia

*Metallacantha* gen. nov. seems to be the only Pterochrozinae without a titillator's sclerite nor a titillatory process. The genitalia of *Pterochroza* analyzed by Chamorro-Rengifo & Lopes-Andrade (2014: fig. 69) show reduced titillatory processes, opening the hypothesis that some Pterochrozinae, such as *Metallacantha* gen. nov., could have lost the titillator in its evolutionary history. However, other Pterochrozinae analyzed by Chamorro-Rengifo & Lopes-Andrade (2014: figs 66–69) also present a spiny structure at the dorsal fold, which seems to be exclusive of pterochrozines (Chamorro-Rengifo & Lopes-Andrade 2014). This structure shows varying degrees of spine sizes and sclerotization, and *Metallacantha* is so far the only member of the lineage where it is bifurcated.

### Bioacoustics

The male calling song is emitted in a pattern frequently found in pterochrozines, mainly by the echemes produced in sets of two, which also occurs in other species of Pterochrozinae from the Atlantic Forest, such as in a species of *Paracycloptera* (Dias *et al.* 2017), and of *Typophyllum inflatum* (Fianco *et al.* 2022). The echemes of the calling song of *Metallacantha aculeata* gen. et sp. nov. differ from *Paracycloptera* in that they are formed by only two syllables, as in *Typophyllum*. The dominant frequency is also quite distinct between taxa: 3 kHz in *Paracycloptera*, 21 kHz in *Typophyllum*, and 10.5 kHz in *Metallacantha aculeata* gen. et sp. nov. The calling songs of *Metallacantha aculeata* gen. et sp. nov. can also be differentiated by not presenting any distinct harmonics (Fig. 21) and being comparatively broadbanded. This broader frequency spectra pattern tendency was observed in other Pterochrozinae found in more open, highland areas (Braun 2015). For *Metallacantha* it could also be related to the openness of their environment – as the shrubland of the Caatinga and the drier forests of the Serra da Jiboia have a significantly lower canopy than that of typical tropical forests, where most pterochrozines occur. The frequency pattern between one syllable and the next changes in the aggressive call (Fig. 21), which seems to be peculiar, at least for katydids known to us (e.g., Fianco *et al.* 2022; Fianco 2023), although we did not review the subject and is out of the scope of this paper, so this remains something to be explored.

### Final considerations

*Metallacantha* gen. nov. represents both the first pterochrozine for the Caatinga and the first with significantly reduced hind wings. The dry environments of South America, such as the Caatinga and Cerrado, are very poorly explored regarding Ensifera (Fianco 2023), and the new genus, presenting striking characteristics, indicates the high potential for new species and unique lineages to be found with increased sampling in these areas.

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