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New species and taxonomic notes of Meconematini (Orthoptera, Tettigoniidae, Meconematinae) from Sabah

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Abstract

Two new species were discovered from Maliau Basin and Meligan and are described here: *Cercoteratura reniforma* **sp. nov.**, *Pseudoteratura* (*Pseudoteratura*) *bifurcata* **sp. nov.** and *Pseudoteratura* (*Pseudoteratura*) *maliau* **sp. nov.** The male of *Pseudoteratura* (*Pseudoteratura*) *mima* Gorochov, 2014 and the male calling song of *Euanisous tawau* Gorochov, 2014 are also described for the first time. New material of *Alloteratura longa* Gorochov, 2008, *Cercoteratura repens* Tan *et al.*, 2022, *Odonturisca ?epiproctalis* Gorochov, 2008 and *Pseudoteratura* (*Subtilotura*) *subtilissima* Gorochov, 2008 are also documented here.

Key words: Bioacoustics, Borneo, calling song, East Malaysia, taxonomy

Introduction

Meconematini is a speciose tribe of the subfamily Meconematinae, particularly those from the Southeast Asian region. Many species and new genera have recently been described, and more are expected to be discovered (e.g., Jin *et al.*, 2022; Gorochov, 2022, 2024; Tan *et al.*, 2022). As more samplings were done in different parts, new locality records also improved our understanding of the distribution of known species (e.g., Jin *et al.*, 2020; Tan & Wahab, 2020; Tan *et al.*, 2024a, 2024b). Lately, the calling songs of Meconematini from the region are also examined (Tan *et al.*, 2023), but they remain unknown for most genera and species.

An orthopteran survey in Sabah State (East Malaysia, Borneo) at the Maliau Basin Conservation Area and around Meligan (including near Long Pasia and Sinipung Hill) was recently concluded. We found new species, new locality records and previously unknown calling song of Meconematini. Here, we describe *Cercoteratura reniforma* **sp. nov.**, *Pseudoteratura* (*Pseudoteratura*) *bifurcata* **sp. nov.** and *Pseudoteratura* (*Pseudoteratura*) *maliau* **sp. nov.**, and the calling song of *Euanisous tawau* Gorochov, 2014.

Material and methods

Between 10 and 25 November 2024, opportunistic collection and light-trapping were conducted at Maliau Basin Conservation Area and around Meligan, near Long Pasia and Sinipung Hill in Sabah State (East Malaysia),

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Borneo. The permissions for collecting and exporting material were granted by the Sabah Biodiversity Centre (JKM/MBS.1000-2/2 JLD.1 and JKM/MBS.1000-2/3 JLD.5 (106)). The permissions for research in Maliau Basin Conservation Area was also supported by the Maliau Basin Management Committee under the Yayasan Sabah (YS/MBMC(RA)/2024/3). The fieldwork was also supported by the National Geographic Grant (NGS-73188R-20). Whenever possible, live specimens were photographed using a Canon EOS 500D digital SLR camera with a compact-macro lens EF 100 mm f/2.8 Macro USM, and Canon Macro Twin Lite MT-24EX was used for lighting and flash.

Sound recording of the male calling songs was done in captivity using a Wildlife Acoustics Song Meter (SM) Mini acoustic recorder programmed to record continuously with a sampling frequency of 96 kilo-samples per second and channel gain of 18 dB (16 bit). The katydid was kept isolated in a small insect cage with nylon cover and the microphone was placed at most 30 cm away beside the cage with the microphone pointing horizontally towards the cage.

The specimens were preserved in absolute analytical-grade ethanol and later pinned and dry-preserved. Typically, a single leg (not standardised) from each specimen was kept in absolute analytical-grade ethanol for future molecular work.

The pinned specimens were imaged using a Canon EOS 6D digital SLR camera attached to a Visionary Digital Passport system. For habitus, a compact-macro lens EF 50 mm at f/2.5 was used; for close-up images of morphological features, a macro photo lens MP-E 65 mm f/2.8 USM (1–5×) (sometimes with Tamron SP AF Tele-Converter 14OF-CA 1.4×) was used. Image stacking was done using Zerene Stacker version 1.04. Image editing was accomplished using Adobe Photoshop 2025 (Adobe Systems Incorporated, San Jose, CA, USA).

Measurements of dry, pinned specimen were made from images using ImageJ 1.54g (Wayne Rasband, Research Services Branch, National Institute of Mental Health, Bethesda, MD, USA). For the measurements, the following abbreviations are used: BL = body length; BWL = body with wing length; PL = pronotum length; TL = tegmen length; HWT = hind wing tail; HFL = hind (posterior) femur length; HTL = hind (posterior) tibia length.

Acoustic analysis and song terminology generally follow Tan *et al.* (2023). Parameters of the temporal domain (e.g., durations and intervals) were measured manually using Raven Lite 2.0.0. The peak frequency ('meanpeakf', frequency with highest energy from the mean frequency spectrum) and the spectral entropy ('sp.ent', energy distribution of the frequency spectrum; pure tone ~ 0; noisy ~ 1) were obtained using the 'spectro_analysis' function from the R package warbleR version 1.1.27 (Araya-Salas & Smith-Vidaurre, 2017) in the R software version 4.4.1.

The specimens were eventually deposited in:

FRC	Forest Research Centre (Sepilok), Sabah Forestry Department, East Malaysia
MNHN	Muséum national d'Histoire naturelle, Paris, France
ZRC	Zoological Reference Collection, Lee Kong Chian Natural History Museum, Singapore

Taxonomic parts

Subfamily Meconematinae Burmeister, 1838

Tribe Meconematini Burmeister, 1838

Alloteratura (*Meconemopsis*) *longa* Gorochov, 2008

Alloteratura longa Gorochov, 2008: 34—Gorochov, 2016: 13, 17; Tan *et al.*, 2024a: 592.

New material examined. EAST MALAYSIA; Sabah State • 2♂; Meligan (P28 a.k.a. pt 2); N4.57619 E115.73923, 1266.0±6.8 m.a.s.l.; 23 November 2024, 22h00; attracted to light trap on the road; coll. M.K. Tan; SBH.24.262, 264 (ZRC).

Distribution. Borneo (Sabah: Mount Trus Madi, Mount Kinabalu and Meligan [new locality record]).

Type locality. EAST MALAYSIA: Sabah State: Mount Trus Madi.

***Cercoteratura reniforma* sp. nov.**
(Figs 1, 2)

Material examined. Holotype: EAST MALAYSIA; Sabah State • ♂; Maliau Basin Conservation Area, along trail from Agathis–Nepenthes camps at 1 km; 14 November 2024, night; coll. M.K. Tan; SBH.24.93 (FRC).

Diagnosis. The new species is most similar to *Cercoteratura variegata* Gorochov, 2019 from Sumatra and Sarawak and *Cercoteratura mirabilis* (Tan & Wahab, 2018) from Brunei Darussalam by the dark colour patterns, its general habitus and shape of the epiproct and cercus; but differs by the combination of these characters: the epiproct (*ep*) large, with a large median lobe narrowest at the middle and its apex roundly truncated, consisting of a pair of large dorsal (*dl*) and ventral (*vl*) lobes (instead of having only one distinct pair of lateral lobes, with ventral lobes highly reduced); the epiproct at apex, in posterior view reniform and clearly separated into two closely spaced lobes at the middle (dorsal lobes) (instead of only partly separated in *C. variegata*, and distinctly separated at both lateral ends in *C. mirabilis*); its cercus with the basal part having a ventral inner lobe (*il*) irregularly rectangular, pointing internally, wider than long and its apex truncated (instead of having acute apices); the apical end of its cercus forming a rounded flattened lobe, in posterior view reniform (instead of a long curved process with acute apex in *C. variegata* and folding at apex in *C. mirabilis*). The male genitalia is very similar to *C. mirabilis* by the shape of the epiphallus; but differs by the size and relative positions of lateral spines.

Etymology. The species name refers to the reniform shape, in posterior view, of the dorsal lobe of its epiproct and the apical end of the cercus.

Description. Male (holotype). Relatively large and slender Meconematini with habitus typical of this genus (Figs 1A, 1B). Eyes globular and distinctly protruding (Fig. 1C). Frontal rostrum conical, slightly wider than scapus, with dorso-median sulcus (Fig. 1C). Fifth (apical) segment of maxillary palpus longer than fourth (subapical) segment, slender but slightly widened apically. Fourth and third segments of subequal length, both longer than second segment. Pronotum covering tegminal mirror; dorsal disc roundly turned into lateral lobes; with distinct transverse sulcus separating prozona and metazona; metazona raised (Figs 1C, 1D). Anterior margin of pronotal disc straight, posterior margin broadly rounded (Fig. 1C); humeral sinus indistinct (Fig. 1D); ventral margin of pronotal lateral lobe very short (Fig. 1D). Thoracic auditory spiracle (= thoracic foramen) large, with ventral half elongated and dorsal half widened and with oblique cover at dorsal end, not covered with pronotal lateral lobe (Fig. 1D). Macropterous; tegmen extending well behind hind knees; hindwing distinctly extending beyond tegmina (Fig. 1B). Coxal spur of foreleg long (Fig. 1C). Fore tibia with both tympana elongated oval and open. Fore tibiae each with 5 outer and 4 inner subapical spines; middle tibiae each with 4–5 outer and 4 inner subapical spines; inner and outer genicular lobes of hind femora with obtuse lobe and with spinules; hind tibiae ventrally and dorsally with numerous outer and inner spines as well as 2 ventral and 1 dorsal apical spurs on each side.

Last abdominal tergite transverse (10^{th}) with postero-median lobe very broad and apex broad and almost truncated (Fig. 2A). Epiproct (*ep*) large, with large median lobe narrowest at middle and apex roundly truncated, consisting of one pair of dorsal (*dl*) and ventral (*vl*) lobes each (Figs 2A–C). Dorsal lobe of epiproct hoof-shaped, longer than broad, pointing dorso-posteriorly, apex truncated and carinated, posterior view reniform (Figs 2A–C); ventral lobe elongated and process-like, pointing ventrad, longer and more cylindrical than dorsal lobe (Figs 2B, 2C), in posterior view slightly curved with apex subacute (Fig. 2C). Cercus robust, in profile view strongly curved dorsad (Fig. 2B); with basal part dorso-ventrally thickened, in ventral view triangular with external margin more sclerotized and having inner lobe (*il*) irregular rectangular, pointing internally, wider than long and apex truncated (Fig. 2D); thereafter almost laterally compressed and lamellar (Figs 2A, 2B); at apex with rounded flattened lobe, in posterior view reniform (Fig. 2C). Subgenital plate trapezoidal, apical end distinctly narrower, with posterior margin at medial emarginated, having stout styles (Fig. 2D). Phallic complex consists of yoke-shaped epiphallus (Fig. 2E); in posterior view with two lateral lobes at dorsal end; three pairs of lateral spinose processes; processes slightly curved with apices acute, middle ones larger than dorsal ones, ventral ones near end and smallest; another two pairs of smaller spinules towards ventral end; ventral end tapering into subacute apex.

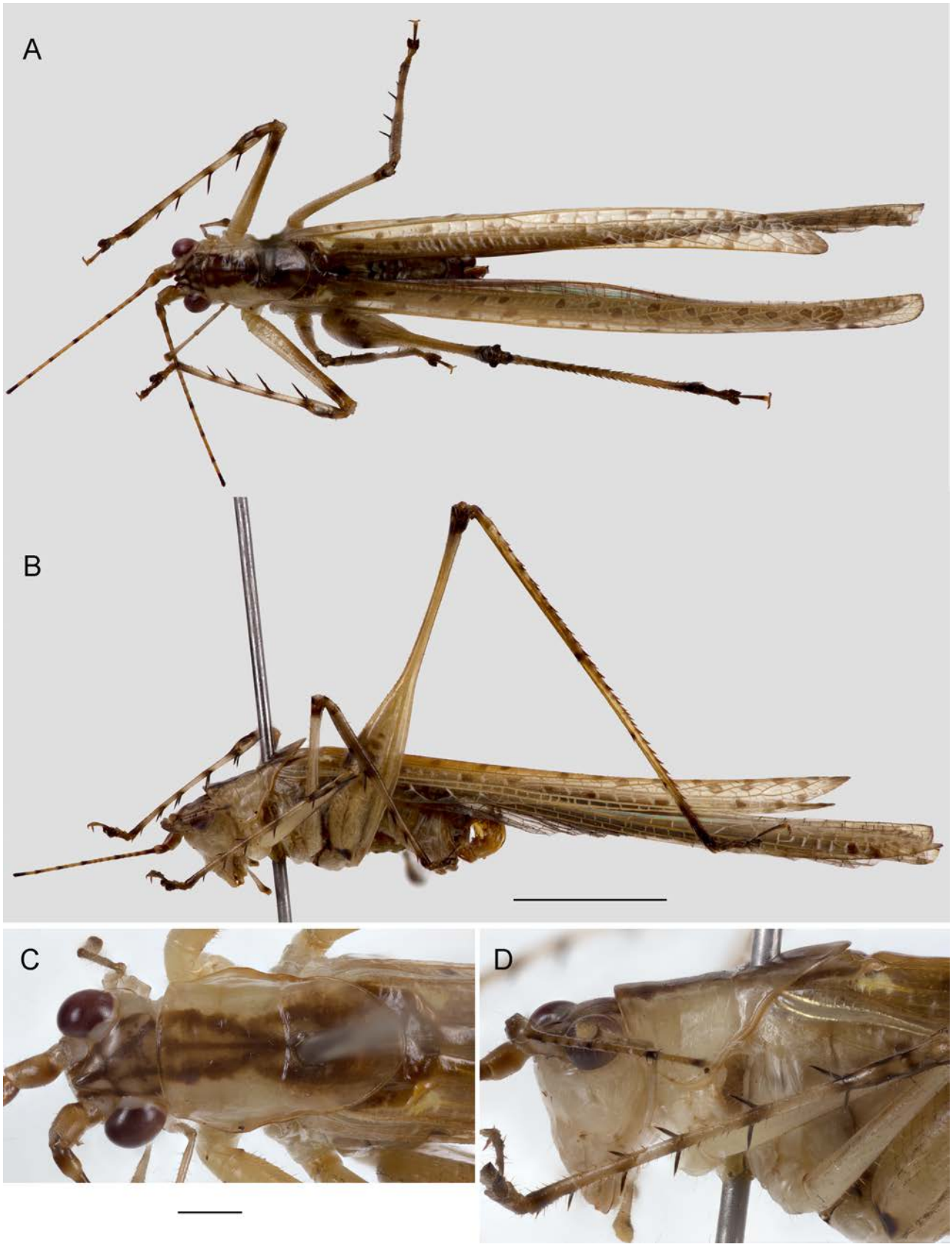

FIGURE 1. *Cercoteratura reniforma* **sp. nov.** ♂ holotype habitus in dorsal (A) and lateral (B) views; head and pronotum in dorsal (C) and lateral (D) views. Scale bars: 5 mm (A, B); 1 mm (C, D).

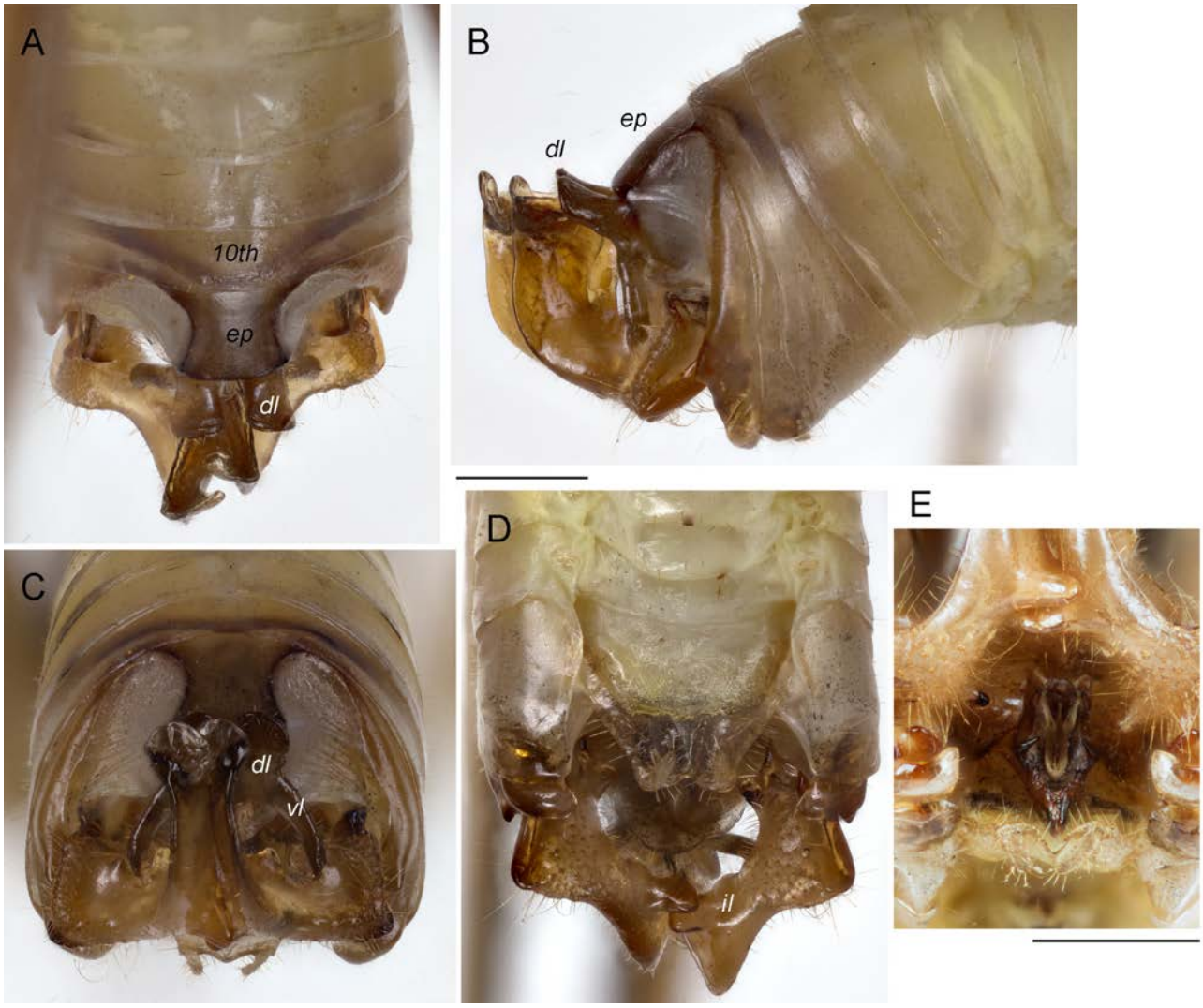

FIGURE 2. *Cercoteratura reniforma* **sp. nov.** ♂ abdominal apex in dorsal (A), posterior (B), lateral (C) and ventral (D) views; genitalia in posterior view (E). Scale bars: 1 mm.

Female. Unknown.

Colouration. Generally pale brown with dark brown patterns (Figs 1A, 1B). Head dorsum, including fastigium dark brown with patches of pale brown (Fig. 1C); otherwise, head including face, gena and mouth parts pale coloured (Fig. 1D). Eyes red brown (Fig. 1C). Scapus yellow brown with inner side slightly darker; pedicel at basal half dark brown and apical half yellow brown; antennae yellow brown some black rings (incomplete and complete) (Fig. 1). Pronotal disc pale brown with narrow dark-brown medial longitudinal stripe; anterior half with two thicker and irregularly margined band converging at transverse suture; brown pattern narrowest before transverse suture; posterior half broad and margins poorly defined, covering almost entire metazona (Fig. 1C). Tegmen with numerous large black infumated dots (Figs 1A, 1B). Fore and middle femora generally pale coloured, at apical end and knee areas dark brown; tibiae darker, dark rings around where spines inserted; ventral spines black. Hind femur also pale brown, at middle with dark and irregular patch on dorsal surface; apical end and knee area black. Hind tibia at basal and apical ends black; otherwise, dark brown; spines dark. Tarsi generally very dark brown. Abdomen brown.

Measurements (in mm). See Table 1.

TABLE 1. Measurements of dried pinned ♂ Meconematini (in mm).

	BL	BWL	PL	TL	HWT	HFL	HTL
Cercoteratura reniforma **sp. nov.**							
Holotype (SBH.24.93)	10.9	25.2	3.8	18.7	2.9	12.3	13.8
Pseudoteratura bifurcata **sp. nov.**							
Holotype (TR24-200)	10.3	24.1	3.7	17.4	2.9	10.0	11.0
Pseudoteratura maliau **sp. nov.**							
Holotype (SBH.24.38)	9.5	21.9	3.6	17.0	1.8		
Pseudoteratura mima							
SBH.24.74	8.4	20.4	3.6	15.2	2.5	10.2	10.6
SBH.24.121	9.8	21.1	3.7	15.3	2.7		

Cercoteratura repens Tan, Jin, Wang, Japir & Chung, 2022

(Figs 3, 4)

Cercoteratura repens Tan *et al.*, 2022: 465.

New material examined. EAST MALAYSIA; Sabah State • 1♂; Maliau Basin, along Knowledge Trail; N4.74338 E116.97242, 257.6±5.8 m.a.s.l.; 13 November 2024, 18h00; under foliage of tree; coll. M.K. Tan; SBH.24.61 (ZRC).

Remarks. Our male specimen (Fig. 3) is nearly identical to the holotype described from Tabin Wildlife Reserve (Tan *et al.*, 2022) in the abdominal appendages (Fig. 4).

Distribution. Borneo (Sabah: Tabin, Maliau Basin [new locality record]).

Type locality. EAST MALAYSIA: Sabah State: Tabin Wildlife Reserve.

FIGURE 3. *Cercoteratura repens* Tan *et al.*, 2022 in its natural environment.

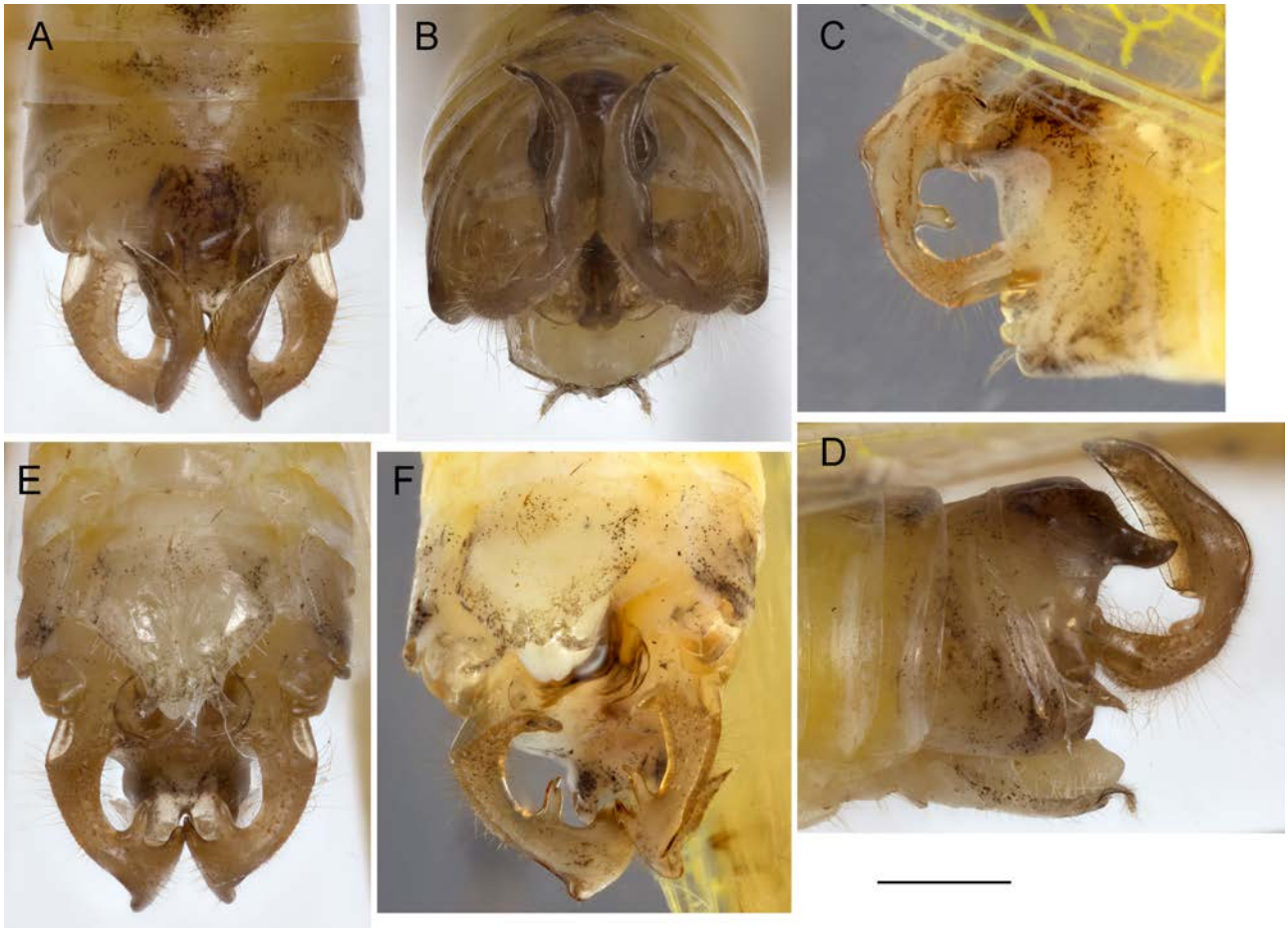

FIGURE 4. *Cercoteratura repens* Tan *et al.*, 2022 ♂ abdominal apex in dorsal (A), posterior (B), lateral (C, D) and ventral (E, F) views; recently dried-preserved (A, B, D, E), in ethanol (C, F). Scale bar: 1 mm.

Euanisous tawau **Gorochov, 2014**

(Figs 5–7)

Euanisous tawau Gorochov, 2014: 2.

New material examined. EAST MALAYSIA; Sabah State • 1♂; Maliau Basin, along EE Trail; N4.73687 E116.97295, 238.7±6.5 m.a.s.l.; 11 November 2024, 18h08; under foliage of small tree; coll. M.K. Tan; SBH.24.22 (ZRC) • 1♀; Maliau Basin, EE Trail; N4.73678 E116.97410, 247.7±7.1 m.a.s.l.; 17 November 2024, 17h51; under foliage of tree; coll. M.K. Tan; SBH.24.122 (FRC).

Remarks. Our male specimen (Fig. 5A) is nearly identical to the holotype described from Tawau Hills (Gorochov, 2014) in the abdominal appendages (Fig. 6).

Distribution. Borneo (Sabah: Tawau Hills, Maliau Basin [new locality record]).

Type locality. EAST MALAYSIA: Sabah State: Tawau Hills National Park.

FIGURE 5. *Euanisous tawau* Gorochov, 2014 ♂ (A) and ♀ (B) in their natural environment.

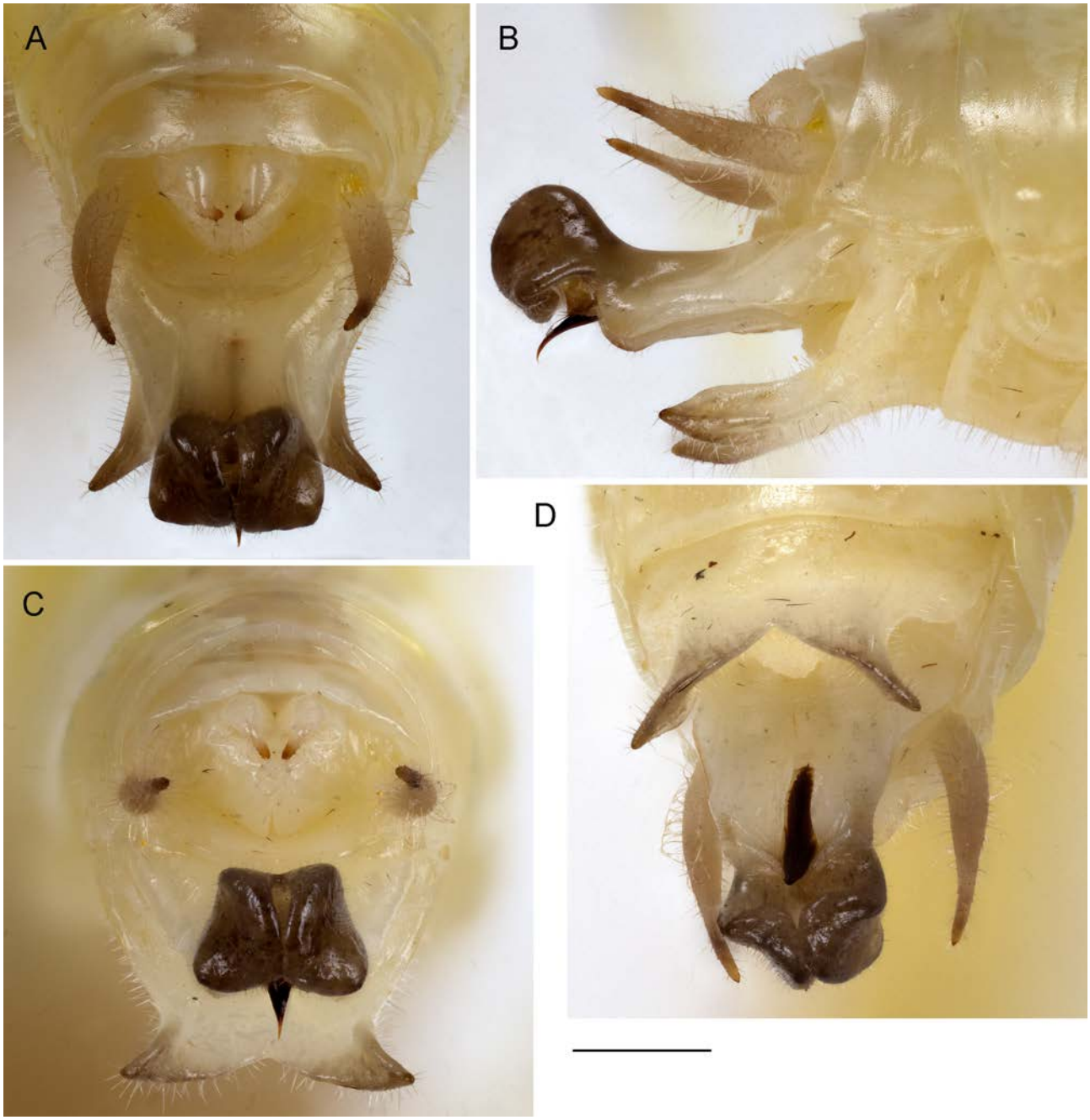

FIGURE 6. *Euanisous tawau* Gorochov, 2014 ♂ abdominal apex in dorsal (A), lateral (B), posterior (C) and ventral (D) views; recently dried-preserved. Scale bar: 1 mm.

Calling song (Fig. 7). The calling song consists of echemes with an average duration of 0.33±0.06 s (0.25–0.48 s) and made up of an average 63±12 discrete syllables (48–91 syllables). On rare occasions, the echeme can be longer in duration of up to 0.72 s made up of 138 discrete syllables. Within each echeme, the average syllable duration is 0.5±0.1 ms (0.4–0.8 ms), the average down time between consecutive syllables is 4.8±0.1 ms (4.4–8.0 ms) and the average syllable period is 5.3±0.1 ms (5.2–5.5 ms). The call spectrum has a peak frequency of 29.72±0.88 kHz (28.29–31.58 kHz), and the spectral entropy is 0.68±0.03 (0.64–0.74). The frequency spectrum is broad-band and is symmetrical.

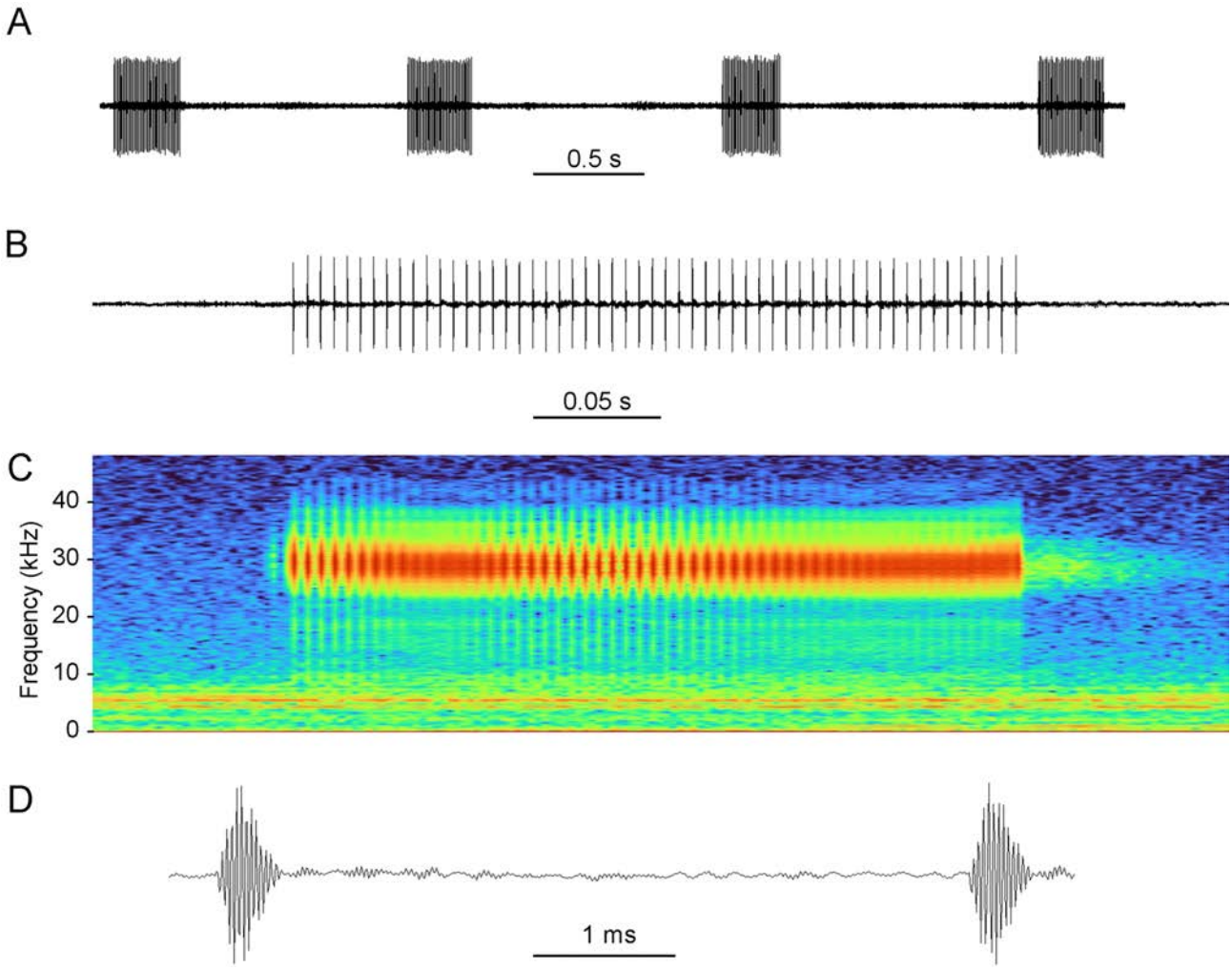

FIGURE 7. *Euanisous tawau* Gorochov, 2014 ♂ calling song: oscillograms showing four echemes (A), one echeme (B), spectrogram of the same echeme (C), oscillogram of two syllables (D).

Odonturisca cf. *epiproctalis* Gorochov, 2008

(Fig. 8)

Odonturisca epiproctalis Gorochov, 2008: 39—Gorochov, 2022: 24, 25; Tan *et al.*, 2024a: 596.

New material examined. EAST MALAYSIA; Sabah State • 1♂; Meligan (P28 a.k.a. pt 2); N4.57619 E115.73923, 1266.0±6.8 m.a.s.l.; 23 November 2024, 22h00; attracted to light trap on the road; coll. M.K. Tan; SBH.24.263 (FRC).

Remarks. Among the congeners, our single male most resembles *Odonturisca epiproctalis* Gorochov, 2008 from Mount Trus Madi by the general habitus (Figs 8A, 8B), the shapes of its fastigium (Fig. 8C), abdominal appendages (including the tenth abdominal tergite having two lateral lobes and its posterior margin emarginated at the medial part, the epiproct simple and the subgenital plate narrowing at apical end with two stout syli inserted) (Figs 8E–I) and genitalia (Gorochov, 2008; Tan *et al.*, 2024a); but also exhibits clear differences in the cercus longer and slenderer, its apical third sinuous and not curved dorsad and without strong setae along inner margin (Figs 8E–I). Our specimen may represent an undescribed species; but we need more specimens, including the females, to confirm.

Distribution. Borneo (Sabah: Mount Trus Madi, Meligan [new locality record?]).

Type locality. EAST MALAYSIA: Sabah State: Mount Trus Madi.

FIGURE 8. *Odonturisca ?epiproctalis* Gorochov, 2008 ♂ habitus in dorsal (A) and lateral (B) views; head and pronotum in dorsal (C) and lateral (D) views; abdominal apex in dorso-lateral (E), ventral (F, G), ventro-lateral (H) and lateral (I) views; recently dried-preserved (A–F), in ethanol (G–I). Scale bars: 5 mm (A, B); 1 mm (C–I).

***Pseudoteratura* (*Pseudoteratura*) *bifurcata* sp. nov.**
(Figs 9, 10A, 10E, 10I)

Material examined. Holotype: EAST MALAYSIA; Sabah State • ♂; forest near Meligan village; N4.67986 E115.68787, 863 m (24SA16); 24 November 2024, night; on plant; coll. T. Robillard; TR24-200 (FRC).

FIGURE 9. *Pseudoteratura* (*Pseudoteratura*) *bifurcata* **sp. nov.** ♂ habitus in lateral view (A); abdominal apex in dorsal (B), posterior (C), lateral (D), latero-posterior (E), ventro-posterior (F) and ventral (G) views. Scale bars: 5 mm (A); 1 mm (B–G).

Diagnosis. The new species is characterised by the male epiproct having a slender and elongated process at the posterior end with apex widened and flattened and posterior margin somewhat emarginated; the male cercus with strongly bifurcated apex and at middle having a triangular inner lobule; the apical dorsal lobe at the apex of cercus much longer and more than half the entire length of cercus, apical ventral lobe shorter and further bifurcated into two lobules; dorsal lobule longer than ventral lobule; male subgenitial plate long and tapering into narrow and subacute apex; the pronotal disc at the posterior end with a red spot without white or black spot.

Pseudoteratura (*P.) bifurcata* is most similar to *Pseudoteratura* (*P.*) *tridenta* Liu, 2020 from Sarawak (female paratypes are also found in Sabah but it is not clear if the females correspond to the male holotype from Sarawak) by the epiproct having an elongated and slender process with apex widened; cercus with strongly bifurcated apex and the ventral lobe shorter and further bifurcated into two lobules; the pronotal disc with posterior end not having black spot. It differs from *P.* (*P.*) *tridenta* by epiproct at the apex of the process not as strongly emarginated to form two lateral apical lobules; the cercus with the dorsal lobe much longer (instead of less than half the length of cercus); the tegmen having many more black spots.

It is similar to *Pseudoteratura* (*Pseudoteratura*) *bella* Gorochov, 2008 from Mount Trus Madi, Sabah, and *Pseudoteratura* (*Pseudoteratura*) *spinea* Gorochov, 2014 and *Pseudoteratura* (*Pseudoteratura*) *sundaica* (Kästner, 1932) from Sumatra by the male cercus having a strongly bifurcated apex and the bifurcated lobes in lateral view long and slender with dorsal lobe longer. The male cercus differs from these three species by the bifurcated ventral lobe forked into two lobules.

It is also similar to *P.* (*P.*) *bella* by the pronotal disc with a red median band that broadens near the posterior margin not having a black spot, and the subgenital plate having subacute apex; but differs by the epiproct with an elongated process slender and widened at apex (instead of somewhat rectangular); the cercus at middle having a more distinct and triangular inner lobule; the subgenital more elongated and slender.

It differs from *P.* (*P.*) *spinea* by the epiproct having a process distinctly slender and elongating (instead of stout with pair of posterolateral spine-like projections and a pair of rounded tubercles under these projections); the cercus at middle having a triangular inner lobule (instead of spine-like); the pronotal disc with posterior end not having black spot.

It is also similar to *Pseudoteratura* (*Pseudoteratura*) *picta* (Karny, 1924) from Java by the epiproct having an elongated and slender process with apex widened and the cercus bifurcated at apex; but differs by the epiproct with the apex of process less wide and not as strongly emarginated; the cercus having bifurcated process much longer and slenderer; and the dorsal disc of pronotum without a black spot at the posterior end.

Etymology. The species name refers to the characteristic bifurcations of the cercus and ventral lobes of the male cercus, as well as at the basal part of the epiproct.

Description. Male (holotype). Relatively small and very slender Meconematini with habitus typical of this genus (Fig. 9A). Eyes globular and slightly protruding (Figs 10A, 10E). Frontal rostrum conical, moderately small with apex somewhat blunt, with dorsomedian sulcus (Fig. 10E). Fifth (apical) segment of maxillary palpus slender but slightly and obliquely widened apically. Fifth, fourth and third segments of subequal length, all longer than second segment. Pronotum covering tegminal mirror (Fig. 10E). Dorsal disc roundly turned into lateral lobes, without distinct transverse sulcus (Fig. 10E); pronotum barely inflated in posterior half (when viewed in profile) (Fig. 10A); anterior margin of pronotal disc straight, posterior margin broadly rounded (Fig. 10E); humeral sinus indistinct (Fig. 10A); ventral margin of pronotal lateral lobe mostly straight (Fig. 10A). Thoracic auditory spiracle (= thoracic foramen) large, ovular, anterior margin slightly emarginated at middle, ventral end slightly narrower than dorsal end (Fig. 10A). Macropterous; tegmen extending well behind hind knees; hindwing distinctly extending beyond tegmina. Coxal spur of foreleg relatively short and small. Fore tibia with both tympana elongated oval and open; inner tympanum slightly larger than outer tympanum; fore tibiae each with 4 outer and 4 inner subapical spines; middle tibiae each with 4 outer and 4 inner subapical spines.

Tenth abdominal tergite (*10th*) with posterior margin deeply and triangularly emarginated widely in median part (Figs 9B, 9C). Epiproct (*ep*) large and somewhat complex: basal part somewhat fused with tenth abdominal tergite, tongue-shaped with median furrow that diverge at posterior end of basal part; this basal part not reaching posterior end of tenth abdominal tergite; beyond this basal part, a narrow process extend between bifurcated furrow; this process long and slender, surpassing tenth abdominal tergite, at posterior third widens and fan-shaped, posterior margin truncated (Figs 9B, 9C). Cercus generally flattened, but complex (Figs 9D–G). Cercus with basal half robust but laterally compressed; along dorso-inner margin at middle of cercus with triangular flattened lobe pointing internally (*ibl*); thereafter, cercus bifurcated into two lobes; dorsal lobe (*dl)* very long, longer than half the length of cercus, laterally compressed, pointing dorso-posteriorly, apex obtuse and slightly curved inwards; ventral lobe (*vl*) shorter, further bifurcated into two lobules; dorsal lobule compressed, longer, pointing dorso-posteriorly with apex obtuse; ventral lobule distinctly more robust, rounded and swollen and pointing somewhat ventrad. Subgenital plate elongate, basal area broad, thereafter strongly narrow and shaft-like with lateral margins more or less parallel; apically tapering into narrow and obtuse apex; with styli short and stout, inserted on each side of the obtuse apex

(Fig. 9G). Genitalia (Figs 9D–G) weakly sclerotized; with lamellar dorsal plate (*pd*), forming two triangular lateral lobes; elongated shaft (*vs*) ventrad of dorsad plate, surpassing dorsal plate, relatively simple, without lobes or projections or processes; at middle bent dorsad, apical margin roundly truncated.

Female. Unknown.

Colouration. Green when alive; yellow (discoloured) in alcohol (Fig. 9A). Head dorsum, including fastigium, orange at middle, apex of fastigium black (Fig. 10E); otherwise, pale coloured (Fig. 10A). Scapus with inner side black; pedicel with basal half orange and apical half black (Fig. 10E); antennae yellow brown with intermittent black rings. Apical part of apical segment slightly darkened (Fig. 10A). Pronotal disc with orange longitudinal median stripe, without black or white spot at posterior end; this stripe at prozona slightly wider and margins parallel, at metazona narrower and faintly widen towards apex (Fig. 10E). Tegmen with numerous large black infumated dots; anal tegminal margin orange (Fig. 10A). Exposed apical part of hindwing with two and three round black spots moderately spaced together (Fig. 10I). Legs generally very pale green; apical half of tarsus black; ventral spines not differently coloured as rest of legs. Fore tibia with tympanum not different coloured. Abdomen generally pale green.

Measurements (in mm). See Table 1.

Pseudoteratura (*Pseudoteratura*) *maliau* sp. nov.

(Figs 10B, 10F, 10J, 11, 12)

Material examined. Holotype: EAST MALAYSIA; Sabah State • ♂; Maliau Basin, along trail from Agathis–Nepenthes camps at 2 km; N4.70723 E116.89538, 954.4±5.3 m.a.s.l.; 12 November 2024, 18h00; coll. M.K. Tan; SBH.24.38 (FRC).

Diagnosis. The new species is characterised by the shape of the cercus, particularly in the shape of the proximal medial process (*rl*) (elongated and rectangular, with its apex truncated and strongly sclerotized, with the surface finely denticulated) and inner-ventral lobe (*fl*) (elongated and extending to apex, its margin finely denticulated, at the anterior end with blunt triangular lobe pointing internally), and the shape of the genitalia (with a lamellar dorsal plate (*pd*) and an elongated shaft (*vs*) ventrad of the dorsad plate, surpassing the dorsal plate, its apex with two dorsal (*dlb*) and two ventral (*vlb*) lobules).

The new species is most similar to *Pseudoteratura* (*Pseudoteratura*) *lambir* Gorochov, 2014 from Lambir Hills (in Sarawak) and *Pseudoteratura* (*Pseudoteratura*) *kenuan* Tan, Gorochov & Wahab, 2017 from Brunei Darussalam by the pronotum disc with the longitudinal stripe somewhat broken at the base of metazona, the shapes of the male cercus, male genitalia and male subgenital plate; but differs by the male cercus with its proximal medial process more elongated, apex of this process reaching basal parts of its inner-ventral lobes and at its apex not inflated (slightly inflated in *P.* (*P.*) *lambir* and distinctly inflated in *P.* (*P.*) *kenuan*); and the inner-ventral lobe more rectangular (instead of triangular in *P.* (*P.*) *kenuan* or rounded in *P.* (*P.*) *lambir*) with its proximal inner angle with a lobule; the apex of its cercus in lateral view subobtuse, intermediate between being truncated in *P.* (*P.*) *kenuan* and being more acute in *P.* (*P.*) *lambir*) and the male genitalia having the dorsal (*dlb*) lobules more triangular with more acute apices (instead of rounded with more obtuse apices). The new species is also similar to *P.* (*P.*) *lambir* in the exposed part of the hindwings with two black spots close together (whereas *P.* (*P.*) *kenuan* only has one spot); but differs from both species by the fastigium of its vertex not black.

The new species somewhat resembles *Pseudoteratura* (*Pseudoteratura*) *mittena* Liu, 2020 from Sarawak (Matang) and Sabah (Tawau Hills) by the shape of the cercus (presence of a proximal medial process); but differs by the cercus having a distinct, large and rectangular inner-ventral lobe (instead of a small mitten-like fold). The new species also somewhat resembles *Pseudoteratura* (*Pseudoteratura*) *aglaia* (Hebard, 1922) from Zamboanga (Mindanao) by the shape of the cercus and longitudinal stripe of the pronotal disc; but differs by the cercus with its inner-ventral lobe more elongated than wide (instead of almost as elongated as wide) and the shape of the genitalia.

Etymology. The species is named after the type locality, Maliau Basin; noun in apposition.

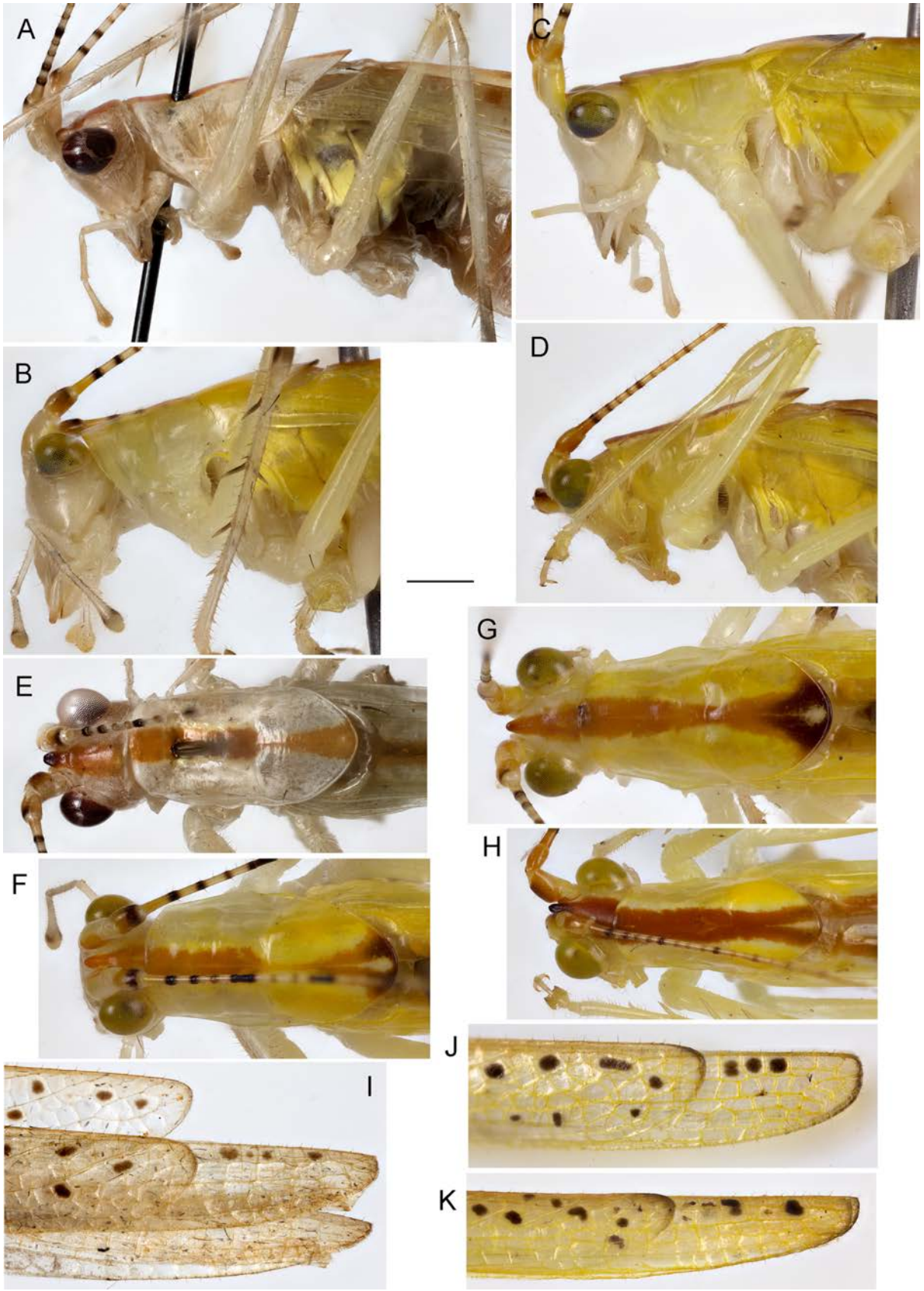

FIGURE 10. *Pseudoteratura* head and pronotum in lateral (A–D) and dorsal (E–H), exposed parts of hind wings (I–K): *Pseudoteratura* (*Pseudoteratura*) *bifurcata* **sp. nov.** (A, E, I); *Pseudoteratura* (*Pseudoteratura*) *maliau* **sp. nov.** (B, F, J); *Pseudoteratura* (*Pseudoteratura*) *mima* Gorochov, 2014 (C, G, K); *Pseudoteratura* (*Subtilotura*) *subtilissima* Gorochov, 2008 (D, H). Scale bar: 1 mm.

Description. Male (holotype). Relatively small and very slender Meconematini with habitus typical of this genus (Fig. 11). Eyes globular and slightly protruding (Figs 10B, 10F). Frontal rostrum conical, moderately small with apex somewhat blunt, with dorsomedian sulcus present (Fig. 10F). Fifth (apical) segment of maxillary palpus slender but slightly and obliquely widened apically. Fifth, fourth and third segments of subequal length, all longer than second segment. Pronotum covering tegminal mirror (Fig. 10F). Dorsal disc roundly turned into lateral lobes, without distinct transverse sulcus (Fig. 10F); pronotum barely inflated in posterior half (when viewed in profile) (Fig. 10B); anterior margin of pronotal disc straight, posterior margin broadly rounded (Fig. 10F); humeral sinus indistinct (Fig. 10B); ventral margin of pronotal lateral lobe mostly straight (Fig. 10B). Thoracic auditory spiracle (= thoracic foramen) large, with ventral half elongated and dorsal half widened and rounded, not covered with pronotal lateral lobe (Fig. 10B). Macropterous; tegmen extending well behind hind knees; hindwing distinctly extending beyond tegmina. Coxal spur of foreleg relatively short and small. Fore tibia with both tympana elongated oval and open; fore tibiae each with 4 outer and 4 inner subapical spines; middle tibiae each with 4 outer and 4 inner subapical spines.

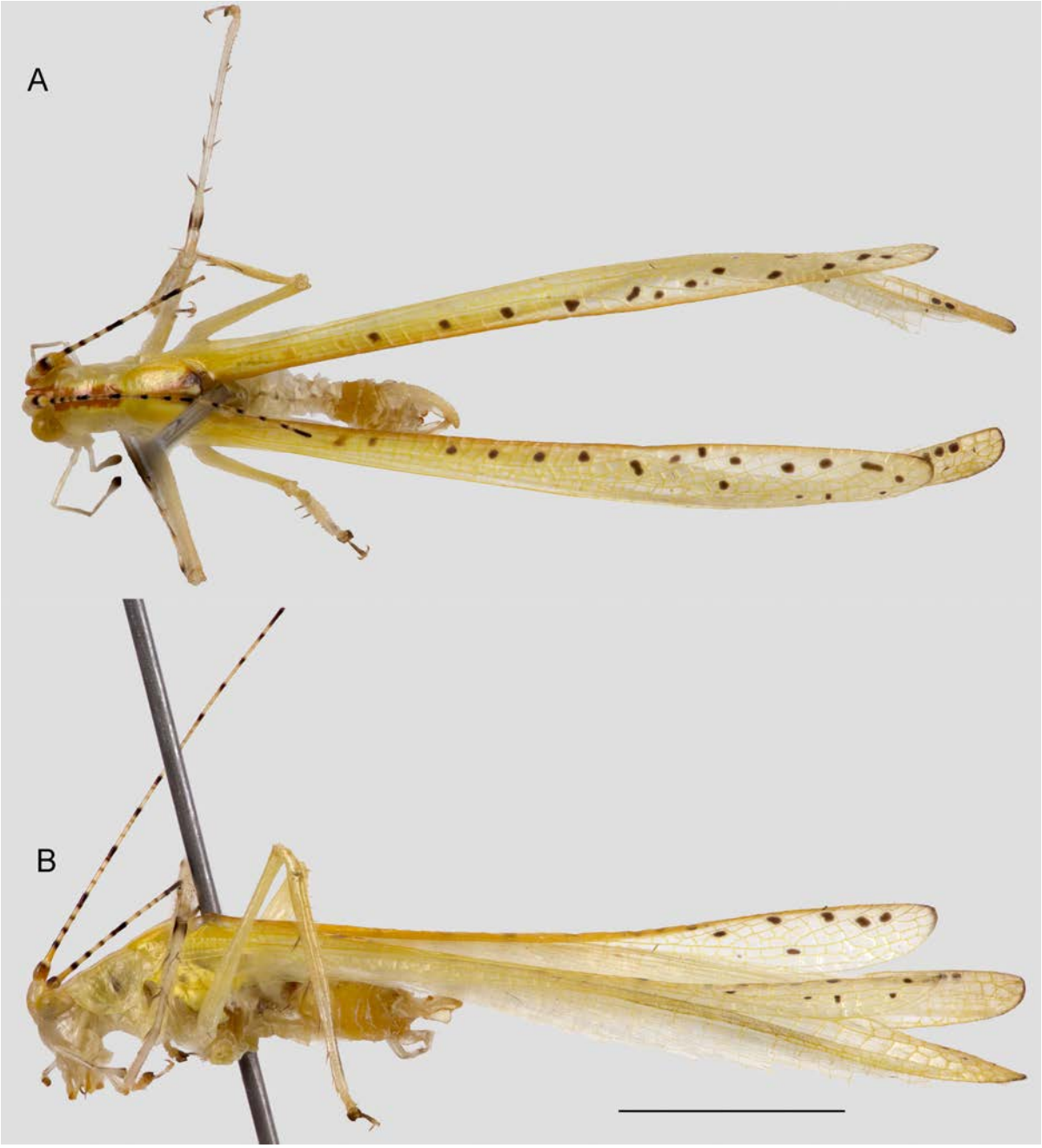

FIGURE 11. *Pseudoteratura* (*Pseudoteratura*) *maliau* **sp. nov.** ♂ holotype habitus in dorsal (A) and lateral (B) views. Scale bar: 5 mm.

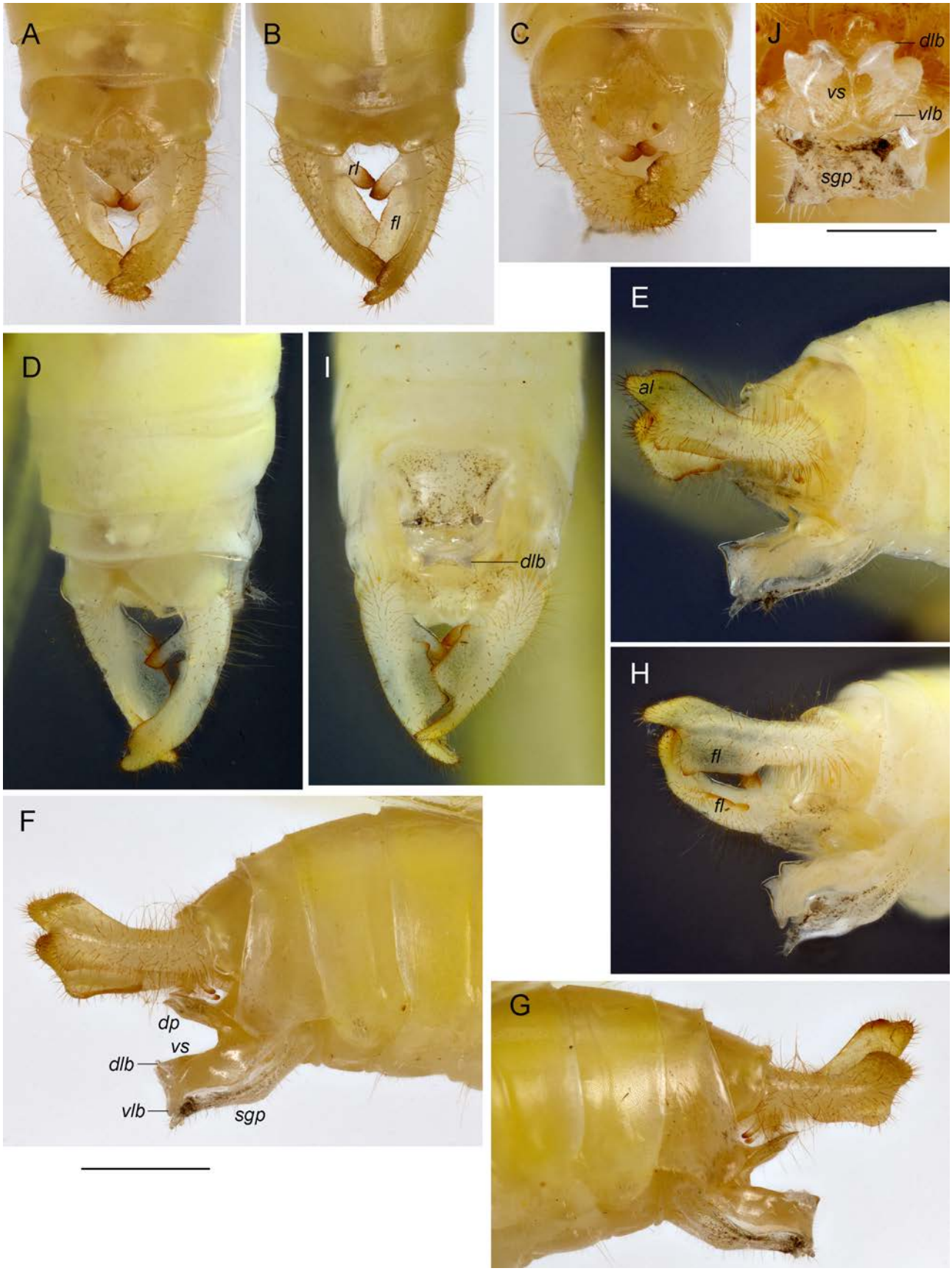

FIGURE 12. *Pseudoteratura* (*Pseudoteratura*) *maliau* **sp. nov.** ♂ abdominal apex in dorsal (A, B), dorso-posterior (C), dorso-lateral (D), lateral (E–H) and ventral (I) views; genitalia in posterior view (J); recently dried-preserved (A–C, F, G), dried preserved (J), in ethanol (D, E, H, I). Scale bars: 1 mm (all except J); 0.5 mm (J).

Tenth abdominal tergite with posterior margin deeply and triangularly emarginated widely in median part (Figs 12A, 12B). Epiproct small and broadly rounded tongue-shaped (Fig. 12A). Cercus generally flattened (Figs 12A–I). Basal part of cercus with small inner flattened and rectangular proximal medial process (*rl*), this process elongated and pointing inner-posteriorly, with apex truncated and strongly sclerotized, with surface finely denticulated. Posterior of basal lobe along inner ventro-margin with rectangular dorso-ventrally flattened inner-ventral lobe (*fl*) extending to apex, margin finely denticulated, at anterior end with blunt triangular lobe pointing internally. Cercus at apical end forming elongated triangular flattened lobe (*al*), at dorsal margin slightly notched, apex blunt. Subgenital plate (*sgp*) elongate trapezoidal, longer than broad; apical margin truncated; with styli short and stout (Fig. 12I). Genitalia weakly sclerotized (Fig. 12J); with lamellar dorsal plate (*pd*), at posterior end triangularly emarginated at middle, forming two stout and fairly broad tongue-shaped lateral lobes, these lobes not surpassing proximal medial process of cercus; elongated shaft (*vs*) ventrad of dorsad plate, surpassing dorsal plate, apex with two dorsal (*dlb*) and two ventral (*vlb*) lobules; dorsal lobules triangular with subacute apices pointing latero-posteriorly, margin broadly emarginated between the lobules; ventral lobules more broadly rounded.

Female. Unknown.

Colouration. Green when alive; yellow (discoloured) in alcohol (Fig. 11). Head dorsum, including fastigium, orange at middle (Fig. 10F); otherwise, pale coloured (Fig. 10B). Scapus with inner side orange; pedicel with basal half orange and apical half black (Fig. 10F); antennae yellow brown with intermittent black rings. Apical part of apical segment slightly darkened (Fig. 10B). Pronotal disc at prozona having orange longitudinal median stripe with margins parallel, at metazona stripe very faint and narrow, near posterior margin with small black patch and white spot within black patch (Fig. 10F) Tegmen with numerous large black infumated dots; anal tegminal margin orange (Fig. 11). Exposed apical part of hindwing with three round black spots closely spaced together (Fig. 10J). Legs generally very pale green; apical half of tarsus black; ventral spines darkened. Fore tibia with tympanum black. Abdomen generally pale green.

Measurements (in mm). See Table 1.

Pseudoteratura (*Pseudoteratura*) *mima* Gorochov, 2014

(Figs 10C, 10G, 10K, 13, 14)

Pseudoteratura (*Pseudoteratura*) *mima* Gorochov, 2014: 9.

New material examined. EAST MALAYSIA; Sabah State • 1♂; Maliau Basin, along trail from Agathis–Nepenthes camps at 1 km; N4.70144 E116.90346, 580.4±5.7 m.a.s.l.; 14 November 2024, 18h11; on foliage near ground; coll. M.K. Tan; SBH.24.74 (ZRC) • 1♂; Maliau Basin, along EE Trail; N4.73678 E116.97410, 247.7±7.1 m.a.s.l.; 17 November 2024, 17h51; under foliage of tree; coll. M.K. Tan; SBH.24.121 (ZRC).

Remarks. Although we did not encounter females, we postulate that our male specimens belong to *Pseudoteratura* (*Pseudoteratura*) *mima* Gorochov, 2014 described from Tawau (not too far away) by the exposed part of the hindwings with two black spots spaced apart (Fig. 10K). These two spots on the hindwings are invariable and nearly identical to the image of the female holotype (Gorochov, 2014). The spots on the tegmina are slightly different between the two male specimens as well as between our specimens and the female holotype. Likewise, the patterns of the dorsum of its head and pronotum show sexual dimorphism but are relatively stable between the males. Our specimens exhibit at the posterior end of the pronotum a larger (more extensive) black spot than the female holotype, but with an unbroken orange longitudinal band not different from the female holotype.

New diagnosis. The male is characterised by the unique shape of the cercus, particularly the lobes at the apical part, and the shapes of the male cercus (Fig. 14).

Male description. Habitus as shown in Fig. 13. Tenth abdominal tergite with posterior margin at median part emarginated, margin along emargination with setae (Figs 14A–C). Epiproct small, triangle and with apex truncated (Figs 14A–C). Cercus cylindrical with apical third bent internally and complex (Figs 14A–C). Apical part forked into dorsal (*dl*) and ventral (*vl*) processes; dorsal process pointing internally, swollen, apical part rounded and more swollen than basal part, apex obtuse; ventral process not as elongated as dorsal process, more flattened and narrower, pointing ventrad and tapering into subacute apex, at base anterior margin with broadly rounded lobule (*bll*) (Fig. 14). Subgenital plate (*sgp*) elongate trapezoidal, longer than broad; apical margin truncated; with styli

long and slender. Genitalia (Fig. 14) with dorsal process (*dp*) more membranous; dorsal process at base broadly rounded, narrowing into short shaft near basal third before expanding rectangular and bulbous apex; ventral part (*vp*) more sclerotized, divided into two lamellar lateral lobes pointing posteriorly; ventral part in ventral view with sclerotized transverse bridge, somewhat divided at middle; each lateral lobe having apex sclerotized (more sclerotized along external margin) and obtuse, and before apex with dorsal lobule; dorsal lobule broadly rounded and pointing dorso-posteriorly.

FIGURE 13. *Pseudoteratura* (*Pseudoteratura*) *mima* Gorochov, 2014 in their natural environment.

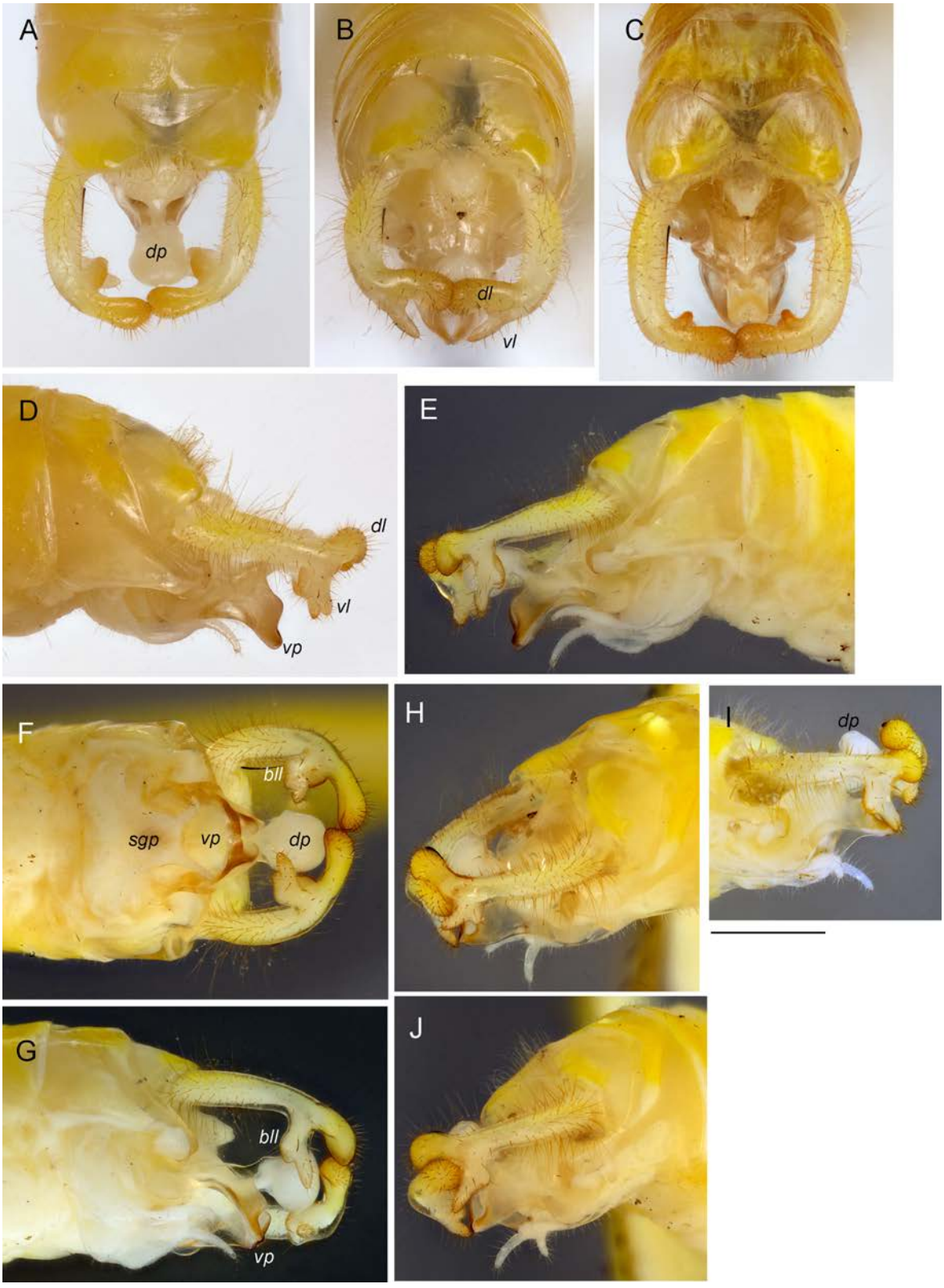

FIGURE 14. *Pseudoteratura* (*Pseudoteratura*) *mima* Gorochov, 2014 ♂ abdominal apex in dorsal (A), dorso-posterior (B, C), lateral (D, E), ventral (F), ventro-lateral (G) views; cercus in posterio-lateral (H), lateral (I) and ventro-lateral (J) views; recently dried-preserved (A, B, D), dried preserved (C), in ethanol (E–J). Scale bar: 1 mm.

Distribution. Borneo (Sabah: Tawau Hills, Maliau Basin [new locality record]).
Type locality. EAST MALAYSIA: Sabah State: Tawau Hills National Park.

***Pseudoteratura* (*Subtilotura*) *subtilissima* Gorochov, 2008**
(Figs 10D, 10H, 15, 16)

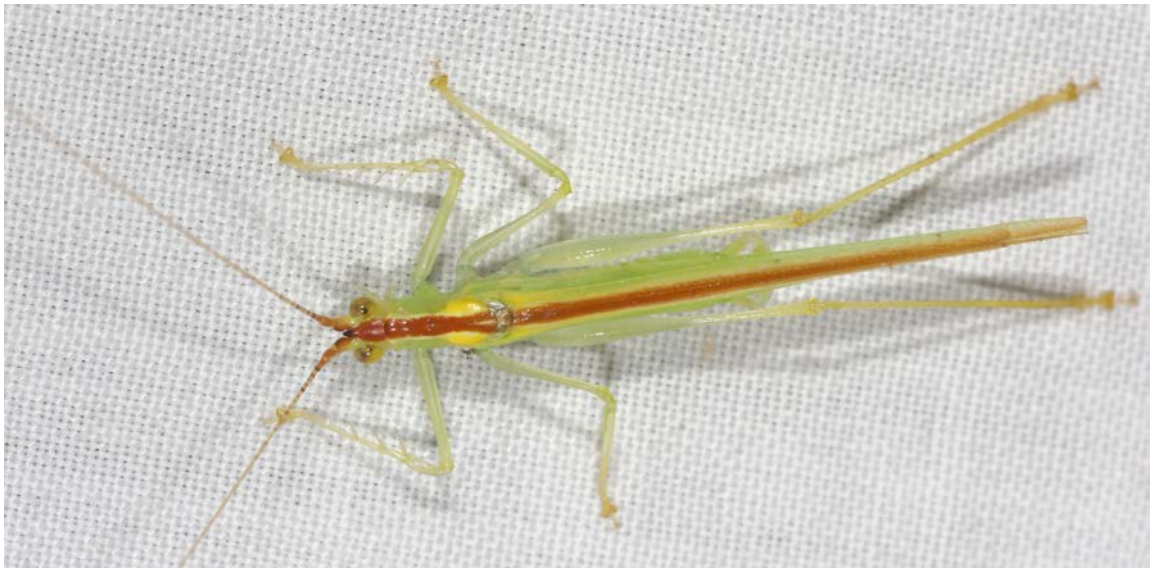

FIGURE 15. *Pseudoteratura* (*Subtilotura*) *subtilissima* Gorochov, 2008 in their natural environment.

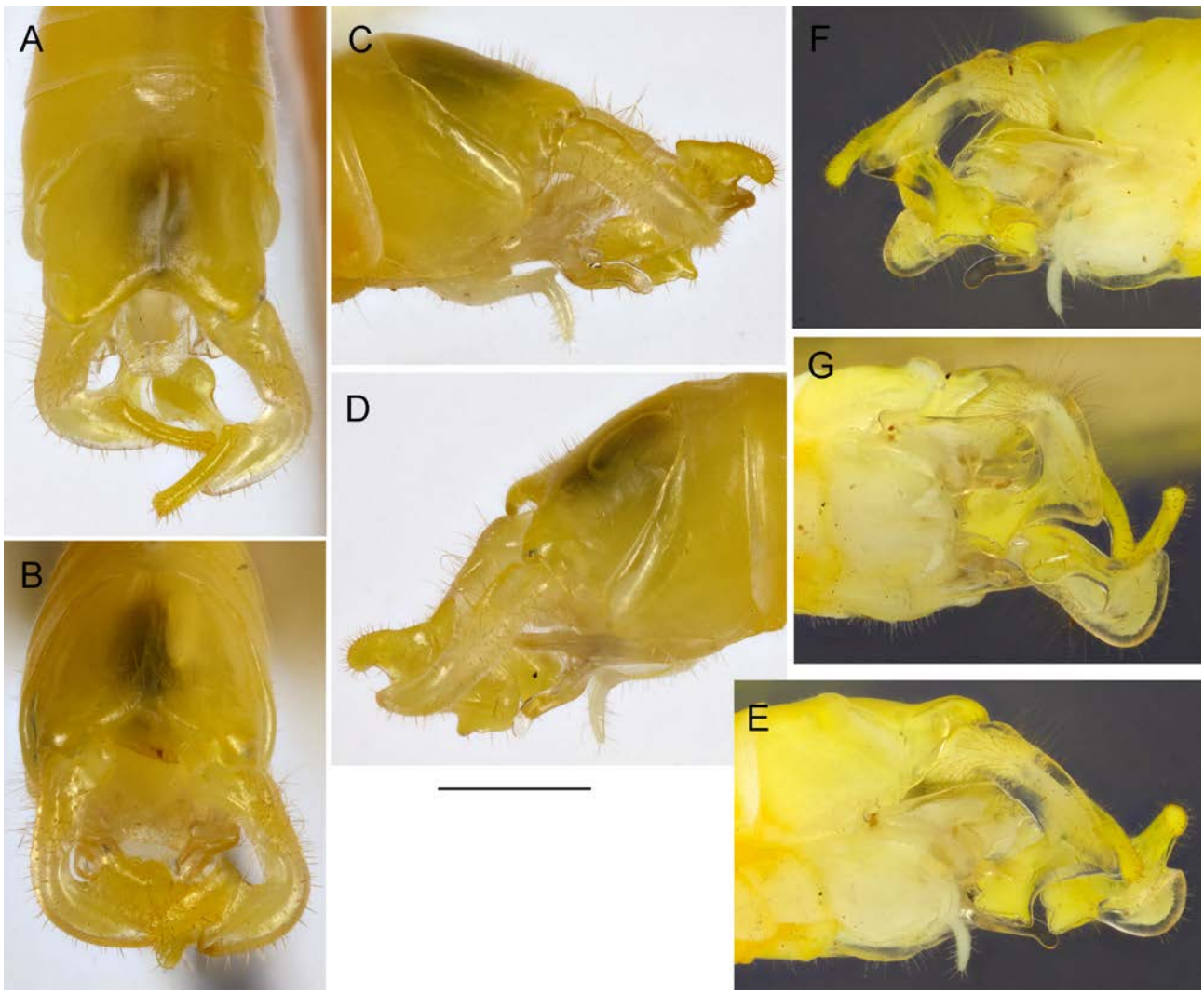

FIGURE 16. *Pseudoteratura* (*Subtilotura*) *subtilissima* Gorochov, 2008 ♂ abdominal apex in dorsal (A), posterior (B), lateral (C–E), ventro-lateral (F, G) views; recently dried-preserved (A–D), in ethanol (E–G). Scale bar: 1 mm.

Pseudoteratura (*Subtilotura*) *subtilissima* Gorochov, 2008: 31—Gorochov, 2016: 30; Jin *et al.*, 2020: 36.

New material examined. EAST MALAYSIA; Sabah State • 1♂; Meligan (P28 a.k.a. pt 2); N4.57619 E115.73923, 1266.0±6.8 m.a.s.l.; 23 November 2024, 22h00; attracted to light trap on the road; coll. M.K. Tan; SBH.24.257 (FRC).

Distribution. Borneo (Sabah: Mount Trus Madi, Sepilok and Meligan [new locality record]; Sarawak).

Type locality. EAST MALAYSIA: Sabah State: Mount Trus Madi.

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