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New species of little-known crickets from the subfamily Pteroplistinae (Orthoptera, Grylloidea) from Sabah and contribution to their bioacoustics

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Abstract

Recent fieldwork in eastern Sabah led to the discovery of new little-known crickets from the subfamily Pteroplistinae (Orthoptera, Grylloidea). Three new species are described: *Tembelingiola biaculeata* **sp. nov.** and *Tembelingiola kabili* **sp. nov.** from Sepilok; *Pteroplistes silam* **sp. nov.** from Mount Silam. Previously, the calling song of only one species of Pteroplistinae was known. Here, the calling songs of the three new species, as well as that of *Pteroplistes lagrecai* Gorochov, 2004, are also described for the first time. Therefore, distinctive calling songs for five species and three genera of Pteroplistinae are presently known.

Key words: Borneo, calling song, *Pteroplistes*, Southeast Asia, sympatry, *Tembelingiola*

Introduction

Pteroplistinae is a small subfamily of crickets made up of 11 genera from parts of Southeast Asia and of India Subcontinent. With the exception of *Pteroplistes*, each genus tends to comprise of a small number of species (Cigliano *et al.*, 2024). Despite the overall similarities in general morphology, these small crickets can exhibit vast diversity in the morphology of their male genitalia (Gorochov, 2004, 2018, 2022). Many Pteroplistinae are also highly cryptic in nature: during the daytime they usually hide under exfoliated (peeling) bark on tree trunk or thick branches (Gorochov, 2004; Tan *et al.*, 2021). The males are usually located by their calls and will evade detection by ceasing calling activity. Consequently, they are not readily collected and studied (Tan *et al.*, 2021).

New genera and species of Pteroplistinae are still being discovered (see Gorochov, 2022), further demonstrating that we still lack knowledge about the species richness in this subfamily. Furthermore, very little is known about the male calling song for Pteroplistinae. To date, only one species has been recorded, i.e., *Singapuriola separata* Gorochov & Tan, 2012 (Gorochov & Tan, 2012).

During recent orthopteran collections in eastern Sabah, three species new to science were discovered and are described here: *Tembelingiola biaculeata* **sp. nov.**, *Tembelingiola kabili* **sp. nov.** and *Pteroplistes silam* **sp. nov.** Their male calling songs were also recorded and are described here. Additionally, we also recorded and describe the calling song of *Pteroplistes lagrecai* Gorochov, 2004 for the first time.

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Materials and Methods

Sampling

We conducted orthopteran surveys in different parts of Sabah between 11 and 19 May 2022: Kabili Sepilok Forest Reserve (Sepilok), Mount Silam, Kawag Forest Reserve and Tabin Wildlife Reserve. We collected specimens by sight during night. Whenever possible, we took in-situ images 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. Video-recording was done using SONY Handycam FDR-AX53 4K 16.6 megapixels.

Acoustic and video recordings

We recorded the cricket songs using a modified Condenser Microphone Capsule CM16 (Avisoft Bioacoustics, Berlin) connected to a Fostex FR-2LE digital field recorder (96 kilo-samples per second sampling frequency, 16 bit) or 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). This was done either in the field or in captivity. In captivity, the cricket to be recorded was kept 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. We used a temperature logger, HOBO 8K Pendant® Temperature logger (model: UA-001-08, Onset, Bourne, MA) to record the ambient temperature.

The basic cricket song terminology generally follows Baker & Chesmore (2020):

Calling song = spontaneous song produced by an isolated male to attract a female

Dominant frequency = frequency with highest energy from the mean spectrum

Echeme = a first-order assemblage of syllables

Echeme-sequence = a first-order assemblage of echemes

Interval = silent interval between calls and/or pulses, or down-time

Syllable = duration of sound produced from the stridulatory movement (i.e., opening of wings)

Acoustic analyses follow that of Tan *et al.* (2022, 2023). We measured the parameters of the temporal domain (e.g., durations and intervals) manually using Raven Lite 2.0.0. The peak frequency was 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 4.1.3.

Methodology and specimen curation

The specimens were preserved in absolute analytical-grade ethanol and later pinned and dry-preserved. A single leg was preserved in absolute analytic-grade ethanol for future molecular work. Habitus images of pinned specimens were done using a Canon EOS 6D digital SLR camera with a compact-macro lens EF 100 mm f/2.8 Macro USM; close-up images of morphological features using a macro photo lens MP-E 65 mm f/2.8 USM (1–5×). Imaging stacking was done using Helicon Remote version 9.3.1. and Helicon Focus 6.8.0. Image editing was accomplished using Adobe Photoshop CC 2014. Measurements of dried-pinned specimen were then made from these images using ImageJ 1.51j8 (Wayne Rasband, Research Services Branch, National Institute of Mental Health, Bethesda, MD, USA).

For the general morphology, the following abbreviations are used: I, II, III = anterior (fore), median, posterior (hind); F = femur; FW = forewing; T = tibia. In the measurements, the following abbreviations are used: BL = body length (from frontal rostrum to apical end of subgenital plate); BWL = body with wing length; HL = head length; PronL = pronotum length; PronW = pronotum width (at posterior margin); FWL = forewing length; FWW = forewing width; FIIIL = hind femur length; TIIIL = hind tibia length; TaIIIL = hind tarsus length; OL = ovipositor length.

Male genitalia were dissected from softened specimens, then cleaned using aqueous KOH, and imaged using a binocular microscope Leica MZ16 with AMScope Microscope Eyepiece Camera (MU1000, 10 MP Aptina Colour, CMO50) attached via an AmScope FMA050 fixed microscope adaptor and the software ToupView. Subsequently, the genitalia were preserved in glycerine or hand sanitiser. Terminology used to describe the male genitalia follows Desutter-Grandcolas (2003) and Gorochov (1995, 2015) [in square brackets]:

Pseudepiphallus (ps) [epiphallus]
Pseudepiphallic lophi (ps l) [posterolateral epiphallic lobes]
Pseudepiphallic paramere (ps p) [ectoparamere]
Ectophallic fold (ec f) [rachis (= guiding rod)]
Ectophallic apodeme (ec ap) [endoparameral apodeme]
Endophallic sclerite (en s) [formula (= mold of spermatophore attachment plate)]
Rami (ra)

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

Results and Discussion

From eastern Sabah, we collected four species of Pteroplistinae from Sepilok and Mount Silam (Fig. 1). Two sympatric species of *Tembelingiola* Gorochov, 2004 from Sepilok were found to be new, whereas a new species of *Pteroplistes* Brunner von Wattenwyl, 1873 was also collected from Mount Silam. We also collected *Pteroplistes lagrecai* Gorochov, 2004 from Sepilok.

Prior to this study, the calling song of only one species, *Singapuriola separata* was known (Gorochov & Tan, 2012). Here, we describe the calling songs of the four species collected from eastern Sabah (Figs 2–4). A typical calling song of Pteroplistinae has a dominant frequency of around 5–7 kHz, with *P. lagrecai* having a particularly high dominant frequency of 7.39 kHz compared to other Pteroplistinae (Fig. 2). The call structure differs between congeners (Figs 3, 4). The calling song of *Tembelingiola biaculeata* **sp. nov.** consists of echemes that can be short or long (ten-fold increase in the number of syllables) (Fig. 3A), whereas the calling song of *Tembelingiola kabili* **sp. nov.** consists of echeme-sequence made up of 6 to 8 three-syllabic echemes (Fig. 3B). The two congeners also differ in the call parameters, i.e., *T. biaculeata* **sp. nov.** (Fig. 4A) has a distinctly longer syllable duration than *T. kabili* **sp. nov.** (Fig. 4B). The two *Pteroplistes* also differ in their calling songs: *Pteroplistes silam* **sp. nov.** produces a continuous trill (Fig. 3C), whereas *P. lagrecai* produce a relatively complex echeme-sequence (Fig. 3D). The call parameters also differ between the two congeners: *P. silam* **sp. nov.** has a distinctly longer syllable duration but a shorter interval between consecutive syllables than *P. lagrecai*.

Taxonomy part

Superfamily Grylloidea Laicharting, 1781

Family Gryllidae Laicharting, 1781

Subfamily Pteroplistinae Chopard, 1936

Genus *Tembelingiola* Gorochov, 2004

Tembelingiola Gorochov, 2004: 384

Type species: *Tembelingiola plana* Gorochov, by original designation.

FIGURE 1. Forest in Sepilok (A) and the trail entrance near the peak of Mount Silam (B) where the Pteroplistinae were collected.

Included species

Tembelingiola belaitensis Tan, Gorochov & Wahab, 2019
Tembelingiola biaculeata **sp. nov.**
Tembelingiola plana Gorochov, 2004
Tembelingiola kabili **sp. nov.**

Distribution. Borneo, Malay Peninsula

Tembelingiola biaculeata Tan, Gorochov & Robillard, sp. nov.

(Figs 2A, 3A, 4A, 5, 6, 7A–D, 8)

Material examined. Holotype: EAST MALAYSIA: • ♂; Sabah State, Sandakan District, Sepilok, Rainforest Discovery Centre, dipterocarp forest; N5.87552, E117.94131, 62.6±6.0 m.a.s.l.; 18.v.2022, 22h36; on foliage of shrub near ground; M.K. Tan & T. Robillard leg.; SBH.22.159 (FRC).

Paratype: EAST MALAYSIA: • ♂; Sabah State, Sandakan District, Sepilok, Rainforest Discovery Centre, dipterocarp forest; N5.87536, E117.93977, 57.6±6.8 m.a.s.l.; 19.v.2022, 21h06; among branches and twigs; M.K. Tan & T. Robillard leg.; SBH.22.165 (ZRC).

Diagnosis. This species differs from *Tembelingiola plana* Gorochov, 2004 from Peninsular Malaysia by the pseudepiphallic paramere [ectoparamere] thicker (less slender), directed downwards (but not backwards), with acute and hooked apical part; and the ectophallic fold [rachis] narrowing posteriorly into acute apex and slightly surpassing pseudepiphallic bridge.

It also differs from *Tembelingiola belaitensis* Tan, Gorochov & Wahab, 2019 from Brunei Darussalam by the pseudepiphallic lophi [posterolateral epiphallic lobes] directed partly externally (but not curved internally in distal part); pseudepiphallic parameres [ectoparameres] completely sclerotized and somewhat longer but directed downwards (in *T. belaitensis*, they are in the form of membranous lobules directed backwards and with thin sclerotized ribbon ventrally); ectophallic fold [rachis] much shorter and less strongly sclerotized; and endophallic sclerite [formula] clearly less wide and not divided into a pair of sclerotized plates.

Etymology. The species name refers to the acute apices at the posterior end of both the pseudepiphallic parameres [ectoparameres]; bi- referring to two (a pair), and aculeatus = with spike in Latin.

Description. Small-sized, body well pubescent, brown with head, pronotum and abdomen with rufous tinge (Figs 5, 6). Rostrum between antennal cavities 1.1 times wider than scapes (Fig. 7A), angularly-rounded in profile (Fig. 7B). Maxillary palps pale coloured, with apical, subapical and third segments of subequal lengths; with apical segment elongated-triangular, very broadly expanded apically (Fig. 7B). Head wider than high in facial view. Face dark brown (Fig. 7C); median ocellus present, round; fenestrae between the scapes, anterior of median ocellus, also round and similar in size as median ocellus. Pronotal dorsal disc densely pubescent, weakly transverse, 1.1–1.3 times as wide as long, faintly widening posteriorly; anterior and posterior margins fairly straight to faintly concave and convex, respectively and with numerous long and thick setae (Fig. 7A). Lateral lobe 1.7 times as long as wide; posterior margin oblique, with numerous long and thick setae (more so than other parts of lateral lobe); ventral margin raised posteriorly; vaguely darker than dorsal disc (Fig. 7B). Inner tympanum on TI large, elongated oval (opened); outer tympanum undeveloped. TIII with only numerous small dorsal denticles; with 3 pairs of apical spurs, inner ones typically longer than outer ones; hind basitarsus with 2 rows of dorsal spines (each row with 5–6 spines). Legs generally pale brown. FIII pale brown, but distal part and knee dark rufous, and TIII dark rufous.

Male. FW light brown; barely reaching abdominal apex, 1.8–1.9 times as long as wide (Fig. 7D). Dorsal field with diagonal vein long and slightly sinuous; 5 oblique veins (3 long, parallel sinusoidal posterior ones and 2 anterior shorter and fainter ones); mirror approximately 1.1 times as wide as long, separated by two dividing veins, dividing veins mostly straight but at anal end slightly bent; with moderately short apical area (Fig. 7D). Lateral field of FW with about 9 branches of Sc and 12 cross veins between R and M. Hind wings not exposed (Fig. 6). Thoracic sternites brown. Subgenital plate with apex having an angular notched in the middle.

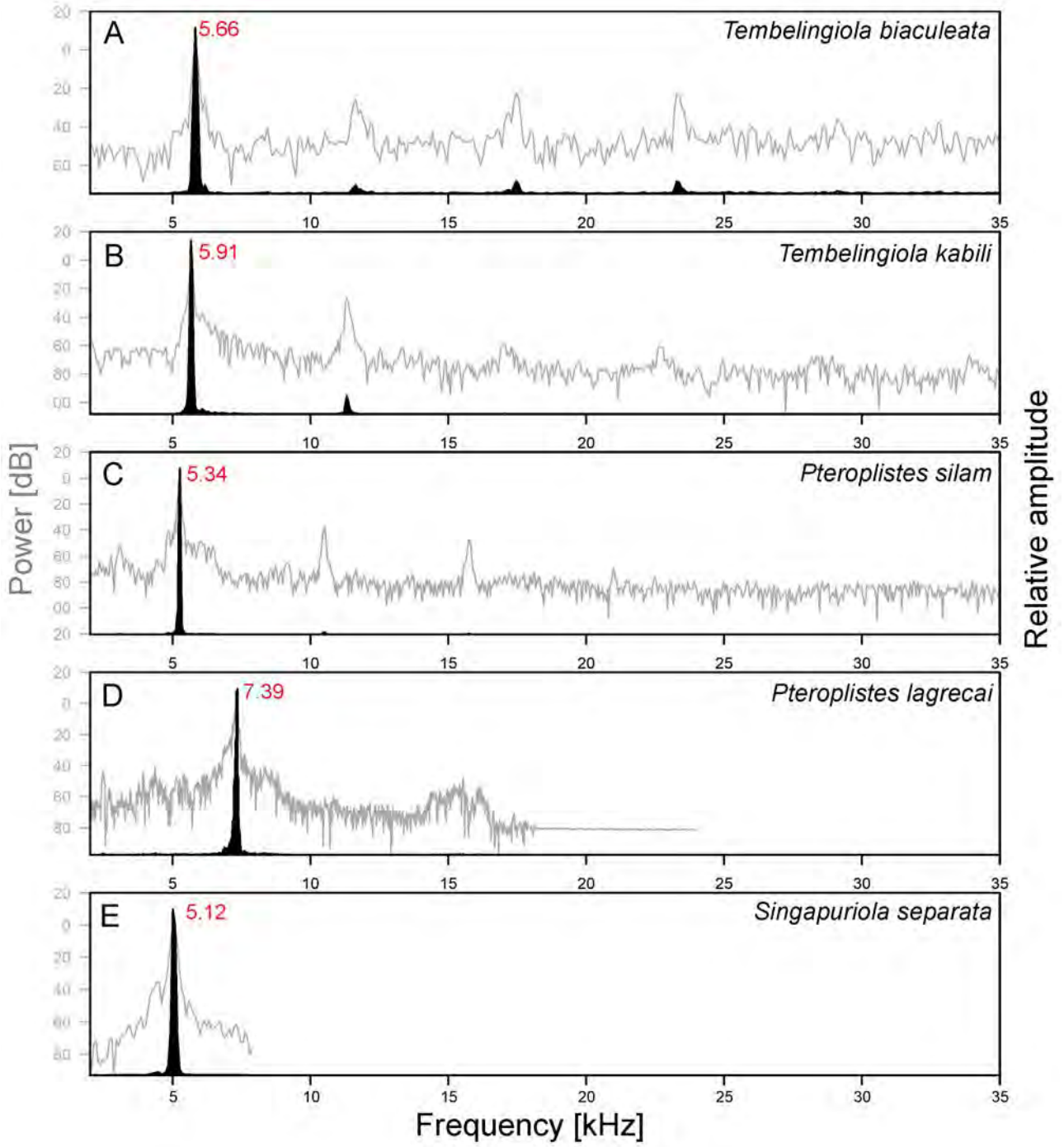

FIGURE 2. Power spectra of the calling songs of the pteroplistine cricket species: *Tembelingiola biaculeata* **sp. nov.** (A), *Tembelingiola kabili* **sp. nov.** (B), *Pteroplistes silam* **sp. nov.** (C), *Pteroplistes lagrecai* Gorochov, 2004 (D) and *Singapuriola separata* Gorochov & Tan, 2012 (E). The grey line represents the power [dB] (axis name and scale in grey) and the black solid peak represents the relative amplitude (axis name in black).

Genitalia as shown in Fig. 8. Pseudepiphallus [epiphallus] divided into two lateral parts. Pseudepiphallic lophi [posterolateral epiphallic lobes] dorso-ventrally compressed; basal third broad, after basal third taper and bent externally, with external margins concave; apex roundly truncated. Pseudepiphallic lophi [epiphallic lateral lobes] connected by narrow bridge; pseudepiphallus with anterior part transversely straight. Pseudepiphallic parameres [ectoparameres] strongly sclerotized, elongated, not directed downwards and with hooks apically; hook with apex acute, not reaching apex of pseudepiphallic lophi. Ectophallic fold [rachis] semi-tube-like, approximately triangular

with basal part having two lateral plates; ectophallic fold narrowing posteriorly into acute apex and slightly surpassing pseudepiphallic bridge. Endophallic sclerite [formula] lamellate, transverse and strongly sclerotized with lateral tongues at anterior and posterior parts. Rami fused with pseudepiphallus. Additional lateral sclerotized plate (p) elongated-pyriform with posterior apex narrow and subacute.

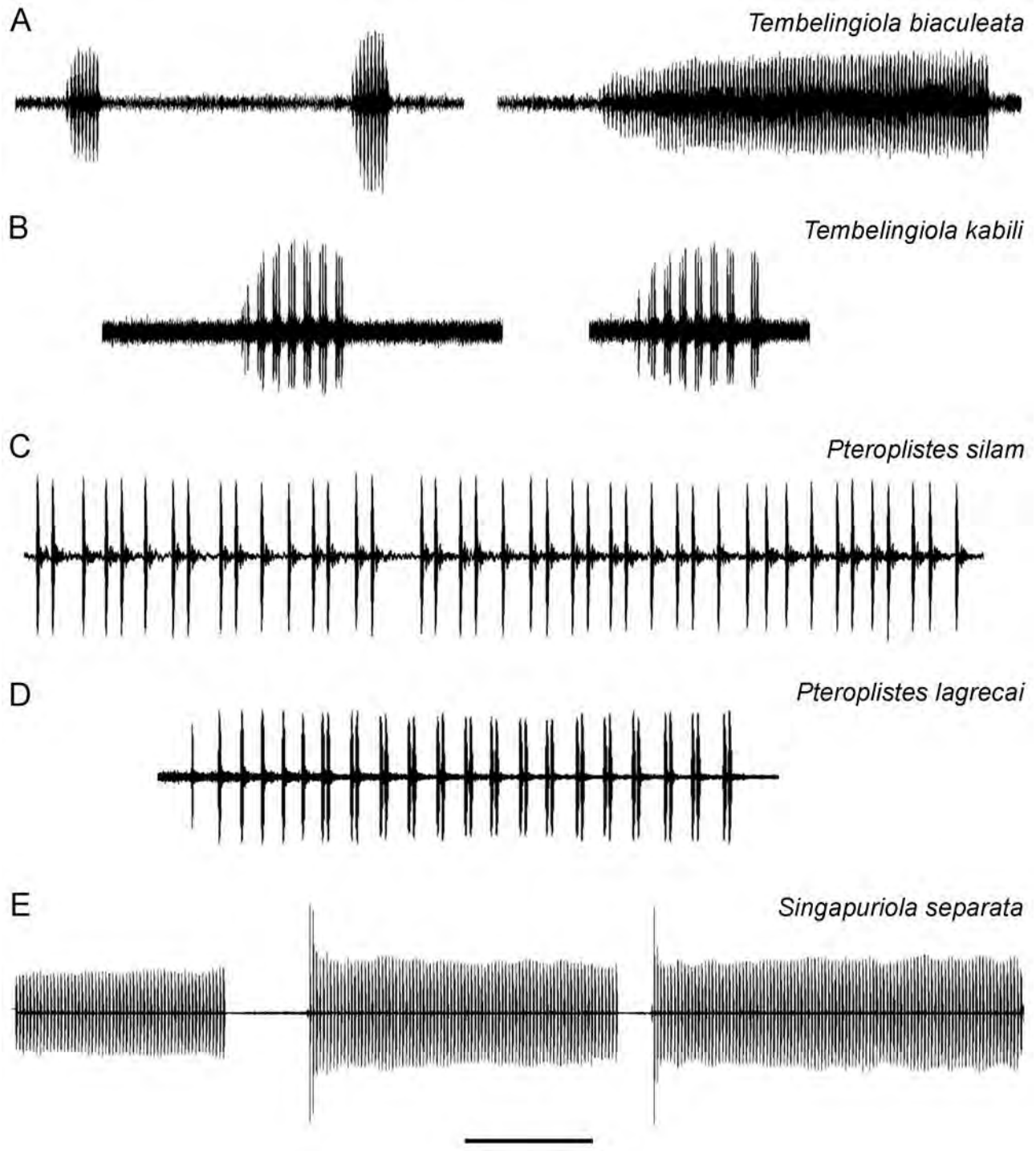

FIGURE 3. Oscillograms of the calling songs of the pteroplistine cricket species: three echemes with different lengths of *Tembelingiola biaculeata* **sp. nov.** (A), two echeme-sequences of *Tembelingiola kabili* **sp. nov.** (B), continuous trill of *Pteroplistes silam* **sp. nov.** (C), an echeme-sequence of *Pteroplistes lagrecai* Gorochov, 2004 (D) and three echemes of *Singapuriola separata* Gorochov & Tan, 2012 (E). Scale bar: 1 s.

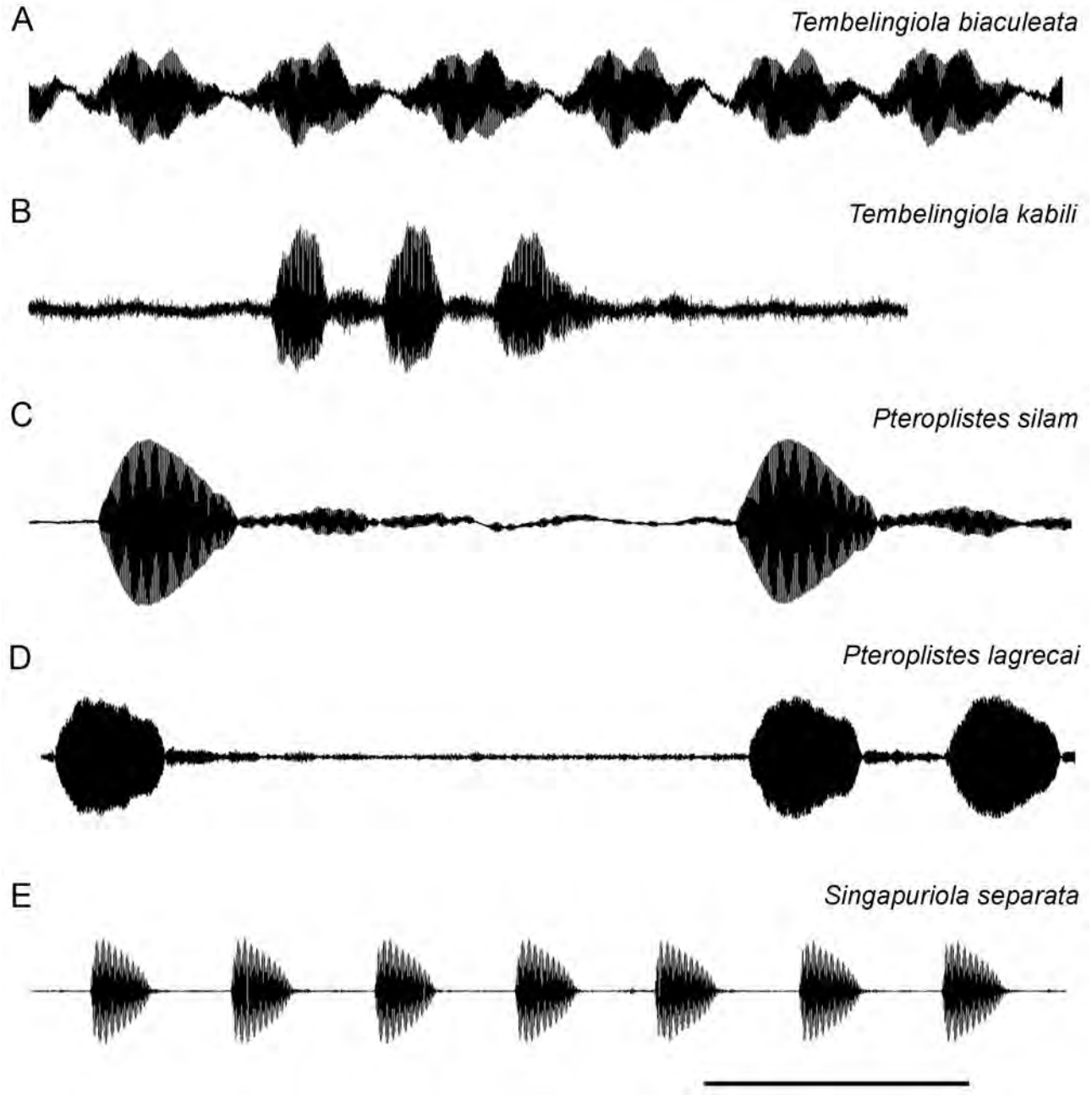

FIGURE 4. Oscillograms of the syllables of the pteroplistine cricket species: *Tembelingiola biaculeata* **sp. nov.** (A), *Tembelingiola kabili* **sp. nov.** (B), *Pteroplistes silam* **sp. nov.** (C), *Pteroplistes lagrecai* Gorochov, 2004 (D) and *Singapuriola separata* Gorochov & Tan, 2012 (E). Scale bar: 0.05 s.

Female. Unknown

Measurements. • ♂ holotype: BL = 8.9; BWL = 9.6; HL = 1.9; PronL = 2.2; PronW = 2.8; FWL = 5.9; FWW = 3.3; FIIIL = 6.3; TIIIL = 4.0; TaIIIL = 3.1 • ♂ paratype: BL = 8.3; BWL = 9.4; HL = 1.3; PronL = 2.3; PronW = 2.6; FWL = 5.8; FWW = 3.1; FIIIL = 5.9; TIIIL = 3.6; TaIIIL = 3.0.

Ecology. This species occurs in sympatry with *Tembelingiola kabili* **sp. nov.** One male individual was found on a foliage of a low-shrub, whereas another male was found on a dead branch (Fig. 5).

Distribution. EAST MALAYSIA: Sabah: Sepilok

Calling song (Figs 2A, 3A, 4A). Consists of either short or long echemes. At 31.50–31.75°C, a short echeme has a duration of 0.26±0.02 s (0.23–0.29 s) and consists of an average of nine syllables (8–10 syllables). A long echeme has a duration of 3.02±0.48 s (2.50–3.77 s) and consists of an average of 101 syllables (82–127 syllables).

The silent interval between consecutive echemes is 1.7±0.8 s (0.9–3.4 s). Within each echeme, the average syllable duration is 18.8±2.1 ms (14.0–21.9 ms) and the average silent interval between consecutive syllables is 11.1±2.9 ms (7.3–17.3 ms). The frequency spectrum is pure-tonal and forms a harmonics, with the energy peaking at a dominant frequency of 5.66±0.09 kHz (5.53–5.72 kHz).

FIGURE 5. Male *Tembelingiola biaculeata* **sp. nov.** in its natural habitat in Sepilok.

Tembelingiola kabili Tan, Gorochov & Robillard, sp. nov.

(Figs 2B, 3B, 4B, 7E–I, 9–12)

Material examined. Holotype: EAST MALAYSIA: ♀; Sabah State, Sandakan District, Sepilok, Rainforest Discovery Centre, dipterocarp forest; N05.87395, E117.93871, 54 m; 18.v.2022, night; on tree trunk (h=1m); T. Robillard & M.K. Tan leg.; TR22-30 (FRC).

Paratypes (1♂, 1♀)**:** EAST MALAYSIA: • 1♂; Sabah State, Sandakan District, Sepilok, Rainforest Discovery Centre, dipterocarp forest; N05.87395, E117.93871, 54 m; 18.v.2022, night; on tree trunk (h=1m); T. Robillard & M.K. Tan leg.; call recording: video files 65–66, sound files Pap268–271, TR22-30 (MNHN-EO1277) • 1♀; same information (MNHN-EO1278).

Diagnosis. This species differs from all congeners by the male genitalia with its pseudepiphallic lophi [posterolateral epiphallic lobes] straight (bent in *T. plana* and *T. belaitensis*) or narrow (narrower than in *T. biaculeata*); sclerotized bridge connecting the two lateral parts of pseudepiphallus distinctly longer; pseudepiphallic parameres [ectoparameres] membraneous; ectophallic fold [rachis] with two long and slender anterolateral ribbons; endophallic sclerite [formula] nearly divided into two compact lateral parts (each part somewhat U-shaped); additional plates rather long and narrow as well as obliquely located.

Etymology. The species name refers to the Kabili Monster tree, an Obah Suluk tree (*Shorea pauciflora*) near to where the species was found; noun in apposition.

Description. General appearance, including tegminal structure, very similar to *Tembelingiola biaculeata* **sp. nov.** but with following differences (Figs 9, 7E–G): rostrum between antennal cavities wider, 1.3 times wider than scapes (Fig. 7E); maxillary palp with apical segment slightly more elongate; pronotum less pubescent (Fig. 7E).

FIGURE 6. Habitus of *Tembelingiola biaculeata* **sp. nov.**, male in dorsal (A) and lateral (B) views. Scale bars: 2 mm.

Male. FW brown, reaching abdominal apex, 2.2 times as long as wide (Fig. 7H). Dorsal field more slender, 2.2 times as long as wide, with only 4 harp veins, and with mirror longer than wide; with a faint diagonal vein; harps with 4 oblique veins including 2 long, parallel sinusoidal posterior veins fused anteriorly, and 2 anterior shorter and fainter one; mirror approximately 1.1 times longer than wide, separated by two dividing veins, dividing veins mostly straight but slightly bent at anal end. Apical field moderately short (Fig. 7H). Lateral field with about 7 branches of Sc and 9 cross veins between R and M. Hind wings not exposed (Fig. 9). Genitalia as shown in Fig. 10. Pseudepiphallus [epiphallus] consisting of two lateral parts connected with each other by broad bridge; pseudepiphallic lophi [posterolateral epiphallic lobes] dorso-ventrally compressed, straight, diverging slightly posteriorly, and with apices roundly truncated; between these lophi, pseudepiphallus posteriorly angularly concave. Pseudepiphallic parameres [ectoparameres] membraneous. Ectophallic fold [rachis] semi-tube-like, narrowing posteriorly into acute apex, slightly surpassing pseudepiphallic bridge, and with a pair of long and slender anterolateral sclerotized ribbons. Endophallic sclerite [formula] lamellate and somewhat transverse but compact, almost divided into two U-shaped lateral parts (each part with medial half more sclerotized and lateral half almost semi-sclerotized. Rami weakly sclerotized, fused with epiphallus. Additional lateral sclerotized plates (p) very long and slender, obliquely located, slightly curved in profile.

Female (Fig. 11). Colouration and structure of body similar to male. Tegminal dorsal field with 4 oblique longitudinal branches and with numerous and slightly irregular cross-veins (some cross-veins rather long and very oblique, i.e., situated almost longitudinally); most-anal branch after middle splits into two sub-branches (Fig. 7I). Lateral field with 3 branches of Sc and with cross-veins between R and M indistinct. Subgenital plate wide but gradually narrowing backwards, with almost widely truncate apex having shallow and rather wide postero-median notch. Ovipositor dark rufous, weakly arcuate in profile, with middle part rather high (wide) and distal third gradually narrowing to acute apex (Fig. 11B).

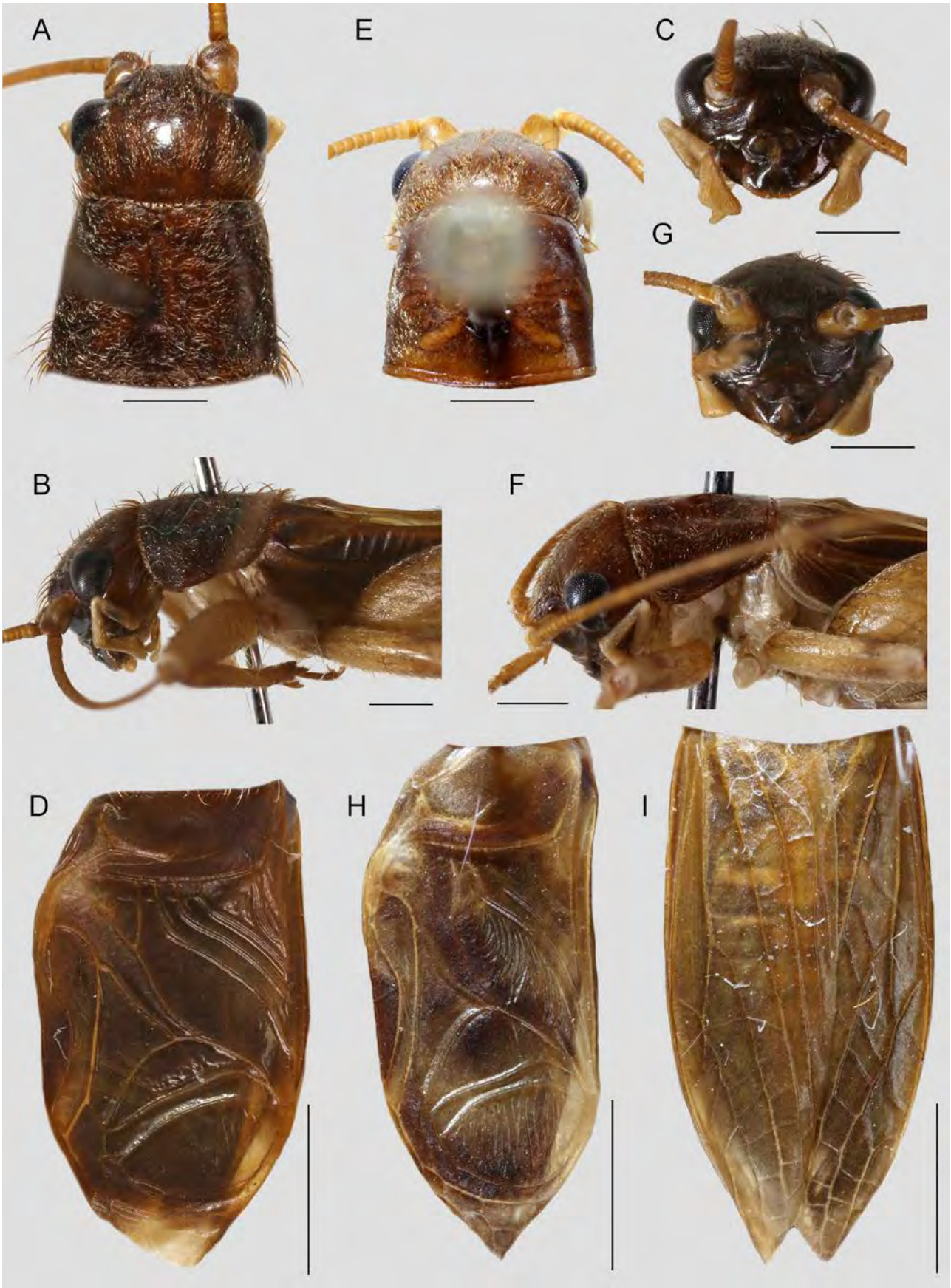

FIGURE 7. *Tembelingiola biaculeata* **sp. nov.** (A–D) and *Tembelingiola kabili* **sp. nov.** (E – I): head and pronotum in dorsal (A, E) and lateral (B, F) views, face in anterior view (C, G), male FW in dorsal view (D, H), female FWs in dorsal view (I). Scale bars: 2 mm (D, H, I), 1 mm (rest).

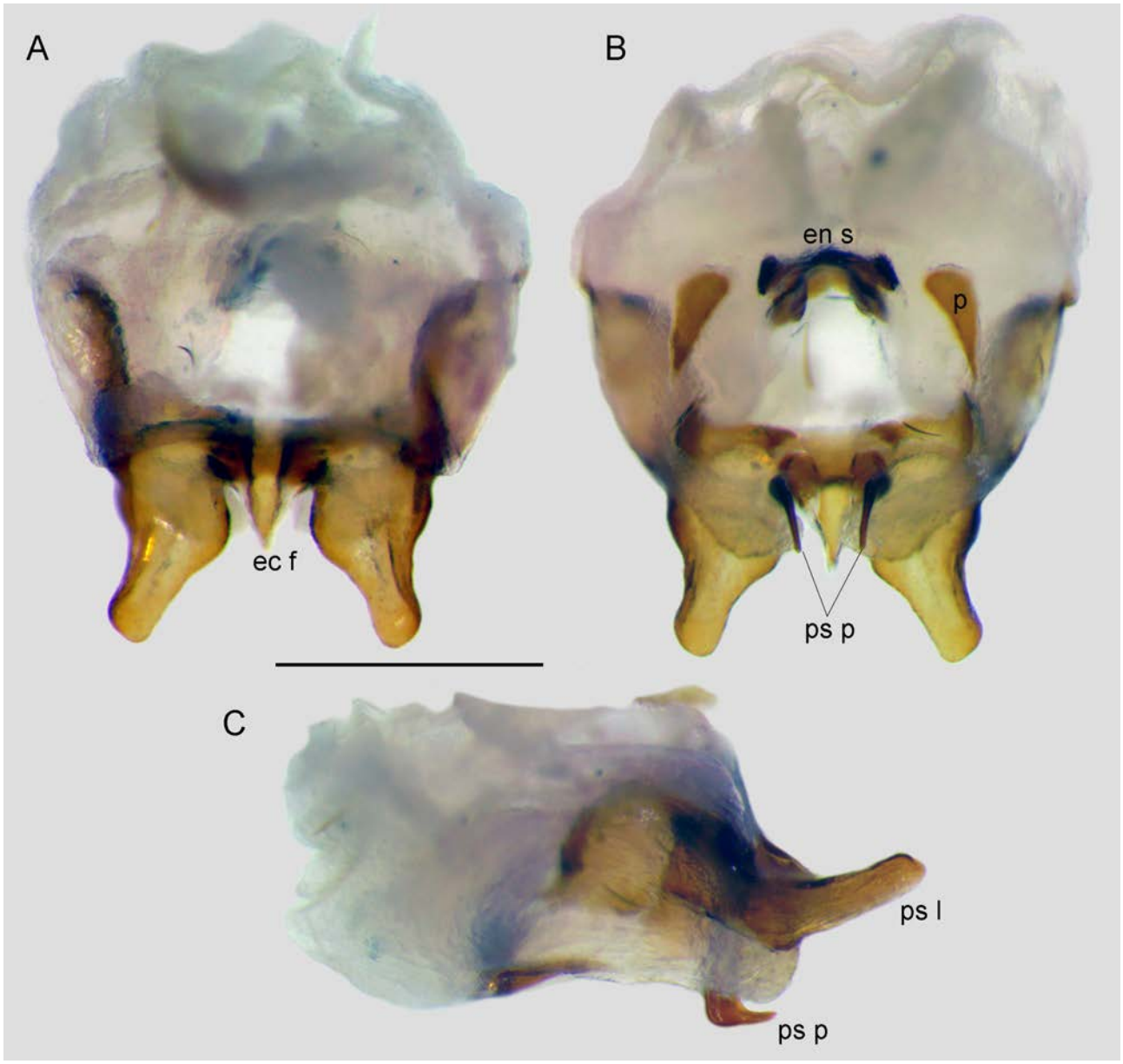

FIGURE 8. Male genitalia of *Tembelingiola biaculeata* **sp. nov.** in dorsal (A), ventral (B) and lateral (C) views. Scale bar: 0.5 mm.

Measurements. • ♂ holotype: BL = 8.0; BWL = 9.3; HL = 1.2; PronL = 2.2; PronW = 2.5; FWL = 6.1; FWW = 2.8; FIIIL = 5.8; TIIIL = 3.6; TaIIIL = 2.8 • ♀ paratype: BL = 7.9; BWL = 9.5; HL = 1.0; PronL = 2.4; PronW = 2.6; FWL = 6.4; FWW = 1.8; FIIIL = 6.9; TIIIL = 3.9; TaIIIL = 3.0; OL = 5.4 • ♀ paratype: BL = 7.3; BWL = 9.5; HL = 1.1; PronL = 2.4; PronW = 2.7; FWL = 6.4; FWW = 1.7; FIIIL = 6.2; TIIIL = 3.5; TaIIIL = 2.9; OL = 5.2

Ecology. A male was observed producing short echemes behind two females on a tree trunk at night (Fig. 12).

Distribution. EAST MALAYSIA: Sabah: Sepilok

Calling song (Figs 2B, 3B, 4B). Consists of echeme-sequence, each made up of 6 to 8 echemes. At 26°C, each echeme-sequence has an average duration of 0.84±0.08 s (0.67–0.99 s). The silent interval between consecutive echeme-sequences is 11.9±5.7 s (7.4–29.7 s). Each echeme consists of 3 syllables and has an average duration of 56.2±1.4 ms (53.6–59 ms). The silent interval between consecutive echemes is 66.4±3.5 ms (60.5–72.1 ms). Within each echeme, the average syllable duration is 11.5±0.5 ms (10.5–12.2 ms) and the average silent interval between consecutive syllables is 9.5±0.5 ms (8.6–10.2 ms). The frequency spectrum is pure-tonal and forms a clear harmonic series, with the energy peaking at a dominant fundamental frequency of 5.91 kHz.

FIGURE 9. Habitus of *Tembelingiola kabili* **sp. nov.**, male in dorsal (A) and lateral (B) views. Scale bars: 2 mm.

Genus *Pteroplistes* Brunner von Wattenwyl, 1873

Pteroplistes Brunner von Wattenwyl, 1873: 169; Kirby, 1906: 62; Chopard 1968: 254; Chopard, 1969: 230; Gorochov, 2004: 381; Jaiswara & Desutter-Grandcolas, 2014: 98; Tan *et al.*, 2019; 10; Gorochov, 2022: 447

Type species: *Pteroplistes acinaceus* Saussure, by subsequent designation

Included species

Pteroplistes (*Eupteroplistes*) *tarbinskyi* Gorochov, 2022
Pteroplistes (*Pteroplistes*) *acinaceus* Saussure, 1877
Pteroplistes (*Pteroplistes*) *borneoensis* Gorochov, 2004
Pteroplistes (*Pteroplistes*) *borneoensis sabahi* Gorochov, 2018
Pteroplistes (*Pteroplistes*) *bruneiensis* Tan, Gorochov & Wahab, 2019
Pteroplistes (*Pteroplistes*) *lagrecai* Gorochov, 2004

Pteroplistes (*Pteroplistes*) *malaccanus* Gorochov, 2018
Pteroplistes (Pteroplistes) silam **sp. nov.**
Pteroplistes (*Pteroplistes*) *sumatranus* Gorochov, 2004
Pteroplistes masinagudi Jaiswara, 2014
Pteroplistes kervasae Jaiswara, 2014

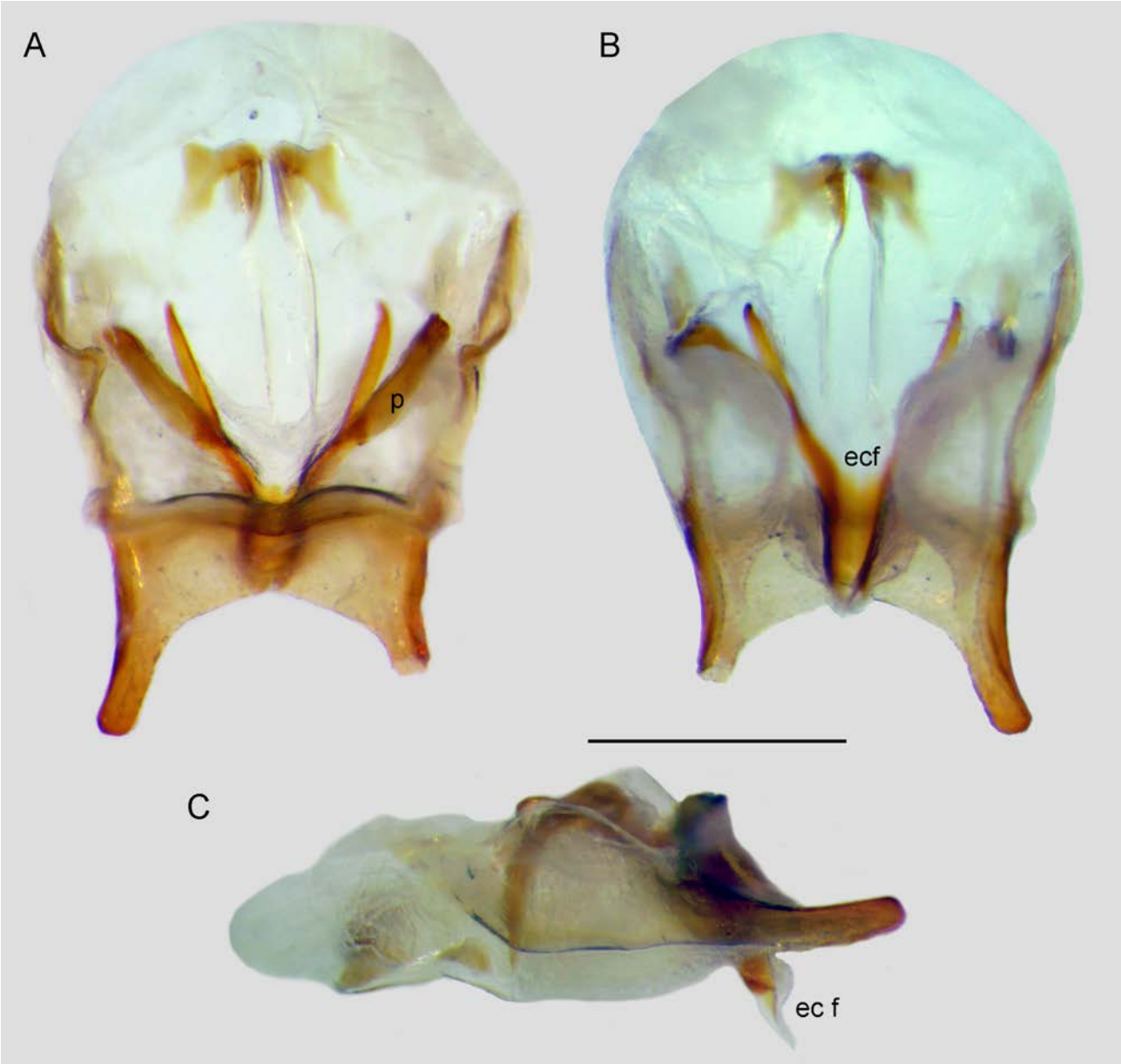

FIGURE 10. Male genitalia of *Tembelingiola kabili* **sp. nov.** in dorsal (A), ventral (B) and lateral (C) views. Scale bar: 0.5 mm.

Species tentatively placed in *Pteroplistes* s. l. in Orthoptera Species File (Cigliano et al., 2024)

Pteroplistes platycleis Bolívar, 1900
Pteroplistes platyxiphus (Haan, 1844) (genus unclear)

Distribution. Borneo, Java?, Sumatra, Malay Peninsula, Indian Subcontinent

FIGURE 11. Habitus of *Tembelingiola kabili* **sp. nov.**, female in dorsal (A) and lateral (B) views. Scale bars: 2 mm.

***Pteroplistes silam* Tan, Gorochov & Robillard, sp. nov.**
(Figs 2C, 3C, 4C, 13, 14, 15A)

Material examined. Holotype: EAST MALAYSIA: • ♂; Sabah State, Mount Silam, near Lahad Datu; N4.96878, E118.17189, 736.1±5.4 m.a.s.l.; calling on tree trunk; 12.v.2022, 21h56; M.K. Tan, T. Robillard & R. Japir leg.; SBH.22.42 (FRC).

Diagnosis. This species is most similar to *Pteroplistes acinaceus* Saussure, 1877 from Malay Peninsula and *Pteroplistes bruneiensis* Tan, Gorochov & Wahab, 2019 from Borneo in the ectophallic fold [rachis] of the male genitalia with a pair of rather large and sclerotized processes on its dorsal surface (dp) (before the apical part) but distinguished from them by these processes thickened, almost straight and with acute apices (these processes in *P. acinaceus* with characteristic hooks distally, and in *P. bruneiensis*, they are triangular). It is also similar to *P. acinaceus*, *P. bruneiensis* and *Pteroplistes lagrecai* by the shapes of the anal plate having a pair of small lobules (hooks), but differs from them by the lobules spaced widely apart (instead of nearly touching each other in *P. bruneiensis* and *Pteroplistes lagrecai*) and with the apices of the lobules slightly enlarged (instead of tapering into acute apices in *P. acinaceus*). The new species also differs from congeners from India (*Pteroplistes masinagudi*, *Pteroplistes kervasae* and *Pteroplistes platycleis*) by the head dorsum without distinct pale bands behind eyes, shapes of male anal plate and male genitalia.

Etymology. The species is named after Mount Silam, its type locality.

FIGURE 12. *Tembelingiola kabili* **sp. nov.**: a male with two females on a tree trunk in Sepilok (A); the male started calling (B).

Description. Body distinctly dorsoventrally compressed, with head and pronotum finely pubescent. Head rostrum 1.3 times as wide as scape, with apex truncated (Fig. 13A). Head wider than high in facial view (Fig. 13C). Maxillary palps elongated, with apical segment widened apically and subequal to third segment in length, and with subapical segment longest and slightly broadened apically (Fig. 13B). Eyes elongated in profile view, slightly protruding anteriorly (Fig. 13B); median ocellus small and rounded; lateral ocelli larger and more elongated; fenestrae between scapes rounded, small like median ocellus (Fig. 13C). Pronotal disc 1.3 times as wide as long, finely pubescent along anterior and posterior margins; anterior margin of disc concave; posterior margin of disc straight; lateral margins sub straight and parallel (Fig. 13A). Pronotal lateral lobe 2.1 times as long as high, with ventral margin rising posteriorly (Fig. 13B). TI with minute oval tympana on both sides; legs I and II generally pubescent (especially along ventral margin) and with a few stout setae usually located along dorsal margin, and their tarsus with a row of stout setae on ventral surface; FIII pubescent and flattened, without ventral spines; TIII also pubescent, with about 18 small and stout spines on each dorsal side, and with 2 long ventral apical spurs on inner margin and 4 shorter other apical spurs; hind basitarsus with about 7 inner and 7 outer denticles.

Male. Metanotal gland with two lateral areas cream coloured, broadly triangular and slightly raised (Fig. 13A). FW extending beyond abdominal apex, with dorsal field slightly longer than lateral field (Figs 13D, 13E); dorsal tegminal field (Figs 13D, 13E) in harp area with 6 oblique veins, mostly almost straight and parallel (except for posterior one which slightly sinuous); mirror in this field large and rounded, as wide as long, with anterior margin roundly angular, with posterior margin somewhat more widely rounded, and with two parallel dividing veins (these dividing veins arcuate and located close to one another); apical field about as long as length of mirror, separated from mirror by distinctive transverse cell (Figs 13D, 13E); lateral field wide, with about 20 branches of Sc and about 10 cross-veins (some veins faint) between R and M, as well as with R and M mostly parallel and strongly converging towards the apex (Figs 13D, 13E). Hind wings slightly surpassing FWs. Anal plate broadly tongue-shaped and slightly bilobed apically, with a pair of small lobules (hooks) in central part of dorsal surface but not very near each other; each of these lobules pointing inwards and tapering into subacute apex (Fig. 13F). Subgenital plate trapezoidal, about as long as wide; anterior margin wide, tapers slightly posteriorly, and with posterior margin deeply emarginated.

Male genitalia as shown in Fig. 14. Pseudepiphallus [epiphallus] almost H-shaped, with transverse but moderately long median bridge between lateral parts, moderately short posterolateral lobes and long anterolateral parts; pseudepiphallic lophi [posterolateral epiphallic lobes] lamellate, with inner margin strongly sclerotized and concave, with lateral margin distinctly convex, and with apical part forming small hook directed dorso-externally; median bridge (mb) in shape of parallelogram, with anterior margin 1.9 times as wide as long; anterolateral parts of pseudepiphallus lamellate, sinuate and divergent, anteriorly fused with rami. Ectophallic fold [rachis (= guiding rod)] very strongly sclerotized and directed almost perpendicularly downwards in relation to the longitudinal axis of genitalia, with distal half having anterior margin slightly convex, with apical third tapering into acute apex, with basal part having upper process (up) almost perpendicular to ectophallic fold (this process distally bifurcated into two short triangular lobes with subacute apices); dorsum of upper process with pair of dark lateral sclerites (dp) projecting laterally and posteriorly, these projections connect with ectophallic apodemes. Ectophallic apodemes [endoparameres] strongly sclerotized, slender, with middle parts almost touching each other, and with anterior parts in shape of long arcuate ribbons curved downwards and aside (Fig. 14B). Endophallic sclerite [formula (= mold of spermatophore attachment plate)] consists of three small but elongated plates (a pair of lateral oblique plates and unpaired transverse one) as well as a pair of larger and longer but oblique and isolated plates in anteroventral parts of genitalia. Rami rather short and narrow, strongly (arcuately) curved, lamellate and with anterior end tapering almost into acute apex.

Measurements. • ♂ holotype: BL = 14.4; BWL = 18.8; HL = 1.9; PronL = 3.3; PronW = 4.5; FWL = 15.3; FWW = 6.6.

Ecology. This species was found calling on a tree trunk at night (Fig. 15A).

Distribution. EAST MALAYSIA: Sabah: Mount Silam

Calling song (Figs 2C, 3C, 4C). Consists of a trill made up of long syllables irregular spaced-apart. At 23.6°C, average syllable duration is 26.8±1.1 ms (25.6–29.7 ms) and average silent interval between consecutive syllables is 115.8±40.1 ms (89.8–249.2 ms). The frequency spectrum is pure-tonal and forms a clear harmonic series, with the energy peaking at a dominant fundamental frequency of 5.34 kHz.

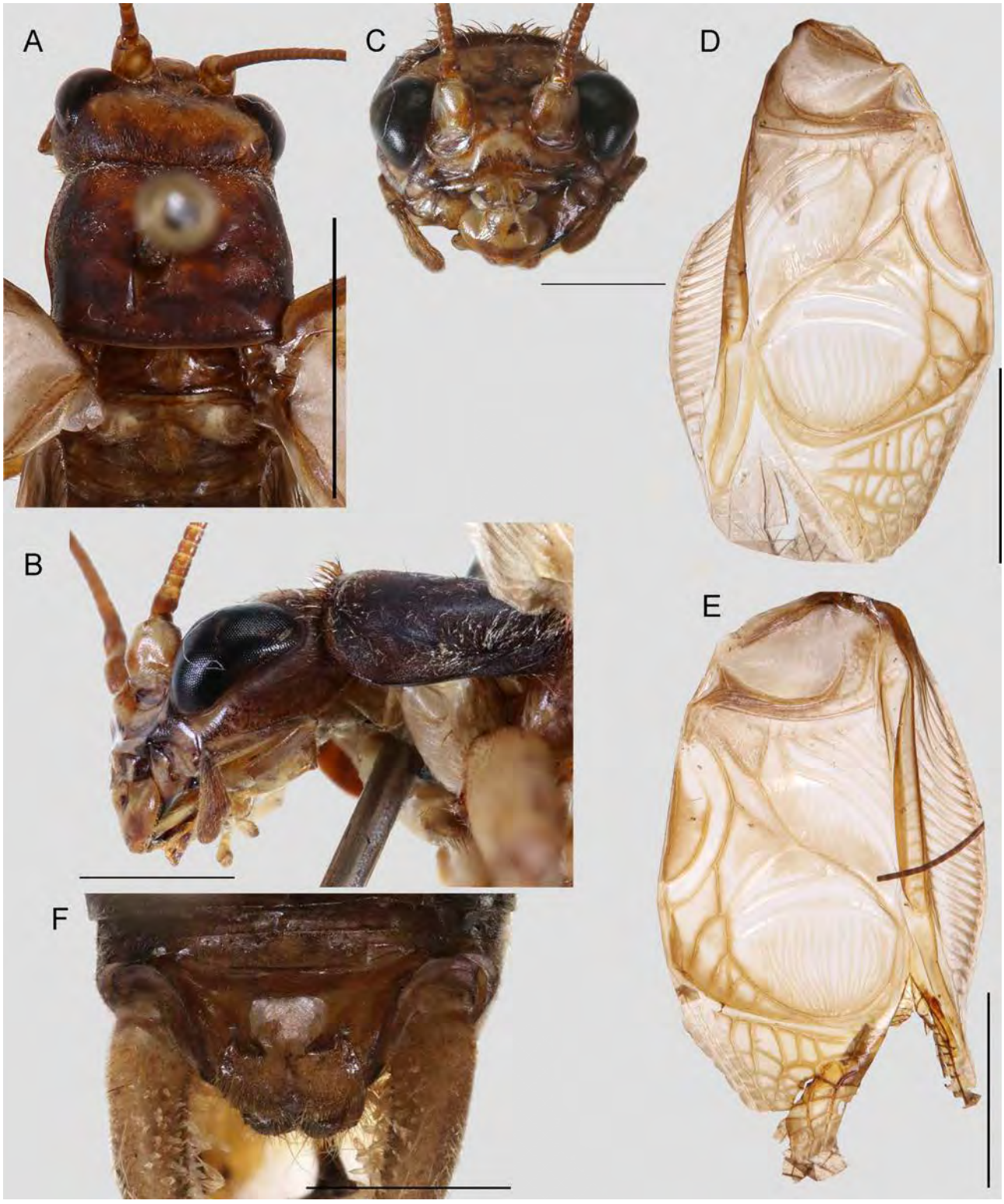

FIGURE 13. *Pteroplistes silam* **sp. nov.**: head and pronotum in dorsal (A) and lateral (B) views, face in anterior view (C), left (D) and right (E) FWs in dorsal view, supra-anal plate in dorsal view (F). Scale bars: 5 mm (A, D, E); 2 mm (rest).

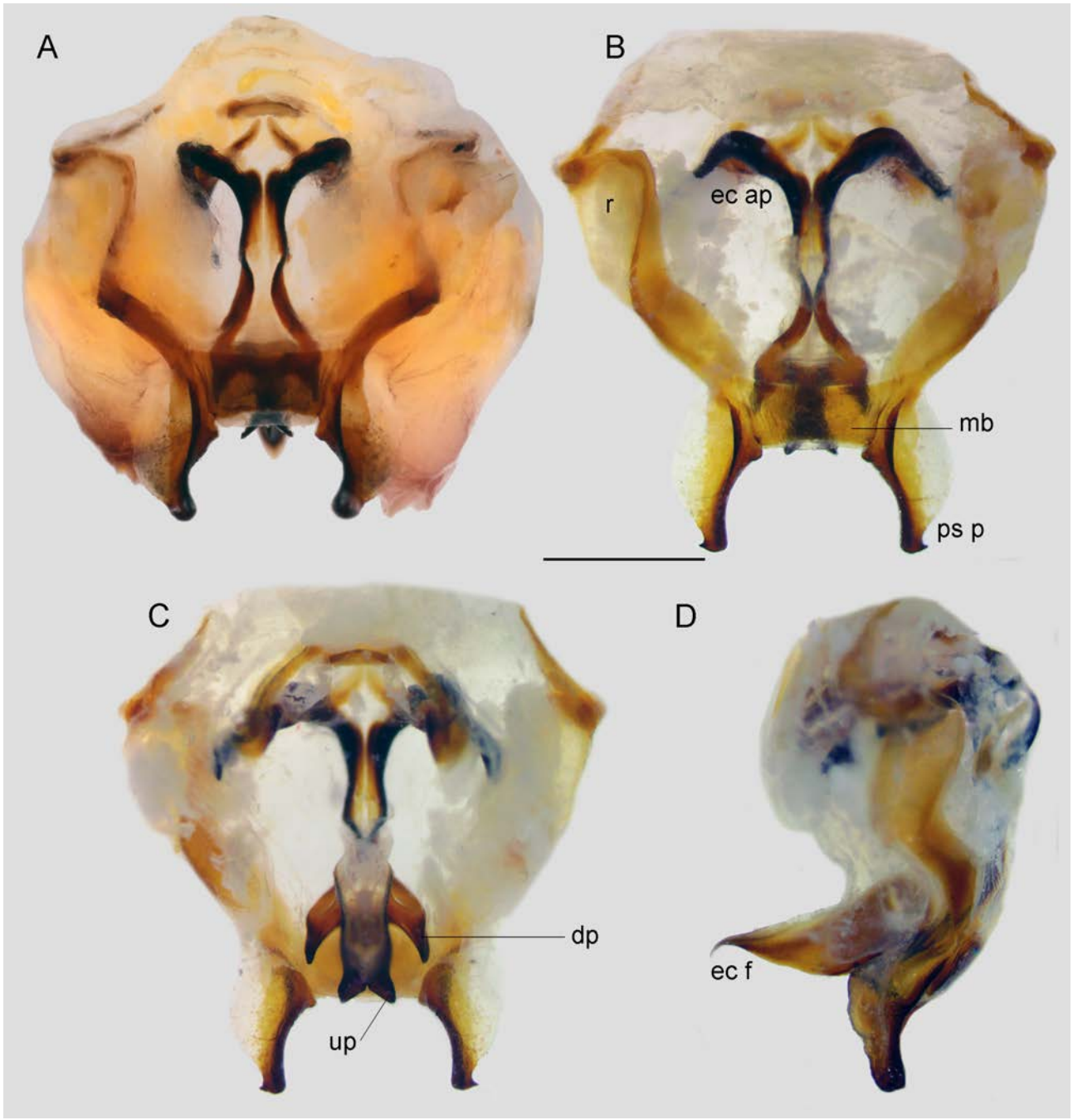

FIGURE 14. Male genitalia of *Pteroplistes silam* **sp. nov.** in posterodorsal (A), dorsal (B), ventral (C) and lateral (D) views, before (A) and after (B–D) cleaning with KOH. Scale bar: 1 mm.

Pteroplistes lagrecai **Gorochov, 2004**

(Figs 2B, 3B, 4B, 15B)

Pteroplistes lagrecai Gorochov, 2004: 382—Gorochov, 2022: 447

Material examined. EAST MALAYSIA**:** • ♂; Sabah State, Sandakan District, Sepilok, Rainforest Discovery Centre, dipterocarp forest; N05.87395, E117.93871, 54m; 18.v.2022, night (19h); on tree trunk; T. Robillard & M.K. Tan leg.; TR22-27, call recording video 0062; MNHN-EO1288.

Ecology. This species was found calling on a tree trunk at night, where two females were located near it.

Distribution. EAST MALAYSIA: Sabah: Sepilok.

FIGURE 15. *Pteroplistes silam* **sp. nov.** calling on the tree trunk in Mount Silam (A), and *Pteroplistes lagrecai* Gorochov, 2004 calling on the tree in Sepilok (B).

Calling song (Figs 2D, 3D, 4D). Consists of an echeme-sequence. At 26°C, each echeme-sequence consists two parts, the first being 6±2 (5–10) isolated syllables, followed by the second being 11±4 (5–16) echemes made up of two syllables (doublet) each. For the first part, the average syllable duration is 22.1±1.5 ms (19.6–25.2 ms) and

the average interval between consecutive syllables is 0.14±0.03 s (0.12–0.20 s). For the second part, the average echeme duration is 58.8±1.8 ms (57.5–64.1 ms) and the average silent interval between consecutive echemes is the same as the average silent interval between consecutive syllables in the first part of the song. The average syllable duration of the doublet is 22.4±0.5 ms (21.5–23.2 ms), barely longer than that in the first part; and the average silent interval between the two syllables is 13.1±0.7 ms (11.8–14.1 ms). The frequency spectrum is pure-tonal and forms an harmonic series, with the energy peaking at a dominant fundamental frequency of 7.39 kHz.

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