



Revised checklist of Cicadidae (Insecta: Hemiptera) of Mindanao, Philippines, with descriptions of a new genus and nine new species

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ABSTRACT

This paper provides a revised faunal checklist for the subfamilies, tribes, subtribes, genera and species of the family Cicadidae (Insecta: Hemiptera) from Mindanao, Philippines, comprising 31 species belonging to 19 genera. A new genus, *Neopurana* Lee and Marshall gen. nov., and nine new species, *Platycleura bella* Lee and A. Mohagan sp. nov., *Platycleura minima* Lee and Marshall sp. nov., *Chremistica flavialata* Lee and Marshall sp. nov., *Oncotympana obesa* Lee and Marshall sp. nov., *Neopurana bouptera* Lee and Marshall sp. nov., *Purana mindanaensis* Lee and Marshall sp. nov., *Mogannia tenebrosa* Lee and Marshall sp. nov., *Philipsalta exilis* Lee and Marshall sp. nov. and *Philipsalta lata* Lee and Marshall sp. nov., are described. *Platycleura transitiva* Lee, 2021 is newly added to the list of cicadas from Mindanao. Male calling songs are illustrated and described for all new species. Information on the geographic distributions of the 31 Mindanao species is provided.

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Introduction

This paper contributes to the knowledge of cicada diversity in Mindanao, the second largest island of the Philippines, and provides a new checklist revised from those provided by Lee (2010, 2015). The first records of the cicadas of Mindanao were made by Banks (1910), Distant (1916), Haupt (1924) and Schmidt (1924). Later, Endo and Hayashi (1979), Bregman (1985), Duffels (1991), Beuk (1999) and Lee (2009a) added both new species and higher taxa. The first checklist of Mindanao Cicadidae Latreille, 1802 (Lee 2010) recorded 17 species belonging to 13 genera. New additions and replacements by Lee (2015) brought the total to 22 species belonging to 16 genera. Recently, Lee (2021) described a new species, *Platycleura transitiva* Lee, 2021, from Mindanao, which replaced a misidentified species that was removed from the list of the Mindanao cicadas.

In this study, we describe a new genus and nine new species of Cicadidae. With these additions, the cicada fauna of Mindanao now comprises 31 species belonging to 19

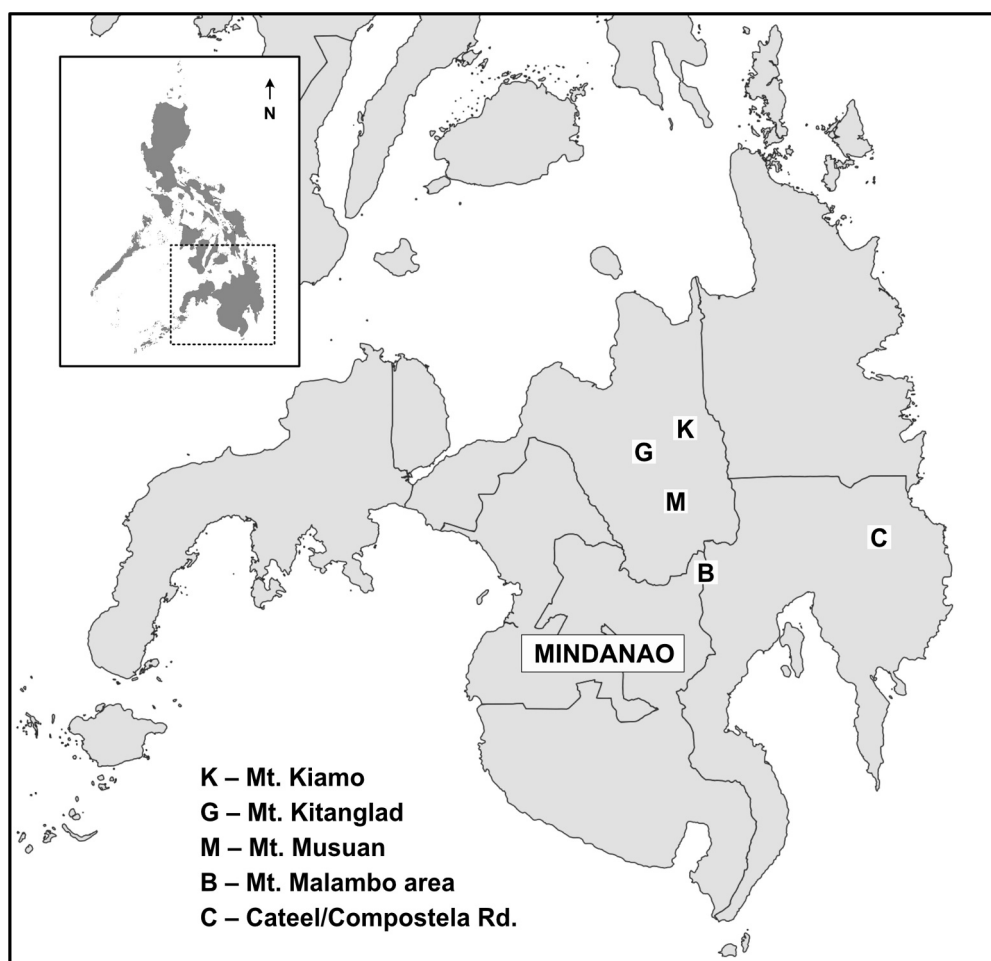


Figure 1. Type locations of new Mindanao taxa named in this study. The inset shows the location of Mindanao in the southern Philippines.

genera. We also present a revised checklist of the cicadas of Mindanao. Type locations of new taxa in this study are mapped in [Figure 1](#).

Materials and methods

This revised checklist includes all known subfamilies, tribes, subtribes, genera and species of the family Cicadidae from Mindanao Island, excluding adjacent islands such as Dinagat, Camiguin and others (see Lee et al. 2016). Because the checklist revises those found in Lee (2010, 2015), synonymic lists are provided only for the newly recorded or noteworthy taxa. We include only those references that specifically mention the fauna of Mindanao Island, in addition to the original descriptions with the type localities (TL) as given in the original publications in the synonymic lists for species. For other species, only the specific names, references to the earlier checklists of Lee (2010, 2015) and distributions are provided as

well as information on additional material examined, song descriptions and/or biological information, if any.

Newly recorded species and new species are based on the specimens collected from a field trip to Mindanao Island in April–May 2012 by the second and the fourth authors in collaboration with the third author, and on specimens collected by the third and fifth authors from several localities in Mindanao in May 2010, August 2010 and April 2011. Diagnostic comparisons are made to other species from the region that are morphologically similar enough to be potentially confused.

The holotypes of the new species described in this paper will be deposited at the National Museum of the Philippines, Manila (NMPM). Other specimens including paratypes are deposited in the Biological Collections Facility at the University of Connecticut, Storrs (UCONN). Specimens with voucher numbers noted below have had one or two legs removed and preserved in ethanol for DNA analysis. The tissue samples have been stored at -20°C in the laboratory of Chris Simon at the University of Connecticut. Digital recordings of the songs of some species, noted below, will be deposited with the BioAcoustica Wildlife Sounds Database (<http://bio.acousti.ca>) following publication.

Nomenclature for family, subfamily, tribe and subtribe classification follows that of Lee (2014) and Hill et al. (2021). Morphological measurements were made using a Vernier calliper in millimetres and are listed as averages with ranges in parentheses for the new species.

Songs were digitally recorded in the field at 44.1 kHz or 48.0 kHz using a Marantz (Mahwah, NJ, USA) audio recorder (PMD-670) or at 96 kHz using a Zoom H4n Handy Recorder (Zoom Corporation, Hauppauge, NY, USA), together with a Sennheiser (Old Lyme, CT, USA) ME66 short shotgun microphone plus windscreen. The microphones were sometimes powered by a Sennheiser K6 power module. This equipment has a flat sound frequency response of 40 Hz–20 kHz $\pm$ 2.5 decibels (dB).

Measurements of acoustic features were made in Raven Pro version 1.5 (Cornell Lab of Ornithology, Ithaca, NY). Repetition rates of sound components were measured from oscillograms (waveforms) to the nearest 0.001 s. Recordings were sometimes filtered below a threshold frequency to remove background sound energy. Spectrograms were generally made using the following parameter settings: Hann window, size 512 samples, 3 dB filter, bandwidth 270 Hz, discrete Fourier transform (DFT) size 256 samples, grid spacing 188 Hz, overlap 50%, hop size 256 samples, averaging 1 spectrum, with no clipping. For short time segments, these parameters were changed to window size 150, bandwidth 921 kHz, hop size 75, DFT size 256 and grid spacing 375 Hz. Song spectra are characterised by frequency limits between which the sound intensity remains within 20 dB of the peak value. Some males were recorded while kept in 1.5 L mesh fabric ‘Port-a-Bug’ cages obtained from Insect Lore, P.O. Box 1353, Shafter, CA.

Terminology for male calling song descriptions is as follows: A *pulse* is a burst of sound energy containing multiple sound waves (the primary pressure-amplitude waveform), which dampen to zero if not followed by another sound burst; pulses often appear in pairs as *doublets*. This definition does not assume a specific mechanical basis, so a pulse could be created by one timbal collapsing or rebounding, both timbals collapsing/rebounding in synchrony, or one or more ribs of one or both timbals collapsing/rebounding (e.g. Fleming 1975). A *syllable* is a group of pulses or doublets repeated at an approximately uniform rate. An *echeme* is a repeated assemblage of syllables of different types. A *phrase* is higher-order repeated pattern of syllables and echemes.

Taxonomy

Family **CICADIDAE** Latreille, 1802

Subfamily **CICADINAE** Latreille, 1802

Tribe **PLATYPLEURINI** Schmidt 1918

Hamzaria Distant 1905b: 382.

Hamzini: Lee 2014: 61 (Platypleurini synonymised with Hamzini).

Platypleurini Schmidt 1918: 378; Marshall et al. 2018a: 50–52; ICZN, 2020: 147–149 (Platypleurini conserved over Hamzaria); ICZN, 2021: 60 (date correction); Lee 2021: 261.

Genus **Platypleura** Amyot and Audinet-Serville, 1843

1. **Platypleura bella** Lee and A. Mohagan sp. nov.

(Figures 2, 3, 6(B))

Type material

Holotype. Male, PHILIPPINES, Mindanao, Bukidnon, Mt. Kiamo, 7 May 2012, A.B. Mohagan (NMPM).

Paratypes. 1 male, 1 female, same data as holotype, A.B. Mohagan (UCONN); 2 males, PHILIPPINES, Mindanao, Mt. Kitanglad trailhead, 1689 m, 08°10.22'N, 124°56.14'E, 4 May 2012, K.B.R. Hill, D.C. Marshall and D. Mohagan (UCONN); 1 female, same location, 1 May 2012, K.B.R. Hill, D.C. Marshall and D. Mohagan (UCONN).

Etymology

The specific name is the Latin feminine adjective *bella* meaning 'pretty' or 'handsome'.

Measurements of types (4 males, 2 females)

Length of body: males 20.6 (19.6–21.2), females 19.8 (18.7–20.8). Length of head and thorax together: males 10.5 (9.9–10.7), females 10.6 (10.3–10.8). Length of abdomen: males 10.1 (9.7–10.6), females 9.2 (8.4–10.0). Width of head including compound eyes: males 8.5 (8.4–8.6), females 8.8 (8.5–9.1). Width of pronotum: males 11.5 (10.8–12.2), females 11.7 (11.2–12.1). Width of mesonotum: males 8.8 (8.7–9.1), females 8.9 (8.4–9.4). Width of abdominal tergite 3: males 9.3 (9.0–9.7), females 9.4 (9.3–9.5). Length of fore wing: males 28.4 (27.9–28.9), females 29.6 (29.2–30.0). Width of fore wing: males 10.2 (9.8–10.4), females 10.7 (10.6–10.8). Wing span: males 65.8 (65.4–66.6), females 67.5 (65.6–69.4).

Diagnosis

This new species is very similar to *Platypleura elizabethae* Lee, 2009 (Figure 6(C)) from Palawan but has much less infuscation on the inner half of the fore wing and the hind wing and has the following differences: fore wing apical cell 6 seldom with infuscation or with tiny spot on its proximal end (vs with quite large infuscation on about its proximal

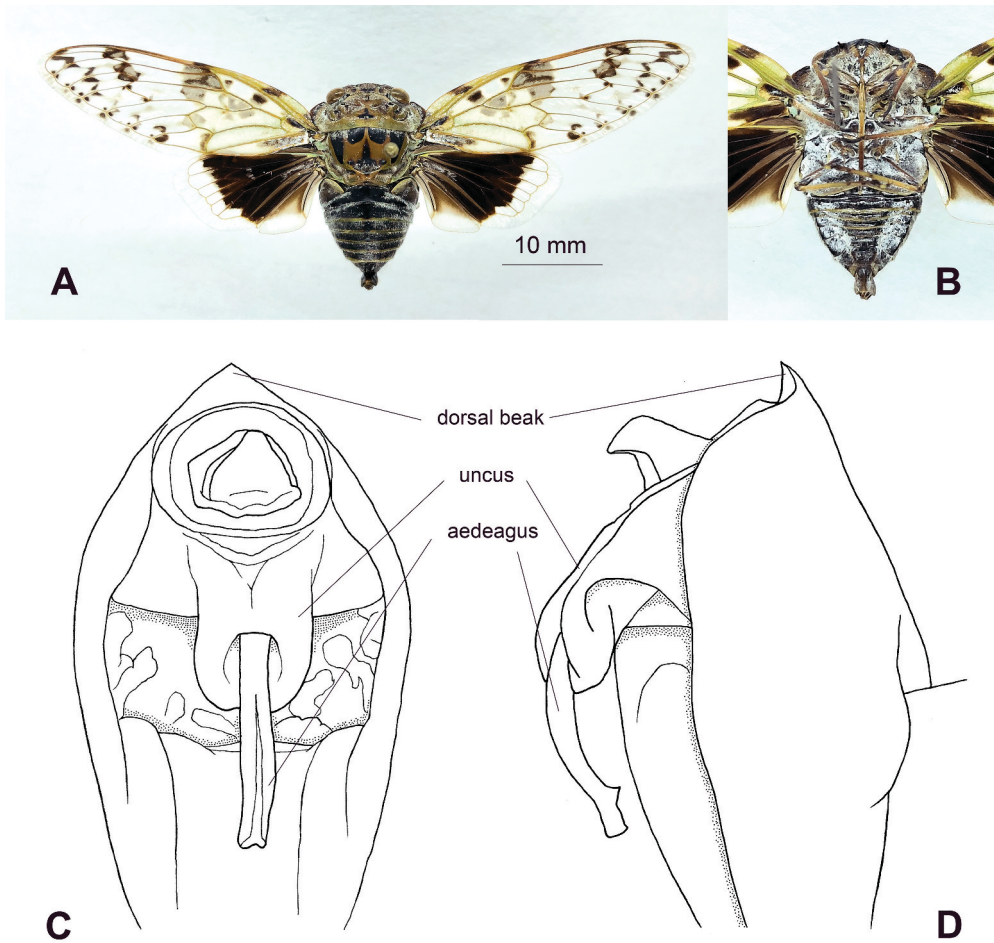


Figure 2. *Platypleura bella* Lee and *A. Mohagan* sp. nov., holotype, male, Mindanao, Philippines. (A) Dorsal habitus; (B) ventral habitus; (C) pygofer, ventral view; (D) pygofer, slightly oblique lateral view.

sixth in *P. elizabethae*); fore wing medial cell with a few tiny grey spots (vs with cloudy patterns covering about half of the cell in *P. elizabethae*); and fore wing apical cells 5 and 6 each with multiple tiny sub-distal spots (vs with no such spots in *P. elizabethae*).

This species can be distinguished from *Platypleura transitiva* Lee, 2021 (from Mindanao) (Figure 6(D)) by the following characteristics: fore wing basal cell with black patch or infuscation on about half of its area (vs basal cell entirely black in *P. transitiva*); and hind wing apical cells 1–2 fuscous on about or less than half of their area (vs fuscous on far more than half of their area in *P. transitiva*).

Platypleura bella sp. nov. is also similar to *P. minima* sp. nov., as explained in the *Diagnosis* for that taxon below.

Description of male

Head. Vertex ochraceous to castaneous with the following black marks: median large spot enclosing ocelli, with anterior and posterior ends reaching anterior and posterior

margins of vertex, and with short transverse branch at each lateral end; a pair of small spots between lateral ocelli and compound eyes; a pair of small spots on posterolateral corners of vertex; a pair of short obliquely longitudinal fasciae between postclypeus and compound eyes; and a pair of narrow fasciae along compound eyes. Distance between lateral ocelli and compound eyes about twice the distance between lateral ocelli. Antenna mostly castaneous but pedicel and scape black to fuscous. Postclypeus not swollen anteriorly; ochraceous with a medial longitudinal black fascia, wider anteriorly, a pair of large spots antero-laterally through anterior five transverse grooves, which are connected to the medial longitudinal fascia, and short transverse fasciae along lateral parts of the remaining transverse grooves. Anteclypeus black except ochraceous median ridge. Rostrum ochraceous but darkened towards apex to become black apically; with apex reaching medial part of posterior margin of abdominal sternite II. Lorum black except ochraceous anterior and lateral margins. Gena black to dark brown with dull brown spot on posterior margin.

Thorax. Pronotum ochraceous to greenish ochraceous. Inner area of pronotum with the following black to fuscous marks: posteromedial inverted T mark; indistinct spot on anteromedial part of inner area; irregularly shaped marks along paramedian fissures; a pair of irregularly shaped marks along lateral fissures; and a pair of curved fasciae along lateral margins of inner area. Pronotal collar darkened anteriorly and laterally on both sides. Anterolateral pronotal collar broadly developed and roundly angulated with an angle of 100–110°, expanding to a width much greater than the widest width of posterior pronotum, mesonotum and abdomen. Mesonotum reddish ochraceous with the following black marks: median longitudinal fascia, with its posterior end widened and reaching anterior margin of cruciform elevation, but its anterior end not reaching anterior margin of mesonotum; a pair of small roundish spots enclosing scutal depressions; a pair of large semicircular spots on submedian sigilla, with their anterior ends reaching anterior margin of mesonotum; and a pair of long inverted triangular marks on lateral sigilla, with their anterior ends reaching anterior margin of mesonotum. Cruciform elevation ochraceous to greenish ochraceous. Fore-, mid- and hind trochanters and femora brown to dark brown.

Wings. Fore wing outer margin (not anterior margin) slightly curved outwardly (not straight or linear). Fore wing with venation ochraceous to reddish ochraceous, darker apically; furnished with white patch on about basal two-fifths to one-half (hyaline on remaining part: about apical half) and with the following infuscations: three spots on radial cell; mark on both ends of both ulnar cells 1 and 2; rather indistinct marks on basal half and tiny spot on apical end of ulnar cell 3; indistinct small marks on medial cell; mark on both apical and basal ends of apical cell 1; irregularly shaped small marks on subapical parts of apical cells 2–7, sometimes indistinct; one or two tiny dots on apical ends of apical cells 2–7; two spots on apical end of apical cell 8. Basal membrane dark grey with light green or green margin. Hind wing fuscous except outer marginal area and apical portion of apical cells 1–6. Anal cell 2 fuscous on about basal one-third to two-thirds. Anal cell 4 fuscous on about basal half to two-thirds. Anal cell 5 fuscous on about basal half to two-thirds. Hind wing jugum light grey with light green margin.

Operculum mostly fuscous except greenish ochraceous margin; semicircular, transversely wide; short, nearly reaching posterior margin of abdominal sternite II. Opercula overlapping medially.

Abdomen obconical in dorsal view, short, about as long as or slightly shorter than head and thorax together; mostly black with narrow greenish ochraceous caudal margin on each of tergites 3–8. Timbal cover black to fuscous with greenish ochraceous inner anterior margin; semicircular, wider than long. Timbal concealed by timbal cover in dorsal and lateral views. Abdominal sternites mostly black with greenish ochraceous caudal margin on each of sternites III–VI.

Genitalia. Pygofer long ellipsoidal with acuminate apex (wide dorsal beak) in ventral view. Uncus simple, not bifurcate, with apical margin rounded. Aedeagus not tapering down to apex, with short subapical process.

Description of female

Head, thorax and wings similar to male. Abdomen obconical in dorsal view, short, shorter than head and thorax together; mostly black with narrow greenish ochraceous to dull brown (probably due to discoloration) caudal margin on each of tergites 3–7. Abdominal sternites mostly black with greenish ochraceous caudal margin on each of sternites III–VI. Abdominal sternite VII with a pair of large paramedian patches, extending to posterior margin. Gonocoxite IX greenish ochraceous to dull brown (probably due to discoloration). Ovipositor not extending beyond dorsal beak.

Song (Figure 3)

About 500 s of song was recorded from uncollected males on 1–2 May 2012, at three locations on Mt. Kitanglad, including the paratype location. The sound is a continuous whining buzz with a rapid frequency modulation. Pulses are regularly produced at a rate of 434–450/s. Pulse amplitude more than doubles across oscillations that occur at a rate of 35–40/s, with the peak frequency subtly shifting within the range 8–9 kHz across these cycles. Most sound energy lies within the range 7.5–10 kHz. The distinguishing features of the song are discussed along with those of the next species below.

2. *Platycleura minima* Lee and Marshall sp. nov.

(Figures 4, 5, 6(A))

Type material

Holotype. Male, specimen code 12.PH.MN.MUS.06, PHILIPPINES, Mindanao, Bukidnon, Maramag, Mt. Musuan, 7°52.62'N, 125°4.19'E, 21 April 2012, K.B.R. Hill, D.C. Marshall and A. B. Mohagan (NMPM).

Etymology

The specific name is the feminine form of the Latin adjective *minimus* meaning 'smallest' or 'least', in reference to the black and grey patterns on the wings, which is the lightest or least infuscated among the Philippine species of *Platycleura*.

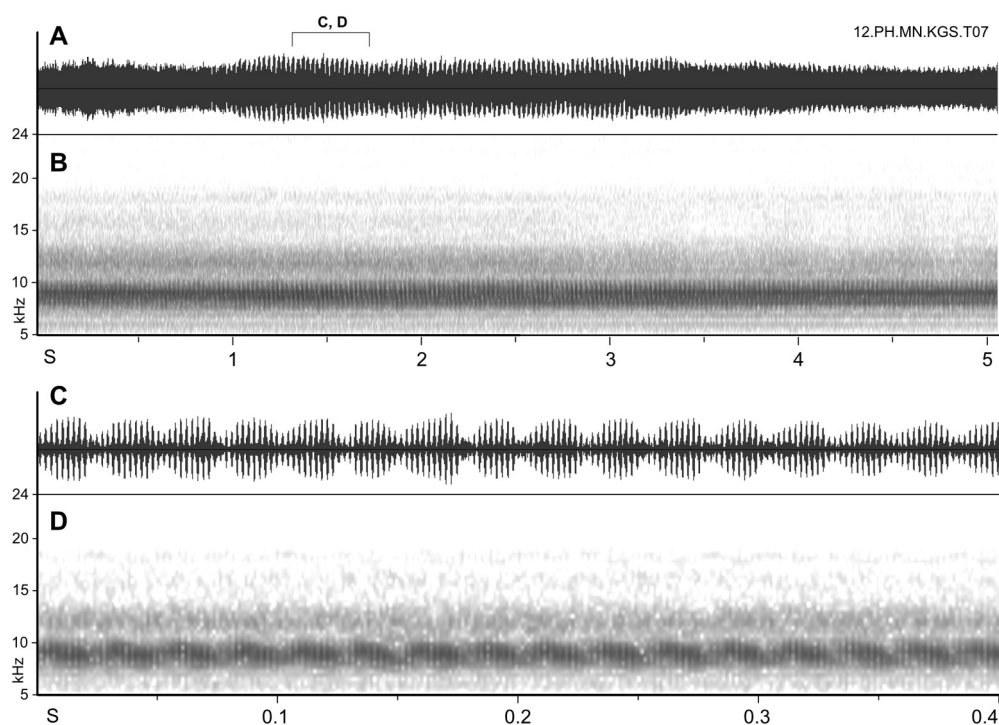


Figure 3. *Platyleura bella* Lee and A. Mohagan sp. nov. Waveforms (A, C) and spectrograms (B, D) of male calling song at two time scales. Sound energy above 11 kHz is mainly background noise.

Measurements of type (1 male)

Length of body: 18.7. Length of head and thorax together: 9.6. Length of abdomen: 9.1. Width of head including compound eyes: 8.3. Width of pronotum: 10.3. Width of mesonotum: 7.9. Width of abdominal tergite 3: 8.4. Length of fore wing: 25.5. Width of fore wing: 9.2. Wing span: 59.1.

Diagnosis

This new species is very similar to *Platyleura bella* Lee and A. Mohagan sp. nov. but smaller in body size (outside of the range of all the body part sizes of the available male specimens of *P. bella*) and has less infuscation on the fore wing and the hind wing with some distinguishing points: anal cell 2 fuscous on about basal one-fourth (vs fuscous on about basal one-third to two-thirds in *P. bella*); anal cell 4 fuscous on about basal one-third (vs fuscous on about basal half to two-thirds in *P. bella*); anal cell 5 fuscous on about basal one-third (vs fuscous on about basal half to two-thirds in *P. bella*); longitudinal length of light greenish ochraceous portion of tergite 8 long, about four times as long as black portion (vs very short, shorter than one-third as long as black portion in *P. bella*); and timbal cover mostly greenish ochraceous (vs mostly black to fuscous in *P. bella*).

The calling songs are readily distinguishable from each other, as discussed below.

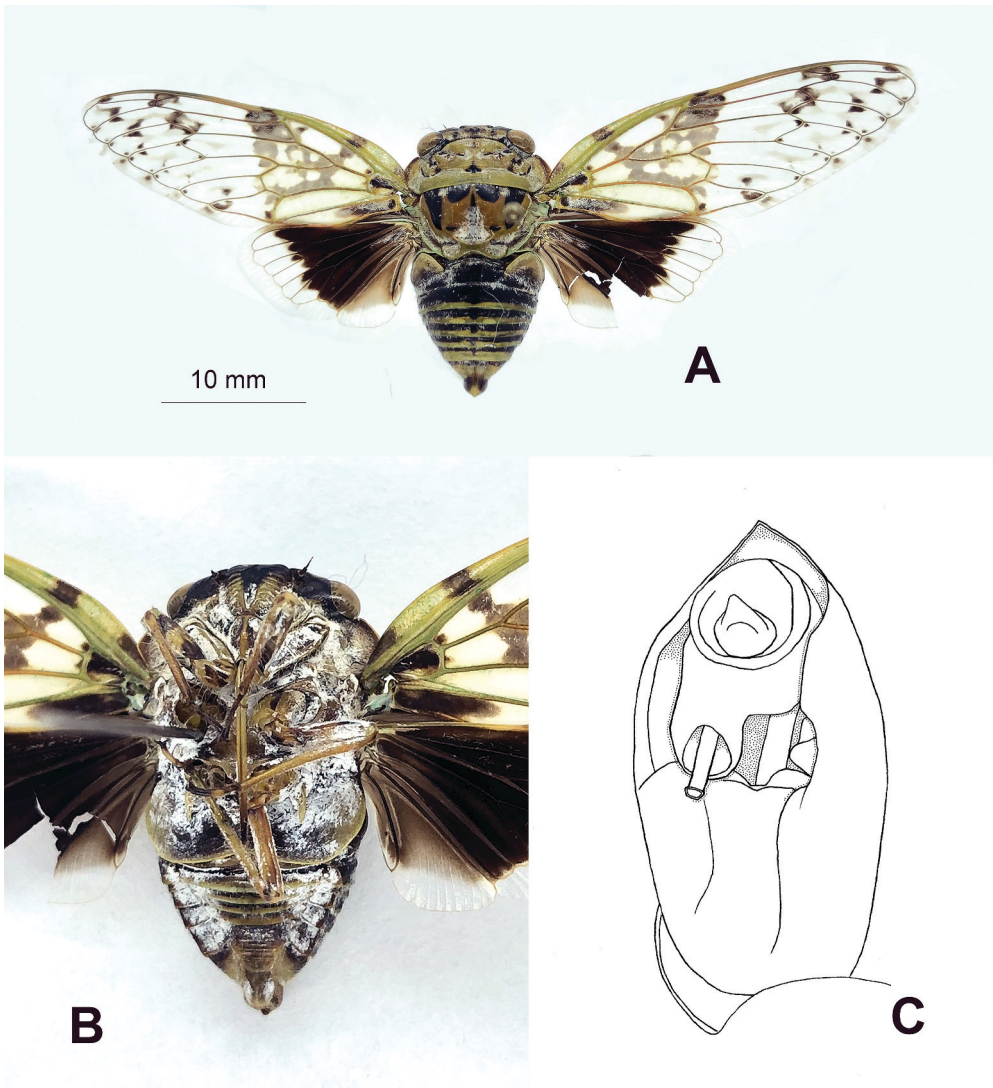


Figure 4. *Platypleura minima* Lee and Marshall sp. nov., holotype, male, Mindanao, Philippines. (A) Dorsal habitus; (B) ventral habitus; (C) pygofer, oblique ventral view.

Description of male

Head. Vertex slightly greenish ochraceous with the following black marks: median large spot enclosing ocelli, with its anterior end reaching anterior margin of vertex; a pair of small longitudinal spots between lateral ocelli and compound eyes; a pair of small spots on posterolateral corners of vertex; a pair of short obliquely longitudinal fasciae between postclypeus and compound eyes; and a pair of narrow fasciae along compound eyes. Distance between lateral ocelli and compound eyes distinctly longer than twice the distance between lateral ocelli. Antenna mostly castaneous but pedicel fuscous. Postclypeus not swollen anteriorly; greenish ochraceous with a medial longitudinal black fascia, wider anteriorly, and transverse fasciae along transverse grooves, becoming indistinct going posteriad. Anteclypeus dull brown except ochraceous median ridge. Rostrum slightly greenish

ochraceous but darkened towards apex to become black apically; with apex not reaching medial part of posterior margin of abdominal sternite II. Lorum black except ochraceous anterior and lateral margins. Gena black to fuscous with greenish ochraceous spot on posterior margin.

Thorax. Pronotum ochraceous to greenish ochraceous. Inner area of pronotum with the following black to fuscous marks: posteromedial inverted T mark; indistinct spot on anteromedial part of inner area; rather indistinct irregularly shaped marks along paramedian fissures; a pair of irregularly shaped marks along lateral fissures; and a pair of curved fasciae along lateral margins of inner area. Pronotal collar darkened anteriorly and laterally on both sides. Anterolateral pronotal collar broadly developed and roundly angulated with an angle of 100–110°, expanding to a width much greater than the widest width of posterior pronotum, mesonotum and abdomen. Mesonotum reddish ochraceous with the following black marks: median longitudinal fascia, with its posterior end widened and reaching anterior margin of cruciform elevation, but its anterior end not reaching anterior margin of mesonotum; a pair of small transverse spots enclosing scutal depressions; a pair of large semicircular spots on submedian sigilla, with their anterior ends reaching anterior margin of mesonotum; and a pair of long inverted triangular marks on lateral sigilla, with their anterior ends reaching anterior margin of mesonotum. Cruciform elevation greenish ochraceous. Fore-, mid- and hind trochanters and femora brown to dark brown.

Wings. Fore wing outer margin slightly curved outwardly (not straight or linear). Fore wing with venation ochraceous to reddish ochraceous, darker apically; furnished with white patch on about basal two-fifths to one-half (hyaline on remaining part: about apical half) and with the following infuscations: three spots on radial cell; mark on both ends of both ulnar cells 1 and 2; rather indistinct marks on basal half and tiny spot on apical end of ulnar cell 3; indistinct small marks on medial cell; mark on both apical and basal ends of apical cell 1; irregularly shaped small marks on subapical parts of apical cells 2–7, sometimes indistinct; one or two tiny dots on apical ends of apical cells 2–7; and two spots on apical end of apical cell 8. Basal membrane dark grey with light green margin. Hind wing fuscous except outer marginal area and apical portion of apical cells 1–6. Anal cell 2 fuscous on about basal one-fourth. Anal cell 4 fuscous on about basal one-third. Anal cell 5 fuscous on about basal one-third. Hind wing jugum grey with light green margin.

Operculum mostly fuscous except greenish ochraceous margin; semicircular, transversely wide; short, nearly reaching posterior margin of abdominal sternite II. Opercula overlapping medially.

Abdomen obconical in dorsal view, short, slightly shorter than head and thorax together; mostly black with light greenish ochraceous caudal margin on each of tergites 3–7. Tergite 8 mostly light greenish ochraceous except for narrow anterior part, with longitudinal length of light greenish ochraceous portion about four times as long as black portion. Timbal cover mostly greenish ochraceous with black to fuscous patch posteriorly; semicircular, wider than long. Timbal concealed by timbal cover in dorsal and lateral views. Abdominal sternites black with greenish ochraceous to dull brown caudal margin on each of sternites II–VII.

Genitalia. Pygofer long ellipsoidal with acuminate apex (wide dorsal beak) in ventral view. Uncus simple, not bifurcate, with apical margin rounded. Aedeagus not tapering down to apex.

Song (Figure 5)

About 103 s of song was recorded from uncollected males at Mt. Musuan, Bukidnon, on 21 April 2012, at 11:05 AM. An additional 95 s of song was recorded on 7 July 2010, at the same location, although no specimens were collected. The sound is a continuous frequency-modulated whining buzz, similar in quality to a car alarm. Pulses of approximately uniform amplitude are regularly produced at about 435–455 pulses/s in the 2012 recordings, and at 380 pulses/s in the 2010 recording. The sound sweeps upward and downward (the latter more slowly) in pitch at about 3.7–3.8 cycles/s in all recordings, with amplitude subtly shifting concordantly. Most sound energy lies within the range 6.5–12.5 kHz, with the peak shifting from about 8.5 to about 9.5 kHz across the cycles.

Males sang from the upper surface of lateral branches of an *Acacia mangium* tree with the head elevated and the abdomen and wings angled downward. This together with their lichenlike colour pattern contributed to making them difficult to locate.

The song of *P. minima* differs from that of *P. bella* in the much slower rate of concordant amplitude and frequency oscillation, ca. 3.7–3.8 cycles/s (vs 35–40 cycles/s in *P. bella*). This rate difference, nearly an order of magnitude, is not likely to be caused by environmental temperature differences during recording because the underlying pulse rate is similar for

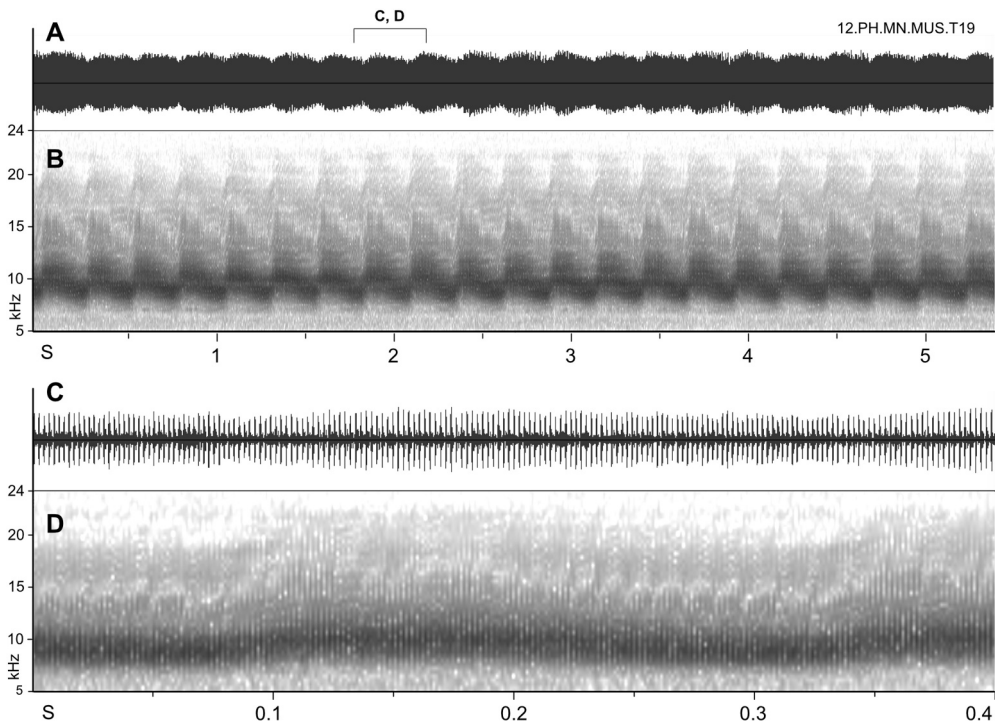


Figure 5. *Platyleura minima* Lee and Marshall sp. nov. Waveforms (A, C) and spectrograms (B, D) of male calling song at two time scales.

both species. Furthermore, some platypleurine species have been shown to thermoregulate (e.g. Sanborn et al. 2004), which reduces the significance of environmental temperature.

Remarks

Endo and Hayashi (1979) reported *Platypleura* sp. aff. *nobilis* (Germar, 1830) (TL: Java) based on a male specimen collected from Mt. Apo. Lee (2010) identified the specimen as *P. elizabethae*. However, this record is more likely to be *Platypleura minima* because the cloudy patterns on the wings of *Platypleura nobilis* are more similar to those of *P. minima* than to *P. bella*, *P. elizabethae* or *P. transitiva*, which was misidentified as *P. elizabethae* by Lee (2010, 2015).

The dorsal habiti of male specimens of several Philippine *Platypleura* species are shown in Figure 6 for comparison.

3. *Platypleura transitiva* Lee, 2021

(Figure 6(D))

Platypleura elizabethae: Lee 2010: 15, fig. 1A, B; Lee 2015: 546; Lee et al. 2016: 190 (nec Lee 2009b).

Platypleura transitiva Lee 2021: 261–263, figs 1, 2(B) [TL: Surigao del Sur, Mindanao, Philippines].

Distribution

Philippines (Mindanao).

Genus *Hamza* Distant, 1904

4. *Hamza ciliaris* (Linnaeus, 1758)

Hamza ciliaris: Lee 2010: 15, fig. 1C, D; Lee 2015: 546.

Distribution

Philippines (Mindanao), Palau and Indonesia (Maluku, Timor and Banggai Archipelago).

Tribe **CRYPTOTYMPANINI** Handlirsch, 1925

Genus *Chremistica* Stål, 1870

Remarks

With the presence of the claspers and the long lateral lobes in the male pygofer, the following three species seem to belong to the *Chremistica tridentigera* species group, as suggested by Bregman (1985) and Yaakop et al. (2005), together with other Philippine species such as *Chremistica semperi* Stål, 1870 and *Chremistica tagalica* (Stål, 1870).

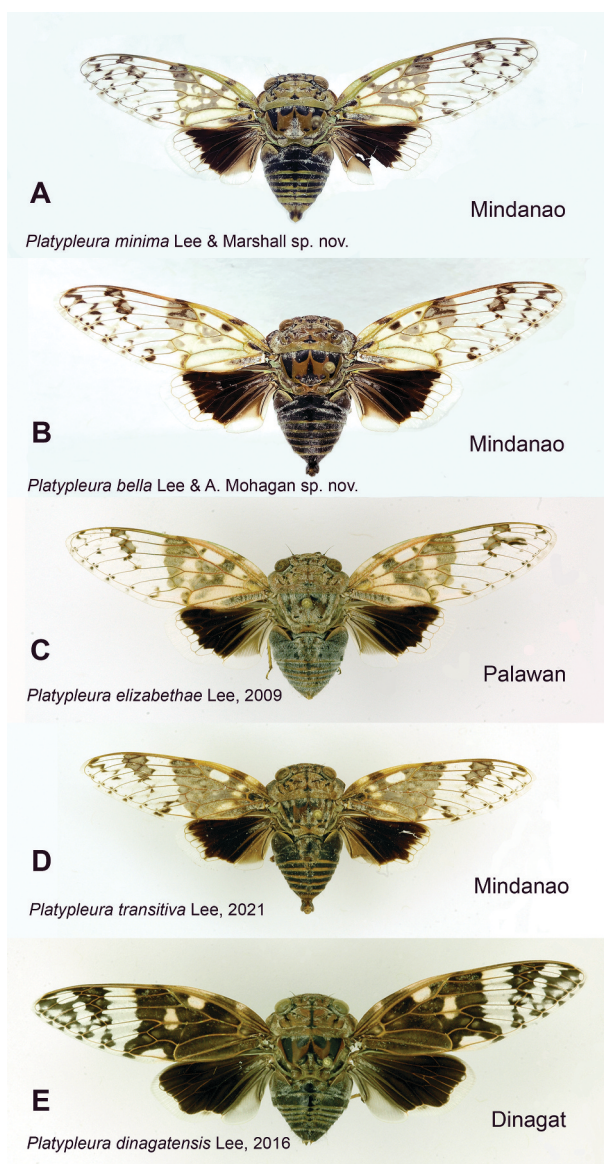


Figure 6. Male dorsal habitus of the *Platycleura* species from the Philippines. (A) *Platycleura minima* Lee and Marshall sp. nov.; (B) *Platycleura bella* Lee and A. Mohagan sp. nov.; (C) *Platycleura elizabethae* Lee, 2009; (D) *Platycleura transitiva* Lee, 2021; (E) *Platycleura dinagatensis* Lee, 2016.

5. *Chremistica kyoungheae* Lee 2010

Chremistica kyoungheae Lee 2010: 16–18, fig. 2; Lee 2015: 546.

Distribution

Philippines (Dinagat and Mindanao).

6. *Chremistica minor* Bregman, 1985

Chremistica minor: Lee 2010: 16; Lee 2015: 546.

Distribution

Malaysia (peninsular Malaysia and Sarawak), Indonesia (Kalimantan) and Philippines? (Mindanao?).

Remarks

Bregman (1985, p. 48) stated that ‘Two female specimens from Mindanao, Philippines showed great resemblance to the male types of *C. minor*. It is not quite certain whether these females indeed belong to *C. minor*’. *Chremistica minor* has not been found in Mindanao or any other part of the Philippines by the present authors or by any other authors after Bregman (1985). We suspect that *C. minor* (TL: Kalimantan, Indonesia) is not distributed in Mindanao. As the body colouration of *C. minor* somewhat resembles that of *Chremistica kyoungheeeae*, it is possible that the two Mindanao females noted by Bregman (1985) are specimens of *C. kyoungheeeae*.

7. *Chremistica flavialata* Lee and Marshall sp. nov.

(Figures 7, 8)

Type material

Holotype. Male, specimen code 12.PH.MN.MUS.15, PHILIPPINES, Mindanao, Bukidnon, Maramag, Mt. Musuan, 7°52.62’N, 125°4.19’E, 5 May 2012, K.B.R. Hill, D.C. Marshall and A.B. Mohagan (NMPM).

Paratypes. 1 male, PHILIPPINES, Mindanao, Bukidnon, Maramag, Bayabason, P4B, 8 May 2012, R. Estorco and A.B. Mohagan (UCONN); 3 males, PHILIPPINES, Mindanao, Malaybalay City, San Martin, 24 August 2010, A.B. Mohagan (UCONN).

Etymology

The specific name is the Latin prefix *flavi-*, meaning ‘yellowish’, plus the feminine form of the Latin adjective *alata*, meaning ‘winged’, in reference to the wings of this species, which are deeply tinged with yellowish brown.

Measurements of types (5 males)

Length of body: 33.8 (31.9–37.1). Length of head and thorax together: 15.9 (15.0–16.9). Length of abdomen: 17.9 (16.4–20.2). Width of head including compound eyes: 12.8 (12.4–13.5). Width of pronotum: 13.3 (12.5–14.1). Width of mesonotum: 11.2 (10.7–11.7).

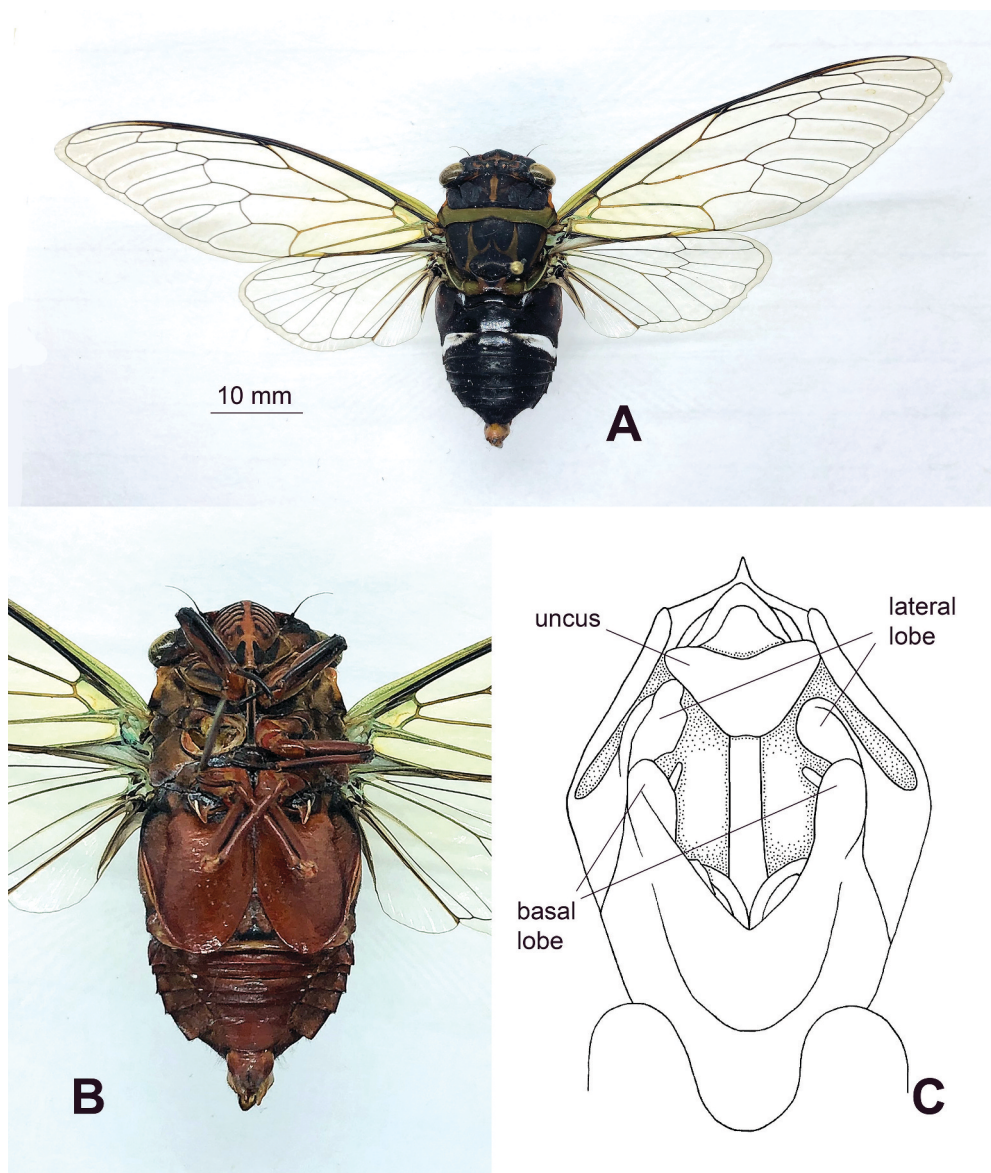


Figure 7. *Chremistica flavialata* Lee and Marshall sp. nov., male, Mindanao, Philippines. (A) Dorsal habitus of holotype; (B) ventral habitus of holotype; (C) pygofer, ventral view.

Width of abdominal tergite 3: 13.2 (12.7–13.9). Length of fore wing: 42.0 (39.3–45.6). Width of fore wing: 13.7 (12.9–14.7). Wing span: 94.3 (88.2–102.3).

Description of male

Head. Eyes slightly narrower than pronotum (including pronotal collar). Vertex black with the following reddish-brown marks, sometimes interrupted or incomplete: a pair of T-shaped marks between ocelli and compound eyes; and a pair of inverted L-shaped marks between

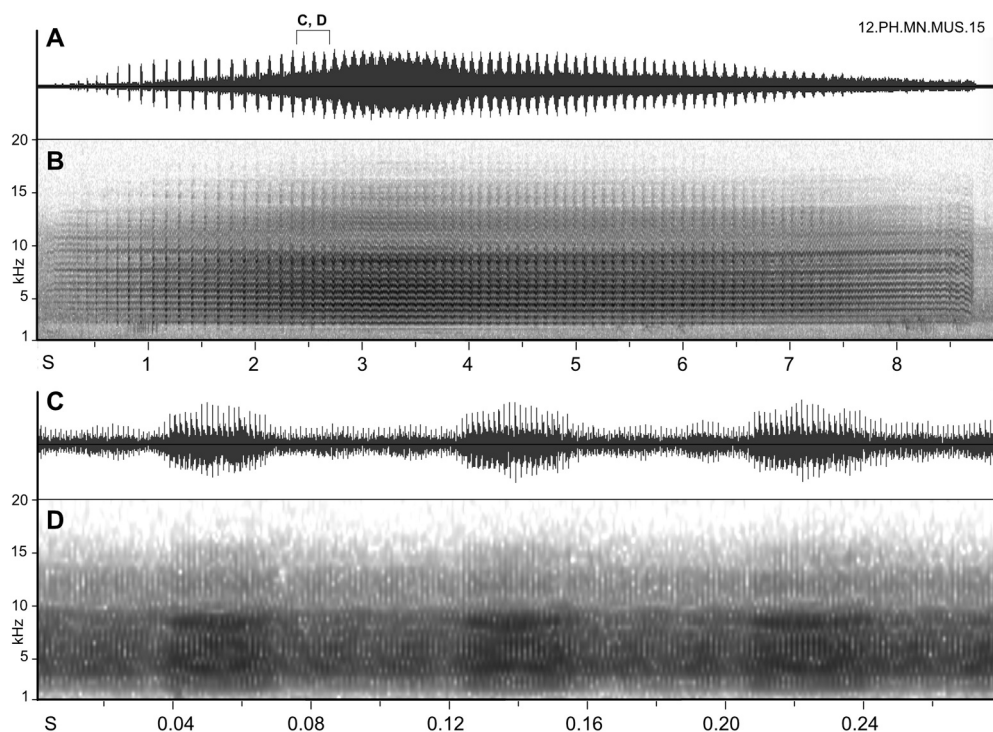


Figure 8. *Chremistica flavialata* Lee and Marshall sp. nov., holotype male calling song. Waveforms (A, C) and spectrograms (B, D) are shown at two time scales.

postclypeus and compound eyes. Distance between lateral ocelli and compound eyes distinctly longer than distance between lateral ocelli. Antenna black to fuscous. Postclypeus moderately swollen. Postclypeus black in about anterior one-fourth but reddish brown (or dull ochraceous in discoloured specimens) in remaining part with black transverse fasciae along transverse grooves. Anteclypeus reddish brown with a pair of large elliptical black marks occupying most of the anteclypeus except for median longitudinal part and anterior and posterior margins. Rostrum reddish brown to ochraceous but black apically and with longitudinal median fascia on labium; nearly reaching posterior margin of hind coxae. Lorum dull brown to ochraceous with a large black patch on inner corner. Gena reddish brown to ochraceous with broad black patch on anterior margin.

Thorax. Inner area of pronotum black to fuscous with a pair of narrow transverse ochraceous fascia on anterior margin and median longitudinal thick ochraceous fascia, and irregularly spread dull purplish patches. Pronotal collar dull light green (or ochraceous in discoloured specimens) with dull ochraceous antero-lateral part and a pair of branch-like black marks derived from lateral corner of inner area. Anterolateral pronotal collar slightly developed and roundly angulated. Mesonotum black with the following dull greenish ochraceous (or reddish ochraceous in discoloured specimens) marks: median W-shaped mark along outside of submedian sigilla, extending to anterior arms of cruciform elevation; and a pair of longitudinal marks along lateral margin of mesonotum, connected to the median W-shaped mark posteriorly. Cruciform elevation reddish brown

(dull brown in discoloured specimens) medially but dull light green (ochraceous in discoloured specimens) laterally with the following black marks: antero-median spot; narrow fascia along posterior margin; and a pair of spots on middle of anterior arms. Thoracic sternites dull brown to dull ochraceous with some black trivial marks. Legs reddish brown to ochraceous. Fore femur with a small subapical spine as well as primary and secondary spines; with black to fuscous fascia along midline of ventral side. Fore tibia black to fuscous. Fore- and mid tarsi mostly black to fuscous. Fore-, mid- and hind pretarsal claws fuscous apically.

Wings hyaline, tinged slightly with greenish yellow, especially basally. Fore wing venation dull greenish ochraceous (ochraceous in discoloured specimens) basally and brownish to fuscous apically, without infuscation. Basal cell more tinged with green. Basal membrane grey (tinged with green in fresh specimens). Hind wing jugum grey.

Operculum reddish brown with black antero-lateral margin; much longer than wide, with slightly oblique and convex lateral margin and rounded apical margin; nearly reaching or slightly passing beyond posterior margin of abdominal sternite II. Opercula meeting medially.

Abdomen slightly longer than head and thorax together; black with a pair of narrow white pubescent fasciae along anterior margin of tergite 3. Abdominal tergite 3 wider than head including compound eyes. Timbal cover tinged with purple, wider than long. Abdominal sternites mostly reddish brown, but sternite II ochraceous to reddish ochraceous or greenish ochraceous with fuscous mark.

Genitalia. Pygofer diamond-shaped in ventral view with angles rounded. Uncus shaped like flower shovel, with roundly pointed apex and without lateral protrusions. A pair of claspers originating from lateroventral uncus hidden behind uncus and lateral lobes. Aedeagus without subapical or ventral processes. Basal lobe of pygofer long, with roundish apex and with slender finger- or thumb-like protrusion branching out at subapical inner part of the basal lobe. Lateral lobe present, much longer than basal lobe and obliquely covering basal lobe. Dorsal beak narrowly triangular.

Remarks

This new species is similar to *Chremistica tagalica* (Stål, 1870) (TL: Philippine Islands) in marks and colours on the body but can be distinguished from *C. tagalica* mainly by the following characteristics: head comparatively narrow (vs wider than width of pronotal collar in *C. tagalica*); pronotal collar with short and wide triangular black mark on medio-posterior margin (vs without such a mark in *C. tagalica*); male abdomen comparatively wide or thick, with tergite 3 wider than head including compound eyes (vs comparatively narrow or slender, with tergite 3 narrower than head including compound eyes in *C. tagalica*); transverse white marks on abdominal tergite 3 narrow (vs broader, covering whole tergite 3 laterally, in *C. tagalica*); uncus without bumps on underside (vs with bumps in *C. tagalica*); and, finally and most importantly, basal lobe of pygofer with slender finger- or thumb-like protrusion branching out at subapical inner part of the basal lobe (vs with very short protrusion at subapical inner part of the basal lobe in *C. tagalica*).

Song (Figure 8)

The holotype male was recorded for about 102 s at 2.58pm on 5 May 2012. A further recording of 103 s of anonymous males from the same location on 7 July 2010 was also examined. Song

is produced in phrases of 9.5–11.5 s duration, separated by slightly shorter gaps. A song phrase contains a complex range of 12–13 major frequency bands appearing at intervals of about 0.65 kHz from 1.8–8.9 kHz, with the middle frequencies being the loudest (much weaker bands extend beyond this range). The acoustic character of the song is dominated by a synchronised sharp frequency and amplitude modulation of about 8–9 cycles/s at the beginning of the phrase, accelerating to 12/s during the middle section, which is also louder, and then slowing again. The spectrum of frequencies also shifts slightly downward in concert by about 100–200 Hz during the central section of the phrase, and then rebounds. Sound pulses produced at about 588–606/s form the most basic structure of the song.

Genus *Cryptotympana* Stål, 1861

8. *Cryptotympana consanguinea* Distant 1916

Cryptotympana consanguinea: Lee 2010: 19; Lee 2015: 546.

Distribution

Philippines (Dinagat, Mindanao and Basilan).

Tribe **DUNDUBIINI** Distant, 1905

Subtribe **DUNDUBIINA** Distant, 1905

Genus *Dundubia* Amyot and Audinet-Serville, 1843

9. *Dundubia vaginata* (Fabricius, 1787)

Dundubia vaginata: Lee 2010: 24; Lee 2015: 546.

Distribution

S. China, Philippines (Luzon, Sibuyan, Panay, Palawan, Dinagat and Mindanao), Malay Archipelago, S. Myanmar and India.

Genus *Champaka* Distant, 1905

10. *Champaka nigra* (Distant, 1888)

Champaka nigra: Lee 2010: 25, fig. 6C, D; Lee 2015: 547.

Distribution

Philippines (Luzon, Sibuyan, Samar and Mindanao).

11. *Champaka virescens* (Distant, 1905)

Champaka virescens: Lee 2010: 25; Lee 2015: 547.

Distribution

Philippines (Luzon, Camiguin Island north of Luzon, Negros, Samar, Mindanao and Basilan) and Borneo.

12. *Chompaka solivenae* Lee, 2015

Chompaka solivenae Lee 2015: 548–550, fig. 1.

Additional material examined

1 male, specimen code 12.PH.MN.KGS.10, PHILIPPINES, Mindanao, Mt. Kitanglad, 1773 m, 08°09.91'N, 124°55.96'E, 2 May 2012, K.B.R. Hill, D.C. Marshall and D. Mohagan (UConn); 1 male, PHILIPPINES, Mindanao, Cotabato, Mt. Apo, small volcano, 6374 feet, 07°00.49'N, 125°15.28'E, 20 May 2010, D. Mohagan (UConn).

Distribution

Philippines (Mindanao).

Subtribe *Orientopsaltriina* Lee 2014**Genus *Orientopsaltria* Kato, 1944****13. *Orientopsaltria inermis* (Stål, 1870)**

Orientopsaltria inermis: Lee 2010: 22–24, fig. 6A, B; Lee 2015: 550.

Distribution

Philippines (Samar, Camiguin and Mindanao).

Additional material examined

2 males, PHILIPPINES, Mindanao, Cotabato, Mt. Apo, Agro-ecosystem (Sudsuwayan), 25 May 2010, D. Mohagan (UConn).

14. *Orientopsaltria fuliginosa* (Walker, 1850)

Orientopsaltria fuliginosa: Lee 2010: 24; Lee 2015: 550.

Distribution

Philippines (Luzon, Mindoro, Homonhon, Samar, Leyte, Panay, Negros, Mindanao and Basilan).

Tribe *ONCOTYMPANINI* Ishihara, 1961**Genus *Oncotympana* Stål, 1870****Remarks**

Currently, *Oncotympana* includes nine species, all from the Philippines: *O. pallidiventris* Stål, 1870 (Samar and Mindanao), *O. grandis* Lee, 2010 (Luzon), *O. viridicincta* Stål, 1870 (Philippines) [= *O. consobrina* (Distant, 1906)], *O. nigristigma* (Walker, 1850) (Philippines),

O. capitulum Lee and Mohagan, 2021 (Negros), *O. simonae* Lee, 2010 (Luzon), *O. brevis* Lee, 2010 (Luzon), *O. undata* Lee, 2010 (Luzon) and *O. averta* Lee, 2011 (Mindanao). Lee and Mohagan (2021) provided a key to the nine species. With the new species described below, *Oncotympana* now has 10 species.

15. *Oncotympana averta* Lee, 2011

Oncotympana sp.: Lee 2010: 20.

Oncotympana averta Lee, 2011: 168–169 [TL: Philippines]; Lee 2015: 550–551.

Distribution

Philippines (Mindanao).

Additional material examined

1 male, PHILIPPINES, Mindanao, Cotabato, Mt. Apo, small volcano, 6374 feet, 07°00.49'N, 125°15.28'E, 20 May 2010, D. Mohagan (UCONN); 2 males, same data except for 20–23 May 2010 (UCONN); 3 males, same data except for 20–24 May 2010 (UCONN).

16. *Oncotympana obesa* Lee and Marshall sp. nov.

(Figures 9, 10)

Oncotympana cf. *averta*: Hill et al. 2021: table 1, figs 4, 12, 14.

Type material

Holotype. Male, specimen code 12.PH.MN.KGC.01, PHILIPPINES, Mindanao, ca. 1/2 h up trail to Mt. Kitanglad, 1776 m, 08°09.81'N, 124°55.95'E, 1 May 2012, K.B.R. Hill, D.C. Marshall and D. Mohagan (NMPM).

Paratypes. 2 males, PHILIPPINES, Mindanao, Bukidnon, Mt. Kiamo, 7 May 2012, A.B. Mohagan (UCONN); 2 males, PHILIPPINES, Mindanao, Mt. Kitanglad, 1773 m, 08°09.91'N, 124°55.96'E, PH.MN.KGS, 3 May 2012 (UCONN).

Etymology

The specific name is the Latin feminine adjective *obesa*, meaning 'fat', 'obese', 'plump' or 'swollen'.

Measurements of types (5 males)

Length of body: 22.3 (21.3–23.3). Length of head and thorax together: 11.3 (11.0–11.6). Length of abdomen: 11.0 (10.2–11.7). Width of head including compound eyes: 6.3 (6.1–6.4). Width of pronotum: 8.9 (8.6–9.4). Width of mesonotum: 8.0 (7.7–8.4). Width of abdominal tergite 3: 9.8 (9.7–10.1). Length of fore wing: 31.2 (30.6–32.3). Width of fore wing: 10.0 (9.5–10.2). Wing span: 68.6 (67.1–71.7).

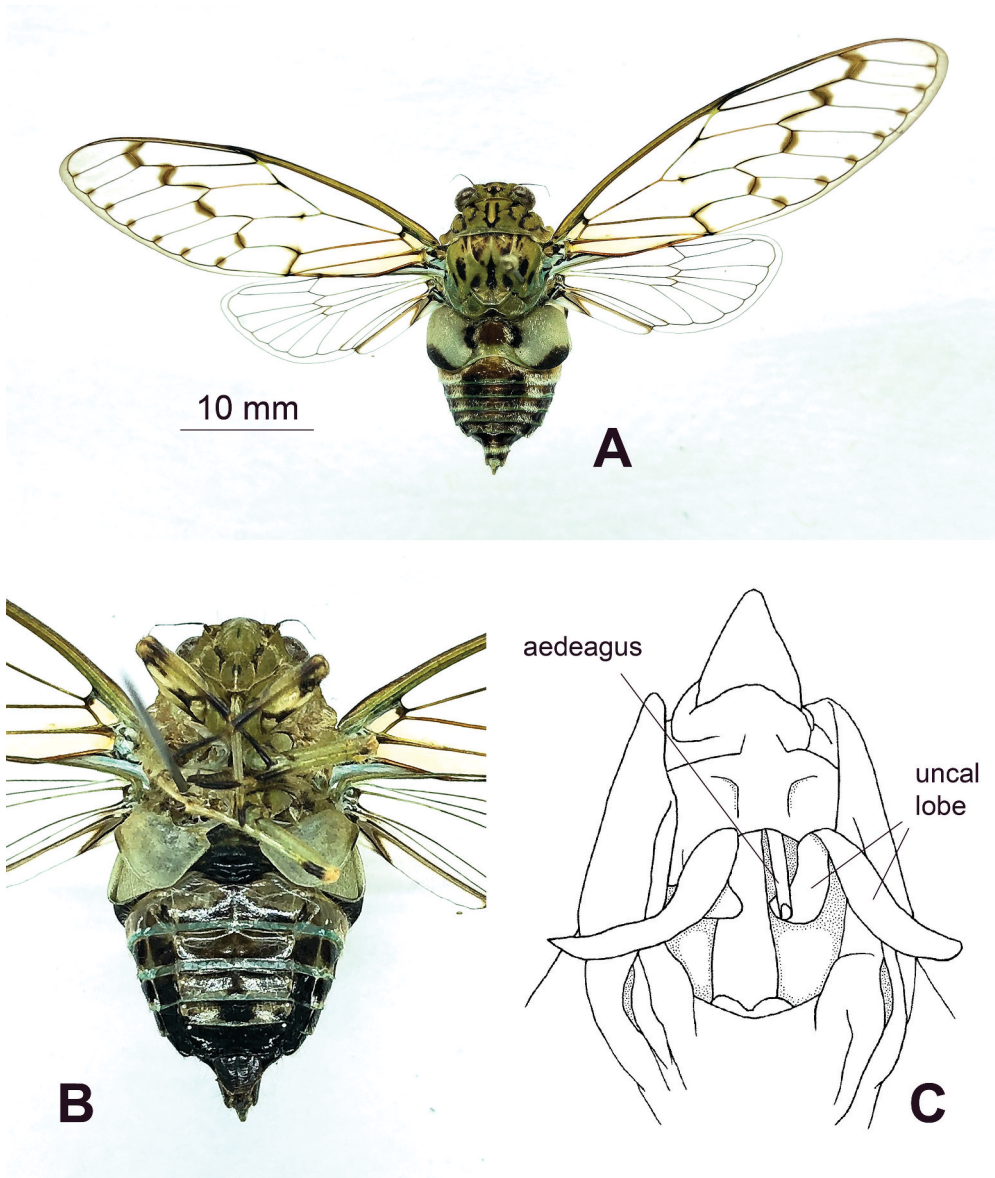


Figure 9. *Oncotympana obesa* Lee and Marshall sp. nov., male, Mindanao, Philippines. (A) Dorsal habitus of holotype; (B) ventral habitus of holotype; (C) pygofer, slightly oblique ventral view.

Diagnosis

This new species resembles *Oncotympana averta* but has a distinctively larger body, more distinct infuscations on the fore wing, a proportionally much larger male abdomen, and differently shaped uncal lobes of the male genitalia, as detailed in the Remarks below.

Description of male

Head. Vertex yellowish green with the following black to dark brown marks: median mark enclosing ocelli, reaching posterior margin of vertex; a pair of spots on supra-

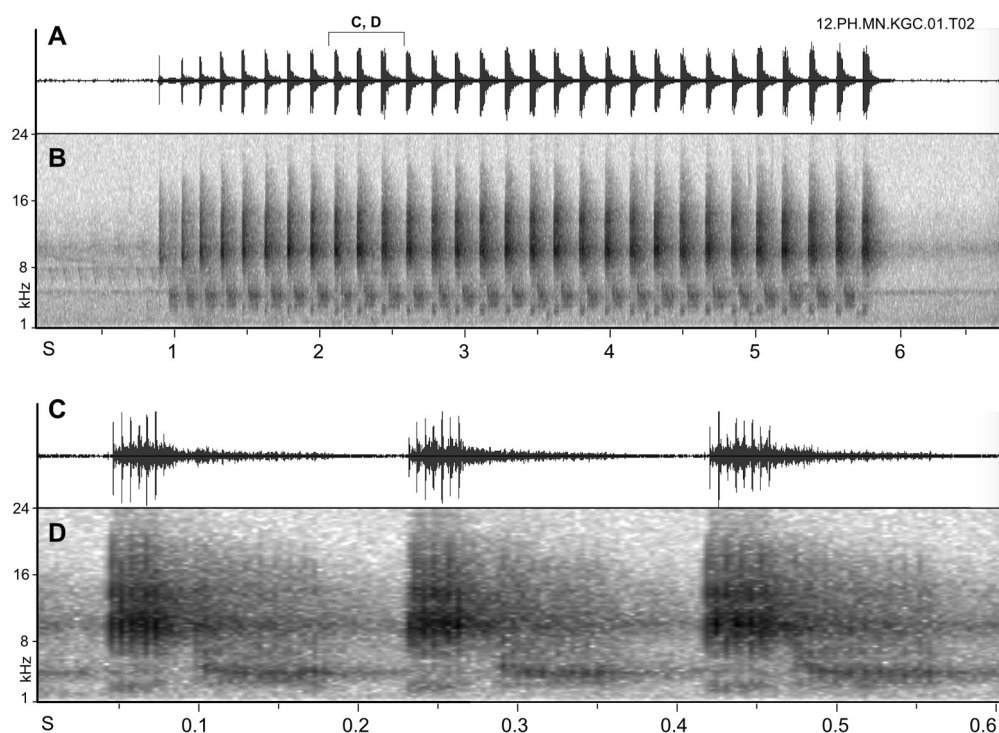


Figure 10. *Oncotympana obesa* Lee and Marshall sp. nov., holotype male calling song. Waveforms (A, C) and spectrograms (B, D) are shown at two time scales.

antennal plates; a pair of obliquely longitudinal small spots on posterolateral corners of vertex; a pair of indistinct tiny spots on anterolateral parts of vertex; and irregularly shaped transverse fascia along anterior margin of vertex. Supra-antennal plates produced anteriad, covering scape. Compound eyes brown in life. Distance between lateral ocelli and compound eyes about twice the distance between lateral ocelli. Antenna mostly black but with dark brown to fuscous pedicel. Postclypeus moderately swollen; yellowish green with a few black to dark brown fasciae along anterior transverse grooves. Anteclypeus ochraceous with a pair of central fuscous spots. Rostrum ochraceous with black apex, passing posterior margin of hind trochanter.

Thorax. Pronotum greenish ochraceous. Inner area of pronotum with the following fuscous marks: a pair of medial longitudinal fasciae not reaching anterior margin of pronotum, broadened near posterior ends and meeting each other at posterior ends; a pair of marks along paramedian fissures; a pair of short longitudinal fasciae between median parts of paramedian fissures and posterior ends of lateral fissures; a pair of marks along lateral fissures; and a pair of curved fasciae along lateral margins of inner area. Pronotal collar with a pair of indistinct marks near posterolateral corners; posterior marginal area very narrow. Anterolateral pronotal collar not dentate but sinuate. Mesonotum greenish ochraceous with the following fuscous to black marks: medial longitudinal fascia reaching anterior margin of cruciform elevation but not reaching

anterior margin of mesonotum; a pair of small roundish spots enclosing scutal depressions; a pair of large obconical paramedian marks on submedian sigilla, indistinct in their inner parts; a pair of long obconical sublateral marks on lateral sigilla, discontinued in the middle; and a pair of small spots on posterolateral corners of mesonotum. Cruciform elevation greenish ochraceous without distinct marks. Thoracic sternites greenish ochraceous. Legs greenish ochraceous to green with some brown parts and black to fuscous marks. Fore femur with primary and secondary spines and minute subapical spines.

Wings hyaline, slightly tinged with brown. Fore wing costal vein mostly ochraceous but fuscous near node. Basal vein of apical cell 1 about one-third to one-fourth as long as longitudinal vein of the apical cell 1. Infuscation present at bases of apical cells 1–5 and 7–8 and on cubitus anterior 2 vein. A distinct spot appearing on each hind margin of radius anterior 2, radius posterior, median 1–4 and cubitus anterior 1 veins, forming a series of spots on subapical margin of fore wing. Basal membrane and base of hind wing jugum greenish (bright blue in life).

Operculum light greenish ochraceous without distinct marks; much wider than long, with rounded posterior apex passing beyond posterior margin of abdominal sternite II and with posterolateral corner almost straight but slightly convex. Opercula separated from each other.

Abdomen obconical in dorsal view, short, shorter than or about as long as head and thorax together. Tergites 2–8 mostly castaneous, with light green to green posterior margins (blue in life). Tergites 2–5 with a pair of fuscous paramedian patches. Tergites 4–8 with a pair of lateral fuscous patches. Posterior margin of tergite 3 much wider than pronotum or mesonotum. Timbal cover dull greenish ochraceous with black to fuscous patch along posterior margin; globose, wider than long, with anterior and posterior inner corners smoothly rounded. Timbal completely concealed by timbal cover in dorsal view. Abdominal sternites II–VIII fuscous, with green posterior margins of sternites III–VI.

Genitalia. Pygofer barrel-shaped in ventral view. Uncus bifurcate. Uncal lobes each divided into two parts: a long external part, and a shorter internal part, which is less than half as long as external part: in ventral view, external parts curved and extended obliquely laterad, and internal parts convexly curved with tips directed inward; in lateral view, external parts convexly curved with tips directed inward, and internal parts curved inward. Aedeagus slender. Dorsal beak long, narrow, about as long as anal styles.

Remarks

This species is very similar to *Oncotympana averta* but can be distinguished from *O. averta* by the following characteristics: body distinctly larger; infuscation present at base of apical cells 4 and 8 (vs absent there in *O. averta*); basal membrane and base of hind wing jugum greenish (vs greyish in *O. averta*); operculum with posterolateral corner almost straight but slightly convex (vs slightly concave in *O. averta*); posterior margin of tergite 3 much wider than pronotum or mesonotum (vs about as wide as or slightly narrower than mesonotum in *O. averta*); abdominal sternites II–VIII fuscous (vs sternites II–V mostly ochraceous but sternites VI–VIII fuscous in *O. averta*); timbal cover globose but more or less flat (vs much more prominently globose in *O. averta*); dark-coloured patch absent on inner corner of timbal cover (vs present in *O. averta*); external parts of uncal lobes curved and extended obliquely laterad in ventral view (vs nearly parallel to each

other but with curved tips extended obliquely laterad in *O. averta*); and internal parts of uncal lobes convexly curved with tips directed inward in ventral view (vs concavely curved with hooked tips extended laterad in *O. averta*).

Song (Figure 10)

Recordings of male calling song totalling 320 s were taken at the type locality (the holotype male is illustrated). Males were recorded producing song in phrases of 4–11 s duration (4–6 most common) comprised of two-syllable echemes repeated at about 5.2–6.5 echemes/s. Note that such values are commonly dependent on temperature. The syllables within each echeme contain strongly contrasting sound frequencies. The first syllable contains most of its sound energy within the range 7–15 kHz, with a peak at about 10 kHz, while the second syllable, which is nearly an order of magnitude quieter than the first, contains sound energy with a peak of 4.5 kHz and a broad shoulder of quieter frequencies ranging from 2–16 kHz. The fundamental sound pulses are produced at about 225/s in the first syllable, which lasts 0.04 s, and slightly faster at about 235/s in the second syllable which is twice as long.

This species sang from low stations on tree trunks in the forest understory in low light conditions, as early as 7.00am. Males could be attracted by mouth-clicks or finger-snaps produced a fraction of a second after the end of the complete song phrase. Immediately after hearing the response, the male would flick his wings with a synchronised timbal click, before turning or moving in the direction of the sound. Several specimens from the paratype series were collected with this technique.

Genus *Neoncotympana* Lee, 2011

17. *Neoncotympana leeseungmoi* Lee 2011

Neoncotympana leeseungmoi Lee 2011: 169–171, fig. 2 [TL: Mt. Kitanlad Intavas, Mindanao]; Lee 2015: 551.

Additional material examined

2 males, specimen code 12.PH.MN.KGS.05 and 12.PH.MN.KGS.06, PHILIPPINES, Mindanao, Mt. Kitanglad, 1773 m, 08°09.91'N, 124°55.96'E, 4 May 2012, K.B.R. Hill, D.C. Marshall, D. Mohagan and T. Catanach (UCONN); 1 female, PHILIPPINES, Mindanao, Cotabato, Mt. Apo, Agro-ecosystem (Sudsuwayan), 25 May 2010, D. Mohagan (UCONN).

Distribution

Philippines (Mindanao).

Tribe LEPTOPSALTRIINI Moulton, 1923

Remarks

Hill et al. (2021) noted molecular phylogenetic evidence of confusion between the tribes Gaeanini Distant, 1905 and Leptopsaltriini Moulton, 1923 and suggested that Gaeanini could perhaps be redefined as a subtribe within Leptopsaltriini. However, in such a case

tribe Gaeanini would take priority since it is the older family group. In this paper, we refrain from synonymising Leptopsaltriini with Gaeanini, awaiting a further comprehensive morphological review.

Subtribe **EUTERPNOSSIINA** Lee, 2013

Euterpnosiina Lee, 2013 in Lee and Emery, 2013: 527–528.

Remarks

The position of the new genus described immediately below is unique and independent from any other known species of Leptopsaltriini in the phylogenetic tree constructed by Hill et al. (2021). Therefore, this genus could form a separate new subtribe within Leptopsaltriini. This genus has very long fore wing apical cells, which is one of its peculiar characteristics within Leptopsaltriini, and has tubercle-like projections only on the sternite III, which is seen only in some members of *Tanna* Distant, 1905 and *Vietanna* Lee and Pham, 2021. This genus is different from the genera of Puranina Lee, 2013 because of the anterolateral pronotal collar which is not dentate, the male abdominal sternite IV which does not have tubercle-like projections, and the aedeagus which is thick apically.

This genus is tentatively placed in Euterpnosiina because the type specimen of the genus was largely grouped with genera of Euterpnosiina in the phylogenetic tree constructed by Hill et al. (2021) in spite of many morphological differences, including the following: timbal cover well developed (vs minute in Euterpnosiina); male abdominal sternite III with tubercle-like projections (vs mostly without them in Euterpnosiina); aedeagus thick (vs thin in Euterpnosiina); and basal lobe of pygofer absent (vs present in Euterpnosiina). Further taxonomic study is required to find its proper subtribe placement.

Genus **Neopurana** Lee and Marshall gen. nov.

Type species

Neopurana bouptera Lee and Marshall sp. nov., monotypic.

Etymology

The generic name is feminine, a combination of the Greek prefix *neo-* meaning ‘new’ and the name of an allied genus, *Purana*.

Description

Body small-sized (24.4 mm long in holotype of the type species). Head including compound eyes (6.8 mm wide in holotype) about as wide as mesonotum (6.7 mm wide in holotype). Postclypeus moderately swollen. Rostrum slightly passing beyond hind coxae. Anterolateral pronotal collar not dentate. Wings hyaline. Fore wing with infuscations on crossveins and along its hind submargin. Fore wing with very long apical cells, with ulnar cell 2 about as long as apical cell 4. Male operculum small, about as long as wide, extending to anterior margin of abdominal sternite III. Opercula widely separated from each other. Male abdomen long obconical, distinctly longer than head and thorax

together. Male abdominal tergite 3 wider than mesonotum. Timbal cover about as long as wide, concealing timbal in dorsal view. Male abdominal sternite III with tubercle-like projection on each posterolateral surface, long protruding posteriorly. Male pygofer oval in ventral view. Uncus simple, short, not bifurcate. Distal shoulder not pointed. Basal lobe of pygofer absent.

Remarks

Neopurana Lee and Marshall gen. nov. resembles various species and species groups of the genus *Purana* Distant, 1905 in the following characters, and especially in the similar-looking marks and patterns on the mesonotum: body small-sized; wings hyaline; male operculum small; and male abdominal sternite III with tubercle-like projection on each lateral surface. However, this genus can be distinguished from *Purana* by the following characteristics: anterolateral pronotal collar not dentate; fore wing with very long apical cells; male abdominal sternite IV without tubercle-like projections; and aedeagus thick apically. This genus can be distinguished from all other genera of Puranina Lee, 2013 by the fore wing with very long apical cells and the aedeagus very thick apically (as illustrated in Figure 11(C)).

18. *Neopurana bouptera* Lee and Marshall sp. nov.

(Figures 11, 12)

Cicadinae sp. C: Hill et al. 2021: table 1, figs 5, 9, 10, 13, 14.

Type material

Holotype. Male, specimen code 12.PH.MN.KGS.01, PHILIPPINES, Mindanao, Mt. Kitanglad, 1773 m, 08°09.91'N, 124°55.96'E, 3 May 2012, K.B.R. Hill, D.C. Marshall and D. Mohagan (NMPM).

Paratype. 1 male, specimen code 12.PH.MN.KGS.02, same collection data (UCONN).

Etymology

The specific name is the feminine noun, a combination of the Greek prefix *bou-* meaning 'large' and the Greek *ptera* meaning 'wing'.

Measurements of types (2 males, holotype is larger)

Length of body: 23.6 (22.7–24.4). Length of head and thorax together: 10.2 (9.8–10.6). Length of abdomen: 13.4 (12.9–13.8). Width of head including compound eyes: 6.6 (6.4–6.8). Width of pronotum: 7.4 (7.0–7.8). Width of mesonotum: 6.5 (6.2–6.7). Width of abdominal tergite 3: 7.5 (7.3–7.7). Length of fore wing: 31.4 (29.4–33.3). Width of fore wing: 9.4 (9.1–9.7). Wing span: 68.1 (64.7–71.5).

Description of male

Head. Vertex light green with the following black marks: median mark surrounding ocelli, with its anterior tip broadened and nearly touching frontoclypeal suture; a pair of small longitudinal spots on both sides of the median mark; a pair of small transverse spots

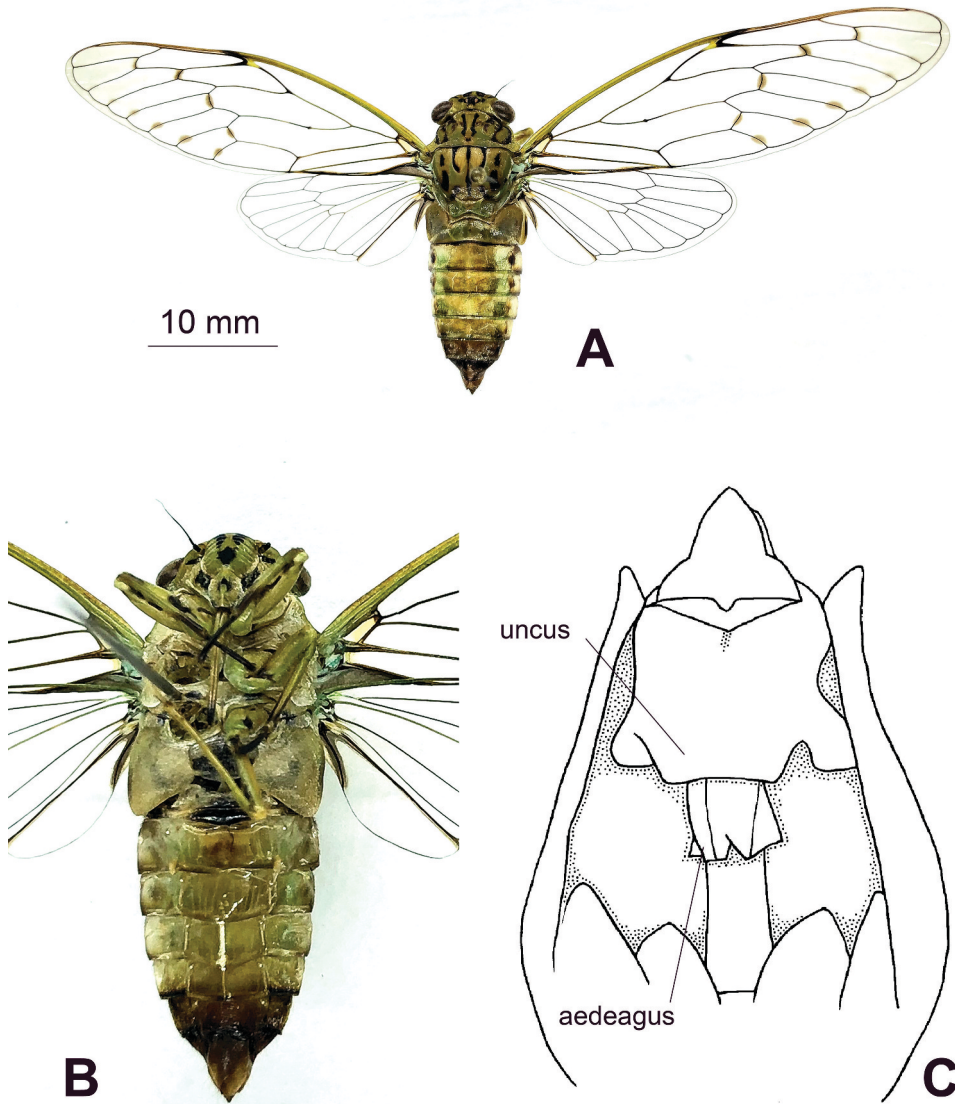


Figure 11. *Neopurana bouptera* Lee and Marshall gen. and sp. nov., holotype, male, Mindanao, Philippines. (A) Dorsal habitus; (B) ventral habitus; (C) pygofer, slightly oblique ventral view.

on antero-sublateral corners of vertex, with their inner tips connected to anterior tips of the small longitudinal spots; a pair of indistinct transverse spots on supra-antennal plates; and a pair of tiny spots posteromedially. Distance between lateral ocelli and compound eyes slightly longer than twice the distance between lateral ocelli. Postclypeus moderately swollen. Antennae black but lighter towards tip. Postclypeus light green with the following black marks: short fasciae or spots along inner parts of anterior half of transverse grooves; and large median spot on posterior one-third of postclypeus. Anteclypeus light

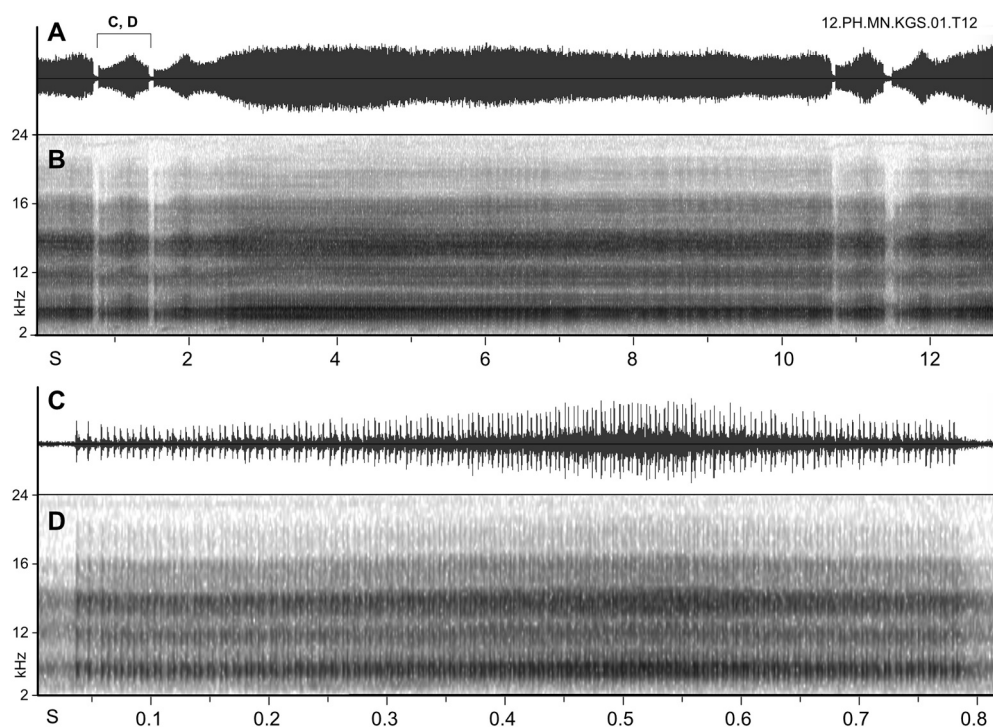


Figure 12. *Neopurana bouptera* Lee and Marshall gen. and sp. nov., holotype male calling song. Waveforms (A, C) and spectrograms (B, D) are shown at two time scales.

green to greenish yellow with W-shaped mark in the middle. Rostrum greenish ochraceous to ochraceous but black apically; slightly passing beyond hind coxae. Lorum ochraceous with large black patch on inner corner. Gena greenish ochraceous with transverse spot between postclypeus and compound eye, touching postclypeus.

Thorax. Pronotum green, greenish ochraceous, and ochraceous (medially). Inner area of pronotum with the following marks: a pair of median longitudinal black fasciae slightly broadened at both anterior and posterior ends; tiny spot medio-posteriorly; irregularly shaped brown spots and marks along or near paramedian and lateral fissures; transverse narrow black to fuscous fascia along anterior margin of pronotum; and a pair of curved broad fasciae along lateral margins of inner area. Pronotal collar greenish ochraceous with narrow transverse fascia along posterior margin. Anterolateral pronotal collar not dentate. Mesonotum green, greenish ochraceous, and ochraceous (medially) with the following black to fuscous marks: median longitudinal fascia broadened anteriorly and posteriorly, not reaching anterior margin of cruciform elevation; a pair of small round spots enclosing scutal depressions; a pair of inwardly curved fasciae along inner side of parapsidal sutures; a pair of two longitudinally arranged large spots on lateral sigilla; and a pair of tiny spots on lateral margin of mesonotum. Cruciform elevation light green to greenish ochraceous with a pair of black patches on apices of arms. Thoracic sternites greenish ochraceous to ochraceous with a pair of black spots on episterna 3. Legs light green to greenish ochraceous with black to fuscous marks. Fore femur with black primary, secondary and

subapical spines and with black patch posteriorly on inner side. Fore- and mid tibiae fuscous apically. Fore- and mid pretarsi black.

Wings hyaline. Fore wing with infuscations on radial, radiomedial, medial and medio-cubital crossveins. Small, roundish infuscation present on each hind margin of radius posterior, median 1–4, and cubitus anterior 1 veins but not distinct on radius posterior and median 1 veins among them. Basal cell slightly tinged with ochraceous. Basal membrane dark grey. Hind wing jugum dark grey (proximally) to light grey (distally).

Operculum slightly greenish ochraceous; obliquely trapezoidal with posterior angles rounded, extending to anterior margin of abdominal sternite III. Anterior inner margin concave. Opercula widely separated from each other, with gap about two-thirds as wide as operculum.

Abdomen obconical, distinctly longer than head and thorax together. Tergites 2–6 light green (sub-medially) to ochraceous with a pair of brown sublateral spots. Posterior margins of tergite 2 narrowly fuscous. Tergite 7 castaneous with a pair of fuscous sublateral spots. Tergite 8 fuscous with brown median patch. Tergite 3 wider than mesonotum. Timbal cover slightly greenish ochraceous; nearly quarter circle with rounded anterolateral corner, about as long as wide. Timbal concealed by timbal cover in dorsal view. Abdominal sternites III–VI slightly greenish ochraceous. Sternite VII castaneous with black posterior margin. Sternite VIII castaneous with lighter postero-lateral parts. Sternites III with light ochraceous tubercle-like projection on each posterolateral surface, protruding posteriorly to partly cross anterior margin of sternite IV. Epipleurites 3–6 greenish ochraceous. Epipleurites 7–8 castaneous. Epipleurites 6–8 with black posterior margins.

Genitalia. Pygofer oval in ventral view. Uncus simple, short, not bifurcate and with a widely truncate apex in ventral view; without median groove. Uncus slightly curved inward in lateral view. Aedeagus protruding from uncus; thick and bifurcate at apex. Basal lobe of pygofer absent.

Song (Figure 12)

About six minutes of song was recorded for this species at Mt. Kitanglad, including a sample from the holotype male, which is illustrated. The sound is a complex, resonant, amplitude-modulated buzz comprised mainly of pulse pairs (doublets) produced at approximately 100–150/s, although in a few samples the doublets are paired and in one segment the pulses appear briefly in threes. The song is produced in phrases containing, usually, one short echeme of ca. 0.6–1 s followed by a much longer echeme of ca. 8.5–11 s, sometimes with the phrases paired or strung together into longer series. One male produced a series of phrases lasting at least 125 s. Both short and long echemes begin with a string of single pulses and continue with (usually) doublets. Phrases are separated by short silent gaps of ca. 40–110 ms, as are (commonly) the short and long echemes contained within a phrase, and occasionally a gap of a few tens of milliseconds in duration occurs within what otherwise appears to be one of the long syllables.

Amplitude modulates considerably, with intensity increasing to nearly double on the waveform and then back down in one cycle for each short echeme, and once or sometimes twice for long echemes. In the latter case, the initial amplitude modulation resembles a second short echeme appended to the long echeme. This gives the song a slow

'revving' quality. Frequency content is not modulated but is complex, including two major peaks around 3.5–5 (usually dominant) and 11–13 kHz and a least one weaker peak around 8.5 kHz.

The holotype specimen was collected by attracting it down from its perch on a vertical tree trunk, by movement of the collector around the base of the tree and gentle scratching and tapping of the trunk, followed by climbing and hand-capture. The male continued to face upward while backing down the tree trunk.

Subtribe **PURANINA** Lee, 2013

Remarks

We continue to use subtribe Puranina here. Unfortunately, no species of the *Purana tigrina* species group (see Duffels et al. 2007; Lee 2009a) or the true *Purana* Distant, 1905 (type species: *Dundubia tigrina* Walker, 1850) was included in the study by Hill et al. (2021).

Genus **Purana** Distant, 1905

Remarks

The *Purana carmentis* species group was proposed by Schouten and Duffels (2002), of which 16 member species have been found so far in southern China, Vietnam, Thailand, Malaysia, Indonesia and the Philippines. The independence of the *Purana carmentis* species group was also brought up by Lee (2009b). The new *Purana* species described below belongs to this species group.

Two of the other *Purana* species of Mindanao, *Purana nana* Lee, 2009 and *Purana crassinotata* Lee, 2015, are included in the *Purana abdominalis* species group proposed by Lee (2009a).

Lee (2009a) suggested *Purana guttularis* (Walker, 1858) be placed in the *Purana ubina* species group, but no male specimens have been confirmed. Its type specimen, which is a female, seems close to *Purana kpaworensis* Boulard, 2007, which was placed in the *Purana tigrina* species group by Lee (2009a), considering the similarities in fore wing venation. However, the species group placements of *P. guttularis* and *P. kpaworensis* need further study.

19. **Purana nana** Lee, 2009

Purana nana: Lee 2010: 22; Lee 2015: 551.

Distribution

Philippines (Mindanao).

20. **Purana crassinotata** Lee, 2015

Purana crassinotata Lee 2015: 551–553, fig. 2.

Additional material examined

1 male, specimen code 12.PH.MN.IMP.04, PHILIPPINES, Mindanao, Bukidnon Province, Impasugong Municipality, Impalutao Barangay, Impalutao Forest, 08°15.072'N, 125°01.891'E, 21 April 2012, K. Hill, D. Marshall, T. Catanach and A. Mohagan (UCONN).

Distribution

Philippines (Camiguin and Mindanao).

21. *Purana guttularis* (Walker, 1858)

Purana guttularis: Lee 2010: 22; Lee 2015: 553.

Distribution

S. China, Philippines (including Mindanao) (not previously reported from specific islands), Indonesia (Borneo, Java, Sumatra and Nias), Malaysia, Thailand, Myanmar and India.

Remarks

As Lee (2010, 2015) indicated, the identity of this species in the Philippines should be reconsidered. The female type of *P. guttularis* is hardly distinguishable from the female paratype of *P. nana* as shown in Lee (2009a). We suspect that the record of *P. guttularis* from Mindanao is due to misidentification. *Purana guttularis* may have to be removed from the cicada list of Mindanao.

22. *Purana mindanaoensis* Lee and Marshall sp. nov.

(Figures 13, 14)

Purana cf. *barbosae*: Hill et al. 2021: table 1, figs 5, 13, 14.

Type material

Holotype. Male, specimen code 12.PH.MN.MUS.01, PHILIPPINES, Mindanao, Bukidnon, Maramag, Mt. Musuan, 7°52.62'N, 125°4.19'E, 19 April 2012, K.B.R. Hill, D.C. Marshall and A. B. Mohagan (NMPM).

Paratypes. 1 male, specimen code 12.PH.MN.MUS.05, same collection data (UCONN); 1 male, specimen code 12.PH.MN.HWB.01, PHILIPPINES, Mindanao, W side Mt. Hamiguitan, 1 h up trail from Tumulite Village, 6°43.849'N, 126°7.856'E, 24 April 2012, K.B.R. Hill, D.C. Marshall and A.B. Mohagan (UCONN).

Additional location audio recorded

PHILIPPINES, Mindanao, Cateel/Compostela Rd., nr bdry, 646 m, 07°40.39'N, 126°12.77'E, PH.MN.CAB, 6 May 2012, K.B.R. Hill, D.C. Marshall and A.B. Mohagan.

Etymology

The new species is named after the type locality, Mindanao.

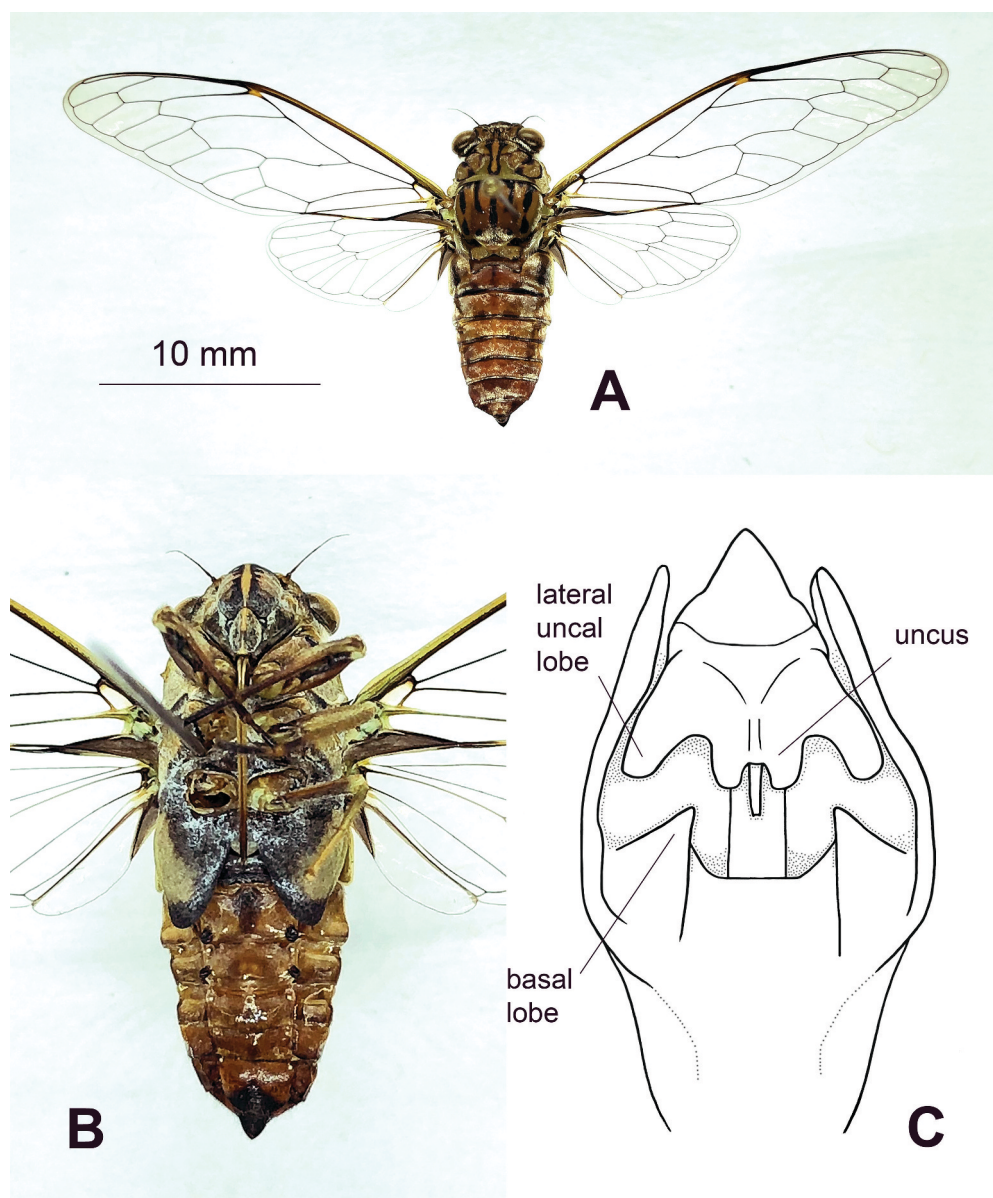


Figure 13. *Purana mindanaoensis* Lee and Marshall sp. nov., male, Mindanao, Philippines. (A) Dorsal habitus of holotype; (B) ventral habitus of holotype; (C) pygofer, ventral view.

Measurements of types (3 males)

Length of body: 20.8 (20.2–21.4). Length of head and thorax together: 10.1 (9.8–10.3). Length of abdomen: 10.7 (10.4–11.1). Width of head including compound eyes: 6.5 (6.2–6.6). Width of pronotum: 7.2 (7.1–7.4). Width of mesonotum: 6.3 (6.3–6.4). Width of abdominal tergite 3: 6.9 (6.8–6.9). Length of fore wing: 27.2 (24.7–28.9). Width of fore wing: 8.9 (8.5–9.3). Wing span: 60.2 (56.1–63.8).

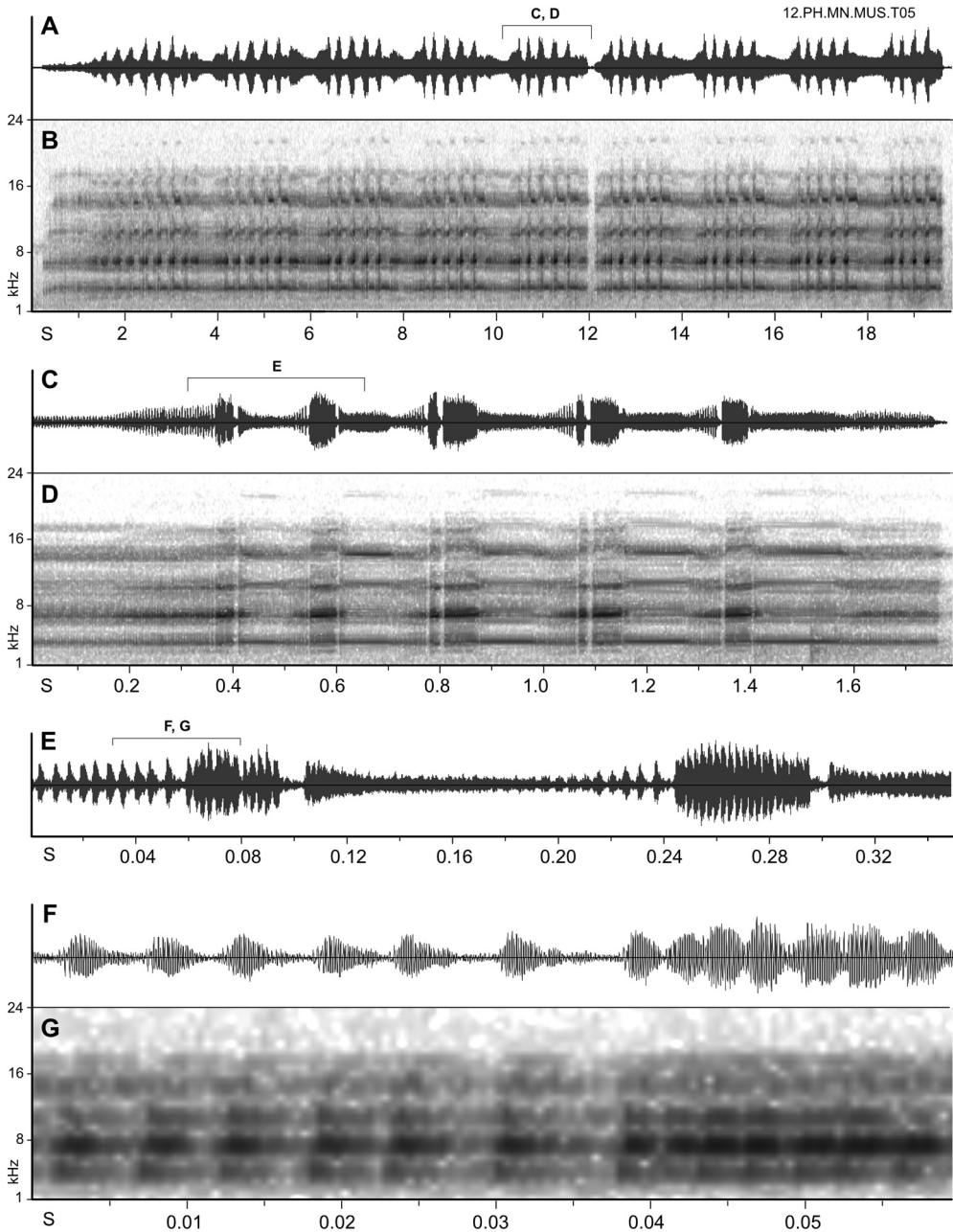


Figure 14. *Purana mindanaoensis* Lee and Marshall sp. nov. Waveforms (A, C, E, F) and spectrograms (B, D, G) of male calling song at different time scales.

Description of male

Head. Vertex dark ochraceous tinged with green and with the following black marks: inverted triangular large median mark surrounding ocelli, with its anterior tip not reaching frontoclypeal suture; a pair of longitudinal F-shaped marks on both sides of the median

mark, extending to supra-antennal plates; a pair of narrow fasciae along compound eyes; and a pair of tiny spots posteromedially. Distance between lateral ocelli and compound eyes longer than twice the distance between lateral ocelli. Antennae dark brown to fuscous. Postclypeus moderately swollen anteriorly; light ochraceous, tinged with green anteriorly, with fasciae or spots along transverse grooves, all connected at inner ends, of which first five long but remainder short. Anteclypeus black except ochraceous median ridge. Rostrum ochraceous but black to fuscous apically; not reaching abdominal sternite III. Lorum ochraceous on anterior one-third but black on posterior two-thirds. Gena ochraceous with obliquely transverse black fascia between postclypeus and compound eye and fascia along compound eye.

Thorax. Pronotum mostly ochraceous but partly light green. Inner area of pronotum ochraceous but light green posteromedially with the following black to fuscous marks: a pair of median longitudinal fasciae slightly broadened at both anterior and posterior ends; a pair of short, oblique indistinct branches along paramedian fissures arising from around middle of the median longitudinal fasciae; a pair of indistinct short longitudinal fasciae between about middle of paramedian fissures and posterior ends of lateral fissures; a pair of fasciae along lateral fissures, interrupted in the middle; and a pair of curved fasciae along lateral margins of inner area. Pronotal collar greenish ochraceous with narrow transverse black fascia along posterior margin and a pair of fuscous spots on sublateral parts. Anterolateral pronotal collar dentate. Mesonotum brown (medially) to dark greenish ochraceous (laterally) with the following black marks: median longitudinal fascia slightly broadened posteriorly to reach anterior margin of cruciform elevation; a pair of small round spots enclosing scutal depressions; a pair of inwardly curved fasciae along inner side of parapsidal sutures; a pair of longitudinally arranged two spots on lateral sigilla: anterior ones longitudinally long touching anterior margin of mesonotum but posterior ones roundish. Cruciform elevation greenish ochraceous but tinged with brown centrally with black posterior margin. Thoracic sternites light greenish ochraceous with black to fuscous spot each on basisternum 2, episternum 2, meron 2, basisternum 3, episternum 3 and meron 3. Legs ochraceous to greenish ochraceous. Fore femur with black primary, secondary and subapical spines and with black fascia along midline of ventral side of fore femur. Fore-, mid- and hind femora with large brown to light brown patches. Fore tibia mostly fuscous except small proximal part. Mid tibia with small distal fuscous part. Fore- and mid pretarsi black.

Wings hyaline and without infuscations but slightly tinged with brown distally. Costal vein greenish ochraceous basally but darkening to become castaneous to fuscous distally. Basal cell slightly tinged with greenish ochraceous. Basal membrane and hind wing jugum dark grey. Ulnar cell 3 very broad, with border adjoining radial cell more than twice as long as that between radial cell and ulnar cell 2.

Operculum inverted triangular with posterior angle rounded, and extending far beyond middle of abdominal sternite III but not reaching posterior margin of sternite III; dull light green laterally and widely black to fuscous along inner and posterior margins, and covered with short silvery hairs and white pollinosity. Anterior one-fourth of inner margin deeply concave. Opercula separated from each other, with gap about one-fourth as wide as operculum.

Abdomen castaneous to light brown; long obconical, longer than head and thorax together. Posterior margins of each tergite narrowly black to fuscous, sometimes indistinct. Tergite 3 wider than mesonotum. Timbal cover greenish ochraceous with a large fuscous patch sublaterally; nearly quarter circle with rounded anterolateral corner, about as long as wide. Timbal concealed by timbal cover in dorsal view. Abdominal sternites dull ochraceous to light brown. Sternites III and IV each with a pair of black tubercle-like projections on posterolateral surfaces, protruding ventrolaterally but slightly obliquely downward.

Genitalia. Pygofer barrel-shaped in ventral view. Uncus short, consisting of median lobe with blunt bicuspidate apex and a pair of lateral lobes. Distal shoulder not pointed. Basal lobe of pygofer triangularly prominent.

Remarks

The existing 16 species of the *Purana carmente* species group are very similar to each other and often hard to distinguish. This new species has two longitudinally arranged fasciae or spots on the lateral sigillum, which are always separate from each other. This characteristic is seen only in *Purana mindanaoensis* Lee and Marshall sp. nov. and *Purana natae* Boulard, 2007. Other species of the *Purana carmente* species group have only one long, continuous longitudinal fascia on the lateral sigillum, except for *Purana barbosa* (Distant, 1889), which has no such distinct fasciae or spots at all on the lateral sigillum.

The male operculum of this new species has a broadly black patch along the inner margin, about half as wide as the operculum. The following eight species have a much thinner or nearly absent black patch on the male operculum: *Purana barbosa*, *Purana obducta* Schouten and Duffels, 2002, *Purana sagittata*, 2002, *Purana infuscata*, 2002, *Purana mickhuanae* Boulard, 2009, *Purana natae*, *Purana phetchabuna* Boulard, 2008 and *Purana tanae* Boulard, 2007.

The following eight species have their own peculiar uncus shapes, respectively: *Purana carmente* (Walker, 1850), *Purana hermes* Schouten and Duffels, 2002, *Purana infuscata*, *Purana sagittata*, *Purana chueatae* Boulard, 2007, *Purana mickhuanae*, *Purana natae* and *Purana tanae* (see Schouten and Duffels 2002; Boulard 2013). The remaining species of the *Purana carmente* species group, including *Purana mindanaoensis*, have somewhat similar uncus shapes, but *Purana mindanaoensis* has largely expanded lateral uncal lobes, which are larger or more developed than those of any other species of the *Purana carmente* species group.

Purana dimidia Chou and Lei, 1997 has a comparatively short male operculum. *Purana trui* Pham et al., 2012 has very thin longitudinal fascia on the timbal cover, a very broad black patch on the male operculum, and a blunt apical angle of the basal lobe of pygofer. *Purana opaca* Lee, 2009 has darker body pigmentation and an almost entirely black timbal cover and male operculum.

Song (Figure 14)

Recordings of the song of this species, totalling several minutes, were obtained at the type locality. The sound is a resonant, stuttering buzz with a bell-like quality, and it contains amplitude and frequency modulation as well as a complex pattern of fundamental pulses, syllables and echemes. The song is arranged into phrases that change in structure as a male continues to sing, progressing from shorter, usually isolated phrases, to longer ones up to ca. 2 s often concatenated into sets lasting up to 49 s in our limited sample. In its most developed form, a single phrase usually consists of 4–6 repeated echemes, each comprising (1) an initial syllable containing coalesced pulses lasting about 40–80 ms, (2)

a shorter syllable containing isolated pulses repeated at about 180/s, and (3) ca. 1–3 higher amplitude syllables lasting 15–50 ms and containing pulses produced at about 360/s. The phrase begins and ends with less well-defined strings of pulses. Complex frequency and amplitude modulation patterns occur, with the loudest syllables having a lower dominant pitch (ca. 6.8 kHz) than the syllables containing coalesced pulses (14.2 kHz), and with the transition occurring during the syllables containing isolated pulses. Frequency modulation is also apparent at a shorter time scale, within individual pulses.

Genus *Maua* Distant, 1905

23. *Maua philippinensis* Schmidt, 1924

Maua philippinensis: Lee 2010: 22, fig. 5; Lee 2015: 553.

Distribution

Philippines (Mindanao).

Additional material examined

1 male, specimen code 12.PH.MN.HWF.01, PHILIPPINES, Mindanao, W side of Mt. Hamiguitan, 648 m, 6°43.358'N, 126°9.211'E, 25 April 2012, K.B.R. Hill, D.C. Marshall and A.B. Mohagan (UCONN).

Subfamily *CICADETTINAE* Buckton, 1890

Tribe *CICADATRINI* Distant, 1905

Cicadatraria Distant 1905a: 304–305.

Genus *Mogannia* Amyot and Audinet-Serville, 1843

Mogannia Amyot and Audinet-Serville 1843: 467.

Type species

Mogannia illustrata Amyot and Audinet-Serville 1843 (Java) [junior synonym of *Mogannia conica* (Germar, 1830)].

Cephaloxys Signoret, 1847: 294.

Type species

Cicada conica Germar, 1830 (Java).

24. *Mogannia tenebrosa* Lee and Marshall sp. nov. (Figures 15, 16)

Type material

Holotype. Male, specimen code 12.PH.MN.CAB.01, PHILIPPINES, Mindanao, Cateel/Compostela Rd., nr bdry, 646 m, 07°40.39'N, 126°12.77'E, 6 May 2012, K.B.R. Hill, D.C. Marshall and A.B. Mohagan (NMPM).

Paratypes. 1 male, same location as holotype, genitalia dissection G103 (UCONN); 1 male, specimen code 12.PH.MN.HWM.01, PHILIPPINES, Mindanao, W side Mt. Hamiguitan, Ca. 1.5 h up trail from Tumulite, 282 m, 06°43.95'N, 126°08.13'E, 26 April 2012, K.B.R. Hill, D.C. Marshall and A.B. Mohagan (UCONN).

Etymology

The specific name is a Latin feminine adjective meaning 'dark', in reference to the dark-coloured body and the base of the fore wings of this species.

Measurements of types (2 males, holotype (larger) and paratype from Mt. Hamiguitan)

Length of body: 12.5 (11.2–13.7). Length of head and thorax together: 6.3 (5.4–7.1). Length of abdomen: 6.2 (5.8–6.6). Width of head including compound eyes: 3.2 (3.1–3.2). Width of pronotum: 4.6 (4.1–5.0). Width of mesonotum: 4.0 (3.6–4.4). Width of abdominal tergite 3: 5.3 (4.6–5.9). Length of fore wing: 15.4 (14.0–16.8). Width of fore wing: 5.2 (4.8–5.5). Wing span: 33.4 (30.8–36.0).

Description of male

Head black to fuscous; narrow, much narrower than mesonotum. Distance between lateral ocelli and compound eyes slightly shorter than distance between lateral ocelli. Antenna mostly dull ochraceous but with black pedicel and scape. Postclypeus greatly protruding anteriorly. Rostrum with small dull ochraceous patch proximally, with apex slightly passing beyond posterior margin of mid coxae.

Thorax including cruciform elevation black to fuscous. Anterolateral pronotal collar not dentate. Fore-, mid- and hind coxae each with light green distal membrane.

Wings: Fore wing partly hyaline with venation ochraceous except for basal half of costal vein pinkish brown and with broad dark brown patch on basal half of fore wing. Basal cell tinged with pinkish brown. Basal membrane pinkish brown. Hind wing hyaline. Hind wing costal cell, radial cell and medial cell with small pinkish brown patch basally. Vannus with pinkish brown patch basally on about basal one-fourth. Hind wing jugum pinkish brown.

Operculum black to fuscous; hook- or meniscus-shaped, with length of 2.5–3 times the width, with apex heading towards centre of body; not reaching posterior margin of abdominal sternite II. Opercula nearly touching each other medially.

Abdomen wide and short, about as long as head and thorax together; mostly black with small reddish brown patches, especially on median and sublateral parts. Tergite 3 much wider than pronotum. Timbal cover black but tinged with reddish brown, very small, triangular with anterior angle rounded, wider than long. Timbal mostly exposed. Abdominal sternites dark brown to reddish brown with black caudal margin on each of sternites II–VII. Sternite VIII and epipleurite VIII nearly red.

Genitalia. Pygofer circular in ventral view. Dorsal beak narrow and long. Uncus short with widely concave apex. Median clasper process extending posteriorly in ventral view, but curved inward in lateral view. Lateral clasper lobe short. Aedeagus with spine-like processes apically. Distal shoulder with short triangular tooth in lateral view. Upper lobe uncurved, with rounded apex in lateral view. Basal lobe indistinct.

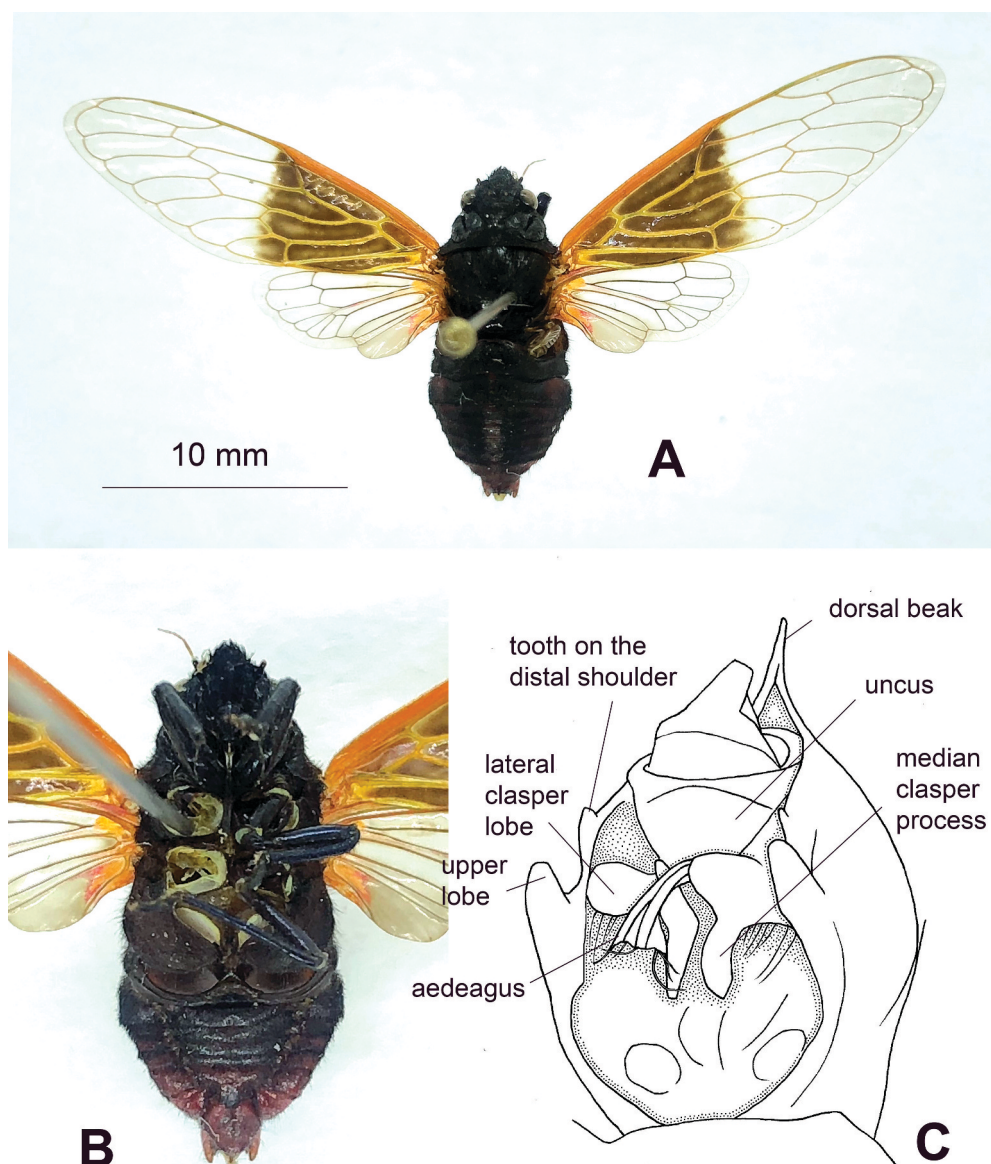


Figure 15. *Mogannia tenebrosa* Lee and Marshall sp. nov., holotype, male, Mindanao, Philippines. (A) Dorsal habitus; (B) ventral habitus; (C) pygofer, oblique ventral view.

Remarks

This species resembles *Mogannia conica* (Germar, 1830) (TL: Java) because its fore wing also has a broad dark-coloured patch halfway from the base, but *M. conica* has the reddish postclypeus (vs black in the new species), narrower patch on the fore wing, smoothly rounded distal shoulder of the male pygofer (vs with a short triangular tooth in the new species), and a lobe-like process under the lateral clasper lobe (vs absent in the new species).

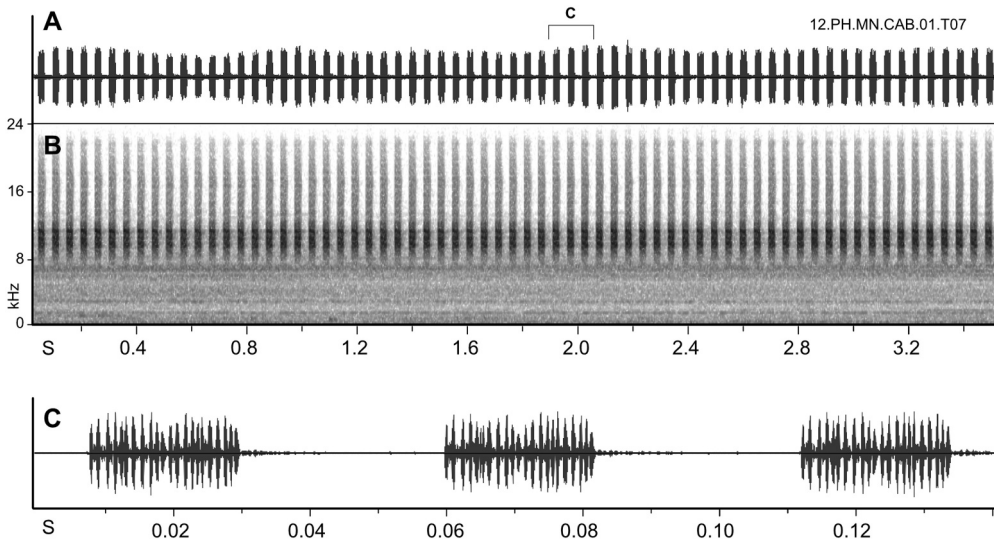


Figure 16. *Mogannia tenebrosa* Lee and Marshall sp. nov. Waveforms (A, C) of male calling song at two time scales, the former with accompanying spectrogram (B).

Also similar is *Mogannia funettae* Boulard, 2008 from northern Thailand, but like *M. conica*, *M. funettae* has the fore wing basal cell clear or tinged with bright colour rather than infuscated with dark brown to match the remainder of the basal fore wing (see Boulard 2013). As discussed below, the song of *Mogannia tenebrosa* Lee and Marshall sp. nov. also suggests a relationship to *M. funettae*.

This species is similar also to *Mogannia formosana* Matsumura, 1907 because of the blackish body colour and the brownish patch on the fore wing, but *M. formosana* has a much more brightly coloured patch on the fore wing and light colouration on the ventral side of the body.

Two other *Mogannia* previously recorded from the Philippines are *Mogannia indigotea* Distant, 1917 (TL: Tonkin) and *Mogannia viridis* (Signoret, 1847) (TL: Java) although we suspect that they are not distributed in the Philippines. Both differ from *M. tenebrosa* in the main body colour (*M. indigotea* is dark indigo blue, and *M. viridis* green to ochraceous). While the dark body colour of *M. indigotea* could be confused in poorly preserved specimens, the fore wing colour pattern is different, with some sections of the fore wing hyaline or tinted in *indigotea* but fully infuscated in *tenebrosa* (see Chen et al. 2012).

Song (Figure 16)

The song of the holotype male was recorded and is illustrated here. The sound is a high-pitched staccato buzz that continues indefinitely (at least 62s in our recording). Syllables containing approximately six pulses each are closely grouped or coalesced into echemes comprising four syllables, with the beginning and ending pulses of each syllable sometimes overlapping. The syllables are produced at about 200/s, and the echemes at about 20/s. There is minor amplitude modulation that helps to define the syllables, but otherwise sound intensity and frequency are not regularly modulated. The frequency spectrum is broad, reaching from at least 8 kHz to above 20 kHz, but most energy is concentrated within the range 8–12 kHz. The dominant frequency is about 10 kHz. Males were observed to sing while perching on the upper sides of leaves, as noted by Boulard (2013) for other *Mogannia* in Thailand.

No songs have been published previously for the genus *Mogannia* in the Philippines. The song of *M. funettae*, as shown in Boulard (2013), is very similar to that of *M. tenebrosa*, differing mainly in having a somewhat faster echeme repetition rate of about 28/s and inter-echeme intervals that are about the same duration as the echemes themselves.

Tribe **NELCYNDANINI** Moulds and Marshall, 2018

Nelcyndanini Moulds and Marshall, 2018 *in* Marshall et al., 2018b: 26.

Genus ***Nelcyndana*** Distant, 1906

25. ***Nelcyndana tener*** (Stål, 1870)

Nelcyndana tener: Lee 2010: 26, fig. 7; Lee 2015: 553.

Distribution

China, Philippines (including Mindanao) (not previously reported from specific islands) and Borneo.

Tribe **CICADETTINI** Buckton, 1890

Genus ***Huechys*** Amyot and Audinet-Serville, 1843

26. ***Huechys parvula*** Haupt, 1924

Huechys parvula: Lee 2010: 25; Lee 2015: 553–554.

Distribution

Philippines (Samar, Camiguin and Mindanao).

Genus ***Scieroptera*** Stål, 1866

27. ***Scieroptera sanaoensis*** Schmidt, 1924

Scieroptera sanaoensis: Lee 2010: 26; Lee 2015: 554.

Distribution

Philippines (Mindanao).

Genus ***Ggomapsalta*** Lee, 2009

28. ***Ggomapsalta fragilis*** Lee, 2015

Ggomapsalta fragilis Lee 2015: 554–555, fig. 3.

Distribution

Philippines (Mindanao).

Genus *Philipsalta* Lee, Marshall and Hill, 2016

Philipsalta Lee, Marshall and Hill, 2016 in Lee et al., 2016: 197.

Type species

Philipsalta nigrina Lee, Marshall and Hill, 2016 (Dinagat, Philippines).

Remarks

The two new species described below under *Philipsalta* are placed in this monotypic genus because their morphological characteristics fit many of the characteristics listed in the description of the genus given by Lee et al. (2016), which are as follows.

Body tiny. Postclypeus rather flat ventrally. Pronotal collar very narrow, not dentate. Wings hyaline without infuscation. Fore wing cubital cell spacious, about as broad as medial cell. Hind wing with six apical cells. Male operculum small, not reaching posterior margin of sternite II. Male abdomen triangular in dorsal view, longer than head and thorax together. Timbal cover absent. Timbals not extending below wing bases ventrally. Pygofer ovate with triangular dorsal beak in ventral view. Upper lobe of pygofer present. Dorsal beak triangular. A pair of clasper-like processes protruding downward.

29. *Philipsalta exilis* Lee and Marshall sp. nov.

(Figures 17, 18)

Type material

Holotype. Male, specimen code 12.PH.MN.SSM.02, PHILIPPINES, Mindanao, Davao City, Marilog District, Datu Salumay, Mt. Malambo, 7°29.28'N, 125°15.18'E, 18 April 2012, K.B.R. Hill, D.C. Marshall and A.B. Mohagan (NMPM).

Paratype. 1 male, specimen code 12.PH.MN.SSM.01, DNA voucher, same collection data.

Etymology

The specific name is a Latin adjective meaning 'slender', 'thin', 'feeble' or 'small', in reference to the small and slender body of this species.

Measurements of holotype (1 male)

Length of body: 14.2. Length of head and thorax together: 5.5. Length of abdomen: 8.7. Width of head including compound eyes: 3.6. Width of pronotum: 4.2. Width of mesonotum: 3.5. Width of abdominal tergite 3: 3.9. Length of fore wing: 16.8. Width of fore wing: 6.3. Wing span: 37.0.

Description of male

Body tiny and slender. Head: Vertex ochraceous with the following fuscous marks: inverted triangular mark surrounding median ocellus; a pair of rather indistinct marks surrounding lateral ocelli; a pair of spots on inner corners of supra-antennal plates; and a pair of spots on posterolateral corner of vertex (touching compound eyes). Distance between lateral ocelli and compound eyes about as long as distance between lateral

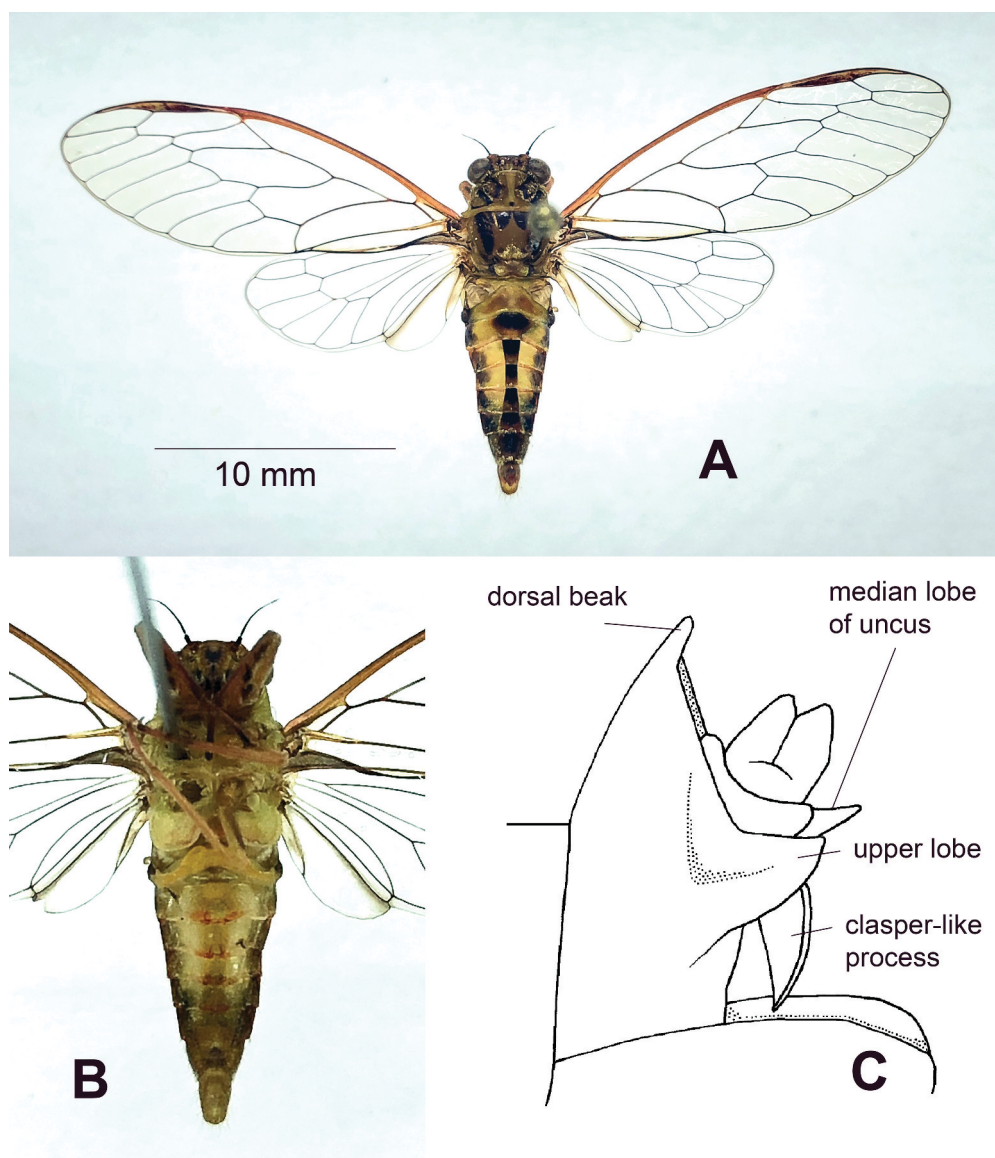


Figure 17. *Philipsalta exilis* Lee and Marshall sp. nov., holotype, male, Mindanao, Philippines. (A) Dorsal habitus; (B) ventral habitus; (C) pygofer, lateral view.

ocelli. Antennae black except for reddish-brown scape and base of pedicel. Postclypeus not swollen anteriorly and rather flat ventrally; reddish brown to ochraceous with V-shaped black median mark, of which posterior part merged into a large patch. Anteclypeus reddish ochraceous with median fuscous spot and fuscous posterior margin. Rostrum brown with black apex; with apex extending slightly beyond posterior margin of mid trochanter. Lorum ochraceous with large fuscous spot posteriorly. Gena ochraceous without distinct marks.

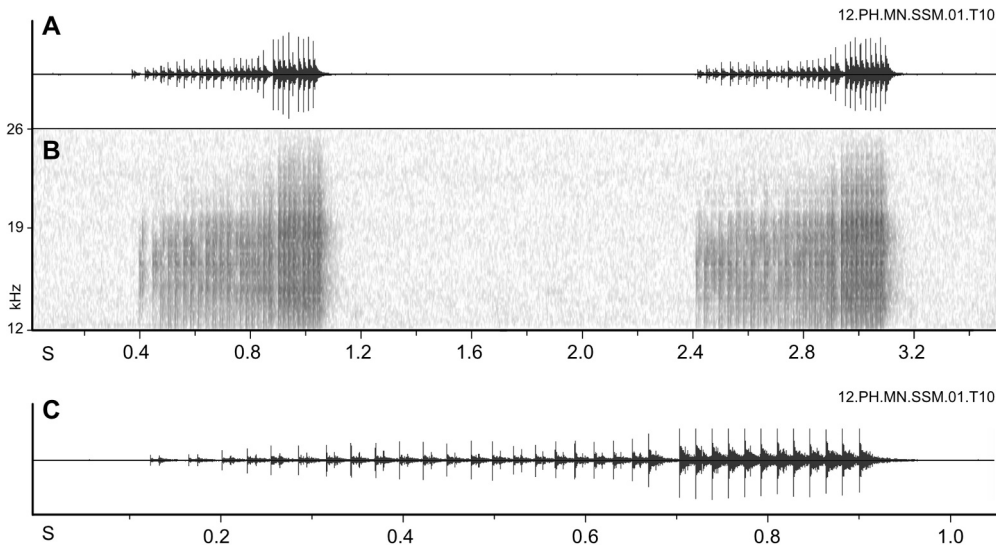


Figure 18. *Philipsalta exilis* Lee and Marshall sp. nov. Waveforms (A, C) of male calling song at two time scales, the former with accompanying spectrogram (B).

Thorax

Pronotum ochraceous. Inner area of pronotum with the following fuscous marks: tiny spot on posteromedian margin of inner area; a pair of short longitudinal fasciae between about middle of paramedian fissures and posterior ends of lateral fissures; a pair of fasciae along lateral fissures; irregular indistinct marks between paramedian fissures and lateral fissures; and a pair of curved fasciae along lateral margins of inner area. Pronotal collar very narrow; without marks. Anterolateral pronotal collar not dentate. Mesonotum dull ochraceous with a pair of fuscous patches on entire submedian sigilla and a pair of longitudinal larger patches on almost entire lateral sigilla. Cruciform elevation light ochraceous or yellow without distinct marks. Thoracic sternites greenish light ochraceous. Legs ochraceous to reddish brown with some fuscous spots. Fore femur with primary, secondary and subapical spines.

Wings hyaline without infuscation; with extremely narrow marginal areas. Fore wing venation reddish brown basally but fuscous distally. Basal membrane yellowish grey. Hind wing with five or six apical cells (possibly with six apical cells normally, considering other *Philipsalta* species have six apical cells).

Operculum small, semicircular, not reaching posterior margin of sternite II; greenish light ochraceous. Opercula separated from each other.

Abdomen long triangular in dorsal view, much longer than head and thorax together, with ridge formed on tergites 4–7 dorsomedially; slightly greenish light ochraceous with grey-tinged lateral margins. Tergite 1 very short, less than one-fourth as long as tergite 2 in median length. Tergites 3–8 black to fuscous on about anterior half and brown to ochraceous on about posterior half dorsomedially; upper lateral surfaces slightly translucent. A pair of fuscous globose bumps present on lateral margins of tergite 2. Timbal cover absent. Timbals not extending below wing bases ventrally. Abdominal sternites translucent, ochraceous indistinctly with pinkish caudal margin on each of sternites 3–6.

Genitalia

Pygofer ovate with triangular dorsal beak in ventral view. Upper lobe moderately pointed. Dorsal beak triangular. Median lobe of uncus moderately protruding. A pair of clasper-like processes protruding straight downward.

Remarks

This new species can be distinguished from *Philipsalta nigrina* by body colouration and by the comparative size and shape of each part of the body and wings as follows: body colouration not monotonous (vs entirely black in *P. nigrina*); head comparatively short, about half as long as pronotum (vs about two-thirds as long as pronotum in *P. nigrina*); fore wing radial cell comparatively narrow, narrower than ulnar cell 3 (vs spacious, broader than ulnar cell 3 in *P. nigrina*); and male abdomen much longer than head and thorax together (vs slightly longer in *P. nigrina*).

Song (Figure 18)

About 190 s of song was recorded from this species at the type locality, including that of the paratype male, which is illustrated here. Males produce song phrases of about 0.3–0.85 s duration at a regular pace of about 0.5 phrases/s. Each phrase begins with about 8–20 doublet pulses produced at 40 doublets/s, with the first pulse of each doublet louder. The doublets increase in intensity towards the end of this long syllable. After a gap equivalent to the time needed for one additional doublet, the phrase concludes with a syllable of 6–13 doublets produced at a faster rate (60/s) and with a greater intensity. In our recording, it is difficult to discern the quieter pulse of each doublet in the second syllable.

There is a tendency, across phrases, for pulse doublets to drop out occasionally within both syllables. The recording was taken with the recordist close to the cicada and attempting to attract it with finger-snaps, so disturbance could have occurred.

The frequency spectrum is broad, reaching from at least 8 kHz to above 20 kHz, but most energy is concentrated within the range 8–12 kHz. The dominant frequency is about 10 kHz.

Males sang from perches on vertical surfaces (e.g. ferns, tree trunks, small branches) around 2–4 m aboveground in the forest interior. The song of *Philipsalta exilis* Lee and Marshall sp. nov. can be distinguished from that of the next new species of *Philipsalta* (below) by the absence of a short single-doublet element ending many of the phrases and by the uniform rate of production of pulse doublets within the first syllable/echeme. *Philipsalta exilis* and *P. nigrina* have a similar song structure, but in the latter species the pulses in the first section of each phrase form widely separated four-pulse syllables, the intervening gaps being much longer than the syllables.

30. *Philipsalta lata* Lee and Marshall sp. nov.

(Figures 19, 20)

Type material

Holotype. Male, specimen code 12.PH.MN.CAC.01, PHILIPPINES, Mindanao, Cateel/Compostela Rd., nr bdry, 726 m, 07°39.93'N, 126°12.82'E, 6 May 2012, K.B.R. Hill, D.C. Marshall and A.B. Mohagan (NMPM).

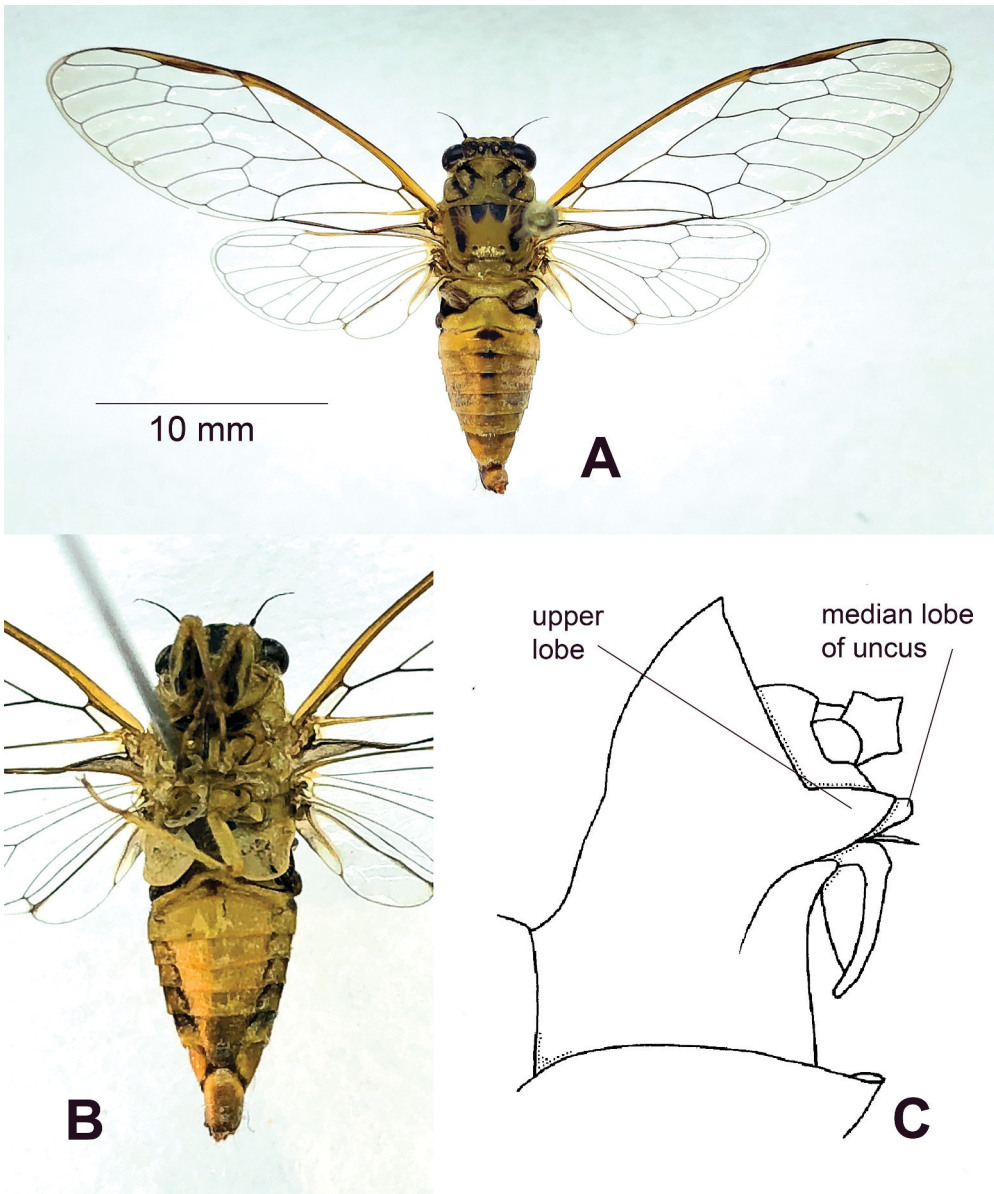


Figure 19. *Philipsalta lata* Lee and Marshall sp. nov., holotype, male, Mindanao, Philippines. (A) Dorsal habitus; (B) ventral habitus; (C) pygofer, lateral view.

Etymology

The specific name is a Latin feminine adjective meaning 'broad' or 'wide', in reference to the broader body of this species compared with the previous species.

Measurements of type (1 male)

Length of body: 15.4. Length of head and thorax together: 6.4. Length of abdomen: 9.0. Width of head including compound eyes: 4.1. Width of pronotum: 4.6. Width of

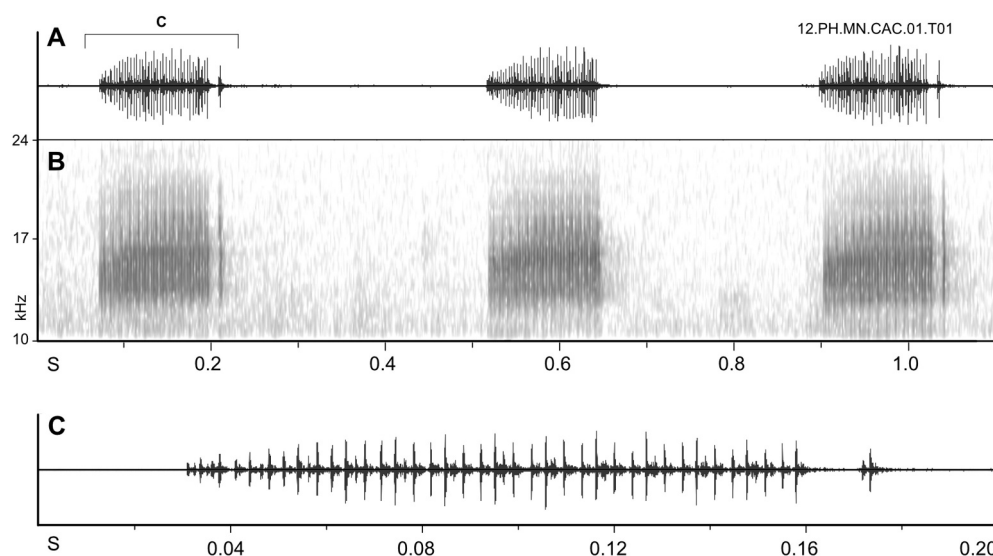


Figure 20. *Philipsalta lata* Lee and Marshall sp. nov., holotype male calling song. Waveforms (A, C) of male calling song at two time scales, the former with accompanying spectrogram (B).

mesonotum: 4.0. Width of abdominal tergite 3: 4.3. Length of fore wing: 17.7. Width of fore wing: 6.6. Wing span: 39.1.

Description of male

Body tiny. Head: Vertex ochraceous with the following black marks, connected to each other: inverted triangular mark surrounding median ocellus; a pair of marks surrounding lateral ocelli, expanding to anterior and lateral margins of vertex; a pair of spots on inner corners of supra-antennal plates; and a pair of spots on posterolateral corner of vertex (touching compound eyes). Compound eyes light brown in life. Distance between lateral ocelli and compound eyes about as long as distance between lateral ocelli. Antennae black to fuscous. Postclypeus not swollen anteriorly and rather flat ventrally; dull ochraceous with broad black median fascia. Anteclypeus dull ochraceous with median fuscous fascia and fuscous lateral margins. Rostrum ochraceous with black apex; with apex extending slightly beyond posterior margin of mid coxa. Lorum dull ochraceous with black longitudinal spot on inner corner of lorum. Gena dull ochraceous with black spot on inner corner of gena.

Thorax. Pronotum dull ochraceous. Inner area of pronotum with the following black to fuscous marks: tiny indistinct spot on posteromedian margin of inner area; a pair of short longitudinal fasciae between about middle of paramedian fissures and posterior ends of lateral fissures; a pair of fasciae along paramedian fissures, with their posterior parts indistinct; a pair of fasciae along lateral fissures; and a pair of curved fasciae along lateral margins of inner area. Pronotal collar very narrow; without distinct marks. Anterolateral pronotal collar not dentate. Mesonotum dull ochraceous with a pair of black to fuscous patches on entire submedian sigilla and a pair of larger longitudinal patches on almost entire lateral sigilla but partly indistinct. Cruciform elevation light ochraceous without

marks. Thoracic sternites ochraceous. Legs ochraceous to dull brown with some fuscous marks. Fore femur with primary, secondary and subapical spines.

Wings hyaline without infuscation; with extremely narrow marginal areas. Fore wing venation dull brown basally but fuscous distally. Basal membrane grey. Hind wing with six apical cells.

Operculum small, semicircular, with lateral margin slightly concave, not reaching posterior margin of sternite II; light ochraceous. Opercula separated from each other.

Abdomen triangular in dorsal view, much longer than head and thorax together; ochraceous. Tergite 1 about half as long as tergite 2 in median length. Tergites 3–7 each with fuscous spot anteromedially. A pair of fuscous globose bumps present on lateral margins of tergite 2. Timbal cover absent. Timbals not extending below wing bases ventrally. Abdominal sternites ochraceous with greyish patches irregularly.

Genitalia. Pygofer ovate with triangular dorsal beak in ventral view. Upper lobe moderately pointed. Dorsal beak triangular. Median lobe of uncus very short. A pair of clasper-like processes protruding downward but slightly curved, with apices heading outward.

Remarks

This new species can be distinguished from *Philipsalta exilis* Lee and Marshall sp. nov. mainly by the following characteristics, besides the differences in colours and marks: fore wing ulnar cell 2 more spacious than ulnar cell 1 (vs smaller than ulnar cell 1 in *P. exilis*); male operculum with lateral margin slightly concave (vs not concave in *P. exilis*); male abdomen with convex lateral margins in dorsal view (vs with almost linear marginal lines in *P. exilis*); median lobe of uncus comparatively short (vs moderately protruding, longer in *P. exilis*); and clasper-like processes slightly curved outward in ventral view (vs straight in *P. exilis*).

Song (Figure 20)

A 70s song sample was recorded from the holotype male and is illustrated here. Males produce phrases of 0.1–0.16 s duration at 1.8–2.6 phrases/s. Most phrases contain a single echeme followed by an isolated doublet after a silent gap of about 11–13 ms; some phrases lack the final doublet. The quality of the one recording is weak, in part due to environmental noise and echo, but for the clearest phrases the main echeme exhibits a complex pulse pattern, with sets of three stronger pulses or doublets produced at 350 pulses/s separated by single weaker pulses, and with the gaps preceding and following the weaker pulses being shorter than those separating the main pulses.

The frequency spectrum is broad, reaching from at least 8 kHz to well above 20 kHz, and has a peak around 13 kHz. Both the sound frequency and amplitude increase somewhat during the first half of each song phrase.

The song of *Philipsalta lata* Lee and Marshall sp. nov. is distinguishable from those of *P. exilis* and *P. nigrina* by the short single-doublet element ending most phrases, as well as by the complex 3 + 1 pulse pattern within the main echeme (*P. exilis* and *P. nigrina* have pulses or doublets produced at a uniform rate).

Tribe **PRASIINI** Matsumura, 1917

Genus ***Lembeja*** Distant, 1892

31. ***Lembeja fatiloqua*** (Stål, 1870)

Lembeja fatiloqua: Lee 2015: 555.

Distribution

Philippines (Mindanao and Basilan) and Malaysia (Sabah).

Additional material examined

2 males, PHILIPPINES, Mindanao, Bukidnon, Maramag, Mt. Musuan, 7 May 2012, K.B.R. Hill, D.C. Marshall and A.B. Mohagan (UCONN); 1 male, PHILIPPINES, Mindanao, Davao City, Bunawan Hilltop, 22 April 2011, A. Baguhin (UCONN).

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Disclosure statement

No potential conflict of interest was reported by the authors.

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