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Systematics and Phylogeny of the Australian Cicada Genus *Pauropsalta* Goding and Froggatt, 1904 and Allied Genera (Hemiptera: Cicadidae: Cicadettini)

by

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Front cover image—This new species of *Pauropsalta* was collected from various arid localities in the Northern Territory and Western Australia. It is named to honour Kathy Hill in recognition of her substantial contribution to Australian cicada systematics (see pages 157–159 and Plate 3).

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Systematics and Phylogeny of the Australian Cicada Genus *Pauropsalta* Goding and Froggatt, 1904 and Allied Genera (Hemiptera: Cicadidae: Cicadettini)

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ABSTRACT. A revision of the Australian cicada genera *Pauropsalta* and *Palapsalta* is presented. Twenty-two new species and five new genera are proposed with supporting evidence from a cladistic analysis of thirty morphological characters and a maximum likelihood molecular phylogeny that includes five loci. Most species descriptions include male genitalia drawings, distribution maps, and male calling song to aid in the identification of species. Furthermore, we include a key to all male and female species within *Pauropsalta* and the newly described genera. The following five genera are described as new: *Atrapsalta* n.gen., *Haemopsalta* n.gen., *Falcatpsalta* n.gen., *Relictapsalta* n.gen., and *Popplepsalta* n.gen. The following 22 species are described as new: *Atrapsalta emmotti* n.sp., *Atrapsalta furcilla* n.sp., *Atrapsalta vinea* n.sp., *Haemopsalta flammeata* n.sp., *Haemopsalta georgina* n.sp., *Popplepsalta aeroides* n.sp., *Palapsalta palaga* n.sp., *Palapsalta serpens* n.sp., *Pauropsalta accola* n.sp., *Pauropsalta adelphe* n.sp., *Pauropsalta agasta* n.sp., *Pauropsalta confinis* n.sp., *Pauropsalta conflua* n.sp., *Pauropsalta contigua* n.sp., *Pauropsalta ewarti* n.sp., *Pauropsalta herveyensis* n.sp., *Pauropsalta juncta* n.sp., *Pauropsalta katherina* n.sp., *Pauropsalta kriki* n.sp., *Pauropsalta similis* n.sp., *Pauropsalta sinavilla* n.sp., and *Uradolichos rotunda* n.sp.

KEYWORDS: *Pauropsalta*; Cicadettini; cicadas; taxonomy; morphology

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Pauropsalta Goding & Froggatt, 1904, is currently the largest genus of Australian cicadas with 26 described species. Those species belonging to *Pauropsalta* have been distinguished from all other genera in having the following: *(a)* an infuscation on the hind wing at the distal end of vein 2A; *(b)* complete fusion or abutted forewing veins M and CuA; *(c)* head never wider than the mesonotum; *(d)* exceptionally large upper pygofer lobes; and *(e)* ornamented apex of endotheca (Moulds, 2012). Those few species currently placed in *Pauropsalta* from outside Australia, viz. New Caledonia, India, and Asia, do not possess the above attributes and will be treated in future studies. This work forms part of a larger study of *Pauropsalta* by the senior author, which will examine molecular relationships among genera and species and explore the tempo and mode of *Pauropsalta* species as they radiated through Australia. Here we address the taxonomy of *Pauropsalta* and *Palapsalta* Moulds, 2012, a closely related genus, and present a cladistic analysis based upon morphology of all described species from which we identify attributes defining new genera and assess intergeneric relationships. In addition, we provide song analyses and molecular evidence from 5 genes (1 mtDNA, 4 nDNA; Owen *et al.,* 2015) in support of species and generic differentiation.

The genus *Pauropsalta* was poorly documented until Ewart (1989) reviewed the Queensland species of the genus, describing 10 new species and providing notes on others. Moulds (1990) provided an overview of 13 species none of which were those described by Ewart (1989) that had been published only a few weeks earlier. Additional notes on Queensland *Pauropsalta* species not summarized by Ewart (1989) or Moulds (1990) (mainly of songs and distribution) have been published by Ewart (1990, 1998a,b, 2001a,b, 2005), Popple (2003), Popple & Ewart (2002), Popple & Strange (2002), Popple, Walter & Raghu (2007) and Moulds & Owen (2011).

Despite the above publications, the identities of 11 described species have remained vague, nothing having been published on them since their brief original descriptions. The identities of these species are addressed below as part of this review of the genus. We describe five new genera and a further 22 new species. We do not address those species previously well documented when we have nothing new to add, although all species are included in our cladistic and molecular analyses. A key to all known species of *Pauropsalta*, *Atrapsalta* n.gen., *Falcatpsalta* n.gen., *Haemopsalta* n.gen., *Palapsalta*, some *Popplepsalta* n.gen., *Relictapsalta* n.gen., and *Uradolichos* is provided. Song analyses are provided for most new species as well as for those species whose songs were previously undocumented.

The following two names could not be associated with any species and are treated as *nomen dubia* in this work.

***Pauropsalta stigmatica* Distant, 1905**. The type is a female from Adelaide and because there are no known associated males its identity cannot be resolved and consequently is here treated as a *nomen dubium*. The complete fusion of fore wing veins M and CuA beyond the basal cell and the possession of 5 apical cells in the hind wing together with its small size, colouring and little to no infuscation on the hind wing suggest that it may be most closely allied to species of the *Pau. annulata* species group.

***Pauropsalta rubra* (Goding & Froggatt, 1904)**. The type is a female from Sale, Victoria that according to the original description should be in MV. The specimen could not be traced and the Museum has no record of it ever having been housed there. From the original description it would appear that the species is allied to *Atrapsalta encaustica.* The identity of the type is further clouded because it is a female and it is unlikely that it could be associated with a male to resolve its identity. Consequently the name is here treated as a *nomen dubium*.

The following species have been recently transferred from *Pauropsalta* to other genera, or have been synonymized by Moulds (2012) and consequently are not treated here:

basalis Goding & Froggatt, 1904, to *Nanopsalta* Moulds, 2012
bellatrix Ashton, 1914, to *Physeema* Moulds, 2012
dubia Goding & Froggatt, 1904, to *Platypsalta* Moulds, 2012
emma Goding & Froggatt, 1904, to *Mugadina* Moulds, 2012
lineola Ashton, 1914, =*Dipsopsalta signata* (Distant, 1914)
nodicosta Goding & Froggatt, 1904, to *Clinata* Moulds, 2012
signata Distant, 1914, to *Dipsopsalta* Moulds, 2012

Terminology for morphological features and higher classification follows those of Moulds (2005). The following abbreviations have been used for collections housing specimens: *AE*, collection of A. Ewart; *AJE*, collection of A. J. Emmott, Noonbah Station; *AM*, Australian Museum, Sydney; *ANIC*, Australian National Insect Collection, Canberra; *DE*, collection of David Emery, Sydney; *GAD*, collection of G. A. D. Davis, Hobart; *HOPE*, Hope Entomological Collections, Oxford University Museum, Oxford; *JM*, collection of J. Moss, Brisbane; *JO*, collection of J. Olive, Malanda; *LP*, collection of Lindsay Popple, Brisbane; *MM*, Macleay Museum, University of Sydney; *MSM*, collection of M. S. Moulds, Kuranda; *MV*, Museum of Victoria, Melbourne; *NHM*, Natural History Museum, London; *NTM*, Museum and Art Gallery of the Northern Territory, Darwin; *PH*, collection of Paul Hutchinson, Perth; *QM*, Queensland Museum, Brisbane; *SAM*, South Australian Museum, Adelaide; *UCS*, University of Connecticut, Storrs, USA; and *WAM*, Western Australian Museum, Perth.

Methods

Genitalia preparation and terminology

Genitalia were dissected and prepared following the methodology of Moulds (2012). Terminology for genital structures follows that of Moulds (2005) (Fig. 1). However, the homologies of the basal pygofer lobe proved difficult to interpret. Within *Pauropsalta* and its allied genera there are two lobed structures on the pygofer wall below the sclerital suture, the suture of the pygofer wall that indicates the point of fusion between abdominal tergite 9 and sternite 9 that together form the pygofer. The basal pygofer lobe is that situated immediately below the sclerital suture as defined by Moulds (2005).

In *Pauropsalta* and allied genera the basal lobe shows considerable variation and its identity can be confusing. In some species such as *Pauropsalta ewarti* n.sp. the basal lobe is large and rounded, clearly positioned immediately below the sclerital suture and is easily identified (Figs 1A, 1B). However, in other species such as *Haemopsalta flammeata* gen. et n.sp., the basal lobe turns inwards and is reduced to a small knob-like or spine-like structure (Figs 1C, 1D). Simultaneously with reduction of the basal lobe a secondary basal lobe, that is undeveloped in most cicadas, attains prominence and appears as if it were the true basal

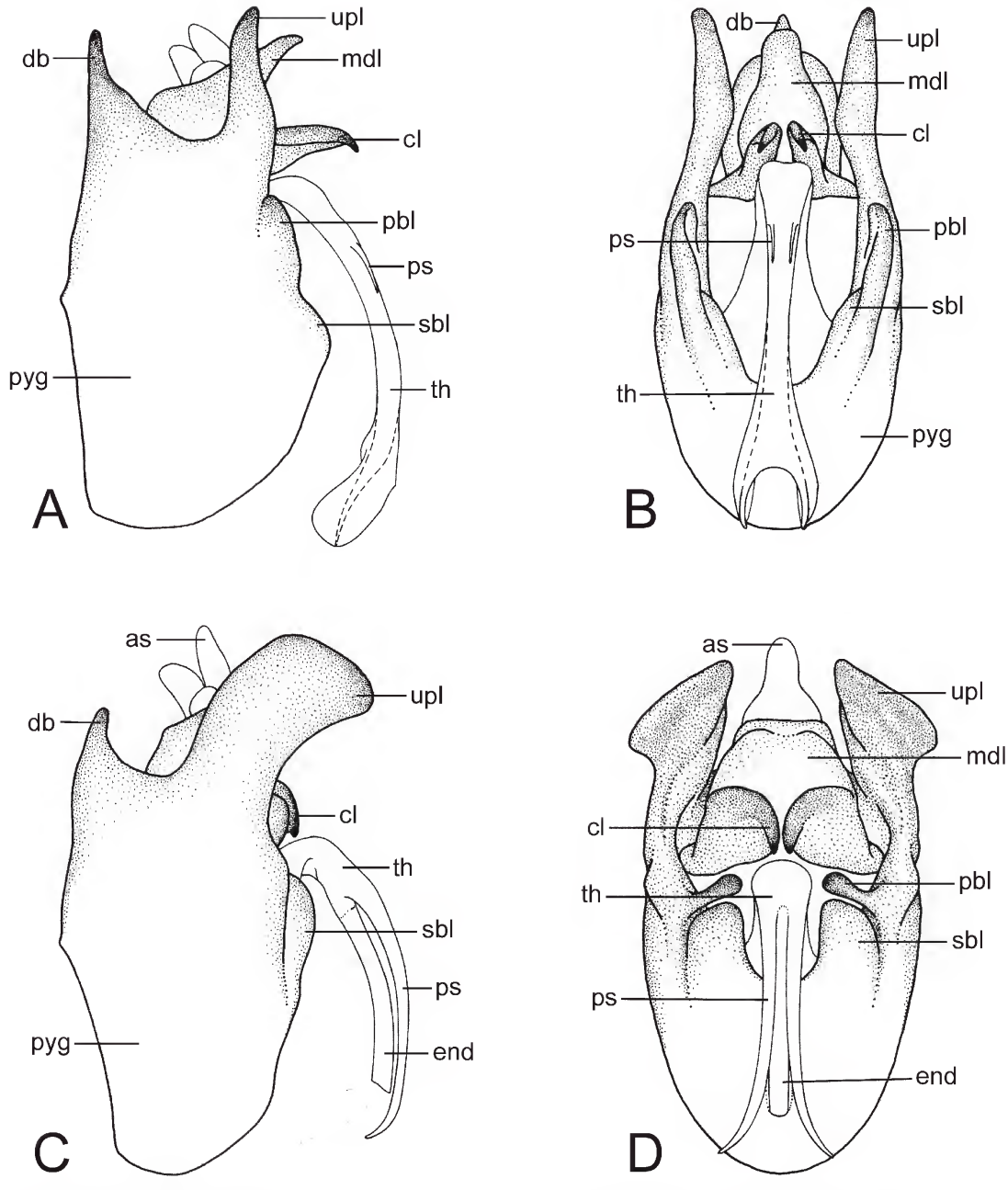


Figure 1. Male genitalia: *(A)* lateral view, *Pauropsalta ewarti* n.sp.; *(B)* ventral view, same species; *(C)* lateral view, *Haemopsalta flammeata* n.gen., n.sp.; *(C)* ventral view, same species. Terminology after Moulds (2005). *(as)* anal style); *(cl)* clasper; *(db)* dorsal beak; *(end)* endotheca; *(mdl)* median lobe of uncus; *(pbl)* pygofer basal lobe; *(ps)* pseudoparamere; *(pyg)* pygofer; *(sbl)* secondary basal lobe; *(th)* theca; *(upl)* upper pygofer lobe.

lobe (Figs 1C, 1D). A species showing intermediate transition in reduction of the basal lobe and increasing development of the secondary basal lobe is *Pauropsalta confinis* (Fig. 16).

Song analyses

All song recordings were collected by Simon Lab (University of Connecticut) personnel; primarily, David C. Marshall, John Cooley, and Kathy B. R. Hill. Songs were recorded in the field with a Marantz PMD-660 compact flash recorder with a Sennheiser ME-62 omnidirectional microphone mounted in a SONY PBR-330 parabolic reflector. Waveforms and spectrograms were viewed in Raven Pro 1.4 (Cornell Bioacoustics Laboratory, Ithaca, NY). For most species low frequency noise outside the kilohertz range of the song was removed from spectrograms to improve song clarity and enhance visualization. Furthermore, most depicted songs include an enhanced portion of the waveform to show fine-scale detail of song structure. Raw songs are available from the senior author upon request.

Type species designation and synonymies

Where possible we have selected holotype specimens from voucher specimens representing DNA samples and sometimes also with associated song recordings. It is our intention to clearly define holotype specimens as far as possible using morphological, molecular, and song data in case that a species needs to be separated from potential cryptic sister species (e.g., Marshall *et al.,* 2011).

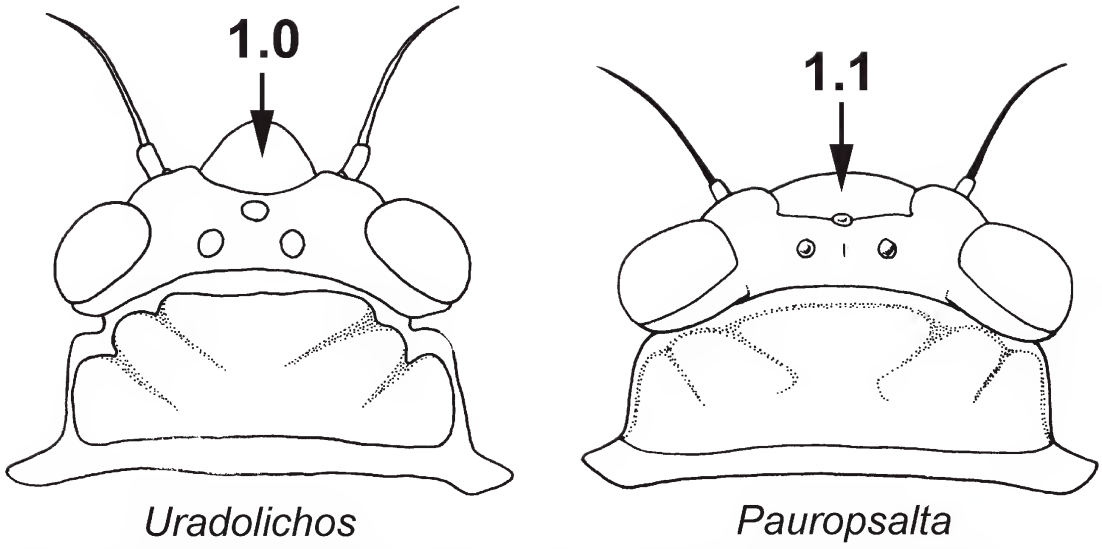


Figure 2. Character 1. *Postclypeus in dorsal view:* (0) substantially protruding, almost semicircular in outline when viewed from above; (1) tending confluent with anterior margin of head, tending angular in outline when viewed from above.

Listing of synonymies for previously described species have been restricted to primary entries only as detailed entries with all literature references are available elsewhere. In some cases literature not previously listed in earlier published synonymies is provided.

Justification for species

The delineation of species is supported by three sources of data; DNA (Owen *et al.*, 2015), morphology, and song, although DNA and/or song were not available for all species. First, 460 specimens were sequenced for c. 800 bp of the 3'COI gene and sequences were run in a Maximum Likelihood analysis (see above) to identify clusters of specimens (Owen *et al.,* 2015). The outward appearance of individuals in these clusters was then used to aid in sorting approximately 5,000 collection specimens to putative species.

Once sorted, 450 genitalia preparations were made from representatives of all putative species. The genitalia preparations were used as additional evidence in confirming the species status of the putative species. Described species were then identified from among the putative species recognized by comparison with type material (including male genitalia where practical). Remaining species groupings were thus considered new species. Once specimens were sorted according to DNA and morphology, available song recordings were compared. Songs are known to be species specific (Marshall *et al.,* 2008) and are thus useful in delimiting cryptic species. Thus, based on our sampling we believe the species we describe in this study represent unique taxa that do not share identical molecular, morphological, and acoustical characteristics with any previously described species and warrant description.

Justification for genera

The genera described in this study are based on the results of a cladistic analysis (detailed below) of a novel dataset of 30 binary and multistate characters. This suite of characters demonstrates common ancestry among groups of species examined and provides characters for which we define each new genus. Other characters used for defining genera were taken from those identified as relevant for defining the genus *Pauropsalta* by Moulds (2012). Four previously described genera with similar morphological features, and known to be closely allied to *Pauropsalta* by DNA (Owen *et al.,* 2015), have been included in the analysis to help clarify nodes representing putative new genera.

Cladistic analysis

All described Australian *Pauropsalta* species together with those new species described in this monograph, plus exemplars from *Graminitigrina*, *Gudanga*, *Nanopsalta*, *Palapsalta*, and *Uradolichos* were scored for the following 30 multistate and binary characters believed to be meaningful at generic level.

Characters

1 *Postclypeus in dorsal view*: (0) substantially protruding, almost semicircular in outline when viewed from above (Fig. 2); (1) tending confluent with anterior margin of head, tending angular in outline when viewed from above (Fig. 2).

2 *Fore wings*: (0) entirely suffused black; (1) entirely hyaline or almost so.

3 *Fore wing veins M and CuA*: (0) not touching before reaching basal cell; (1) completely fused as one before reaching basal cell; (2) abutted for some distance before reaching basal cell.

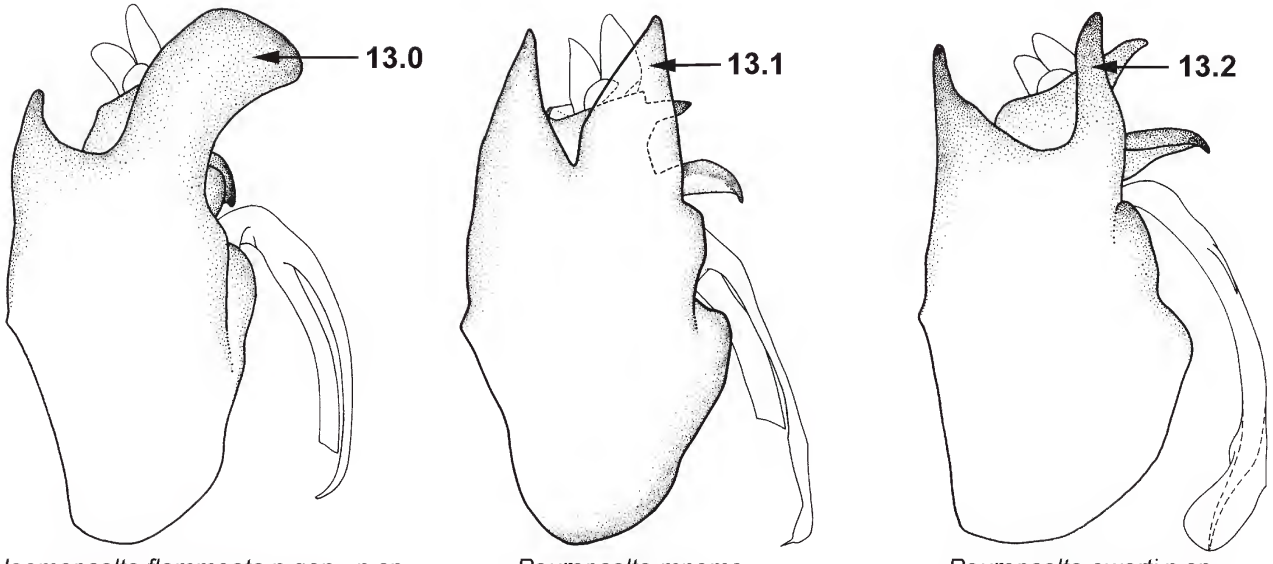
4 *Costa colour*: (0) dark brown to black; (1) red.

5 *Hind wing apical cells*: (0) 6 cells; (1) 5 cells.

Note: species with 5 hind wing apical cells usually have a small number of individuals with 4 or 6 apical cells (usually only in one wing). Such specimens are considered to have 5 apical cells and those minority individuals with 4 or 6 are regarded as abnormal.

6 *Hind wing apical cell 1*: (0) of usual size, more than half the length of apical cell 2; (1) very small, far less than half the length of apical cell 2.

7 *Male abdomen*: (0) about as long or shorter than head plus thorax; (1) longer than head plus thorax.



Haemopsalta flammeata n.gen., n.sp. *Pauropsalta mneme* *Pauropsalta ewarti* n.sp.

Figure 3. Character 13. *Upper pygofer lobe shape in lateral view*: (0) dorsal margin with basal portion strongly angled to axis of pygofer; very broad basally and tapering to a broad apex; (1) dorsal margin with basal portion nearly aligned with axis of pygofer; broad basally and tapering to a broad apex; (2) dorsal margin with basal portion nearly aligned with axis of pygofer; narrow basally so that upper pygofer lobe tends towards a linear structure with the distal portion slightly tilted downward.

8 *Male abdomen*: (0) about as wide as thorax; (1) very wide, much wider than thorax.

9 *Male abdomen*: (0) ridged along dorsal midline; (1) broadly rounded across dorsal half.

10 *Male abdomen*: (0) epipleurites reflexed inwards; (1) epipleurites not flexed inwards, abdomen below rounded in cross section.

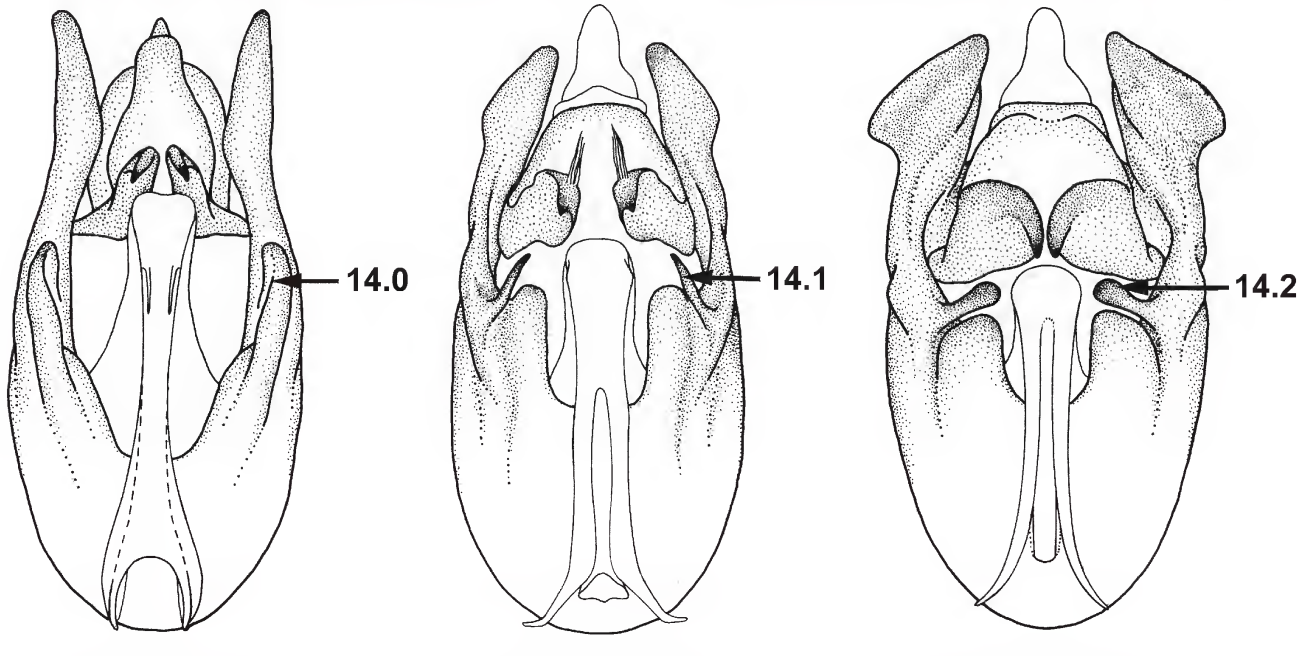
11 *Pygofer caudal beak*: (0) broad, short, not well developed; (1) spine-like, well developed.

12 *Upper pygofer lobe*: (0) single lobed; (1) bi-lobed.

13 *Upper pygofer lobe shape in lateral view*: (0) dorsal margin with basal portion strongly angled to axis of pygofer; very broad basally and tapering to a broad apex (Fig. 3); (1) dorsal margin with basal portion nearly aligned with axis of pygofer, broad basally and tapering to a broad apex (Fig. 3); (2) dorsal margin with basal portion nearly aligned with axis of pygofer; narrow basally so that upper pygofer lobe tends towards a linear structure with the distal portion slightly tilted downward (Fig. 3).

14 *Pygofer basal lobe*: (0) flap-like, sometimes turned inwards (Fig. 4); (1) spike-like (Fig. 4); (2) peg with rounded distal end (Fig. 4).

15 *Pygofer secondary basal lobe shape*: (0) fold-like, in lateral view projecting and broadly rounded, in ventral



Pauropsalta ewarti n.sp. *Pauropsalta dolens* *Haemopsalta flammeata* n.gen., n.sp.

Figure 4. Character 14. *Pygofer basal lobe:* (0) flap-like, sometimes turned inwards; (1) spike-like; (2) peg with rounded distal end.

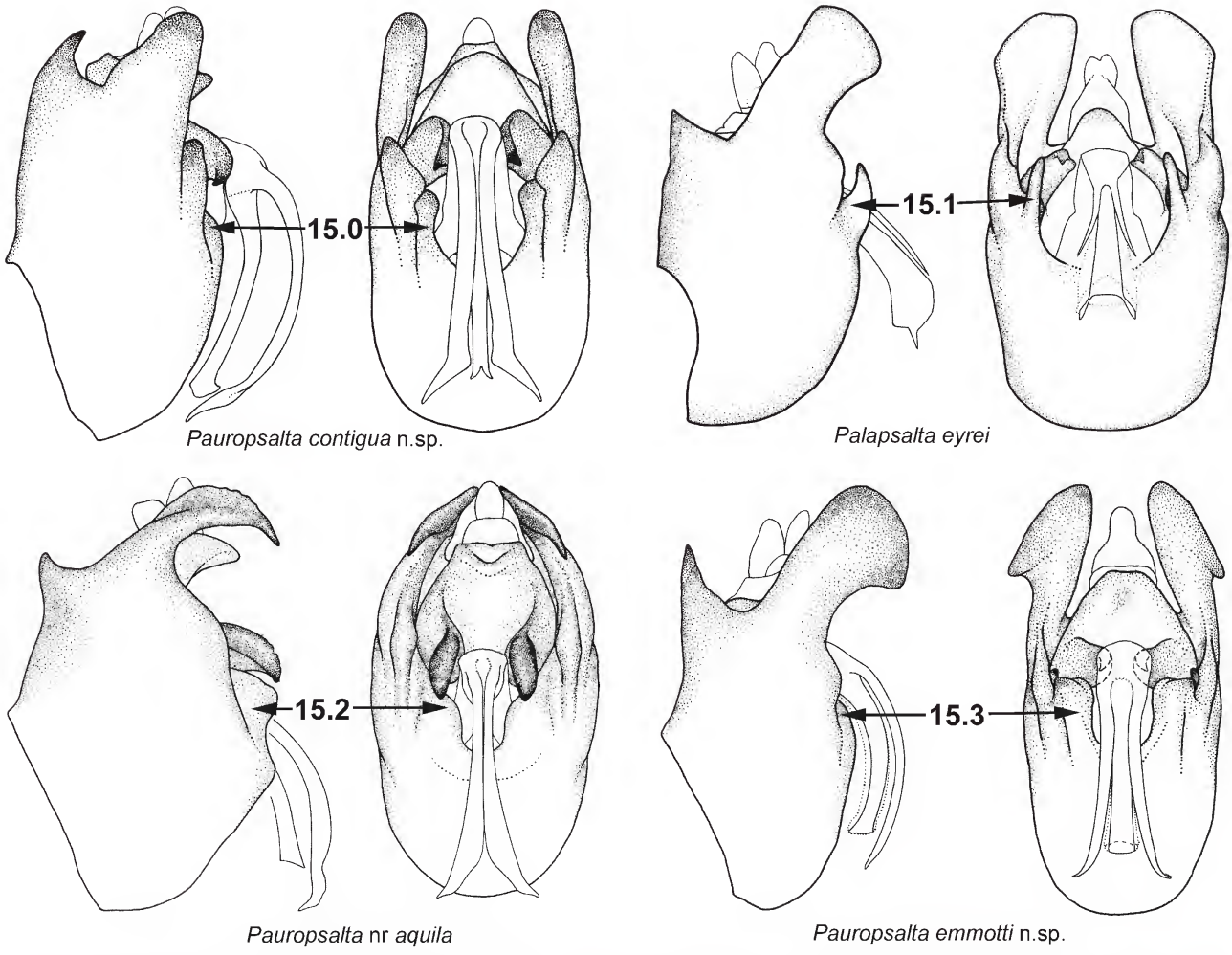


Figure 5. Character 15. *Pygofer secondary basal lobe shape:* (0) fold-like, in lateral view projecting and broadly rounded, in ventral view either closely aligned with pygofer margin or projecting to varying extent but always totally fused to pygofer margin at rear; (1) plate-like and well developed, in lateral view clearly projecting and subtriangular with a broad base tapering to a slightly upturned pointed apex, in ventral view long and spike-like; (2) tending fold-like, in lateral view broadly angled and moderately projecting, in ventral view broad and rounded; (3) lobe like and domed, in lateral view not or moderately projecting and broadly rounded, in ventral view well developed with rounded apex that is sometimes two-tiered and fusion with pygofer margin not reaching apex.

view either closely aligned with pygofer margin or projecting to varying extent but always totally fused to pygofer margin at rear (Fig. 5); (1) plate-like and well developed, in lateral view clearly projecting and subtriangular with a broad base tapering to a slightly upturned pointed apex, in ventral view long and finger-like (Fig. 5); (2) tending fold-like, in lateral view broadly angled and moderately projecting, in ventral view broad and rounded (Fig. 5); (3) lobe like and domed, in lateral view not or moderately projecting and broadly rounded, in ventral view well developed with rounded apex that is sometimes two-tiered and fusion with pygofer margin not reaching apex (Fig. 5).

16 *Secondary basal lobe shape*: (0) outer face rounded; (1) outer face ridged longitudinally. Note: The secondary basal lobe in *Graminitigrina bowensis* is small and it is difficult to confirm the presence or absence of a ridge on the outer face; consequently, for this species the character has been scored as "?".

17 *Uncus in dorsal view*: (0) linear, dorsal surface flat or domed; (1) broad, rounded, flat or depressed along dorsal midline; (2) broad, short, distal margin straight; (3) triangular and depressed along dorsal midline; (4) triangular with dorsal surface flat or domed.

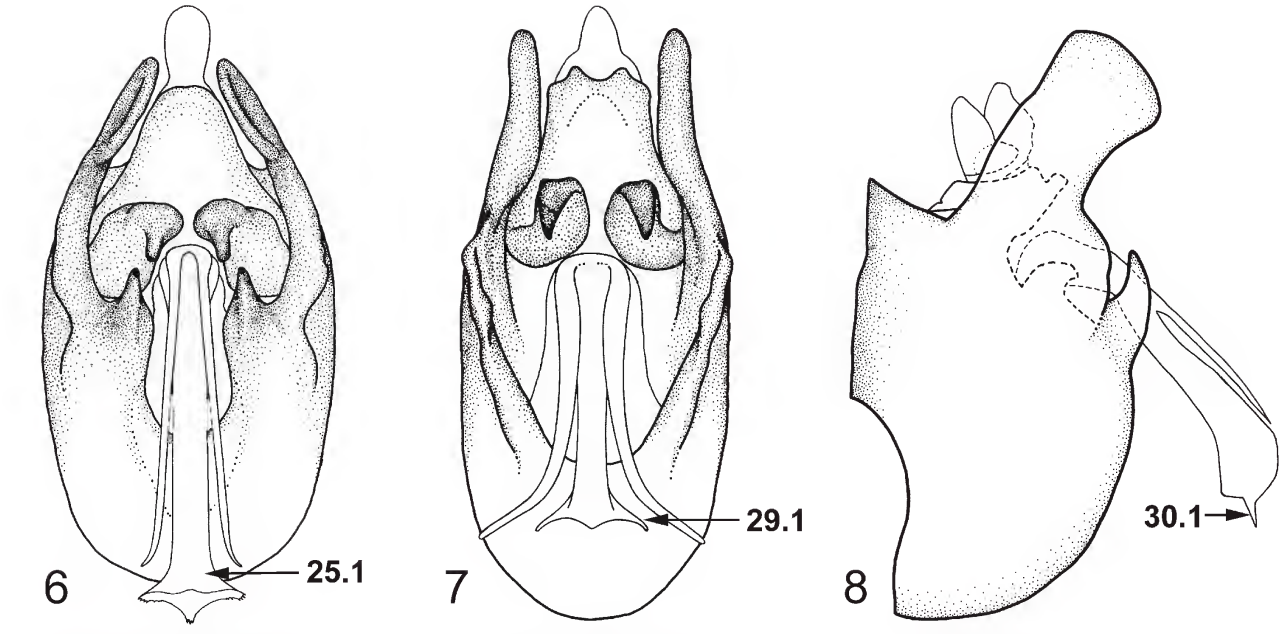
18 *Claspers in lateral view*: (0) long, projecting outward far beyond margin of pygofer, cavernous below for most of length; (1) extending no more than a little beyond margin of pygofer, claw-like with minimum or no cavity below.

19 *Claspers*: (0) extreme basal region concave, not developed forward; (1) extreme basal region projecting forward as a broad rounded lobe.

20 *Theca*: (0) trifid, that is with a pair of dorsal pointed pseudoparameres and a pointed ventral support surrounding an exposed endotheca; (1) not trifid, with a pair of pseudoparameres but lacking a ventral support.

21 *Pseudoparameres*: (0) robust, flattened or rounded in cross section, not hair-like; (1) hair-like.

22 *Pseudoparameres*: (0) arising independently at the base; (1) partly fused beyond the base.



Popplepsalta aeroides n.gen., n.sp. *Pauropsalta extrema* *Palapsalta eyrei*

Figures 6–8. Characters 25, 29 and 30. *(Fig. 6)* Character 25, *Endotheca shaft*: (1) trumpet-shaped in apical region.; *(Fig. 7)* Character 29, *Endotheca apex*: (1) with lateral "wing-like" flanges; *(Fig. 8)* Character 30, *Endotheca apex*: (1) with a spine-like projection at each lateroventral corner.

23 *Pseudoparameres in lateral view*: (0) adjacent to or close by theca and not arched high above it; (1) arched high above a nearly straight theca.

24 *Pseudoparameres*: (0) distal ends turned outwards; (1) distal ends straight; (2) distal ends turned inwards.

25 *Endotheca*: (0) shaft parallel-sided in apical region; (1) shaft trumpet-shaped in apical region (Fig. 6).

26 *Endotheca in lateral view*: (0) about as broad as or broader than pseudoparameres; (1) exceedingly thin, narrower than pseudoparameres.

27 *Endotheca*: (0) dorsal region sclerotized similar to that of lateral and ventral surfaces; (1) dorsal region sclerotized less than lateral and ventral surfaces; (2) much of surface weakly sclerotized and in part translucent.

28 *Endotheca apex*: (0) with margin either lacking serrations or partly serrated but not continuously around lateral and ventral margins; (1) with margin continuously serrated around lateral and ventral margins.

29 *Endotheca apex*: (0) without lateral "wing-like" flanges; (1) with lateral "wing-like" flanges (Fig. 7).

30 *Endotheca apex*: (0) without spine-like projection at each lateroventral corner; (1) with a spine-like projection at each lateroventral corner (Fig. 8).

The species incorporated in the cladistic analysis are listed in Table 1 together with the scoring of their character states. Uncertainty in a characters state for a species was scored as "?". *Gudanga boulayi* was chosen as an outgroup taxon based on the sister relationship of *Gudanga* to the lineage examined in this study (Moulds, 2005; Marshall *et al.*, 2016). A parsimony analysis was performed in PAUP* 4b10 (Swofford, 2003) using the tree bisection-reconstruction (TBR) algorithm with all characters treated as unweighted and unordered. Starting trees were generated with random sequence addition (RSA) and 1000 replicate tree searches were performed from different starting trees to ensure searches did not get stuck in a local optimum. Trees were then loaded into CLADOS version 1.2 (Nixon, 1992) to plot character state transformations along branches according to DELTRAN optimization and from which the final tree was printed. Branch support was estimated using 1000 bootstrap replications retaining a maximum of 500 trees at each replication.

Molecular phylogeny

Owen *et al.* (2015) recently estimated the molecular phylogeny of *Pauropsalta* and the new genera described in this study; therefore, we defer to the molecular phylogeny within Owen *et al.* (2015) to portray the relations among species and genera addressed in this study. Briefly, the molecular data set included all species in the cladistic analysis except: *Pauropsalta rubea*, *Pauropsalta fuscata*, *Pauropsalta ayrensis*, and *Uradolichos longipennis*. Fresh tissue was unavailable for those species. The molecular sequence data set included 1 mtDNA locus and 4 nDNA loci: cytochrome oxidase c subunit 1 (COI), elongation factor 1 alpha (EF1a), period (Per), acetyltransferase (ARD1), and glutaminyl tRNA synthetase (QtRNA). The nucleotide sequences were aligned in Mesquite v.2.75 (Maddison and Maddison 2011) using MUSCLE (Edgar, 2004) and adjusted by eye. The alignment was partitioned by locus and codon position if a protein-coding gene and partitions were assigned a model of evolution using PartitionFinder v.1.1.1 (Lanfear *et al.*, 2012). We estimated a maximum likelihood (ML) phylogeny in Garli (Zwickl, 2006) using default parameters and 15 independent searches starting from different starting trees. Branch support was estimated using 100 nonparametric bootstrap replicates (BS) with 2 independent tree searches, each from random starting trees, for each replicate. The tree was rooted with *Gudanga boulayi.*

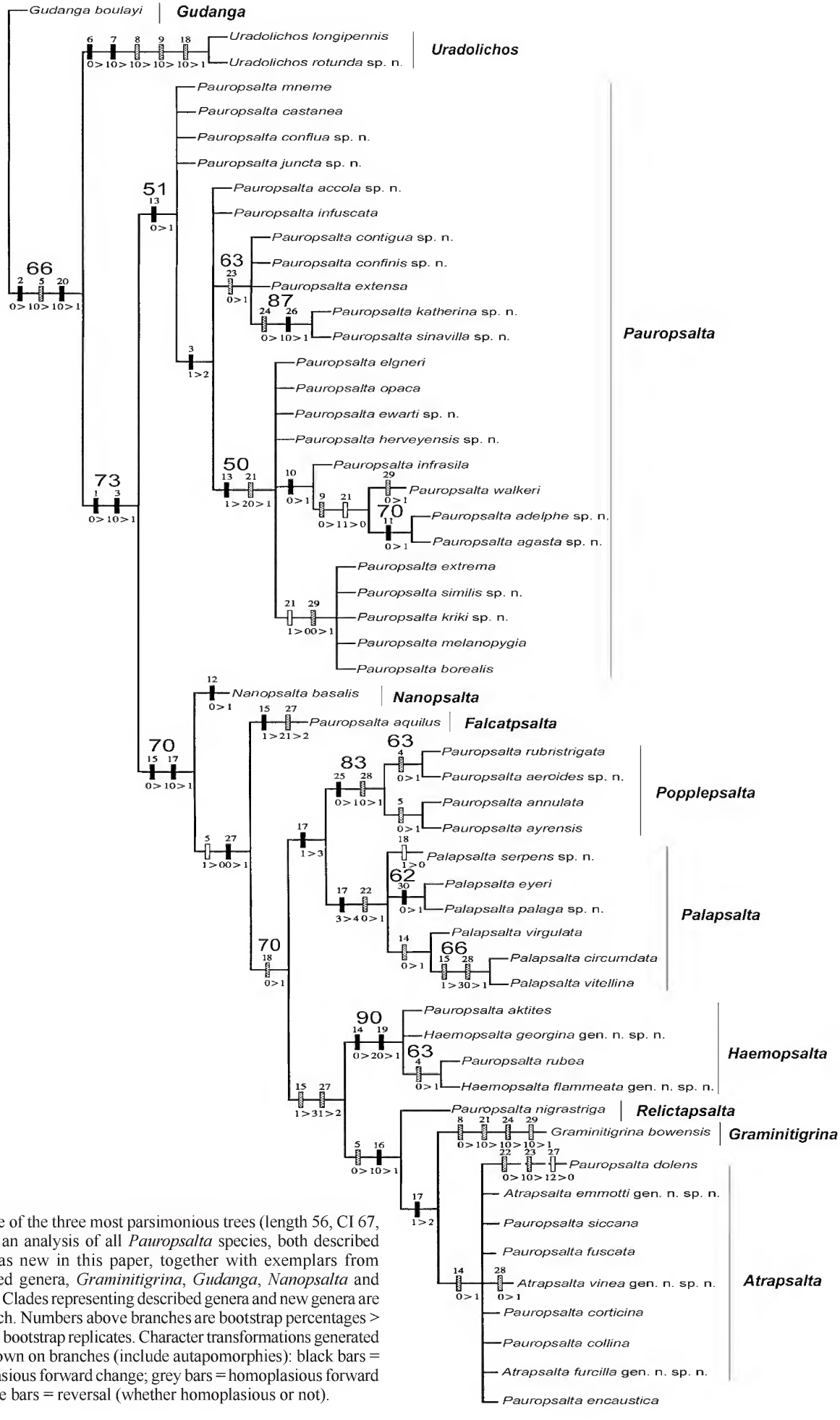


Figure 9. One of the three most parsimonious trees (length 56, CI 67, RI 92) from an analysis of all *Pauropsalta* species, both described and named as new in this paper, together with exemplars from four described genera, *Graminitigrina*, *Gudanga*, *Nanopsalta* and *Uradolichos*. Clades representing described genera and new genera are labeled as such. Numbers above branches are bootstrap percentages > 50 from 1000 bootstrap replicates. Character transformations generated in Clados shown on branches (include autapomorphies): black bars = non-homoplasious forward change; grey bars = homoplasious forward change; white bars = reversal (whether homoplasious or not).

Molecular and morphological phylogenetic results and generic groupings

Results from the morphological cladistic analysis found 24 shortest trees from which a strict consensus tree placed 23 of the *Pauropsalta* species as unresolved near the base of the tree that was otherwise reasonably well resolved. However, by de-activating character 21 just three equally parsimonious trees of length of 56, CI 67 and RI 92 were recovered, all with the 23 species previously unresolved clustered into a single clade and with no other changes in tree morphology. The three trees were identical except for minor differences in the placement of *Pauropsalta accola* n.sp. within *Pauropsalta* and one of these trees is shown in Fig. 9. In this tree clades representing described genera, and proposed new genera, are labelled as such along with bootstrap values.

The cladistic analysis recovered all previously described genera as monophyletic except *Pauropsalta*. *Pauropsalta* species were distributed among six clades, five of which we consider to be new genera. Most described genera and clades recovered lack branch support, which is most likely due to a paucity of characters. However, and most importantly, all the clades representing described genera and proposed new genera are well supported by a comprehensive molecular analysis described below and it is on this basis we have confidence in the generic groupings of the morphological tree.

In the molecular ML phylogeny (Fig. 10) all clades representing described and proposed genera are strongly supported except *Graminitigrina*. The ML phylogeny placed *Graminitigrina bowensis* in a clade (< 70 BS) that includes *Pauropsalta corticina, P. siccana, P. dolens, P. collina, P. encaustica,* and three new species we describe in this study. The non-monophyly of *Graminitigrina* may be due to poor taxon sampling for the genus, which is only represented in our molecular study by one of five described species (Fig. 10; Ewart & Marques, 2008). Although branch support for *Graminitigrina* is lacking in the molecular and morphological phylogenies, four apomorphies (all be it homoplasious ones) in the cladistic analysis distinguish *Graminitigrina* from all other species (Fig. 9). Therefore, we do not dispute the identity of *Graminitigrina*. Although no apomorphy could be found to unite the remaining species in the *Graminitigrina* clade, they are remarkably similar to each other given the characters we used, and we consider these to represent a new genus *Atrapsalta,* sister to *Graminitigrina.*

In conclusion, the generic decisions made here have been based on both the phylogenetic morphological and molecular analyses, which together support all proposed new genera and elucidate the placement of species in previously described genera.

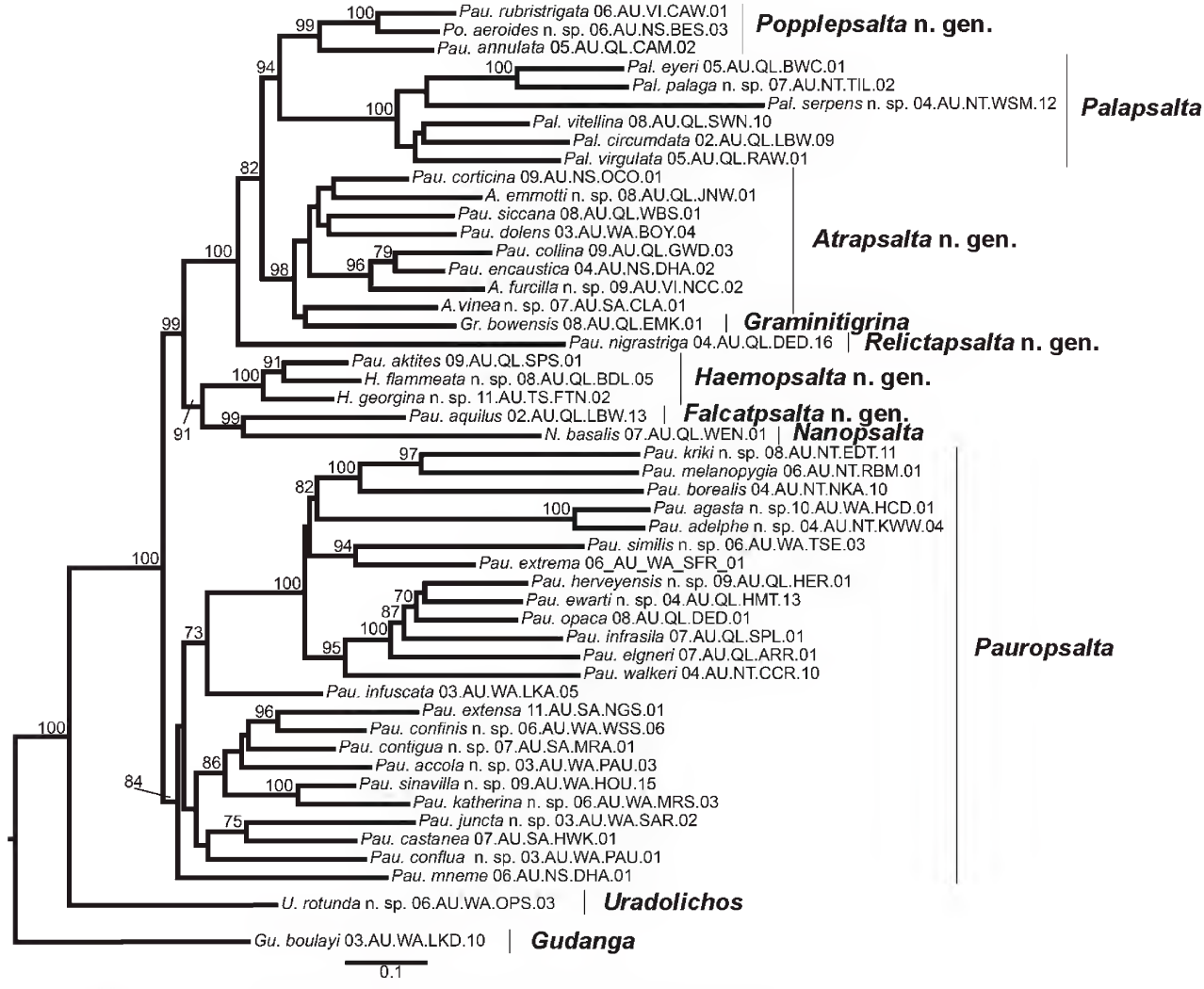


Figure 10. Maximum likelihood tree estimated using Garli 2.0 with 5 loci (1 mtDNA and 4 nDNA). Branch support values are bootstrap percentages from 100 non parametric bootstrap replicates. Bootstrap support values ≥ 70 are shown. Molecular voucher numbers are adjacent to species names.

Taxonomy

Family Cicadidae Latreille
Subfamily Cicadettinae Buckton
Tribe Cicadettini Buckton

Summary of genera treated in this paper with their included species

Pauropsalta Goding & Froggatt, 1904
- *accola* n.sp.
- *adelphe* n.sp.
- *agasta* n.sp.
- *borealis* Goding & Froggatt, 1904
- *castanea* (Goding & Froggatt, 1904)
- *confinis* n.sp.
- *conflua* n.sp.
- *contigua* n.sp.
- *elgneri* Ashton, 1912
- *ewarti* n.sp.
- *extensa* Goding & Froggatt, 1904
- *extrema* (Distant, 1892)
- *herveyensis* n.sp.
- *infrasila* Moulds, 1987
- *infuscata* (Goding & Froggatt, 1904)
- *juncta* n.sp.
- *katherina* n.sp.
- *kriki* n.sp.
- *melanopygia* (Germar, 1834)
- *mneme* (Walker, 1850)
- *opaca* Ewart, 1989
- *similis* n.sp.
- *sinavilla* n.sp.
- *walkeri* Moulds & Owen, 2011

Atrapsalta n.gen.
- *collina* (Ewart, 1989), n.comb.
- *corticina* (Ewart, 1989), n.comb.
- *dolens* (Walker, 1850), n.comb.
- *emmotti* n.sp.
- *encaustica* (Germar, 1834), n.comb.
- *fuscata* (Ewart, 1989), n.comb.
- *furcilla* n.sp.
- *siccana* (Ewart, 1989), n.comb.
- *vinea* n.sp.

Haemopsalta n.gen.
- *aktites* (Ewart, 1989), n.comb.
- *flammeata* n.sp.
- *georgina* n.sp.
- *rubea* (Goding & Froggatt, 1904), n.comb.

Palapsalta Moulds, 2012
- *circumdata* (Walker, 1852)
- *eyrei* (Distant, 1882)
- *palaga* n.sp.
- *serpens* n.sp.
- *virgulata* Ewart, 1989
- *vitellina* Ewart, 1989

Popplepsalta n.gen.
- *aeroides* n.sp.
- *annulata* (Goding & Froggatt, 1904), n.comb.
- *ayrensis* (Ewart, 1989), n.comb.
- *blackdownensis* (Popple, 2013), n.comb.
- *corymbiae* (Popple, 2013), n.comb.
- *decora* (Popple, 2013), n.comb.
- *granitica* (Popple, 2013), n.comb.
- *inversa* (Popple, 2013), n.comb.
- *kobongoides* (Popple, 2013), n.comb.
- *notialis incitata* (Popple, 2013), n.comb.
- *notialis notialis* (Popple, 2013), n.comb.
- *rubristrigata* (Goding & Froggatt, 1904), n.comb.
- *simplex* (Popple, 2013), n.comb.
- *subtropica* (Popple, 2013), n.comb.
- *torrensis* (Popple, 2013), n.comb.
- *tremula* (Popple, 2013), n.comb.

Falcatpsalta n.gen.
- *aquilus* (Ewart, 1989), n.comb.

Relictapsalta n.gen.
- *nigristriga* (Goding & Froggatt, 1904), n.comb.

Uradolichos Moulds, 2012
- *longipennis* (Ashton, 1914)
- *rotunda* n.sp.

Key to species of *Pauropsalta* and allied genera

Pauropsalta and allied genera share a sclerotized endotheca that lacks a ventral support and all share an infuscation at the distal end of hind wing vein 2A except most species in the genus *Palapsalta*.

1 Fore wing veins M and CuA with their stems meeting the basal cell completely fused as one (view carefully under magnification) 29

—— Fore wing veins M and CuA with their stems meeting the basal cell closely abutted or parted, not fused as one 2

2(1) Fore wing basal membrane predominantly grey to brown or black 3

—— Fore wing basal membrane predominantly orange or red 21

3(2) Hind wing with 6 apical cells (if 6 in one wing and 5 in the other then treat as 5) ..... *Pauropsalta infuscata*

—— Hind wing with 5 apical cells 4

4(3) Pronotum with an adjacent pair of circular black dots on midline adjacent to pronotal collar distinctly separated from any other dark colour (view under low magnification) 5

—— Pronotum lacking such spots, although often with black markings but not like circular dots 6

5(4) Anteclypeus *predominantly* pale yellow or muddy yellow; found in Northern Territory ..... *Pauropsalta kriki*

—— Anteclypeus *predominantly* black (there is some yellow); found in northern Queensland ..... *Pauropsalta elgneri*

6(4) Length of rostrum reaching to at least apices of hind coxae 7

—— Length of rostrum reaching to about apices of mid coxae 13

7(6) Male 8

—— Female (not available for *herveyensis*) 18

8(7) Abdomen not rounded in cross section, the epipleurites reflexed inwards from junction with tergites on underside of abdomen 9

—— Abdomen completely rounded in cross section, the epipleurites not reflexed inwards 10

9(8) Pronotum black with reddish brown and yellow markings ..... *Pauropsalta opaca*

—— Pronotum black with yellow markings ..... *Pauropsalta herveyensis*

10(8) Abdominal tergite 8 entirely or partly jet black 11

—— Abdominal tergite 8 yellowish brown to dark brown but never partly jet black 12

11(10) Pronotum predominantly black with yellow markings ..... *Pauropsalta walkeri*

—— Pronotum black with yellow and brown/reddish brown markings ..... *Pauropsalta infrasila*

12(10) Submedian sigilla partly dark brown or black and partly yellowish brown, not uniformly coloured; male genitalia with apical part of endotheca *not* bifurcate ..... *Pauropsalta agasta*

—— Submedian sigilla black or dark brown throughout, uniformly coloured; male genitalia with apical part of endotheca bifurcate ..... *Pauropsalta adelphe*

13(6) Length of body including head longer than 20 mm; found in Queensland ..... *Pauropsalta ewarti*

—— Length of body including head equal to or shorter than 20 mm; found in South Australia or Western Australia 14

14(13) Male 15

—— Female ..... *Pauropsalta accola, P. confinis* or *P. contigua*

15(14) Dorsal portion of tergite 1 hidden 16

—— Dorsal portion of tergite clearly visible 17

16(15) Pygofer entirely black ..... *Pauropsalta extensa*

—— Pygofer substantially muddy yellow, especially on upper pygofer lobes and dorsal beak ..... *Pauropsalta confinis*

17(15) Male fore wing length usually longer than 19.7 mm, if less than 19.7 (there are no records below 19.5 mm) then male aedeagus with pseudoparameres lying immediately adjacent to endotheca in lateral view ..... *Pauropsalta accola*

—— Male fore wing length never longer than 19.7 mm, if above 19.4 mm then male aedeagus with pseudoparameres lying high above endotheca ..... *Pauropsalta contigua*

18(7) Pronotum black with brownish red markings 19

—— Pronotum black or brown with yellow or dark brown markings 20

19(18) Black markings on abdomen confined to dorsal half; male abdomen inflated ..... *Pauropsalta infrasila*

—— Black markings on abdomen extended to lower lateral region; male abdomen not inflated ..... *Pauropsalta opaca*

20(18) Pronotum black with yellow markings ..... *Pauropsalta walkeri*

—— Pronotum brown with dark brown markings ..... *Pauropsalta adelphe* or *P. agasta*

21(2) Rostrum reaching to or slightly beyond apices of mid coxae 22

—— Rostrum reaching at least to apices of hind coxae 24

22(21) Fore wing veins M and CuA with their stems meeting the basal cell completely separated (view ×10 magnification) ..... *Uradolichos rotunda*

—— Fore wing veins M and CuA with their stems meeting the basal cell closely abutted 23

23(22) Tergites mostly black or bright orange ..... *Pauropsalta katherina*

—— Tergites mostly brown or yellowish brown ..... *Pauropsalta sinavilla*

24(21) Tergites 4–6 bright orange 25

—— Tergites 4–6 brown, orange or red with dark brown to black markings 26

25(24) Not distinguishable by outward appearance; male genitalia with apex of aedeagus with wide lateral wing; west of the Great Sandy Desert, Western Australia ..... *Pauropsalta extrema*

—— Male genitalia with apex of aedeagus lacking lateral wings; distributed east of the Great Sandy Desert, Western Australia ..... *Pauropsalta similis*

26(24) Head width equal to or less than 4.9 mm ..... *Pauropsalta borealis*

—— Head width greater than 4.9 mm 27

27(26) Forewing length more than 23 mm 28

—— Forewing 23 mm or less ..... *Pauropsalta melanopygia*

28(27) Black markings on abdomen confined to dorsal half; male abdomen inflated ..... *Pauropsalta infrasila*

—— Black markings on abdomen extended to lower lateral region; male abdomen not inflated ..... *Pauropsalta opaca*

29(1) Hind wing with 5 apical cells (if 5 in one wing and 6 in the other then treat as 5) 30

—— Hind wing with 6 apical cells 64

30(29) Length of fore wing greater than or equal to 20 mm 31

—— Length of fore wing less than 20 mm 34

31(30) Fore wing broad, ratio of width to length about 2.3–2.5 ..... *Pauropsalta mneme*

—— Fore wing of usual proportions, ratio width to length 2.7 or greater 32

32(31) Tergites mostly brown ..... *Relictapsalta nigristriga*
—— Tergites mostly black 33

33(32) Rostrum reaching apices of mid coxae ..... *Pauropsalta accola*
—— Rostrum reaching almost to apices of hind coxae ..... *Pauropsalta castanea*

34(30) Dorsolateral interior of pronotum with dark red or reddish brown markings (view under magnification) 35
—— Dorsolateral interior of pronotum lacking dark red or reddish brown markings 38

35(34) Male 36
—— Female ..... *Pauropsalta accola* or *P. conflua* (female of *P. juncta* unknown)

36(35) Upper pygofer lobe brown or black 37
—— Upper pygofer lobe mostly yellow ..... *Pauropsalta accola*

37(36) Upper pygofer lobe triangular ..... *Pauropsalta conflua*
—— Upper pygofer lobe semi-circular ..... *Pauropsalta juncta*

38(34) Rostrum reaching to or slightly beyond apices of mid coxae 40
—— Rostrum reaching at least to apices of hind coxae 39

39(38) Length of body including head less than or equal to 17.1 mm ..... *Atrapsalta emmotti*
—— Length of body including head greater than 17.1 mm ..... *Pauropsalta castanea*

40(38) Pronotal collar edged brown to reddish brown 41
—— Pronotal collar edged yellow, orange or red 46

41(40) Male 42
—— Female 44

42(41) Upper pygofer lobes black 43
—— Upper pygofer lobes brown or muddy yellow ..... *Atrapsalta collina*

43(42) Upper pygofer lobe (visible without dissection) hooked downwards terminally ..... *Atrapsalta fuscata*
—— Upper pygofer lobe terminally rounded, paddle-like blinkers ..... *Atrapsalta corticina*

44(41) Fore wing length greater than 19.4 mm ..... *Atrapsalta corticina*
—— Fore wing length 19.4 mm or less 45

45(44) Abdomen below entirely black ..... *Atrapsalta fuscata*
—— Abdomen below not entirely black ..... *Atrapsalta collina*

46(40) Pronotal collar edged yellow or orange 47
—— Pronotal collar edged red 52

47(46) No markings on mesonotum, completely black 48
—— Red, yellow or orange markings on mesonotum 50

48(47) Black tergites edged orange; found in Queensland and New South Wales 49
—— Black tergites edged yellow; found in Western Australia and South Australia ..... *Atrapsalta dolens*

49(48) Male upper pygofer lobe apex dark and hooked downwards ..... *Popplepsalta ayrensis*
—— Male upper pygofer lobe apically pale and weakly hooked downwards or rounded and bulbous ..... *Popplepsalta annulata* group*

* Refer to Popple's (2013) key

50(47) Fore wing longer than 19 mm; found in Western Australia ..... *Pauropsalta accola*
—— Fore wing shorter than 19 mm; found in all States 51

51(50) Tergites mostly orange and wide ..... *Graminitigrina bowensis*
—— Tergites black and edged yellow ..... *Popplepsalta ayrensis* or *P. annulata* group*

52(46) Sternites orange or yellow, sometimes with a black fascia along midline 57
—— Sternites black (sometimes brown) or black edged yellow (consider black if majority of sternites are black except for area adjacent to epipleurites) 53

53(52) Male 58
—— Female 54

54(53) Ovipositor sheath projecting 1 mm (from Western Australia) ..... *Pauropsalta accola*
—— Ovipositor sheath projecting much less than 1 mm (from Queensland or NSW) 55

55(54) Fore wing length greater than 19.4 mm ..... *Atrapsalta corticina*
—— Fore wing length 19.4 mm or less 56

56(55) Abdomen below entirely black ..... *Atrapsalta fuscata* or *A. encaustica*
—— Abdomen below not entirely black ..... *Atrapsalta collina, A. corticina, A. encaustica* or *A. furcilla*

57(52) No markings on mesonotum ..... *Atrapsalta dolens*
—— Yellow markings on mesonotum ..... *Atrapsalta siccana*

58(53) Upper pygofer lobes black 59
—— Upper pygofer lobes brown or muddy yellow 61

59(58) Upper pygofer lobe (visible without dissection) hooked downwards terminally 60
—— Upper pygofer lobe terminally rounded, paddle-like blinkers ..... *Atrapsalta corticina*

60(59) Apex of endotheca (requires dissection) when viewed end on with broad dorsal and ventral lips, and spined all around ..... *Atrapsalta encaustica*
—— Apex of endotheca when viewed end on with narrow dorsal and ventral lips, and lacks spines across dorsal lip ..... *Atrapsalta fuscata*

61(58) Upper pygofer lobe (visible without dissection) tapering throughout most of its length to a rounded point ..... *Pauropsalta accola*
—— Upper pygofer lobe tending parallel-sided and widening distally 62

62(61) Upper pygofer lobes brown ..... *Atrapsalta collina*
—— Upper pygofer lobes muddy pale yellow 63

63(62) Apex of endotheca (requires dissection) when viewed end on with broad dorsal and ventral lips, and spined all around ..... *Atrapsalta encaustica*
—— Apex of endotheca when viewed end on with narrow dorsal and ventral lips, and lacks spines across dorsal lip ..... *Atrapsalta furcilla*

64(29) Costa and/or R+Sc red, reddish orange, or reddish brown 65
—— Costa and/or R+Sc brown or yellow 71

65(64) Fore wing with no infuscation between CuP+1A and 2A+3A 66
—— Fore wing with slight infuscation between CuP+1A and 2A+3A 69

* Refer to Popple's (2013) key

66(65) Fore wing at least 26 mm long ..... *Popplepsalta rubristrigata*
—— Fore wing less than 26 mm long 67

67(66) Sternites mostly black along midline 68
—— Sternites mostly red or orange along midline ..... *Palapsalta circumdata*

68(67) Fore wing no longer than 19 mm ..... *Haemopsalta rubea*
—— Fore wing 20 mm or longer ..... *Popplepsalta aeroides*

69(65) Tergite 2 entirely black; male upper pygofer lobe terminating to a long sharp point ..... *Falcatpsalta aquilus*
—— Tergite 2 black with yellow, red or brown hind margin (at least in part); male upper pygofer lobe terminating in a broad rounded end 70

70(69) Abdomen below with a distinct broad black fascia along midline ..... *Haemopsalta rubea*
—— Abdomen below lacking a distinct broad black fascia along midline ..... *Haemopsalta flammeata*

71(64) Anterior lateral margins with at least some tergites coloured orange 72
—— Anterior lateral margins of tergites coloured black 76

72(71) Black markings along midline of tergites 73
—— Orange or orange brown markings along midline of tergites 74

73(72) Black markings along midline of tergites wider around midline and thinning laterally ..... *Palapsalta virgulata*
—— Black markings on tergites about the same width on midline and laterally ..... *Palapsalta circumdata*

74(72) Tergites 1 and 2 orange ..... *Palapsalta eyrei*
—— Tergites 1 and 2 brown, sometimes tending black 75

75(74) Pronotum black with yellow markings ..... *Palapsalta palaga*
—— Pronotum brown with yellow markings ..... *Palapsalta vitellina*

76(71) Large white or pale brown spot on lateral sides of abdomen covering tergites 3–5 ..... *Palapsalta serpens*
—— No large white or pale brown spot on side of abdomen 77

77(76) Tergites mostly reddish orange (sometimes reddish brown) with black markings along midline ..... *Haemopsalta aktites*
—— Tergites black and usually edged yellow or orange 78

78(77) Pronotal collar entirely orange-brown or yellow-brown ..... *Popplepsalta annulata* group*
—— Pronotal collar black, often edged reddish-brown on posterior margin 79

79(78) Male 80
—— Female 81

80(79) Opercula entirely jet black ..... *Haemopsalta georgina*
—— Opercula black on basal half or so, otherwise pale muddy yellow ..... *Atrapsalta vinea*

81(79) Membranes at wing bases with reddish orange; leg joints often showing similar reddish orange ..... *Haemopsalta georgina*
—— Membranes at wing bases muddy pale yellow or grey; leg joints often showing muddy yellow ..... *Atrapsalta vinea*

* Refer to Popple's (2013) key

Genus *Pauropsalta* Goding & Froggatt, 1904

Pauropsalta Goding & Froggatt, 1904: 615.

Type species. *Pauropsalta leurensis* Goding & Froggatt, 1904, a junior synonym of *Cicada mneme* Walker, 1850, by original designation.

Included species: *accola* n.sp.; *adelphe* n.sp.; *agasta* n.sp.; *borealis* Goding & Froggatt, 1904; *castanea* (Goding & Froggatt, 1904); *confinis* n.sp.; *conflua* n.sp.; *contigua* n.sp.; *elgneri* Ashton, 1912; *ewarti* n.sp.; *extensa* Goding & Froggatt, 1904; *extrema* (Distant, 1892); *herveyensis* n.sp.; *sinavilla* n.sp.; *infrasila* Moulds, 1987; *infuscata* (Goding & Froggatt, 1904); *juncta* n.sp.; *katherina* n.sp.; *kriki* n.sp.; *melanopygia* (Germar, 1834); *mneme* (Walker, 1850); *opaca* Ewart, 1989; *similis* n.sp.; *walkeri* Moulds & Owen, 2011.

Revised diagnosis

As defined by Moulds (2012) with the following additions:

Head. Postclypeus in dorsal view tending confluent with anterior margin of head and tending angular in outline when viewed from above.

Wings. Hyaline. Fore wing veins M and CuA either abutted for some distance before reaching basal cell, or completely fused; hind wing with 5 or 6 apical cells.

Male genitalia. Upper pygofer lobe shape in lateral view with basal portion of dorsal margin nearly aligned with axis of pygofer; either broad basally and tapering to a broad apex, or narrow basally so that upper pygofer lobe tends towards a linear structure with the distal portion slightly tilted downward; pygofer basal lobe flap-like, sometimes turned inwards; pygofer secondary basal lobe shape fold-like, in lateral view projecting and broadly rounded, in ventral view either closely aligned with pygofer margin or projecting to varying extent but always totally fused to pygofer margin at rear; secondary basal lobe shape outer face rounded; uncus in dorsal view linear, dorsal surface flat or domed; claspers in lateral view long, projecting outward far beyond margin of pygofer, cavernous below for most of length; claspers extreme basal region concave, not developed forward; pseudoparameres arising independently at the base; endotheca shaft parallel-sided in apical region; endotheca dorsal region sclerotized similar to that of lateral and ventral surfaces.

Distinguishing features

Pauropsalta can be distinguished from all other genera by the combination of the following characters: hind wing with five or six apical cells; theca not trifid, but with a pair of pseudoparameres and lacking a ventral support; postclypeus tending confluent with the anterior margin of the head and tending angular in outline when view from above; fore wing veins M and CuA either closely abutted for some distance or completely fused as one before reaching the basal cell; upper pygofer lobe shape in lateral view with basal portion of dorsal margin nearly aligned with the axis of the pygofer.

Pauropsalta accola n.sp.

Fig. 11, Pl. 2

Pauropsalta accola Owen *et al.*, 2015: 260, *nomen nudum*.

Types. *Holotype* male (molecular voucher 03.AU.WAU.PAU.03), S of Balladonia Station, Western Australia, 143 m, 33°14'S 123°26'E, 13.i.2003, Moulds, Hill, Marshall & Vanderpool (WAM). *Paratypes:* WESTERN AUSTRALIA: 1♂, Madura, Nullarbor Plain, 6.xii.1978, M.S. & B.J. Moulds (AE). 1♂ (genitalia prep. PAU 323 and molecular voucher 09.AU.WAU.MAE.01), Moodini Bluff, 26 km E of Madura, 31°54.671'S 127°17.125'E, 6.ii.2009, K. Hill & D. Marshall; 1♂ (genitalia prep. PAU 263 and molecular voucher 03.AU.WAU.PAU.02; GenBank accessions: KM377172, KM377384, KM377409, KM377554, KM668355), S of Balladonia Station, 143 m, 33°14'S 123°26'E, 13.i.2003, Moulds, Hill, Marshall & Vanderpool (AM). 1♂, Madura, Nullarbor Plain, 6.xii.1978, M.S. & B.J. Moulds (LP). 2♂♂ (genitalia preps. PAU 369 & PAU 470), Madura, 26.xii.1990, M.S. & B.J. Moulds; 3♂♂ (genitalia preps. PAU 271 & PAU 288), Madura, Nullarbor Plain, 6.xii.1978, M.S. & B.J. Moulds; 1♂, Madura roadhouse, 31°54'S 127°10'E, 15.xii.1995, M.S. & B.J Moulds & K.A. Kopestonsky; 1♂ (genitalia prep. PAU 327), 1♀ (in cop. with PAU 327), S of Balladonia Station, 143 m, 33°14'S 123°26'E, 13.i.2003, Moulds, Hill, Marshall & Vanderpool; 2♂♂ (genitalia preps. PAU 368 & PAU 469), 10 km S of Pine Hill near Mt Ragged, 33°24.85'S 123°25.06'E, 17.xii.1995, M.S. & B.J. Moulds; 2♂♂ (genitalia preps PAU 365 & 466), Lake King, 31.xii.1990, M.S. & B.J. Moulds; 1♂ (genitalia prep. PAU 376), L. Carmody, 37.0 km N of L. Varley, 21.i.2002, P. Hutchinson (MSM). 1♂, 26.5 km N of Mt. Ragged Rd turnoff, 13.i.2003, Vanderpool, Marshall, Hill, M.S. & B.J. Moulds; 1♂, Moodini Bluff, 26 km E of Madura, 31°54.671'S 127°17.125'E, 6.ii.2009, K. Hill & D. Marshall (WAM).

Distribution (Fig. 11). Western Australia where it is confined to the southern, dry, subcoastal fringe between Hyden and Lake King in the west and Moodini Bluff near Madura in the east. In most years adults are present around Madura roadhouse. It is a common species but adults tend to be wary. There are records from early December to early February.

Habitat. This species has only been seen calling from mallee stems.

Description

Male (Pl. 2). *Head* narrower than lateral angles of pronotal collar; dominantly black with muddy yellow spot at posterior midline. Postclypeus jet black with pale yellow or pale reddish brown markings; a muddy yellow or pale reddish brown mark on midline around most anterior portion; lateral and posterior margins muddy yellow or pale reddish brown; transverse ridges and central groove distinct. Anteclypeus jet black. Rostrum black, occasionally tending brown proximally, reaching to or just beyond apices of mid coxae. Antennae black tending white distally. Supra-antennal plates black, sometimes edged reddish brown along anterior margin.

Thorax. Pronotum black, usually with reddish brown and pale yellow markings; center of pronotum with reddish brown patches; fascia along midline pale yellow, usually extending from near head and pronotal collar; sometimes a small, muddy yellow marking near midline of pronotal collar; pronotal collar between lateral angles black with posterior margin edged muddy yellow or reddish brown; lateral margin of pronotal collar not, or barely, ampliate. Mesonotum primarily black with reddish brown markings; usually a reddish brown marking on either side from, or near, anterior arms or the cruciform elevation to, or almost to, pronotum between lateral and submedian sigilla, this marking projecting inwards to varying degrees around its mid length and sometimes meeting and sometimes thereafter extending anteriorly on midline; sometimes a reddish brown

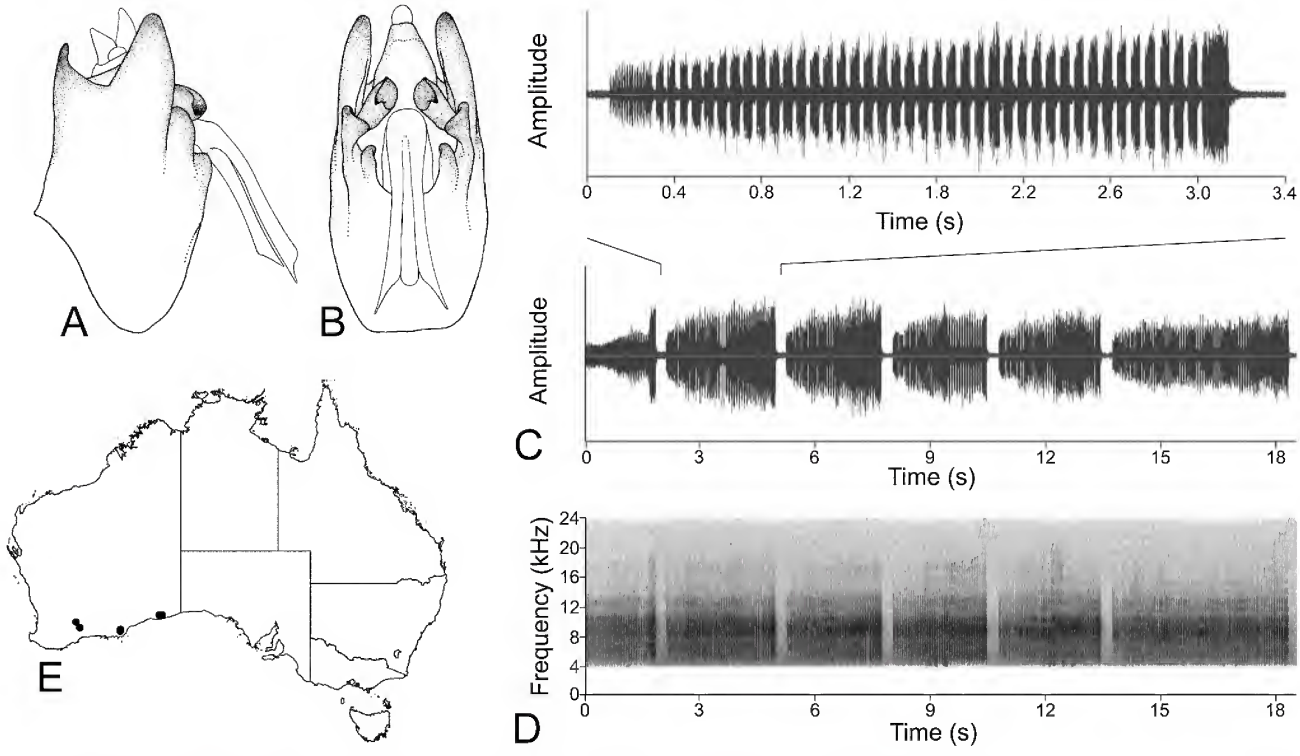


Figure 11. *Pauropsalta accola* n.sp. *(A)* male genitalia, lateral view (genitalia prep PAU 263); *(B)* male genitalia, ventral view (genitalia prep PAU 263); *(C)* waveform of male calling song recorded from 26.5 km north of Mt. Ragged, WA; *(D)* spectrogram of male calling song; *(E)* species distribution map.

blotch between anterior arms of cruciform elevation; lower lateral area usually with a reddish brown streak; scutal depressions occasionally visible as black dots surrounded by reddish brown; cruciform elevation black and reddish brown, sometimes partly muddy yellow; anterior arms usually reddish brown or muddy yellow with distal ends black, posterior arms usually black but sometimes yellow or brown, often a black fascia down midline. Metanotum black at hind wing base, remainder reddish brown, sometimes black near dorsal midline.

Legs. Fore legs mostly black usually with two reddish brown fascia to varying degrees along anterior length of femora, sometimes a brownish fascia along lateral interior and exterior of femora; femora with spines usually black, sometimes reddish brown distally; pretarsal claws black with pale yellow apices. Mid and hind legs mostly black or brown tending dark brown; coxae with proximal margin edged pale reddish brown or dull yellow; reddish brown along anterior length of femora; tibiae and tarsi brown tending dark brown. Meracanthus black with outer lateral margin and apex pale yellow.

Wings. Hyaline. Fore wing with stems of veins M and CuA either completely fused as one or abutted on meeting the basal cell, sometimes a combination of both on a single individual; venation brown; costa curving inward near arculus; infuscation distally on clavus; basal membrane grey to black. Hind wing with 5 apical cells; venation brown except for pale yellowish brown 2A and 3A; plaga muddy white to grey and pale brown; black infuscation on wing margin at distal end of vein 2A.

Opercula. For the most part reaching or almost reaching distal margin of tympanal cavity; widely separated; flat other than a low rounded swelling of epimeron 3; black, sometimes yellowish brown on distal half.

Timbals with four long ribs spanning the width of timbal membrane and one anterior long rib terminating before lower end of adjacent intercalary rib.

Abdomen. Tending triangular in cross section with epipleurites reflexed inwards from junction with tergites. Tergites black with reddish brown and yellow markings. Tergite 1 black; tergite 2 black with posterior margin narrowly edged reddish brown to muddy yellow, sometimes with a reddish brown to muddy yellow spot adjacent to posterior margin on midline; tergites 3–7 with posterior margin edged reddish brown laterally, extreme margin usually outlined dull yellow; tergite 8 black with dull yellow and/or reddish brown posterior margin, widest around midline. Sternite I black; sternites II–VII black with posterior margin reddish brown to dull yellow to varying degrees; sternite VIII black tending yellowish brown distally.

Genitalia (Fig. 11). Pygofer upper lobe long, in lateral view tapering to a rounded apex. Basal pygofer lobe a triangular flap-like lobe pointed inwards; secondary basal lobe small and rounded. Median lobe of uncus wider than long, duck-billed. Claspers claw-like, flattened in dorsal view, concave below. Aedeagus with pseudoparameres as long as or slightly longer than endotheca, slender, flattened in cross section, lying immediately adjacent to endotheca in lateral view, in dorsal view parallel to each other but slightly diverging at distal ends. Endotheca nearly straight, parallel sided, circular in cross-section, apex sloping backwards ventrally, without ornamentation.

Female (Pl. 2). Similar to male. Abdominal segment 9 black with margins pale muddy yellow, the yellow widest ventrally but the extent of this yellow may be considerably variable between individuals. Ovipositor sheath extending approximately 1.0 mm beyond apex of abdomen, coloured black.

Measurements. Range and mean (in mm) for 10♂♂ and 1♀; includes smallest and largest of available specimens. *Length of body*: male 15.5–18.2 (17.1); female 20.0. *Length of fore wing*: male 19.5–22.2 (20.5); female 23.2. *Width of fore wing*: male 6.6–7.6 (7.0); female 8.0. *Ratio length/ width of fore wing*: male 2.7–3.1 (2.9); female 2.9. *Width of head (including eyes):* male 5.1–6.1 (5.4); female 5.8. *Width of pronotum (across lateral angles):* male 5.4–6.1 (5.8); female 6.4.

Distinguishing features

Very similar in outward appearance to *Pauropsalta conflua*, *Pau. contigua, Pau. confinis, Pau. juncta* and *Atrapsalta dolens,* all of which occur in the southwest of Western Australia.

Those individuals of *Pau. accola* with the stems of fore wing veins M and CuA closely abutted rather than fused (even abutted only in one wing) are similar in this regard to *Pau. infuscata*, *Pau. contigua* and *Pau. confinis*. Distinguished from *Pau. infuscata* in having 5 apical cells in the hind wing instead of 6 (in *both* wings). Males are distinguished from *Pau. confinis* by having abdominal tergite 1 clearly visible dorsally; that of *Pau. confinis* is not visible dorsally. To separate males of *Pau. accola* having the stems of fore wing veins M and CuA abutted from *Pau. contigua* examination of the male aedeagus is necessary; the pseudoparameres of *Pau. accola* are adjacent to the endotheca whereas in *Pau. contigua* they rise very high above the endotheca. However, any specimens with a fore wing length of 19.4 mm or below are most likely to be *Pau. contigua* as no specimens of *Pau. accola* are known to have a fore wing that short. Females of *Pau. accola* are indistinguishable from those of *Pau. confinis* and *Pau. contigua*.

Those individuals with the stems of fore wing veins M and CuA completely fused as one are very similar in outward appearance to *Atrapsalta dolens, Pauropsalta conflua* and *Pau. juncta. Pauropsalta accola* differs from *Atrapsalta dolens* in its larger size, the fore wing length being 19.5 mm or longer while the fore wing of *A. dolens* never reaches 19.5 mm. Males can be distinguished from *Pau. conflua* and *Pau. juncta* by their substantially yellow upper pygofer lobes; these structures in *Pau. conflua* and *Pau. juncta* are almost all black or dark brown. Females of *Pau. accola* are indistinguishable from females of *Pau. conflua* (females of *juncta* are unknown).

The male genitalia are unique in having the following combination of characters: a large upper pygofer lobe that gradually tapers to a blunt point, an endotheca lacking a ventral support and a pair of pseudoparameres that lie immediately adjacent to the endotheca in lateral view with their distal ends extending to or a little beyond the apex of the endotheca.

Etymology. From the Latin *accola* meaning neighbor, and referring to the closely abutted but independent stems of veins M and CuA of the fore wing, an unusual feature amongst small black cicadas where the stems of these veins are usually fused as one.

Song (Fig. 11). The body of the song consists of a series of echemes with a rate of about 1 echeme every 3 s. The echemes range in length from c. 3 to 4–5 s. The frequency of echemes is contained between 4 kHz and 13 kHz.

Pauropsalta adelphe n.sp.

Fig. 12; Pl. 2

Pauropsalta adelphe Owen *et al.*, 2015: 260, *nomen nudum*.

Types. *Holotype* male (molecular voucher 04.AU.NT.KWW.11), genitalia prep. PU222), 30 km W [SW] of Katherine, Northern Territory, 163 m, 14°40.8'S 132°05.1'E, 24.i.2004, Cooley, Hill, Marshall, Moulds (NTM). *Paratypes*—NORTHERN TERRITORY: 1♂, 20 mi [miles] NE [of] Oenpelli [12°20'S 133°03E], Oct. 1910 [1960], W. Omer-Cooper (AM). 1♀, 30 km W of Katherine, 14°40'42"S 132°05'17"E, 24.i.2004, J. Olive (JO). 3♂♂ (one molecular voucher 04.AU.NT.KWW.05; GenBank accessions: KM377375, KM377449, KM668296) (one genitalia prep. PAU 222), 30 km W [SW] of Katherine, 163 m, 14°40.8'S 132°05.1'E, 24.i.2004, Cooley, Hill, Marshall, Moulds; 1♂, Howard Springs, nr Darwin, 29.xii.1986, M.S. & B.J. Moulds; 1♂ (genitalia prep. PAU 280), Berry Springs, 29.x.1993, G. Husband (MSM). 3♂♂ (genitalia prep. PAU 222), 30 km W [SW] of Katherine, 163 m, 14°40.8'S 132°05.1'E, 24.i.2004, Cooley, Hill, Marshall, Moulds; 1♂ (molecular voucher 11.AU.NT.MIK.08), Yurmikmik trailhead area/parking lot on road to Gunlom Falls area, Kakadu National Park, c. 4 km W of South Alligator River, 82 m, 13°518'S 132°452'E, 12.i.2011, K. Hill, D. Marshall (NTM). 3♂♂, 1♀, Mary River NP (Proposed), 12°53.496'S 131°38.311'E, 28.xi.2008, L. Popple, D. Emery, 700-0001 to 700-0004; 4♂♂, Leaning Tree Lagoon, 12°42.459'S 131°25.206'E, 28.xi.2008, L. Popple, D. Emery, 700-0005 to 700-0008; 5♂♂, Pine Creek (lookout), 13°50'S 131° 50'E, 27–28.xi.2008, L. Popple, D. Emery, 700-0009 to 700-0013 (LP).

Distribution (Fig. 12). Top End of the Northern Territory where there are records from Howard Springs and Berry Springs near Darwin, Oenpelli on the western edge of Arnhem Land, Mary River National Park, Pine Creek and 30 km southwest of Katherine. Usually an uncommon species but sometimes locally common. Adults have been taken from late October to late January. Adults are active and difficult to approach.

Habitat. Open eucalypt woodland where adults rest on tree trunks and limbs.

Description

Male (Pl. 2). *Head* a little wider than width of lateral margins of pronotal collar, about as wide or narrower than lateral margins of pronotum; dominantly black. Postclypeus black and orange brown; dorsal surface orange brown in central region; ventral surface with a broad black fascia centered on midline, never reaching lateral extremities; transverse ridges distinct, central groove indistinct. Anteclypeus dark brown. Rostrum pale brown with a black apex, reaching to apices of hind coxae. Antennae brown to dark brown. Supra-antennal plates orange brown.

Thorax. Pronotum orange brown with black markings; a black fascia on either side of midline, not always continuous, extending from the head and meeting at the pronotal collar, widest near head and pronotal collar; black fascia along paramedian fissure, diverging at posterior end to become parallel to midline; lateral fissure black; lateral edge of pronotum black; pronotal collar between lateral angles dominantly pale brown; lateral margins of pronotal collar mostly black, narrowly edged orange brown, not ampliate, some specimens with a small rounded tooth at margin that is indistinct or missing in others. Mesonotum orange brown with black to dark brown markings; submedian sigilla black to dark brown with margins sometimes edged reddish brown; lateral sigilla black to dark brown fading to reddish brown in parts; sometimes a black fascia on either side of midline, with anterior end starting at the center of the mesonotum and extending to, or towards, anterior arms of cruciform

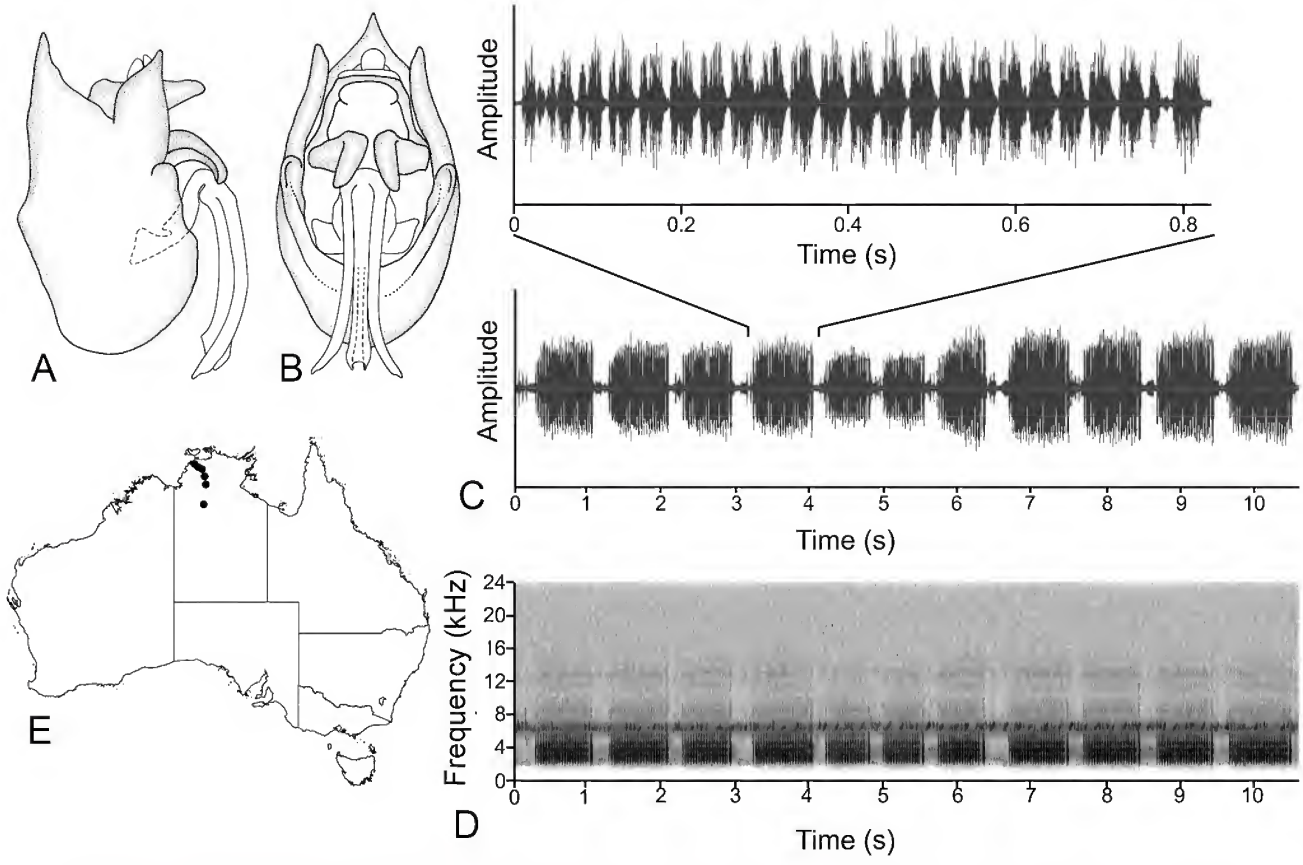


Figure 12. *Pauropsalta adelphe* n.sp. *(A)* male genitalia, lateral view (genitalia prep PAU 222); *(B)* male genitalia, ventral view (genitalia prep PAU 222); *(C)* waveform of male calling song recorded from 30 km west of Katherine on the Victoria Hwy (Hwy 1), NT; *(D)* spectrogram of male calling song; *(E)* species distribution map.

elevation; brown to dark brown fascia extending from centre of mesonotum, along midline to cruciform elevation; black or dark brown marking on anterior lateral margin of mesonotum; scutal depressions marked as black spots; lower ridge of wing groove orange brown; cruciform elevation orange brown with black fascia along midline joining with fascia along midline of mesonotum. Metanotum dark brown at hind wing base, remainder orange brown.

Legs. Fore legs mostly orange brown to dark brown; thin dark brown band outlining proximal edge of coxa; femora mostly dark brown; distal end of tarsi and pretarsal claws dark brown, almost black. Mid and hind legs orange brown to dark brown; dark brown outline on the proximal edge of coxa; femora dark brown; tibiae dark brown tending orange brown on distal half; distal end of tarsi and pretarsal claws dark brown, almost black. Meracanthus dark brown to black near base with a brown distal half.

Wings. Hyaline. Fore wing with fused stem of veins M and CuA not complete, the veins abutted rather than fused as one; venation dark brown; without infuscations; basal membrane grey to black, sometimes with hints of brown. Hind wing with 5 apical cells; venation brown; blackish infuscation along 2A and on wing margin at distal end of vein 2A; plaga grey.

Opercula. Small, not reaching distal margin of tympanal cavity; widely separated; a low rounded swelling on epimeron 3; dark brown to black on epimeron 3, otherwise orange brown.

Timbals with the ribs not heavily sclerotized; four long ribs spanning the width of timbal membrane and a much shorter anterior long rib terminating before lower end of adjacent intercalary rib.

Abdomen. Tending round in cross section with epipleurites not reflexed inwards but following curvature of abdomen; orange brown to dark brown. Tergite 1 dark brown tending black; tergite 2 dark brown tending black, primarily on anterior lateral half; tergites 3–7 orange brown with posterior edged light brown; tergite 8 usually brown rather than orange brown. Sternites I–VIII orange brown.

Genitalia (Fig. 12). Pygofer upper lobe long, in lateral view almost tear-drop in shape, very wide and rounded at base, thereafter narrowing to a narrow rounded apex. Basal pygofer lobe small, in lateral view broadly rounded. Median lobe of uncus wider than long, slightly bi-lobed at apex, the branches broad and rounded. Claspers claw-like, concave below, of medium width in dorsal profile. Aedeagus with pseudoparameres a little longer than endotheca, slender, flattened in cross section with distal portion gradually tapering to a point, in lateral view aligned with endotheca tube, in dorsal view parallel to each other but distally gradually diverging outwards by about 30°; endotheca nearly parallel sided, circular in cross-section, apex in cross section key-hole shaped, in lateral view distal portion of endotheca expanding towards apex, apex in lateral view sloping forwards dorsally, sloping backwards much more so ventrally.

Female (Pl. 2). Similar to male. Abdominal segment 9 yellowish brown, with a black or dark brown fascia on either side of midline extending distally from the anterior margin but not reaching posterior margin. Caudal beak very small, barely discernable. Ovipositor sheath extending 2.0 mm

beyond apex of abdomen; dark brown to black.

Measurements. Range and mean (in mm) for 10♂♂ and 1♀; includes smallest and largest of available specimens. *Length of body*: male 22.4–25.6 (23.9); female 22.0. *Length of fore wing*: male 28.8–31.3 (29.8); female 28.1. *Width of fore wing*: male 8.6–9.9 (9.2); female 8.4. *Ratio length/width of fore wing*: male 3.1–3.4 (3.2); female 3.3. *Width of head (including eyes)*: male 6.9–7.4 (7.1); female 6.8. *Width of pronotum (across lateral angles)*: male 7.4–8.2 (7.9); female 7.4.

Distinguishing features

Distinguished from most other species of the *Pauropsalta* group of genera (i.e. those genera with species bearing an infuscation at the distal end of hind wing vein 2A) by the following combination of characters. Fore wing veins M and CuA with their stems closely abutted but not fused as one (view under magnification), a fore wing length longer than 27 mm, and a pronotum with a background that is dominantly brown rather than black.

Pauropsalta adelphe is most similar to *Pau. agasta*. While their distributions appear to be separate (*Pau. adelphe* from the central part of the Top End of the Northern Territory, *Pau. agasta* from the far west of the Top End) there is little to distinguish the two species. As a general rule *Pau. adelphe* differs from *Pau. agasta* in having the markings on the mesonotum black rather than brown, but examination of the male genitalia is required for positive identification.

The male genitalia differ in the distal portion of the endotheca. In *Pau. adelphe* the apical part in dorsal view is bifurcate; that of *Pau. agasta* is not bifurcate.

Etymology. From the Greek *adelphe* meaning sister and referring to the close relationship of this species with *Pau. agasta*.

Song (Fig. 12). The song is composed of a series of echemes all at a length equal to or less than 1 s. The echemes have been recorded at a rate slightly above 1 echeme per second. The majority of the echemes fall within the frequency of 2 kHz and 16 kHz.

Pauropsalta agasta n.sp.

Fig. 13, Pl. 2

Pauropsalta agasta Owen et al., 2015: 260, *nomen nudum*.

Types. *Holotype* male (molecular voucher 10.AU.WA.DBE.01), Junction Le Lievre St and Derby Hwy, E edge of Derby, 3.2 km NW of Gibb River Rd, Western Australia, 17 m, 17°316'S 123°651'E, 19.i.2010, Hill, Marshall, Moulds (WAM). *Paratypes*—WESTERN AUSTRALIA: 2♂♂ (molecular vouchers 10.AU.WA.HCD.01 and 10.AU.WA.HCD.02; GenBank accessions: KM377132, KM377322, KM377461, KM668257), 14 km E of Halls Creek on Duncan Rd, 18°14.806'S 127°46.661'E, 23.i.2010, K. Hill & D. Marshall (AM). 1♂, 274 m, 183 km W of Halls Creek on Great Northern Hwy, c. 110 km E of Fitzroy Crossing, 18°748'S 126°197'E, 24.i.2010, K. Hill, D. Marshall; 1♂ (molecular voucher 11.AU.WA.KNM.01), 10.5 km W of Kununurra on Victoria Hwy, 15°766'S 128°661'E, K. Hill, D. Marshall; 1♂, 26.5 km SW of Mt. Barnet Roadhouse turnoff on Gibb River Rd., SW of Station Creek xing, 16°53.232'S 125°47.971'E, 21.xi.2011, K. Hill, D. Marshall; 1♂, 29.2 km SE of Fitzroy River on Great Northern Hwy, SE of Fitzroy Crossing, 18°400'S 125°742'E, 25.xi.2011, K. Hill, D. Marshall (MSM). 1♂, Mitchell Plateau, 14.8886°S 126.0402°E, 7.x.2009, *E. tetradonta*, *C. nesophila*, L. W. Popple. SF007031, 700-016 (LP); 1♂, Drysdale River Hsd 15°42'03"S 126°22'56"E, 6.x.2009, *E. tetradonta*, L. W. Popple, SF007031, 700-0014 (LP). NORTHERN TERRITORY: 1♂, 110 km E of Kununurra, Victoria Hwy, 26.xii.1991, M.S. & B.J. Moulds (AE). 1♂ (genitalia prep. PAU 223), 1♀, 110 km E of Kununurra, Victoria Hwy, 26.xii.1991, M.S. & B.J. Moulds (MSM). 1♂ 183 km WSW of Halls Creek, 18°44.939'S 126°11.661'E, 274 m, 24 i.2010, K. Hill & D. Marshall; 1♂, Tanami Rd, 39 km SE of Great Northern Hwy, 18°35.067'S 127°37.925'E, 25.i.2010, Hill, Marshall, Moulds (WAM).

Distribution (Fig. 13). Northeastern Western Australia in the vicinity of Fitzroy Crossing and Halls Creek, and the Top End of the Northern Territory within some 60 km of the Western Australian border. The only known localities are 183 km WSW of Halls Creek, 14 km east of Halls Creek, some 40 km south of Halls Creek and 110 km east of Kununurra. Specimens have been taken in December and January but most likely occur over a much wider range of months.

Habitat. Open eucalypt woodland where adults rest on tree trunks and limbs.

Description

Male (Pl. 2). Head wider than width of lateral margins of pronotal collar, about as wide or narrower than lateral margins of pronotum; dominantly black. Postclypeus black and light orange brown; dorsal surface light orange brown in central region; ventral surface with a broad black fascia centered on midline, never reaching lateral extremities; transverse ridges distinct, central groove indistinct. Anteclypeus dark brown. Rostrum pale brown with a black apex, reaching to apices of hind coxae. Antennae brown to dark brown. Supra-antennal plates light orange brown.

Thorax. Pronotum light orange brown with black markings; a black fascia on either side of midline, not always continuous, extending from the head and meeting at the pronotal collar, widest near head and pronotal collar; black fascia along paramedian fissure, diverging at posterior end to become parallel to midline; lateral fissure black; lateral edge of pronotum black; pronotal collar between lateral angles dominantly pale brown; lateral margins of pronotal collar mostly black, narrowly edged light orange brown, not ampliate. Mesonotum light orange brown with black to dark brown markings; submedian sigilla black to dark brown with margins sometimes edged reddish brown; lateral sigilla black to dark brown fading to reddish brown in parts; brown to dark brown fascia extending from centre of mesonotum, along midline to cruciform elevation; scutal depressions marked as black spots; lower ridge of wing groove light orange brown; cruciform elevation light orange brown, sometimes with black fascia along midline joining with fascia along midline of mesonotum. Metanotum brown at hind wing base, remainder light orange brown.

Legs. Fore legs mostly light orange brown to dark brown; thin dark brown band outlining proximal edge of coxa; femora mostly dark brown; distal end of tarsi and pretarsal claws dark brown, almost black. Mid and hind legs light orange brown to dark brown; dark brown outline on the proximal edge of coxa; femora dark brown; tibiae dark brown tending light orange brown on distal half; distal end of tarsi and pretarsal claws dark brown, almost black. Meracanthus dark brown to black near base with a brown distal half.

Wings. Hyaline. Fore wing with fused stems of veins M and CuA not. complete, the veins abutted rather than fused as one; venation dark brown; without infuscations; basal membrane grey to black, sometimes with hints of brown. Hind wing with 5 apical cells; venation brown; blackish

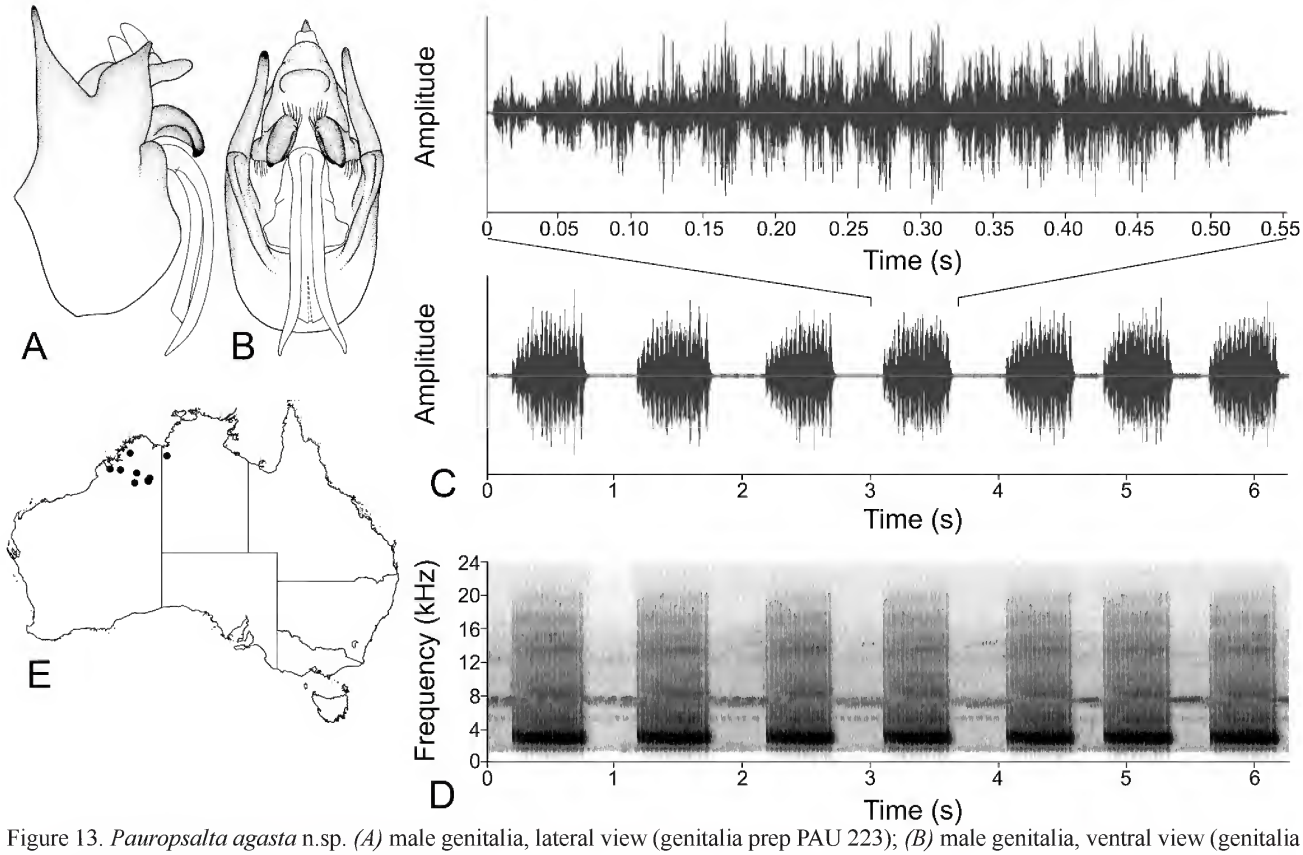


Figure 13. *Pauropsalta agasta* n.sp. *(A)* male genitalia, lateral view (genitalia prep PAU 223); *(B)* male genitalia, ventral view (genitalia prep PAU 223); *(C)* waveform of male calling song recorded from east of Derby, 3.2 km northwest of Gibb River Rd, WA; *(D)* spectrogram of male calling song; *(E)* species distribution map.

infuscation along 2A and on wing margin at distal end of vein 2A; plaga grey.

Opercula. Small, not reaching distal margin of tympanal cavity; widely separated; a low rounded swelling on epimeron 3; dark brown to black on epimeron 3, otherwise light orange brown.

Timbals with the ribs not heavily sclerotized; four long ribs spanning the width of timbal membrane and a much shorter anterior rib terminating before lower end of adjacent intercalary rib.

Abdomen. Tending round in cross section with epipleurites not reflexed inwards but following curvature of abdomen; light orange brown to brown. Tergite 1 brown; tergite 2 brown, primarily on anterior lateral half; tergites 3–8 light orange brown with posterior edged light brown. Sternites I–VIII light orange brown.

Genitalia (Fig. 13). Pygofer upper lobe long, in lateral view almost tear-drop in shape, very wide and rounded at base, thereafter narrowing to a narrow rounded apex. Basal pygofer lobe small, in lateral view broadly rounded. Median lobe of uncus wider than long, slightly bi-lobed at apex, the branches broad and rounded. Claspers claw-like, concave below, of medium width in dorsal profile. Aedeagus with pseudoparameres a little longer than endotheca, slender, flattened in cross section with distal portion gradually tapering to a point, in lateral view aligned with endothecal tube, in dorsal view parallel to each other but distally gradually diverging outwards by about 30°; endotheca nearly parallel sided, slightly expanded distally, circular in cross-section, apex in cross section circular, without ornamentation.

Female (Pl. 2). Similar to male. Black fascia along midline of mesonotum from pronotal collar to cruciform elevation. Abdominal segment 9 light orange brown, without markings. Ovipositor sheath long, extending some 2.3 mm beyond apex of abdomen; dark brown to black.

Measurements. Range and mean (in mm) for 6♂♂ and 1♀. *Length of body*: male 21.5–24.9 (24.1); female 28.5. *Length of fore wing*: male 27.3–31.8 (31.1); female 31.5. *Width of fore wing*: male 8.1–9.5 (9.0); female 9.6. *Ratio length/width of fore wing*: male 3.3–3.4 (3.35); female 3.3. *Width of head (including eyes)*: male 6.2–7.6 (7.2); female 7.9. *Width of pronotum (across lateral angles)*: male 6.9–8.3 (7.8); female 8.6.

Distinguishing features

Distinguished from most other species of the *Pauropsalta* group of genera (i.e. those genera with species bearing an infuscation at the distal end of hind wing vein 2A) by the following combination of characters. Fore wing veins M and CuA with their stems closely abutted but not fused as one (view under magnification), a fore wing length longer than 27 mm, and a pronotum with a background that is dominantly brown rather than black.

Pauropsalta agasta is most similar to *Pau. adelphe*. While their distributions appear to be separate (*Pau. agasta* from Western Australia and the far west of the Top End of the Northern Territory, *Pau. adelphe* from the central part of the Top End) there is little to distinguish the two species. As a general rule *Pau. agasta* differs from *Pau. adelphe* in having the markings on the mesonotum brown rather than black, but examination of the male genitalia is required for positive identification.

The male genitalia differ in the distal portion of the endotheca. In *Pau. agasta* the apical part in dorsal view is not bifurcate; that of *Pau. adelphe* is bifurcate.

Etymology. From the Greek *agastor* meaning twin or near kinsman, and referring to the close similarity of this species to *Pau. adelphe*.

Song (Fig. 13). The body of the song is composed of a series of echemes. Each echeme is less than 1 s in length, while the echemes occur at a rate of slightly above 1 echeme per second. The majority of echemes fall between 2 kHz and 20 kHz.

Pauropsalta borealis Goding & Froggatt, 1904

Fig. 14

Pauropsalta borealis Goding & Froggatt, 1904: 615, 627, 566; Distant, 1906: 179; Hahn, 1962: 9; Metcalf, 1963: 405; Ewart, 1989: 293; Moulds, 1990: 131; Owen *et al.*, 2015: 260.
Melampsalta borealis Burns, 1957: 647.
Pauropsalta "near *walkeri*" Marshall & Hill, 2009: 4.

Material examined. NORTHERN TERRITORY: *Holotype* female (by monotypy), 1895, Tepper (ANIC, on permanent loan from Macleay Museum, University of Sydney). 1♂, Howard Springs, S of Darwin, 10.xii.1982, A. Walford-Huggins (AE). 1♂, Darwin, 3.ii.1977, M.S. & B.J. Moulds (LP). 1♂, Parap [Darwin], 5.xii.1972, N. Forrester; 1♂, Marrikae Rd, 30 km SSE of Darwin, 7.i.1992, M.S. & B.J. Moulds; 1♂, Rum Jungle, 7.i.1992, M.S. & B.J. Moulds; 2♀♀, Barry Springs Rd, via Darwin, 25–26. xi.1978, R.I. Storey; 1♂, Darwin, 3.ii.1977, M.S. & B.J. Moulds; 1♂, 1♀, Howard Springs, S of Darwin, 10.xii.1982, A. Walford-Huggins; 1♂, 29 km W of Batchelor, 89 m, 13°1.3'S 130°56.2'E, 22.i.2004, Cooley, Hill, Marshall, Moulds; 1♂, Dripstone Cliffs, 23.i.2004, Cooley, Hill, Marshall, Moulds; 1♂, 6 km E Humpty Doo, 9.ii–1.iii.1987, R.I. Storey (MSM); 1♂ (molecular voucher 04.AU.NT.NKA.10; GenBank accessions: KM377125, KM377291, KM377507, KM668302), Stuart Hwy (Hwy 1) 34.1 km N Katherine, -14.2498 132.0545, 24.i.2004, Cooley, Marshall, Hill, Moulds, Moulds, Olive, Olive, Cowan (UCS).

Distribution (Fig. 14). Top End of the Northern Territory excluding Arnhem Land between Darwin and the Roper River. It is a common species in and around Darwin. There are records from late November to late February.

Habitat. Usually found in open eucalypt woodland but also sometimes in suburban streets and gardens.

Re-description

Male. *Head* wider than lateral margins of pronotal collar; black with muddy yellow spot at posterior midline. Postclypeus jet black with muddy yellow markings; usually with muddy yellow dorsally, variable in extent; usually a muddy yellow mark on midline around most anterior portion; lateral and posterior margins muddy yellow; transverse ridges and central groove distinct. Anteclypeus dark brown tending black. Rostrum brown tending black distally, sometimes all black, reaching to or just beyond bases of hind coxae. Antennae brown tending light brown to white distally. Supra-antennal plates black, sometimes edged yellowish brown along anterior margin.

Thorax. Pronotum predominantly brown and black with some pale yellow markings; central area of pronotum a mixture of brown and black patches, the black often, but not always, following fissures; fascia along midline pale yellow, usually extending from near head almost to pronotal collar, this fascia usually outlined in black except at anterior end; sometimes a muddy yellow marking dorsally abutting and/or on anterior margin of pronotal collar; pronotal collar not, or barely, ampliate, brown to muddy yellow in colour with dorsal anterior margin edged black to varying degrees and lateral angles mostly black. Mesonotum black and light brown; submedian and lateral sigilla black; usually a black fascia partly or entirely filling space between anterior arms of cruciform elevation, and often extending anteriorly between submedian sigilla; lower lateral area often with a black streak; scutal depressions occasionally visible as black dots surrounded by brown; cruciform elevation light brown, sometimes partly muddy yellow, usually with black midline and often black between anterior and posterior arms. Metanotum black at hind wing base, remainder light brown, sometimes black near dorsal midline.

Legs. Fore legs mostly dark brown tending black, with a yellowish brown fascia to varying degrees along anterior length of femora; femora with spines brown or black; tarsi light brown tending dark brown distally; pretarsal claws brown and black with pale yellow apices. Mid and hind legs mostly brown tending black; coxae with proximal margin edged light brown; femora dark brown tending black; tibiae and tarsi brown tending black. Meracanthus brown with outer lateral margin and apex pale yellow.

Wings. Hyaline. Fore wing with fused stem of veins M and CuA not complete, the veins abutted rather than fused as one; venation brown; basal membrane orange. Hind wing with 5 apical cells; venation brown except for pale yellowish brown 2A and CuP; plaga muddy white to brownish black; inconspicuous black infuscation on wing margin at distal end of vein 2A.

Opercula. For the most part not reaching distal margin of tympanal cavity; widely separated; flat other than a low rounded swelling of epimeron 3; yellowish brown, usually with some black basally.

Timbals with four long ribs spanning the width of timbal membrane and one much shorter anterior rib terminating level with upper end of adjacent intercalary rib.

Abdomen. Tending triangular in cross section with epipleurites reflexed inwards from junction with tergites. Tergites orange brown with black or brown markings. Tergite 1 black to dark brown with anterior and lateral margins edged light brown; tergites 2–8 with anterior margin black or dark brown to varying degrees, otherwise orange brown with posterior margin often edged light brown to yellow. Sternite I black to muddy brown; sternites II–VII orange to orange brown with posterior margin tending yellow to varying degrees; sternite VIII brown to orange brown.

Genitalia (Fig. 14). Pygofer upper lobe narrow and long, in lateral view tending parallel-sided and tapering to a rounded apex. Secondary basal pygofer lobe small, in lateral view broadly rounded; basal lobe a rounded, flap-like, not protruding inwards. Median lobe of uncus longer than wide, concave below, apex broadly rounded. Claspers claw-like, medium width in dorsal view, concave below, apices turned slightly outwards. Aedeagus with pseudoparameres two thirds to three quarters or so the length of endotheca, very thin and slender, slightly flattened in cross section, lying immediately above endotheca and usually slightly sloping downwards in lateral view, in dorsal view parallel to each other but distally curved slightly outwards. Endotheca nearly straight or slightly up-curved, parallel-sided, circular in cross section, apex terminating in a spine-like projection

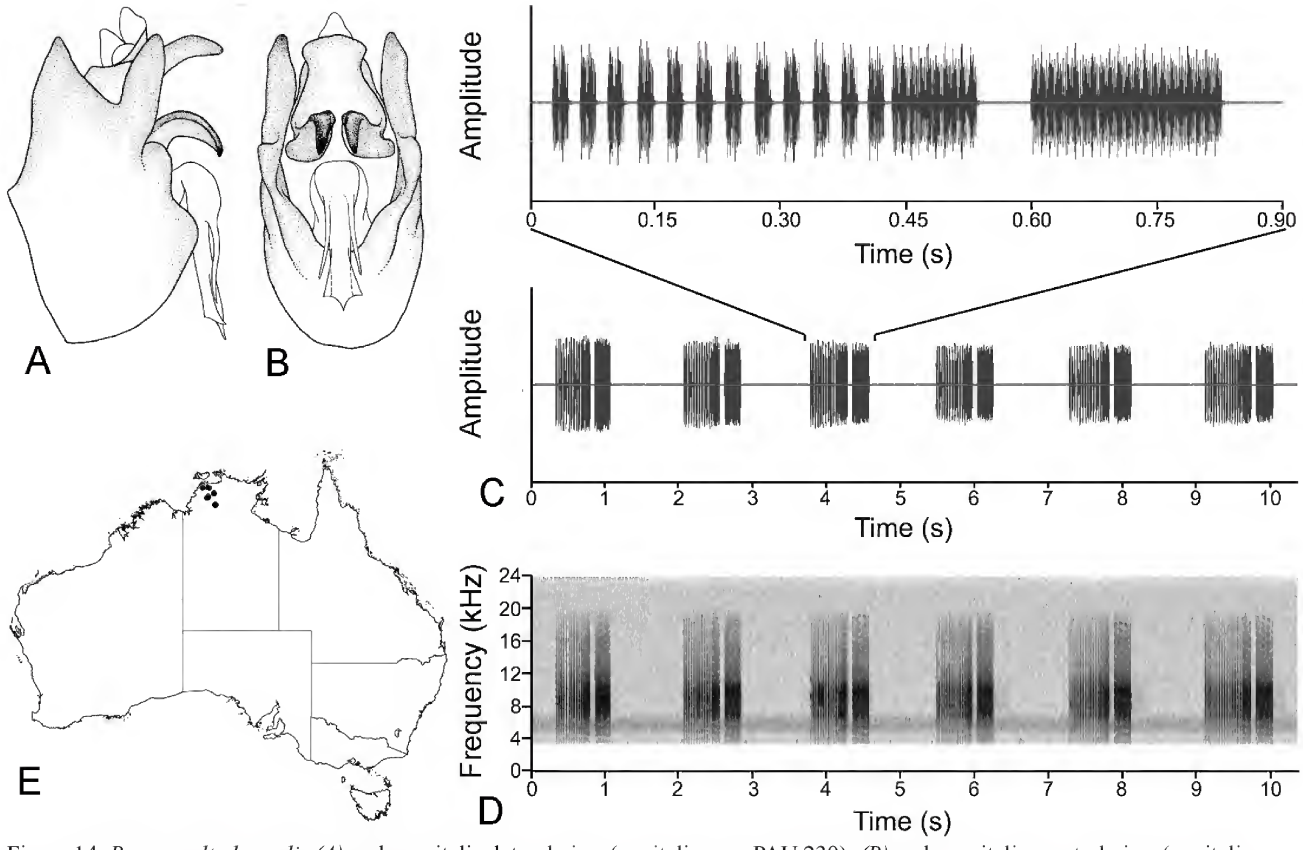


Figure 14. *Pauropsalta borealis (A)* male genitalia, lateral view (genitalia prep PAU 230); *(B)* male genitalia, ventral view (genitalia prep PAU 230); *(C)* waveform of male calling song recorded from 34.1 km north of Katherine on the Stuart Hwy (Hwy 1), NT; *(D)* spectrogram of male calling song; *(E)* species distribution map.

at dorsal midline, apex in lateral view sloping backwards ventrally, apex in dorsal view distally flanged either side with translucent membrane.

Female. Similar to male. Abdominal segment 9 brown with a dark brown or black subdorsal fascia on each side of midline extending from the anterior margin but not reaching posterior margin; often midline marked dark brown to black beyond the pair of subdorsal fascia; sometimes also dark brown to black pigment laterally, sometimes covering much of lateral side; caudal beak absent. Ovipositor sheath long, extending some 1.0–1.5 mm beyond apex of abdomen; dark brown to black.

Measurements. Range and mean (in mm) for 9♂♂ and 4♀♀; includes smallest and largest of available specimens. *Length of body*: male 12.6–15.9 (14.5); female 14.1–16.7 (15.4). *Length of fore wing*: male 15.0–19.7 (17.3); female 17.3–19.8 (18.8). *Width of fore wing*: male 5.2–6.9 (6.2); female 6.0–7.4 (6.7). *Ratio length/width of fore wing*: male 2.6–2.9 (2.8); female 2.7–2.9 (2.8). *Width of head (including eyes):* male 3.8–4.9 (4.2); female 4.1–4.9 (4.5). *Width of pronotum (across lateral angles):* male 4.0–5.5 (4.7); female 4.7–5.6 (5.1).

Distinguishing features

Within the distribution of *Pauropsalta borealis* care should be taken not to confuse this species with *Pau. melanopygia*. Distinguished from *Pau. melanopygia* by the length of the rostrum; that of *borealis* reaches to or beyond the apices of the hind coxae while that of *Pau. melanopygia* reaches only to the bases.

Song (Fig. 14). Each song is composed of a series of pulses and echemes. Each phrase begins with a series of pulses, about 12 pulses per phrase, followed immediately by a short echeme. This is followed by a brief pause, which is followed by a second echeme to end the phrase. Each phrase is less than 1 s long, while the rate of echemes occur at less than 1 per second. The highest energy is between 6 kHz and 11 kHz.

Pauropsalta castanea Goding & Froggatt, 1904

Fig. 15

Pauropsalta castanea Goding & Froggatt, 1904: 617–618; Owen *et al.*, 2015: 260.

Goding & Froggatt (1904) described *castanea* from a teneral female from Karth and deposited in the South Australian Museum. However, the specimen labelled as type in that museum does not match the original description and bears a locality label "Devonport Tas". Another specimen labelled as the type of *Pau. castanea* is in the ANIC, ex Macleay Museum. This specimen does match the original description with its unique teneral colouring and we considered this the true type. Burns (1957) placed *Pau. castanea* as a junior synonym of *Melampsalta abdominalis* (now *Yoyetta abdominalis*) but this synonymy is clearly incorrect and we recognize *Pau. castanea* as a species distinct from *Y. abdominalis*. Owen (2015) previously took *Pau. castanea* from synonymy with *Y. abdominalis* but gave no explanation for doing so.

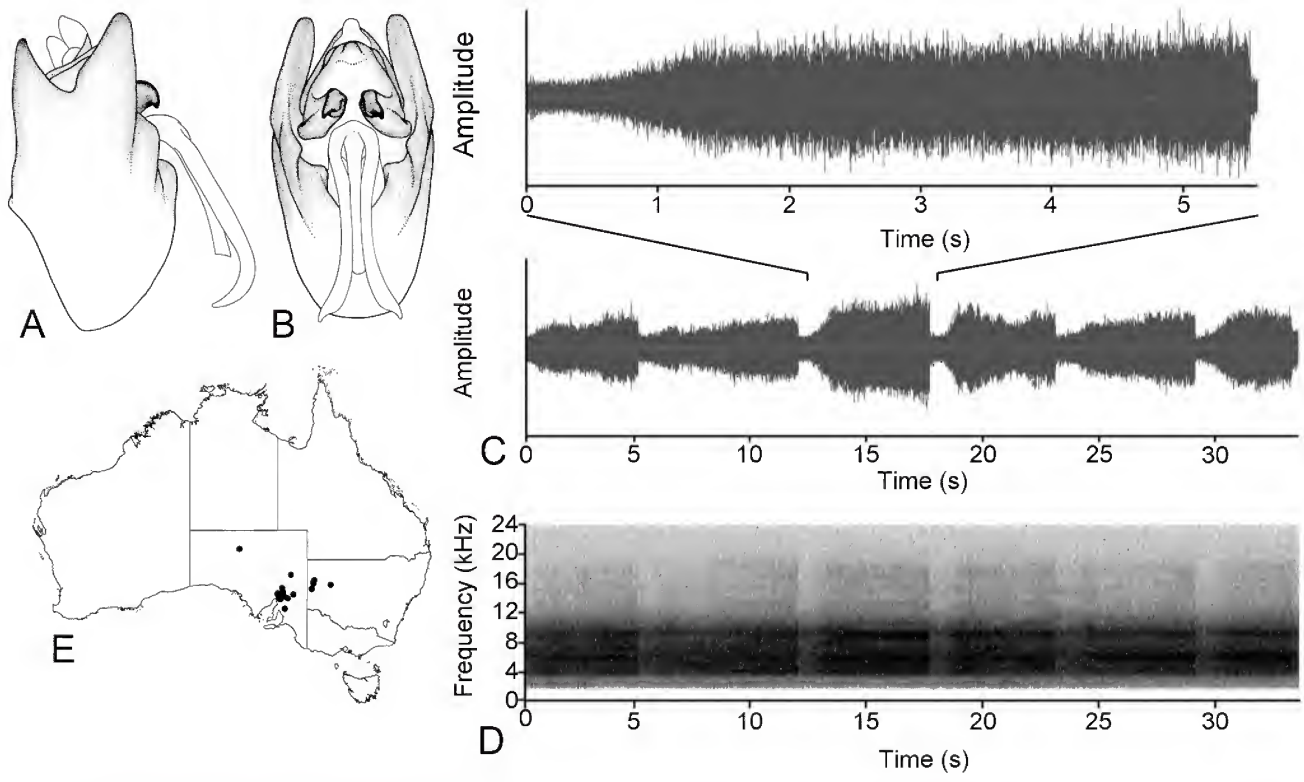


Figure 15. *Pauropsalta castanea (A)* male genitalia, lateral view (genitalia prep PAU 341); *(B)* male genitalia, ventral view (genitalia prep PAU 341); *(C)* waveform of male calling song recorded from c. 105 km north of Broken Hill at Fowlers Gap Creek, NSW; *(D)* spectrogram of male calling song; *(E)* species distribution map.

Material examined. Holotype female (in ANIC) and the erroneously labelled type (in SAM) as mentioned above, plus the following specimens. NEW SOUTH WALES: 1♂ (molecular voucher 11.AU.NS.FOW.01, song recorded) Fowlers Gap, c. 105 km N of Broken Hill, New South Wales, 183 m, 31°05.234'S 141°42.593'E, 10.i.2011, K. Hill, D. Marshall (AM). 1♂, 1♀, Fowlers Gap, 21–23.xii.2005, George Hangay (AE). 1♂, Fowlers Gap, c. 105 km N of Broken Hill, 183 m, 31°05.234'S 141°42.593'E, 10.i.2011, K. Hill, D. Marshall; 1♀, Eurlow Ck, 74 km N of Broken Hill, 248 m, 31°22.328'S 141°36.713'E, 10.i.2011, K. Hill, D. Marshall (LP). 2♂♂ (1 genitalia prep. PAU341), Fowlers Gap, c. 105 km N of Broken Hill, 183 m, 31°05.234'S 141°42.593'E, 10.i.2011, K. Hill, D. Marshall; 2♂♂, 1♀, Fowlers Gap, 21–23.xii.2005, George Hangay; 1♀, Eurlow Ck, 74 km N of Broken Hill, 248 m, 31°22.328'S 141°36.713'E, 10.i.2011, K. Hill, D. Marshall; 2♂♂, E edge of Wilcannia, Barrier Hwy nr Darling River, 73 m, 31°33.703'S 143°22.877'E, 11.i.2011, K. Hill, D. Marshall (MSM). SOUTH AUSTRALIA: 1♂, SE side of Wilmington, 337 m, 32°39.332'S 138°06.144'E, 8.i.2011, K. Hill, D. Marshall; 1♂ (molecular voucher 11.AU.SA.PBE.02), Barrier Hwy, 2.3 km NE of rd to Peterborough, 521 m, 32°56.412'S 138°59.476'E, 9.i.2011, K. Hill, D. Marshall (AM). 2♂♂, 1♀, Evelyn Ck, 2 km N of Mt Willoughby Hsd, 6.ii.1984, M.S. and B.J. Moulds; 1♂, Balcanoona, Flinders Ranges, 1.iii.1984, R. H. Fisher; 1♀, Germein Gorge, E of Port Germein, 18.xi.1985, M.S. and B.J. Moulds; 1♀, Pichi Richi Pass, near Port Augusta, 17.i.1976, M.S. and B.J. Moulds; 2♂♂, Broken Hill, 31°57.817'S 141°26.030'E, 304 m, 4.ii.2007, K. Hill, D. Marshall; 1♂, south edge of Broken Hill, 31°59.405'S 141°26.956'E, 296 m, 4.ii.2007, K. Hill, D. Marshall; 1♂, 5 km W of Wilmington, 442 m, 32°39.211'S 138°02.946'E, K. Hill, D. Marshall; 1♀, Horrock's Pass, E of Port Augusta, 26.i.1989, M.S. and B.J. Moulds (MSM); 1♂, 1♀, Wilmington, 340 m, 32°39.703'S 138°06.591'E, 7.i.2011, K. Hill, D. Marshall (SAM); 1♂ (molecular voucher 07.AU.SA.HWK.01; GenBank accessions: KM377182, KM377267, KM377453, KM377610, KM668278), Hawker information centre on main road through town, -31.8894° 138.4200°, 2.iii.2007, D. Marshall and K. Hill (UCS).

Distribution (Fig. 15). South Australia where it has been taken at Evelyn Creek near Mount Willoughby Homestead (some 150 km north of Coober Pedy), on the edge of the Flinders Ranges and in the mountains east of Port Augusta as far south as Peterborough, and far western New South Wales from Broken Hill north to Fowlers Gap and at Wilcannia on the Darling River. It is a locally common species and can be found in most years at Horrocks Pass west of Wilmington in South Australia and at Fowlers Gap north of Broken Hill in New South Wales. There are records for mid November to early March.

Habitat. Primarily associated with *Eucalyptus camaldulensis*, nearly always growing along water courses that are often dry. Adults are usually found on the upper branches, sometimes at considerable height.

Description

Male. *Head* with eyes of live specimens cherry red; wider than lateral margins of pronotal collar; dominantly black with muddy yellow spot at posterior midline. Postclypeus jet black usually (but not always) with pale yellow or brown markings; usually muddy yellow or pale reddish brown markings on dorsal area variable in extent; usually a muddy yellow or brown mark on midline around most anterior portion; usually lateral margins muddy yellow or brown; transverse ridges and central groove distinct; central groove with muddy yellow or brown marking about mid length. Anteclypeus jet black. Rostrum black tending brown proximally, reaching to or just beyond bases of hind coxae. Antennae black. Supra-antennal plates black, sometimes edged reddish brown along anterior margin.

Thorax. Pronotum black, usually with brown and pale yellow markings; fascia along midline pale yellow, usually extending from near head towards or almost to pronotal collar, often discontinuous; sometimes a transverse muddy yellow marking on either side of midline dorsally abutting and/or on anterior margin of pronotal collar; pronotal collar

between lateral angles black with posterior margin edged muddy yellow or brown to varying degrees; lateral margin of pronotal collar not, or barely, ampliate. Mesonotum primarily black with pale yellow or brown markings; usually a reddish brown marking on either side from, or near, anterior arms or the cruciform elevation to, or almost to, pronotum between lateral and submedian sigilla, this marking projecting inwards to varying degrees around its mid length and sometimes meeting; sometimes a pale yellow blotch between anterior arms of cruciform elevation; lower lateral area sometimes with a pale yellow streak; scutal depressions occasionally visible as black dots surrounded by pale yellow; cruciform elevation nearly always pale yellow, rarely nearly all black; anterior arms tending black distally to varying degrees, often a black fascia down midline. Metanotum black at hind wing base, remainder pale yellow or brown, sometimes black near dorsal midline.

Legs. Fore legs mostly black but with a pale yellow fascia to varying degrees along exterior and anterior length of femora; femora with spines black tending brown distally; pretarsal claws black with brown apices. Mid and hind legs mostly black with pale yellow markings; coxae with proximal margin edged pale yellow; femora black tending pale yellow distally; mid leg tibiae black; hind leg tibiae black tending pale yellow distally; tarsi black sometimes tending pale yellow to brown proximally. Meracanthus black with outer lateral margin and apex pale yellow.

Wings. Hyaline. Fore wing with fused stem of veins M and CuA complete, the veins fused as one; venation brown; infuscation distally on clavus; basal membrane grey to black. Hind wing with 5 apical cells; venation brown except for pale yellowish brown 2A and 3A; plaga muddy white to grey; black infuscation on wing margin at distal end of vein 2A, proximal side of 3A, and partly on anal lobe.

Opercula. For the most part not reaching distal margin of tympanal cavity; widely separated; flat other than a low rounded swelling of epimeron 3; black, sometimes yellowish brown on distal half.

Timbals with four long ribs spanning the width of timbal membrane and one much shorter anterior rib terminating level with upper end of adjacent intercalary rib.

Abdomen. Tending triangular in cross section with epipleurites reflexed inwards from junction with tergites. Tergites black with orange to orange brown markings; tergite 1 black; tergites 2–7 black with posterior margin orange to orange brown to varying degrees; tergite 8 black with orange posterior margin, widest around midline. Sternite I black; sternites II black with posterior margin orange to varying degrees; sternites III–VII orange to muddy orange with black along anterior midline; sternite VIII orange to muddy orange.

Genitalia (Fig. 15). Pygofer upper lobe wide and long, in lateral view gradually tapering to a broad rounded apex. Pygofer basal lobe flap-like in lateral view, in ventral view slightly turned inward; secondary basal lobe fold-like, in lateral view projecting and broadly rounded. Median lobe of uncus in ventral view duck-bill like, tapering to small rounded point. Claspers claw-like, medium width in dorsal view, concave below, apices tending truncate in dorsal view. Aedeagus with pseudoparameres longer than endotheca, slender, flattened in cross section, lying adjacent for most of endotheca length in lateral view, in dorsal view curved outwards basally, thereafter parallel to each other but distally curved outwards, their apices turned slightly backwards. Endotheca nearly straight, short, parallel-sided, circular in cross-section, apex without ornamentation.

Female. Similar to male. Abdominal segment 9 yellowish brown, with a black or dark brown fascia on either side of midline extending distally from the anterior margin but not reaching posterior margin. Ovipositor sheath extending 1.75–2.0 mm beyond apex of abdomen; dark brown to black.

Measurements. Range and mean (in mm) for 10♂♂ and 10♀♀; includes smallest and largest of available specimens. *Length of body*: male 16.9–21.9 (20.0); female 19.4–22.3 (21.1). *Length of fore wing*: male 20.0–25.1 (23.0); female 23.3–27.8 (24.8). *Width of fore wing*: male 6.9–9.0 (8.3); female 8.2–9.5 (8.8). *Ratio length/width of fore wing*: male 2.7–2.9 (2.8); female 2.7–3.0 (2.8). *Width of head (including eyes):* male 5.8–7.0 (6.4); female 6.4–7.0 (6.7). *Width of pronotum (across lateral angles):* male 6.0–7.5 (6.9); female 7.0–7.6 (7.2)

Distinguishing features

A distinctive species differing from all other species of *Pauropsalta* and allied genera (those species with an infuscation on wing margin at the distal end of hind wing vein 2A) in having fore wing veins M and CuA completely fused as one before the basal cell, a rostrum that almost reaches the apices of the hind coxae, a fore wing 20 mm or longer, and a second abdominal segment that is largely jet black.

The male genitalia have a broad, tapering upper pygofer lobe, small beak-like claspers, robust pseudoparameres that lie laterally against the endotheca, and a simple apical termination to the endotheca.

Song (Fig. 15). The song is composed of a series of consecutive echemes. Each echeme is between c. 5 s and c. 7.5 s in length. The song occurs at a frequencies between 4 kHz and 18 kHz, while plateauing between 4 kHz and 10 kHz.

Pauropsalta confinis n.sp.

Fig. 16, Pl. 2

Pauropsalta sp. "sandstone", Marshall & Hill, 2009: 4, fig. 6H.
Pauropsalta confinis Owen *et al.*, 2015: 260, *nomen nudum*.

Types. *Holotype* male (genitalia prep. PAU212, molecular voucher 06.AU.WA.WSS.06; GenBank accessions: KM377206, KM377332, KM377504, KM377546, KM668345), 30.5 km W of Sandstone, Western Australia, 28°00.692'S 118°59.922'E, 570 m, 17.ii.2006, Hill, Marshall, Moulds (WAM). *Paratypes*—WESTERN AUSTRALIA: 1♂, 1♀, 29 km S of Menzies, 9.ii.2006, M. Hanlon & M. Powell (AE). 1♀, 29 km S of Menzies, 9.ii.2006, M. Hanlon & M. Powell (LP). 2♂♂ (1 molecular voucher 06.AU.WA.WSS.06), 30.5 km W of Sandstone, 28°00.692'S 118°59.922'E, 570 m, 17.ii.2006, Hill, Marshall, Moulds; 1♂ (genitalia prep. PAU 289), 26 km S of Menzies, 9.ii.2006, M. Hanlon & M. Powell; 1♂ (genitalia prep. PAU 375), 36.4 km N of Bullfinch, 12.i.2002, P. Hutchinson; 1♂, 2♀♀, 29 km S of Menzies, 9.ii.2006, M. Hanlon & M. Powell; 2♀♀, 23 km S of Menzies, 10.ii.2006, M. Hanlon & M. Powell; 1♂, 55 km S of Menzies, 9.ii.2006, M. Hanlon & M. Powell (MSM). 1♂ (genitalia prep. PAU 324), 30.5 km W of Sandstone, 28°00.692'S 118°59.922'E, 570 m, 17.ii.2006, Hill, Marshall, Moulds (WAM).

Distribution (Fig. 16). Western Australia where it is known from an area north of the wheat belt in the drier southern third of the State, north to near Sandstone, west to 57 km inland from Mullewa, east as far as the Menzies district and south to near Bullfinch. All known localities are areas receiving approximately 200–400 mm average annual rainfall. There

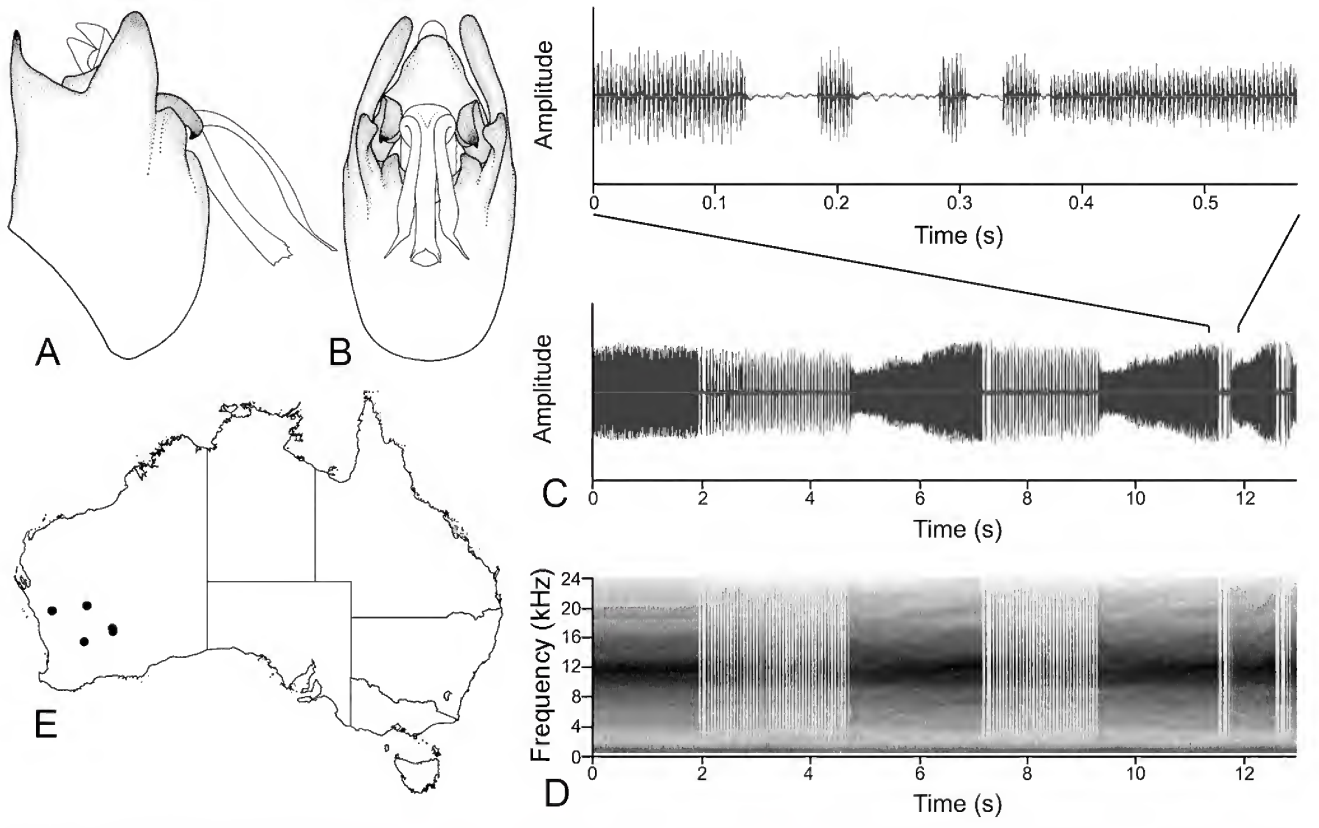


Figure 16. *Pauropsalta confinis* n.sp. *(A)* male genitalia, lateral view (genitalia prep PAU 212); *(B)* male genitalia, ventral view (genitalia prep PAU 212); *(C)* waveform of male calling song recorded from 30.5 km west of Sandstone, WA; *(D)* spectrogram of male calling song; *(E)* species distribution map.

are records between mid January and mid February only but emergence of adults is probably associated with periods of high rainfall during the hotter months of the year.

Habitat. Adults inhabit mallee and other eucalypts where they perch on the trunks and branches.

Description

Male (Pl. 2). *Head* wider than lateral margins of pronotal collar; dominantly black with muddy yellow spot at posterior midline. Postclypeus jet black with pale yellow or pale reddish brown markings; a muddy yellow or pale reddish brown mark on midline around most anterior portion; lateral margins muddy yellow or pale reddish brown; transverse ridges and central groove distinct. Anteclypeus jet black. Rostrum black, occasionally tending brown proximally, reaching to or beyond apices of mid coxae, but usually to base of hind coxae. Antennae black tending white distally. Supra-antennal plates black, sometimes partly edged dull yellow or reddish brown along anterior margin.

Thorax. Pronotum black, usually with reddish brown and pale yellow markings; center of pronotum with reddish brown patches; fascia along midline pale yellow, usually extending from near head towards or almost to pronotal collar; sometimes a transverse muddy yellow marking dorsally abutting and/or on anterior margin of pronotal collar; pronotal collar between lateral angles black or dark brown with posterior margin edged muddy yellow or reddish brown; lateral margin of pronotal collar not, or barely, ampliate. Mesonotum primarily black with reddish brown markings; often a narrow reddish brown fascia on midline variable in length between individuals; usually a reddish brown marking on either side from, or near, anterior arms or the cruciform elevation to, or almost to, pronotum between lateral and submedian sigilla, this marking projecting inwards to varying degrees around its mid length and sometimes meeting and sometimes thereafter becoming confluent with marking along midline; sometimes a reddish brown blotch between anterior arms of cruciform elevation; lower lateral area usually with a reddish brown streak; scutal depressions occasionally visible as black dots surrounded by reddish brown; cruciform elevation yellow to muddy yellow, anterior arms with distal ends black, sometimes a black fascia down midline. Metanotum black at hind wing base, remainder reddish brown or muddy yellow, sometimes black near dorsal midline.

Legs. Fore legs mostly black but with a brown to yellowish brown fascia to varying degrees along anterior length of femora, sometimes a brownish fascia along lateral exterior of femora; femora with spines black to dark brown; pretarsal claws black to dark brown. Mid and hind legs mostly black or brown tending dark brown; coxa with proximal margin edged pale reddish brown; reddish brown along anterior length of femora; tibiae and tarsi brown tending yellowish brown. Meracanthus black with outer lateral margin and apex pale yellow.

Wings. Hyaline. Fore wing with fused stem of veins M and CuA not complete, the veins abutted rather than fused as one; venation brown; costa slightly curving inwards near arculus; minor infuscation distally on clavus; basal membrane grey to black. Hind wing with 5 apical cells; venation brown except for pale yellowish brown 2A and 3A; plaga muddy white to grey to pale brown; black infuscation on wing margin at distal end of vein 2A.

Opercula. For the most part reaching to or almost to distal margin of tympanal cavity; widely separated; flat other than a low rounded swelling of epimeron 3; black tending dull yellow on distal half.

Timbals with four long ribs spanning the width of timbal membrane and one much shorter anterior rib terminating before end of adjacent intercalary rib.

Abdomen. Tending triangular in cross section with epipleurites reflexed inwards from junction with tergites. Tergites black with reddish brown to yellow markings. Tergite 1 black and greatly reduced, not visible at dorsal midline; tergite 2 black with posterior margin narrowly edged reddish brown to muddy yellow, sometimes with a reddish brown to muddy yellow spot adjacent to posterior margin on dorsal midline; tergites 3–7 black with posterior margin narrowly edged reddish brown to yellow to varying degrees, sometimes with reddish brown to yellow spot adjacent to posterior margin and sometimes an elongate mark of similar colour laterally; tergite 8 black with reddish brown and/or yellow posterior margin, widest around midline. Sternite I black; sternites II–VII black with posterior margin yellow to varying degrees, widest at lateral extremities; sternite VIII black tending yellowish brown distally.

Genitalia (Fig. 16). Pygofer upper lobe wide and long, in lateral view gradually tapering to a broad rounded apex. Basal pygofer lobe small, rounded; a rounded flap-like lobe above basal pygofer lobe. Median lobe of uncus wider than long with a rounded apex. Claspers claw-like, but very flattened, apices turned outwards and rather short and conical. Aedeagus with pseudoparameres as long as or a little longer than endotheca, slender, flattened in cross section, lying arched high above endotheca in lateral view, in dorsal view tending parallel to each other but distally slightly diverging, their apices constricted and almost spine-like in shape. Endotheca gently curved upwards in lateral view, circular in cross-section, apex square-cut or nearly so with a rim bearing minute spines.

Female (Pl. 2). Similar to male. Tergites VIII black with posterior half reddish brown and yellow. Abdominal segment 9 black with a black fascia on each side of midline extending from the anterior margin but not reaching posterior margin. Ovipositor sheath long, extending some 2.0 mm beyond apex of abdomen; dark brown to black.

Measurements. Range and mean (in mm) for 7♂♂ and 1♀; includes smallest and largest of available specimens. *Length of body*: male 15.2–18.0 (16.6); female 19.8. *Length of fore wing*: male 19.4–22.6 (20.6); female 22.4. *Width of fore wing*: male 6.4–7.7 (6.9); female 7.5. *Ratio length/width of fore wing*: male 2.9–3.1 (3.0); female 3.0. *Width of head (including eyes)*: male 5.1–6.3 (5.5); female 5.7. *Width of pronotum (across lateral angles)*: male 5.3–6.5 (5.8); female 6.2.

Distinguishing features

Distinguished from most small black cicadas by having the stems of fore wing veins M and CuA closely abutted on reaching the basal cell rather than fused as one (view under low magnification).

Amongst those species of small black cicadas with M and CuA abutted *Pau. confinis* differs from all in having the dorsal portion of tergite 1 concealed, whereas it is clearly visible in the other species.

The male genitalia are unique in having the endotheca curved upwards and the following combination of characters: a large and broad upper pygofer lobe that gradually tapers to a blunt point, an endotheca lacking a ventral support and with its apex square-cut and edged in minute spine-like projections, and a pair of pseudoparameres that arch high above the endotheca in lateral view.

Etymology. From the Latin *confinis* meaning neighboring, adjoining, and referring to the closely abutted but independent stems of veins M and CuA of the fore wing, an unusual feature amongst small black cicadas where the stems of these veins are usually fused as one.

Song (Fig. 16). The song is composed of long series of continuous pulses and echemes. The pulses usually last for less than 0.25 s to greater than 2 s. Echemes range in size from 2 s to less than 1 s. The song ranges from 0–24 kHz.

Pauropsalta conflua n.sp.

Fig. 17, Pl. 2

Pauropsalta conflua Owen *et al.*, 2015: 260, *nomen nudum.*

Types. *Holotype* male (genitalia prep. PAU 264, molecular voucher 03.AU.WAU.NMR.02), 88 km N of Mt. Ragged, Western Australia, 162 m, 33°23'S 123°24'E, 13.i.2003, Moulds, Hill, Marshall & Vanderpool; (WAM). *Paratypes*—WESTERN AUSTRALIA: 1♂, Madura [roadhouse], [31°54'S 127°01'E], 26.xii.1990, M.S. & B.J. Moulds; 1♀, 8 km E Salmon Gums, 32°58'S 121°42'E, 5.i.1987, G. & A. Daniels (AE). 1♀ (molecular voucher 03.AU.WAU.RAT.05), Ravensthorpe, 209 m, 33°35'S 120°04'E, 10.i.2003, Moulds, Marshall, Hill & Vanderpool; 1♂ (molecular voucher 03.AU.WAU.LKD.07), near Lake Douglas, 16.i.2003, Moulds, Marshall, Hill & Vanderpool (AM). 1♂, 19 km S of Forrestania, x-rds, 5.xii.2003, P. Hutchinson (JO). 1♂ Madura [roadhouse], [31°54'S 127°01'E], 27.xi.1985, M.S. & B.J. Moulds; 1♀, Newmanns Rocks, 50 km W of Balladonia Motel, 32°06'S 123°10'E, 30.xii.1986, G. & A. Daniels (LP). 3♂♂ (one genitalia prep. PAU 284), 1♀, Moir's Rock, 42 km NNW Salmon Gums, 32°39'S 121°25'E, 2.i.1987, G. & A. Daniels; 1♂, 2♀♀, 8 km E Salmon Gums, 32°58'S 121°42'E, 5.i.1987, G. & A. Daniels; 1♂, 1♀, Salmon Gums, 32°58'S 121°38'E, 5.i.1987, G. & A. Daniels; 1♂, Ravensthorpe, 8.xii.1985, M.S. & B.J. Moulds; 2♂♂ (one genitalia prep. PAU 292), 1♀, 150 km SSW of Coolgardie, 32°10'S 120°34'E, 23.xii.1995, M.S. & B.J. Moulds & K.A. Kopestonsky; 1♂ (genitalia prep. PAU 390), 1♀, 57 km S of Norseman, 32°38'S 121°32'E, 30.xii.1985, G. & A. Daniels; 2♂♂ (one genitalia prep. PAU 391), 1♀, Newmanns Rocks, 50 km W of Balladonia Motel, 32°06'S 123°10'E, 30.xii.1986, G. & A. Daniels; 2♂♂ (genitalia preps. PAU 272 & PAU 283), Balladonia, western edge of Nullarbor Plain, 7.xi.1984, S. Lamond; 2♂♂, Mount Ragged, 17.xii.1995, M.S. & B.J. Moulds & K.A. Kopestonsky; 2♂♂ (molecular vouchers 03.AU.WA.PAU.01, 03.AU.WA.PAU.03; GenBank accessions: KM377200, KM377329, KM377430, KM377560, KM668242), 26.5 km North of Mt. Ragged campsite turn off road, 33°233'S 123°434'E, 17.i.2003, Moulds, Moulds, Hill, Marshall, Vanderpool; 4♂♂ (one genitalia prep. PAU 472), Madura [roadhouse], [31°54'S 127°01'E], 26.xii.1990, M.S. & B.J. Moulds; 1♂, Madura, Nullarbor Plain, 6.xii.1978, M.S. & B.J. Moulds (MSM). 1♂, 1♀, Moir's Rock, 42 km NNW Salmon Gums, 32°39'S 121°25'E, 2.i.1987, G. & A. Daniels (WAM). SOUTH AUSTRALIA: 2♂♂, 3.2 km S. of Karoonda Hwy, 27.xii.2014, L. Popple & A McKinnon, 35.1565°S 139.5519°E, 652-0001 to 652-0002 (LP).

Distribution (Fig. 17). The southern third of Western Australia south from Kalgoorlie, west as far as Ravensthorpe and the Hyden district and east to Madura roadhouse on the Nullarbor Plain and in southeastern South Australia from near Karoonda. All known localities are in areas receiving very low to low average annual rainfall of 200–500 mm. There are records for December and January only but adults most likely occur in other months.

Habitat. Mallee woodland.

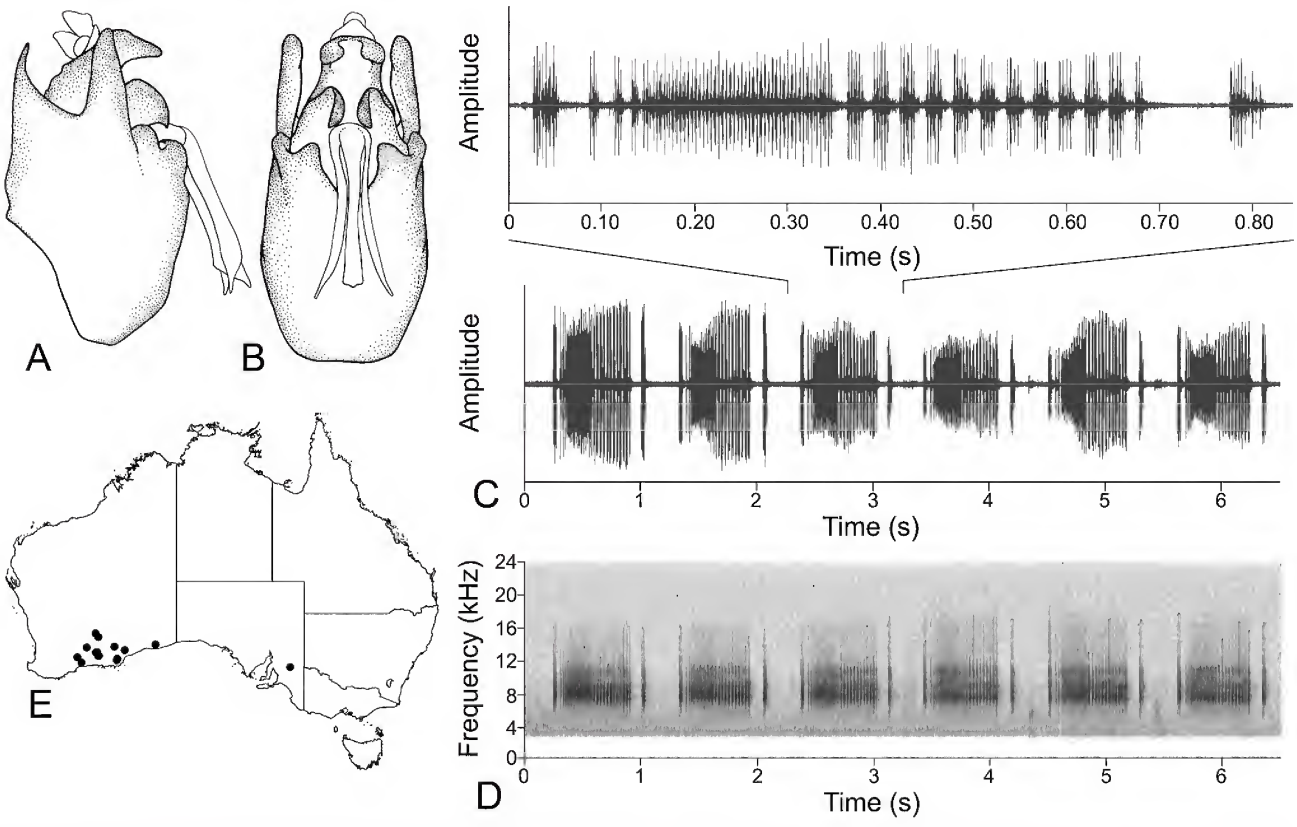


Figure 17. *Pauropsalta conflua* n.sp. *(A)* male genitalia, lateral view (genitalia prep PAU 264); *(B)* male genitalia, ventral view (genitalia prep PAU 264); *(C)* waveform of male calling song recorded from 8.8 km north from the turnoff to Mt. Ragged campsite, WA; *(D)* spectrogram of male calling song; *(E)* species distribution map.

Description

Male (Pl. 2). *Head* wider than lateral angles of pronotal collar; dominantly black with muddy yellow spot at posterior midline. Postclypeus jet black with pale yellow or pale reddish brown markings; a muddy yellow or pale reddish brown mark on midline around most anterior portion; lateral and posterior margins muddy yellow or pale reddish brown; transverse ridges and central groove distinct. Anteclypeus jet black. Rostrum black, occasionally tending brown proximally, reaching to or just beyond apices of mid coxae. Antennae black tending white distally. Supra-antennal plates black, sometimes edged reddish brown along anterior margin.

Thorax. Pronotum black, usually with reddish brown and pale yellow markings; center of pronotum with reddish brown patches; fascia along midline pale yellow, usually extending from near head and pronotal collar; sometimes a small, muddy yellow marking near midline of pronotal collar; pronotal collar between lateral angles black with posterior margin edged muddy yellow or reddish brown; lateral margin of pronotal collar not, or barely, ampliate. Mesonotum primarily black with reddish brown markings; usually a reddish brown marking on either side from, or near, anterior arms or the cruciform elevation to, or almost to, pronotum between lateral and submedian sigilla, this marking projecting inwards to varying degrees around its mid length and sometimes meeting and sometimes thereafter extending anteriorly on midline; sometimes a reddish brown blotch between anterior arms of cruciform elevation; lower lateral area usually with a reddish brown streak; scutal depressions occasionally visible as black dots surrounded by reddish brown; cruciform elevation black and reddish brown, sometimes partly muddy yellow; anterior arms usually reddish brown or muddy yellow with distal ends black, posterior arms usually black but sometimes yellow or brown, often a black fascia down midline. Metanotum black at hind wing base, remainder reddish brown, sometimes black near dorsal midline.

Legs. Fore legs mostly black but with two reddish brown fascia to varying degrees along anterior length of femora, sometimes a brownish fascia along lateral interior and exterior of femora; femora with spines usually black, sometimes reddish brown distally; pretarsal claws black with pale yellow apices. Mid and hind legs mostly black or brown tending dark brown; coxa with proximal margin edged pale reddish brown; reddish brown along anterior length of femora; tibiae and tarsi brown tending dark brown. Meracanthus black with outer lateral margin and apex pale yellow.

Wings. Hyaline. Fore wing with stems of veins M and CuA completely fused as one; venation brown; costa curving inward near arculus; infuscation distally on clavus; basal membrane grey to black. Hind wing with 5 apical cells; venation brown except for pale yellowish brown 2A and 3A; plaga muddy white to grey and pale brown; black infuscation on wing margin at distal end of vein 2A.

Opercula. For the most part reaching or almost reaching distal margin of tympanal cavity; widely separated; flat other than a low rounded swelling of epimeron 3; black, sometimes yellowish brown on distal half.

Timbals with four long ribs spanning the width of timbal membrane and one much shorter anterior rib terminating level with lower end of adjacent intercalary rib.

Abdomen. Tending triangular in cross section with epipleurites reflexed inwards from junction with tergites. Tergites black with reddish brown and yellow markings. Tergite 1 black; tergite 2 black with posterior margin narrowly edged reddish brown to muddy yellow, sometimes with a reddish brown to muddy yellow spot adjacent to posterior margin on midline; tergites 3–7 with posterior margin edged reddish brown laterally, extreme margin usually outlined dull yellow; tergite 8 black with dull yellow and/or reddish brown posterior margin, widest around midline. Sternite I black; sternites II–VII black with posterior margin reddish brown to dull yellow to varying degrees; sternite VIII black tending yellowish brown distally.

Genitalia (Fig. 17). Pygofer upper lobe slender and long, in lateral view slightly tapering to a rounded apex. Basal pygofer lobe small, broadly rounded; secondary basal lobe, small, dome-like. lobe. Median lobe of uncus wider than long, bi-lobed with lobes wide apart. Claspers claw-like, flattened in dorsal view, concave below. Aedeagus with pseudoparameres as long as or slightly longer than endotheca, slender, flattened in cross section, lying immediately adjacent to or just above endotheca in lateral view, in dorsal view parallel to each other but slightly diverging at distal ends. Endotheca nearly straight, parallel sided, circular in cross-section, apex sloping backwards ventrally, without ornamentation.

Female (Pl. 2). Similar to male. Tergites VIII black with posterior half reddish brown and yellow. Abdominal segment 9 black with a reddish brown fascia on each side of midline extending from the anterior margin but not reaching posterior margin. Ovipositor sheath long, extending some 1.5 mm beyond apex of abdomen; dark brown to black.

Measurements. Range and mean (in mm) for 10♂♂ and 7♀♀; includes smallest and largest of available specimens. *Length of body*: male 13.5–16.0 (15.0); female 13.9–17.3 (15.5). *Length of fore wing*: male 14.7–22.0 (18.9); female 17.0–22.0 (19.1). *Width of fore wing*: male 5.2–7.3 (6.5); female 5.9–7.5 (6.6). *Ratio length/width of fore wing*: male 2.8–3.0 (3.0); female 2.8–3.0 (2.9). *Width of head (including eyes)*: male 4.1–5.3 (4.8); female 4.3–5.4 (4.7). *Width of pronotum (across lateral angles)*: male 4.2–6.1 (5.0); female 4.0–4.9 (4.4).

Distinguishing features

Very similar in outward appearance to *Pauropsalta accola*, *Pau. contigua, Pau. confinis, Pau. juncta, and Atrapsalta dolens*; all of which occur in the southwest of Western Australia.

Distinguished from *Pau. infuscata*, *Pau. confinis*, *Pau. contigua* and *some* individuals of *Pau. accola* by having the stems of fore wing veins M and CuA completely fused as one, rather than closely abutted (view under low magnification).

Distinguished from *Atrapsalta dolens* by the dark reddish-brown markings on the inner part of the pronotum. Males differ from those individuals of *Pau. accola* with fused fore wing veins M and CuA in having sternite VIII and the pygofer black or dark brown, while *Pau. accola* has a large proportion of these structures yellow. Males differ from those of *Pau. juncta* in the shape of the upper pygofer lobes (visible without dissection); those of *Pau. conflua* are triangular while those of *Pau. juncta* are semi-circular. Females are indistinguishable from females of *Pau. accola* (females of *Pau. juncta* are unknown).

The male genitalia are unique in having the following combination of characters: a large upper pygofer lobe tending slender, parallel-sided or with a slight taper and a rounded apex, a pair of pseudoparameres that reach to the distal end of the endotheca or just beyond, and an endotheca lacking a ventral support. It is the only Western Australian *Pauropsalta* species with a bi-lobed uncus.

Etymology. From the Latin *conflua*, meaning flowing together, uniting, and referring to the complete fusion of the stems of veins M and CuA on the fore wing, a feature uncommon amongst the small black cicadas of *Pauropsalta*.

Song (Fig. 17). The song is composed of phrases containing pulses and echemes. Each phrase begins with a single click followed by a slight pause. This is followed by a short series of pulses leading to an echeme, which is followed by pulses. Following the second series of pulses is a pause that is followed by a click. Each phrase is shorter than one second long and phrases occur at a rate greater than one per second. The frequency of the song occurs between 6 kHz and 16 kHz.

Pauropsalta contigua n.sp.

Fig. 18, Pl. 3

Pauropsalta contigua Owen *et al.*, 2015: 260, *nomen nudum.*

Types. *Holotype* male (genitalia prep. PAU 266, molecular voucher 07.AU.SA.MRA.01; GenBank accessions: KM377189, KM377288, KM377426, KM377551, KM668286), Agnes Ck, Stuart Hwy, c. 75 km S of SA/NT border, 26°38.308'S 133°16.713'E, 1.ii.2007, K. Hill & D. Marshall (SAM). *Paratypes*—WESTERN AUSTRALIA: 1♂, 25 km E of Sandstone, 17.i.1989, M.S. & B.J. Moulds (AE). 1♂, Cue, [erroneously labelled as a cotype of *Cicadetta bellatrix*]; 1♂ (genitalia prep. PAU326, molecular voucher 09.AU.MUE.01), 7.7 km E of Mundrabilla, 31°49.164'S 128°18.356'E; 6.ii.2009, 17 m, K. Hill & D. Marshall; 1♂ (molecular voucher 06.AU.WA.NUE.01), 13.2 km E of Cocklebiddy, 32°00.692'S 126°14.208'E, 72 m, 21.ii.2006, Hill, Marshall, Moulds; 2♂♂ (one genitalia prep. PAU338), 24 km WSW of Madura, 31°55.778'S 126°46.737'E, 98 m, 21.ii.2006, Hill, Marshall, Moulds; 1♂ (genitalia prep. PAU 206, molecular voucher 03.AU.WAU.LKD.04), Lake Douglas, nr Kalgoorlie, Western Australia, 377 m, 30°50'S 121°23'E, 15.i.2003, Moulds, Hill, Marshall & Vanderpool (AM). 1♂, 25 km E of Sandstone, 17.i.1989, M.S. & B.J. Moulds (LP). 1♂, 25 km E of Sandstone, 17.i.1989, M.S. & B.J. Moulds; 1♂ (genitalia prep. PAU 373), 29 km S of Menzies, 9.ii.2006, M. Hanlon & M. Powell; 2♂♂ (genitalia preps. PAU 467 & PAU 468), 1♀, 12 km SW of Kalgoorlie, 13.i.1989, M.S. & B.S. Moulds; 1♂ (genitalia prep. PAU 371), Kalgoorlie, 15.i.1989, A.J. Graham; 1♂, Newman Rock, 50 km W Balladonia motel, 32°06'S 123°10'E, 18.i.1986, G. & A. Daniels; 1♂, Madura roadhouse, 31°54'S 127°01'E, 15.xii.1995, M.S. & B.J. Moulds & K.A. Kopestonsky; 1♂ (genitalia prep. PAU273), 40 km W of Caiguna, Nullarbor Plain, 6.xii.1978, M.S. & B.J. Moulds; 2♂♂ (one genitalia prep. PAU 474), Madura, 26.xii.1990, M.S. & B.J. Moulds (MSM). 1♂ (genitalia prep. PAU 229), Balladonia roadhouse, 32°21.285'S 123°37.069'E, 177 m, 20.ii.2006, Hill, Marshall, Moulds; 1♂, 7.7 km E of Mundrabilla, 31°49.164'S 128°18.356'E; 6.ii.2009, 17 m, K. Hill & D. Marshall (WAM). SOUTH AUSTRALIA: 1♂s (one molecular voucher 07.AU.SA.MRA.02), Agnes Ck, Stuart Hwy, c. 75 km S of SA/NT border, 26°38.308'S 133°16.713'E, 1.ii.2007, K. Hill & D. Marshall (AM). 1♂ (genitalia prep. 357), Border Village, nr WA/SA border, 25.i.1989, M.S. & B.J. Moulds; 1♂ (genitalia prep. PAU 364), 183 km W Nullarbor roadhouse, 31°40'S 129°01'E, 23.i.1987, G. & A. Daniels (MSM). 1♂, Agnes Ck, Stuart Hwy, c. 75 km S of SA/NT border, 26°38.308'S 133°16.713'E, 1.ii.2007, K. Hill & D. Marshall; 1♂ (genitalia prep. PAU 325), 0.5 km SE of Minnipa, 32°51.932'S 135°9.696'E, 5.ii.2009, 143 m, K. Hill & D. Marshall (SAM).

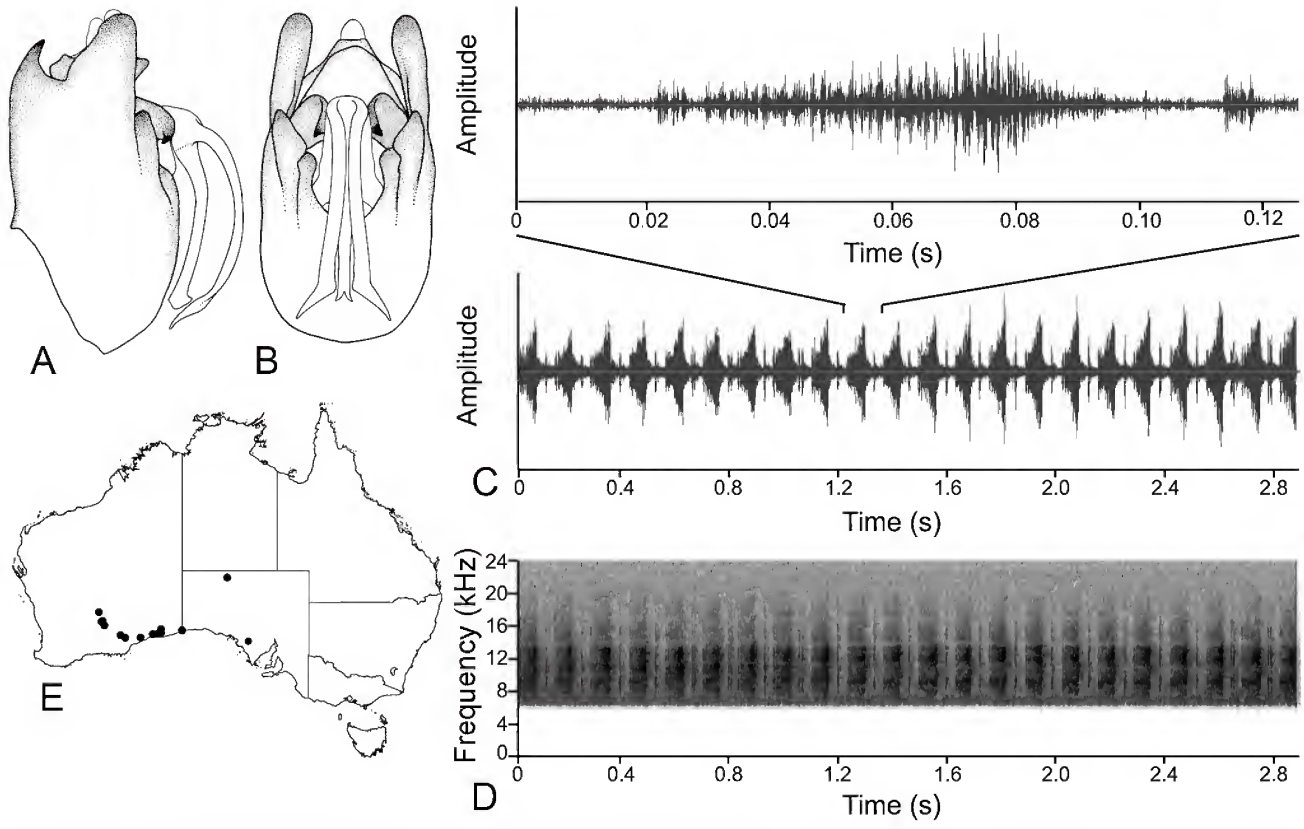


Figure 18. *Pauropsalta contigua* n.sp. *(A)* male genitalia, lateral view (genitalia prep PAU 206); *(B)* male genitalia, ventral view (genitalia prep PAU 206); *(C)* waveform of male calling song recorded from c. 75 km S of SA/NT border, Marryat Rest Area at Agnes Creek, Stuart Hwy, SA; *(D)* spectrogram of male calling song; *(E)* species distribution map.

Distribution (Fig. 18). Arid areas of Western Australia and South Australia receiving between approximately 200–250 mm average annual rainfall. In Western Australia there are records from between Cue and Madura, and across the southern margin of the Nullarbor Plain along the Eyre Highway. In South Australia there are just three widespread records, in the far southwest near Border Village, in the far north at Agnes Creek some 75 km south of the Northern Territory border on the Stuart Highway, and from Minnipa on the Eyre Peninsula. There are records for December, January and February but adults may well occur in other months.

Habitat. Adults inhabit eucalypt trees where they prefer the trunks and larger branches.

Description

Male (Pl. 3). *Head* wider than lateral margins of pronotal collar; dominantly black with muddy yellow spot at posterior midline. Postclypeus jet black with pale yellow or pale reddish brown markings; a muddy yellow or pale reddish brown mark on midline around most anterior portion; lateral margins, and sometimes distal margins, muddy yellow or pale reddish brown; transverse ridges and central groove distinct; sometimes central groove reddish brown. Anteclypeus jet black. Rostrum black, occasionally tending brown proximally, reaching to or just beyond apices of mid coxae. Antennae black, sometimes white distally. Supra-antennal plates black, sometimes edged reddish brown along anterior margin.

Thorax. Pronotum black, usually with reddish brown and pale yellow markings; center of pronotum usually with reddish brown patches; fascia along midline pale yellow, usually extending from near head towards or almost to pronotal collar; sometimes a transverse muddy yellow marking dorsally abutting and/or on anterior margin of pronotal collar; pronotal collar between lateral angles black with posterior margin edged muddy yellow or reddish brown; lateral margin of pronotal collar not, or barely, ampliate. Mesonotum primarily black with reddish brown markings; usually a reddish brown marking on either side from, or near, anterior arms of cruciform elevation to, or almost to, pronotum between lateral and submedian sigilla, this marking projecting inwards to varying degrees around its mid length and sometimes meeting and sometimes thereafter extending anteriorly along midline; sometimes a reddish brown blotch between anterior arms of cruciform elevation; scutal depressions occasionally visible as black dots surrounded by reddish brown; cruciform elevation black and reddish brown, sometimes partly muddy yellow; anterior arms usually reddish brown with distal ends black, posterior arms usually black, often a black fascia down midline. Metanotum black at hind wing base, remainder reddish brown or muddy yellow, sometimes black near dorsal midline.

Legs. Fore legs mostly black but with one, sometimes two, reddish brown fascia to varying degrees along anterior length of femora, sometimes a brownish fascia along lateral exterior of femora; femora with spines black tending dark brown; pretarsal claws black with pale yellow apices. Mid and hind legs mostly black or brown tending dark brown; coxae with proximal margin edged pale reddish brown; reddish brown along anterior length of femora; tibiae and

tarsi brown tending dark brown. Meracanthus black with outer lateral margin and apex pale yellow.

Wings. Hyaline. Fore wing with fused stem of veins M and CuA not complete, the veins abutted rather than fused as one; venation brown; costa curving inward near arculus; infuscation distally on clavus; basal membrane grey to black. Hind wing with 5 apical cells; venation brown except for pale yellowish brown 2A and 3A; plaga muddy white to grey to pale brown; black infuscation on wing margin at distal end of vein 2A.

Opercula. For the most part reaching to or almost to distal margin of tympanal cavity; widely separated; flat other than a low rounded swelling of epimeron 3; usually muddy yellow with swelling black, sometimes all black or black with distal margin muddy yellow.

Timbals with four long ribs spanning the width of timbal membrane and one much shorter anterior rib terminating level with lower end of adjacent intercalary rib.

Abdomen. Tending triangular in cross section with epipleurites reflexed inwards from junction with tergites. Tergites black with reddish brown to yellow markings. Tergite 1 black; tergite 2 black with posterior margin narrowly edged reddish brown to muddy yellow, sometimes with a reddish brown to muddy yellow spot adjacent to posterior margin on dorsal midline; tergites 3–7 black with posterior margin narrowly edged reddish brown and/or yellow to varying degrees; tergite 8 black with yellow posterior margin, widest around midline. Sternite I black; sternites II–VII black with lateral margins yellow to varying degrees; sternite VIII black tending yellowish brown distally.

Genitalia (Fig. 18). Pygofer upper lobe wide and long, in lateral view tapering to a broad rounded apex. Basal pygofer lobe well developed, much longer than wide; secondary basal lobe small, in lateral view greatly reduced. Median lobe of uncus wider than long with a rounded apex. Claspers claw-like, but tilted sideways towards center of pygofer, apices turned outwards, concave below. Aedeagus with pseudoparameres longer than endotheca, slender, flattened in cross section, arched high above endotheca in lateral view, in dorsal view more or less parallel to each other but distally curved outwards, their apices diverging approximately 30°; endotheca gently curved, parallel sided, circular in cross-section, apex in lateral view rounded, crested dorsally, in dorsal view triangularly recessed.

Female (Pl. 3). Similar to male. Abdominal segment 9 black or a mixture of black and dark brown with margins dull pale muddy yellow near caudal beak and distal margin to varying extent. Ovipositor sheath extending approximately 1.5 mm beyond apex of abdomen; black.

Measurements. Range and mean (in mm) for 10♂♂ and 2♀♀; includes smallest and largest of available specimens. *Length of body*: male 12.0–16.0 (14.4); female 16.1–17.4 (16.8). *Length of fore wing*: male 16.6–19.6 (18.0); female 18.7–20.5 (19.6). *Width of fore wing*: male 5.9–6.8 (6.3); female 6.4–7.6 (7.0). *Ratio length/width of fore wing*: male 2.7–3.0 (2.9); female 2.7–2.9 (2.8). *Width of head (including eyes):* male 4.2–5.1 (4.8); female 4.7–4.9 (4.8). *Width of pronotum (across lateral angles):* male 4.6–5.5 (5.2); female 5.1–5.2 (5.15).

Distinguishing features

Distinguished from most small black cicadas by having the stems of fore wing veins M and CuA closely abutted on reaching the basal cell rather than fused as one (view under low magnification).

Amongst small black cicadas with fore wing veins M and CuA abutted, *Pau. contigua* differs from *Pau. infuscata* in having 5 apical cells in the hind wing whereas *Pau. infuscata* has 6 (in *both* hind wings). Males of *Pau. contigua* differ from *Pau. confinis* in having the dorsal portion of abdominal segment 1 exposed rather than hidden. To separate males of *Pau. contigua* from those individuals of *Pau. accola* having the stems of fore wing veins M and CuA abutted, examination of the male aedeagus is necessary; the pseudoparameres of *Pau. contigua* rise very high above the endotheca while those of *Pau. accola* are either adjacent to the endotheca. However, any specimens with a fore wing length of 19.4 mm or below are most likely to be *Pau. contigua* as no specimens of *Pau. accola* are known to have a fore wing that short. Females of *Pau. confinis* and *Pau. accola* are indistinguishable from those of *Pau. contigua*.

The male genitalia are unique in having the following combination of characters: a large and broad upper pygofer lobe that gradually tapers to a rounded point, a pair of pseudoparameres that arch high above the endotheca in lateral view, and an endotheca lacking a ventral support and with its apex bi-lobed.

Etymology. From the Latin *contigua* meaning lying near, neighboring, and referring to the closely abutted but independent stems of veins M and CuA of the fore wing, an unusual feature amongst small black cicadas where the stems of these veins are usually fused as one.

Song (Fig. 18). The song is composed of a series of echemes and clicks. The echemes are short and nearly 3 occur every 0.4 s. Echemes are c. 0.07 s long. Following each echeme is a click, however, two clicks can occur. The song occurs between 6 kHz and 20 kHz with the dominant frequency between 8 kHz and 14 kHz.

Pauropsalta ewarti n.sp.

Fig. 19, Pl. 4

Pauropsalta ewarti Owen *et al.*, 2015: 261, 272, *nomen nudum*.

Types. *Holotype* male (molecular voucher 04.AU.QL.HMT.13; GenBank accessions: KM377157, KM377337, KM377435, KM668293), Herberton, Queensland, 943 m, 17°23.2'S 145°22.7'E, 9.i.2004, Cooley, Hill, Marshall, Moulds (QM). *Paratypes*—QUEENSLAND: 1♂ (genitalia prep. PAU 52), Walsh's Pyramid, nr Gordonvale, 18.ii.1983, G, Wood; 7♂♂ (two genitalia preps. JH2, JH3), Herberton, 943 m, 17°23.2'S 145°22.7'E, 9.i.2004, Cooley, Hill, Marshall, Moulds (MSM). 1♂ (genitalia prep. JH1), Herberton, 943 m, 17°23.2'S 145°22.7'E, 9.i.2004, Cooley, Hill, Marshall, Moulds (AE). 1♂, Herberton, 943 m, 17°23.2'S 145°22.7'E, 9.i.2004, Cooley, Hill, Marshall, Moulds (DE). 1♂, 1♀, Top of Herberton Range. 17°20'32'S 145°25'02'E, 27.xii.2007, L. Popple & A. McKinnon, 384-0001 to 383-0002; 1♂, Herberton district, 17°23'22"S 145°21'02"E, 7.xii.2008, L. Popple & D. Emery, 384-0003 (LP).

Distribution (Fig. 19). Known from just two localities in northeastern Queensland; Herberton at the drier southwestern edge of the Atherton Tableland, and Walshs Pyramid south of Gordonvale. There are records for December, January and mid February.

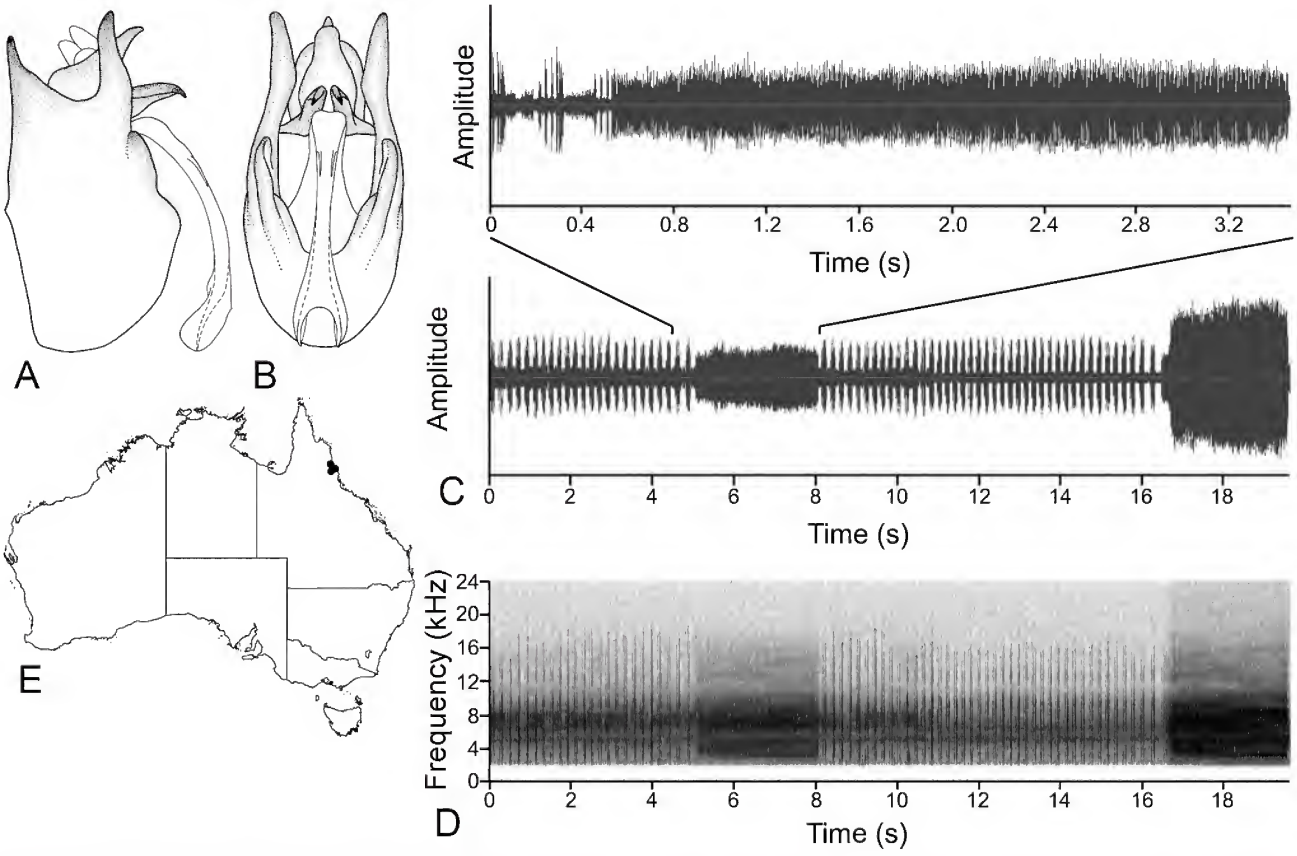


Figure 19. *Pauropsalta ewarti* n.sp. *(A)* male genitalia, lateral view (genitalia prep PAU 52); *(B)* male genitalia, ventral view (genitalia prep PAU 52); *(C)* waveform of male calling song recorded from Herberton Mine Tailings, near Herberton, QLD; *(D)* spectrogram of male calling song; *(E)* species distribution map.

Habitat. Dry open eucalypt forest where adults prefer the upper branches of trees of medium height.

Description

Male (Pl. 4). *Head* wider than lateral margins of pronotal collar but narrower than lateral angles; dominantly black with yellowish brown spot at posterior midline. Postclypeus black with yellowish brown markings; usually a partly yellowish brown dorsally; a yellowish brown mark on midline around most anterior portion; lateral, and usually posterior, margins yellowish brown; transverse ridges and central groove distinct. Anteclypeus black. Rostrum black, tending brown proximally, reaching to or near bases of hind coxae. Antennae brown. Supra-antennal plates black, edged yellowish brown along anterior margin to varying degrees.

Thorax. Pronotum black with yellowish brown markings; fascia along midline yellowish brown, usually extending from or near head towards or almost to pronotal collar; a yellowish brown marking on either side of midline dorsally, abutting and/or on anterior margin of pronotal collar; a yellowish brown marking extending from head against inner margin of paramedian fissure, variable in length; sometimes yellowish brown patches laterally to varying degrees; pronotal collar yellowish brown; lateral angles sometimes black to varying degrees; lateral margin not, or barely, ampliate. Mesonotum primarily black with yellowish brown or reddish brown markings; usually a yellowish brown or reddish brown marking on either side from, or near, anterior arms or the cruciform elevation to, or almost to, pronotum between lateral and submedian sigilla, this marking projecting inwards to varying degrees around its mid length sometimes meeting and sometimes extending along midline, and sometimes surrounding scutal depressions; lateral margins usually yellowish brown; cruciform elevation yellowish brown and black, sometimes muddy brown, anterior arms usually yellowish brown, posterior arms usually brown, sometimes proximally black, black between anterior and posterior arms, often a black fascia down midline. Metanotum black at hind wing base, remainder reddish brown, sometimes black at dorsal midline.

Legs. Fore legs mostly black but with a brown to reddish brown fascia to varying degrees along anterior and exterior length of femora, sometimes a brownish red fascia along lateral interior of femora; femora with spines black; tarsi usually with two yellowish brown patches; pretarsal claws yellowish brown tending black distally. Mid and hind legs mostly black or brown tending dark brown; coxae with proximal margin edged brown; yellowish brown fascia along anterior, interior, exterior length of femora; tibiae brown tending black distally; tarsi sometimes with two yellowish brown patches. Meracanthus black with outer lateral margin and apex pale yellow.

Wings. Hyaline. Fore wing with fused stem of veins M and CuA not complete, the veins abutted rather than fused as one; venation brown; inconspicuous infuscation distally on clavus; basal membrane muddy brown. Hind wing with 5 apical cells; venation brown except for pale yellowish brown 2A and 3A; plaga muddy white to brown; black infuscation on wing margin at distal end of vein 2A.

Opercula. For the most part not reaching distal margin of tympanal cavity; widely separated; a low rounded swelling of epimeron 3; black, sometimes yellowish brown on distal half.

Timbals with four long ribs spanning the width of timbal membrane and one much shorter anterior rib terminating about level with lower end of adjacent intercalary rib

Abdomen. Tending triangular in cross section with epipleurites reflexed inwards from junction with tergites. Tergites black with reddish brown and yellow markings. Tergite 1 black; tergites 2–8 black with posterior margin reddish brown to varying degrees, sometimes a reddish brown spot adjacent to posterior margin on dorsal midline, extreme posterior margin usually narrowly edged orange. Sternite I brownish black with muddy yellow dorsally; sternites II mostly black or nearly so; sternites III–VII orange, sometimes with posterior margin yellowish orange to varying degrees; sternite VIII yellowish brown.

Genitalia (Fig. 19). Pygofer upper lobe narrow and long, in lateral view gradually tapering to a rounded apex, apex slightly down-curved. Basal lobe longer than wide, rounded in lateral view, flat, not turned inwards. Secondary basal pygofer lobe small, in lateral view tending linear, the upper half broadly rounded. Median lobe of uncus tending triangular with a narrow rounded apex. Claspers claw-like, flattened and narrow in dorsal view, distally slightly diverging, concave below. Aedeagus with pseudoparameres inconspicuous, translucent, hair-like, lying adjacent to dorsal surface of endotheca, arising at about one quarter length of endotheca and very short. Endotheca long, parallel sided, circular in cross-section; apex divided into a pair of similar flat lobes, in lateral view these paddle-like, in dorsal view diverging more or less in a Y-shape.

Female. Female is similar to male, ovipositor sheath extends c. 1.5 mm past termination of abdomen.

Measurements. Range and mean (in mm) for 10♂♂; includes smallest and largest of available specimens. *Length of body*: 20.3–24.3 (22.1). *Length of fore wing*: 26.9–29.6 (28.3). *Width of fore wing*: 9.4–10.3 (9.7). *Ratio length/width of fore wing*: 2.8–3.0 (2.9). *Width of head (including eyes)*: 6.7–7.4 (7.0). *Width of pronotum (across lateral angles)*: 6.9–8.0 (7.5).

Distinguishing features

Distinguished from most other species of *Pauropsalta* in having the stems of fore wing veins M and CuA closely abutted rather than fused as one. Amongst those species with abutted veins care should be taken not to confuse this species with *Pau. opaca* or *Pau. herveyensis*. Distinguished from both by having a rostrum that barely reaches the bases of the hind coxae; those of *Pau. opaca* and *Pau. herveyensis* extend clearly beyond the bases and usually to the apices of the hind coxae.

Male genitalia are unique in having an aedeagus with pseudoparameres that are very short, hair-like, translucent and virtually indiscernible, and an endotheca that has its apex divided into a pair of paddle-like lobes rounded apically.

Etymology. Named after Tony Ewart who has contributed significantly to the revision of *Pauropsalta* species and other Australian cicadas.

Song (Fig. 19). The song is composed of a series of pulses and echemes. Pulses usually occur for 5–9 s. Echemes follow each series of pulses and each echeme lasts for nearly 3 s. The frequency of the song occurs between 2 kHz and 24 kHz, with the dominant frequency between 4 kHz and 11 kHz.

Pauropsalta extensa Goding & Froggatt, 1904

Fig. 20

Pauropsalta extensa Goding & Froggatt, 1904: 618–619.
Pauropsalta prolongata Goding & Froggatt, 1904: 618; Burns, 1957: 658 (as a junior synonym of *Pauropsalta mneme*); Ewart, 1989: 293. **New synonym**.
Melampsalta prolongata (Goding & Froggatt): Ashton, 1914: 353.
Melampsalta extensa (Goding & Froggatt): Burns, 1957: 651.
Pauropsalta extensa Goding & Froggatt: Duffels and van der Laan, 1985: 301; Owen *et al.*, 2015: 261.

The holotype of *Pau. extensa* is a female from the Murray River. There are two specimens labelled as holotype of *Pau. prolongata*, one in the ANIC and one in the SAM. It is difficult to say which is the true type, which according to the original description should reside in SAM. However, the specimen in ANIC may be the true type as it bears reddish markings as in the original description rather than dull yellow. But we consider both specimens to be conspecific so it is not a concern which is the true type.

Because the type of *Pau. extensa* and *Pau. prolongata* are females it is difficult to associate males. We have males (but no females) that are morphologically similar to the female types, notably in the closely abutted stems of fore wing veins M and CuA that are not fused as one, in the head structure including rostrum length, in the unusually concave costa near the arculus, the five apical cells in the hind wings, and in the bold marginal infuscation at the distal end of hind wing vein 2A. These males we consider to be conspecific with the types. Further, three of these males come from close to the Murray River, the type locality of *Pau. extensa.*

Burns placed *Pauropsalta prolongata* as a junior synonym of *Pauropsalta mneme* (Walker) but this cannot be correct. The types of *prolongata* in ANIC and SAM both have fore wing veins M and CuA closely abutted for some distance before reaching the basal cell whereas *Pau. mneme* has these clearly fused as one before the basal cell. Further, *Pau. prolongata* is a slender species whereas *Pau. mneme* has a more robust body and much broader fore wings.

Material examined. Holotype of *Pau. extensa*, female, bearing labels as follows "*Pauropsalta / extensa* / G & F. / Murray Riv S.A." handwritten, "Murray Rr / Scrub ? ? ? / Tepper" handwritten, "I.5030." handwritten, "Type" hand printed on a red disc, "*Pauropsalta extensa* G & F. / S.A. TYPE" produced from typewriter except for the word TYPE handwritten in red ink (SAM). Presumed holotype of *prolongata*, female, bearing three labels as follows "*Pauropsalta / prolongata* / G. & F. / S. Australia" in Froggatt's handwriting, "Type" handwritten in red ink; "On permanent loan from Macleay Museum" printed on white card (ANIC). Alternative holotype of *prolongata*, female, conspecific with presumed holotype, bearing labels as follows "Mt Lofty Ra" handwritten possibly by Goding, "*Pauropsalta prolongata* / type" handwritten, "Type" hand printed on a red disc (SAM); 1♂ (molecular voucher AU.SA.NGS.01; GenBank accessions: KM377105, KM377301, KM377412, KM377584, KM668271), AU.SA.NGS, Bordertown-Pinnaroo Rd, c. 52 km N of Western Hwy, 158 m, 35°49.806'S 140°47.433'E, 5 Jan. 2011, K. Hill, D. Marshall; 3♂♂ (one molecular voucher AU.SA.TBE.01, genitalia prep. PAU512), AU.SA.TBE, 13.5 km E of Tailem Bend on Mallee Hwy, 27 m, 35°17.300'S 139°35.922'E, 6 Jan, 2011, K. Hill, D. Marshall (AM, MSM).

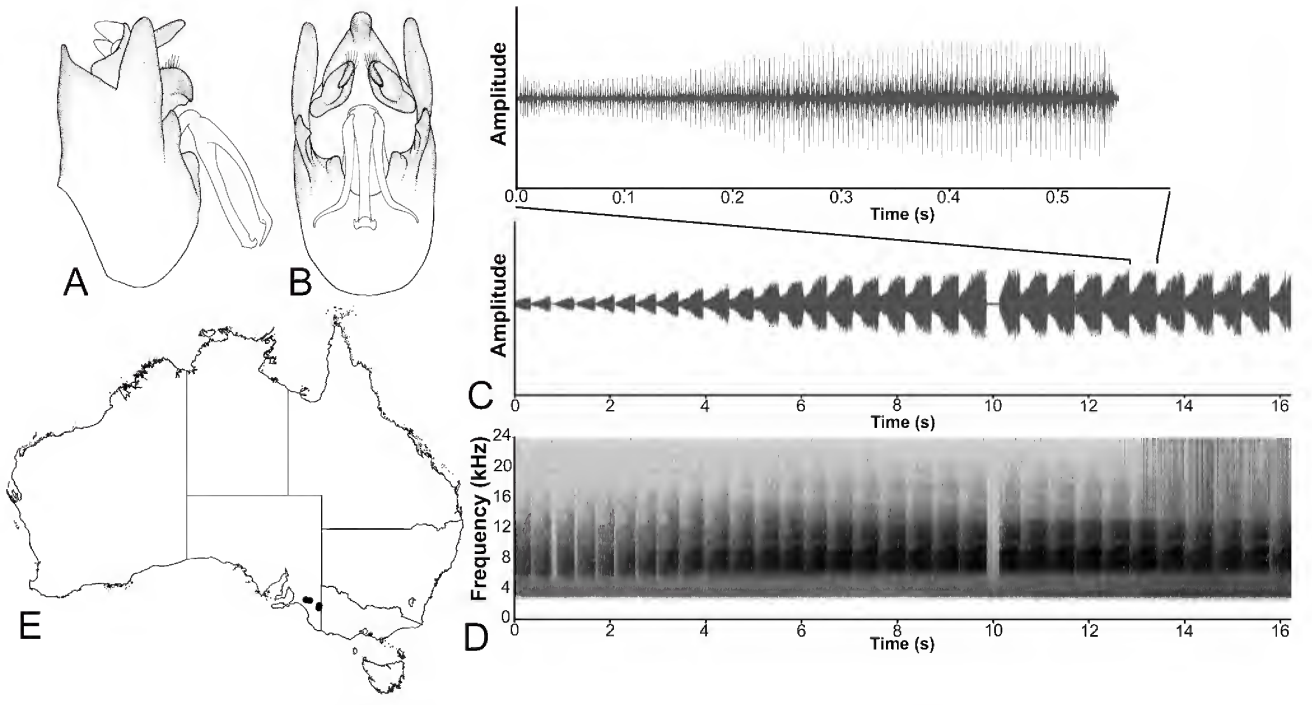


Figure 20. *Pauropsalta extensa (A)* male genitalia, lateral view (genitalia prep PAU 512); *(B)* male genitalia, ventral view (genitalia prep PAU 512); *(C)* waveform of male calling song recorded from 13.5 km E of Tailem Bend on Mallee Hwy, SA; *(D)* spectrogram of male calling song; *(E)* species distribution map.

Distribution (Fig. 20). South Australia where it is known from Mount Lofty Ranges north of Adelaide, near Tailem Bend on the lower Murray River and from some 60 km north of Bordertown. There are records for early January only.

Habitat. Adults inhabit mallee and other eucalypts where they perch on the trunks and branches.

Description

Male. *Head* wider than lateral margins of pronotal collar; dominantly black sometimes with muddy yellow spot at posterior midline. Postclypeus jet black with pale yellow or pale reddish brown markings; a muddy yellow or pale reddish brown mark on midline around most anterior portion; lateral margins muddy yellow or pale reddish brown; transverse ridges and central groove distinct. Anteclypeus jet black. Rostrum black, occasionally tending brown proximally, reaching to or beyond apices of mid coxae. Antennae black tending white distally. Supra-antennal plates black.

Thorax. Pronotum black, usually with reddish brown and pale yellow markings; center of pronotum with reddish brown patches; fascia along midline dull yellow, usually extending from near head towards or almost to pronotal collar; pronotal collar between lateral angles black or dark brown with posterior margin edged muddy yellow or reddish brown; lateral margin of pronotal collar not, or barely, ampliate. Mesonotum primarily black with reddish brown markings; usually a reddish brown marking on either side from, or near, anterior arms or the cruciform elevation to, or almost to, pronotum between lateral and submedian sigilla, this marking projecting inwards to varying degrees around its mid length; scutal depressions occasionally visible as black dots surrounded by reddish brown; cruciform elevation muddy yellow, anterior arms with distal ends black, sometimes a black fascia down midline. Metanotum black at hind wing base, remainder reddish brown or muddy yellow, sometimes black near dorsal midline.

Legs. Fore legs mostly black but with a brown to yellowish brown fascia to varying degrees along anterior length of femora, sometimes a brownish fascia along lateral exterior of femora; femora with spines black to dark brown; pretarsal claws black to dark brown. Mid and hind legs mostly black or brown tending dark brown; coxae black; reddish brown along anterior length of femora; tibiae and tarsi brown tending yellowish brown. Meracanthus black sometimes with outer lateral margin and apex pale yellow.

Wings. Hyaline. Fore wing with fused stem of veins M and CuA not complete, the veins abutted rather than fused as one; venation brown and black; costa slightly curving inwards near arculus; minor infuscation distally on clavus; basal membrane grey to black. Hind wing with 5 apical cells; venation brown except for pale yellowish brown 2A and 3A; plaga muddy white to grey to pale brown; strong black infuscation on wing margin at distal end of vein 2A.

Opercula. For the most part reaching to or almost to distal margin of tympanal cavity except at distal outer corner; widely separated; flat other than a low rounded swelling of epimeron 3; black tending dull yellow on distal half.

Timbals with four long ribs spanning the width of timbal membrane and one much shorter anterior rib terminating level with upper end of adjacent intercalary rib.

Abdomen. Tending triangular in cross section with epipleurites reflexed inwards from junction with tergites. Tergites black with dull yellow markings. Tergite 1 black and greatly reduced, not visible at dorsal midline; tergites 2–7 black with posterior margin narrowly edged muddy yellow to varying degrees; tergite 8 black with muddy yellow posterior margin barely discernible. Sternite I black; sternites II–VII black with posterior margin yellow to varying degrees, widest at lateral extremities; sternite VIII black tending yellowish brown distally.

Genitalia (Fig. 20). Pygofer upper lobe wide and long, in lateral view gradually tapering to a broad rounded apex. Basal pygofer lobe angular in lateral view, flap-like, partly turned inwards. Secondary basal lobe small, domed. Median lobe of uncus a little longer than wide with a rounded apex. Claspers claw-like, but very flattened, apices turned outwards and rather short and conical. Aedeagus with pseudoparameres as long as or a little longer than endotheca, slender, rounded in cross section, lying arched high above endotheca in lateral view, in dorsal view tending parallel to each other but distally slightly diverging, distally swollen before turning outwards and downwards and tapering to a long sharp point. Endotheca straight in lateral view, circular in cross-section, apex more or less square-cut with a very small upturned flat lobe either side and a rim bearing minute spines.

Female. Similar to male but with brown and yellow markings on head and body more extensive. Abdominal segment 9 brown with a black fascia on each side of midline. Ovipositor sheath long, extending 1 mm beyond apex of abdomen; dark brown to black.

Measurements. Range and mean (in mm) for 4♂♂ and 1♀; includes all available specimens. *Length of body*: male 16–18.5 (17.4); female 19.8. *Length of fore wing*: male 18.4–20.6 (19.6); female 22.4. *Width of fore wing*: male 6.1–7.3 (6.8); female 7.5. *Ratio length/width of fore wing*: male 2.8–3.0 (2.9); female 3.0. *Width of head (including eyes)*: male 5.1–5.5 (5.3); female 5.7. *Width of pronotum (across lateral angles)*: male 5.3–6.0 (5.7); female 6.2.

Distinguishing features

Distinguished from most small black cicadas by having the stems of fore wing veins M and CuA closely abutted on reaching the basal cell rather than fused as one (view under low magnification).

Among those species of small black cicadas with M and CuA abutted *Pau. extensa* differs from all except *Pau. confinis* in having the dorsal portion of tergite 1 concealed or nearly so, whereas it is clearly visible in the other species. Males differ from *Pau. confinis* in having the dorsal beak and upper pygofer lobe black while in *Pau. confinis* they are dull yellow. Females differ from *Pau. confinis* in having the distal part of abdominal segment 9 and the dorsal beak black (except sometimes for the very tip of the dorsal beak) while and these areas in *Pau. confinis* are dull yellow.

The male genitalia are unique in having the pseudoparameres swollen immediately preceding the long tapering apices and the following combination of characters: a large and broad upper pygofer lobe that gradually tapers to a blunt point, an endotheca lacking a ventral support and with its apical rim edged in minute spine-like projections, and a pair of pseudoparameres that arch high above the endotheca in lateral view.

Song. The song is composed of a series of similar echemes at a rate of 2–2.5 per second. The frequency of the song occurs between 6 kHz and 20 kHz, with the dominant frequency between 6 kHz and 10 kHz.

Pauropsalta extrema (Distant, 1892)

Fig. 21, Pl. 3

Melampsalta extrema Distant, 1892: 323–324.
Pauropsalta extrema (Distant). Goding & Froggatt, 1904: 619; Ewart, 1989: 300–301; Moulds, 1990: 132–133; Owen *et al.*, 2015: 261, 272.

Previously, the identity of *Pauropsalta extrema* erroneously included an undescribed species. True *Pau. extrema* is a species confined to localities west of the Great Sandy Desert in Western Australia, while those individuals previously considered to be *Pau. extrema* from east of the Great Sandy Desert clearly differ from *Pau. extrema* in the male genitalia and song and consequently are here recognized as *Pau. similis* n.sp. True *Pau. extrema* can be documented as follows.

Material examined. Lectotype male, Roebourne N.W. Aust. Saunders, Distant coll. 1911-383; designated by Ewart (1989: 300) (NHM), and specimens from the following localities: WESTERN AUSTRALIA: Fortescue R., Hamersley Rg; (MV). Millstream; 0.5 km WNW of

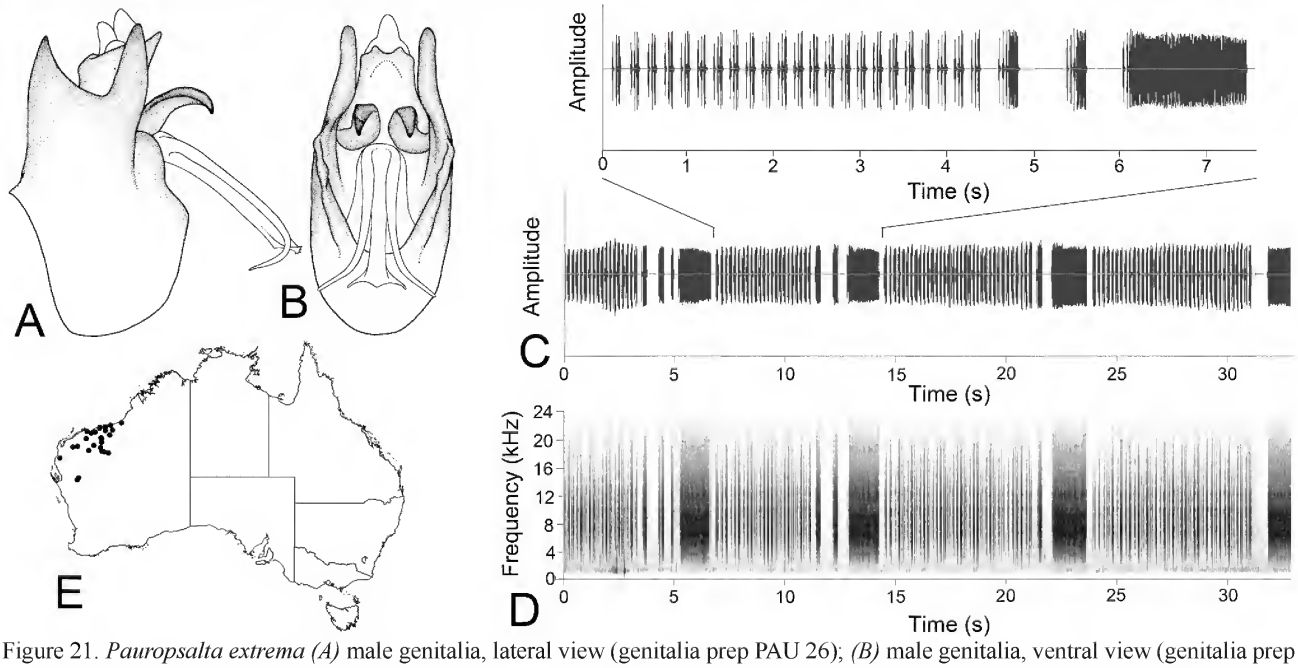


Figure 21. *Pauropsalta extrema (A)* male genitalia, lateral view (genitalia prep PAU 26); *(B)* male genitalia, ventral view (genitalia prep PAU 26); *(C)* waveform of male calling song recorded from west side of Roebourne, WA; *(D)* spectrogram of male calling song; *(E)* species distribution map

Millstream; 2 km ENE of Millstream Hsd; Mt Tom Price; Mt Newman (JM). House Ck, c. 60 km E of Nanutarra roadhouse, 22°32.646'S 115°29.981'E; Nanutarra roadhouse, 22°32.646'S 115°29.981'E; 54 km NW of Paraburdoo, 22°57.687'S 117°19.925'E; Minilya River x-ing, 23°49.108'S 114°0.483'E; 66.5 km N of Murchison Roadhouse, 26°19.884'S 116°0.3'E; 100 km N of Murchison Roadhouse, nr Byro Hsd, 26°05.146'S 116°09.516'E; Marble Bar; Millstream, Fortescue R., S of Roebourne; Sherlock R.; Yule R., approx. 160 km S of Port Hedland (MSM & WAM). Fortescue R., Hamersley Rg (SAM); 1♂ (molecular voucher 06.AU.WA.SFR.01; GenBank accessions: KM377099, KM377369, KM377424, KM668301), Sandfire Roadhouse on Great Northern Hwy, -19.771° 121.092°, 9.ii.2006, Hill, Marshall, and Moulds (UCS).

Distribution (Fig. 21). Northwestern Western Australia, for the most part between the Murchison and De Grey Rivers. It occurs in both coastal districts (e.g., Roebourne, type locality) and inland as far as Newman and Byro Station (some 200 km inland from Shark Bay) (K. Hill and D. Marshall). The occurrence of the species at Sandfire roadhouse, about half way between Broome and Port Hedland and well within the Great Sandy Desert (Hill, Marshall and Moulds), is probably due to an accidental introduction with cultivated eucalypts and the species is considered unlikely to occur there naturally. Adults have been taken from late December to early March but the species almost certainly will be found to occur in other months, both before and after these dates.

Habitat. Usually on the upper branches or trunks of eucalypts growing along rivers, watercourses or in well-watered gardens.

Distinguishing features

Size, colour and markings are indistinguishable from those of *Pau. similis*. However, males can be separated from *Pau. similis* by the shape of the distal end of the endotheca; that of *Pau. extrema* bears wing-like flanges that extend laterally beyond the shaft of the endotheca (Fig. 21). In contrast, the distal end of the endotheca of *Pau. similis* is bi-lobed with the lobes *not* spreading laterally beyond the shaft (Fig. 28). Females are indistinguishable morphologically and can only be identified to species by locality.

Song (Fig. 21). A succession of buzz-like ticks followed by a longer buzz-like call, somewhat resembling the sound of typing followed by carriage return on a manual typewriter. The locals of Marble Bar call this species the Typewriter. The dominant song frequency ranges from 6–12 kHz.

Pauropsalta herveyensis n.sp.

Fig. 22, Pl. 4

Pauropsalta herveyensis Owen *et al.*, 2015: 261, 272, *nomen nudum*.

Types. *Holotype* male (genitalia prep. PAU 225), Herveys Rg., W of Townsville, Queensland, 19°21.636'S 146°27.215'E, 374 m, 10.i.2009, M. Moulds, K. Hill, D. Marshall, C. Owen (QM). *Paratypes*—QUEENSLAND: 2♂♂ (one genitalia prep. PAU328; 2 molecular vouchers 09.AU.QL.HER.01, 09.AU.QL.HER.02; GenBank accessions: KM377100, KM377345, KM377466, KM668337), Herveys Rg., W of Townsville, 19°21.636'S 146°27.215'E, 374 m, 10.i.2009, M. Moulds, K. Hill, D. Marshall, C. Owen (MSM).

Distribution (Fig. 22). Known only from Herveys Range, west of Townsville, Queensland. The three known specimens were taken on 10th January.

Habitat. Dry open eucalypt forest where adults prefer the upper branches of trees of medium height.

Description

Male (Pl. 4). *Head* wider than lateral margins of pronotal collar but narrower than lateral angles; dominantly black with yellowish brown spot at posterior midline. Postclypeus black with yellowish brown markings; usually a partly yellowish brown dorsally; a yellowish brown mark on midline around most anterior portion; lateral, and usually posterior, margins yellowish brown; transverse ridges and central groove distinct. Anteclypeus black. Rostrum black, tending brown proximally, reaching to beyond apices of hind coxae. Antennae brown. Supra-antennal plates black, edged yellowish brown along anterior margin to varying degrees.

Thorax. Pronotum black with yellowish brown markings; fascia along midline yellowish brown, usually extending from or near head towards or almost to pronotal collar; a yellowish brown marking on either side of midline dorsally, abutting and/or on anterior margin of pronotal collar; pronotal collar yellowish brown; lateral angles sometimes black to varying degrees; lateral margin not, or barely, ampliate. Mesonotum primarily black with yellowish brown or reddish brown markings; usually a yellowish brown or reddish brown marking on either side from, or near, anterior arms or the cruciform elevation to, or almost to, pronotum between lateral and submedian sigilla, this marking projecting inwards to varying degrees around its mid length sometimes meeting and sometimes extending along midline, and sometimes surrounding scutal depressions; lateral margins usually yellowish brown; cruciform elevation yellowish brown and black, sometimes muddy brown, anterior arms usually yellowish brown, posterior arms usually brown, sometimes proximally black, black between anterior and posterior arms, often a black fascia down midline. Metanotum black at hind wing base, remainder reddish brown, sometimes black at dorsal midline.

Legs. Fore legs mostly black but with a brown to reddish brown fascia to varying degrees along anterior and exterior length of femora, sometimes a brownish red fascia along lateral interior of femora; femora with spines black; tarsi usually with one yellowish brown patches; pretarsal claws yellowish brown tending black distally. Mid and hind legs mostly black or brown tending dark brown; coxae with proximal margin edged brown; yellowish brown fascia along anterior, interior, exterior length of femora; tibiae brown tending black distally; tarsi sometimes with one yellowish brown patches. Meracanthus black with outer lateral margin and apex pale yellow.

Wings. Hyaline. Fore wing with fused stem of veins M and CuA not complete, the veins abutted rather than fused as one; venation brown; basal membrane muddy brown. Hind wing with 5 apical cells; venation brown except for pale yellowish brown 2A and 3A; plaga muddy white to brown; black infuscation on wing margin at distal end of vein 2A.

Opercula. For the most part not reaching distal margin of tympanal cavity; widely separated; a low rounded swelling of epimeron 3; black, sometimes yellowish brown on distal half.

Timbals with four long ribs spanning the width of timbal membrane and one much shorter anterior rib terminating level with upper end of adjacent intercalary rib.

Abdomen. Tending triangular in cross section with epipleurites reflexed inwards from junction with tergites. Tergites black with reddish brown and yellow markings. Tergite 1 black; tergites 2–8 black with posterior margin reddish brown to varying degrees, sometimes a reddish

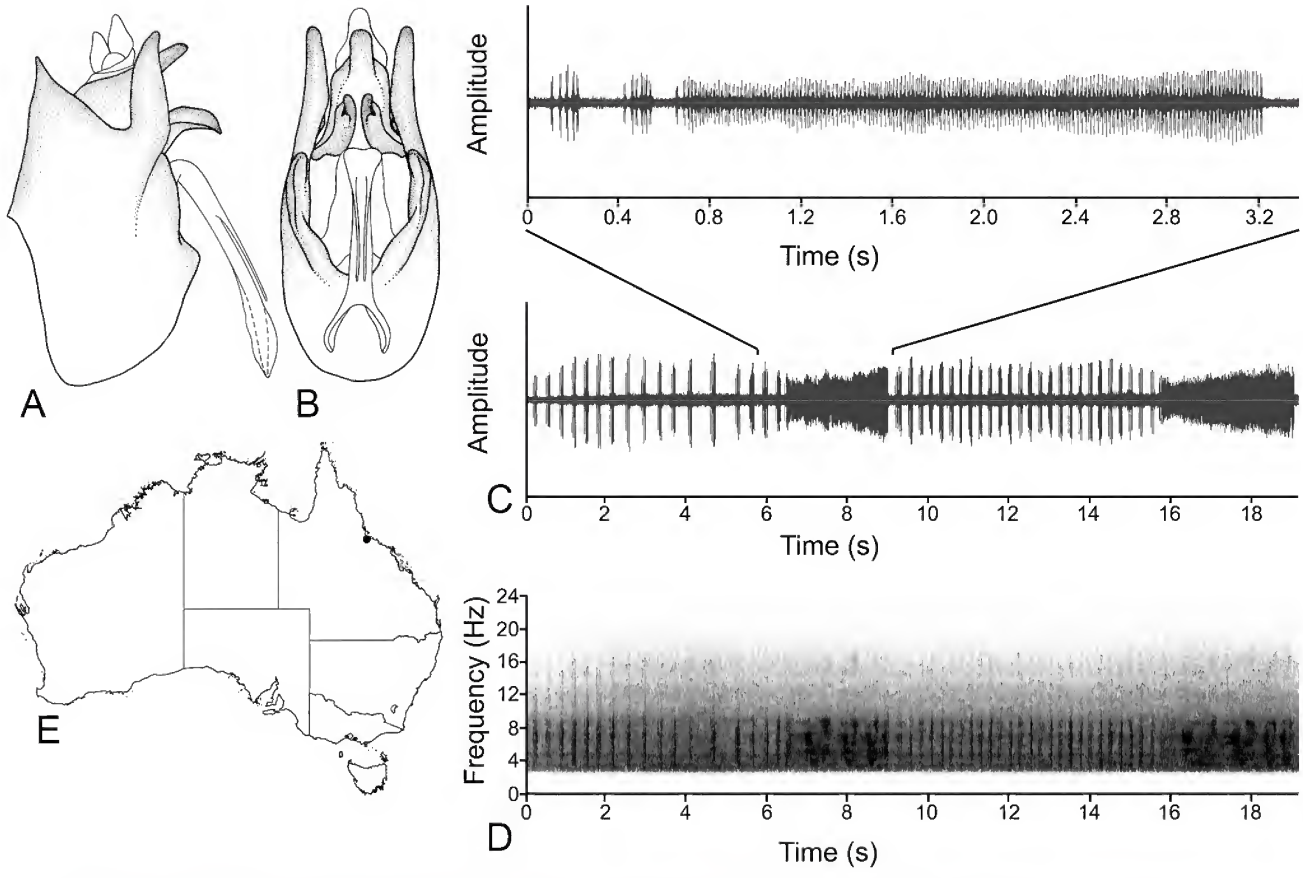


Figure 22. *Pauropsalta herveyensis* n.sp. *(A)* male genitalia, lateral view (genitalia prep PAU 225); *(B)* male genitalia, ventral view (genitalia prep PAU 225); *(C)* waveform of male calling song recorded from 25–30 km west of Townsville, junction of Thornton's Gap Rd and Hervey's Range Development Rd, QLD; *(D)* spectrogram of male calling song; *(E)* species distribution map.

brown spot adjacent to posterior margin on dorsal midline, extreme posterior margin usually narrowly edged orange. Sternite I brownish black with muddy yellow dorsally; sternites II mostly black or nearly so; sternites III–VII orange, sometimes with posterior margin yellowish orange to varying degrees; sternite VIII yellowish brown.

Genitalia (Fig. 22). Pygofer upper lobe narrow and long, in lateral view gradually tapering to a rounded apex, apex slightly down-curved. Basal lobe well developed, distally rounded in ventral view, flat, not turned inwards. Secondary basal pygofer lobe small, in lateral view rounded. Basal lobe rounded in lateral view, flat, not turned inwards. Median lobe of uncus tending triangular with a narrow rounded apex. Claspers claw-like, flattened and narrow in dorsal view, distally slightly diverging, concave below. Aedeagus with pseudoparameres inconspicuous, translucent, hair-like, lying adjacent to dorsal surface of endotheca, arising at about one quarter length of endotheca and terminating at about three quarters its length. Endotheca long, parallel sided, circular in cross-section; apex divided into a pair of similar flat lobes, lateral view these paddle-like with apices pointed, in dorsal view diverging more or less in a Y-shape.

Female. Unknown.

Measurements. Range and mean (in mm) for 3♂♂; includes smallest and largest of available specimens. *Length of body*: 21.3–22.8 (22.1). *Length of fore wing*: 27.6–28.7 (28.3). *Width of fore wing*: 9.0–9.8 (9.4). *Ratio length/width of fore wing*: 2.9–3.1 (3.0). *Width of head (including eyes)*: 6.9–7.5 (7.2). *Width of pronotum (across lateral angles)*: 7.3–8.2 (7.7).

Distinguishing features

Distinguished from most other species of *Pauropsalta* in having the stems of fore wing veins M and CuA closely abutted rather than fused as one. Amongst those species with abutted veins care should be taken not to confuse this species with *Pau. opaca* or *Pau. ewarti*. Distinguished from *Pau. ewarti* by the length of the rostrum; that of *Pau. herveyensis* reaches or almost reaches the apices of the hind coxae while that of *Pau. ewarti* barely reaches the bases of the hind coxae. Distinguished from *Pau. opaca* in having the inner areas of the pronotum entirely black whereas *Pau. herveyensis* has much of the inner pronotum pigmented with dark reddish brown patches.

Male genitalia are unique in having an aedeagus with pseudoparameres that are very small, hair-like, translucent and almost indiscernible, and an endotheca that has its apex divided into a pair of paddle-like lobes narrowed apically.

Etymology. Named after Hervey's Range where the only specimens have been collected.

Song (Fig. 22). The song is composed of a series of phrases each with a series of clicks followed by an echeme. The number of clicks ranges from 17–26. Echemes range in length from 1–3 s. The length of each phrase usually ranges from 9–11 s. The frequency of the song ranges from 3–18 kHz.

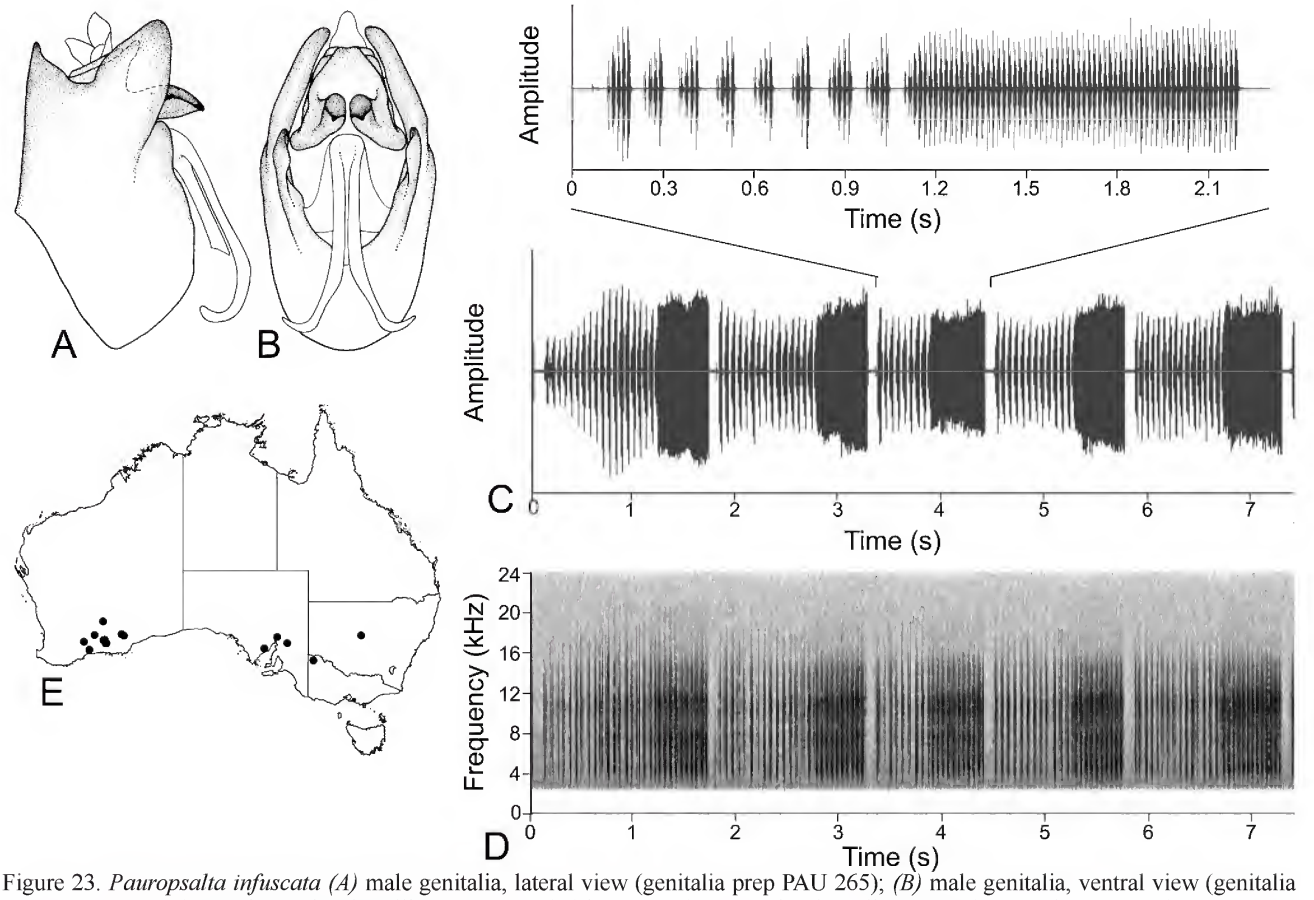


Figure 23. *Pauropsalta infuscata (A)* male genitalia, lateral view (genitalia prep PAU 265); *(B)* male genitalia, ventral view (genitalia prep PAU 265); *(C)* waveform of male calling song recorded from c. 12 km SW of Kalgoorlie, near Lake Douglas, WA; *(D)* spectrogram of male calling song; *(E)* species distribution map.

Pauropsalta infuscata Goding & Froggatt, 1904

Fig. 23, Pl. 4

Melampsalta infuscata Goding & Froggatt, 1904: 641.
Pauropsalta infuscata (Goding & Froggatt): Ewart, 1989: 293; Owen *et al.*, 2015: 261, 273.

Material examined. Syntype of *infuscata*, male (only known specimen), bearing labels as follows "*Melampsalta / infuscata* /G. & F. / Type / S. Australia" in Froggatt's handwriting, "Type" handwritten in red ink, "On permanent loan from Macleay Museum University of Sydney" printed on white card (ANIC). WESTERN AUSTRALIA: 1♂ (molecular voucher WAU.GIL.02), 56 km S of Norseman, 0.8 km SW of Esperance Hwy, 32°37.714'S 121°32.354'E, 7.ii.2009, K. Hill & D. Marshall (AM). 1♀, 6 km S of Varley, 31.xii.1990, M.S. & B.J. Moulds (AE). 1♀, 6 km S of Varley, 31.xii.1990, M.S. & B.J. Moulds (LP). 2♂♂ (one genitalia prep. PAU 367), 4♀♀, 6 km S of Varley, 31.xii.1990, M.S. & B.J. Moulds; 1♂ (molecular voucher WAU.RAT.03), Ravensthorpe, 10.i.2003, 209 m, 33°35'S 120°04'E, Moulds, Marshall, Hill & Vanderpool; 4♂♂ (three genitalia preps. PAU 270, PAU286, PAU 362), Moir's Rock, 42 km NNW Salmon Gums, 32°39'S 121°25'E, 2.i.1986, 3.i.1987, G. and A. Daniels; 1♂ (genitalia prep. PAU 363), Salmon Gums, 32°58'S 121°38'E, 5.i.1987, G. and A. Daniels; 1♂, 8 km E Salmon Gums, 32°58'S 121°42'E, 5.i.1987, G. & A. Daniels; 3♂♂ (genitalia preps. PAU 278 & PAU 366), 150 km SSW of Coolgardie, 32°10'S 120°34'E, 23.xii.1995, M.S. & B.J. Moulds & K.A. Kopestonsky; 1♂ (genitalia prep. PAU 265; molecular voucher 03.AU.WAU.LKA.05; GenBank accessions: KM377135, KM377378, KM377400, KM377601, KM668248), Lake Douglas, nr Kalgoorlie, 369 m, 30°51'S 121°23'E, 15.i.2003, Moulds, Hill, Marshall & Vanderpool; 1♂ (molecular voucher WAU.GIL.01 and genitalia prep. PAU 322), 56 km S of Norseman, 0.8 km SW of Esperance Hwy, 32°37.714'S 121°32.354'E, 7.ii.2009, K. Hill & D. Marshall; 2♀♀, Newmann's Rocks, 50 km W of Balladonia Motel, 32°06'S 123°10'E, 31.xii.1986, G. & A. Daniels; 1♂ (voucher # WA.NOE.08), 27 km NW of Balladonia, 32°13.526'S 123°22.660'E, 237 m, 20.ii.2006, Hill, Marshall, Moulds (MSM). SOUTH AUSTRALIA: 1♂, Quorn, 289 m, 32°20.820'S 138°02.105'E, 08.i.2011, K. Hill, D. Marshall (AE). 1♂, Quorn, 289 m, 32°20.820'S 138°02.105'E, 08.i.2011, K. Hill, D. Marshall (LP). 1♂ (genitalia prep. PAU 354), 55 km ESE of Kimba, on Kimba/Iron Knob road, 12.xii.1995, M.S. & B.J. Moulds & K.A. Kopestonsky; 7♂♂ (two molecular vouchers 11.AU.SA.QUO.02, 11.AU.SA.QUO.03 and two song recorded), 2♀♀, Quorn, 289 m, 32°20.820'S 138°02.105'E, 08.i.2011, K. Hill, D. Marshall; 1♂ (1 molecular voucher 11.AU.SA.PBE.01 and song recorded), Barrier Hwy, 2.3 km NE of rd to Peterborough, 521 m, 32°56.412'S 138°59.476'E, 9.i.2011, K. Hill, D. Marshall (MSM). VICTORIA: 1♂ (molecular voucher 10.AU.VIC.MSP.10 and song recorded), 21 km S of Bambill, 74 m, 34°35.8'S 141°29.8'E, 3.ii.2004, Hill, Marshall, Moulds (MSM). NEW SOUTH WALES: 2♂♂, 1♀, Round Hill NR, 32°57'06"S 146°04'53"E, 21.xi.2010, S12588, L. W. Popple, D. Emery, 693-0001 to 693-0003 (LP).

Distribution (Fig. 23). Southern part of Western Australia in an area bordered by Varley and Ravenshoe to the west, Kalgoorlie in the north and almost to Balladonia in the east, South Australia in the vicinity of the upper Spencer Gulf, and northwestern Victoria. Most records are from Western Australia especially around the Norseman and Salmon Gums areas. There are only three known localities from South Australia, 55 km ESE of Kimba, Quorn, and near Peterborough. The only Victorian record is from 21 km S of Bambill.

Habitat. Open eucalypt woodland where adults inhabit the taller trees.

Description

Male (Pl. 4). *Head* narrower than lateral angles of pronotal collar; dominantly black with muddy yellow spot at posterior midline. Postclypeus jet black with pale yellow or pale reddish brown markings; sometimes a muddy yellow or pale reddish brown marking on either side of midline near the dorsal proximal area; a muddy yellow or pale reddish brown mark on midline around most anterior portion; lateral margins muddy yellow or pale reddish brown; transverse ridges and central groove distinct. Anteclypeus jet black. Rostrum black, occasionally tending brown proximally, reaching to or just beyond apices of mid coxae. Antennae black. Supra-antennal plates black, sometimes edged reddish brown along anterior margin.

Thorax. Pronotum black, usually with reddish brown and pale yellow markings; center of pronotum with reddish brown patches; fascia along midline pale yellow, usually extending from near head towards or almost to pronotal collar; sometimes a transverse muddy yellow marking dorsally abutting and/or on anterior margin of pronotal collar; pronotal collar between lateral angles black with posterior margin edged muddy yellow or reddish brown; lateral margin of pronotal collar not, or barely, ampliate. Mesonotum primarily black with reddish brown markings; usually a reddish brown marking on either side from, or near, anterior arms or the cruciform elevation to, or almost to, pronotum between lateral and submedian sigilla, this marking projecting inwards to varying degrees around its mid length and sometimes meeting and sometimes thereafter extending anteriorly along midline; sometimes a reddish brown blotch between anterior arms of cruciform elevation; lower lateral area usually with a reddish brown streak; scutal depressions occasionally visible as black dots surrounded by reddish brown; cruciform elevation black and reddish brown, sometimes partly muddy yellow, anterior arms usually reddish brown with distal ends black, posterior arms usually black, often a black fascia down midline. Metanotum black at hind wing base, remainder reddish brown, sometimes black near dorsal midline.

Legs. Fore legs mostly black but with a reddish brown fascia to varying degrees along anterior length of femora, sometimes a brownish fascia along lateral exterior of femora; femora with spines always black; pretarsal claws black with pale yellow apices. Mid and hind legs mostly black or brown tending dark brown; coxae with proximal margin edged pale reddish brown; reddish brown along anterior length of femora; tibiae and tarsi brown tending dark brown. Meracanthus black with outer lateral margin and apex pale yellow.

Wings. Hyaline. Fore wing with fused stem of veins M and CuA not complete, the veins abutted rather than fused as one; venation brown; costa curving inward near arculus; infuscation distally on clavus; basal membrane grey to black. Hind wing with 6 apical cells; venation brown except for pale yellowish brown 2A and 3A; plaga muddy white to grey to pale brown; black infuscation on wing margin at distal end of vein 2A.

Opercula. For the most part not reaching distal margin of tympanal cavity; widely separated; flat other than a low rounded swelling of epimeron 3; black, sometimes yellowish brown on distal half.

Timbals with four long ribs spanning the width of timbal membrane and one much shorter anterior rib terminating before the upper end of adjacent intercalary rib.

Abdomen. Tending triangular in cross section with epipleurites reflexed inwards from junction with tergites. Tergites black with reddish brown to yellow markings. Tergite 1 black; tergite 2 black with posterior margin narrowly edged reddish brown to muddy yellow, sometimes with a reddish brown to muddy yellow spot adjacent to posterior margin on dorsal midline; tergites 3–7 black with posterior margin narrowly edged reddish brown to yellow of varying degrees; tergite 8 black with yellow posterior margin, widest around midline. Sternite I black; sternites II–VII black with posterior margin yellow to varying degrees; sternite VIII black tending yellowish brown distally.

Genitalia (Fig. 23). Pygofer upper lobe wide and long, in lateral view gradually tapering to a broad rounded apex. Basal pygofer lobe well developed, distally rounded in ventral view, tending flat. Secondary basal lobe small, in lateral view barely discernible. Median lobe of uncus wider than long with a rounded apex. Claspers claw-like, medium width in dorsal view, concave below, apices tending truncate in dorsal view. Aedeagus with pseudoparameres much longer than a shortened endotheca, slender, flattened in cross section, lying immediately above endotheca in lateral view, in dorsal view parallel to each other but distally curved outwards, their apices turned slightly backwards. Endotheca nearly straight, short, parallel sided, circular in cross-section, apex sloping backwards ventrally, without ornamentation.

Female. Unknown.

Measurements. Range and mean (in mm) for 9♂♂; includes smallest and largest of available specimens. *Length of body*: 15.0–18.3 (16.8). *Length of fore wing*: 20.0–23.4 (21.9). *Width of fore wing*: 6.6–8.6 (7.6). *Ratio length/width of fore wing*: 2.7–3.0 (2.9). *Width of head (including eyes)*: 5.1–6.1 (5.7). *Width of pronotum (across lateral angles)*: 5.3–6.6 (6.0).

Distinguishing features

Distinguished from most small black cicadas by having the stems of fore wing veins M and CuA closely abutted on reaching the basal cell rather than fused as one (view under low magnification). *Pauropsalta infuscata* differs from those species with abutted fore wing veins M and CuA (*Pau. contigua*, *Pau. confinis, Pau. extensa,* and some individuals of *Pau. accola*), in having six apical cells in the hind wings (in *both* hind wings) instead of five.

The male genitalia are unique in having the following combination of characters: a large and broad upper pygofer lobe that gradually tapers to a blunt point, an endotheca lacking a ventral support and a pair of pseudoparameres that lie immediately above the endotheca in lateral view with their distal ends extending far beyond the apex of the endotheca and considerably diverging.

Song (Fig. 23). The song consists of a series of phrases each containing a series of clicks followed by an echeme. The number of clicks ranges from 8–18. Echemes are generally less than < 1 s in length. Phrases occur at a rate of c. 0.6 per second. Dominant song frequency occurs between 4 kHz and 12 kHz.

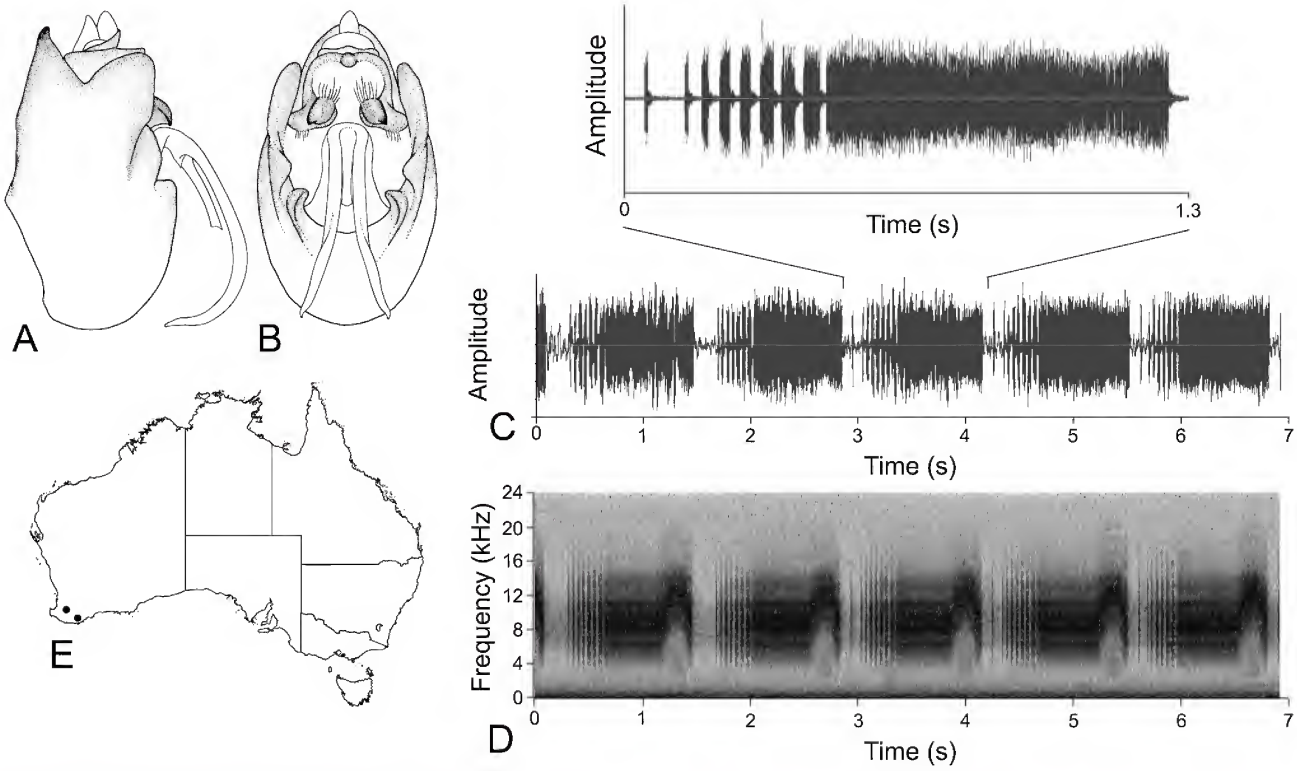


Figure 24. *Pauropsalta juncta* n.sp. *(A)* male genitalia, lateral view (genitalia prep PAU 370); *(B)* male genitalia, ventral view (genitalia prep PAU 370); *(C)* waveform of male calling song recorded from c. 51.2 km southwest of Arthur River (town) on road from Arthur River to Boyup Brook, WA; *(D)* spectrogram of male calling song; *(E)* species distribution map.

Pauropsalta juncta n.sp.

Fig. 24, Pl. 2

Pauropsalta juncta Owen *et al.*, 2015: 261, *nomen nudum*.

Types. *Holotype* male (molecular voucher 03.AU.WAU.SAR.01), 50 km SW Arthur River, Western Australia, 250 m, 33°40'S 116°41'E, 5.i.2003, Moulds, Hill, Marshall & Vanderpool (WAM). *Paratypes*—WESTERN AUSTRALIA: 1♂, 50 km SW Arthur River, 250 m, 33°40'S 116°41'E, 5.i.2003, Moulds, Hill, Marshall & Vanderpool (AE). 1♂, 50 km SW Arthur River, 250 m, 33°40'S 116°41'E, 5.i.2003, Moulds, Hill, Marshall & Vanderpool (AM). 1♂, 50 km SW Arthur River, 250 m, 33°40'S 116°41'E, 5.i.2003, Moulds, Hill, Marshall & Vanderpool (LP). 1♂ (genitalia prep. PAU227, molecular voucher 03.AU.WAU.WOO.01), Sterling Rgs, Kalgan R. Rd, 175 m, 34°32'S 117°52'E, 8.i.2003, Moulds, Hill, Marshall & Vanderpool; 5♂♂ (molecular voucher 03.AU.WAU.SAR.02; GenBank accessions: KM377106, KM377269, KM377417, KM668332)(one genitalia prep. PAU 370), 50 km SW Arthur River, 250 m, 33°40'S 116°41'E, 5.i.2003, Moulds, Hill, Marshall & Vanderpool (MSM). 3♂♂, 50 km SW Arthur River, 250 m, 33°40'S 116°41'E, 5.i.2003, Moulds, Hill, Marshall & Vanderpool (WAM).

Distribution (Fig. 24). Southwestern Western Australia where it is known from only two localities, 50 km SW of Arthur River and the Stirling Ranges. All known specimens have been taken in January.

Habitat. Eucalypt forest where adults are usually high up in trees.

Description

Male (Pl. 2). *Head* narrower than lateral angles of pronotal collar; dominantly black with muddy yellow spot at posterior midline. Postclypeus jet black with pale yellow or pale reddish brown markings; sometimes a muddy yellow marking on the dorsal proximal area; a muddy yellow or pale reddish brown mark on midline around most anterior portion; lateral margins reddish brown; transverse ridges and central groove distinct. Anteclypeus jet black. Rostrum black, occasionally tending brown proximally, reaching to about bases of hind coxae. Antennae black, sometimes white distally. Supra-antennal plates black, sometimes edged reddish brown along anterior margin.

Thorax. Pronotum black, usually with reddish brown and pale yellow markings; center of pronotum with reddish brown patches; anterior margin edged pale yellow or reddish brown; fascia along midline pale yellow, usually extending from near head towards but clearly not reaching pronotal collar; pronotal collar between lateral angles black with posterior margin edged reddish brown; lateral margin of pronotal collar not, or barely, ampliate. Mesonotum primarily black with reddish brown markings; usually a reddish brown marking on either side from, or near, anterior arms or the cruciform elevation to, or almost to, pronotum between lateral and submedian sigilla, this marking projecting inwards to varying degrees around its mid length and often meeting and sometimes thereafter extending anteriorly along midline; sometimes a reddish brown blotch between anterior arms of cruciform elevation; lower lateral area usually with a reddish brown streak; cruciform elevation black and reddish brown or black and muddy yellow, anterior arms reddish brown or muddy yellow with distal ends black, posterior arms reddish brown or dull yellow sometimes also with black and sometimes a black fascia down midline. Metanotum black at hind wing base, remainder reddish brown or dull yellow, sometimes black near dorsal midline.

Legs. Fore legs mostly black but with two reddish brown fascia to varying degrees along anterior length of femora, sometimes a brownish fascia along lateral exterior of femora; femora with spines always black; pretarsal claws muddy yellow with black apices. Mid and hind legs mostly black or brown tending dark brown; coxae with proximal margin edged pale reddish brown; reddish brown fascia along anterior and interior length of femora; tibiae and tarsi dark brown tending black, sometimes a brown to reddish brown patch proximally on tibiae. Meracanthus black with outer lateral margin and apex pale yellow.

Wings. Hyaline. Fore wing with fused stem of veins M and CuA complete, the veins fused as one; venation brown to black; costa tending to curve inwards near arculus; minimal infuscation distally on clavus; basal membrane grey to black. Hind wing with 5 apical cells; venation brown to black; plaga muddy white to grey to pale brown; black infuscation on wing margin at distal end of vein 2A.

Opercula. For the most part just reaching distal margin of tympanal cavity; widely separated; flat other than a low rounded swelling of epimeron 3; black, sometimes yellowish brown on distal half.

Timbals with four long ribs spanning the width of timbal membrane and one much shorter anterior rib terminating level with lower end of adjacent intercalary rib.

Abdomen. Tending triangular in cross section with epipleurites reflexed inwards from junction with tergites. Tergites black with reddish brown to yellow markings. Tergite 1 black; tergite 2 black, sometimes with a reddish brown spot adjacent to posterior margin on dorsal midline; tergites 3–7 black with posterior margin narrowly edged reddish brown to yellow to varying degrees; tergite 8 black, sometimes with a red spot on midline near posterior margin. Sternite I black; sternites II–VII black with posterior margin yellow and sometimes reddish brown to varying degrees; sternite VIII black tending yellowish brown distally.

Genitalia (Fig. 24). Pygofer upper lobe short, wider than long, in lateral view broadly rounded apically. Basal lobe rounded, flap-like lobe, slightly turned inward. Secondary basal pygofer lobe small, in lateral view about as wide as long, apex rounded, in ventral view turned interiorly. Median lobe of uncus very small, short, wider than long, tapering to small rounded apex. Claspers claw-like, medium width in dorsal view, not excavated below, apices pointed and slightly turned outwards. Aedeagus with pseudoparameres much longer than a very small endotheca, slender, round in cross section but tending flat ventrally on proximal half or more, in lateral view lying immediately above endotheca with apices curving backwards, in dorsal view parallel to each other but distally curved outwards. Endotheca nearly straight, slightly down-curved, short, parallel sided, circular in cross-section, apex slightly curved backwards in an arc ventrally, without ornamentation.

Female. Unknown.

Measurements. Range and mean (in mm) for 10♂♂; includes smallest and largest of available specimens. *Length of body*: 15.8–18.0 (16.8). *Length of fore wing*: 17.9–19.9 (19.0). *Width of fore wing*: 6.3–7.3 (7.0). *Ratio length/width of fore wing*: 2.6–2.9 (2.7). *Width of head (including eyes)*: 5.0–5.7 (5.3). *Width of pronotum (across lateral angles)*: 5.2–5.9 (5.7).

Distinguishing features

Very similar in outward appearance to *Pauropsalta accola, Pau. conflua*, *Pau. contigua, Pau. confinis,* and *Atrapsalta dolens,* all of which occur in the southwest of Western Australia.

Males can be distinguished by the following combination of characters: fore wing veins M and CuA meet the basal cell completely fused as one (view under magnification), and the upper pygofer lobe (visible without dissection) is short, broad, about as wide as long, with a broadly rounded apex (rather than long and thin or long and blinker-shaped). Females are unknown but are probably not distinguishable from *Pau. conflua* and those individuals of *Pau. accola* with the stems of veins M and CuA completely fused as one.

The male genitalia are unique amongst *Pauropsalta* and allied genera (i.e. those species with an infuscation on the hind wing margin at the distal end of vein 2A) in having pseudoparameres that are exceptionally long, far longer than the endotheca.

Etymology. From the Latin *junctus,* meaning to unite or join, referring to the complete fusion of the stems of fore wing veins M and CuA.

Song (Fig. 24). The song is composed of a series of phrases each with a series of clicks and an echeme. Each phrase usually begins with 7 clicks and is followed by an echeme that is less than 1 s long. The echeme is unique in that the last third of the echeme increases in frequency. Each phrase is slightly longer than 1 s. Phrases occur at a rate of c. 0.7 phrases per second. The dominant frequency starts between 5 kHz and 12 kHz followed by a modulation with the dominant frequency between 8 kHz and 15 kHz.

Pauropsalta katherina n.sp.

Fig. 25, Pl. 3

Pauropsalta kathrina Owen *et al.*, 2015: 261, *nomen nudum*.

Types. *Holotype* male, (one genitalia prep. PAU208 and molecular voucher 06.AU.NT.STC.06; GenBank accessions: KM377166, KM377247, KM377487, KM377608, KM668284) 60 km S of Tennant Creek, Northern Territory, 20°10.932'S 134°13.125'E, 388 m, 31.i.2006, Hill, Marshall, Moulds (NTM). *Paratypes*—WESTERN AUSTRALIA: 1♂, 1♀, nr Mt Robinson, 112 km NW of Newman, 12.ii.2006, 23°03.386'S 118°51.977'E, Hill, Marshall, Moulds (AE). 1♂, Sandstone, E of Mt Magnet, 15.i.06, S. Lamond (JO). 1♀, nr Mt Robinson, 112 km NW of Newman, 12.ii.2006, 23°03.386'S 118°51.977'E, Hill, Marshall, Moulds (LP). 2♂♂ (one genitalia prep. PAU203), 5♀♀, nr Mt Robinson, 112 km NW of Newman, 12.ii.2006, 23°03.386'S 118°51.977'E, Hill, Marshall, Moulds; 1♂ (genitalia prep. PAU269), 25 km E of Sandstone, 17.i.1989, M.S. & B.J. Moulds; 1♂ (genitalia prep. PAU 377), 45 km SE of Leinster, 28°13'S 121°1'E, 16.i.1989, M.S. & B.J. Moulds (MSM). 1♂, 2♀♀, nr Mt Robinson, 112 km NW of Newman, 12.ii.2006, 23°03.386'S 118°51.977'E, Hill, Marshall, Moulds (WAM). NORTHERN TERRITORY: 3♂♂ 4♀♀, 60 km S of Tennant Creek, 20°10.932'S 134°13.125'E, 388 m, 31.i.2006, Hill, Marshall, Moulds; 1♂, Ti Tree, Hwy 87, 2.i.2000, R.P. Meyer; 1♂, 37.5 km NW of Tilmouth Well on Tanami Rd, 22°36.749'S 132°19.111'E, 30.i.2007, K. Hill & D. Marshall; 1♂ (molecular voucher 10.AU.NT.TMU.01), Tanami Rd, 130 km NW of Yuendumu, 21°30.242'S 130°58.991'E, 27.i.2010; 2♂♂, 1♀, c. 20 km S of Alice Springs on Stuart Hwy, 23°50.792'S 133°49.020'E, 1.ii.2007, K. Hill & D. Marshall (MSM). QUEENSLAND: 1♂ (genitalia prep. PAU298), Alnagatta Bore, Ethabuka Reserve, S.W.Q., 23°15.565'S 138°28.855'E, 4.ii.2007, S. Morrison (MSM).

Distribution (Fig. 25). Inland Western Australia from Mount Robinson (some 112 km NW of Newman) south to Sandstone and near Leinster, the Northern Territory from

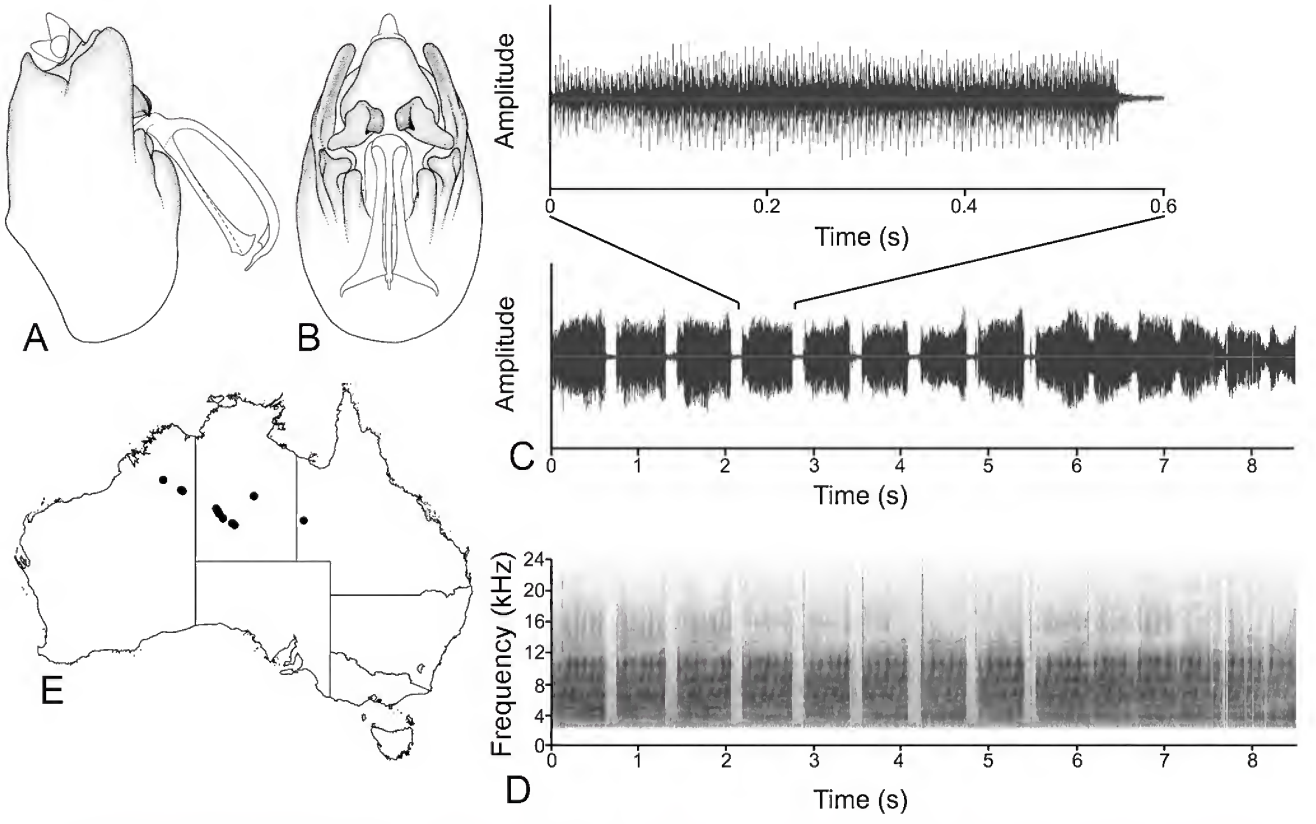


Figure 25. *Pauropsalta katherina* n.sp. *(A)* male genitalia, lateral view (genitalia prep PAU 208); *(B)* male genitalia, ventral view (genitalia prep PAU 208); *(C)* waveform of male calling song recorded from 60 km south of Tennant Creek on Stuart Hwy (Hwy 87), NT; *(D)* spectrogram of male calling song; *(E)* species distribution map.

the Tanami Desert, near Tennant Creek township south to approximately 20 km south of Alice Springs, and in southwestern Queensland on the eastern edge of the Simpson Desert. It was found to be locally common around Tilmouth Well (some 180 km NW of Alice Springs) in the Northern Territory and around Mount Robinson in Western Australia, on both occasions after periods of heavy rain. The single record from Queensland was also taken during a period of good rains. Adults have been taken from early January to mid February but their appearance is probably tied to good rainfall during warmer months.

Habitat. Spinifex (*Triodia* species), where males often call from the stalks of prominent seed heads.

Description

Male (Pl. 3). Available specimens in two main colour forms; those from central Australia, the single male from near Sandstone, W.A., and the single male from south west Queensland are almost entirely black, while those from the Pilbara region of Western Australia are primarily orange (mainly on the abdomen and ventral thorax). A pair from 60 km south of Tennant Creek township are somewhat intermediate. The holotype is almost entirely black.

Head narrower than lateral angles of pronotal collar; dominantly black; orange or yellowish spot adjacent to pronotum midline, sometimes fused with orange or yellow fascia of pronotum. Postclypeus jet black with complete or incomplete orange to pale yellow ventral margin; occasionally with an orange spot on midline around most anterior portion; transverse ridges and central groove moderately developed. Anteclypeus jet black. Rostrum black, occasionally tending orange or yellow proximally, reaching to or just beyond apices of mid coxae. Antennae black to dark brown. Supra-antennal plates black, sometimes edged orange.

Thorax. Pronotum black, usually with orange or yellowish markings; fascia along midline orange or yellowish, usually extending from head to near pronotal collar; orange or yellowish patch exterior to lateral fissures variable in extent, sometimes also orange or yellowish patch between paramedian and lateral fissures and sometimes also between paramedian fissures excluding midline; pronotal collar between lateral angles black or partially black with posterior margin orange or yellowish, usually mostly orange or yellowish near midline; lateral margin of pronotal collar ampliate. Mesonotum primarily black with orange or yellowish markings; orange or yellowish marking on either side of midline extending from the anterior arms or the cruciform elevation, usually to pronotum between lateral and submedian sigilla, often swollen around mid point but never crossing midline; lower ridge of wing groove orange or yellowish; cruciform elevation black or partly orange or yellowish, if orange, then distal ends of arms black, sometimes midline black. Metanotum black at hind wing base, remainder orange, sometimes black near midline.

Legs. Fore legs black with orange or yellow to varying degrees but with coxae and femora always yellowish or orange at extreme distal end; femora with spines always black; all tarsi usually black, sometimes with hint of orange. Pretarsal claws always black or dark brown apically, sometimes entirely black. Meracanthus black with outer

lateral margin edged orange or yellowish.

Wings. Hyaline. Fore wing with fused stem of veins M and CuA not complete, the veins abutted rather than fused as one; venation brown; without infuscations; basal membrane grey to black, sometimes with hints of brown. Hind wing with 5 apical cells; venation brown except for pale yellow 2A; plaga muddy white to grey to pale brown; black infuscation on wing margin at distal end of vein 2A and also often abutting plaga.

Opercula. Reaching a little beyond distal margin of tympanal cavity; medial apices not widely separated but by no means very close; flat other than a low rounded swelling of epimeron 3; orange or black but often a mixture of both.

Timbals with four long ribs spanning the width of timbal membrane and one shorter anterior rib terminating level with upper end of adjacent intercalary rib.

Abdomen. Tending triangular in cross section with epipleurites reflexed inwards from junction with tergites. Dorsally black, orange or yellowish brown. Tergite 1 black with narrow orange or yellow anterior margin; tergites 2–7 black, orange or a mixture of both variable between individuals, but distal margins nearly always narrowly edged yellow or light orange; tergite 8 black with orange or yellowish posterior margin. Sternite I–VIII either orange with black spot around anterior midline or predominantly black with yellow posterior margin.

Genitalia (Fig. 25). Pygofer upper lobe a rounded flap-like lobe tending to point interiorly. Secondary basal pygofer lobe small, in lateral view broadly rounded, in ventral view parallel-sided and apically rounded. Median lobe of uncus wider than long with a rounded apex with a slight median depression. Claspers short, stumpy, with short conical apices turned strongly outwards. Aedeagus with pseudoparameres about as long as endotheca, slender, flattened in cross section, arched high above endotheca, in dorsal view the distal portion of each flattened and considerably expanded, this flattened section partly divided into two arms, the interior arm short and triangular, the outer arm much longer and sharply pointed. Endotheca nearly straight, nearly parallel sided, circular in cross-section, apex steeply angled backwards on ventral side and with a dorsal fleshy projection that is broadly triangular in shape (somewhat resembling the dorsal fin of a shark).

Female (Pl. 3). Similar to male. Abdominal segment 9 orange or muddy yellow, with a dark brown or black fascia on each side of midline extending distally from the anterior margin but not reaching posterior margin; dorsal beak absent. Ovipositor sheath long, extending some 1.0–1.5 mm beyond apex of abdomen; dark brown to black.

Measurements. Range and mean (in mm) for 10♂♂ and 10♀♀; includes smallest and largest of available specimens. *Length of body*: male 15.8–18.4 (17.2); female 15.7–18.3 (17.1). *Length of fore wing*: male 16.0–18.1 (17.2); female 17.1–20.1 (18.4). *Width of fore wing*: male 6.0–6.9 (6.5); female 6.5–7.5 (6.9). *Ratio length/width of fore wing*: male 2.5–2.7 (2.6); female 2.6–2.8 (2.7). *Width of head (including eyes):* male 4.6–5.3 (4.9); female 4.5–5.3 (5.0). *Width of pronotum (across lateral angles):* male 4.9–5.6 (5.3); female 5.0–6.0 (5.5).

Distinguishing features

A distinctive species within *Pauropsalta* and allied genera (those species with an infuscation on wing margin at the distal end of hind wing vein 2A), the males of which have an abdomen that is clearly wider then the thorax, and a pygofer with a poorly developed caudal beak that is obtuse in dorsal view rather than sharply pointed. Females have a protruding ovipositor sheath but lack a dorsal beak on abdominal segment 9.

Pauropsalta katherina is closely allied to *Pau. sinavilla* from which it differs not only in its substantially black colouring (*Pau. sinavilla* is prominently orange and black), but males have a much less rounded abdomen in cross section being reflexed at the epipleurites while that of *Pau. sinavilla* is very rounded in cross section.

The male genitalia have remarkable pseudoparameres that arch high above the endotheca and terminate in front of the endothecal gonopore, a feature shared only with *Pau. sinavilla*. The male genitalia clearly differ from those of *Pau. sinavilla* in lacking serrations along the apical margin of the pseudoparameres.

Etymology. From the Latin form of the Greek *Alkaterine*, meaning "pure", the origin of the English name Katherine, and here used to honour Kathy Hill in recognition of her substantial contribution to Australian cicadas systematics.

Song (Fig. 25). The song is composed of a series of echemes. Each echeme is less than 1 s in length. Echemes usually occur at a rate of c. 1.4 echemes per second. The song frequency ranges from 2–19 kHz with the dominant frequency occurring between 4 kHz and 11 kHz.

Pauropsalta kriki n.sp.

Fig. 26, Pl. 3

Pauropsalta kriki Owen *et al.*, 2015: 262, *nomen nudum.*

Types. *Holotype* male (one genitalia prep. PAU211; one molecular voucher 04.NTR.EDT.10), Edith R. xing, Stuart Hwy, 118 m, 14°11.1'S 132°1.7'E, 21.i.2004, Cooley, Hill, Marshall, Moulds (NTM). *Paratypes*—NORTHERN TERRITORY: 3♂♂, 1♀, U.D.P. Falls, Waterfall Ck, ENE of Pine Creek, 1.i.1987, M.S. & B.J. Moulds (AE). 1♂ (one molecular voucher 04.AU.NT.EDT.11; GenBank accessions: KM377231, KM377283, KM377415, KM668342), Edith R. xing, Stuart Hwy, 118 m, 14°11.1'S 132°1.7'E, 21.i.2004, Cooley, Hill, Marshall, Moulds; 1♂, 1♀, Cullen R. x-ing, S of Pine Ck, 3.i.1992, M.S. & B.J. Moulds (AM). 1♂, U.D.P. Falls, Waterfall Ck, ENE of Pine Creek, 1.i.1987, M.S. & B.J. Moulds; 1♀, Waterhouse River, Mataranka Hsd, 23.xii.1986, 24.xii.1986, 25.xii.1986, M.S. & B.J. Moulds (ANIC). 1♂, U.D.P. Falls, Waterfall Ck, ENE of Pine Creek, 1.i.1987, M.S. & B.J. Moulds; 1♀, nr Obiri Rock, Kakadu Nat. Pk., 31.xii.1986, M.S. & B.J. Moulds (DE). 1♂, Australia NT, Litchfield NP, Buley Rockhole, 27.xi.2008, L. Popple, D. Emery, 13°05.845'S 130°47.031'E, 658-0001; 3♂♂, 1♀, Australia NT, Rapid Creek, Darwin, 24.xi.2008, L. Popple, D. Emery, 12°23' 55"S 130°52'26"E, 658-0002 to 658-0005; 2♂♂, 1♀, Australia NT, Wangi Tourist Park, 25–26.xi.2008, L. Popple, D. Emery, 13°07.577'S 130°39.312'E, 658-0006 to 658-0008 (LP). 1♂, Berry Springs, 31 x.1993, G. Husband; 4♂♂ (genitalia prep. 236), 2♀♀, Howard Springs, nr Darwin, 29.i.1977, 30.i.1977, 3.ii.1977, M.S. & B.J. Moulds; 1♂, Howard Springs, 11.i.1993, D.N. Wilson; 1♂, South Alligator Motor Inn, Arnhem Hwy, 28.xii.1986, M.S. & B.J. Moulds; 1♂, Maningrida, 4.i.1976, J. Grigg; 2♂♂, Springvale Stn., 12 km W of Katherine, 8.xii.1982, A. Walford-Huggins; 2♂♂, 4♀♀, Waterhouse River, Mataranka Hsd, 9.i.1986, 23.xii.1986, 24.xii.1986, 25.xii.1986, M.S. & B.J. Moulds; 3♂♂, 2♀♀, Edith R. xing, Stuart Hwy, 118 m, 14°11.1'S 132°1.7'E, 21.i.2004, Cooley, Hill, Marshall, Moulds; 6♂♂, 4♀♀, Cullen R. x-ing, S of Pine Ck, 3.i.1992, M.S. & B.J. Moulds; 2 male, 4♀♀, nr Obiri Rock, Kakadu Nat. Pk., 31.xii.1986, M.S. & B.J. Moulds; 11♂♂, 2♀♀, U.D.P. Falls, Waterfall Ck, ENE of Pine Creek, 1.i.1987, M.S. & B.J. Moulds (MSM). 1♂, U.D.P. Falls, Waterfall Ck, ENE of Pine Creek, 1.i.1987, M.S. & B.J. Moulds 1♀,

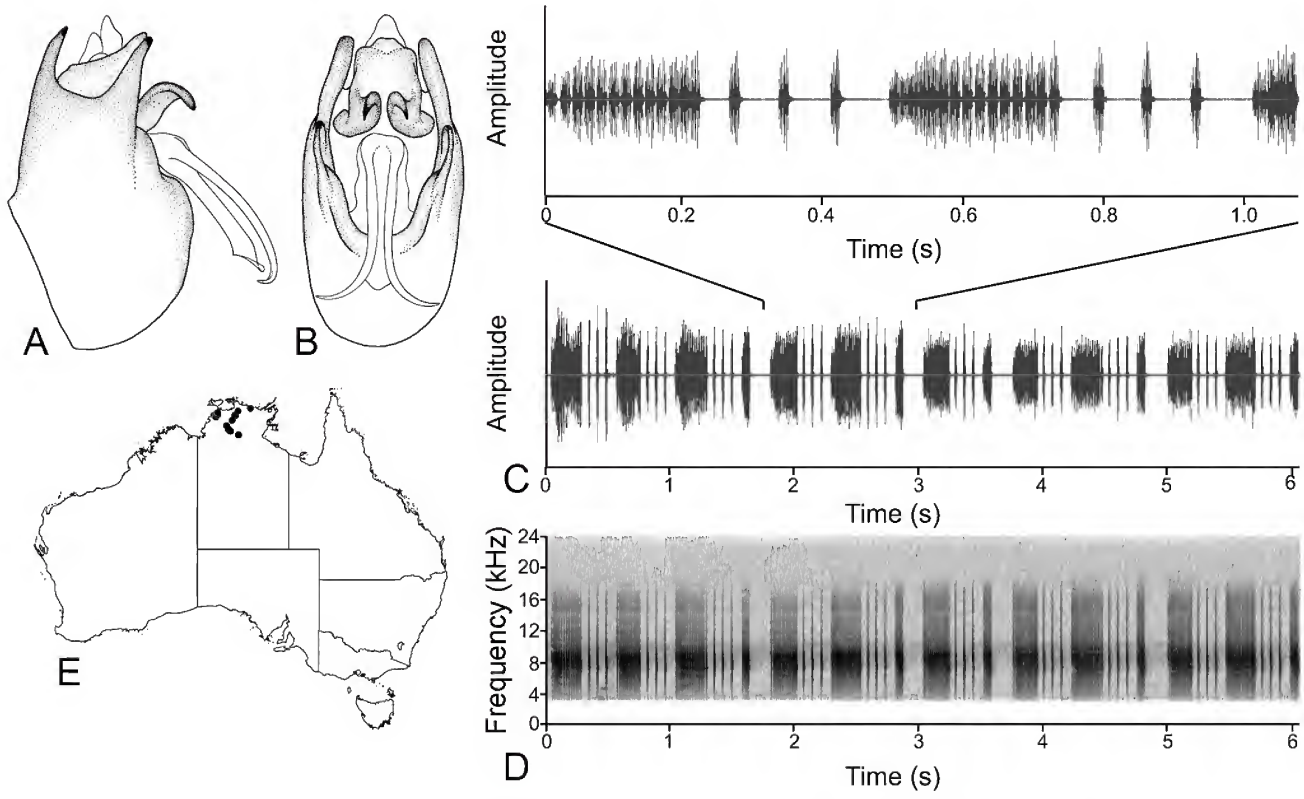


Figure 26. *Pauropsalta kriki* n.sp. *(A)* male genitalia, lateral view (genitalia prep PAU 236); *(B)* male genitalia, ventral view (genitalia prep PAU 236); *(C)* waveform of male calling song recorded from Edith River, Stuart Hwy (Hwy 1), NT; *(D)* spectrogram of male calling song; *(E)* species distribution map.

nr Obiri Rock, Kakadu Nat. Pk., 31.xii.1986, M.S. & B.J. Moulds (NHM). 2♂♂, 1♀, U.D.P. Falls, Waterfall Ck, ENE of Pine Creek, 1.i.1987, M.S. & B.J. Moulds (NTM). 1♂, 1♀, U.D.P. Falls, Waterfall Ck, ENE of Pine Creek, 1.i.1987, M.S. & B.J. Moulds (QM).

Distribution (Fig. 26). Top End of the Northern Territory from Berry Springs near Darwin south to Mataranka and east into Kakadu National Park. In Kakadu it is usually a common species around Waterfall Creek and Obiri Rock. Elsewhere there are records from Edith River and Cullen River (south of Pine Creek township) and from near Katherine. Adults have been taken from late October to the latter half of February but they most likely occur over a much longer period, especially into the later part of the wet season.

Habitat. The species is associated with riverine vegetation or trees growing in well-watered situations. Adults usually perch on trunks and branches beyond arm's reach.

Description

Male (Pl. 3). *Head* equal to, or marginally wider than, width of lateral angles of pronotal collar; dominantly black. Postclypeus pale yellowish green; dorsal surface black; ventral midline with a jet black fascia variable in extent but never reaching posterior or anterior extremities, tapering towards posterior; transverse ridges distinct, central groove indistinct. Anteclypeus light yellowish green with a brown stripe down midline. Rostrum pale yellowish brown with a black apex, reaching to or just beyond apices of hind coxae. Antennae brown to dark brown. Supra-antennal plates pale yellowish green, usually glossy.

Thorax. Pronotum yellowish brown with dark brown markings primarily confined to paramedian and lateral fissures; two dark brown dots, sometimes fused, adjacent to pronotal collar on either side of midline; pronotal collar between lateral angles dominantly pale yellow; lateral margins of pronotal collar not ampliate. Mesonotum yellowish brown with dark brown to black markings; submedian sigilla dark brown to black with interior margins sometimes edged reddish brown; lateral sigilla dark brown to black fading to reddish brown in parts; a dark brown to black fascia along the midline from the cruciform elevation, but never reaching pronotum; scutal depressions marked as black spots; lower ridge of wing groove yellowish brown; cruciform elevation yellowish brown. Metanotum dark brown at hind wing base, remainder yellowish brown.

Legs. Fore legs mostly yellowish brown to brown; thin dark brown band outlining proximal edge of coxae; femora yellowish brown, occasionally with dark brown lateral exterior. Mid and hind legs yellowish brown, dark brown outline on the proximal edge of coxae; femora brown on interior and exterior lateral sides; tibiae tending brown on distal half; tarsi yellowish brown. Pretarsal claws yellowish brown on proximal third or so, otherwise dark brown. Meracanthus yellowish brown with base partly edged dark brown.

Wings. Hyaline. Fore wing with fused stem of veins M and CuA not complete, the veins abutted rather than fused as one; venation brown; without infuscations; basal membrane grey to black, sometimes with hints of brown. Hind wing with 5 apical cells; venation brown except for pale yellow 2A; light infuscation on wing margin at distal end of vein 2A and between 3A and plaga.

Opercula. Small, not tightly closing tympanal cavities; slightly concave below meracanthus, a low rounded swelling of epimeron 3; yellowish brown.

Timbals with ribs not heavily sclerotized; four long ribs spanning the width of timbal membrane and one shorter anterior rib terminating level with lower end of adjacent intercalary rib.

Abdomen. Tending triangular in cross section with epipleurites reflexed inwards from junction with tergites; yellowish brown. Tergite 1 yellowish brown with posterior edged dark brown; tergites 2–3 yellowish brown with an ill-defined dark brown patch either side of midline, darkest on its anterior half, extending laterally around anterior margin, fading on its posterior half and not reaching distal margins of tergites; tergites 4–6 yellowish brown with ill-defined dark brown blotch either side of midline primarily on anterior half; tergite 7 dark brown to black except for partial break on dorsal midline and a narrow yellowish brown distal margin; tergite 8 dominantly dark brown to black with broad yellowish distal margin. Sternites I–VIII brown with posterior margins light brown.

Genitalia (Fig. 26). Pygofer upper lobe long, in lateral view tending slender, tapering evenly to a narrow rounded apex. Basal pygofer lobe tending flat, broadly rounded in lateral view, distally rounded in ventral view. Secondary basal pygofer lobe small, in lateral view broadly rounded. Median lobe of uncus wider than long, triangular with a rounded apex. Claspers claw-like, concave below, narrow in dorsal profile. Aedeagus with pseudoparameres about as long as endotheca, slender, flattened in cross section with distal portion gradually tapering to a point, in lateral view positioned above endothecal shaft but parallel with it, in dorsal view parallel to each other but distally curved outwards; endotheca nearly parallel sided, circular in cross-section, apex ringed by delicate lip that is extended into a pair of flanges dorso-laterally that are microscopically spined along their margin.

Female (Pl. 3). Similar to male. Tergites VII–VIII mostly brown, with anterior margin of tergite VII edged black. Abdominal segment 9 brown, with a dark brown or black fascia on each side of midline extending from the anterior margin but not reaching posterior margin. Ovipositor sheath long, extending some 1.0–1.5 mm beyond apex of abdomen; dark brown to black.

Measurements. Range and mean (in mm) for 10♂♂ and 10♀♀; includes smallest and largest of available specimens. *Length of body*: male 13.4–18.2 (15.6); female 15.5–19.9 (17.9). *Length of fore wing*: male 18.6–23.3 (20.7); female 20.1–23.3 (21.5). *Width of fore wing*: male 5.8–7.6 (6.7); female 6.6–7.7 (7.1). *Ratio length/width of fore wing*: male 2.8–3.3 (3.1); female 2.9–3.2 (3.0). *Width of head (including eyes):* male 4.8–5.8 (5.3); female 5.2–5.9 (5.6). *Width of pronotum (across lateral angles):* male 4.8–6.1 (5.5); female 5.3–6.1 (5.7).

Distinguishing features

In outward appearance *Pauropsalta kriki* is very similar to that of *Pau. elgneri* from which it can be distinguished by having the anteclypeus dominantly yellow whereas that of *Pau. elgneri* is dominantly black. Within the distribution of *Pau. kriki* care should be taken not to confuse this species with *Pau. melanopygia* or *Pau. borealis*. *Pau. kriki* differs from both in having the basal membrane of the fore wing dark grey or blackish; that of the others is orange. Further, *Pau. kriki* usually differs from both in having a pair of small black spots on the midline of the pronotum adjacent to the pronotal collar; these spots are surrounded by pale yellow and absent from the other two species.

The male genitalia have a long narrow upper pygofer lobe and a pair if long pseudoparameres that lie close together but substantially diverge distally where they gradually taper to a sharp point apically.

Etymology. From the Greek *kriko*, meaning along a watercourse, referring to the affinity of this species to watercourses.

Song (Fig. 26). The song is composed of a series of phrases, which contain a series of clicks and echemes. Usually, three clicks precede an echeme. Each echeme ranges in size between 0.05 s and 0.25 s. Occasionally, clicks will not separate two echemes. Phrases occur at a rate of < 1 phrase per second. Dominant song frequency occurs between 6 kHz and 10 kHz.

Pauropsalta opaca Ewart, 1989

Fig. 27, Pl. 4

Pauropsalta opaca Ewart, 1989: 298, 306–308, 369; Owen *et al.*, 2015: 263, 272.

Material examined. QUEENSLAND: *Holotype* male, Bakerville, 11.xii.1972, J.H. Barrett, holotype T11150, *Pauropsalta opaca* Ewart (QM). *Paratypes* as follows: 1♂ (genitalia prep. PAU297), Irvinebank, W of Herberton, 29.xii.1982, G. Wood; 1♂ (genitalia prep. PAU294), Walsh Bluff, 17 km NW of Atherton, 30.xi.1986, D.A. Lane; 1♀, Clohesy R., 17.i.1974, A. & M. Walford-Huggins; 1♂, Mareeba, 3.ii.1974, A. & M. Walford-Huggins; 4♂♂ (one genitalia prep. PAU295), 2♀♀, Tinaroo Lakes, 20.xii.1981, J. Olive, 1♂, Tinaroo Creek Road, nr Mareeba, 21.i.1982, G. & A. Daniels; 1♂, Tinaroo Dam, nr Atherton, 20.xii.1981, J. Olive; 1♂ (genitalia prep. PAU296), 1♀, Station Creek, S of Mt. Carbine, 27.xi.1979, M.S. & B.J. Moulds; 1♀, Davies Creek Falls, nr Mareeba, 21.i.1982, G. & A. Daniels; 1♀, 10 km E of Davies Ck Nat Pk, nr Mareeba, 550 m, 10.i.1980, A. Hiller 2♂♂, Davies Ck nr Mareeba, 20.x.1995, R. Eastwood (MSM). *Other material not paratypes*: 8♂♂ (one genitalia prep. JH6), Herberton, 17°23.2'S 145°22.7'E, 943 m, 9.i.2004, Cooley, Hill, Marshall, Moulds; 1♂, Herberton, 11.xii.2007, M. Moulds & J. Olive; 1♂, Herberton, 15.xii.1996, T. Woodger; 1♂, 8 km E of Mt Garnet, 12.i.1990, D.A. Lane; 1♂, 8 km E of Emuford, 30.xii.1989; M.S. & B.J. Moulds; 6♂♂, 1♀, 15 km W of Mount Molloy, 16°36.9'S 145°13.2'E, 10.i.2004, Cooley, Hill, Marshall, Moulds; 2♀♀, 15 km NW of Mount Molloy, 26.xii.1987, M.S. & B.J. Moulds; 1♀, Rifle Ck xing, Mount Molloy, 394 m, 16°40'S 145°19.6'E, 12.i.2004, Cooley, Hill, Marshall, Moulds; 1♂, Tinaroo Falls Dam, near Atherton, 5.xi.1987, D.A. Lane; 7♂♂ (two genitalia preps. JH4 & JH5; two molecular vouchers 04.QLD.DED.13 and 08.AU.QL.DED.01; GenBank accessions: KM377196, KM377376, KM377522, KM668266), approx. 10 km S of Mt Garnet, 17°44.6'S 145°01.7'E, 7.i.2004, Cooley, Hill, Marshall, Moulds (MSM).

The paratype male from Walshs Pyramid near Gordonvale is not this species, but a specimen of *P. ewarti* described above.

Distribution (Fig. 27). Confined to a small area of northeastern Queensland where it is found in the dryer parts of the Atherton Tablelands and adjoining districts. The most northern record is from Station Creek about midway between Mount Molloy and Mount Carbine. It is occurs as far south as the Mount Garnet district and inland to Irvinebank and nearby Emuford. There are records from mid October to early February but it appears to be most common during the latter half a December and January.

Habitat. Dry open eucalypt forest where adults prefer the upper branches of trees of medium height.

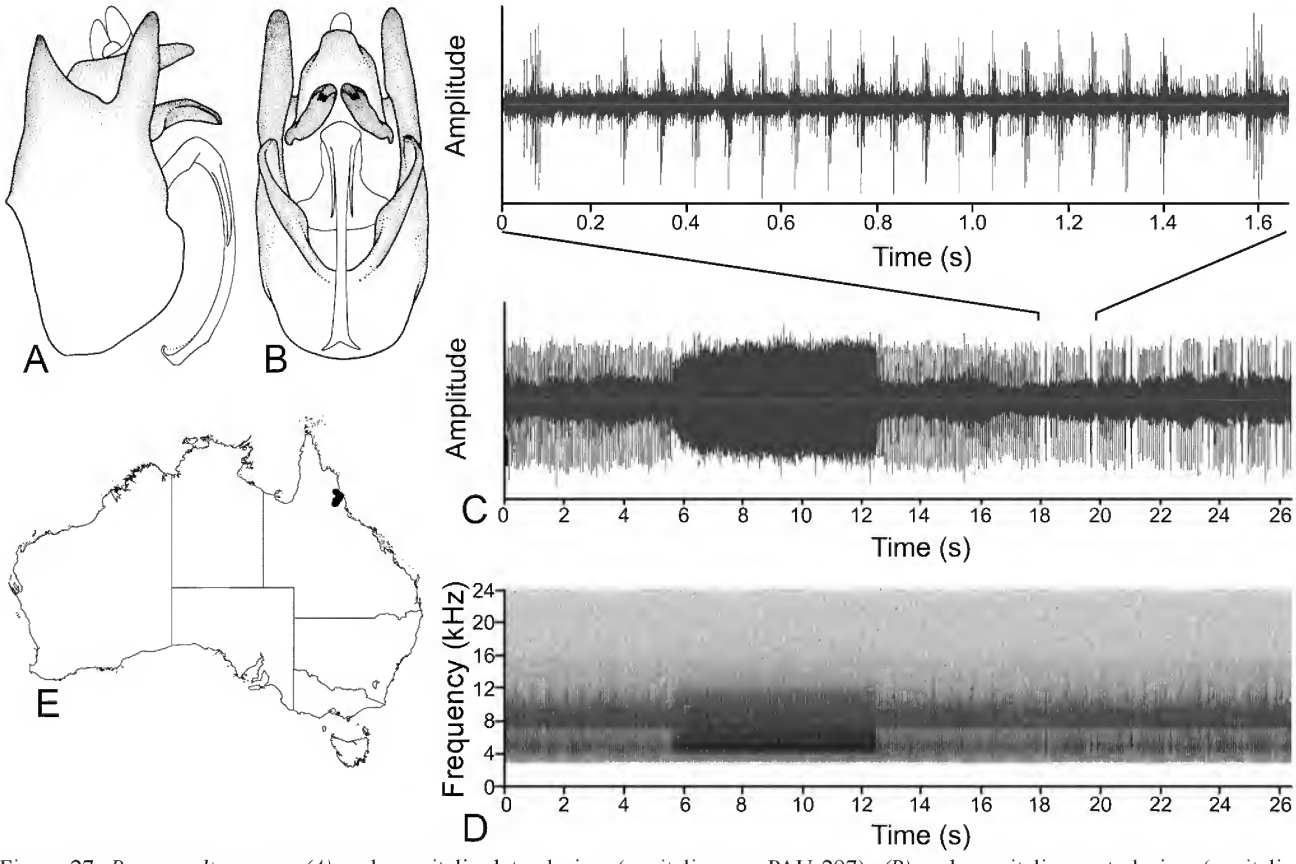


Figure 27. *Pauropsalta opaca (A)* male genitalia, lateral view (genitalia prep PAU 297); *(B)* male genitalia, ventral view (genitalia prep PAU 297); *(C)* waveform of male calling song recorded from 12 km south of Mt. Garnet on Kennedy Development Rd, QLD; *(D)* spectrogram of male calling song; *(E)* species distribution map.

Re-description

The description of Ewart (1989) is based on a mixed series of true *opaca* and at least one, or perhaps two, very similar undescribed species. We therefore re-describe *opaca* and provide distinguishing characters.

Male (Pl. 4). *Head* wider than lateral margins of pronotal collar but narrower than lateral angles; dominantly black with yellowish brown spot at posterior midline. Postclypeus black with yellowish brown markings; usually a partly yellowish brown dorsally; a yellowish brown mark on midline around most anterior portion; lateral, and usually posterior, margins yellowish brown; transverse ridges and central groove distinct. Anteclypeus black. Rostrum black, tending brown proximally, reaching to or beyond apices of hind coxae. Antennae brown. Supra-antennal plates black, edged yellowish brown along anterior margin to varying degrees.

Thorax. Pronotum black with yellowish brown and reddish brown markings; anterior margin yellowish brown to varying degrees; fascia along midline yellowish brown, usually extending from or near head towards or almost to pronotal collar; a yellowish brown marking on either side of midline dorsally, abutting and/or on anterior margin of pronotal collar; interior with reddish brown patches to varying degrees; lateral angles sometimes black to varying degrees; lateral margin not, or barely, ampliate. Mesonotum primarily black with yellowish brown or reddish brown markings; usually a yellowish brown or reddish brown marking on either side from, or near, anterior arms or the cruciform elevation to, or almost to, pronotum between lateral and submedian sigilla, this marking projecting inwards to varying degrees around its mid length sometimes meeting and sometimes extending along midline, and sometimes surrounding scutal depressions; a reddish brown marking along lateral sides; cruciform elevation yellowish brown and black, sometimes muddy brown, anterior arms usually yellowish brown, posterior arms usually brown, sometimes proximally black, black between anterior and posterior arms, often a black fascia down midline. Metanotum black at hind wing base, remainder reddish brown, sometimes black at dorsal midline.

Legs. Fore legs mostly black but with a brown to reddish brown fascia to varying degrees along anterior and exterior length of femora, sometimes a brownish red fascia along lateral interior of femora; femora with spines black; sometimes tarsi with a yellowish brown patch; pretarsal claws yellowish brown tending black distally. Mid and hind legs mostly black or brown tending dark brown; coxae with proximal margin edged brown; yellowish brown fascia along anterior, interior, exterior length of femora; tibiae and tarsi brown tending black distally. Meracanthus black with outer lateral margin and apex pale yellow.

Wings. Hyaline. Fore wing with fused stem of veins M and CuA not complete, the veins abutted rather than fused as one; venation brown; inconspicuous infuscation distally on clavus; basal membrane muddy brown. Hind wing with 5 apical cells; venation brown except for pale yellowish brown 2A and 3A; plaga muddy white to brown; black infuscation on wing margin at distal end of vein 2A.

Opercula. For the most part not reaching distal margin of tympanal cavity; widely separated; a low rounded swelling

of epimeron 3; black, usually tending yellowish brown on distal half.

Timbals with four long ribs spanning the width of timbal membrane and one much shorter anterior rib terminating before lower end of adjacent intercalary rib.

Abdomen. Tending triangular in cross section with epipleurites reflexed inwards from junction with tergites. Tergites black with reddish brown and yellow markings. Tergite 1 black; tergites 2–8 black with posterior margin reddish brown to varying degrees, sometimes a reddish brown spot adjacent to posterior margin on dorsal midline, extreme posterior margin usually narrowly edged orange, sometimes anterior margin edged reddish brown and sometimes heaviest on lateral sides. Sternite I brownish black with muddy yellow dorsally; sternites II mostly black or nearly so; sternites III–VII orange, sometimes with posterior margin yellowish orange to varying degrees; sternite VIII yellowish brown.

Genitalia (Fig. 27). Pygofer upper lobe narrow and long, in lateral view gradually tapering to a rounded apex. Basal pygofer lobe tending flat, barely discernible in lateral view, distally broadly rounded in ventral view, not turned inwards. Secondary basal pygofer lobe small, barely developed, tending linear in ventral view. Median lobe of uncus gradually tapering to a nearly flat apex. Claspers claw-like, flattened and narrow in dorsal view, distally slightly diverging, concave below. Aedeagus with pseudoparameres inconspicuous, translucent, hair-like, lying adjacent to dorsal surface of endotheca, arising at about the base of endotheca and terminating at about a quarter its length. Endotheca long, parallel sided, circular in cross-section; apex with a single lateral projection on each side and a ventral project, dorsal side sloping backwards much more than ventral side.

Female (Pl. 4). Similar to male. Abdominal segment 9 dark brown, with a black fascia on each side of midline extending distally from the anterior margin but not reaching posterior margin; Ovipositor sheath extending some 2.0–2.5 mm beyond apex of abdomen; dark brown to black.

Measurements. Range and mean (in mm) for 10♂♂ and 10♀♀; includes smallest and largest of available specimens. *Length of body*: male 19.3–23.0 (21.5); female 22.5–27.2 (24.4). *Length of fore wing*: male 23.0–28.5 (26.4); female 26.0–29.0 (27.4). *Width of fore wing*: male 7.7–9.5 (8.9); female 8.6–9.7 (9.3). *Ratio length/width of fore wing*: male 2.9–3.1 (3.0); female 2.8–3.0 (2.9). *Width of head (including eyes):* male 6.0–6.8 (6.4); female 6.6–7.0 (6.8). *Width of pronotum (across lateral angles):* male 6.5–7.8 (7.3); female 7.0–8.0 (7.6).

Distinguishing features

Distinguished from most other species of *Pauropsalta* in having the stems of fore wing veins M and CuA closely abutted rather than fused as one. Amongst those species with abutted veins care should be taken not to confuse this species with *Pau. ewarti* or *Pau. herveyensis*. Distinguished from *Pau. ewarti* by the length of the rostrum; that of *opaca* reaches or almost reaches the apices of the hind coxae while that of *Pau. ewarti* barely reaches the bases of the hind coxae. Distinguished from *herveyensis* in having much of the inner pronotum pigmented with dark reddish brown patches whereas that of *Pau. herveyensis* is entirely black.

Male genitalia are unique in having an aedeagus with a pair of pseudoparameres situated laterally near the base of the endotheca that are very small, short, hair-like, barely discernible, and a tubular endotheca that terminates in a small down-turned "beak" and a pair of lateral "ears".

Song (Fig. 27). The song is composed of phrases with clicks and a single echeme. Clicks occur continuously for c. 6 s and this is followed by an echeme. The echeme is usually c. 7 s in length. The song ranges in frequency from 4–16 kHz with the dominant frequency occurring between 4 kHz and 12 kHz.

Pauropsalta similis n.sp.

Fig. 28, Pl. 3

Pauropsalta similis Owen *et al.*, 2015: 263, *nomen nudum*.

Types. *Holotype* male (molecular voucher 06.AU.WA.HCS.01, song recorded), Halls Creek, 18°13.605'S 127°40.031'E, 416 m, 6.ii.2006, Hill, Marshall, Moulds (WAM). *Paratypes*—WESTERN AUSTRALIA: 1♂, 1♀, Wyndham, 15°28.933'S 128°06.801'E, 23 m, 23.ii.2008, K. Hill, D. Marshall, M. Moulds, C. Owen, M. Humphrey (AE). 1♂, 1♀, Wyndham, 15°28.933'S 128°06.801'E, 23 m, 23.ii.2008, K. Hill, D. Marshall, M. Moulds, C. Owen, M. Humphrey (AM). 1♂, 1♀, Wyndham, 15°28.933'S 128°06.801'E, 23 m, 23.ii.2008, K. Hill, D. Marshall, M. Moulds, C. Owen, M. Humphrey (DE). 1♂, 1♀, Wyndham, 15°28.933'S 128°06.801'E, 23 m, 23.ii.2008, K. Hill, D. Marshall, M. Moulds, C. Owen, M. Humphrey (LP). 1♂ (molecular voucher 06.AU.WA.HCS.01, song recorded), Halls Creek, 18°13.605'S 127°40.031'E, 416 m, 6.ii.2006, Hill, Marshall, Moulds; 1♂, 3♀♀, Broome, Hamersley St, 17°57.884'S 122°14.420'E, 11 m, 8.ii.2006, Hill, Marshall, Moulds; 1♂, roadhouse c. 34 km E of Broome, 9.ii.2006, 53 m, 17°51.030'S 122°30.059'E, Hill, Marshall, Moulds; 1♂, Lennard R., Gibb River Rd,17°23.525'S 124°45.304'E, 21.i.2010, Hill, Marshall, Moulds; 1♂, 2♀♀, Barnett River xing on Gibb River Road, 433 m, 16°42.589'S 125°56.143'E, 20.xi.2011, K. Hill, D. Marshall; 15♂♂ (one genitalia prep. PAU 200), 3♀♀, Fitzroy River Crossing, Derby-Broome road, 30.x.1978, 2.xi.1978, 3.xi.1978, M.S. & B.J. Moulds; 2♂♂, Fitzroy Crossing, 18°11.957'S 125°34.075'E, 121 m, 6.ii.2006, Hill, Marshall, Moulds; 4♂♂, 3♀♀, Fitzroy Crossing, 1.i.1986, M.S. & B.J. Moulds; 1♂, Mary R., 109 km W of Halls Creek, 6.ii.2006, 286 m, 18°43.622'S 126°52.210'E, Hill, Marshall, Moulds; 6♂♂, 1♀, Mary R., 109 km W of Halls Creek, 24 i.2010, 286 m, 18°43.622'S 126°52.210'E, K. Hill & D. Marshall; 8♂♂ (one genitalia prep. PAU 29), 3♀♀, Halls Creek, 18°13.605'S 127°40.031'E, 416 m, 8.ii.1977, 2.i.1986, 6.ii.2006, M.S. & B.J. Moulds and Hill, Marshall, Moulds; 5♂♂, Calico Ck, 150 km ENE of Halls Creek, 18°08'34"S 128°43'02"E, 11.i.2001, M.S. & B.J. Moulds; 1♂, Ord River x-ing, N of Halls Creek, 2.i.1986, M.S. & B.J. Moulds; 1♂, Dunham R, c. 33 km S of Victoria Hwy on Great Northern Hwy, 16°08.082'S 128°22.896'E, 24.ii.2008, Hill, Marshall, Moulds, Owen & Humphrey; 1♂ (one genitalia prep. PAU 27), Dunham River, 100 km S of Wyndham, 7.ii.1977, M.S. & B.J Moulds; 6♂♂ (one molecular voucher 08.AU.WA.WYN.02), 5♀♀, Wyndham, 15°28.933'S 128°06.801'E, 23 m, 23.ii.2008, K. Hill, D. Marshall, M. Moulds, C. Owen, M. Humphrey; 2♂♂, 1♀, Doon Doon Stn. [16°18'S 128°14'E], Carr Boyd Ra, 4.i.1987, E.A. Henty; 3 male, 4♀♀, Kununurra, 19.i.1986, 22.i.1986, 4.ii.1986, 7.ii.1986, 18.ii.1986, 1.xii.1986, 28.i.1987, E.A. Henty; 1♂, 39 km NW of Kununurra on Victoria Hwy, at Middle Ck, 15°50.913'S 128°25.626'E, 23.ii.2008, Hill, Marshall, Moulds, Owen, & Humphrey (MSM). 1♂, Drysdale R. at Kalumburu rd crossing (MV). 1♂, 1♀, Wyndham, 15°28.933'S 128°06.801'E, 23 m, 23.ii.2008, K. Hill, D. Marshall, M. Moulds, C. Owen, M. Humphrey (NTM). 1♂, Broome, 12.i.2008, L. Halling; 1♂, 1♀, Wyndham, 15°28.933'S 128°06.801'E, 23 m, 23.ii.2008, K. Hill, D. Marshall, M. Moulds, C. Owen, M. Humphrey (WAM). NORTHERN TERRITORY: 1♂ (molecular voucher 08.AU.NT.KEE.01, song recorded), Butler Ck xing, 4 km E of WA border on Victoria Hwy, 15°59.547'S 129°01.994'E, 23.ii.2008, Hill, Marshall, Moulds, Owen & Humphrey; 4♂♂, 3♀♀, Keep River x-ing, Victoria Hwy, 7.i.1986, M.S. & B.J. Moulds; 2♂♂ (two molecular vouchers 08.AU.NT.TSE.03 and song recorded, 08.AU.NT.TSE.04 and song recorded; GenBank accessions: KM377211, KM377331, KM377462, KM668254), 9 km E of Top Springs, 16°35.487'S 131°51.728'E, 195 m, 17.ii.2008, Hill, Marshall, Moulds, Owen, Humphrey; 1♂, Armstrong R., E of Top Springs, 16°42'S 132°05'E, 24.xii.1991, M.S. & B.J. Moulds; 3♂♂ (one genitalia prep. PAU 329 and molecular voucher 04.AU.NT.DUM.11; two genitalia preps. JH 34, JH 35), Dunmarra, 16°40.9'S 133°24.7'E, 26.i.2004, Cooley, Hill, Marshall, Moulds (MSM).

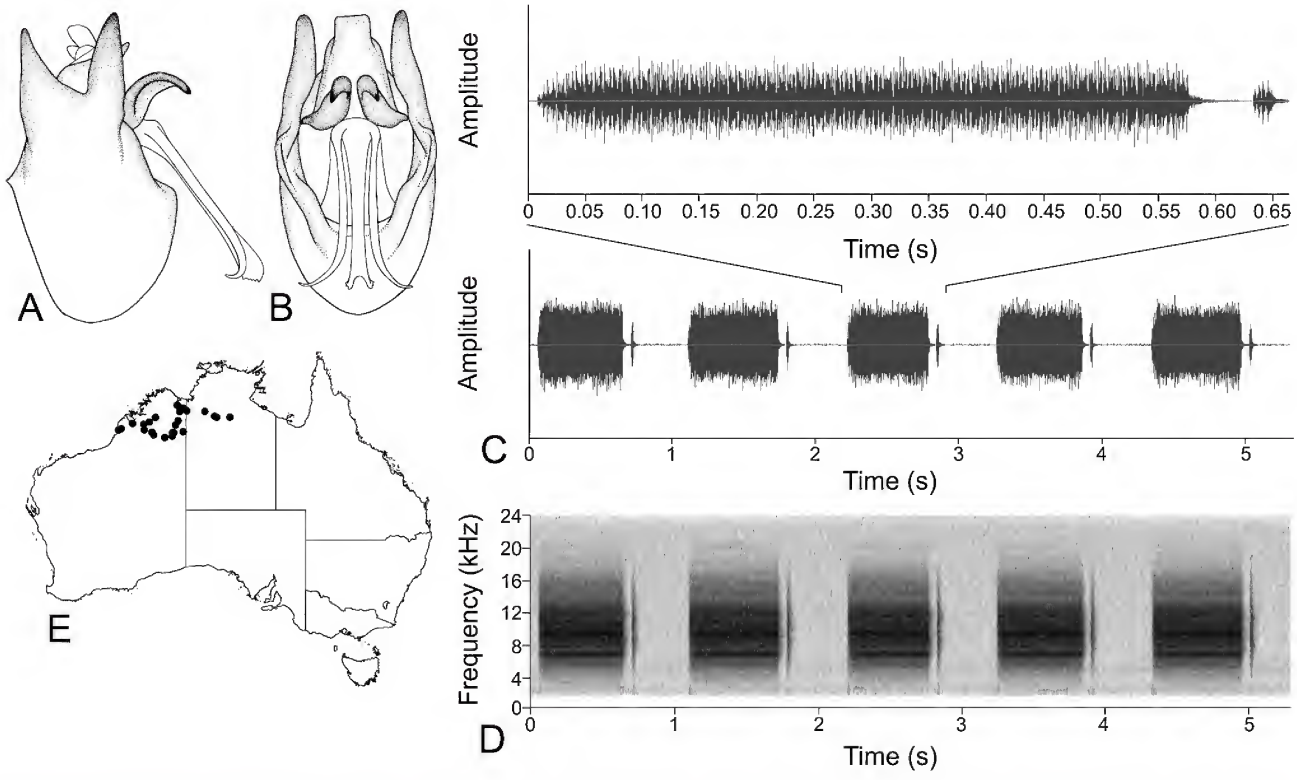


Figure 28. *Pauropsalta similis* n.sp. *(A)* male genitalia, lateral view (genitalia prep PAU 329); *(B)* male genitalia, ventral view (genitalia prep PAU 329); *(C)* waveform of male calling song recorded from Dunmarra Roadhouse, Stuart Hwy (Hwy 87), NT; *(D)* spectrogram of male calling song; *(E)* species distribution map.

Distribution (Fig. 28). Broome and the Kimberley region of Western Australia and the Northern Territory from the Keep River area (near the WA border) to Dunmarra. From the Kimberley region there are records from the Lennard and Barnett Rivers on the Gibb River road, from along the Kalumburu road in the central mountains, and along much of the length of the Great Northern Highway skirting the inland perimeter of the region. Records from Northern Territory are limited to the Victoria Highway near the Western Australian border (Keep River area), near Top Springs and Dunmarra. Adults have been taken from late October to late February but the species almost certainly occurs in other months, especially during the later months of the wet season.

Habitat. Usually on the upper branches or trunks of eucalypts growing along rivers, watercourses or in well-watered gardens.

Description

Male (Pl. 3). In two main colour forms, usually with body dominantly orange or light yellow, but sometimes in intermediate hues of orange yellow.

Head a little narrower than lateral angles of pronotal collar; dominantly black. Postclypeus black and light yellow or orange, the most anterior part usually glossy, either light yellow or orange; lateral and posterior margins edged dull yellow; black centrally; transverse ridges distinct, central groove weak. Anteclypeus black. Rostrum brown, with a black apex; reaching to or just beyond apices of hind coxae. Antennae either light yellow or orange. Supra-antennal plates yellow or orange, usually glossy.

Thorax. Pronotum light yellow to orange with black markings; a pale orange to dull yellow fascia along midline not reaching pronotal collar; pronotal collar between lateral angles dominantly light brown or orange, the lateral margin not ampliate, partly black extending to lateral angles. Mesonotum light brown to orange with black markings that are usually dominant; submedian and lateral sigilla entirely or partially jet black; a jet black fascia along midline often occupying entire space between anterior arms of cruciform elevation (but sometimes reduced to reveal the pair of black scutal depressions), thereafter abruptly narrowing and usually merging with black submedian sigilla; lower ridge of wing groove muddy yellow or dull orange; cruciform elevation dull yellow to orange. Metanotum glossy black at hind wing base, remainder dull yellow to orange.

Legs. Fore legs mostly brown or dark brown; femora dull yellow at distal ends and a blurred dull yellow to brown dorsal fascia; usually tending black around femoral spines. Mid and hind legs tending yellow or orange brown rather than brown; tibiae dull yellow to orange brown; tarsi either dull yellow or orange brown. Pretarsal claws brown on proximal third or so, otherwise black. Meracanthus with black proximal margin and either orange or yellow apically.

Wings. Hyaline. Fore wing with fused stem of veins M and CuA not complete, the veins abutted rather than fused as one; venation pale yellow proximally tending brown distally; without infuscations; basal membrane either orange or yellow. Hind wing normally with 5 apical cells (rarely 6 or 4 and then only in one wing); venation brown except for pale yellow 2A and 3A; plaga white; with or without a small infuscation around junction of vein 2A and wing margin.

Opercula. Small, not tightly closing tympanal cavities; more or less flat except for low rounded swelling of epimeron

3; either orange or yellow with a black suffusion on swelling of epimeron 3.

Timbals with the ribs not heavily sclerotized; four long ribs spanning the width of timbal membrane and one much shorter anterior rib terminating before lower end of adjacent intercalary rib.

Abdomen. Tending triangular in cross section with epipleurites reflexed inwards from junction with tergites; either black and orange, or black and yellow. Tergite 1 mostly black; tergite 2 mostly black, posterior margin around midline either orange or yellow; tergite 3 mostly black, midline and posterior margin either orange or yellow; tergites 4–6 either orange or yellow; tergites 7–8 dominantly black, tergite 8 with either orange or yellow posterior margin. Sternite I either orange or yellow; sternite II either dull orange or dull yellow, sometimes with small suffusion of black at lateral extremities; sternites III–VIII either orange or yellow, sometimes with darker posterior margin.

Genitalia (Fig. 28). Pygofer upper lobe long, in lateral view tending slender, tapering to a narrow rounded apex, the distal third or so slightly tilted ventrally. Basal pygofer lobe small, in lateral view with its margin almost straight, apically rounded in ventral view, tending flat. Secondary basal lobe broadly rounded. Median lobe of uncus bi-lobed, with apices rounded. Claspers claw-like, concave below. Aedeagus with pseudoparameres about as long as endotheca, slender, flattened in cross section with distal portion gradually tapering to a point, more or less aligned with endotheca in lateral view, parallel to each other in dorsal view but distally curved outwards, the apices turned slightly backwards; endotheca nearly parallel sided, circular in cross section, apical portion bisected and U-shaped in dorsal view, the sides forming a pair of lateral lobes, these lobes in lateral view with their apices truncate, angled backwards, the corners rounded, the distal margin outlined with minute spines.

Female (Pl. 3). Similar to male. Abdominal segments dull orange or brown with orange posterior margins; tergites 7 and 8 sometimes partly black. Abdominal segment 9 pale yellowish orange to orange, nearly always with a black subdorsal fascia either side terminating with a rounded apex well before distal end of segment. Ovipositor sheath long, extending some 1.0–1.5 mm beyond apex of abdomen; dark brown to black.

Measurements. Range and mean (in mm) for 10♂♂ and 10♀♀; includes smallest and largest of available specimens. *Length of body*: male 13.8–19.0 (16.6); female 16.0–20.0 (18.2). *Length of fore wing*: male 18.6–24.6 (21.5); female 20.7–25.0 (22.2). *Width of fore wing*: male 5.2–6.3 (5.8); female 5.4–6.1 (5.8). *Ratio length/width of fore wing*: male 3.3–4.0 (3.7); female 3.5–4.0 (3.8). *Width of head (including eyes):* male 4.9–6.3 (5.5); female 5.3–6.3 (5.8). *Width of pronotum (across lateral angles):* male 5.2–7.1 (6.0); female 5.7–6.7 (6.2).

Distinguishing features

Pauropsalta similis is identical to *Pauropsalta extrema* in size, colour and markings. Males can be separated from *Pau. extrema* by the pair of truncated lobes at the apex of the endotheca that do not extend laterally beyond the line of the endotheca. In contrast, the distal end of the endotheca of *Pau. extrema* bears wing-like flanges that extend laterally beyond the shaft of the endotheca. Females are indistinguishable morphologically and can only be associated with a species by locality.

Etymology. From the Latin *similis* meaning like or resembling and referring to the close similarity of this species with *P. extrema*.

Song (Fig. 28). The song includes a series of phrases that include an echeme followed by a click. Each echeme is usually < 1 s in length. Each phrase occurs at a rate of c. 1 phrase per second. The song frequency ranges from 2–20 kHz with the dominant frequency between 6 kHz and 12 kHz.

Pauropsalta sinavilla n.sp.

Fig. 29, Pl. 3

Pauropsalta sinavilla Owen *et al.*, 2015: 263, *nomen nudum*.

Types. *Holotype* male, House Ck, c. 60 km E of Nanutarra roadhouse, Western Australia, 22°27.970'S 116°02.240'E, 13.ii.2009, K. Hill & D. Marshall; (WAM). *Paratypes*—WESTERN AUSTRALIA: 1♂, House Ck, c. 60 km E of Nanutarra roadhouse, 22°27.970'S 116°02.240'E, 13.ii.2009, K. Hill & D. Marshall (AE). 1♂, House Ck, c. 60 km E of Nanutarra roadhouse, 22°27.970'S 116°02.240'E, 13.ii.2009, K. Hill & D. Marshall (AM). 1♂, House Ck, c. 60 km E of Nanutarra roadhouse, 22°27.970'S 116°02.240'E, 13.ii.2009, K. Hill & D. Marshall (AJE). 1♂, House Ck, c. 60 km E of Nanutarra roadhouse, 22°27.970'S 116°02.240'E, 13.ii.2009, K. Hill & D. Marshall (ANIC). 1♂, House Ck, c. 60 km E of Nanutarra roadhouse, 22°27.970'S 116°02.240'E, 13.ii.2009, K. Hill & D. Marshall (DE). 1♂, House Ck, c. 60 km E of Nanutarra roadhouse, 22°27.970'S 116°02.240'E, 13.ii.2009, K. Hill & D. Marshall (JO). 1♂, House Ck, c. 60 km E of Nanutarra roadhouse, 22°27.970'S 116°02.240'E, 13.ii.2009, K. Hill & D. Marshall (LP). 1♂ (genitalia prep. PAU 314), Fortescue, 21.ii.1985, K. & E. Carnaby; 12♂♂ (two genitalia preps. PAU 309 and PAU 335; two molecular vouchers 09.AU.WA.HOU.15 and 09.AU.WA.HOU.16; GenBank accessions: KM377173, KM377305, KM377428, KM377602, KM668250), 4♀♀, House Ck, c. 60 km E of Nanutarra roadhouse, 22°27.970'S 116°02.240'E, 13.ii.2009, K. Hill & D. Marshall; 1♂, Sherlock River, 22.ii.1985, K. & E. Carnaby (MSM). 1♂, House Ck, c. 60 km E of Nanutarra roadhouse, 22°27.970'S 116°02.240'E, 13.ii.2009, K. Hill & D. Marshall (NHM). 1♂, House Ck, c. 60 km E of Nanutarra roadhouse, 22°27.970'S 116°02.240'E, 13.ii.2009, K. Hill & D. Marshall (PH). 12♂♂, House Ck, c. 60 km E of Nanutarra roadhouse, 22°27.970'S 116°02.240'E, 13.ii.2009, K. Hill & D. Marshall (WAM).

Distribution (Fig. 29). Western Australia where it is known only from three localities in the far north west of the State between the Ashburton and Sherlock Rivers. Sometimes a locally common species. There are records for the last two weeks of February only.

Habitat. Adults call from high up in smooth-bark eucalypts.

Description

Male (Pl. 3). *Head* wider than lateral margins of pronotal collar but wider than lateral margins; dominantly black with muddy yellow spot at posterior midline. Postclypeus jet black with light brownish orange markings; a light brownish orange mark on midline around most anterior portion; lateral and posterior margins light brownish orange; transverse ridges and central groove distinct, central groove and outer portion of transverse grooves light brownish orange. Anteclypeus jet black. Rostrum black, occasionally tending brown proximally, reaching to or just beyond apices of mid coxae. Antennae brown. Supra-antennal plates light brownish orange.

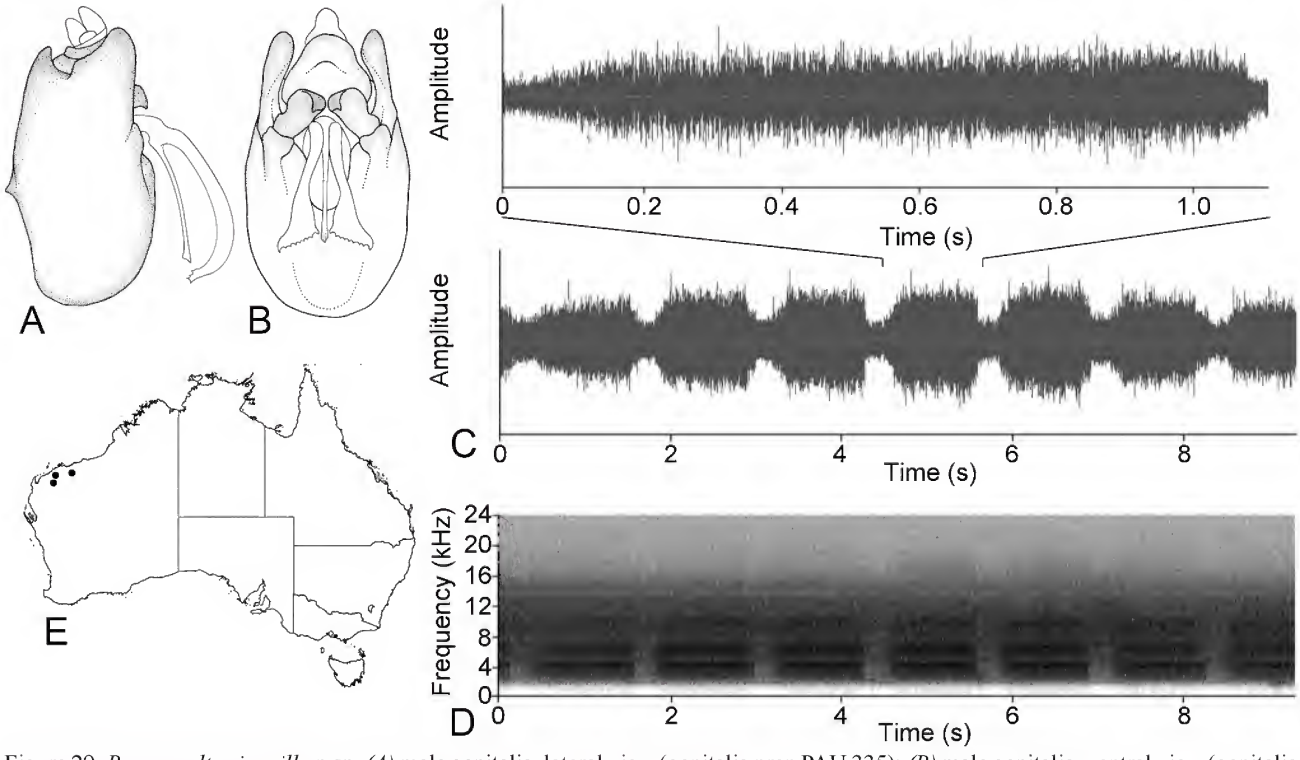


Figure 29. *Pauropsalta sinavilla* n.sp. *(A)* male genitalia, lateral view (genitalia prep PAU 335); *(B)* male genitalia, ventral view (genitalia prep PAU 335); *(C)* waveform of male calling song recorded from c. 60 km east of Nanutarra, c. 59 km east of Northwest Coastal Hwy on road to Tom Price, House Creek rest area, WA; *(D)* spectrogram of male calling song; *(E)* species distribution map.

Thorax. Pronotum black with orange to light brownish orange markings; center of pronotum with orange to light brownish orange patches variable in extent between individuals; fascia along midline orange to light brownish orange, usually extending from head towards or almost to pronotal collar; a transverse orange to light brownish orange marking dorsally abutting anterior margin of pronotal collar usually constricted at midline; pronotal collar orange to light brownish orange; lateral angles tending black; lateral margin not, or barely, ampliate. Mesonotum primarily black with orange to light brownish orange markings; usually an orange to light brownish orange marking on either side from, or near, anterior arms or the cruciform elevation to pronotum between lateral and submedian sigilla, this marking projecting inwards to varying degrees but rarely meeting; sometimes midline orange to light brownish orange; lateral margins usually edged orange to light brownish orange; cruciform elevation orange to light brownish orange, sometimes partly muddy orange, anterior arms usually with distal ends black, posterior arms sometimes partly black. Metanotum black at hind wing base, remainder orange to light brownish orange, sometimes black near dorsal midline.

Legs. Fore legs mostly brownish black but with a orange to light brownish orange fascia to varying degrees along anterior length of femora, sometimes an orange to light brownish orange fascia along lateral exterior of femora; femora with spines always black; pretarsal claws black. Mid and hind legs brown to brownish orange; coxae with proximal margin edged orange; orange to light brownish orange along anterior and exterior length of femora; tibiae and tarsi brownish orange tending light brown. Meracanthus proximally brown tending orange distally.

Wings. Hyaline. Fore wing with fused stem of veins M and CuA not complete, the veins abutted rather than fused as one; venation brown; basal membrane orange. Hind wing with 5 apical cells; venation mostly brown except for pale yellowish brown 2A, 3A, and r-m; plaga muddy white to pale brown; black infuscation on wing margin at distal end of vein 2A and a little adjoining plaga.

Opercula. For the most part reaching or slightly extending beyond distal margin of tympanal cavity; widely separated; flat other than a low rounded swelling of epimeron 3; orange to light brownish orange, sometimes partly brown on epimeron 3.

Timbals with four long ribs spanning the width of timbal membrane and one much shorter anterior rib on dorsal half and one much shorter anterior rib terminating before the upper end of adjacent intercalary rib.

Abdomen. Tending round in cross section with epipleurites marginally reflexed inwards. Tergites mostly orange to light brownish orange with black or dark brown markings. Tergite 1 black or dark brown; tergite 2–7 orange to light brownish orange with anterior dorsal margin boldly marked black or dark brown to varying degrees; tergite 8 black or dark brown with orange posterior margin. Sternite I–VII mostly orange with black or dark brown around midline to varying degrees; sternite VIII orange to muddy orange.

Genitalia (Fig. 29). Pygofer upper lobe long and broad, in lateral view gradually tapering to a rounded apex. Basal lobe a flap-like lobe adjacent to upper pygofer lobe, distally bi-lobed, each lobe somewhat similar in size, one partly hidden behind the other. Secondary basal pygofer lobe small, in lateral view narrow and linear with its rounded apex hidden within pygofer. Median lobe of uncus wider than long with a rounded apex. Claspers claw-like, short, broad in dorsal view, concave below, the very short bluntly pointed

apices diverging outwards. Aedeagus with pseudoparameres extending to about length of endotheca, slender, flattened in cross section, arched high above endotheca but with their apices returning to about level of endotheca, in dorsal view the distal portion of each flattened and considerably expanded inwardly, this flattened broadly triangular, apically pointed. Endotheca exceptionally slender, gently curved downwards in a sweeping arc but almost straight, nearly parallel sided, circular in cross-section, apex steeply angled backwards on ventral side and with a small dorsal crest that is broadly triangular and somewhat resembling the dorsal fin of a shark in shape.

Female (Pl. 3). Similar to male. Abdominal segment 9 orange to light brownish orange, with a black or dark brown fascia on either side of midline extending distally from the anterior margin but not reaching posterior margin; often a dark brown to black suffused patch below subdorsal fascia variable in extent between individuals. Caudal beak very small, barely discernible. Ovipositor sheath long, extending some 1.5–2.0 mm beyond apex of abdomen; dark brown to black.

Measurements. Range and mean (in mm) for 10♂♂ and 4♀♀; includes smallest and largest of available specimens. *Length of body*: male 15.5–18.8 (17.3); female 16.0–18.8 (17.3). *Length of fore wing*: male 17.3–20.5 (19.5); female 18.6–21.6 (19.5). *Width of fore wing*: male 6.0–7.2 (6.7); female 6.2–7.2 (6.7). *Ratio length/width of fore wing*: male 2.7–3.1 (2.9); female 2.7–3.0 (2.9). *Width of head (including eyes):* male 4.4–5.0 (4.8); female 4.6–5.2 (4.9). *Width of pronotum (across lateral angles):* male 4.8–5.4 (5.2); female 4.9–5.6 (5.2).

Distinguishing features

A distinctive species within *Pauropsalta* and allied genera (those species with an infuscation on wing margin at the distal end of hind wing vein 2A), the males of which have an abdomen that is clearly wider than the thorax and rounded in cross section so that the epipleurites are not flexed inwards, and a pygofer with a poorly developed caudal beak that is obtuse in dorsal view rather than sharply pointed. Females have a protruding ovipositor sheath but lack a dorsal beak on abdominal segment 9.

Pauropsalta sinavilla is closely allied to *Pauropsalta katherina* from which it differs not only in its prominent orange and black colouring (*Pau. katherina* is substantially black) but males have a much more rounded abdomen in cross section, that of *Pau. katherina* being reflexed at the epipleurites.

The male genitalia have remarkable pseudoparameres that arch high above the endotheca and terminate in front of the endothecal gonopore, a feature shared only with *Pau. katherina*. The male genitalia clearly differ from those of *Pau. katherina* in having serrations along the apical margin of the pseudoparameres, a feature absent in *Pau. katherina*.

Etymology. For the Latin *sina-* meaning irritated or grumpy, which resembles the general tone of this species song, and the Latin *-villa* for house because it is found near House creek, WA.

Song (Fig. 29). The song is composed of a series of echemes. Each is less than 2 s in length. Echemes occur at a rate of c. 1 per second. The song ranges in frequency from 2–16 kHz.

Genus *Atrapsalta* n.gen.

Atrapsalta Owen *et al.*, 2015: 259–264, 271, 273, 274, *nomen nudum*.

Type species. *Atrapsalta emmotti* n.sp.

Included species. *collina* (Ewart, 1989) n.comb.; *corticina* (Ewart, 1989) n.comb.; *dolens* (Walker, 1850) n.comb.; *emmotti* n.sp.; *encaustica* (Germar, 1834) n.comb.; *fuscata* (Ewart, 1989) n.comb.; *furcilla* n.sp.; *siccana* (Ewart, 1989) n.comb.; *vinea* n.sp.

Etymology. From the Latin *atra* meaning black, referring to the dominant colour of most species in the genus, and from psalta, derived from *psaltria* meaning female harpist. Feminine

Diagnosis

Head including eyes about as wide as mesonotum, sometimes a little narrower, sometimes a little wider; supra-antennal plate meeting or nearly meeting eye; postclypeus broadly rounded transversely across ventral midline, in lateral profile angulate between "top" and "sides"; postclypeus in dorsal view angled but tending confluent with anterior margin of head.

Thorax. Pronotal collar width at dorsal midline much less than diameter of eyes; paranota confluent with adjoining pronotal sclerites, no mid lateral tooth; cruciform elevation with its dome wider than long; epimeral lobe not reaching operculum.

Wings. Hyaline. Fore wings with 8 apical cells; subapical cells absent; ulnar cell 3 angled to radial cell; basal cell long and narrow; costal vein (C) clearly higher than R+Sc; costa parallel-sided to node; pterostigma present; vein CuA only weakly bowed so that cubital cell no wider than medial cell; veins M and CuA completely fused as one before reaching basal cell; vein RA_1 aligned closely with Sc for its length and not diverging in subapical region; vein CuA_1 divided by crossvein m-cu so that proximal portion shortest; veins CuP and 1A fused in part; infuscation absent; wing outer margin developed for its total length, never reduced to be contiguous with ambient vein. Hind wings usually with 5 apical cells, 6 in *A. vinea*; infuscation at distal end of vein 2A spread on wing margin; width of 1st cubital cell at distal end at least twice that of 2nd cubital cell; anal lobe broad with vein 3A curved, long, separated from wing margin; veins RP and M fused basally.

Legs. Fore leg femoral primary spine erect.

Male opercula more or less reaching margin of tympanal cavity, directed towards distomedial margin of tympanal cavity, apically broadly rounded, clearly not meeting, clearly raised above level of tympanal cavity on its outer half or so.

Male abdomen in cross-section with sides of tergites straight or weakly convex, epipleurites reflexed ventrally from junction with tergites; tergites 2–7 all similar in size (2 and 3 not considerably larger); sternites III–VII in cross-section convex.

Timbals. Timbal covers absent; timbal ribs irregular in size and spaced with prominent intermediate short ribs; basal dome very large; timbals not extended below level of wing bases.

Male genitalia. Pygofer with distal shoulders not developed; upper pygofer lobe in lateral view with basal portion of dorsal margin strongly angled to axis of pygofer, very broad basally and tapering to a broad apex; pygofer

basal lobe spike-like; pygofer secondary basal lobe lobe-like and domed, outer face ridged longitudinally, in lateral view not or moderately projecting and broadly rounded, in ventral view well developed with rounded apex that is sometimes two-tiered; dorsal beak present and a part of chitinized pygofer. Uncus in dorsal view broad, short, distal margin straight. Claspers in lateral view extending no more than a little beyond margin of pygofer, claw-like with minimum or no cavity below; extreme basal region concave, not developed forward. Aedeagus with basal plate weakly depressed on dorsal midline; in dorsal view tending to be Y-shaped; in lateral view undulated basal portion directed forwards away from thecal shaft; ventral rib completely fused with basal plate; junction between theca and basal plate with a functional "hinge" that is small and substantially compressed between theca and basal plate in lateral view; thecal shaft straight or curved in a gentle arc; pseudoparameres present, dorsal of theca and originating near thecal base; pseudoparameres arising independently at their bases, except in *dolens* where they are partly fused beyond the base; endotheca exposed, much of surface weakly sclerotized and in part translucent; endotheca shaft parallel-sided in apical region; endothecal ventral support absent; thecal apex entirely chitinized, thecal subapical cerci absent; flabellum absent; conjunctival claws absent; vesica retractable, vesical opening apical on theca.

Distinguishing features

Atrapsalta can be separated from all other genera by the combination of the following: fore wing length less than 20 mm; fore wing veins M and CuA with their stems completely fused as one on meeting basal cell; hind wing with 5 apical cells; claspers in lateral view extending no more than a little beyond the margin of the pygofer, claw-like with minimum or no cavity below; pygofer basal lobe spike-like, well-developed; pygofer secondary basal lobe shape is lobe-like and domed, in lateral view not or moderately projecting and broadly rounded, in ventral view well developed with rounded apex that is sometimes two-tiered and fusion with pygofer margin not reaching apex; endotheca dorsal surface weakly sclerotized and in part translucent.

Atrapsalta dolens (Walker, 1850) n.comb.

Fig. 30, Pl. 6

Cicada dolens Walker, 1850: 190; Stål, 1862: 482 [as a junior synonym of *Cicada juvenis* Stål] and 484 [as a junior synonym of *Melampsalta arclus* Stål].

Pauropsalta dolens Walker: Goding & Froggatt 1904: 565 [as a junior synonym of *Pauropsalta encaustica* (Germar)]; Ewart, 1989: 293, 310.

Atrapsalta dolens Owen *et al.*, 2015: 274, *nomen nudum.*

Material examined. *Syntype* male, King George's Sound [Albany, Western Australia], 40 12 16 257 [=16th Dec. 1840, No. 257 in Register], [only known syntype specimen] (NHM). 2♂♂ (one genitalia prep. PAU301, molecular voucher 02.AU.WAU.PIN.05; one genitalia prep. PAU 304, molecular voucher 02.AU.WAU.PIN.06), Pinjarra, 33°38'S 115°52'E, 23 m, 31.xii.2002, Moulds, Marshall, Hill & Vanderpool; 2♂♂ (one genitalia prep. PAU 310, molecular voucher 03.AU.WAU.BOY.03; one genitalia prep. PAU 313, molecular voucher 03.AU.WAU.BOY.02; one molecular voucher 03.AU.WA.BOY.04; GenBank accessions: KM377198, KM377382, KM377432, KM377615, KM668224), nr Boyup Brook, 33°48'S 116°27'E, 210 m, 5.i.2003, Moulds, Marshall, Hill & Vanderpool; 2♂♂ (one genitalia prep. PAU 303, molecular voucher 02.AU.WAU.MRC.01; one genitalia prep. PAU311, molecular voucher 02.AU.WAU.MRC.08), Moore R. x-ing, near Nabaroo, 31°04'S 115°33'E, 66 m, 30.xii.2002, Moulds, Marshall, Hill & Vanderpool; 1♂ (genitalia prep. PAU244, molecular voucher 03.AU.WAU.LKA.04), Lake Douglas, nr Kalgoorlie, 30°51'S 121°23'E, 369 m, 15.i.2003, Moulds, Hill, Marshall & Vanderpool; 1♂ (genitalia prep. PAU302, voucher 03.AU.WAU.CAT.05), Cataby, 30°44'S 115°33'E, 144 m, 19.i.2003, Moulds, Marshall, Hill & Vanderpool; 1♂ (genitalia prep. PAU300, molecular voucher 03.AU.WAU.JER.01), Jerramungup, 33°56'S 118°55'E, 324 m, 9.i.2003, Moulds, Hill, Marshall & Vanderpool; 2♂♂ (one genitalia prep. PAU318, molecular voucher 09.AU.WA.MOI.02; one genitalia prep. PAU339, molecular voucher 09.AU.WA.MOI.01), Moir Rock, 56 km S of Norseman, 13 km SW of Esperance Hwy, 32°39.196'S 121°25.357'E, 7.ii.2009, K. Hill & D. Marshall (AM). 1♂, Collie, 11.xii.1985, M.S. & B.J. Moulds (AE). 1♂, Kings Park, 8.xii.1985, P. Yeoh (LP). 1♂, 20 km ESE of Boyup Brook, 6.xii.1985, M.S. & B.J. Moulds; 1♂ (genitalia prep. PAU281), King's Park, 6.i.1955, D.T. Gwynne; 9♂♂, 1♀, Yarloop, 4.i.1991, 11.i.1991, M.S. & B.J. Moulds; 2♂♂, Perth, 31°52'S 115°52'E, 66 m, 22.i.2003, Moulds, Marshall, Hill & Vanderpool; 2♂♂, Stirling Rgs, Chester Pass Rd., 34°25'S 118°05'E, 242 m, 8.i.2003, Moulds, Hill, Marshall & Vanderpool; 1♂, Stirling Rgs, nr Mt Hassell, 34°22'S 118°04'E, 373 m, 8.i.2002, Moulds, Hill, Marshall & Vanderpool; 2♂♂, Stirling Rgs, Mt Magog Picnic Area, 34°24'S 117°55'E, 292 m, 7.i.2003, Moulds, Marshall, Hill & Vanderpool; 1♂, Stirling Rgs, Kalgan R. Rd., 34°32'S 117°52'E, 175 m, 8.i.2003, Moulds, Hill, Marshall & Vanderpool; 1♂, Stirling Rgs., Moingup Camp Area, 34°24'S 118°06'E, 282 m, 8.i.2003, Moulds, Marshall, Hill & Vanderpool; 1♂, West River, W of Ravensthorpe, 33°46'S 119°44'E, 262 m, 10.i.2003, Moulds, Marshall, Hill & Vanderpool; 1♂, Perth, 31°53'S 115°52'E, 88 m, 22.i.2003, Moulds, Marshall, Hill & Vanderpool; 3♂♂, 1♀, Pinjarra, 33°38'S 115°52'E, 23 m, 31.xii.2002, Moulds, Marshall, Hill & Vanderpool; 1♂, Wave Rock, Hyden, 32°27'S 118°54'E, 18.i.2003, Moulds, Marshall, Hill & Vanderpool; 1♂ (genitalia prep. PAU299), Kojunup, 33°50'S 117°10'E, 349 m, 5.i.2003, Moulds, Marshall, Hill & Vanderpool; 1♂ (genitalia prep. PAU277), Moir's Rock, 42 km NNW Salmon Gums, 32°39'S 121°25'E, 2.i.1987, G. & A. Daniels; 4♂♂, 3♀♀, Kalbarrie, 21.xi.1978, M.S. & B.J. Moulds; 1♂, Capel, 11.xii.1985, M.S. & B.J. Moulds; 1♂, Collie, 11.xii.1985, M.S. & B.J. Moulds; 1♂, Kings Park, 8.xii.1985, P. Yeoh; 2♂♂, Martins Lake, Yalgorup N.P., 23.xi.1986, G. R. Brown; 2♂♂, 10 km N Preston Bch, 18.i.1991, M.R.W.; 2♂♂, 1♀, nr base of Mt Ragged, 33°28'S 123°28'E, 176 m, 13.i.2003, Moulds, Hill, Marshall & Vanderpool; 1♂, heathland above escarpment, approx. 20 km WNW of Israelite Bay, 29.xii.1990, M.S. & B.J. Moulds; 1♀, Israelite Bay, 17.xii.1995, M.S. & B.J. Moulds & K.A. Kopestonsky; 1♂, Kalgoorlie, 13.i.1989, M.S. & B.J. Moulds; 1♂, Wave Rock, nr Hyden, 32°27'S 118°53'E, 10.i.1986, G. & A. Daniels; 1♂, 2 km N of Yanchep, 5.i.1995, M.S. & B.J. Moulds; 1♂, Yanchep N.P., 2.i.1992, M.R. Williams; 1♂, W Bannister, 5.i.1961, M.S. Moulds; 1♂, Nth Bannister, 5.i.1961, M.S. Moulds; 1♂, Munday [Munday Brook], 4.ii.1976, M. Powell; 2♂♂, Pinjarra, 33°38'S 115°52'E, 23 m, 31.xii.2002, Moulds, Marshall, Hill & Vanderpool; 1♂, Perth, 1°52'S 115°52'E, 66 m, 22.i.2003, Moulds, Marshall, Hill & Vanderpool; 1♂, nr Boyup Brook, 33°48'S 116°27'E, 210 m, 5.i.2003, Moulds, Marshall, Hill & Vanderpool; 1♂, Moore R. x-ing, near Nabaroo, 31°04'S 115°33'E, 66 m, 30.xii.2002, Moulds, Marshall, Hill & Vanderpool (MSM). 1♂, Perth, 1°52'S 115°52'E, 66 m, 22.i.2003, Moulds, Marshall, Hill & Vanderpool; 1♂, Pinjarra, 33°38'S 115°52'E, 23 m, 31.xii.2002, Moulds, Marshall, Hill & Vanderpool; 1♂, Yarloop, 32°58'S 115°55'E, 76 m, 31.xii.2002, Moulds, Marshall, Hill & Vanderpool; 1♂, Yarloop, 32°56.562'S 115°54.506'E, 59 m, 31.xii.2002, Moulds, Marshall, Hill & Vanderpool (WAM).

Distribution (Fig. 30). Southwestern Western Australia south from Kalbarrie, throughout much of the southwest corner including coastal districts east to Israelite Bay, and inland to Kalgoorlie. It is usually a common species with records from mid-September to early February but it appears to be most abundant during late December and early January.

Habitat. Adults inhabit eucalypts, including mallee in drier districts. They are often found high up in the upper branches.

Description

Male (Pl. 19). *Head* wider than lateral margins of pronotal collar; dominantly black with muddy yellow spot at posterior midline. Postclypeus jet black, sometimes with a muddy yellow mark on midline around most anterior portion; lateral

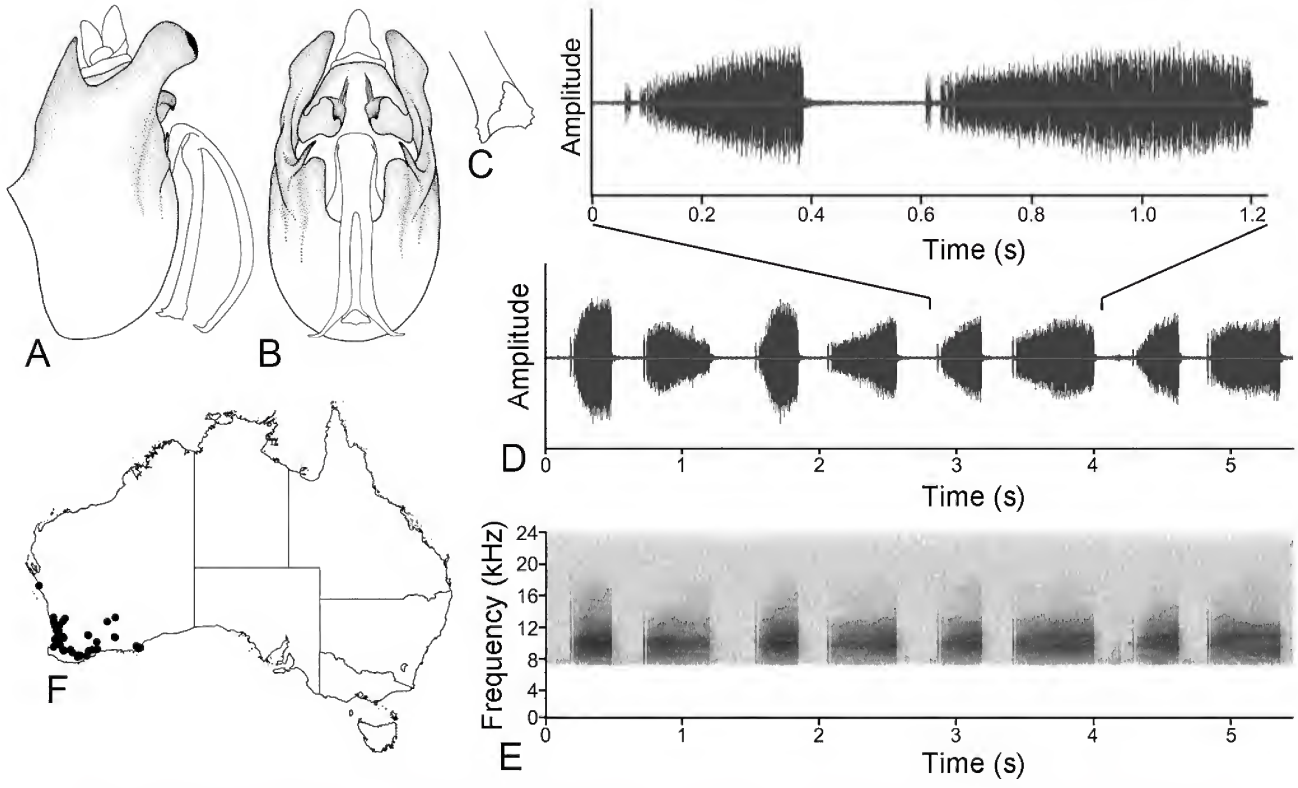


Figure 30. *Atrapsalta dolens (A)* male genitalia, lateral view (genitalia prep PAU 310); *(B)* male genitalia, ventral view (genitalia prep PAU 310); *(C)* endotheca apex; *(D)* waveform of male calling song recorded from Moore River Crossing near Nabaroo, WA; *(E)* spectrogram of male calling song; *(F)* species distribution map.

margins muddy yellow; transverse ridges and central groove distinct. Anteclypeus jet black. Rostrum black, occasionally tending brown proximally, reaching to about bases of hind coxae. Antennae black, sometimes brown distally. Supra-antennal plates black, usually with dull yellow spot around mid length on anterior margin.

Thorax. Pronotum black, usually with muddy yellow markings; anterior margin edged narrowly edged yellow; fascia along midline pale yellow, usually extending from near head towards but not reaching pronotal collar; pronotal collar between lateral angles black with posterior margin edged brown or muddy yellow; lateral margin of pronotal collar not ampliate. Mesonotum primarily black with reddish brown or yellow muddy markings; sometimes a muddy yellow fascia along part of parapsidal suture; usually with a reddish brown or muddy yellow edging along lower lateral margin; cruciform elevation black with arms muddy yellow to reddish brown, but sometimes partly black; lower margin of wing groove partly or entirely muddy yellow or reddish brown. Metanotum black at hind wing base, remainder reddish brown or muddy yellow, sometimes black near dorsal midline.

Legs. Fore legs mostly black with a muddy yellow or yellowish brown fascia to varying degrees along anterior length of femora and lateral exterior of femora; femora with spines black tending brown distally; pretarsal claws brown. Mid and hind legs mostly black or brown tending yellowish brown; coxae with proximal margin edged pale reddish brown or yellowish brown; yellowish brown fascia along anterior and exterior length of femora; tibiae and tarsi brown tending yellowish brown. Meracanthus pale yellow, mostly black near base.

Wings. Hyaline. Fore wing with fused stem of veins M and CuA complete, the veins fused as one; venation brown to black; minimal infuscation distally on clavus; basal membrane grey to black. Hind wing with 5 apical cells; venation brown; plaga muddy white to grey to pale brown; black infuscation on wing margin at distal end of vein 2A.

Opercula. For the most part just reaching distal margin of tympanal cavity; widely separated; flat other than a low rounded swelling of epimeron 3; black basally, muddy yellow distally, the proportions of each considerably variable.

Timbals. Grey to muddy white in colour; four long ribs spanning the width of timbal membrane and one shorter anterior rib terminating level with lower end of adjacent intercalary rib.

Abdomen. Tending triangular in cross section with epipleurites reflexed inwards from junction with tergites. Tergites black with muddy yellow or reddish brown markings. Tergites 1–2 black; tergites 3–8 black with posterior margin narrowly edged yellow or reddish brown to varying degrees. Sternites I–II brown or black; sternites III–VI black to brownish black to varying degrees with posterior margin yellow; sternite VII black, sometimes posterior margin edged yellow; sternite VIII brown or black basally becoming yellowish brown distally.

Genitalia (Fig. 30). Pygofer upper lobe black, long, blinker-shaped with distal portion broadened and rounded. Basal lobe spike-like, projecting inwards and backwards. Pygofer secondary basal lobe in lateral view substantially hidden, in ventral view large, apically broadly rounded. Median lobe of uncus short, wider than long. Claspers claw-like, flattened in dorsal view, apices pointed and slightly turned outwards. Aedeagus with pseudoparameres

as long as or slightly longer than endotheca, in lateral view flattened, arched high above endotheca with apices turned downwards, in dorsal view fused for almost half their length, parallel to each other but subapically slightly broadened and angled outwards, thereafter tapering to a point. Endotheca nearly straight, parallel-sided, circular in cross-section, apex chamfered so that the lip is ventral, the sides turned outward and slightly expanded into marginal flanges with a very small mid ventral keel, both the flanges and keel with their margins in part finely serrated.

Female (Pl. 6). Similar to male. Abdominal segment 9 black. Ovipositor sheath short, extending some 0.5–0.75 mm beyond apex of abdomen; dark brown to black.

Measurements. Range and mean (in mm) for 10♂♂ and 7♀♀; includes smallest and largest of available specimens. *Length of body*: male 12.6–15.6 (13.9); female 12.5–15.3 (13.9). *Length of fore wing*: male 13.2–16.0 (14.6); female 14.4–16.7 (15.4). *Width of fore wing*: male 5.0–6.4 (5.7); female 5.4–6.6 (5.9). *Ratio length/width of fore wing*: male 2.5–2.7 (2.6); female 2.5–2.7 (2.6). *Width of head (including eyes):* male 3.7–4.9 (4.2); female 4.2–4.9 (4.4). *Width of pronotum (across lateral angles):* male 3.8–5.0 (4.4); female 3.8–4.5 (4.0).

Distinguishing features

This species is confined to the south–west of Western Australia where it is similar to *Pau. accola, Pau. confinis, Pau. conflua, Pau. contigua, Pau. juncta* and *Pau. infuscata*.

It differs from all in its smaller size; its maximum fore wing length being 16.0 mm while the shortest known wing length of any of the other species is 16.6 mm. Also differs from *Pau. accola, Pau. conflua* and *Pau. juncta* in lacking dark red patches on the interior of the pronotum (view under magnification). It differs from *Pau. contigua, Pau. confinis* and *Pau. infuscata* in having fore wing veins M and CuA fused as one on reaching the basal cell rather than closely abutted (view under magnification).

The male genitalia differ from all other species in having the pseudoparameres arched high above the endotheca plus the unique structure of the endotheca apex which is minutely flanged either side and keeled ventrally, the flanges and keel very finely serrated.

Song (Fig. 30). The song is composed of a series of echemes and clicks. A single click precedes each echeme and echemes range from 0.3–0.6 s. Approximately 2 phrases occur every second. The song frequency primarily occurs between 8 kHz and 18 kHz.

Atrapsalta emmotti n.sp.

Fig. 31, Pl. 6

Atrapsalta emmotti Owen *et al.*, 2015: 260, *nomen nudum*.

Types. *Holotype* male (genitalia prep. PAU243; molecular voucher 08.AU.QL.JNW.01; GenBank accessions: KM377197, KM377342, KM377393, KM377536, KM668323), Bonniedoon Ck., 13.7 km NW of Winton, Queensland, 22°19.248'S 142°57.817'E, 6.ii.2008, K. Hill, D. Marshall, M. Moulds, C. Owen, M. Humphrey (AM). *Paratypes*—QUEENSLAND: 4♂♂, 4♀♀, Vergemont Ck, "Noonbah", SW of Longreach, 24°05'21"S 143°07'41"E, 16.iii.2003, A.J. Emmott (AE). 8♂♂, 8♀♀, "Noonbah" Stn., SW of Longreach, 24°04'S 143°11'E, 15.iii.2003, A.J., F.F. & A.M. Emmott (AJE). 6♂♂, 6♀♀, Vergemont Ck, "Noonbah", SW of Longreach, 24°05'21"S 143°07'41"E, 16.iii.2003, A.J. Emmott (AM). 4♂♂, 4♀♀, Vergemont Ck, "Noonbah", SW of Longreach, 24°05'21"S 143°07'41"E, 16.iii.2003, A.J. Emmott; 2♂♂, 2♀♀, 3 km W. of Bundeena HS SW. of Quilpie QLD, 12.ii.1972, R. C. Lewis (ANIC). 4♂♂, 4♀♀, Vergemont Ck, "Noonbah", SW of Longreach, 24°05'21"S 143°07'41"E, 16.iii.2003, A.J. Emmott (DE). 4♂♂, 4♀♀, Vergemont Ck, "Noonbah", SW of Longreach, 24°05'21"S 143°07'41"E, 16.iii.2003, A.J. Emmott (JM). 4♂♂, 4♀♀, Vergemont Ck, "Noonbah", SW of Longreach, 24°05'21"S 143°07'41"E, 16.iii.2003, A.J. Emmott (JO). 4♂♂, 4♀♀, Vergemont Ck, "Noonbah", SW of Longreach, 24°05'21"S 143°07'41"E, 16.iii.2003, A.J. Emmott; 1♂, 1♀, Birdsville Developmental Road, 25°41'37"S 141°10'39"E, 14.i.2007, L. Popple, J. Hereward, 425-0001 to 425-0002; 2♂♂, Diamantina River, Birdsville, 25°54'01"S 139°21'15"E, 14–15.i.2007, L. Popple, J. Hereward, 425-0003 to 425-0004 (LP). 62♂♂, 56♀♀, "Noonbah" Stn., SW of Longreach, 24°04'S 143°11'E, 15.iii.2003, A.J., F.F. & A.M. Emmott; 1♀, Vergemont Ck, "Noonbah", SW of Longreach, 24°05.3'S 143°08.8'E, 8.ii.2004, A.J. Emmott & P. Kleinschmidt; 54♂♂, 49♀♀, Vergemont Ck, "Noonbah", SW of Longreach, 24°05'21"S 143°07'41"E, 16.iii.2003, A.J. Emmott; 1♂ (genitalia prep. PAU411, molecular voucher 08.AU.QL.JNW.02), Bonniedoon Ck., 13.7 km NW of Winton, 22°19.248'S 142°57.817'E, 6.ii.2008, K. Hill, D. Marshall, M. Moulds, C. Owen, M. Humphrey; 3♂♂ (one genitalia prep. PAU412), 2♀♀, Windorah, 15.i.2002, Cooley, Cowan, Hill, Marshall & Moulds; 1♂ (genitalia prep. PAU410), Cooper Ck., nr Windorah, 25°22.283'S 142°44.669'E, 140 m, 14.i.2002, Cooley, Hill, Marshall, Cowan, Moulds; 1♂ (molecular voucher 08.AU.QL.MTC.11), 48 km, E of Middleton, 121 km W of Winton, Kennedy Dev. Rd., 22°16.187'S 141°56.299'E, 28.ii.2008, Hill, Marshall, Moulds, Owen & Humphrey; 1♂ , nr junct. Plenty Hwy and Urandangi Rd, 22°16.245'S 137°55.915'E, K. Hill & D. Marshall (MSM). 4♂♂, 4♀♀, Vergemont Ck, "Noonbah", SW of Longreach, 24°05'21"S 143°07'41"E, 16.iii.2003, A.J. Emmott (NHM). 4♂♂, 4♀♀, Vergemont Ck, "Noonbah", SW of Longreach, 24°05'21"S 143°07'41"E, 16.iii.2003, A.J. Emmott (PH). 6♂♂, 6♀♀, Vergemont Ck, "Noonbah", SW of Longreach, 24°05'21"S 143°07'41"E, 16.iii.2003, A.J. Emmott (QM). 4♂♂, 4♀♀, Vergemont Ck, "Noonbah", SW of Longreach, 24°05'21"S 143°07'41"E, 16.iii.2003, A.J. Emmott (WAM). SOUTH AUSTRALIA: 4♂♂ (one genitalia prep. PAU413), 3♀♀, Innamincka, 27°45.110'S 140°43.830'E, 56 m, 17.i.2002, Cooley, Cowan, Hill, Marshall & Moulds (MSM).

Distribution (Fig. 31). Western Queensland and far northeastern South Australia, along the Thomson River, Diamantina River, Bulloo River, Cooper Creek, and their tributaries. The most northern records are from near Winton, Queensland (on the Western River), and near Middleton (on the Diamantina River) some 150 km due west of Winton. The most southern record is from Innamincka on Cooper Creek in South Australia. There are records from mid January to mid March but most specimens have been taken mid March. Emergence seems to follow good summer/early autumn rains. Under favourable conditions populations can be immense.

Habitat. Favoured trees are coolabah, *Eucalyptus coolabah,* and River Gum, *E. camaldulensis,* growing along permanent or semi permanent water courses. Adults tend to prefer the upper branches of tall trees although they will inhabit lower branches and even small eucalypts when populations are very high.

Description

Male (Pl. 6). *Head* slightly wider than pronotal collar across lateral margins; dominantly black. Vertex with muddy yellow spot at posterior midline. Postclypeus black with pale yellow markings; usually a pale yellow spot on midline around most anterior portion; lateral margins and sometimes posterior margins pale yellow; transverse ridges and central groove distinct. Anteclypeus jet black. Rostrum black, sometimes brown proximally, reaching to or almost to apices of hind coxae. Antennae black. Supra-antennal plates black with a pale yellow margin variable in extent.

Thorax. Pronotum black, with pale yellow markings; usually anterior margin edged pale yellow, variable in extent;

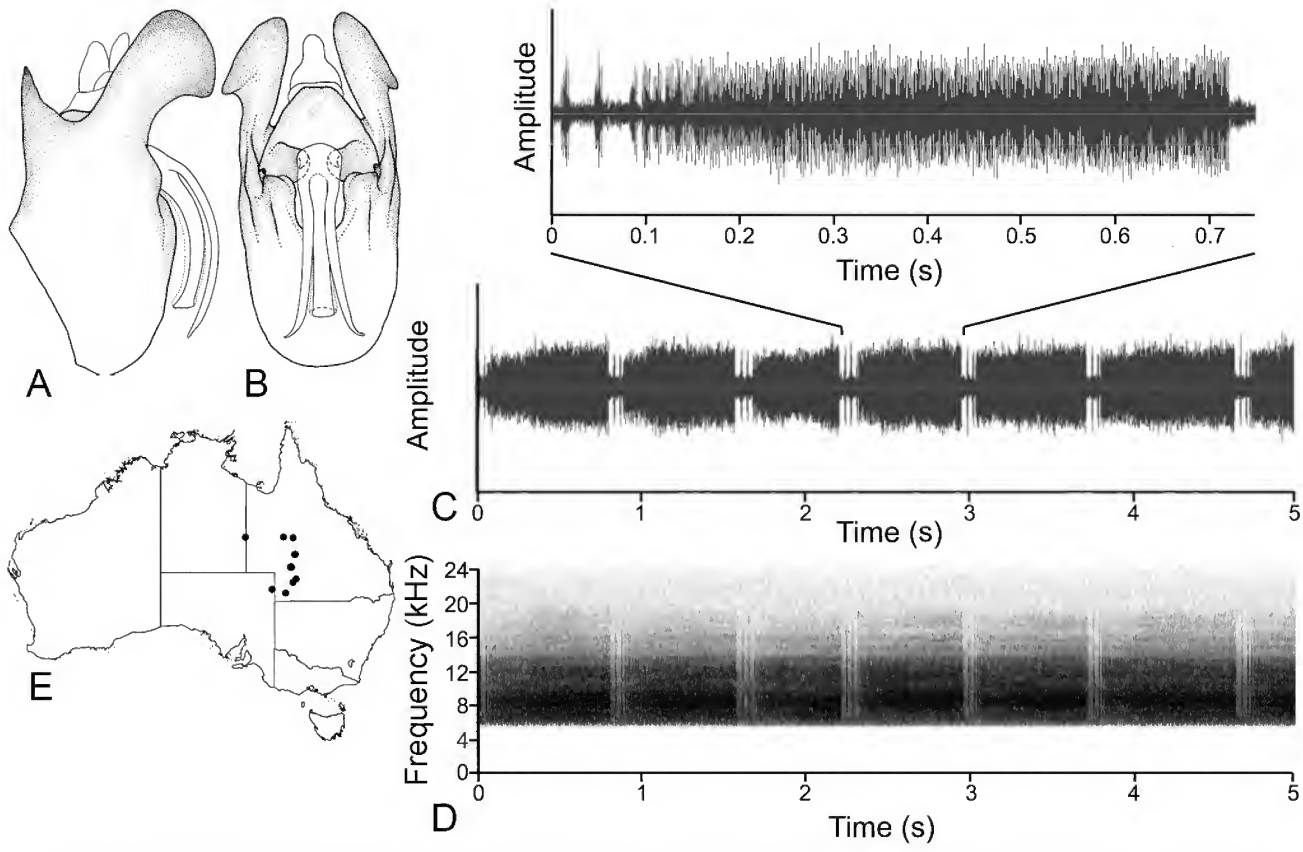


Figure 31. *Atrapsalta emmotti* n.sp. *(A)* male genitalia, lateral view (genitalia prep PAU 320); *(B)* male genitalia, ventral view (genitalia prep PAU 320); *(C)* waveform of male calling song recorded from Cooper Creek, near Windorah, QLD; *(D)* spectrogram of male calling song; *(E)* species distribution map.

fascia along midline pale yellow, variable in length; a pale yellow marking dorsally abutting and/or on anterior margin of pronotal collar and often broken at midline; pronotal collar and lateral angles black with posterior margin pale yellow or orange yellow; lateral margin of pronotal collar not, or barely, ampliate. Mesonotum primarily black usually with pale yellow or almost white markings; the posterior rim from cruciform elevation to wing bases entirely pale yellow or almost white; usually a pale yellow marking on either side of midline from, or near, anterior arms or the cruciform elevation to, or almost to, pronotum between lateral and submedian sigilla, this marking sometimes projecting inwards to varying degrees around its mid length; cruciform elevation pale yellow to muddy yellow with a black fascia along midline, anterior arms usually partly black, sometimes muddy yellow proximally, area between anterior arms black, posterior arms pale yellow to orange yellow, edged black along and between posterior arms. Metanotum black at hind wing base, remainder pale yellow, sometimes black near dorsal midline.

Legs. Fore legs black to dark brown; femora black with a pale yellow fascia along anterior length; femora with spines black, sometimes brown distally; tibiae and tarsi black to dark brown; pretarsal claws black or brown, often with yellow near bases. Mid and hind legs mostly black and pale yellow; coxae with proximal margin edged pale yellow; femora black; mid leg tibiae black; hind leg tibiae and tarsi pale yellow. Meracanthus mostly black, with distal end and lateral exterior pale yellow.

Wings. Hyaline. Fore wing with fused stem of veins M and CuA complete, the veins fused as one; venation brown; basal membrane almost white or pale grey to pale brown. Hind wing with 5 apical cells; venation brown except for pale yellowish brown 2A and 3A; plaga muddy white to pale brown; black infuscation on wing margin at distal end of vein 2A and across much of posterior margin of anal lobe.

Opercula. For the most part not reaching distal margin of tympanal cavity; widely separated; flat other than a low rounded swelling of epimeron 3; mostly black with distal margin pale yellow or muddy yellow.

Timbals with four long ribs spanning the width of timbal membrane and one much shorter anterior rib terminating level with upper end of adjacent intercalary rib.

Abdomen. Tending triangular in cross section with epipleurites reflexed inwards from junction with tergites. Tergites dominantly black with posterior margins brownish red or yellow to varying degrees; tergite 1 black. Sternite I yellowish brown to black; sternites II–VII black, sometimes with lateral sides and posterior margin pale yellow to varying degrees; sternite VIII muddy yellow, sometimes partly pale brown.

Genitalia (Fig. 31). Pygofer upper lobe wide and long, blinker-shaped, ventral apex bluntly hook-shaped, dorsal apex broadly rounded. Secondary basal pygofer lobe small, in ventral view evenly rounded, turned inwards slightly; basal lobe an inner peg-like projection above the secondary basal pygofer lobe. Median lobe of uncus wider than long with a broad rounded apex. Claspers claw-like, very short, apically turned outwards, slightly concave below. Aedeagus with pseudoparameres a little longer than endotheca, slender, distally flattened in cross section, lying immediately above endotheca in lateral view, in dorsal view parallel to each other

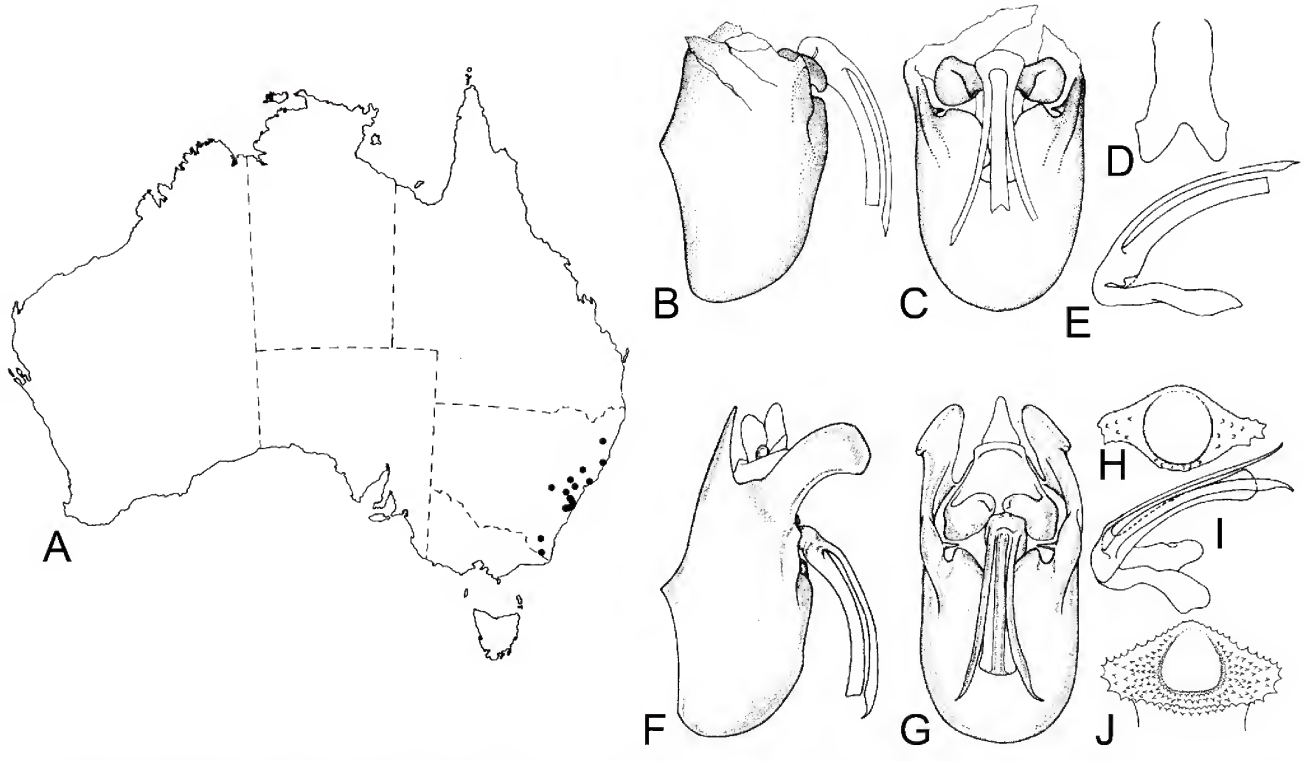


Figure 32. *Atrapsalta encaustica (A)* species distribution map; *(B)* type specimen male genitalia, lateral view; *(C)* type specimen male genitalia, ventral view; *(D)* type specimen aedeagal basal plate; *(E)* type specimen aedeagus *(F)* recent *A. encaustica* specimen male genitalia, lateral view; *(G)* recent *A. encaustica* specimen male genitalia, ventral view; *(H)* recent *A. encaustica* aedeagus apex end on; *(I)* recent specimen of *A. encaustica* aedeagus; *(J)* recent *A. encaustica* aedeagus apex end on.

but distally curved outwards. Endotheca slightly curved, parallel sided, circular in cross-section, apex circular and finely serrated laterally and ventrally.

Female (Pl. 6). Similar to male. Abdominal segment 9 pale yellow to brown with anterior margin edged black and a black fascia along midline from anterior margin to, or almost to, caudal beak; a black spot mid laterally each side. Ovipositor sheath extending some 0.5–1.0 mm beyond apex of abdomen; dark brown to black.

Measurements. Range and mean (in mm) for 10♂♂ and 10♀♀; includes smallest and largest of available specimens. *Length of body*: male 13.6–16.7 (15.2); female 14.3–17.1 (15.9). *Length of fore wing*: male 15.9–19.2 (17.9); female 17.5–21.0 (19.2). *Width of fore wing*: male 5.5–6.6 (6.0); female 6.0–7.0 (6.5). *Ratio length/width of fore wing*: male 2.9–3.1 (3.0); female 2.9–3.0 (3.0). *Width of head (including eyes):* male 4.2–5.0 (4.7); female 4.6–5.5 (5.0). *Width of pronotum (across lateral angles):* male 4.2–5.2 (4.7); female 4.7–5.6 (5.1).

Distinguishing features

Distinguished from all other species of *Pauropsalta* and allied genera (i.e. those species with an infuscation on the hind wing margin at the distal end of vein 2A) in having the following combination of characters. Fore wing veins M and CuA completely fused as one (not closely abutted, view under magnification); 5 apical cells in the hind wing; and a mesonotum with a pale yellow or nearly white posterior rim between cruciform elevation and wing bases.

The male genitalia are unique in having an aedeagus with the following combination of attributes. An endotheca with a simple, square-cut apex that is minutely spined around most of its circular perimeter, and pseudoparameres that lye immediately above the endotheca with only their distal half or less flattened.

Etymology. Named after Angus Emmott of Noonbah Station who has collected most of the known specimens and whose knowledge of western Queensland cicadas has contributed significantly to our understanding of these insects.

Song (Fig. 31). The song is composed of a series of echemes and clicks. Usually two clicks precede each echeme. Each echeme is about 1 s or less in length. Phrases occur at a rate of between 1 and 2 per second. The frequency of the song extends between 5 kHz and 20 kHz with the dominant frequency occurring between 5 kHz and 14 kHz.

Atrapsalta encaustica (Germar, 1834) n.comb.

Fig. 32

Atrapsalta encaustica Owen *et al.*, 2015: 260, *nomen nudum*.

Material examined. NEW SOUTH WALES: *Lectotype* male, "N.H." [New Holland], Moreton Bay Australia etc. [see Ewart 1989 for comments on erroneous Moreton Bay label] (HOPE). 1♂ (genitalia prep. 519, molecular voucher 06.AU.NS.DHA.02; GenBank accessions: KM377152, KM377264, KM377385, KM377545, KM668338), Dharawal State Cons. area, Victoria Rd, Wedderburn, 34°09.580'S 150°49.699'E, 284 m, 21.xi.2006, K. Hill, D. Marshall, D. & S. Emery; 1♂ (molecular voucher 05.AU.NS.AQP.04), Asquith, edge of Nat. Park, 33°40.882'S 151°06.140'E, 152 m, 5.xii.2005, Chen, Hill, Marshall, Moulds; 1♀ (molecular voucher 05.AU.NS.AQP.07), Asquith, edge of Nat. Park, 33°40.882'S 151°06.140'E, 152 m, 5.xii.2005, Chen, Hill, Marshall, Moulds; 1♂ (molecular voucher 05.AU.NS.AQP.08), Asquith, edge of Nat. Park, 33°40.882'S 151°06.140'E, 152 m, 5.xii.2005, Chen, Hill, Marshall, Moulds; 1♂ (molecular voucher 05.AU.NS.BLP.02), 5.4 km E of Bilpin, near Blue Mts, 11.xii.2005;

J.H. Chen, M. Moulds; 1♂ (molecular voucher 11.AU.NS.BLU.01), Blue Mts, above Lithgow, 33°29.278'S 150°11.702'E, 513 m, 25.i.2002, Cooley, Cowan, Hill, Marshall, Moulds; 1♂ (molecular voucher 02.AU.NS.BXR.04), NW of Windsor, 1.2 km S of Putty Rd, on Blaxlands Ridge Rd, 124 m, 33°28.210'S 150°47.987', 14.i.2011, K. Hill, D. Marshall (AM). 1♂ (song voucher 11.AU.NS.BRI), Fairburn Rd, Wedderburn, 34°09.009'S 150°49.789'E, 135 m, 2.i.2011, K. Hill, D. Marshall; 1♂ (song voucher 11.AU.NS.ORE), Mitchell Hwy, 34 km E of Orange, 22 km W of Bathurst, 985 m, 33°25.920'S 149°22.836'E, 13.i.2011, K. Hill, D. Marshall; 1♂ (genitalia prep. PAU 486), Kew, near Port Macquarie, 10.i.1972, M.S. Moulds; 1♂ (genitalia prep. PAU 139), Cooma, 22.i.1975, W. Rixon; 1♂ (genitalia prep. PAU 491), Springwood, 14.xii.1974, J.V. Peters (MSM).

Distribution (Fig. 32). New South Wales along the Great Dividing Range south from Ebor (1,500 m altitude) almost to the Victorian border around Cooma (780 m) and Bombala (680 m), and subcoastal districts between Port Macquarie and Sydney. It is a common species on the sandstone ridges around Sydney. Adults have been taken from October to January.

Habitat. Dry sclerophyll forest or open woodland, often growing on a sandstone substrate and with a heath-like understory. Adults prefer the trunks and larger limbs of *Eucalyptus* or *Angophora* where they usually settle on dark surfaces where they are well camouflaged.

Note on the identity of *A. encaustica*

Atrapsalta encaustica forms part of a complex of very similar species that are difficult to separate morphologically. Ewart (1989) concluded from examination of the lectotype that *A. encaustica* was that species possessing yellowish upper pygofer lobes as distinct from those species with black or brown upper pygofer lobes, viz. *A. collina*, *A. fuscata* and others. However, molecular studies by one of us (CLO) (Owen *et al.,* 2015) show that there are two distinct species with yellowish upper pygofer lobes, one found through Sydney and adjoining districts, the other in Victoria and Tasmania. Ewart (1989) considered *A. encaustica* to be the species from the Sydney region.

We have re-examined the lectotype of *A. encaustica* designated by Ewart. It is in rather poor condition and badly broken, with the abdomen, fore legs and genitalia carded below an otherwise pinned specimen. However, there is no guarantee that the abdomen, genitalia and fore legs belong to the pinned portion because there are two fore legs glued to the card and another attached to the pinned portion! This suggests more than one specimen was damaged. It is most likely that the abdomen and genitalia (which are also damaged, see Fig. 32) do in fact belong to the pinned portion because all appear to match the species found around Sydney in size, colour and pygofer upper lobe colour. We therefore follow Ewart (1989) in concluding that *A. encaustica* is the species found commonly through the Sydney region. The other species with yellowish upper pygofer lobes from Victoria and Tasmania that is closely allied to *A. encaustica* we describe in this monograph as *Atrapsalta furcilla*; a paralectotype of *A. encaustica* from Van Diemans Land (= Tasmania) is this species.

Distinguishing features

Distinguished from other small black cicadas except *Pauropsalta accola* and *Atrapsalta furcilla* by its yellowish upper pygofer lobes; those of other species are brown or black. Males differ from *Pau. accola* (which is confined to dryer areas of southwestern Western Australia) by the shape of the upper pygofer lobes (visible without dissection) that tend to be parallel-sided and widen distally compared to those of *accola* that taper throughout most of their length to a rounded point. Males differ from those of *A. furcilla* in the apex of the endotheca (visible only with dissection) which is thick-lipped with spines across the entire surface when viewed end on (Fig. 32) while that of *A. furcilla* is thin-lipped with no spines across its dorsal surface (Fig. 32). Females differ from those of *Pau. accola* in having an ovipositor that terminates at the end of the abdomen rather than project about 1 mm. Females of *A. encaustica* are not readily distinguishable from those of *A. furcilla* as well as those of *A. collina* and *A. corticina*.

Atrapsalta furcilla n.sp.

Fig. 33

Pauropsalta sp. nr, *collina/encaustica* Haywood, 2006: 52–56.

Atrapsalta furcilla Owen *et al.*, 2015: 261, *nomen nudum*.

Types. *Holotype* male (molecular voucher 11.AU.TS.FTN.01; genitalia prep 514), NW of Fern Tree on Huon Rd, SW edge of Hobart, 201 m, 42°54.070'S 147°17.628'E, 21.i.2011, K. Hill, D. Marshall (AM). *Paratypes*—NEW SOUTH WALES: 1♂, Cuumbean Nature Reserve, 35°21'34"S 149°15'59"E, 5.xii.2009, L. Popple, S12588, 418-0013; 1♂, Granite hill in Grenfell district, recorded, 33°51'03"S 148°06'21"E, 31.x.2009, L. W. Popple, 418-0001; 1♂, c. 3 km SE. of Captains Flat, 35°36'23"S 149°27'57"E, 5.xii.2009, Low shrubs, L. W. Popple, 418-0014; 2♂♂, Frith St, Acton, 35°16'14"S 149°06'48"E, 22.xi.2010. LT2009371, L. W. Popple, D. Emery, 418-0016 to 418-0017 (LP). AUSTRALIAN CAPITAL TERRITORY: 8♂♂, 2♀♀, Crown land (nr Jaeger Cct) Bruce, 35°15'09"S 149°05'00"E, 3.xi.2009, LT2009371, L. W. Popple, 418-0003 to 418-0012; 1♂ Dryandra St, O'Connor, 35°15'33"S 149°06'37"E, 1.xi.2009, LT2009371, L. W. Popple, *E. rossii*, 418-0002; 1♂, Piccadilly Circus, Brindabella Range, 35°21'37"S 146°47'59"E, 28.xii.2009. L. W. Popple, 415-0014, LT2009371; 1♀, Frith St, Acton, 35°16'14"S 149°06'48"E, 7.xii.2010, LT2009371, L. W. Popple, 418-0018; 1♀, Mt Majura Nature Res, 35°13'47"S 149°10'16"E, 11.xii.2010, LT2009371, L. W. Popple, 418-0019; 1♂, Cooma, 18 km ESE, Tom Groggin Rd, 36°20'47"S 148°13'57"E, 10.xii.2010, L. W. Popple, 418-0020 (LP). VICTORIA: 5♂♂ (one genitalia prep. PAU 257, 4 molecular vouchers 06.AU.VI.NCC.01, 06.AU.VI.NCC.02, 06.AU.VI.NCC.03, 06.AU.VI.NCC.06; GenBank accessions: KM377128, KM377334, KM377501, KM668270), 12.6 km S of Hwy 1 on road to Cape Conran, 28 m, 37°47.889'S 148°43.904'E, 23.xi.2006, D. Marshall, K. Hill; 1♂ (molecular voucher 06.AU.VI.GRD.01), c. 25.5 km N of Dunkeid, Grampians National Park, 297 m, 37°27.300'S 142°26.548'E, 1.xii.2006, D. Marshall, K. Hill; 1♂ (genitalia prep. 520, molecular voucher 06.AU.VI.BAY.01), E of Linton, c. 28 km SW of Ballarat, 4.xii.2006, 37°40.978'S 143°36.377'E, 413 m, D. Marshall, K. Hill; 1♂, Brisbane Ranges, 11.i.2004, Stephen Smith; 1♂, c. 5 km E of Hedley on B440, 9 m, 38°38.026'S 146°33.304'E, 5.xii.2006, D. Marshall, K. Hill; 1♂ (molecular voucher 06.AU.VI.OMS.01), 8.8 km S of Omeo on road to Bruthen, 730 m, 37°09.551'S 147°39.067'E, 24.xi.2006, D. Marshall, K. Hill (MSM and AM); 1♀, Killawarra, Warby Range, 7.xi.1978, M.S. Harvey (ANIC). TASMANIA: 1♂ (molecular voucher 11.AU.TS.POD.03), 8 km SW of Poatina on Poatina Rd, 345 m, 41°48.167'S 146°56.979'E, 23.i.2011, K. Hill, D. Marshall; 1♂ (molecular voucher 11.AU.TS.BRS.01), Bridport Rd, 12 km S of Bridport, 3 km NW of Jetsonville, 103 m, 41°06.470'S 147°27.648'E, 24.i.2011, K. Hill, D. Marshall; 1♂ (molecular voucher 11.AU.TS.WPR.01), SW of Marrawah, West Point Rd, 2.2 km W of Arthur River Rd, 40°56.196'S 144°38.938'E, 64 m, 19.i.2011, K. Hill, D. Marshall; 2♂♂ (one genitalia prep. PAU 515, 2 molecular vouchers 11.AU.TS.WHI.01, 11.AU.TS.WHI.02), Jct Whites Rd & Bass Hwy, 2 km ESE of Montumana, 198 km, 40°57.348'S 145°32.277'E, 19.i.2011, K. Hill, D. Marshall; 1♂ (molecular voucher 11.AU.TS.SCS.04), 4.2 km SE of St Marys on Elephant Pass Rd, 306 m, 41°36.501'S 148°12.742'E, 24.i.2011, K. Hill, D. Marshall; 1♂ (molecular voucher 11.AU.TS.OUS.01), NW of Hamilton, 6 km NW of Ouse on Lyell Hwy, 247 m, 42°26.508'S

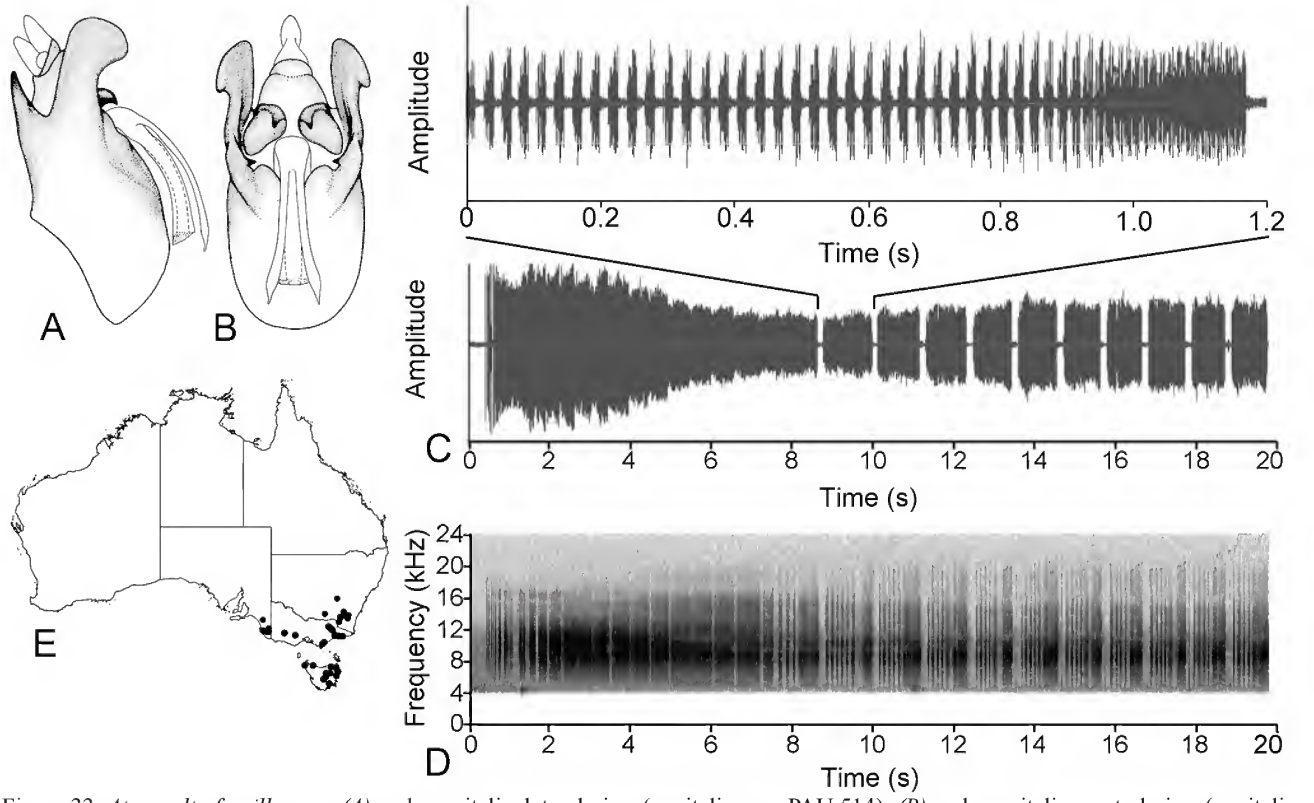


Figure 33. *Atrapsalta furcilla* n.sp. *(A)* male genitalia, lateral view (genitalia prep PAU 514); *(B)* male genitalia, ventral view (genitalia prep PAU 514); *(C)* waveform of male calling song recorded from NW of Fern Tree (NW of road to Mt. Wellington) on B64, TAS; *(D)* spectrogram of male calling song; *(E)* species distribution map.

146°39.810'E, 26.i.2011, K. Hill, D. Marshall; 1♂ (molecular voucher 11.AU.TS.CLE.01), 2.7 km, NW of Cleveland on Midland Hwy, 202 m, 41°47.152'S 147°22.846'E, 23.i.2011, K. Hill, D. Marshall; 1♂ (molecular voucher 11.AU.TS.FTN.05), NW of Fern Tree on Huon Rd, SW edge of Hobart, 201 m, 42°54.070'S 147°17.628'E, 21.i.2011, K. Hill, D. Marshall (MSM and AM).

Distribution (Fig. 33). Far southeastern corner of South Australia between Gum Lagoon and Glencoe (Haywood 2006), Australian Capital Territory and adjacent localities in New South Wales, in Victoria west to the Grampians and east to Omeo and Orbost, and in Tasmania where it is widely distributed throughout much of the State except the far southwest. The scattered records through Victoria suggest that it may be more widespread than is currently known. Adults have been taken from late October to late January.

Habitat. Eucalypt woodland where adults inhabit trees of various heights, sometimes low down but often high up.

Description

Male. *Head* wider than lateral margins of pronotal collar; dominantly black usually with muddy yellow or pale yellow spot at posterior midline. Postclypeus black with light brownish red or pale yellow markings; sometimes a brownish red spot on midline around most anterior portion; usually posterior and lateral margins brownish red or pale yellow; transverse ridges and central groove distinct. Anteclypeus jet black. Rostrum dark brown tending black distally, reaching to or slightly beyond apices of mid coxae. Antennae black. Supra-antennal plates black.

Thorax. Pronotum black, usually with brownish red or dull yellow markings; sometimes a fascia along midline brownish red or dull yellow, extending from near head towards pronotal collar to varying degrees; pronotal collar between lateral angles black, posterior margin usually edged brownish red to varying degrees, lateral margin of pronotal collar not ampliate. Mesonotum primarily black with brownish red markings; occasionally a brownish red marking on either side following parapsidal suture variable in length, sometimes extending near anterior arms of cruciform elevation; lower lateral area usually edged brownish red to varying degrees; cruciform elevation brownish red to dull yellow, occasionally all black, with black fascia along midline and black between arms to varying extent, anterior arms tending black distally, posterior arms sometimes partly black. Metanotum black at hind wing base, remainder dull yellow, brownish red or orange.

Legs. Fore legs mostly black with red or pale yellow markings; femora black except for pale yellow or red fascia along exterior and dorsal lengths, usually a pale yellow or red band along distal anterior margin; femora with spines black, sometimes brown distally; tibiae and tarsi black; pretarsal claws black tending dark brown distally. Mid and hind legs mostly black and brownish red; coxae and femora black, sometimes yellowish at distal end; tibiae black with a proximal pale yellow band; tarsi yellowish brown or black. Meracanthus mostly black tending pale yellow distally.

Wings hyaline. Fore wing with fused stem of veins M and CuA complete, the veins fused as one; venation black; very small infuscation distally on clavus; basal membrane grey to black. Hind wing with 5 apical cells; venation black except for reddish brown 2A and 3A; plaga muddy white to grey to pale brown; black infuscation on wing margin at distal end of vein 2A.

Opercula for the most part not reaching distal margin of tympanal cavity; widely separated; slightly depressed below meracanthus; a low rounded swelling of epimeron 3; pale yellow to yellowish brown with black epimeron 3 swelling.

Timbals grey to muddy white in colour; four long ribs spanning the width of timbal membrane and one shorter anterior rib terminating level with lower end of adjacent intercalary rib.

Abdomen. Tending triangular in cross section with epipleurites reflexed inwards from junction with tergites. Tergites black with yellow to muddy yellow markings; tergites 1 and 2 black, occasionally with posterior edged muddy yellow; tergites 3–8 black with posterior margin edged yellow to muddy yellow to varying degrees. Sternite I black; sternite II black with lateral posterior margin muddy yellow to varying extent; sternites III–VII black with posterior edged yellow to muddy yellow to varying degrees, usually more yellow at intersection of epipleurite and sternite; sternite VIII yellow to muddy yellow.

Genitalia (Fig. 33). Pygofer upper lobe muddy yellow; large, in later view longer than wide, terminally asymmetrically dilated, more concave along the lower margin, somewhat roundly hooked in general appearance. Pygofer basal lobe spike-like, in ventral view turned inwards. Pygofer secondary basal lobe barely projecting in lateral view, in ventral view longitudinally ridged, broad and evenly rounded. Median lobe of uncus wider than long, in lateral view not projecting. Claspers claw-like; in lateral view not projecting. Aedeagus with pseudoparameres a little longer than endotheca, slender, flattened in cross section, lying immediately above endotheca in lateral view, in dorsal view gradually diverging and distally curved outwards. Endotheca gently curved, parallel sided, circular in cross-section for most of length, fleshy outer covering; in lateral view apex slightly sloping backwards dorsally; apex viewed end on wider than tall, lateral margins thicker than dorsal and ventral margins, small spines covering outer face.

Female. Similar to male. Abdominal segment 9 yellow to light brown with black dorsally and a small black spot laterally. Ovipositor sheath not extending beyond apex of abdomen; dark brown to black.

Measurements. Range and mean (in mm) for 10♂♂, 5♀♀; includes smallest and largest of available specimens. *Length of body*: male 14.4–17.1 (15.9); female 15.1–18.0 (16.6). *Length of fore wing*: male 16.3–19.2 (18.1); female 16.4–22.0 (19.2). *Width of fore wing*: male 6.0–7.5 (7.1); female 7.0–8.5 (7.7). *Ratio length/width of fore wing*: male 2.5–2.7 (2.6); 2.4–2.6 (2.56). *Width of head (including eyes):* male 4.8–5.6 (5.2); female 5.0–6.0 (5.4). *Width of pronotum (across lateral angles):* male 4.7–5.5 (5.1); female 4.9–5.9 (5.3).

Distinguishing features

Distinguished from other small black cicadas except *Pauropsalta accola* and *Atrapsalta encaustica* by its yellowish upper pygofer lobes; those of other species are brown or black. Males differs from *accola* (which is confined to dryer areas of southwestern Western Australia) by the shape of the upper pygofer lobes (visible without dissection) that tend to be parallel-sided and widen distally compared to those of *Pau. accola* that taper throughout most of their length to a rounded point. Males differ from those of *A. encaustica* in the apex of the endotheca (visible only with dissection), which is thick-lipped with spines across the entire surface when viewed end on, while that of *A. encaustica* is thin-lipped with no spines across its dorsal surface. Females differ from those of *Pau. accola* in having an ovipositor that terminates near the end of the abdomen rather than projecting about 1 mm. Females of *A. furcilla* are indistinguishable from those of *A. encaustica* as well as those of *A. collina* and *A. corticina*.

Etymology. From the Greek *furcilla*, meaning yellow, referring to the yellow upper pygofer lobes of male specimens.

Song (Fig. 33). Each song is composed of a series phrases with clicks leading to an echeme. The song introduction is composed of a series of echemes that can last as long as 7 s. Each introductory echeme lasts for less than 0.5 s. The body of the song consists of consecutive phrases each with 5–6 clicks leading to an echeme. The echeme is c. 0.25 s in length. The frequency of the song ranges between 4 kHz and 20 kHz.

Atrapsalta vinea n.sp.

Fig. 34

Pauropsalta sp. S, near *encaustica* Sanborn *et al*., 2011: 152, 153.

Atrapsalta vinea Owen et al., 2015: 264, *nomen nudum.*

Types. *Holotype* male (molecular voucher 07.AU.SA.CLA.01; GenBank accessions: KM377113, KM377293, KM377469, KM377587, KM668265), S end of Clare, Main North Rd, South Australia, 33°51.565'S 138°37.158'E, 419 m, 26.i.2007, K. Hill and D. Marshall (SAM). *Paratypes*—SOUTH AUSTRALIA: 2♂♂, 1♀, Penworthham, 10 km S of Clare, 10.xii.1978, M.S. & B.J. Moulds (AE). 4♂♂ (one genitalia prep. PAU 234, molecular voucher 07.AU.SA.CLA.02), S end of Clare, Main North Rd, 33°51.565'S 138°37.158'E, 419 m, 26.i.2007, K. Hill and D. Marshall; 2♂♂ (molecular vouchers 11.AU.SA.AGS.01 and 02), Alligator Gorge, Mt Remarkable N.P. S of Wilmington, 678 m, 32°43.938'S 138°04.791E, 7.i.2011, K. Hill, D. Marshall; 2♂♂ (molecular vouchers 11.AU.SA.AGF.01 and 02), Alligator Gorge, Mt Remarkable N.P. S of Wilmington, 647 m, 32°43.429'S 138°05.373E, 7.i.2011, K. Hill, D. Marshall; 1♂ (molecular voucher 11.AU.SA.WCP.01), Wilmington, 340 m, 32°39.703'S 138°06.591'E, 7.i.2011, K. Hill, D. Marshall (AM). 2♂♂, Penworthham, 10 km S of Clare, 10.xii.1978, M.S. & B.J. Moulds (DE). 1♂, Penworthham, 10 km S of Clare, 10.xii.1978, M.S. & B.J. Moulds (NHM). 1♂, Penworthham, 10 km S of Clare, 10.xii.1978, M.S. & B.J. Moulds (JO). 2♂♂, Penworthham, 10 km S of Clare, 10.xii.1978, M.S. & B.J. Moulds (LP). 1♀, Clare, 27.i.1973, P. McQuillan; 3♂♂ (one genitalia prep. PAU 361), Wilpena Pound, Flinders Ranges, 19.i.1976; 4♂♂, 55 km ESE of Kimba, on Kimba/Iron Knob road, 12.xii.1995, M.S. & B.J. Moulds & K.A. Kopestonsky; 32♂♂ (genitalia prep. PAU 275 and 359), 3♀♀, Penworthham, 10 km S of Clare, 10.xii.1978, M.S. & B.J. Moulds; 1♂s, 4 km N of Melrose, 10.xii.1978, M.S. & B.J. Moulds (MSM). 1♂, Penworthham, 10 km S of Clare, 10.xii.1978, M.S. & B.J. Moulds (PH). 3♂♂, S end of Clare, Main North Rd, 33°51.565'S 138°37.158'E, 419 m, 26.i.2007, K. Hill and D. Marshall (SAM).

Distribution (Fig. 34). South Australia where it is found south from Wilpena Pound in the Flinders Ranges to the Clare district north of Adelaide, and west to a little beyond Iron Knob. Adults have been taken during December and January but most likely occur at other times. The species appears to be common around Clare (type locality).

Habitat. Mallee and other eucalypts where adults often perch on the trunks and larger limbs.

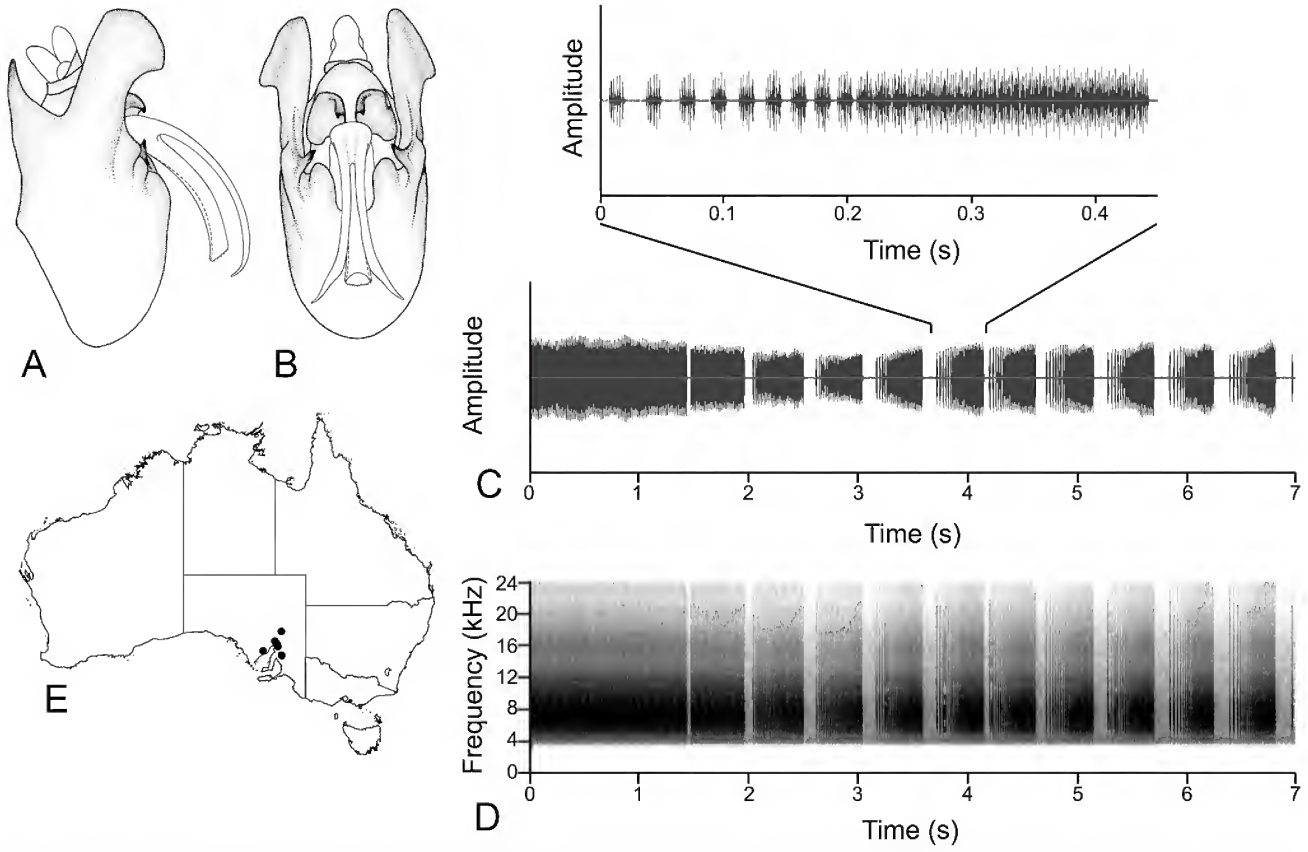


Figure 34. *Atrapsalta vinea* n.sp. *(A)* male genitalia, lateral view (genitalia prep PAU 234); *(B)* male genitalia, ventral view (genitalia prep PAU 234); *(C)* waveform of male calling song recorded from south end of Clare on Main North Rd, SA; *(D)* spectrogram of male calling song; *(E)* species distribution map.

Description

Male. *Head* slightly wider than pronotal lateral margins of pronotal collar; dominantly black. Vertex with muddy yellow spot at posterior midline. Postclypeus black with pale yellow or brown markings; usually a pale yellow or brown spot on midline around most anterior portion; lateral margins and sometimes posterior margin pale yellow or brown; transverse ridges and central groove distinct. Anteclypeus jet black. Rostrum black, usually brown proximally, reaching to or almost to apices of mid coxae. Antennae black, sometimes tending dark brown distally. Supra-antennal plates black, sometimes with a brown spot on the anterior.

Thorax. Pronotum black, with pale yellow and reddish brown markings; usually anterior margin near eyes edged pale yellow or reddish brown; fascia along midline pale yellow or reddish brown, usually not extending to anterior margin and rarely reaching distal margin; pronotal collar black, often with posterior margin reddish brown; lateral margin not ampliate. Mesonotum primarily black usually with reddish brown markings; lateral margin edged reddish brown; usually a muddy yellow or reddish brown marking following parapsidal suture, sometimes extending beyond to anterior arms of the cruciform elevation, this marking sometimes faintly projecting inwards to varying degrees around mid length; cruciform elevation black with pale yellow to reddish brown markings, with a black fascia along midline, anterior and posterior arms partly black distally. Metanotum black at hind wing base, edged pale yellow, usually black near dorsal midline.

Legs. Fore legs black to dark brown; femora black with a pale yellow to reddish brown fascia along anterior and exterior length; femora with spines black, sometimes brown distally; tibiae and tarsi black to dark brown; pretarsal claws black or brown, often tending yellowish brown distally. Mid and hind legs mostly black and pale yellow with reddish brown markings; coxae with proximal margin edged reddish brown; femora black, usually with a pale yellow exterior fascia; mid leg tibiae black; hind leg tibiae black or brown tending pale yellow proximally and distally; hind leg tarsi black tending pale yellow proximally, usually with pale yellow band around mid length. Meracanthus mostly black, with distal end and lateral exterior pale yellow.

Wings. Hyaline. Fore wing with fused stem of veins M and CuA complete, the veins fused as one; venation brown; basal membrane pale grey to blackish. Hind wing with 6 apical cells; venation brown; plaga muddy white to pale brown; black infuscation at bases of CuP, 1a, 2A, and 3A and on wing margin at distal end of vein 2A, sometimes extending and across posterior margin of anal lobe.

Opercula. For the most part not reaching distal margin of tympanal cavity; widely separated; flat other than a low rounded swelling of epimeron 3; often mostly black with distal margin pale yellow or muddy yellow, sometimes mostly yellow.

Timbals with four long ribs spanning the width of timbal membrane and one much shorter anterior rib terminating level with lower end of adjacent intercalary rib.

Abdomen. Tending triangular in cross section with epipleurites reflexed inwards from junction with tergites. Tergites dominantly black with posterior margins brown or yellow to varying degrees; tergite 1 black; tergites 2–8 black,

edged brown to pale yellow to varying degrees. Sternite I black to brownish black; sternites II–VII black to brownish black, usually with lateral sides and posterior margin pale yellow to varying degrees; sternite VIII muddy yellow to brown, sometimes tending black basally.

Genitalia (Fig. 34). Pygofer upper lobe wide and long, blinker-shaped with distal portion broadened, ventral apex bluntly hook-shaped, dorsal apex broadly rounded; basal lobe an inner spike-like projection; secondary basal lobe well-developed, in ventral view apex rounded, turned inwards slightly, ridged along much of length on outer face. Median lobe of uncus short, wider than long with a broad rounded apex. Claspers claw-like, very short, apically turned outwards, thin in ventral view, slightly concave below. Aedeagus with pseudoparameres a little longer than endotheca, slender, distally flattened in cross section, lying above endotheca in lateral view, in dorsal view parallel to each other, fused on basal fifth or so. Endotheca slightly curved, parallel sided, circular in cross-section, sclerotized but with fleshy outer covering, apex circular and finely serrated laterally and ventrally.

Female. Similar to male. Abdominal segment 9 black to dark brown with posterior lateral margins pale yellow. Ovipositor sheath extending some 0.5–1.0 mm beyond apex of abdomen; dark brown to black.

Measurements. Range and mean (in mm) for 10♂♂ and 5♀♀; includes smallest and largest of available specimens. *Length of body*: male 17.4–19.7 (18.4); female 18.3–19.2 (18.8). *Length of fore wing*: male 19.0–23.5 (20.6); female 20.3–21.6 (21.0). *Width of fore wing*: male 6.4–7.7 (7.3); female 7.5–8.3 (7.8). *Ratio length/width of fore wing*: male 3.0 (3.0); female 2.6–2.7 (2.7). *Width of head (including eyes):* male 5.0–5.9 (5.6); female 5.4–5.8 (5.7). *Width of pronotum (across lateral angles):* male 5.4–6.3 (5.9); female 5.6–6.2 (6.1).

Distinguishing features

Similar to *Haemopsalta georgina* and most species of *Atrapsalta*, but differs from all except *H. georgina* in having 6 cells in the hind wing (in *both* hind wings). Very similar to *H. georgina* although the distributions and habitats of the two species are very different. Differs from *H. georgina* in the reddish orange membranes at the wing bases and leg joints; those of *H. georgina* are muddy pale yellow or grey.

Unique amongst *encaustica* and its allies in having the pseudoparameres completely fused together on their basal fifth or so and do not curve inward towards each other throughout their length; in *Atrapsalta encaustica* and its allies the pseudoparameres are separated for their entire length.

Etymology. From the Latin *vinum,* meaning wine, and referring to the large number of vineyards in the region of South Australia where this species is found.

Song (Fig. 34). The introduction begins with an echeme lasting for an undetermined length. This is followed by the body of the song, which includes phrases composed of a series of pulses followed by an echeme. The number of pulses is usually near 10 and the echeme is less than 0.5 s long. Phrases typically occur at a rate of 2 per second. The frequency of the song ranges from 4–24 kHz.

Genus *Haemopsalta* n.gen.

Haemopsalta Owen *et al.*, 2015: 259–261, 263, 271, 273, 274, *nomen nudum*.

Type species. *Pauropsalta aktites* Ewart, 1989.

Included species. *aktites* (Ewart, 1989), n.comb.; *flammeata* n.sp.; *rubea* (Goding & Froggatt, 1904), n.comb.; *georgina* n.sp.

Etymology. From the Greek root *haem-* meaning blood, referring to the dominant red colour of most species, and from psalta, derived from *psaltria,* meaning a female harpist. Feminine.

Diagnosis

Head including eyes about as wide as mesonotum, sometimes a little narrower, sometimes a little wider; supra-antennal plate meeting or nearly meeting eye; postclypeus broadly rounded transversely across ventral midline, in lateral profile angulate between "top" and "sides"; postclypeus in dorsal view tending confluent with anterior margin of head and tending angular in outline when viewed from above.

Thorax. Pronotal collar width at dorsal midline much less than diameter of eyes; paranota confluent with adjoining pronotal sclerites, no mid lateral tooth; cruciform elevation with its dome wider than long; epimeral lobe not reaching operculum.

Legs. Fore leg femoral primary spine erect.

Wings. Hyaline. Fore wings with 8 apical cells; subapical cells absent; ulnar cell 3 angled to radial cell; basal cell long and narrow; costal vein (C) clearly higher than R+Sc; costa parallel-sided to node; pterostigma present; vein CuA only weakly bowed so that cubital cell no wider than medial cell; veins M and CuA completely fused as one before reaching basal cell; vein RA_1 aligned closely with Sc for its length and not diverging in subapical region; vein CuA_1 divided by crossvein m-cu so that proximal portion shortest; veins CuP and 1A fused in part; infuscation absent; wing outer margin developed for its total length, never reduced to be contiguous with ambient vein. Hind wings with 6 apical cells; infuscation at distal end of vein 2A spread on wing margin; width of 1st cubital cell at distal end at least twice that of 2nd cubital cell; anal lobe broad with vein 3A curved, long, separated from wing margin; veins RP and M fused basally.

Male opercula more or less reaching margin of tympanal cavity, directed towards distomedial margin of tympanal cavity, apically broadly rounded, clearly not meeting, clearly raised above level of tympanal cavity on its outer half or so.

Male abdomen in cross-section with sides of tergites straight or weakly convex, epipleurites reflexed ventrally from junction with tergites; tergites 2–7 all similar in size (2 and 3 not considerably larger); sternites III–VII in cross-section convex.

Timbals. Timbal covers absent; timbal ribs irregular in size and spaced with prominent intermediate short ribs; basal dome very large; timbals not extended below wing bases.

Male genitalia. Pygofer with distal shoulders not developed; upper pygofer lobe shape in lateral view with basal portion of dorsal margin strongly angled to axis of pygofer, very broad basally and tapering to a broad apex; dorsal beak present and a part of chitinized pygofer; pygofer basal lobe peg-like with rounded distal end; pygofer secondary basal lobe with outer face ridged longitudinally, lobe-like and domed, in lateral view

not or moderately projecting and broadly rounded, in ventral view well developed with rounded apex that is sometimes two-tiered. Uncus in dorsal view broadly rounded, flat or depressed along dorsal midline. Claspers in lateral view extending no more than a little beyond margin of pygofer, claw-like with minimum or no cavity below; claspers extreme basal region projecting forward as a broad rounded lobe. Aedeagus weakly depressed on dorsal midline; with basal plate in lateral view undulated with basal portion of basal plate directed forwards away from thecal shaft; in dorsal view tending to be Y-shaped; ventral rib completely fused with basal plate; junction between theca and basal plate with a functional "hinge" that is small and substantially compressed between theca and basal plate in lateral view; thecal shaft straight or curved in a gentle arc; pseudoparameres arising independently at the base; endotheca exposed, ridged, much of surface weakly sclerotized and in part translucent; endotheca shaft parallel-sided in apical region; endothecal ventral support absent; thecal apex entirely chitinized, thecal subapical cerci absent; flabellum absent; conjunctival claws absent; vesica retractable, vesical opening apical on theca.

The male genitalia of *Haemopsalta* show little variation between species.

Distinguishing features

Haemopsalta can be separated from all other genera by the following combination of characters: fore wing veins M and CuA with their stems meeting the basal cell completely fused as one; claspers in lateral view extending no more than a little beyond the margin of the pygofer, claw-like with minimum or no cavity below; uncus in dorsal view triangular and depressed along the dorsal midline; endotheca trumpet-shaped in apical region, the apical margin continuously serrated laterally and ventrally.

Haemopsalta flammeata n.sp.

Fig. 35, Pl. 1

Haemopsalta flammeata Owen *et al.*, 2015: 261, *nomen nudum*.

Types. *Holotype* male (molecular voucher 09.AU.QL.EXP.02) Expedition Rg., on Dawson Hwy, 24°38.658'S 149°1.292'E, 437 m, 7.i.2009, Hill, Marshall, Moulds, Owen (AM). *Paratypes*—QUEENSLAND: 1♂, 1♀, Blackdown Tableland, Expedition Range, 8,9.ix.1974, 7,8.i.1976, G. Daniels (AE). 1♂, 1♀, Expedition Rg., on Dawson Hwy, 24°38.658'S 149°1.292'E, 437 m, 7.i.2009, Hill, Marshall, Moulds, Owen (LP). 2♂♂ (one genitalia prep. PAU 255 and molecular voucher 09.AU.QL.EXP.10), 2♀♀, Expedition Rg., on Dawson Hwy, 24°38.658'S 149°1.292'E, 437 m, 7.i.2009, Hill, Marshall, Moulds, Owen; 2♂♂ (genitalia prep. PAU 246 and 2 molecular vouchers 08.AU.QL.BDL.11, 08.AU.QL.BDL.05; GenBank accessions: KM377195, KM377364, KM377436), Blackdown Tablelands N.P., 23°44.897'S 149°2.692'E, 936 m, 25.xii.2008, Hill, Marshall, Moulds, Owen; 1♂, Blackdown Tableland, Expedition Rg., 17.i.1987, M.S. & B.J. Moulds; 1♂, 1♀, same locality, 29.ix.1971, 23.xii.1972, M.S. Moulds; 1♀, same locality, 5–7.xii.1979, G. Daniels, M.A. Schneider; 2♂♂, 1♀, same locality, 8,9.ix.1974, 7,8.i.1976, G. Daniels (MSM). 1♂, 1♀, Expedition Rg., on Dawson Hwy, 24°38.658'S 149°1.292'E, 437 m, 7.i.2009, Hill, Marshall, Moulds, Owen (QM).

Distribution (Fig. 35). Known only from the vicinity of Expedition Range, central eastern Queensland, especially from the Blackdown Tableland. Adults have been taken from early November to mid January.

Habitat. Sclerophyll forest where adults live high in eucalypt trees.

Description

Male (Pl. 1). *Head* wider than lateral margins of pronotal collar; dominantly black usually with muddy yellow spot at posterior midline. Postclypeus black with light brownish red markings; usually a brownish red spot on midline around most anterior portion; posterior and lateral margins brownish red; transverse ridges and central groove distinct. Anteclypeus jet black. Rostrum brown tending black distally, reaching to or almost to apices of hind coxae. Antennae black tending white distally. Supra-antennal plates black and edged brownish red to varying degrees.

Thorax. Pronotum black, usually with brownish red markings; anterior edged pale brownish red to varying degrees; fascia along midline brownish red, extending from near head towards or to pronotal collar, sometimes expanded a little against pronotal collar; pronotal collar between lateral angles brownish red with a black spot at anterior midline, sometimes lateral angles partly black, lateral margin of pronotal collar not ampliate. Mesonotum primarily black with brownish red markings; a brownish red marking on either side following parapsidal suture and extending to or near anterior arms of the cruciform elevation, these markings often projecting inwards to varying extent around mid length and sometimes almost meeting; lower lateral area usually with a brownish red streak; scutal depressions occasionally visible as black dots; cruciform elevation brownish red with black between arms to varying extent, anterior arms with black band subapically. Metanotum black at hind wing base, remainder brownish red to pale brown, sometimes black near dorsal midline.

Legs. Fore legs black and brownish red; mostly brownish red on exterior and anterior sides, usually with a black to muddy red fascia along the exterior length of femora, sometimes a brownish red fascia along lateral interior of femora; femora with spines black, sometimes reddish brown; tibiae and tarsi black to muddy red; pretarsal claws black. Mid and hind legs mostly black and brownish red; coxae with proximal margin edged pale brownish red; femora with black interior and brownish red exterior; tibiae and tarsi reddish brown. Meracanthus mostly pale yellow to pale brownish red with a black base.

Wings hyaline. Fore wing with fused stem of veins M and CuA complete, the veins fused as one; venation brownish red becoming black distally; very small infuscation distally on clavus; basal membrane grey to black. Hind wing with 6 apical cells; venation black except for pale yellowish brown 2A and 3A; plaga muddy white to grey to pale brown; black infuscation on wing margin at distal end of vein 2A.

Opercula for the most part not reaching distal margin of tympanal cavity; widely separated; flat other than a low rounded swelling of epimeron 3; pale yellow to yellowish brown with black epimeron 3 swelling.

Timbals grey to muddy white in colour; four long ribs spanning the width of timbal membrane and sometimes one shorter anterior rib terminating before lower end of adjacent intercalary rib.

Abdomen. Tending triangular in cross section with epipleurites reflexed inwards from junction with tergites. Tergites black with brownish red to yellowish red markings. Tergite 1 black except for extreme yellowish lateral tips; tergites 2–7 black with posterior margin brownish red edged yellow to varying degrees, sometimes heaviest on lateral sides; tergite 8 black with posterior margin yellowish red to

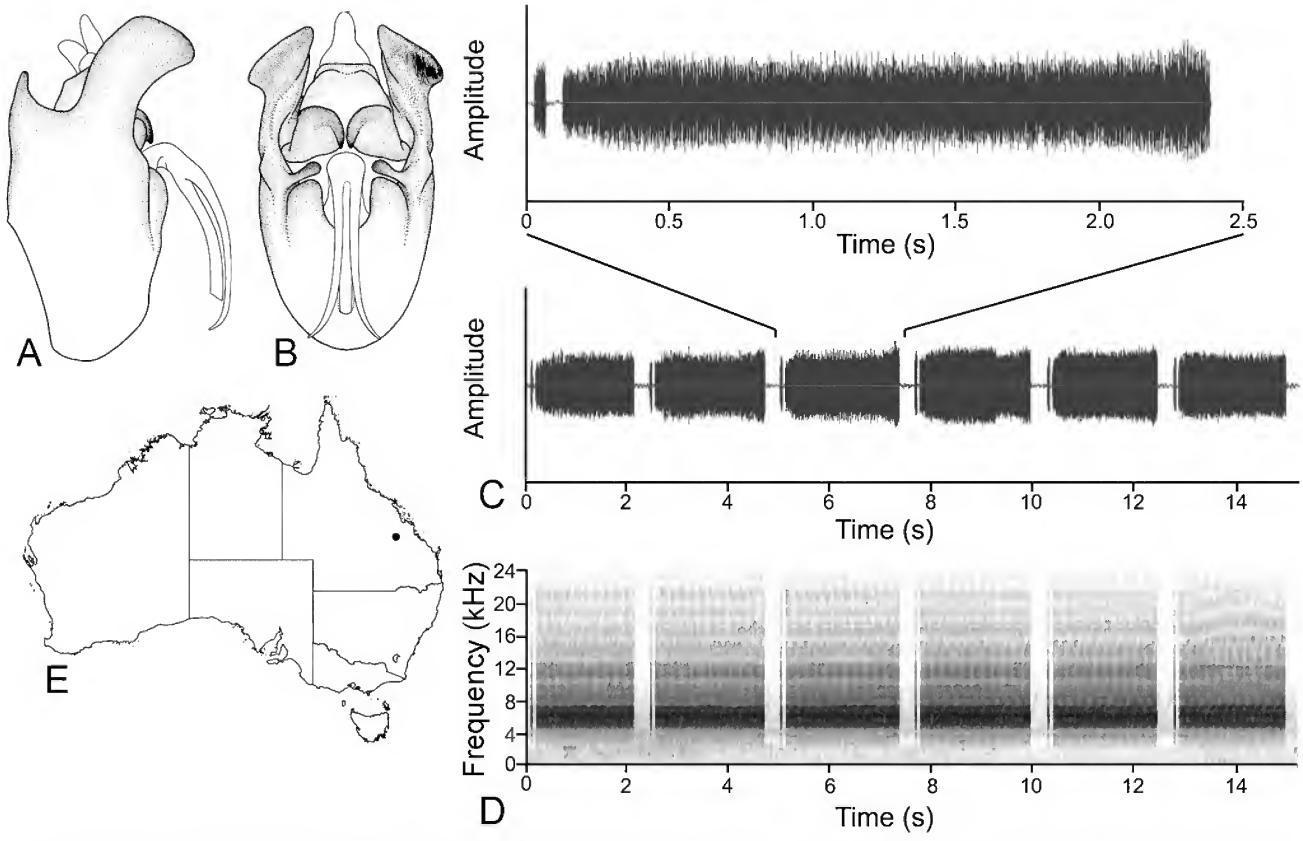


Figure 35. *Haemopsalta flammeata* n.sp. *(A)* male genitalia, lateral view (genitalia prep PAU 255); *(B)* male genitalia, ventral view (genitalia prep PAU 255); *(C)* waveform of male calling song recorded from near crest of the Expedition Range on Dawson Hwy, QLD; *(D)* spectrogram of male calling song; *(E)* species distribution map.

varying degrees. Sternite I muddy yellow with black basally; sternite II black with lateral posterior margin yellow and red to varying extent; sternites III–VI brownish red with posterior margin muddy yellow; sternite VII brownish red or black with apex and lateral margins brownish red; sternite VIII brownish red with black basally to varying extent.

Genitalia (Fig. 35). Pygofer upper lobe large, in later view slightly longer than wide, terminally asymmetrically dilated, slightly more concave along the lower margin, somewhat hooked in general appearance; pygofer basal lobe peg-like, knobbed, capitate; pygofer secondary basal lobe barely projecting in lateral view, in ventral view broad and evenly rounded. Median lobe of uncus wider than long with a broad rounded apex. Claspers claw-like, concave below, apices tending truncate in dorsal view. Aedeagus with pseudoparameres longer than endotheca, slender, flattened in cross section, lying immediately above endotheca in lateral view, in dorsal view parallel to each other but distally curved outwards. Endotheca gently curved, parallel sided, circular in cross-section, apex slightly sloping backwards ventrally, without ornamentation.

Female (Pl. 1). Similar to male. Abdominal segment 9 brown, anterior margin edged black, a black fascia along midline extending from anterior margin to, or almost to, caudal beak, a black spot on each lateral side subapically. Ovipositor sheath long, extending some 1.0–1.5 mm beyond apex of abdomen; dark brown to black.

Measurements. Range and mean (in mm) for 8♂♂ and 4♀♀; includes smallest and largest of available specimens. *Length of body*: male 15.0–18.0 (17.2); female 16.6–19.0 (17.9). *Length of fore wing*: male 19.6–22.1 (20.9); female 21.3–22.7 (22.1). *Width of fore wing*: male 6.5–7.5 (7.1); female 7.3–7.5 (7.4). *Ratio length/width of fore wing*: male 2.9–3.1 (3.0); female 2.9–3.1 (3.0). *Width of head (including eyes):* male 5.2–5.9 (5.5); female 5.7–6.0 (5.9). *Width of pronotum (across lateral angles):* male 5.2–6.0 (5.5); female 5.7–6.0 (5.9).

Distinguishing features

Distinguished from many other *Pauropsalta* species and allied genera in having 6 apical cells in the hind wings (in *both* wings) instead of 5 and a red fore wing costa and/or subcosta. Amongst those species with 6 hind wing apical cells care should be taken not to confuse this species with *Haemopsalta aktites*, *H. rubea, Palapsalta circumdata* or *Popplepsalta rubristrigata,* all species black with reddish markings.

Clearly differs from *Haemopsalta aktites* in size, the fore wing length being greater than 19 mm while that of *H. aktites* never reaches more than 17.4 mm. Males differ from those of *Popplepsalta rubristrigata* and *H. rubea* in lacking a broad fascia along the ventral midline of the abdomen. They differ from *Palapsalta circumdata* in having abdominal tergites entirely black except for a reddish or yellow posterior margin; in *Pal. circumdata* the lateral areas of abdominal segments 2–5 are dominantly reddish or yellow. The male genitalia differ from those of *Po. rubristrigata* in lacking a large sharply-pointed protruding secondary basal lobe that is clearly visible in lateral view (without dissection), and

pseudoparameres that are much longer than the endotheca. There appears to be no consistent difference in male genitalia between this species and *H. rubea.*

Females differ from *Po. rubristrigata* and *Pal. circumdata* in having the ovipositor sheath just passing the end of the abdominal segment 9 rather than very long and extending more than at least 2 mm beyond. They differ from *H. rubea* in lacking a broad fascia along the ventral midline of the abdomen.

Etymology. From Latin *flamma,* meaning flame, referring to the red on the abdomen of this species.

Song (Fig. 35). The song is composed of a series of phrases that include a single click followed by an echeme. The echeme is usually c. 2 s in length. Each phrase is c. 2 s in length. The phrases occur at a rate of c. 0.4 phrases per second. The frequency of song occurs between 2 kHz and 22 kHz.

Haemopsalta georgina n.sp.

Fig. 36, Pl. 5

Haemopsalta georgina Owen *et al.*, 2015: 261, 274, *nomen nudum.*

Types. *Holotype* male (molecular voucher 11.AU.TS.FTN.06, song recorded), NW of Fern Tree on Huon Rd, SW edge of Hobart, Tasmania, 201 m, 42°54.070'S 147°17.628'E, 21.i.2011, K. Hill, D. Marshall (AM). *Paratypes*—TASMANIA: 1♂, 1♀, "Hillside", Church Rd, Broadmarsh, 42°40.982'S 147°7.253'E, 31.xii.2009, G.A.D. Davis (AM). 1♂, 1♀, "Hillside", Church Rd, Broadmarsh, 42°40.982'S 147°7.253'E, 31.xii.2009, G.A.D. Davis (ANIC). 57♂♂, 42♀♀, "Hillside", Church Rd, Broadmarsh, 42°40.982'S 147°7.253'E, 2.i.2000, 20.i.2002, 18.xii.2004, 23.xii.2004, 30.xii.2004, 31.xii.2007, 5.i.2008, 6.i.2008, 10.i.2008, 31.xii.2009, 13.i.2009, G.A.D. Davis; 7♂♂, Cygnet, EN5022178297260, Snug Falls Rd, 25.xi.1999, 27.xi.1999, G.A.D. Davis (GAD); 1♂ (molecular voucher 11.AU.TS.POD.01, song recorded), 0.8 km SW of Poatina on Poatina Rd, 345 m, 41°48.167'S 146°56.979'E, 23.i.2011, K. Hill, D. Marshall; 1♂ (molecular voucher 11.AU.TS.OUS.02, song recorded), NW of Hamilton, 6 km NW of Ouse on Lyell Hwy, 247 m, 42°26.508'S 146°39.810'E, 26.i.2011, K. Hill, D. Marshall; 3♂♂ (1 molecular voucher 11.AU.TS.FTN.04, song recorded; 1 genitalia prep. 513, molecular voucher 11.AU.TS.FTN.02, song recorded; GenBank accessions: KM377194, KM377260, KM377397, KM377576, KM668274), NW of Fern Tree on Huon Rd, SW edge of Hobart, 201 m, 42°54.070'S 147°17.628'E, 21.i.2011, K. Hill, D. Marshall; 1♂ (molecular voucher 11.AU.TS.SNG.02, song recorded), Snug Falls Rd, c. 4 km SW of Snug, 264 m, 43°05.119'S 147°13.260'E, 26.i.2011, K. Hill, D. Marshall; 1♂, 1♀, "Hillside", Church Rd, Broadmarsh, 42°40.982'S 147°7.253'E, 18.xii.2004, 31.xii.2009, G.A.D. Davis (MSM). 1♂, 1♀, "Hillside", Church Rd, Broadmarsh, 42°40.982'S 147°7.253'E, 31.xii.2009, G.A.D. Davis (MV). 1♂, 1♀, "Hillside", Church Rd, Broadmarsh, 42°40.982'S 147°7.253'E, 31.xii.2009, G.A.D. Davis (NHM). 1♂, 1♀, "Hillside", Church Rd, Broadmarsh, 42°40.982'S 147°7.253'E, 31.xii.2007, 31.xii.2009, G.A.D. Davis (QM). 1♂, 1♀, "Hillside", Church Rd, Broadmarsh, 42°40.982'S 147°7.253'E, 31.xii.2009, G.A.D. Davis (SAM). 1♂, 1♀, "Hillside", Church Rd, Broadmarsh, 42°40.982'S 147°7.253'E, 31.xii.2009, G.A.D. Davis (WAM).

Distribution (Fig. 36). Endemic to Tasmania where there are records from Poatina (345 m) in the central north of the island, near Ouse (247 m) northwest of Hobart, near around Hobart (200–280 m), and south to Snug (240–264 m). Adults have been taken from late November to late January and are sometimes locally common.

Habitat. Eucalypt forest where adults are sometimes quite low. Eucalypts common in the habitat include Silver Peppermint, *Eucalyptus tenuiramis* Stringybark, *E. obliqua*, Whitegum, *E. viminalis*, Black Peppermint, *E. amygdalina* and Mountain Whitegum, *E. dalrympleana.* Understory species are varied in density and variety but Silver Wattle, *Acacia dealbata*, Blackwood, *Acacia melanoxylon*, Native Cherry, *Exocarpos cupressiformis*, Dolly Bush, *Cassinia aculeata* and Bracken, *Pterideum esculentum* are present in nearly all situations.

Description

Male (Pl. 5). *Head* wider than lateral margins of pronotal collar; dominantly black usually with muddy yellow spot at posterior midline. Postclypeus black with light brownish red markings; usually a brownish red spot on midline around most anterior portion; posterior and lateral margins brownish red; transverse ridges and central groove distinct. Anteclypeus jet black. Rostrum black tending brown distally, reaching to or slightly beyond apices of mid coxae. Antennae black. Supra-antennal plates black.

Thorax. Pronotum black, usually with brownish red or dull yellow markings; fascia along midline brownish red or dull yellow, extending from near head towards pronotal collar to varying degrees; pronotal collar between lateral angles black, posterior margin edged brownish red to varying degrees, lateral margin of pronotal collar not ampliate. Mesonotum primarily black with brownish red markings; usually a brownish red marking on either side following parapsidal suture variable in length, but usually extending near to anterior arms of the cruciform elevation; lower lateral area usually edged brownish red; cruciform elevation brownish red to dull yellow with black fascia along midline and black between arms to varying extent, anterior arms tending black distally, posterior arms sometimes partly black. Metanotum black at hind wing base, remainder dull yellow, brownish red or orange.

Legs. Fore legs black and brownish red; femora black except for brownish red fascia along interior and dorsal lengths, usually a brownish red band along distal anterior margin; femora with spines black, sometimes brown distally; tibiae and tarsi black; pretarsal claws black to dark brown. Mid and hind legs mostly black and brownish red; coxae and femora black, sometimes yellowish at distal end; tibiae black or brownish red with a proximal pale yellow band; tarsi reddish brown or black. Meracanthus mostly pale yellow with a black base.

Wings hyaline. Fore wing with fused stem of veins M and CuA complete, the veins fused as one; venation black; very small infuscation distally on clavus; basal membrane grey to black. Hind wing with 6 apical cells; venation black except for pale yellowish brown 2A and 3A; plaga muddy white to grey to pale brown; black infuscation on wing margin at distal end of vein 2A.

Opercula for the most part not reaching distal margin of tympanal cavity; widely separated; flat other than a low rounded swelling of epimeron 3; pale yellow to yellowish brown with black epimeron 3 swelling.

Timbals grey to muddy white in colour; four long ribs spanning the width of timbal membrane and sometimes one shorter anterior rib terminating a little before lower end of adjacent intercalary rib.

Abdomen. Tending triangular in cross section with epipleurites reflexed inwards from junction with tergites. Tergites black with brownish red or muddy yellow markings. Tergites 1 and 2 black, occasionally with posterior edged brownish red; tergites 3–7 black with posterior margin

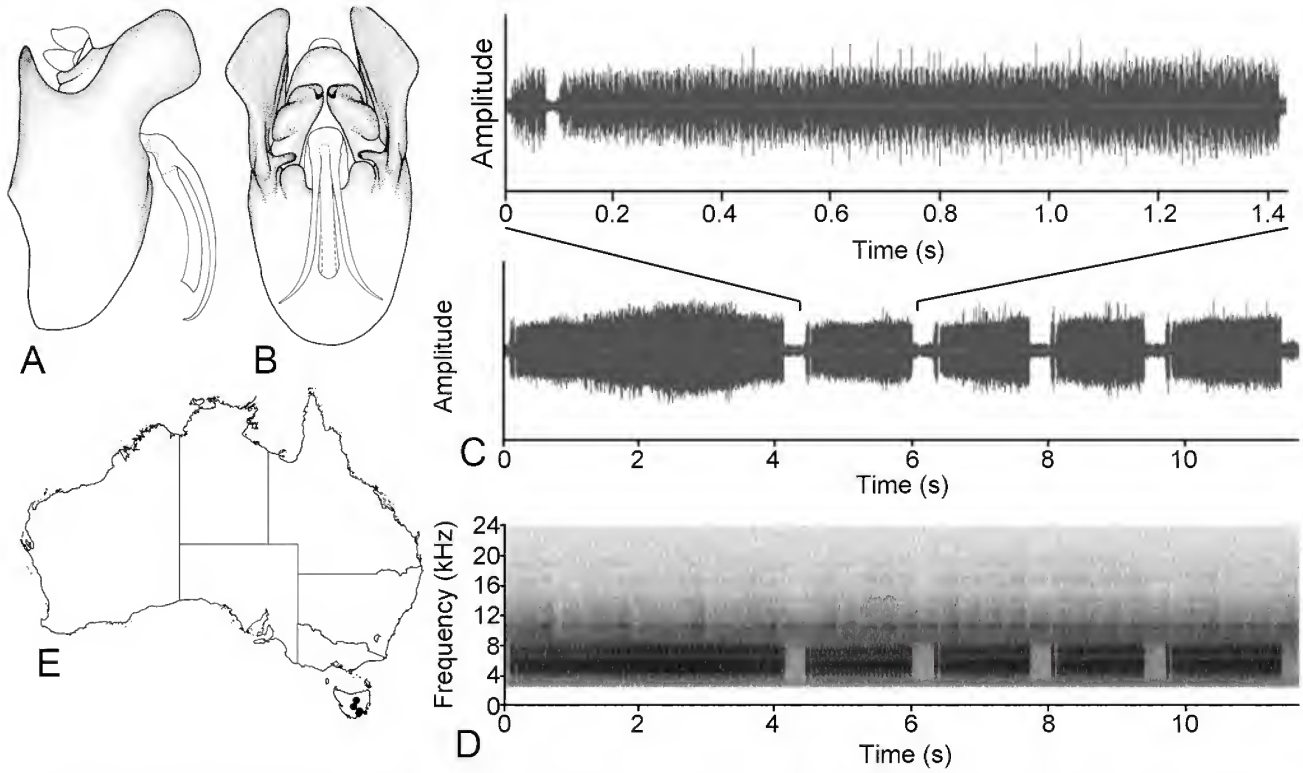


Figure 36. *Haemopsalta georgina* n.sp. *(A)* male genitalia, lateral view (genitalia prep PAU 513); *(B)* male genitalia, ventral view (genitalia prep PAU 513); *(C)* waveform of male calling song recorded from northwest of Fern Tree (NW of road to Mt. Wellington) on B64, TAS; *(D)* spectrogram of male calling song; *(E)* species distribution map.

edged brownish red; tergite 8 black with posterior margin muddy yellow. Sternite I black; sternite II black with lateral posterior margin brownish red to varying extent; sternites III–VI black with posterior edged brownish red to varying degrees; sternite VII black with distal end muddy yellow and lateral posterior margin brownish red; sternite VIII muddy yellow with black basally to varying extent.

Genitalia (Fig. 36). Pygofer upper lobe large, in later view slightly longer than wide, terminally slightly asymmetrically dilated, slightly more concave along the lower margin, somewhat hooked in general appearance. Pygofer basal lobe peg-like, knobbed, capitate. Pygofer secondary basal lobe barely projecting in lateral view, in ventral view broad and evenly rounded. Median lobe of uncus wider than long with a broad rounded apex, depressed on dorsal surface. Claspers claw-like; concave below; apices diverging in ventral view tending truncate in dorsal view. Aedeagus with pseudoparameres longer than endotheca, slender, flattened in cross section, lying immediately above endotheca in lateral view, in dorsal view gradually diverging but distally curved outwards. Endotheca gently curved, parallel sided, circular in cross-section, apex slightly sloping backwards ventrally, without ornamentation.

Female. Similar to male. Abdominal segment 9 black with lateral margins yellowish orange to varying degrees. Ovipositor sheath extending some 0.5–1.0 mm beyond apex of abdomen; dark brown to black.

Measurements. Range and mean (in mm) for 10♂♂ and 10♀♀; includes smallest and largest of available specimens. *Length of body*: male 18.0–20.3 (19.3); female 18.2–20.2 (19.3). *Length of fore wing*: male 20.2–23.2 (21.8); female 20.7–23.0 (22.0). *Width of fore wing*: male 7.4–8.7 (8.0); female 7.6–8.8 (8.2). *Ratio length/width of fore wing*: male 0.3–0.4 (0.4); female 0.3–0.4 (0.4). *Width of head (including eyes):* male 5.5–6.3 (5.9); female 5.6–6.2 (5.9). *Width of pronotum (across lateral angles):* male 5.6–6.7 (6.3); female 5.9–6.9 (6.4).

Distinguishing features

Similar to most other species of *Atrapsalta* but differs from all except *A. vinea* in having 6 cells in the hind wing (in *both* hind wings). Very similar to *A. vinea* although the distributions and habitats of the two species are very different. Differs from *A. vinea* in the muddy pale yellow or grey membranes at the wing bases and leg joints; those of *Haemopsalta georgina* are reddish orange.

The male genitalia have upper pygofer lobes that broaden distally, small knob-like basal lobes, small beak-like claspers, an aedeagus with pseudoparameres that lie a little above the endotheca, and a simple termination to the endotheca.

Etymology. Named after Georgina L. Davis B.Sc. Hons. in recognition of her contributions to botanical, ichthyological and entomological illustration; daughter of George Davis who first discovered the species and who has collected the majority of specimens.

Song (Fig. 36). The song is composed of a series of phrases each with a click followed immediately by an echeme. Echemes can range in length from 1.5–4.2 s. The frequency of the song ranges from 4–8 kHz.

Haemopsalta rubea (Goding & Froggatt, 1904) n.comb.

Pl. 1

Haemopsalta rubea Owen *et al.*, 2015: 263, *nomen nudum*

On the identity of *Haemopsalta rubea*

Goding & Froggatt (1904) described *H. rubea* from several specimens collected from "Brisbane". Ewart (1989) designated a lectotype for *rubea* and placed *Melampsalta geisha* Distant (from Stradbroke island) as a junior synonym. He considered *H. rubea* to be a species with a wide distribution extending as far north as Herberton in far northern Queensland and as far south as Sydney. DNA and song recordings suggest that *H. rubea* may be a complex of closely related species, but we do not have sufficient data to address this difficult group.

Distribution. Northwestern portion of the Windsor Tableland, the Herberton district, the western slopes of the Paluma Range and Townsville in northern Queensland; Lake Elphinstone (100 km WSW of Mackay) and the Expedition Range in central Queensland; southeastern Queensland south from near Gladstone and inland to Kroombit Tops, Miles and near Texas, but mainly coastal including much of Brisbane, Moreton and Stradbroke Islands; and coastal districts of NSW south to Sydney; also from the Capertee River Valley (an inland extension of the deep valley system formed by the eastern-flowing Colo River). The species is sometimes locally common. Adults have been taken from late October to early April, but most records are for January.

The specimens mentioned by Goding & Froggatt (1904) from northwestern Australia are not this species.

Distinguishing features

See Ewart (1989) and Moulds (1990) for descriptions and figures of this species. Distinguished from many species of *Pauropsalta* and allied genera in having 6 apical cells in the hind wings (in *both* wings) instead of 5 and a red fore wing costa and/or subcosta. Amongst those species with 6 hind wing apical cells care should be taken not to confuse this species with *Popplepsalta rubristrigata, Haemopsalta aktites, Haemopsalta flammeata* or *Palapsalta circumdata,* all species black with reddish markings.

Haemopsalta rubea differs from *Po. rubristrigata* in its smaller size; *rubea* has a fore wing length of 19 mm or less while *Po. rubristrigata* has a fore wing greater than 24 mm.

Males differ from those of *Haemopsalta aktites* and *Haemopsalta flammeata* in having a broad black fascia along the ventral midline of the abdomen. They differ from *Pal. circumdata* in having the broad black fascia occupying much of the abdomen below, while *Pal. circumdata* has the black confined to the midline and is usually interrupted at sternite junctions.

Females differ from *Po. rubristrigata* and *Pal. circumdata* in having the ovipositor sheath just passing the end of the abdominal segment 9 rather than very long and extending more than at least 2 mm beyond abdomen. They differ from *H. aktites* and *H. flammeata* in having a broad fascia along ventral midline of abdomen.

Genus *Palapsalta* Moulds, 2012

Palapsalta Moulds, 2012: 167–169.

Type species. *Melampsalta eyrei* Distant, 1882. By original designation.

Included species. *circumdata* (Walker, 1852); *eyrei* (Distant, 1882); *palaga* n.sp.; *serpens* n.sp. *virgulata* (Ewart, 1989); *vitellina* (Ewart, 1989).

Revised diagnosis

As defined by Moulds (2012) with the following additions: *Head:* postclypeus in dorsal view tending angular in outline but also confluent with anterior margin of head. *Male genitalia:* upper pygofer lobe shape in lateral view with basal portion of dorsal margin strongly angled to axis of pygofer, very broad basally and tapering to a broad apex; pygofer basal lobe flap-like, sometimes turned inwards, except in *Palapsalta virgulata, Pal. circumdata* and *Pal. vitellina* where it is spike-like; pygofer secondary basal lobe plate-like and well developed with outer face rounded, in lateral view clearly projecting and subtriangular with a broad base tapering to a pointed apex, in ventral view long and finger-like, except in *Pal. circumdata* and *Pal. vitellina* where it is lobe like and domed; uncus in dorsal view triangular with dorsal surface either flat or domed; claspers in lateral view extending no more than a little beyond margin of pygofer, claw-like with minimum or no cavity below except in *Pal. serpens* where claspers are long, projecting outward far beyond margin of pygofer and cavernous below for most of length; claspers with extreme basal region concave and not developed forward; pseudoparameres partly fused beyond their bases; endotheca dorsal region sclerotized less than lateral and ventral surfaces; endothecal shaft parallel-sided in apical region.

Palapsalta palaga n.sp.

Fig. 37, Pl. 1

Palapsalta palaga Owen *et al.*, 2015: 263, *nomen nudum*.

Types. *Holotype* male, Dugalt R. x-ing, 75 km N of Cloncurry, Queensland, 17.xii.1991, M.S & B.J. Moulds (AM). *Paratypes*—NORTHERN TERRITORY: 2♂♂ (one molecular voucher 07.AU.NT.TIL.01, genitalia prep. PAU 523; one molecular voucher 07.AU.NT.TIL.02; GenBank accessions: KM377226, KM377253, KM377467, KM668344), Napperby Ck, Tilmouth Well on Tanami Rd, 22°48.667'S 132°35.730'E, 30.i.2007, K. Hill, D. Marshall; 1♂ (molecular voucher 10.AU.NT.PLG.01), Edwards Ck, 45 km E of Stuart Hwy on Plenty Hwy, 22°58.263'S 134°00.705'E, 5.ii.2010, 680 m, K. Hill, D. Marshall (AM). 16♂♂, 30♀♀, Tilmouth Well, Napperby Creek, 22°48'40"S 132°35'40"E, 13–14.i.2001, M.S. & B.J. Moulds; 6♂♂, Napperby Ck, Tilmouth Well on Tanami Rd, 22°48.667'S 132°35.730'E, 30.i.2007, K. Hill, D. Marshall (MSM). QUEENSLAND: 4♂♂, 4♀♀, Dugalt R. x-ing, 75 km N of Cloncurry, 17.xii.1991, M.S & B.J. Moulds (AE). 4♂♂, 4♀♀, Dugalt R. x-ing, 75 km N of Cloncurry, 17.xii.1991, M.S & B.J. Moulds (AJE). 1♂ (molecular voucher 04.QLD.GFM.05), approx. 15 km N of Mt Isa, Barkly Hwy, 20°34'S 139°29'E, 17.i.2004, Cooley, Hill, Marshall, Moulds; 1♂ (molecular voucher 08.AU.QL.MTI.01), Mt Isa, Edna Medley Park, 20°42.540'S 139°30.131'E, 347 m, 15.ii.2008, K. Hill, D. Marshall, M. Moulds, C. Cowan, M. Humphrey; 4♂♂, 4♀♀, Dugalt R. x-ing, 75 km N of Cloncurry, 17.xii.1991, M.S & B.J. Moulds (AM). 4♂♂, 4♀♀, Dugalt R. x-ing, 75 km N of Cloncurry, 17.xii.1991, M.S & B.J. Moulds (ANIC). 4♂♂, 4♀♀, Dugalt R. x-ing, 75 km N of Cloncurry, 17.xii.1991, M.S & B.J. Moulds (DE).4♂♂, 4♀♀, Dugalt R. x-ing, 75 km N of Cloncurry, 17.xii.1991, M.S & B.J. Moulds (GAD). 4♂♂, 4♀♀, Dugalt R. x-ing, 75 km N of Cloncurry, 17.xii.1991, M.S & B.J. Moulds (JO). 4♂♂, 4♀♀, Dugalt R. x-ing, 75 km N of Cloncurry, 17.xii.1991, M.S & B.J. Moulds (LP). 3♂♂, Mt Isa, Edna Medley Park, 20°42.540'S 139°30.131'E, 347 m, 15.ii.2008, K. Hill, D. Marshall, M. Moulds, C. Cowan, M. Humphrey; 1♂, Butchers Creek, 20 km W of Cloncurry, 21.i.1977, M.S.

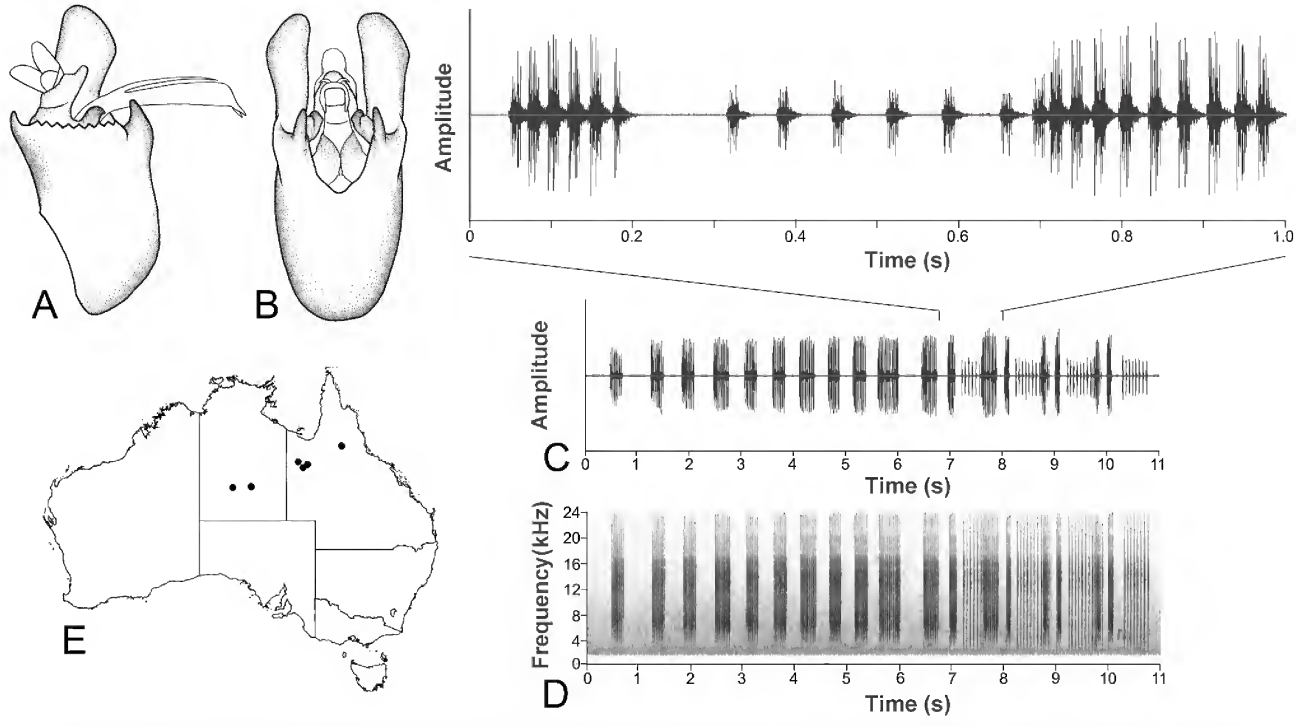


Figure 37. *Palapsalta palaga* n.sp. *(A)* male genitalia, lateral view (genitalia prep PAU 20); *(B)* male genitalia, ventral view (genitalia prep PAU 20); *(C)* waveform of male calling song recorded from Routh Creek, east of Georgetown, on Gulf Development Rd, QLD; *(D)* spectrogram of male calling song; *(E)* species distribution map.

& B.J. Moulds; 198♂♂ (two genitalia preps PAU 21, PAU 102), 186♀♀, Dugalt R. x-ing, 75 km N of Cloncurry, 17.xii.1991, M.S & B.J. Moulds; 3♀♀, Slaty Ck, S of Cloncurry, 20°53'19"S 140°20'45"E, 6.i.2001, M.S. & B.J. Moulds; 35♂♂ (one genitalia prep. PAU 20), 21♀♀, Routh Ck, 21 km E of Georgetown, 4.i.1990, M.S. & B.J. Moulds; 16♂♂, 12♀♀, Routh Ck., E of Georgetown, 18°17.442'S 143°42.802'E, 450 m, 4.ii.2008, K. Hill, D. Marshall, M. Moulds, C. Owen, M. Humphrey (MSM). 4♂♂, 4♀♀, Dugalt R. x-ing, 75 km N of Cloncurry, 17.xii.1991, M.S & B.J. Moulds (MV). 4♂♂, 4♀♀, Dugalt R. x-ing, 75 km N of Cloncurry, 17.xii.1991, M.S & B.J. Moulds (NHM). 8♂♂, Napperby Ck, Tilmouth Well on Tanami Rd, 22°48.667'S 132°35.730'E, 30.i.2007, K. Hill, D. Marshall; 4♀♀, Dugalt R. x-ing, 75 km N of Cloncurry, 17.xii.1991, M.S & B.J. Moulds (NTM). 4♂♂, 4♀♀, Dugalt R. x-ing, 75 km N of Cloncurry, 17.xii.1991, M.S & B.J. Moulds (PH). 4♂♂, 4♀♀, Dugalt R. x-ing, 75 km N of Cloncurry, 17.xii.1991, M.S & B.J. Moulds (QM). 4♂♂, 4♀♀, Dugalt R. x-ing, 75 km N of Cloncurry, 17.xii.1991, M.S & B.J. Moulds (SAM). 4♂♂, 4♀♀, Dugalt R. x-ing, 75 km N of Cloncurry, 17.xii.1991, M.S & B.J. Moulds (WAM).

Distribution (Fig. 37). Northern Territory where there are records from Tilmouth Well (some 160 km northwest of Alice Springs) and Edwards Creek (on the Plenty Highway), and in Queensland where it is widespread around Mount Isa and Cloncurry and at Routh Creek (21 km east of Georgetown). There are records from mid December to early February but adults probably occur over a much wider time frame. At times it can be exceptionally abundant.

Habitat. Eucalypts growing along creek margins.

Description

Male (Pl. 1). *Head* wider than lateral margins of pronotal collar but as wide as or narrower than lateral angles; dominantly black with orange spot at posterior midline. Eyes of live specimens cherry red. Postclypeus orange with broad black fascia along midline; transverse ridges and central groove distinct. Anteclypeus jet black. Rostrum orange brown tending black distally, reaching to or just beyond apices of mid coxae. Antennae orange brown to black, sometimes tending orange distally. Supra-antennal plates orange becoming black or dark brown towards eyes.

Thorax. Pronotum black with orange markings; anterior margin edged orange to varying degrees; fascia along midline orange, extending from head to pronotal collar, widest near head and pronotal collar; usually a black spot on midline adjacent to pronotal collar; pronotal collar orange with lateral margin not, or barely, ampliate. Mesonotum orange with black markings; lateral and submedian sigilla black or tending so; usually black or brown between anterior arms of cruciform elevation often incorporating scutal depressions that are always highlighted black; midline often marked black or brown; cruciform elevation dominantly orange. Metanotum partly black at hind wing bases, remainder orange.

Legs. Fore legs orange; coxae usually with a short black streak along anterior proximal area; femora with spines orange tending brown distally; pretarsal claws tipped black. Mid and hind legs orange; coxae with proximal margin edged brown. Meracanthus orange.

Wings. Hyaline. Fore wing with fused stem of veins M and CuA completely fused as one before meeting basal cell; venation yellow tending brown distally; basal membrane orange. Hind wing with 6 apical cells; venation brown except for pale yellowish brown 2A, 3A, and CuA; plaga muddy white to pale brown; inconspicuous black infuscation on wing margin at distal end of vein 2A.

Opercula. For the most part reaching distal margin of tympanal cavity; widely separated; a low rounded swelling of epimeron 3 and concave below meracanthus; orange, sometimes brown on epimeron 3 swelling.

Timbals. Grey to muddy white in colour; four long ribs spanning the width of timbal membrane and one shorter anterior rib terminating level with upper end of adjacent intercalary rib.

Abdomen. Tending triangular in cross section with epipleurites reflexed inwards from junction with tergites.

Tergites orange with brown markings; tergite 1 orange, sometimes partly brown; tergites 2–7 orange with brown on and around midline to varying degrees; tergite 8 black with posterior margin orange brown. Sternite I–VI orange; sternite VII brownish black with orange along anterior margin; sternite VIII brownish black basally, thereafter orange brown.

Genitalia (Fig. 37). Pygofer upper lobe large; in lateral view slightly longer than wide, terminally asymmetrically dilated but not hooked, only slightly more concave along the margin closest to the basal lobe. Basal pygofer lobe undeveloped, flap-like. Secondary basal lobe plate-like, in lateral view clearly projecting and subtriangular, in ventral view flattened laterally and spike-like. Median lobe of uncus wider than long with a rounded apex, duck-bill shape. Claspers claw-like, of medium width in dorsal view, apices pointed and turned outwards. Aedeagus with pseudoparameres shorter than theca, slender, slightly flattened in cross section, lying immediately above theca in lateral view, in dorsal view parallel to each other and not distally curved. Theca nearly straight, parallel sided, circular in cross-section, distally increasing in diameter; apically sloping forward with a spike-like projection at each lateroventral corner.

Female (Pl. 1). Similar to male. Abdominal segment 9 orange brown with a brown subdorsal fascia on each side of midline extending from the anterior margin to, or near to, posterior margin, sometimes joining posteriorly and extending to caudal beak; a black spot on each lateral side. Ovipositor sheath long, extending some 3.0–3.5 mm beyond apex of abdomen; dark brown to black.

Measurements. Range and mean (in mm) for 10♂♂ and 10♀♀; includes smallest and largest of available specimens. *Length of body*: male 14.7–18.8 (17.4); female 17.6–23.8 (21.9). *Length of fore wing*: male 18.1–22.5 (20.8); female 20.3–23.9 (22.8). *Width of fore wing*: male 6.1–7.9 (7.2); female 6.6–8.8 (7.9). *Ratio length/width of fore wing*: male 2.8–3.0 (2.9); female 2.7–3.1 (2.9). *Width of head (including eyes):* male 4.7–6.0 (5.5); female 5.4–6.6 (6.0). *Width of pronotum (across lateral angles):* male 4.4–6.3 (5.5); female 5.0–6.7 (6.1).

Distinguishing features

Care should be taken not to confuse this species with *Palapsalta vitellina* or *Pal. eyrei*. Fresh specimens of *Pal. palaga* differ in having cherry red eyes instead of black or grey eyes. Males of *Pal. palaga* differ from those of *Pal. eyrei* (apart from being usually larger) in having a much larger operculum that in part extends clearly beyond the margin of the tympanal cavity while that of *Pal. eyrei* does not reach or barely reaches the distal margin. Males of *Pal. palaga* nearly always differ from *Pal. vitellina* in having no or minimal black or grey on the dorsal surface of abdominal segment 1 while *Pal. vitellina* has this area substantially or entirely black or grey; it is necessary to compare the male genitalia of doubtful specimens. Females are easily distinguished from both *Pal. vitellina* and *Pal. eyrei* by the length of the ovipositor sheath; that of *Pal. palaga* is very long, the projection beyond the apex of abdominal segment 9 about equal to the distance between the eyes, unlike that of *Pal. vitellina* and *Pal. eyrei* which projects far less than the distance between the eyes.

Etymology. From the Latin *palaga,* meaning ingot of gold, referring to the dominant yellow colour of this species.

Song (Fig. 37). The song introduction includes a series of echemes followed by a series of click and an echeme for each phrase. Generally, the introduction lasts for at least 6 seconds with c. 2 echemes per second. In each phrase, usually 6–9 clicks precede an echeme. Each echeme usually lasts < 0.5 s and is followed by a shorter echeme. Phrases are c. 1 s in length and occur at a rate of c. 0.9 per second. The song frequency ranges from 4–24 kHz with the dominant frequency between 6 kHz and 16 kHz.

Palapsalta serpens n.sp.

Fig. 38, Pl. 4

Palapsalta serpens Owen *et al.*, 2015: 261, *nomen nudum*.

Types. *Holotype* male (genitalia prep. PAU332, molecular voucher 04.AU.NTR.WSM.12; GenBank accessions: KM377168, KM377276, KM377497, KM668228), 15 km N of Mataranka, Northern Territory, 14°50.4'S 132°58.4'E, 170 m, 21.i.2004, Cooley, Hill, Marshall, Moulds (NTM). *Paratypes*—NORTHERN TERRITORY: 1♂, Buchanan Hwy, 10 km W of Stuart Hwy jct, nr Dunmarra, 16°38'S 133°17'E, 26.i.2004, Cooley, Hill, Marshall, Moulds (AE). 1♂, Buchanan Hwy, 10 km W of Stuart Hwy jct, nr Dunmarra, 16°38'S 133°17'E, 26.i.2004, Cooley, Hill, Marshall, Moulds (AM). 1♂, Buchanan Hwy, 10 km W of Stuart Hwy jct, nr Dunmarra, 16°38'S 133°17'E, 26.i.2004, Cooley, Hill, Marshall, Moulds (LP). 8♂♂ (two molecular vouchers 04.AU.NTR.KWW.20 and 04.AU.NTR.KWW.04), 2♀♀, 30 km W of Katherine, 14°40.8'S 132°05.1'E, 163 m, 24.i.2004, Cooley, Hill, Marshall, Moulds; 7♂♂ (one molecular voucher 04.AU.NTR.WSM.11), 15 km N of Mataranka, 14°50.4'S 132°58.4'E, 170 m, 21.i.2004, Cooley, Hill, Marshall, Moulds; 6♂♂ (one genitalia prep. PAU 331), Edith River, Stuart Hwy, 14°11.073'S 132°01.695'E, 118 m, 21.ii.2008, K. Hill, D. Marshall, M. Moulds, C. Owen, M. Humphrey; 2♂♂, Arnhem Hwy just W of Mary R., 12°50.073'S 131°56.410'E, 60 m, 20.ii.2008, K. Hill, D. Marshall, M. Moulds, C. Owen, M. Humphrey; 3♂♂, Elsey Cemetery, S of Mataranka, 15°04.852'S 133°07.355'E, 2.ii.2006, Hill, Marshall, Moulds; 2♂♂ (one molecular voucher 08.AU.NT.KJC.01), jct Kakadu and Stuart Hwys, 13°48.899'S 131°49.845'E, 209 m, 19.ii.2008, K. Hill, D. Marshall, M. Moulds, C. Owen, M. Humphrey; 1♂, c. 35 km SW of Katherine, 14°42.804'S 132°03.747'E, 103 m, 22.ii.2008, K. Hill, D. Marshall, M. Moulds, C. Owen, M. Humphrey; 1♂, approx. 40 km SW of Katherine, 14°53.8'S 131°53.6'E, 25.i.2004, Cooley, Hill, Marshall, Moulds; 2♂♂ (one genitalia prep. PAU 330 and molecular voucher 08.AU.NT.KAM.03), Kambolgie Ck, Kakadu N.P., 13°30.284'S 132°23.513'E, 108 m, 20.ii.2008, K. Hill, D. Marshall, M. Moulds, C. Owen, M. Humphrey; 6♂♂ (one genitalia prep. PAU 333), Kakadu Hwy, 20 km, N of Gunlom Falls rd, Kakadu N.P., 13°23.459'S 132°16.161'E, ii.2008, Hill, Marshall, Moulds, Owen & Humphrey; 1♂, 36.4 km W of Roper Bar, 14°44.751'S 134°14.420'E, 55 m, 3.ii.2006, Hill, Marshall, Moulds; 1♂, 115 km SSE of Mataranka, 15°51.663'S 133°24.285'E, 195 m, 1.ii.2006, Hill, Marshall, Moulds; 6♂♂ (one genitalia prep. PAU 334), Buchanan Hwy, 10 km W of Stuart Hwy jct, nr Dunmarra, 16°38'S 133°17'E, 26.i.2004, Cooley, Hill, Marshall, Moulds (MSM). 1♂ (molecular voucher 08.AU.NT.KAM.01), Kambolgie Ck, Kakadu N.P., 13°30.284'S 132°23.513'E, 108 m, 20.ii.2008, K. Hill, D. Marshall, M. Moulds, C. Owen, M. Humphrey (NTM).

Distribution (Fig. 38). Top End of the Northern Territory where it is known from an area bordered by the Arnhem Highway in the north, Dunmarra in the south, the Katherine district to the west, and east almost to Roper Bar. It is usually a common species during January and February but population densities never seem to be high.

Habitat. Open woodland where adults prefer the higher branches of eucalypts.

Description

Male (Pl. 4). *Head* as wide as or a little narrower than lateral angles of pronotum; dominantly black. Vertex with muddy yellow spot at posterior midline. Postclypeus black with brown markings; usually a reddish brown spot on

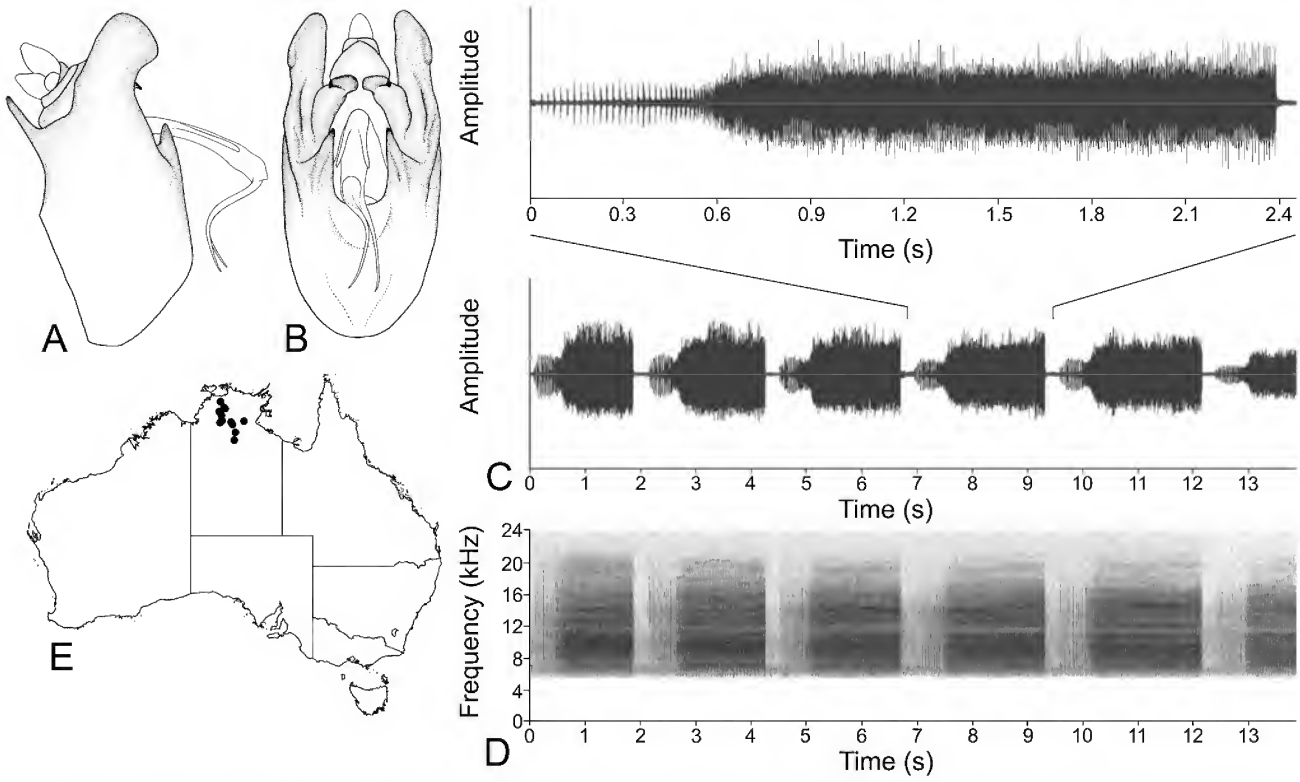


Figure 38. *Palapsalta serpens* n.sp. *(A)* male genitalia, lateral view (genitalia prep PAU 330); *(B)* male genitalia, ventral view (genitalia prep PAU 330); *(C)* waveform of male calling song recorded from 15.4 km north of Mataranka turnoff on Stuart Hwy (Hwy 1), NT; *(D)* spectrogram of male calling song; *(E)* species distribution map.

midline around most anterior portion; lateral margins brown; transverse ridges and central groove distinct. Anteclypeus jet black. Rostrum black, occasionally tending brown proximally, reaching to or just beyond apices of mid coxae. Antennae black. Supra-antennal plates black, edged reddish brown to varying degrees.

Thorax. Pronotum dominantly black with red or dull yellow markings; anterior margin sometimes partly edged pale yellow or brown to varying degrees; fascia along midline red or dull yellow, usually extending from near head almost to pronotal collar; occasionally a dull yellow or reddish brown marking dorsally abutting pronotal collar, and sometimes merging with fascia along midline; pronotal collar red or pale yellow; lateral margin not, or barely, ampliate. Mesonotum primarily black with red markings; a reddish brown marking on either side of midline from, or near, anterior arms or the cruciform elevation to, or almost to, pronotum between lateral and submedian sigilla, this marking projecting inwards to varying degrees around its mid length and sometimes meeting and sometimes thereafter extending anteriorly along midline; occasionally a reddish brown blotch between anterior arms of cruciform elevation; lower lateral area sometimes edged red; scutal depressions occasionally highlighted as black dots surrounded by reddish brown; cruciform elevation dominantly reddish brown, anterior arms usually black subapically, occasionally a black fascia along midline. Metanotum black at hind wing base, remainder reddish brown to pale brown.

Legs. Fore legs black with a reddish brown fascia to varying degrees along anterior and sometimes exterior length of femora; femora with spines black, sometimes brown distally; pretarsal claws brown with black apices. Mid and hind legs black tending dark brown; coxae with proximal margin edged pale reddish brown. Meracanthus black, sometimes muddy yellow along distal margin.

Wings. Hyaline. Fore wing with stems of veins M and CuA completely fused as one before meeting basal cell; venation reddish brown tending brown distally, costa (C) yellowish brown to reddish brown, radius + subcosta (R+Sc) always reddish brown; basal membrane grey to black. Hind wing with 6 apical cells; venation brown except for pale yellowish brown 2A and 3A; plaga muddy white to grey to pale brown; an inconspicuous black infuscation on wing margin at distal end of vein 2A.

Opercula. For the most part not reaching distal margin of tympanal cavity; widely separated; slightly concave below meracanthus; a low rounded swelling on epimeron 3; usually entirely black but sometimes muddy yellow along distal margin.

Timbals with four long ribs spanning the width of timbal membrane and one much shorter anterior rib terminating level with upper end of adjacent intercalary rib.

Abdomen. Tending triangular in cross section with epipleurites reflexed inwards from junction with tergites. Tergites black with brown and pale yellow markings; tergite 1 entirely black; tergite 2 black with posterior margin usually edged pale yellow; tergites 3–6 black with posterior margins pale yellow plus a substantial portion of lateral area of tergites 3 and 4 pale yellow or light brown; tergites 7–8 black with posterior margins edged pale yellow and pinkish red to varying degrees, the red most notable on 7. Sternite I brownish black with distal margin pale yellow; sternite II black; sternites III–V mostly pale yellow with brownish black on and around midline to varying degrees; sternite VI black with distal margin pale yellow; sternite VII black; sternite VIII black tending muddy yellow.

Genitalia (Fig. 38). Pygofer upper lobe large, in lateral view slightly longer than wide, terminally asymmetrically dilated, slightly more concave along the margin closest to the basal lobe, not hook-like. Basal pygofer lobe undeveloped, flap-like. Secondary basal lobe plate-like, in lateral view clearly projecting and triangular. Median lobe of uncus short, wider than long with a rounded apex. Claspers claw-like, short, not concave below, apices pointed and diverging outwards distally. Aedeagus with pseudoparameres just a little shorter than endotheca, slender, flattened, parallel, in dorsal view diverging as separate structures at about three quarters length of endotheca, in lateral view lying immediately adjacent to endotheca, apices not diverging. Endotheca slightly curved downwards, parallel sided, circular in cross-section, apex sloping backwards dorsally, ventrally a long, lightly sclerotized projection resembling a forked snake tongue.

Female (Pl. 4). Similar to male. Mesonotum usually with a brown streak along lateral sides. Abdominal segment 9 orange brown with a brown subdorsal fascia on each side of midline extending from the anterior margin but not reaching posterior margin, a black spot on each lateral side; caudal beak long and spine-like. Ovipositor sheath long, extending some 1.5–2.0 mm beyond apex of abdomen; dark brown to black.

Measurements. Range and mean (in mm) for 10♂♂ and 2♀♀; includes smallest and largest of available specimens. *Length of body*: male 13.0–15.5 (14.0); female 14.9–15.4 (15.2). *Length of fore wing*: male 15.7–18.3 (17.1); female 17.4–17.5 (17.5). *Width of fore wing*: male 5.9–6.8 (6.2); female 6.1–6.4 (6.3). *Ratio length/width of fore wing*: male 2.7–2.9 (2.8); female 2.7–2.9 (2.8). *Width of head (including eyes):* male 4.3–5.2 (4.7); female 4.7–4.8 (4.8). *Width of pronotum (across lateral angles):* male 4.2–5.2 (4.7); female 4.6–4.7 (4.7).

Distinguishing features

Distinguished from most species of *Pauropsalta* and allied genera (i.e. those species with a hind wing infuscation at the distal end of vein 2A) in having fore wing veins M and CuA completely fused as one on meeting the basal cell (view under magnification) and hind wings with 6 apical cells (in *both* wings). Males (and females to lesser degree) are unique in having a large dull yellow to light brown patch on the anterior lateral abdomen. Nearly all specimens have the costal vein (C) dull yellow and the radial/subcostal vein (R+Sc) contrasting red; however, this feature can also be found in specimens of some other species.

The male genitalia are unique in having the endotheca terminating with a long, lightly sclerotized projection resembling a forked snake tongue.

Etymology. From the Latin *serpens* meaning snake and referring to the lightly sclerotized projection resembling the forked tongue of a snake at the end of the male endotheca.

Song (Fig. 38). The song consists of a series of clicks preceding an echeme. The clicks usually range from 25–30. The echeme is generally c. 2 s in length. Phrases occur at a rate of c. 0.4 phrases per second. The frequency of the song ranges from 6–22 kHz.

Genus *Popplepsalta* n.gen.

Popplepsalta Owen *et al.*, 2015: 259–264, 271, 273, 274, *nomen nudum*.

Type species. *Popplepsalta aeroides* n.sp.

Included species. *aeroides* n.sp.; *annulata* (Goding & Froggatt, 1904), n.comb.; *ayrensis* (Ewart, 1989), n.comb.; *blackdownensis* (Popple, 2013), n.comb.; *corymbiae* (Popple, 2013), n.comb.; *decora* (Popple, 2013), n.comb.; *granitica* (Popple, 2013), n.comb.; *inversa* (Popple, 2013), n.comb.; *kobongoides* (Popple, 2013), n.comb.; *notialis incitata* (Popple, 2013), n.comb.; *notialis notialis* (Popple, 2013), n.comb.; *rubristrigata* (Goding & Froggatt, 1904), n.comb.; *simplex* (Popple, 2013), n.comb.; *subtropica* (Popple, 2013), n.comb.; *torrensis* (Popple, 2013), n.comb.; *tremula* (Popple, 2013), n.comb.

Etymology. Named after Lindsay Popple who has contributed significantly to the taxonomy and knowledge of this genus and other Australian cicadas.

Diagnosis

Head including eyes about as wide as mesonotum, sometimes a little narrower, sometimes a little wider; supra-antennal plate meeting or nearly meeting eye; postclypeus broadly rounded transversely across ventral midline, in lateral profile angulate between "top" and "sides"; postclypeus in dorsal view tending confluent with anterior margin of head and tending angular in outline when viewed from above.

Thorax. Pronotal collar width at dorsal midline much less than diameter of eyes; paranota confluent with adjoining pronotal sclerites, no mid lateral tooth; cruciform elevation with its dome wider than long; epimeral lobe not reaching operculum.

Fore leg femoral primary spine erect.

Wings. Hyaline; Fore wings with 8 apical cells; subapical cells absent; ulnar cell 3 angled to radial cell; basal cell long and narrow; costal vein (C) clearly higher than R+Sc; costa parallel-sided to node; pterostigma present; vein CuA only weakly bowed so that cubital cell no wider than medial cell; veins M and CuA completely fused as one before reaching basal cell; vein RA_1 aligned closely with Sc for its length and not diverging in subapical region; vein CuA_1 divided by crossvein m-cu so that proximal portion shortest; veins CuP and 1A fused in part; infuscation absent; wing outer margin developed for its total length, never reduced to be contiguous with ambient vein. Hind wings with 5 or 6 apical cells, except in *annulata* and *ayrensis* which have 5; infuscation at distal end of vein 2A spread on wing margin; width of 1st cubital cell at distal end at least twice that of 2nd cubital cell; anal lobe broad with vein 3A curved, long, separated from wing margin; veins RP and M fused basally.

Male opercula more or less reaching margin of tympanal cavity, directed towards distomedial margin of tympanal cavity, apically broadly rounded, clearly not meeting, clearly raised above level of tympanal cavity on its outer half or so.

Male abdomen in cross-section with sides of tergites straight or weakly convex, epipleurites reflexed ventrally from junction with tergites; tergites 2–7 all similar in size (2 and 3 not considerably larger); sternites III–VII in cross-section convex. *Timbals*. Timbal covers absent; timbal ribs irregular in size and spaced with prominent intermediate short ribs; basal dome very large; timbals not extended below level of wing bases.

Male genitalia. Pygofer with distal shoulders not developed; upper pygofer lobe in lateral view with basal portion of dorsal margin strongly angled to axis of pygofer; very broad basally and tapering to a broad apex. Pygofer basal lobe either as an inward facing spike or flap-like and sometimes turned inwards. Pygofer secondary basal lobe plate-like and well developed with outer face rounded, in lateral view clearly projecting and subtriangular with a broad base slightly upturned pointed apex, in ventral view long and finger-like; dorsal beak present and a part of chitinized pygofer. Uncus in dorsal view triangular and depressed along dorsal midline. Claspers with extreme basal region concave and not developed forward, in lateral view extending no more than a little beyond margin of pygofer, claw-like with minimum or no cavity below. Aedeagus with basal plate in dorsal view tending to be Y shaped, weakly depressed on dorsal midline, in lateral view undulated with basal portion directed forwards away from thecal shaft; ventral rib completely fused with basal plate; junction between theca and basal plate with a functional "hinge" that is small, substantially compressed between theca and basal plate in lateral view; thecal shaft straight or curved in a gentle arc; pseudoparameres arising independently at their base; endotheca exposed, ridged, dorsal region sclerotized less than lateral and ventral surfaces, shaft trumpet-shaped in apical region and entirely chitinized; endothecal ventral support absent; thecal subapical cerci absent; flabellum absent; conjunctival claws absent; vesica retractable, vesical opening apical on theca.

Distinguishing features

Popplepsalta can be separated from all other genera by the combination of the following: fore wing veins M and CuA with their stems meeting the basal cell completely fused as one; claspers in lateral view extending no more than a little beyond margin of pygofer, claw-like with minimum or no cavity below; uncus in dorsal view triangular and depressed along dorsal midline; endothecal shaft trumpet-shaped in apical region with apical margin in part or continuously serrated around lateral and ventral margins.

Popplepsalta aeroides n.sp.

Fig. 39, Pl. 6

Popplepsalta aeroides Owen *et al.*, 2015: 260, 274, *nomen nudum*.

Types. *Holotype* male (molecular voucher 06.AU.NS.BES.03; GenBank accessions: KM377154, KM377314, KM377463, KM377538, KM668291), S of Bega on Hwy 1, c. 33 km N of Eden, New South Wales, 36°50.096'S 149°48.728'E, 191 m, 22.xi.2006, D. Marshall, K. Hill (AM). *Paratypes*—NEW SOUTH WALES: 1♂, Royal N.P., 1.7 km E of road thru park (68), nr Garie, 88 m, 34°10.305'S 151°03.753'E, 15.i.2011, K. Hill, D. Marshall (AE). 1♂ (molecular voucher 11.AU.NS.GAR.01), Royal N.P., 1.7 km E of road thru park (68), nr Garie, 88 m, 34°10.305'S 151°03.753'E, 15.i.2011, K. Hill, D. Marshall (AM). 2♂♂ (one genitalia prep. PAU 420 and one molecular voucher 06.AU.NS.BES.04), S of Bega on Hwy 1, c. 33 km N of Eden, 36°50.096'S 149°48.728'E, 191 m, 22.xi.2006, D. Marshall, K. Hill; 2♂♂, Royal N.P., 1.7 km E of road thru park (68), nr Garie, 88 m, 34°10.305'S 151°03.753'E, 15.i.2011, K. Hill, D. Marshall (MSM). QUEENSLAND: 1♂, Governor's Chair, Spicers Gap, 28°05'07"S 152°25'03"E, 2 Jan 2013, L. Popple, A. McKinnon, 393-0002 (LP).

Distribution (Fig. 39). Known only from one locality in southeastern Queensland at Spicers Gap and two localities in New South Wales, one near Garie in Royal National Park south of Sydney and one on the far south coast between Bega and Eden. There are records for January only. Adults inhabit dry sclerophyll forest.

Description

Male (Pl. 6). *Head* about as wide as lateral angles of pronotal collar; dominantly black. Vertex with muddy yellow to bluish green spot at posterior midline. Postclypeus black with red and brown markings; a reddish brown spot on midline around most anterior portion; sometimes bluish green; lateral and posterior margin brown; transverse ridges and central groove distinct. Anteclypeus jet black. Rostrum black, usually brown proximally, reaching to or almost to apices of mid coxae. Antennae black and edged brown. Supra-antennal plates black sometimes with reddish brown anterior margin.

Thorax. Pronotum black, with brown and reddish brown markings; usually anterior margin edged reddish brown; fascia along midline brown to reddish brown, laterally expanded at pronotal collar where it is usually interrupted by a black mark; pronotal collar brown to reddish brown; lateral margin not ampliate. Mesonotum primarily black with reddish brown markings; lateral margin reddish brown; a reddish brown marking following parapsidal suture and extending to anterior arms of cruciform elevation, this marking projecting inwards to varying degrees around mid length; cruciform elevation reddish brown, sometimes a black fascia along midline. Metanotum black at hind wing base, edged reddish brown or bluish green (usually reddish brown), near dorsal midline.

Legs. Legs mainly brown, with varying degrees of black. Meracanthus black basally, otherwise pale yellow or greenish yellow.

Wings. Hyaline. Fore wing with fused stem of veins M and CuA complete, the veins fused as one before meeting basal cell; venation red to brownish red tending black distally; basal membrane pale grey to blackish. Hind wing with 6 apical cells; venation red to brownish red tending black distally; plaga muddy white to pale brown, sometimes blackish; black infuscation on wing margin at distal end of vein 2A.

Opercula. For the most part not reaching distal margin of tympanal cavity; widely separated; flat other than a low rounded swelling of epimeron 3; often mostly black with distal margin pale yellow or muddy yellow, sometimes mostly yellow.

Timbals with four long ribs spanning the width of timbal membrane and one much shorter anterior rib terminating before lower end of adjacent intercalary rib.

Abdomen. Tending triangular in cross section with epipleurites reflexed inwards. Tergites dominantly black; tergites 1 and 2 entirely black; tergites 3–6 with margins greenish blue, sometimes lateral margins red to varying degrees; tergite 7 with posterior margin red and greenish blue to varying degrees; tergite 8 entirely black. Sternite I black; sternites II–VII black to brownish black, usually with lateral sides and posterior margin reddish brown and greenish blue to varying degrees; sternite VIII muddy yellow to brown, sometimes tending black basally.

Genitalia (Fig. 39). Pygofer upper lobe wide and long, blinker-shaped with distal portion broadened, ventral apex bluntly hook-shaped. Basal lobe as an inner spike-like projection. Secondary basal lobe well-developed, in ventral view longer than wide, spike-like. Median lobe of uncus duck-bill shape, narrowing distally, slightly depressed on dorsal surface. Claspers claw-like, very short, apically turned outwards, thin in ventral view, apex with two small teeth. Aedeagus with pseudoparameres almost as long as

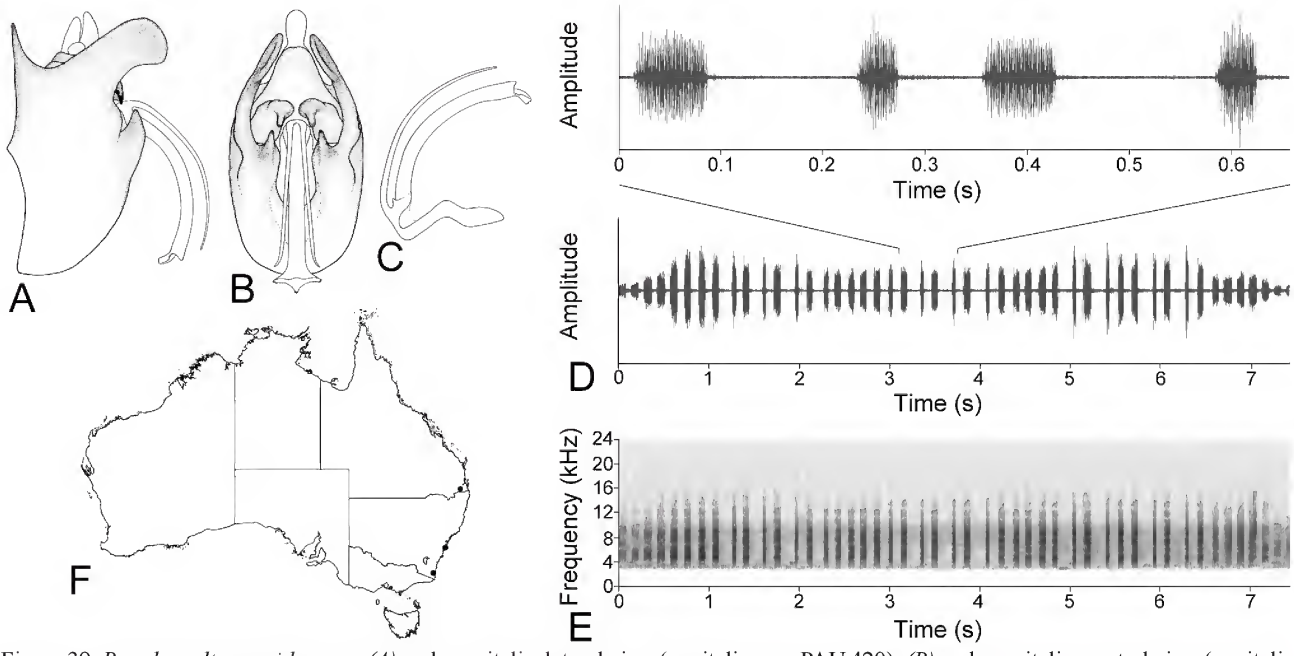


Figure 39. *Popplepsalta aeroides* n.sp. *(A)* male genitalia, lateral view (genitalia prep PAU 420); *(B)* male genitalia, ventral view (genitalia prep PAU 420); *(C)* male aedeagus, lateral view; *(D)* waveform of male calling song recorded from S of Bega on Hwy 1, c. 33 km N of Eden, NSW; *(E)* spectrogram of male calling song; *(F)* species distribution map.

endotheca, slender, lying above endotheca in lateral view, in dorsal view parallel to each other, slightly diverging outward at distal end. Endotheca curved, parallel sided, circular in cross-section, sclerotized but with fleshy dorsal outer covering; apex trumpet-like, wider than tall, serrated laterally and ventrally; in lateral view ventral portion of apex with a small sclerotized process pointing ventrally.

Female. Unknown.

Measurements. Range and mean (in mm) for 7♂♂; includes smallest and largest of available specimens. *Length of body*: male 17.3–20.4 (18.8). *Length of forewing*: male 21.0–25.2 (23.3). *Width of forewing*: male 7.5–8.7 (8.0). *Ratio length/ width of forewing*: male 2.8–2.9 (2.85). *Width of head (including eyes):* male 5.7–6.5 (6.1). *Width of pronotum (across lateral angles):* male 5.6–6.5 (6.0).

Distinguishing features

Most similar in general appearance to *Popplepsalta rubristrigata*. Males differ in having the distal margins of abdominal segments 3–6 greenish blue in fresh specimens; in *Po. rubristrigata* the distal margin of segments 2–7 are pale yellow with a narrow band of red abutting. The male genitalia clearly differ from those of *Po. rubristrigata* in having the basal lobe as a very small triangular flap rather than a long spike-like structure.

Etymology. From the Latin *aeroides* meaning sky blue, referring to the blue on the abdomen of live and recently deceased specimens.

Song (Fig. 39). The song consists of a series of clicks and echemes. Generally, five or more echemes of equal duration are followed by a series of four or more long and short echemes. Echemes are usually shorter than 0.1 s and clicks are all shorter than echemes. The frequency of the song ranges from 4–16 kHz.

Genus *Falcatpsalta* n.gen.

Falcatpsalta Owen *et al.*, 2015: 259, 260, 262, 271, 273, 274, *nomen nudum*.

Type species. *Pauropsalta aquilus* Ewart, 1989.

Included species. *aquilus* Ewart, 1989.

Etymology. From the Latin *falcatus* meaning furnished with sickles, sickle shaped, and referring to the unique shape of the upper pygofer lobes, and from psalta, derived from *psaltria* meaning a female harpist.

Diagnosis

Head including eyes about as wide as mesonotum, sometimes a little narrower, sometimes a little wider; supra-antennal plate meeting or nearly meeting eye; postclypeus broadly rounded transversely across ventral midline, in lateral profile angulate between "top" and "sides", in dorsal view tending angular in outline but nevertheless confluent with anterior margin of head.

Thorax. Pronotal collar width at dorsal midline much less than diameter of eyes; paranota confluent with adjoining pronotal sclerites, no mid lateral tooth; cruciform elevation with its dome wider than long; epimeral lobe not reaching operculum.

Fore leg femoral primary spine erect.

Wings. Hyaline. Fore wings with 8 apical cells; subapical cells absent; ulnar cell 3 angled to radial cell; basal cell long and narrow; costal vein (C) clearly higher than R+Sc; costa parallel-sided to node; pterostigma present; vein CuA only weakly bowed so that cubital cell no wider than medial cell; veins M and CuA completely fused as one before reaching basal cell; vein RA_1 aligned closely with Sc for its length and not diverging in subapical region; vein CuA_1 divided by crossvein m-cu so that proximal portion shortest; veins CuP and 1A fused in part; infuscation absent; wing outer

margin developed for its total length, never reduced to be contiguous with ambient vein. Hind wings with 6 apical cells; infuscation at distal end of vein 2A spread on wing margin; width of 1st cubital cell at distal end at least twice that of 2nd cubital cell; anal lobe broad with vein 3A curved, long, separated from wing margin; veins RP and M fused basally.

Male opercula more or less reaching margin of tympanal cavity, directed towards distomedial margin of tympanal cavity, apically broadly rounded, clearly not meeting, clearly raised above level of tympanal cavity on its outer half or so. *Male abdomen* in cross-section with sides of tergites straight or weakly convex, epipleurites reflexed ventrally from junction with tergites; tergites 2–7 all similar in size (2 and 3 not considerably larger); sternites III–VII in cross-section convex.

Timbals. Timbal covers absent; timbal ribs irregular in size and spaced with prominent intermediate short ribs; basal dome very large; timbals not extended below wing bases.

Male genitalia. Pygofer with distal shoulders not developed; upper pygofer lobe shape in lateral view with basal portion of dorsal margin strongly angled to axis of pygofer, very broad basally and tapering to a broad apex; pygofer basal lobe flap-like, sometimes turned inwards; pygofer secondary basal lobe tending fold-like, in lateral view broadly angled and moderately projecting, in ventral view broad and rounded, outer face rounded; dorsal beak present and a part of chitinized pygofer. Uncus in dorsal view broadly rounded, flat or depressed along dorsal midline. Claspers with extreme basal region concave, not developed forward, in lateral view long, projecting outward far beyond margin of pygofer, cavernous below for most of length. Aedeagus with basal plate in dorsal view tending Y-shaped and weakly depressed on dorsal midline, lateral view undulated with basal portion directed forwards away from thecal shaft; ventral rib completely fused with basal plate; junction between theca and basal plate with a functional "hinge" that is small and substantially compressed between theca and basal plate in lateral view; thecal shaft straight or curved in a gentle arc; pseudoparameres present, dorsal of theca and arising independently at the base; endotheca exposed, ridged, much of surface weakly sclerotized and in part translucent; thecal apex entirely chitinized, parallel-sided in apical region; endothecal ventral support absent; thecal subapical cerci absent; flabellum absent; conjunctival claws absent; vesica retractable, vesical opening apical on theca.

Distinguishing features

Falcatpsalta can be separated from all other genera by the combination of the following attributes: fore wing veins M and CuA with their stems meeting the basal cell completely fused as one; male pygofer upper lobe long and well developed with the apex terminating in a spike; pygofer secondary basal lobe tending fold-like, in lateral view moderately projecting with its margin broadly angled, in ventral view broad and rounded; an exposed endotheca that has its surface weakly sclerotized and in part translucent.

Genus *Relictapsalta* n.gen.

Relictapsalta Owen *et al.*, 2015: 259, 262, 266, 271, 273, 274, *nomen nudum*.

Type species. *Pauropsalta nigristriga* Goding & Froggatt, 1904

Included species. *nigristriga* (Goding & Froggatt, 1904) n.comb.

Etymology. From the Latin *relictus* meaning left behind, referring to this species being a relictual species most-likely caused by the changing environment in Cape York over the last 30 Ma, and from psalta, derived from *psaltria,* meaning a female harpist.

Diagnosis

Head including eyes about as wide as mesonotum, sometimes a little narrower, sometimes a little wider; supra-antennal plate meeting or nearly meeting eye; postclypeus broadly rounded transversely across ventral midline, in lateral profile angulate between "top" and "sides"; postclypeus in dorsal view tending confluent with anterior margin of head and tending angular in outline when viewed from above.

Thorax. Pronotal collar width at dorsal midline much less than diameter of eyes; paranota confluent with adjoining pronotal sclerites, no mid lateral tooth; cruciform elevation with its dome wider than long; epimeral lobe not reaching operculum.

Fore leg femoral primary spine erect.

Wings. Hyaline; Fore wings with 8 apical cells; subapical cells absent; ulnar cell 3 angled to radial cell; basal cell long and narrow; costal vein (C) clearly higher than R+Sc; costa parallel-sided to node; pterostigma present; vein CuA only weakly bowed so that cubital cell no wider than medial cell; veins M and CuA with their stems meeting the basal cell completely fused as one; vein RA_1 aligned closely with Sc for its length and not diverging in subapical region; vein CuA_1 divided by crossvein m-cu so that proximal portion shortest; veins CuP and 1A fused in part; infuscation absent; wing outer margin developed for its total length, never reduced to be contiguous with ambient vein. Hind wings with 5 apical cells; infuscation at distal end of vein 2A spread on wing margin; width of 1st cubital cell at distal end at least twice that of 2nd cubital cell; anal lobe broad with vein 3A curved, long, separated from wing margin; veins RP and M fused basally.

Male opercula more or less reaching margin of tympanal cavity, directed towards distomedial margin of tympanal cavity, apically broadly rounded, clearly not meeting, clearly raised above level of tympanal cavity on its outer half or so. *Male abdomen* in cross-section with sides of tergites straight or weakly convex, epipleurites reflexed ventrally from junction with tergites; tergites 2–7 all similar in size (2 and 3 not considerably larger); sternites III–VII convex in cross-section.

Timbals. Timbal covers absent; timbal ribs irregular in size and spaced with prominent intermediate short ribs; basal dome very large; timbals not extended below level of wing bases.

Male genitalia. Pygofer with distal shoulders not developed; dorsal beak present and a part of chitinized pygofer; upper pygofer lobe shape in lateral view with

basal portion of dorsal margin strongly angled to axis of pygofer, very broad basally and tapering to a broad apex; pygofer basal lobe flap-like, sometimes turned inwards; pygofer secondary basal lobe domed and lobe-like with outer face ridged longitudinally, in lateral view not or moderately projecting and broadly rounded, in ventral view well developed with rounded apex that is sometimes two-tiered and fusion with pygofer margin not reaching apex. Uncus in dorsal view broadly rounded, flat or depressed along dorsal midline. Claspers in lateral view extending no more than a little beyond margin of pygofer, claw-like with minimum or no cavity below, extreme basal region concave but not developed forward. Aedeagus with basal plate in dorsal view tending Y shaped and weakly depressed on dorsal midline, in lateral view undulated with basal portion directed forwards away from thecal shaft; ventral rib completely fused with basal plate; junction between theca and basal plate with a functional "hinge"; that is small and substantially compressed between theca and basal plate in lateral view; thecal shaft straight or curved in a gentle arc; pseudoparameres present, dorsal of theca and arising independently at their bases; endotheca exposed, ridged, parallel-sided in apical region, much of surface weakly sclerotized and in part translucent; thecal apex entirely chitinized; endothecal ventral support absent; thecal subapical cerci absent; flabellum absent; conjunctival claws absent; vesica retractable, vesical opening apical on theca.

Distinguishing features

Relictapsalta is distinguished from all other genera in having the following combination of characters: fore wing veins M and CuA with their stems meeting the basal cell completely fused as one; hind wing with 5 apical cells; upper pygofer lobe in lateral view large, very broad basally and tapering to a broad apex, the basal portion of its upper margin not aligned with axis of pygofer but instead strongly angled to it; secondary basal lobe with its outer face ridged longitudinally; uncus in dorsal view broadly rounded; endotheca lightly sclerotized.

Genus *Uradolichos* Moulds, 2012

Uradolichos Moulds, 2012: 233–235.

Type species. *Urabunana longipennis* Ashton, 1914. By original designation.

Included species. *longipennis* (Ashton, 1914) n.comb.; *rotunda* n.sp.

Revised diagnosis

As defined by Moulds (2012) with the following additions: Fore wing veins M and CuA with their stems either completely fused as one, closely abutted for some distance, or separated on meeting the basal cell.

Male genitalia. Pygofer caudal beak broad, short, not well developed; upper pygofer lobe shape in lateral view with basal portion of dorsal margin strongly angled to axis of pygofer, very broad basally and tapering to a broad apex; pygofer basal lobe flap-like, sometimes turned inwards; pygofer secondary basal lobe shape fold-like with outer face rounded, in lateral view projecting and broadly rounded, in ventral view either closely aligned with pygofer margin or projecting to varying extent but always totally fused to pygofer margin at rear. Uncus in dorsal view linear, dorsal surface flat or domed. Claspers in lateral view long, projecting outward far beyond margin of pygofer, cavernous below for most of length, extreme basal region concave and not developed forward. Theca trifid, that is with a pair of dorsal pointed pseudoparameres and a pointed ventral support surrounding an exposed endotheca; pseudoparameres robust, flattened or rounded in cross section, arising independently at the base, distal ends turned outwards, in lateral view adjacent to or close by theca and not arched high above it; endotheca with shaft parallel-sided in apical region, in lateral view about as broad as or broader than pseudoparameres, dorsal region sclerotized similar to that of lateral and ventral surfaces, apex with margin either lacking serrations or partly serrated but not continuously around lateral and ventral margins and apically without lateral "wing-like" flanges or a spine-like projection at each lateroventral corner.

Uradolichos rotunda n.sp.

Fig. 40, Pl. 5

Uradolichos rotunda Owen *et al.*, 2015: 263, *nomen nudum*.

Types. *Holotype* male (one molecular voucher 06.AU.WA.OPS.02) 19 km NW of Newman, 23°15.204'S 119°36.350'E, 629 m, 12.ii.2006, Hill, Marshall, Moulds (WAM). *Paratypes*—WESTERN AUSTRALIA: 1♂, 1♀, 19 km NW of Newman, 23°15.204'S 119°36.350'E, 629 m, 12.ii.2006, Hill, Marshall, Moulds (AE). 1♂, 1♀, 19 km NW of Newman, 23°15.204'S 119°36.350'E, 629 m, 12.ii.2006, Hill, Marshall, Moulds (AJE). 1♂, 1♀, 19 km NW of Newman, 23°15.204'S 119°36.350'E, 629 m, 12.ii.2006, Hill, Marshall, Moulds (AM). 1♂, 1♀, 19 km NW of Newman, 23°15.204'S 119°36.350'E, 629 m, 12.ii.2006, Hill, Marshall, Moulds (ANIC). 1♂, 1♀, 19 km NW of Newman, 23°15.204'S 119°36.350'E, 629 m, 12.ii.2006, Hill, Marshall, Moulds (DE); 1♂, 1♀, 19 km NW of Newman, 23°15.204'S 119°36.350'E, 629 m, 12.ii.2006, Hill, Marshall, Moulds (JO). 1♂, 1♀, 19 km NW of Newman, 23°15.204'S 119°36.350'E, 629 m, 12.ii.2006, Hill, Marshall, Moulds (LP). 15♂♂, 16♀♀, 19 km NW of Newman, 23°15.204'S 119°36.350'E, 629 m, 12.ii.2006, Hill, Marshall, Moulds; 4♂♂, 1♀ (one molecular voucher 06.AU.WA.OPS.03; GenBank accessions: KM377137, KM377285, KM377514, KM377579, KM668330), 67 km NW of Newman, 23°08.264'S 119°11.021'E, 702 m, 12.ii.2006, Hill, Marshall, Moulds; 13♂♂ (one genitalia prep. PAU317), 10♀♀, 13 km SE of Newman, 23°31.091'S 119°46.216'E, 568 m, 12.ii.2006, Hill, Marshall, Moulds; 4♂♂ (genitalia prep. PAU 307), Yannarie River xing, c. 72 km SW of Nanutarra Roadhouse, 22°51.92'S 114°57.09'E, 13.ii.2009, K. Hill & D. Marshall; 1♂, Tom Price, 22°41.891'S 117°47.098'E, 724 m, 14.ii.2009, K. Hill & D. Marshall; 1♂, Nanutarra/Wittenoon rd, c. 47 km NE of Tom Price, 22°21.17'S 117°54.791'E, 15.ii.2009, K. Hill & D. Marshall; 1♂, 1♀, 58 km E of Paraburdoo, 7.iii.2004, P. Hutchinson; 3♂♂, 3♀♀, 27.8 km N of Meekatharra, 3.iii.2004, P. Hutchinson; 1♂, 2♀♀, 45 km E of Yalgoo, 4.iii.2008, P. Hutchinson; 3♂♂, 1♀, Charles Canyon, Cape Range, 9.iii.2008, P. Hutchinson (MSM). 1♂, 1♀, 19 km NW of Newman, 23°15.204'S 119°36.350'E, 629 m, 12.ii.2006, Hill, Marshall, Moulds (NHM). 1♂, 1♀, 19 km NW of Newman, 23°15.204'S 119°36.350'E, 629 m, 12.ii.2006, Hill, Marshall, Moulds (PH). 1♂, 1♀, 19 km NW of Newman, 23°15.204'S 119°36.350'E, 629 m, 12.ii.2006, Hill, Marshall, Moulds (QM). 20♂♂, 20♀♀, 19 km NW of Newman, 23°15.204'S 119°36.350'E, 629 m, 12.ii.2006, Hill, Marshall, Moulds; 13♂♂, 10♀♀, 13 km SE of Newman, 23°31.091'S 119°46.216'E, 568 m, 12.ii.2006, Hill, Marshall, Moulds; (WAM).

Distribution (Fig. 40). Western Australia from Cape Range east to the Hamersley Range and south to Yalgoo (some 200 km inland from Carnarvon). Most records are from the Hamersley Range area. Adults have been taken between mid February and mid March but their appearance is probably tied to good rainfall during warmer months. Under favourable conditions adults are sometimes found in large numbers.

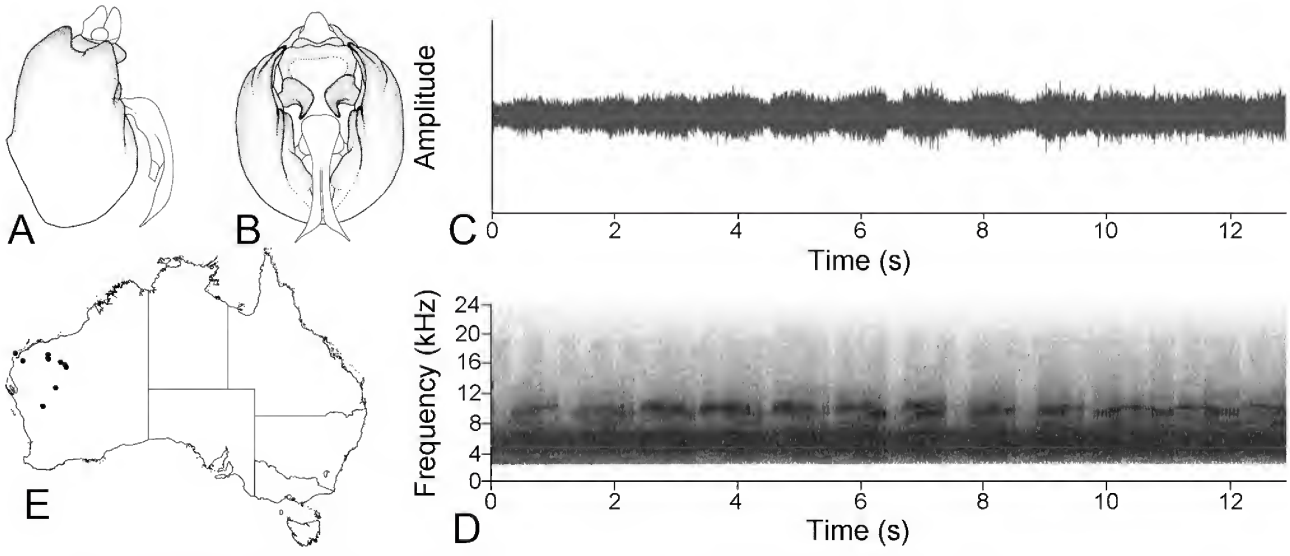


Figure 40. *Uradolichos rotunda* n.sp. *(A)* male genitalia, lateral view (genitalia prep PAU 306); *(B)* male genitalia, ventral view (genitalia prep PAU 306); *(C)* waveform of male chorus recorded from 19 km NW of Newman, WA; *(D)* spectrogram of male chorus; *(E)* species distribution map.

Habitat. Up among the branches of eucalypt trees in open forests near the vicinity of watercourses.

Description

Male (Pl. 5). *Head* small, as wide as, or narrower, than lateral margins of pronotum; dominantly black, sometimes with muddy yellow spot at posterior midline. Postclypeus jet black with pale yellow markings; usually a yellow mark on midline around mos t anterior portion; lateral margins often with yellow or orange, posterior margin sometimes similarly coloured; transverse ridges and central groove distinct. Anteclypeus jet black. Rostrum black, occasionally tending brown proximally, reaching to or just beyond apices of mid coxae. Antennae black. Supra-antennal plates black, sometimes edged yellow along anterior margin.

Thorax. Pronotum black with orange markings; usually a fascia along midline orange, usually extending from near head towards or almost to pronotal collar; sometimes a transverse orange marking dorsally abutting anterior margin of pronotal collar, usually broken at midline; pronotal collar black, sometimes with lateral angles and posterior margin orange; lateral margin of pronotal collar not ampliate. Mesonotum black with orange markings; often an orange marking on either side from, or near, anterior arms or the cruciform elevation to, or almost to, pronotum between lateral and submedian sigilla, this marking projecting inwards to varying degrees around its mid length but rarely meeting; often lower lateral margins edged orange; cruciform elevation orange to muddy orange, much of anterior arms usually black, posterior arms usually orange to muddy orange, sometimes a black fascia down midline. Metanotum black at hind wing base, remainder muddy orange, sometimes black near dorsal midline.

Legs. Fore legs mostly black but with a yellowish brown fascia to varying degrees along anterior length of femora; femora with spines always black; pretarsal claws black. Mid and hind legs mostly black or yellowish brown; coxae with proximal margin edged orange; femora black; tibiae and tarsi mostly yellowish brown. Meracanthus black with margin and apex pale yellow to varying degrees.

Wings. Hyaline. Fore wing with fused stem of veins M and CuA not complete, the veins separated or abutted rather than fused as one; venation yellow tending brown distally; apical cell 1 very narrow; hint of infuscation distally on clavus and distally on pterostigma and apical cell 1; basal membrane orange. Hind wing with 5 apical cells; venation yellowish brown tending brown distally; apical cell 1 reduced; plaga muddy white to grey to pale brown; black infuscation on wing margin at distal end of vein 2A.

Opercula. More or less following distal margin of tympanal cavity; widely separated; flat other than a low rounded swelling of epimeron 3; black, sometimes muddy yellow on distal half.

Timbals with four long ribs spanning the width of timbal membrane and one much shorter anterior rib terminating before lower end of adjacent intercalary rib.

Abdomen. Tending triangular but broadly rounded dorsally in cross section with epipleurites reflexed inwards from junction with tergites, in dorsal view tending parallel-sided. Tergites black with orange markings; tergite 1 black; tergite 2–8 black with posterior margin edged orange. Sternite I black; sternites II–VII black with posterior margin orange to varying degrees; sternite VIII black tending orange distally.

Genitalia (Fig. 40). Pygofer very broad in ventral view, rounded; black tending orange around upper pygofer lobes. Pygofer upper lobe short, in lateral view tending triangular with apex broadly rounded. Basal pygofer lobe small, in lateral view linear and narrow with rounded apex. Secondary basal lobe similar in shape to basal lobe but a little larger. Median lobe of uncus wider than long with a rounded apex. Claspers claw-like, apical half or so curved outwards, not concave below. Dorsal beak absent. Aedeagus with pseudoparameres longer than endotheca, flattened in cross section, lying immediately above endotheca in lateral view, in dorsal view mostly parallel to each other with distal portion turned outwards, gradually expanding in width distally until steeply tapering to soft spine-like apical terminations. Endotheca gently curved downwards, parallel sided, circular in cross-section, apex sloping backwards ventrally, without ornamentation.

Female (Pl. 5). Similar to male. Abdominal segment 9 black with lateral margins edged orange. Ovipositor sheath extending some 0.75–1.0 mm beyond apex of abdomen; dark brown to black.

Measurements. Range and mean (in mm) for 10♂♂ and 10♀♀; includes smallest and largest of available specimens. *Length of body*: male 13.1–17.6 (15.5); female 13.6–17.9 (15.8). *Length of fore wing*: male 15.1–18.4 (17.0); female 16.1–20.0 (18.3). *Width of fore wing*: male 5.1–6.7 (6.0); female 6.0–7.2 (6.6). *Ratio length/width of fore wing*: male 2.7–3.0 (2.8); female 2.7–3.0 (2.8). *Width of head (including eyes):* male 3.3–4.1 (3.8); female 3.6–4.3 (4.0). *Width of pronotum (across lateral angles):* male 4.0–5.1 (4.7); female 4.3–5.4 (4.9).

Distinguishing features

Differs from *U. longipennis* in having veins M and CuA meeting the cell independently and having dominantly black legs instead of light brown or yellowish legs. The male genitalia differ from those of *U. longipennis* in the very rounded pygofer when viewed ventrally, the claspers that strongly diverge distally and the pseudoparameres that are robust and diverge far less than those of *U. longipennis*.

Etymology. From the Latin *rotundus* meaning round, referring to the bulbous abdomen of this species.

Song (Fig. 40). The song is composed of a series of phrases each with a click and an echeme, while sometimes two clicks are present. Occasionally, a click immediately precedes the echeme, while the majority of the phrases only have a click after the echeme. Each echeme is usually less than 1 s in length. The frequency of the song ranges between 3 kHz and 18 kHz.

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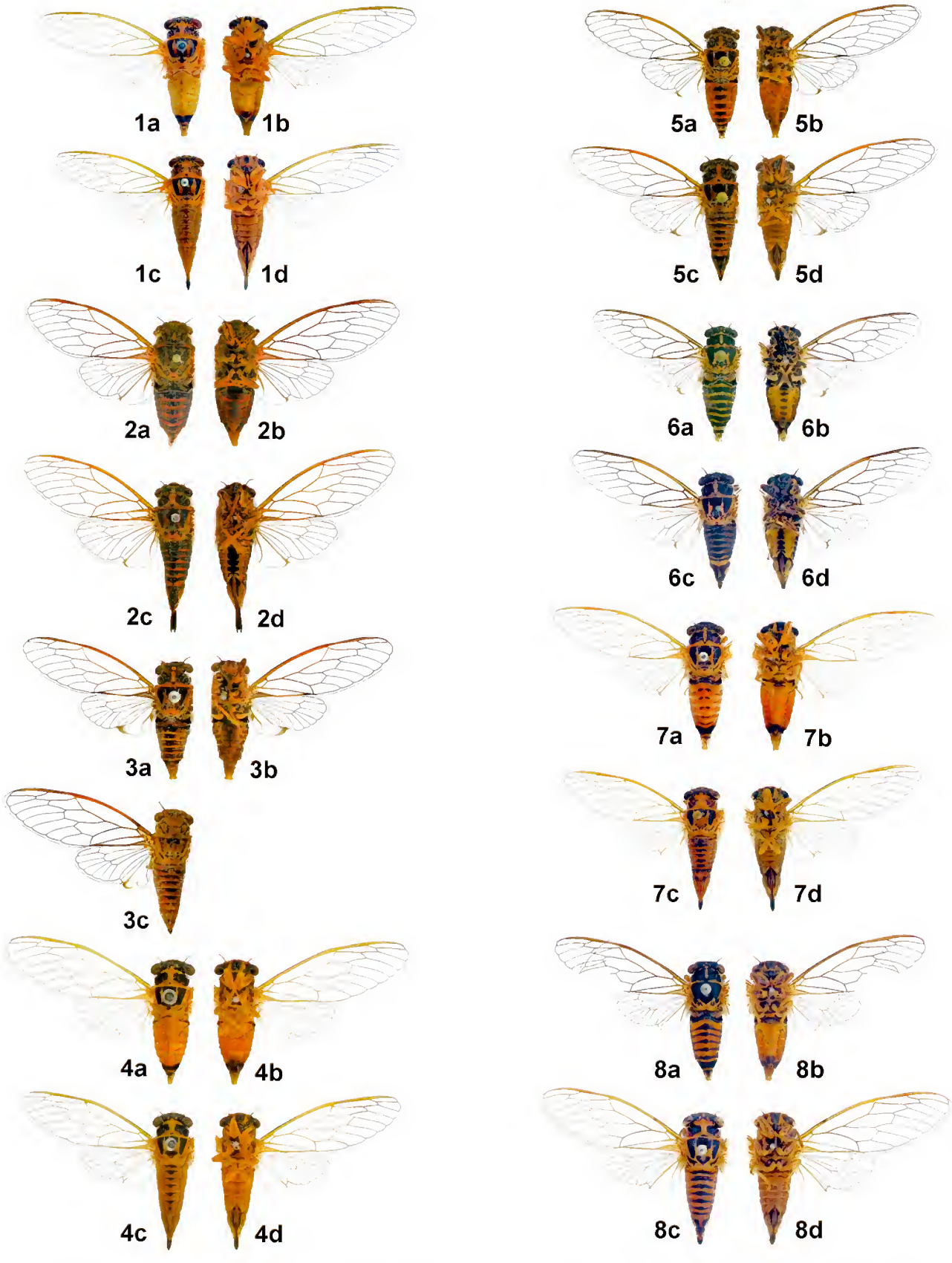

Plate 1. 1a *Palapsalta palaga*, male, dorsal; 1b *Pal. palaga*, male, ventral; 1c *Pal. palaga*, female, dorsal; 1d *Pal. palaga*, female, ventral; 2a *Popplepsalta rubristrigata*, male, dorsal; 2b *Pop. rubristrigata*, male, ventral; 2c *Pop. rubristrigata*, female, dorsal; 2d *Pop. rubristrigata*, female, ventral; 3a *Haemopsalta rubea*, male, dorsal; 3b *H. rubea*, male, ventral; 3c *H. rubea*, female, dorsal; 4a *Pal. eyrei*, male, dorsal; 4b *Pal. eyrei*, male, ventral; 4c *Pal. eyrei*, female, dorsal; 4d *Pal. eyrei*, female, ventral; 5a *H. flammeata*, male, dorsal; 5b *H. flammeata*, male, ventral; 5c *H. flammeata*, female, dorsal; 5d *H. flammeata*, female, ventral; 6a *Atrapsalta siccana*, male, dorsal; 6b *A. siccana*, male, ventral; 6c *A. siccana*, female, dorsal; 6d *A. siccana*, female, ventral; 7a *Pal. vitellina*, male, dorsal; 7b *Pal. vitellina*, male, ventral; 7c *Pal. vitellina*, female, dorsal; 7d *Pal. vitellina*, female, ventral; 8a *Pal. virgulata*, male, dorsal; 8b *Pal. virgulata*, male, ventral; 8c *Pal. virgulata*, female, dorsal; 8d *Pal. virgulata*, female, ventral. (Approximately 1.1–1.2 × natural size).

Plate 2

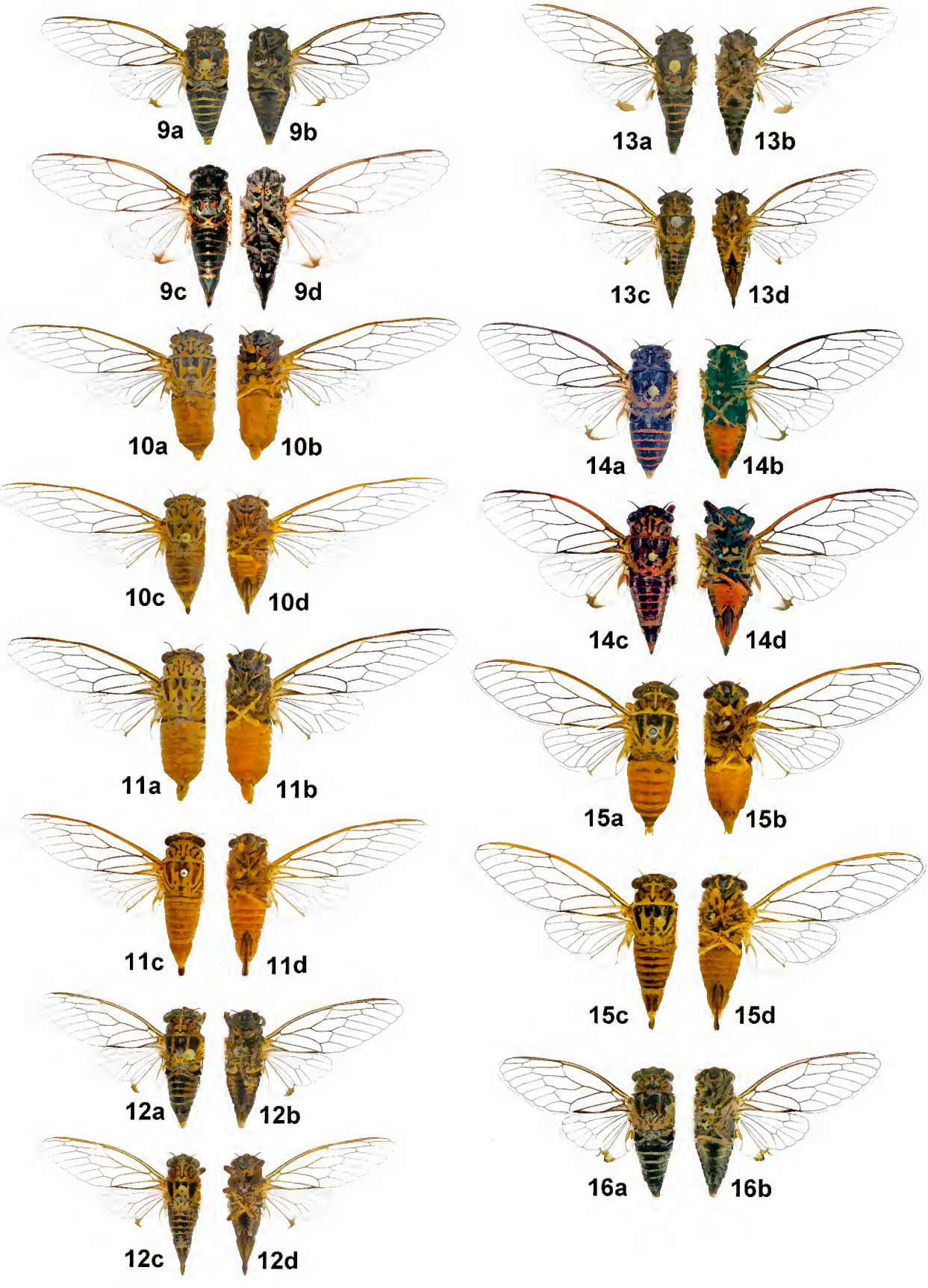

Plate 2. 9a *Pauropsalta accola*, male, dorsal; 9b *P. accola*, male, ventral; 9c *P. accola*, female, dorsal; 9a *P. accola*, female, ventral; 10a *P. adelphe*, male, dorsal; 10b *P. adelphe*, male, ventral; 10c *P. adelphe*, female, dorsal; 10d *P. adelphe*, female, ventral; 11a *P. agasta*, male, dorsal; 11b *P. agasta*, male, ventral; 11c *P. agasta*, female, dorsal; 11d *P. agasta*, female, ventral; 12a *P. confinis*, male, dorsal; 12b *P. confinis*, male, ventral; 12c *P. confinis*, female, dorsal; 12d *P. confinis*, female, ventral; 13a *P. conflua*, male, dorsal; 13b *P. conflua*, male, ventral; 13c *P. conflua*, female, dorsal; 13d *P. conflua*, female, ventral; 14a *P. mneme*, male, dorsal; 14b *P. mneme*, male, ventral; 14c *P. mneme*, female, dorsal; 14d *P. mneme*, female, ventral; 15a *P. infrasila*, male, dorsal; 15b *P. infrasila*, male, ventral; 15c *P. infrasila*, female, dorsal; 15d *P. infrasila*, female, ventral; 16a *P. juncta*, male, dorsal; 16b *P. juncta*, male, ventral. (Approximately 1.1–1.2 × natural size).

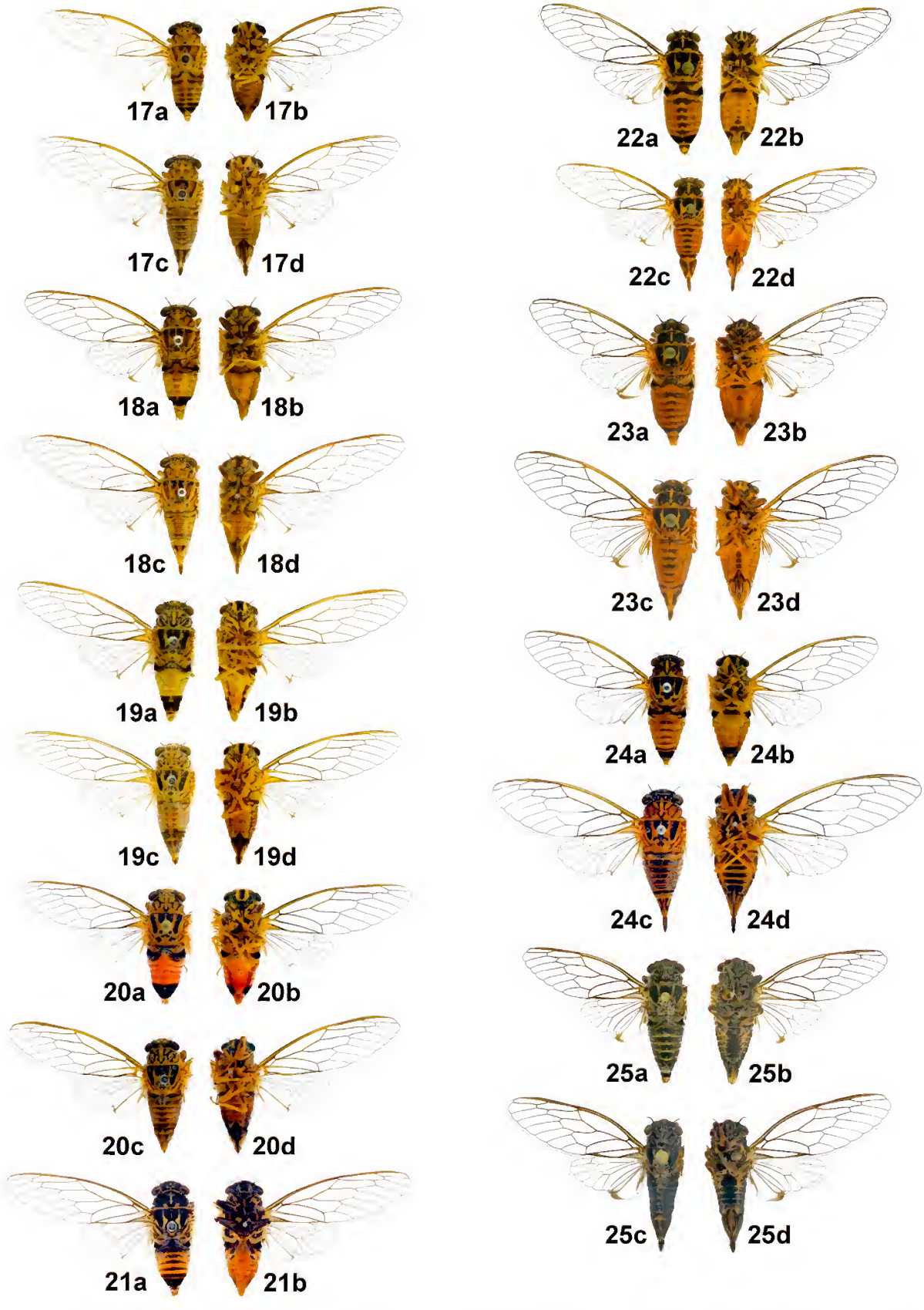

Plate 3. 17a *Pauropsalta kriki*, male, dorsal; 17b *P. kriki*, male, ventral; 17c *P. kriki*, female, dorsal; 17d *P. kriki*, female, ventral; 18a *P. elgneri*, male, dorsal; 18b *P. elgneri*, male, ventral; 18c *P. elgneri*, female, dorsal; 18d *P. elgneri*, female, ventral; 19a *P. extrema*, male, dorsal; 19b *P. extrema*, male, ventral; 19c *P. extrema*, female, dorsal; 19d *P. extrema*, female, ventral; 20a *P. similis*, male, dorsal; 20b *P. similis*, male, ventral; 20c *P. similis*, female, dorsal; 20d *P. similis*, female, ventral; 21a *P. walkeri*, male, dorsal; 21b *P. walkeri*, male, ventral; 22a *P. sinavilla*, male, dorsal; 22b *P. sinavilla*, male, ventral; 22c *P. sinavilla*, female, dorsal; 22d *P. sinavilla*, female, ventral; 23a *P. katherina*, male, dorsal; 23b *P. katherina*, male, ventral; 23c *P. katherina*, female, dorsal; 23d *P. katherina*, female, ventral; 24a *P. melanopygia*, male, dorsal; 24b *P. melanopygia*, male, ventral; 24c *P. melanopygia*, female, dorsal; 24d *P. melanopygia*, female, ventral; 25a *P. contigua*, male, dorsal; 25b *P. contigua*, male, ventral; 25c *P. contigua*, female, dorsal; 25d *P. contigua*, female, ventral. (Approximately 1.1–1.2 × natural size).

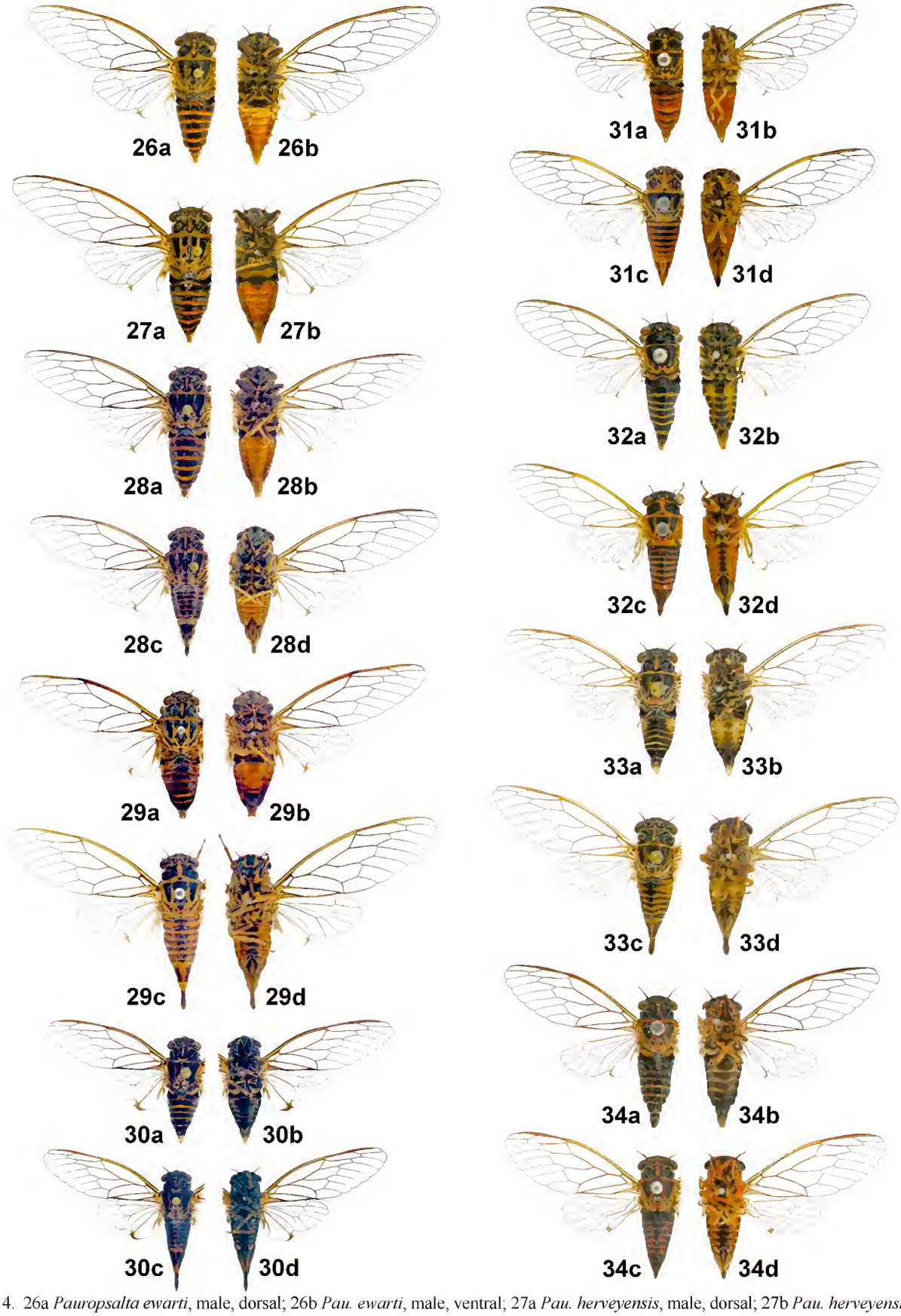

Plate 4. 26a *Pauropsalta ewarti*, male, dorsal; 26b *Pau. ewarti*, male, ventral; 27a *Pau. herveyensis*, male, dorsal; 27b *Pau. herveyensis*, male, ventral; 28a *Pau. opaca*, male, dorsal; 28b *Pau. opaca*, male, ventral; 28c *Pau. opaca*, female, dorsal; 28d *Pau. opaca*, female, ventral; 29a *Pau. nigristriga*, male, dorsal; 29b *Pau. nigristriga*, male, ventral; 29c *Pau. nigristriga*, female, dorsal; 29d *Pau. nigristriga*, female, ventral; 30a *Pau. infuscata*, male, dorsal; 30b *Pau. infuscata*, male, ventral; 30c *Pau. infuscata*, female, dorsal; 30d *Pau. infuscata*, female, ventral; 31a *Haemopsalta aktites*, male, dorsal; 31b *H. aktites*, male, ventral; 31c *H. aktites*, female, dorsal; 31d *H. aktites*, female, ventral; 32a *Popplepsalta annulata*, male, dorsal; 32b *Pop. annulata*, male, ventral; 32c *Pop. annulata*, female, dorsal; 32d *Pop. annulata*, female, ventral; 33a *Palapsalta serpens*, male, dorsal; 33b *Pal. serpens*, male, ventral; 33c *Pal. serpens*, female, dorsal; 33d *Pal. serpens*, female, ventral; 34a *Atrapsalta fuscata*, male, dorsal; 34b *A. fuscata*, male, ventral; 34c *A. fuscata*, female, dorsal; 34d *A. fuscata*, female, ventral. (Approximately 1.1–1.2 × natural size).

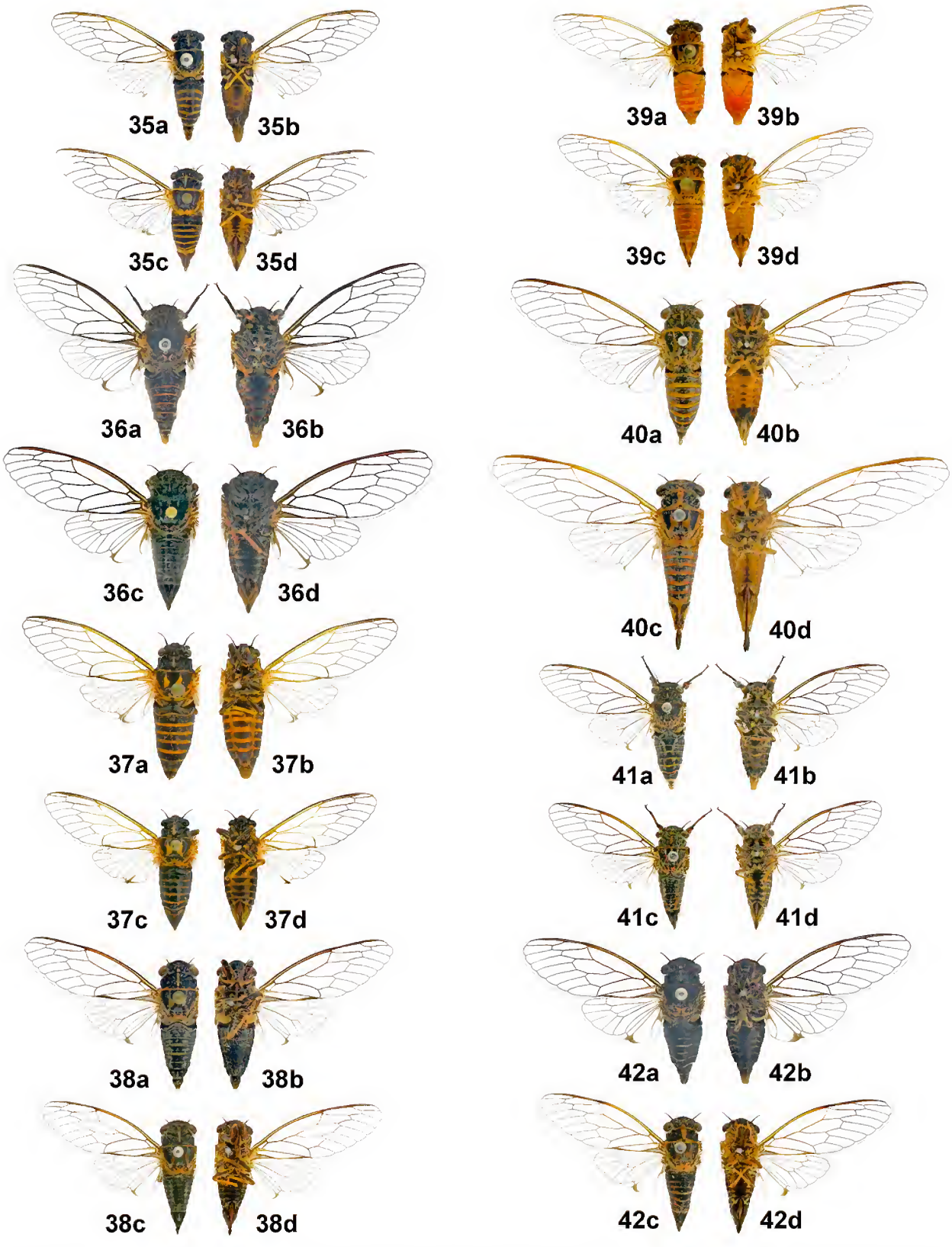

Plate 5. 35a *Popplepsalta ayrensis*, male, dorsal; 35b *Pop. ayrensis*, male, ventral; 35c *Pop. ayrensis*, female, dorsal; 35d *Pop. ayrennsis*, female, ventral; 36a *Haemopsalta georgina*, male, dorsal; 36b *H. georgina*, male, ventral; 36c *H. georgina*, female, dorsal; 36d *H. georgina*, female, ventral; 37a *Uradolichos rotunda*, male, dorsal; 37b *U. rotunda*, male, ventral; 37c *U. rotunda*, female, dorsal; 37d *U. rotunda*, female, ventral; 38a *Falcatpsalta aquilus*, male, dorsal; 38b *F. aquilus*, male, ventral; 38c *F. aquilus*, female, dorsal; 38d *F. aquilus*, female, ventral; 39a *Nanopsalta basalis*, male, dorsal; 39b *N. basalis*, male, ventral; 39c *N. basalis*, female, dorsal; 39d *N. basalis*, female, ventral; 40a *Palapsalta circumdata*, male, dorsal; 40b *P. circumdata*, male, ventral; 40c *P. circumdata*, female, dorsal; 40d *P. circumdata*, female, ventral; 41a *Atrapsalta collina*, male, dorsal; 41b *A. collina*, male, ventral; 41c *A. collina*, female, dorsal; 41d *A. collina*, female, ventral; 42a *A. corticina*, male, dorsal; 42b *A. corticina*, male, ventral; 42c *A. corticina*, female, dorsal; 42d *A. corticina*, female, ventral. (Approximately 1.1–1.2 × natural size).

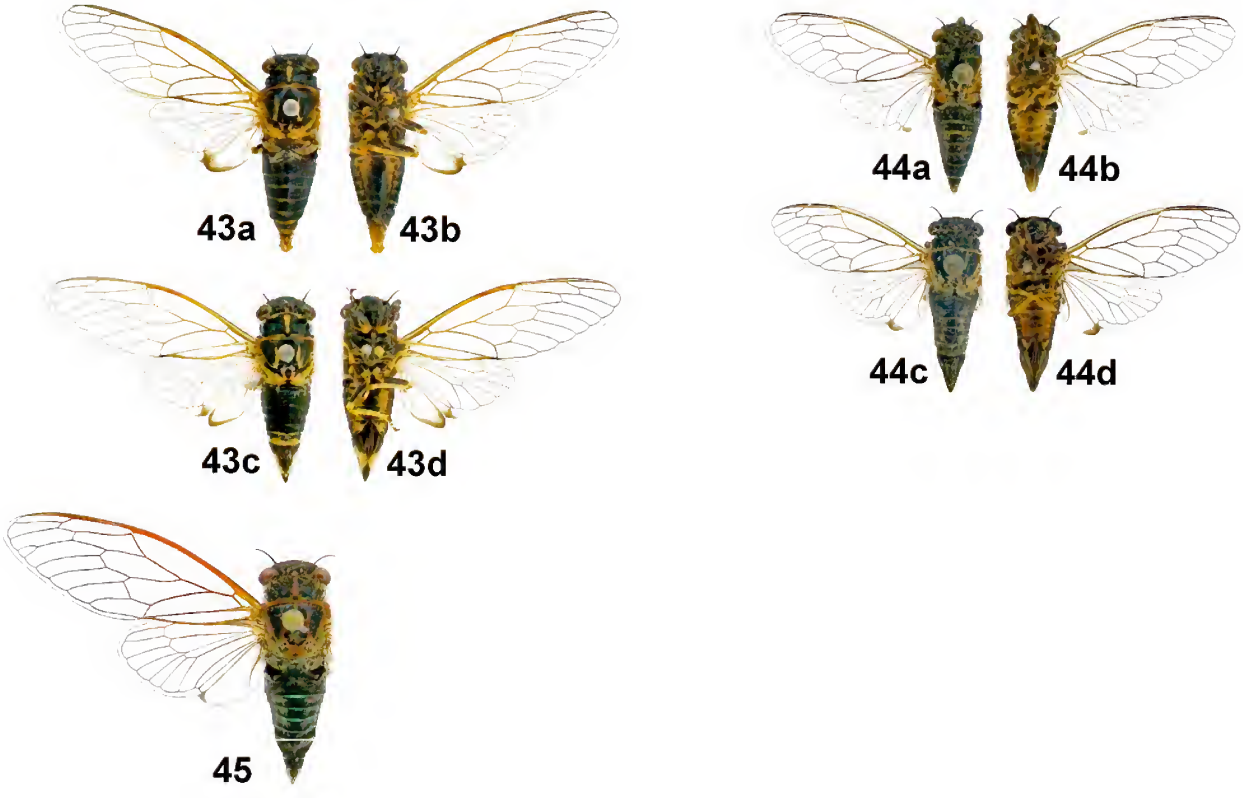

Plate 6. 4 3a *Atrapsalta emmotti*, male, dorsal; 43b *A. emmotti*, male, ventral; 43c *A. emmotti*, female, dorsal; 43d *A. emmotti*, female, ventral; 44a *A. dolens*, male, dorsal; 44b *A. dolens*, male, ventral; 44c *A. dolens*, female, dorsal; 44d *A. dolens*, female, ventral; 45 *Popplepsalta aeroides*, male, dorsal. (Approximately 1.1–1.2 × natural size).

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