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# New genera and new species of Western Australian cicadas (Hemiptera: Cicadidae)

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## Abstract

The cicada fauna of Western Australia is briefly reviewed. Six genera and 14 species are recorded from the State for the first time bringing the total of known species and subspecies to 105 and a list of all 105 is provided. Among the taxa here

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recorded are five new genera and 13 new species belonging to the tribes Macrotristriini (*Illyria viridis* **sp. n.**), Pictilini (*Chrysocicada trophis* **sp. n.**), and Cicadettini (*Calipsalta* **gen. n.**, *Calipsalta brunnea* **sp. n.**, *C. fumosa* **sp. n.**, *C. viridans* **sp. n.,** *Kalarko* **gen. n.**, *Kalarko ferruginosus* **sp. n.**, *Ewartia adusta* **sp. n.,** *Parvopsalta* **gen. n.**, *Parvopsalta victoriae* **sp. n.**, *Pedana* **gen. n.**, *Pedana hesperia* **sp. n.,** *Pegapsaltria* **gen. n.**, *Pegapsaltria lutea* **sp. n.,** *Pyropsalta amnica* **sp. n.**, *Py. patula* **sp. n.,** and *Py. rhythmica* **sp. n**). In addition, *Erempsalta hermannsburgensis* (Distant, 1907) is redescribed and its presence in Western Australia (and four other States) documented for the first time. Songs are analysed for all species except two species of *Pyropsalta* where recordings were unavailable.

**Key words:** cicada songs, Cicadoidea, Auchenorrhyncha, taxonomy

## Introduction

Western Australia represents over a third of Australia's land area, but has held disproportionately few of Australia's described cicada fauna. By 1990 only 51 species were known from the state (Moulds 1990), out of 202 from the country as a whole, and at that time the identities of 17 of them remained obscured. Of the 51 species 12 were described before 1900 and only six after 1914. Two of these species have since been synonymised, one *Simona* and one *Dipsopsalta* (Moulds 2012), and another found not to occur in Western Australia. Thus, in 1990, in reality only 48 species had been recorded.

In the 32 years since the publication of Moulds (1990) a further 41 species and one subspecies have been added to the Western Australia fauna. Twelve of these came from a revision of the genus *Pauropsalta* (Owen & Moulds 2016). A further 12 were the result of generic revisions by Moulds (1996, 2020) who added three *Gudanga* species and three *Punia* species respectively, Moulds and Marshall (2021) who added four *Jassopsaltria* species, and Popple (2017a) who added two species of *Myopsalta*. Other additions included a new species of *Chrysocicada* (Boulard 1989), a new *Kobonga* (Moulds & Kopestonsky 2001), three new *Tryella* (Moulds 2003, Emery *et al.* 2022), a new *Thopha* and new *Thopha* subspecies (Moulds 2008, Moulds & Hill 2015), records of single species of *Popplepsalta* and *Ewartia* (Popple 2013, 2017b), a new *Simona* (Ewart, Popple & Marshall 2015), a new *Auscala* and two new *Palapsalta* (Emery *et al.* 2018, 2020), and a new species in each of two new genera *Kimberpsaltria* (Moulds *et al.* 2021) and *Pericallea* (Moulds *et al.* 2022). In addition Moulds (1994) confirmed that *Burbunga gilmorei* was a Western Australian species. Ewart, Moulds & Marshall (2015) extended the distribution of *Arenopsaltria nubivena* to Western Australia and Moulds (2012) similarly extended the distribution of *Neopunia graminis*. Together these records raised the number of described cicada species (together with one subspecies) recorded from Western Australia to 90. From our knowledge of the Western Australian cicada fauna we estimate this is perhaps less than half the species occurring there.

We now describe a further 13 new species (and five new genera) from Western Australia. In addition *Erempsalta hermannsburgensis* (Distant, 1907) is redescribed and recorded from Western Australia for the first time. This brings the total number of species known from Western Australia to 104 (Table 1) out of a total described Australian cicada fauna of 370 species. Comments on the status of each new species are provided together with notes on their biology and distributions. The song of each species is discussed and analysed where known.

**TABLE 1.** Summary of cicada species known from Western Australia (including the species added in this paper) Higher classification follows that proposed by Marshall *et al.* (2018) and Moulds *et al.* (2021). Total number of species equals 104 in 39 genera.

| |
|---|
| Family CICADIDAE Latreille, 1802 |
| Subfamily CICADETTINAE Buckton, 1890 |
| Tribe CICADETTINI Buckton, 1890 |
| *Adelia* Moulds, 2012 |
| *borealis* (Goding & Froggatt, 1904) |
| *Atrapsalta* Owen & Moulds, 2016 |
| *dolens* (Walker, 1850) |
| *Auscala* Moulds, 2012 |
| *flammea* Emery, Emery & Hutchinson, 2020 |
| *spinosa* (Goding & Froggatt, 1904) |

*Calipsalta* **gen. n.**
*brunnea* **sp. n.**
*fumosa* **sp. n.**,
*viridans* **sp. n.**
*Clinata* Moulds, 2012
*nodicosta* (Goding & Froggatt, 1904)
*Dipsopsalta* Moulds, 2012
*signata* (Distant, 1914)
*Erempsalta* Moulds, 2012
*hermannsburgensis* (Distant, 1907)
*Ewartia* Moulds, 2012
*cuensis* (Distant, 1913)
*adusta* **sp. n.**
*etesia* Popple, 2017
*Froggattoides* Distant, 1910
*pallida* (Ashton, 1912)
*Gudanga* Distant, 1905
*aurea* Moulds, 1996
*boulayi* Distant, 1905
*browni* (Distant, 1913)
*kalgoorliensis* Moulds, 1996
*solata* Moulds, 1996
*Kalarko* **gen. n.**
*ferruginosus* **sp. n.**
*Kobonga* Distant, 1906
*apicans* Moulds & Kopestonsky, 2001
*apicata* (Ashton, 1914)
*froggatti* Distant, 1913
*umbrimargo* (Walker, 1858)
*Marteena* Moulds, 1986
*rubricincta* (Goding & Froggatt, 1904)
*Myopsalta* Moulds, 2012
*chrysopedia* Popple, 2017
*xerograsidia* Popple, 2017
*Neopunia* Moulds, 2012
*graminis* (Goding & Froggatt, 1904)
*Noongara* Moulds, 2012
*issoides* (Distant, 1905)
*Palapsalta* Moulds, 2012
*belli* Emery, Emery & Hutchinson, 2018
*ligneocauda* Emery, Emery &Hutchinson, 2018
*Parvopsalta* **gen. n.**
*victoriae* **sp. n.**
*Pauropsalta* Goding & Froggatt, 1904
*accola* Owen & Moulds, 2016
*agasta* Owen & Moulds, 2016
*confinis* Owen & Moulds, 2016
*conflua* Owen & Moulds, 2016
*contigua* Owen & Moulds, 2016
*extrema* (Distant, 1892)
*infuscata* (Goding & Froggatt, 1904)
*juncta* Owen & Moulds, 2016

*katherina* Owen & Moulds, 2016
*similis* Owen & Moulds, 2016
*sinavilla* Owen & Moulds, 2016
*Pedana* **gen. n.**
*hesperia* **sp. n.**
*Pegapsaltria* **gen. n.**
*lutea* **sp. n.**
*Pericallea* Moulds, Marshall & Hutchinson, 2022
*katherina* Moulds, Marshall & Hutchinson, 2022
*Physeema* Moulds, 2012
*bellatrix* (Ashton, 1914)
*convergens* (Walker, 1850)
*latorea* (Walker, 1850)
*quadricincta* (Walker, 1850)
*Popplepsalta* Owen & Moulds, 2016
*corymbiae* (Popple, 2013)
*Punia* Moulds, 2012
*hyas* Moulds, 2020
*limpida* Moulds, 2020
*minima* (Goding & Froggatt, 1904)
*Pyropsalta* Moulds, 2012
*melete* (Walker, 1850)
*amnica* **sp. n.**
*patula* **sp. n.**
*rhythmica* **sp. n.**
*Simona* Moulds, 2012
*erema* Ewart, Popple & Marshall, 2015
*sancta* (Distant, 1913)
*Uradolichos* Moulds, 2012
*rotunda* Owen & Moulds, 2016

Tribe LAMOTIALNINI Boulard, 1976
*Tryella* Moulds, 2003
*castanea* (Distant, 1905)
*fumipennis* Emery, Emery, Hutchinson & Ong, 2022
*noctua* (Distant, 1913)
*occidens* Moulds, 2003
*rubra* (Goding & Froggatt, 1904)
*stalkeri* (Distant, 1907)
*wuggubun* Emery, Emery, Hutchinson & Ong, 2022

Tribe PICTILINI Moulds & Hill in Marshall *et al.*, 2018
*Chrysocicada* Boulard, 1989
*franceaustralae* Boulard, 1989
*trophis* **sp. n.**
*Pictila* Moulds, 2012
*occidentalis* (Goding & Froggatt, 1904)

Subfamily CICADINAE Latreille, 1802
Tribe ARENOPSALTRIINI Moulds in Marshall *et al.*, 2018
*Arenopsaltria* Ashton, 1921
*fullo* (Walker, 1850)

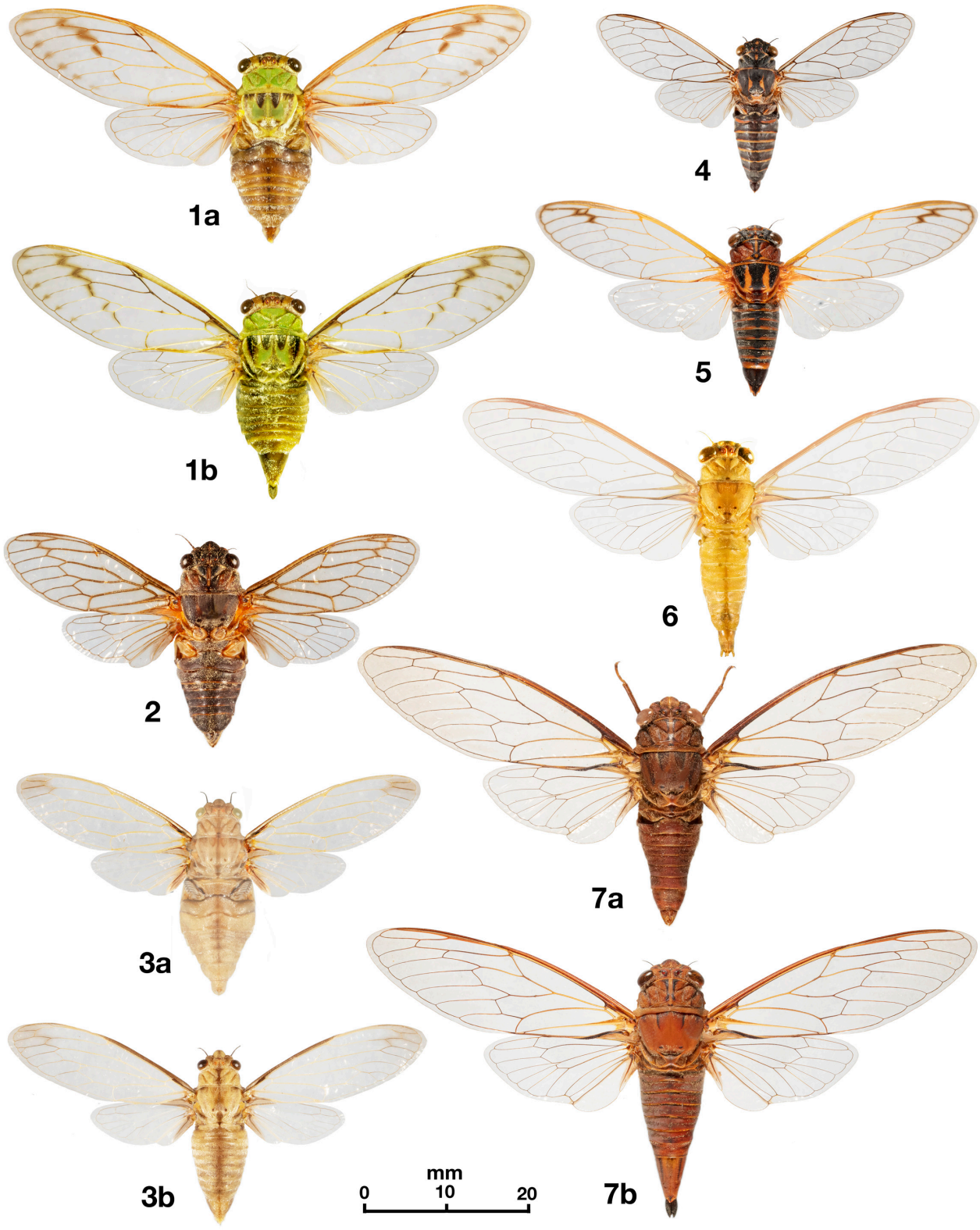
*nubivena* (Walker, 1858)
*pygmaea* (Distant, 1904)
*Parnquila* Moulds, 2012
*magna* (Distant, 1913)
*unicolor* (Ashton, 1921)

Tribe BURBUNGINI Moulds, 2005
*Burbunga* Distant, 1905
*aterrima* Distant, 1914
*gilmorei* (Distant, 1882)
*hillieri* (Distant, 1907) (nec *hillieri* Distant, 1906)
*inornata* Distant, 1905
*nanda* (Burns, 1964)
*nigrosignata* (Distant 1904)
*occidentalis* (Distant, 1912)

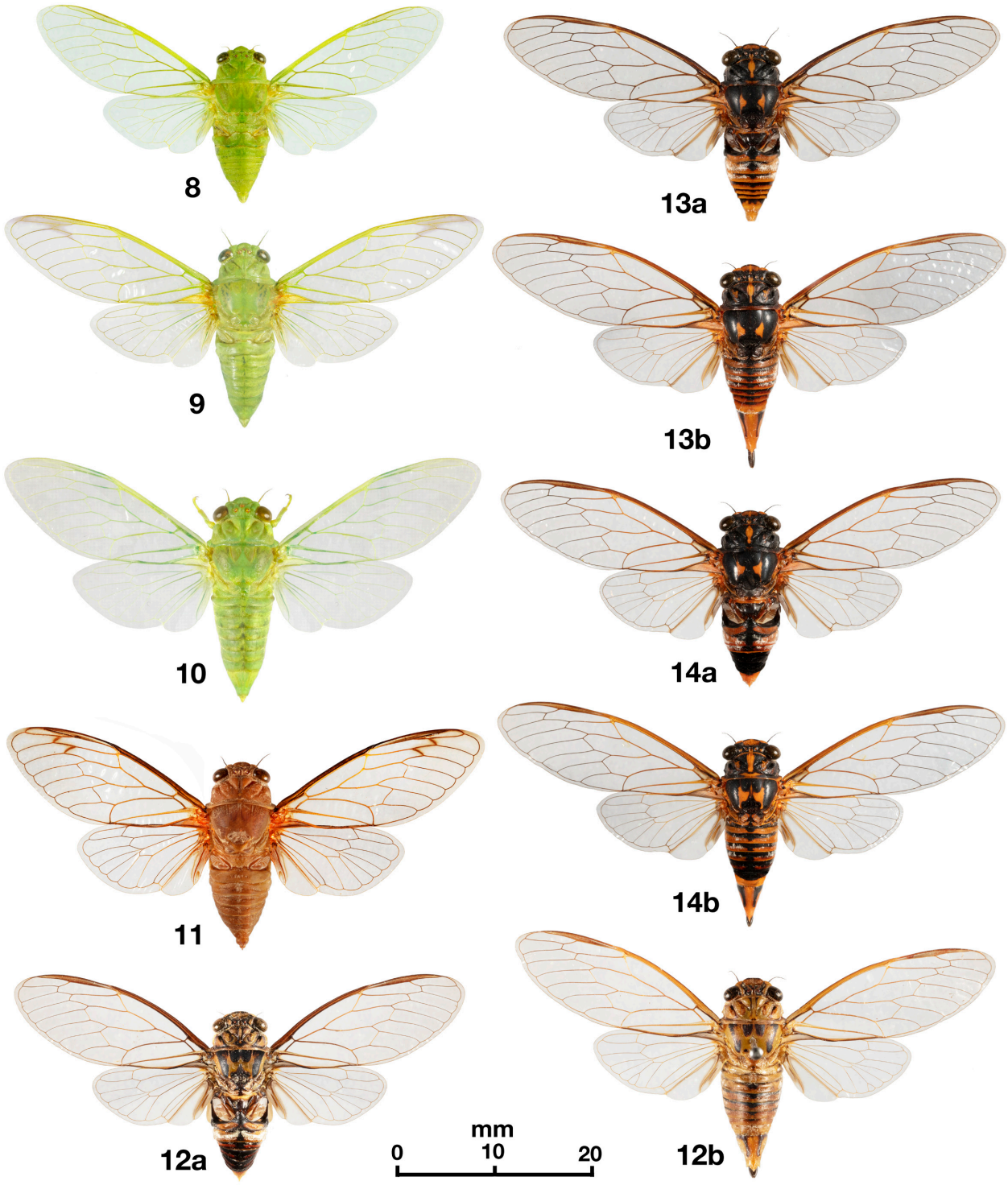
Tribe JASSOPSALTRIINI Moulds, 2005
*Jassopsaltria* Ashton, 1914
*aeroides* Moulds & Marshall, 2021
*cinnamomea* Moulds & Marshall, 2021
*gracilens* Moulds & Marshall, 2021
*minilyaensis* Moulds & Marshall, 2021
*rufifacies* Ashton, 1914

Tribe KIMBERPSALTRIINI Moulds, Marshall & Popple, 2021
*Kimberpsaltria* Moulds, Marshall & Popple, 2021
*taenia* Moulds, Marshall & Popple, 2021

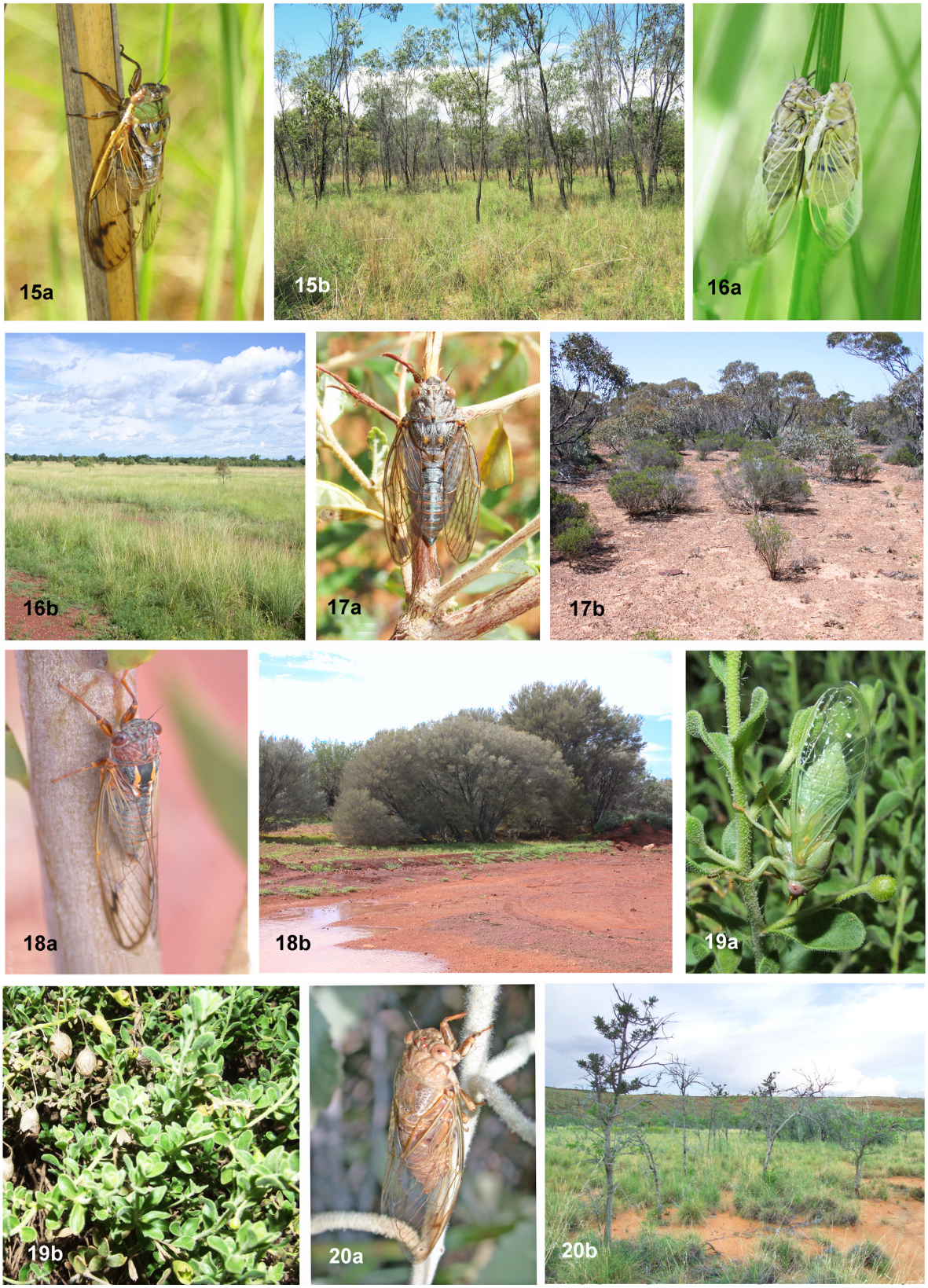
Tribe MACROTRISTRIINI Moulds in Marshall *et al.*, 2018
*Macrotristria* Stål, 1870
*douglasi* Burns, 1964
*extrema* (Distant, 1892)
*hieroglyphicalis* (Kirkaldy, 1909)
*intersecta* (Walker, 1850)
*thophoides* Ashton, 1914
*worora* Burns, 1964
*Illyria* Moulds, 1985
*australensis* (Kirkaldy, 1909)
*burkei* (Distant, 1882)
*hilli* (Ashton, 1914)
*major* Moulds, 1985
*viridis* **sp. n.**
Tribe THOPHINI Distant, 1904
*Thopha* Amyot & Serville, 1843
*colorata* Distant, 1907
*hutchinsoni* Moulds, 2008
*sessiliba clamoris* Moulds & Hill, 2015
*sessiliba sessiliba* Distant, 1892




**FIGURES 1–7**. (1a) *Illyria viridis* **sp. n.**, male; (1b) *Illyria viridis* **sp. n.**, female; (2) *Pedana hesperia* **gen. et sp. n.**, male; (3a) *Chrysocicada trophis* **sp. n.**, male; (3b) *Chrysocicada trophis* **sp. n.**, female; (4) *Parvopsalta victoriae* **gen. et sp. n.**, male; (5) *Ewartia adusta* **sp. n.**, female; (6) *Pegapsaltria lutea* **gen. et sp. n.**, male; (7a) *Kalarko ferruginosus* **gen. et sp. n.**, male; (7b) *Kalarko ferruginosus* **gen. et sp. n.**, female.




**FIGURES 8–14.** (8) *Erempsalta hermannsburgensis* (Distant, 1907), male; (9) *Calipsalta fumosa* **gen. et sp. n.**, male; (10) *Calipsalta viridans* **gen. et sp. n.**, female; (11) *Calipsalta brunnea* **gen. et sp. n.**, male; (12a) *Pyropsalta patula* **sp. n.**, male; (12b) *Pyropsalta patula* **sp. n.**, female; (13a) *Pyropsalta amnica* **sp. n.**, male; (13b) *Pyropsalta amnica* **sp. n.**, female; (14a) *Pyropsalta rhythmica* **sp. n.**, male (14b) *Pyropsalta rhythmica* **sp. n.**, female.




**FIGURES 15–20.** Live adults and their habitats. (15a) *Illyria viridis* **sp. n.**, male singing; (15b) same species, type locality; (16a) *Chrysocicada trophis* **sp. n.**, mating pair; (16b) same species, type locality; (17a) *Pedana hesperia* **gen. et sp. n.**, male calling; (17b) same species, type locality; (18a) *Ewartia adusta* **sp. n.**, male; (18b) same species, type locality; (19a) *Erempsalta hermannsburgensis* (Distant, 1907), male calling in its usual upside-down position; (19b) same species, favoured adult host plant; (20a) *Calipsalta brunnea* **gen. et sp. n.**, male; (20b) same species, habitat near Wolfe Creek Meteorite Crater, close to type locality. Not to scale.

## Materials and methods

The following abbreviations are used for collections housing specimens: AMS Australian Museum, Sydney; ANIC Australian National Insect Collection, Canberra; DE collection of David Emery; LP collection of Lindsay Popple; MSM author's collection; NHMUK Natural History Museum, London; NTM Northern Territory Museum of Arts and Science, Darwin; PH collection of Paul Hutchinson; QM Queensland Museum, Brisbane; UCONN University of Connecticut, Storrs, USA; WAM Western Australian Museum, Perth.

GPS values of localities were obtained using a handheld GPS unit (Garmin GPS V). Maps were generated by hand in Adobe Photoshop CS.

Male calling songs were digitally recorded in the field at a sampling rate of 44.1 kHz or 48.0 kHz using a Sony (Sony Electronics Inc., Fort Myers, FL) TCD-D8 DAT recorder (2002–2004 field work), a one of several models of Marantz (Mahwah, NJ, USA) audio recorders (e.g., PMD-670) (2005–2010 field work), or a Zoom (Zoom Corporation, Tokyo, Japan) H4n audio recorder (late 2011 field work), the latter using a 96 kHz sampling frequency. The digital recorder was combined with a Sennheiser (Old Lyme, CT, USA) ME62 omnidirectional microphone with a windscreen and, in most cases, a Sony PBR-330 parabolic reflector (otherwise a ME66 short shot gun microphone plus windscreen was used). The microphones were powered by Sennheiser K6 power modules, and they have a frequency response that is approximately flat from 40 Hz–20 kHz (+/-2.5 dB).

Terminology for morphological features follows that of Moulds (2005, 2012). Acoustic terminology is as follows: A *pulse* is a burst of sound energy containing multiple sound *waves* (the primary pressure-amplitude waveform); pulses often appear in pairs as *doublets*. This definition does not assume a specific mechanical basis, so a pulse could be created by one timbal collapsing or rebounding, both timbals collapsing/rebounding in synchrony or asynchrony (Puissant & Gurcel 2018), or one or more ribs of one or both timbals collapsing/rebounding (e.g., Fleming 1975). Further, in many recordings a single main pulse is accompanied by one or more much quieter secondary pulses that vary in intensity and degree of coalescence across instances. We emphasize here only the primary pulses. A *syllable* is a group of pulses or doublets repeated at an approximately uniform rate. For some species the term *echeme* is used to denote a characteristic combination of different kinds of syllables. A *phrase* is the highest order combination of stereotypically produced syllables and/or echemes.

Measurements of acoustic features were made using Raven version 1.5 Pro (Cornell Lab of Ornithology, Ithaca, NY, USA). Repetition rates of sound components were measured from oscillograms (waveforms) to the nearest 0.001 s and are presented here as ranges of observed values. Acoustic spectra are reported as ranges within which the sound energy remains within -15 decibels of the intensity of the peak frequency. Recordings were sometimes filtered to remove background sound energy below a threshold frequency, which was adjusted as needed. Spectrograms were made using a Hann window, with size varying from 256–512 samples depending on species, and with Raven allowed to adjust the remaining parameters automatically. Spectrogram illustrations show only the frequencies above the filter threshold in each case. Air temperatures, if taken, were recorded with an Omega HH-25KF temperature meter and type K thermocouple (OMEGA Engineering, Stamford, CT, USA) or in some cases with an ordinary household digital thermometer. Some males were recorded while kept in 1.5 litre mesh fabric 'Port-a-Bug' cages obtained from Insect Lore, 132 South Beech Avenue, Shafter, CA, USA.

## Subfamily Cicadinae Latreille, 1802

### Tribe Macrotristriini Moulds in Marshall *et al.*, 2018

#### *Illyria* Moulds, 1985

When first established the genus *Illyria* included four species (Moulds 1985) and no further species have since been added. Moulds (2012) provided a more detailed analysis of the genus noting, in particular, the wide head (eyes widely separated from the supra-antennal plates), a narrow pronotal collar, timbal covers that almost reach the metathorax (although their upper margin is reduced exposing a small part of the timbal membrane), and distinctive male genitalia that have the distal shoulders upwardly turned at their apices, large rounded and outwardly directed basal lobes, and a theca bearing a pair of subapical cerci (the left one at least exceedingly long). The species described below as *I. viridis* **sp. n.** has all of these attributes including the distinctive male genitalia.

One species, *I. hilli*, differs a little from the three other described species in having a green colouring, a slightly wider male abdomen and a slightly larger tympanal cavity. These are also attributes of *I. viridis* **sp. n.** but in the latter they are exaggerated so that the male abdomen is clearly wider than the thorax and the tympanal cavity occupies around half the length of the ventral abdomen. These shared attributes suggest *I. hilli* and *I. viridis* are sister taxa within *Illyria*.

***Illyria viridis* sp. n.**
urn:lsid:zoobank.org:act:C2761892-97A3-4C9F-AF66-B10AB3A977C6
(Figs 1, 15, 21–23)

**Common name.** Yidiyidi, the name originating from the Wuggubun people who know this cicada well.

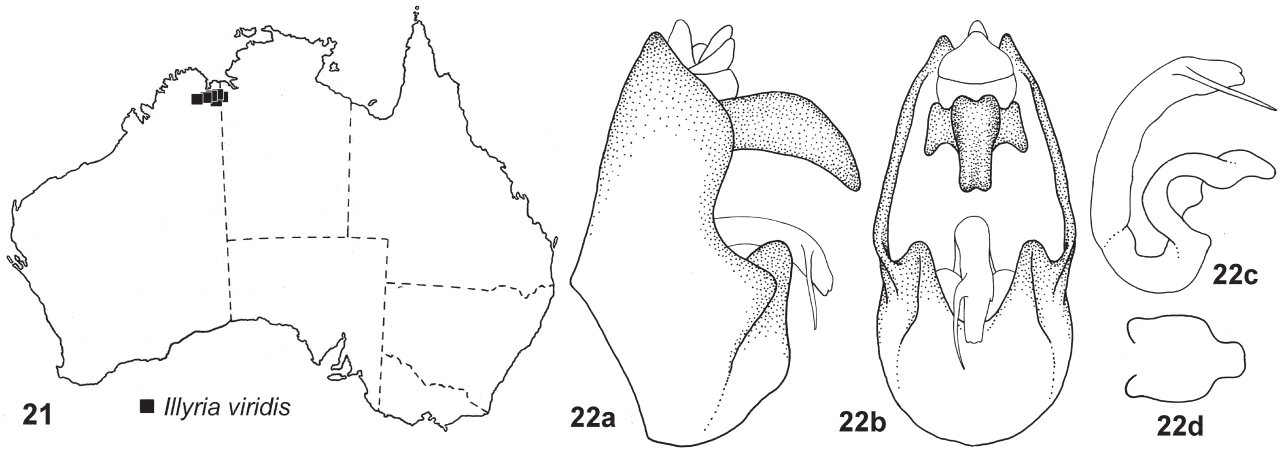
**Etymology.** Named from the Latin adjective *viridis* meaning green and pertaining to the green colour of this species.

**Types.** *Holotype* male, 40 km E of Durack R. x-ing, Gibb R. road, Western Australia, 29.xii.1991, M.S. & B.J. Moulds (WAME 113416) (WAM). *Paratypes* as follows: **WESTERN AUSTRALIA:** 2 males, 40 km W of Kununurra, 6.i.1986, M.S. & B.J. Moulds (AMS). 4 males, 3 females, Durack, Great Northern Highway, 16.005°S 128.418°E, 21.i. 2020, S. Ong; 1 male, near Molly Springs, Victoria Highway, 15.811°S 128.485°E, 26.i.2020, S. Ong; 2 males, Wuggubun Springs, Wuggubun Indigenous Community, 15.961°S 128.380°E, 7.ii.2020, S. Ong; 2 males, 40 km W of Kununurra, 6.i.1986, M.S. & B.J. Moulds; 1 male, AU.WA.DRK, Gibb R. Rd, at Durack R./Bamboo Ck jct. 15º51.613'S 127º21.963'E, 240 m, 19.xi.2011, K. Hill, D. Marshall (DE). 2 males, 40 km W of Kununurra, 6.i.1986, M.S. & B.J. Moulds (LP). 1 male, Valentine Springs, Valentine Springs Rd, Kununurra, 15.720°S 128.652°E, 1.ii.2020, S. Ong, PMH Coll #CIC 2410; 2 males, 40 km W of Kununurra, 6.i.1986, M.S. & B.J. Moulds (PH). 15 males, 40 km W of Kununurra, 6.i.1986, M.S. & B.J. Moulds; 12 males (2 genitalia preps. BUR11, NTR1), 1 female, 40 km E of Durack R. x-ing, Gibb R. road, 29.xii.1991, M.S. & B.J. Moulds; 14 males, 8 km E of Durack R. x-ing, Gibb R. road, 30.xii.1991, M.S. & B.J. Moulds; 18 males (3 Simon Lab. vouchers 11.AU.WA.DRK.01, 11.AU.WA.DRK.02, 11.AU.WA.DRK.03, 11.AU.WA.DRK.05 in ethanol), 2 females, Gibb R. Rd, at Durack R./Bamboo Ck jct. 15º51.61'S 127º21.96'E, 240 m, 19.xi.2011, K. Hill, D. Marshall (MSM). 8 males, Gibb R. Rd, at Durack R./Bamboo Ck jct. 15º51.61'S 127º21.96'E, 240m, 19.xi.2011, K. Hill, D. Marshall (WAME 113417-113424) (WAM). **NORTHERN TERRITORY:** 5 males, 2 females, Gurrandalng [=Goorrandalng] camping area, Keep River Nat. Park, 15°52'S 129°03'E, 100 m, 4.i.1993, G. and A. Daniels (MSM). 5 males, 2 females, Gurrandalng camping area, Keep River Nat. Park, 15°52'S 129°03"E, 100 m, 4.i.1993, G. and A. Daniels (NTM).

**Distribution and habitat** (Figs 15b, 21) . Known only from an area within 150 km of Kununurra in the far north-eastern corner of Western Australia. The most western locality is the Durack River on the Gibb River Road, and the most eastern is just over the Northern Territory border at Keep River. Adults are found in long grass that usually has a mixture of both live and dead leaves and is often found growing next to small water channels. Adults appear after the first rains in December and can be locally common through to at least mid February.

**Adult description.** *Male* (Figs 1a, 15a, 22a–d). *Head* brown, darkest around ocelli, paling towards eyes and often with a faint green tinge. Eyes in life pale tan. Postclypeus brown, similar in tone to that around ocelli. Anteclypeus brown, darkening towards apex. Rostrum brown, becoming black at apex; reaching bases of hind coxae. *Thorax* green dorsally, light brown ventrally. Pronotum often with (but sometimes lacking) a black or dark brown narrow fascia either side of midline, together these forming an inverted keyhole shape extending between anterior pronotal margin and pronotal collar; often irregular black or brown markings along sutures and extending laterally adjacent to the paranota and onto the pronotal collar lateral angles. Mesonotum with submedian and lateral sigilla black, the latter sometimes reticulate; scutal depressions black, and a black or dark brown mark between anterior arms of cruciform elevation that sometimes projects forwards in a lanceolate spike; cruciform elevation sometimes tending light yellowish brown. *Forewing* hyaline; costa light yellowish brown often with hints of green, most other venation on basal half also light yellowish brown; 2A+3A black adjacent to basal membrane; venation on distal half of wing dark brown or black; infuscation on veins forming bases of apical cells 2–5 and 7; distal ends of longitudinal veins forming apical cells 1–7 with an infuscated spot; basal cell tinted brown, often only on anterior half; basal membrane pale brown to pale pinkish orange. *Hindwing* venation dark brown to black except for very pale brown CuA, CuP, and 1A–3A; a narrow white plaga on 2A and a wide plaga on 3A, both reaching full length. *Legs* yel-

lowish brown to dark brown, often with green tints; fore femora with spines short, the primary spine no longer than any other; meracantha dark brown basally becoming pale yellow distally. Opercula broad and rounded, not quite meeting or slightly overlapping, confined to margins of tympanal cavities; pale yellow with a large black suffusion on anterior distal half but not reaching apex. *Abdomen* with tergites brown, often darker or tending black on tergites 2 and 3; sternites yellowish brown to mid brown but always paler than tergites. *Timbal covers* similar in colour to tergite 2 but usually palest apically; reaching about half way across timbal cavity. *Timbals* as in generic description above.




**FIGURES 21–22.** *Illyria viridis* **sp. n. (21)** distribution; (22a) male genitalia in lateral view; (22b) same in ventral view; (22c) dissected aedeagus in lateral view; (22d) basal plate in dorsal view, apex at right.

Genitalia (Figs 22a–d). Uncus in lateral view gently curved, widest at about mid length and tapering on distal half to a bluntly rounded point; uncus in dorsal view barely tapered, the apex emarginate, the dorsal midline depressed. Aedeagus robust; basal plate in dorsal view terminating in a short, somewhat squared apical projection; two subapical 'cerci', one very long on left side protruding beyond thecal apex, the other ill-defined.

*Female* (Fig. 1b). Colouration and markings similar to male. Abdominal segment 9 brown on dorsal half, pale yellow on ventral half with a small dull black mark against ventral basal margin; apical spine black or tending so; ovipositor sheath distally black, projecting about 1.5 mm beyond apical spine.

**Measurements.** Range and mean (in mm) for 10 males, 9 females (includes smallest and largest specimens). *Length of body* (including head): male 15.6–17.3 (16.2); female (including ovipositor) 14.8–18.7 (16.5). *Length of forewing*: male 18.6–22.6 (20.6); female 17.7–20.5 (19.2). *Width of head* (including eyes): male 5.1–5.7 (5.4); female 4.8–5.5 (5.2). *Width of pronotum* (across lateral angles): male 5.6–6.2 (6.0); female 5.1–6.1 (5.8).

**Distinguishing features.** *Illyria viridis* **sp. n.** is closest to *I. hilli* in its overall green appearance and markings, and has somewhat similar male genitalia. It differs, however, in having the distal ends of the veins forming the apical cells each bearing an infuscated spot, in its distinctly swollen male abdomen and very large tympanal cavity the occupies half the length of the abdomen.

**Song** (Figs 23a–d). Recordings were examined only from the WA.DRK paratype location.

The male calling song is a continuous, slightly rattle-like call. Short syllables of generally 3–8 pulses are produced at a uniform rate of 23–27 syllables/s. The song oscillates between series of syllables of contrasting length, with syllable length slowly decreasing with a concordant drop in amplitude and then more suddenly returning to longer, louder syllables. The resulting phrases are about 4.5–7 s in duration. Occasionally, just as the shift to longer, louder syllables begins, short single pulses are produced between the syllables. Peak sound frequency varies slightly between 10–11.5 kHz, with a drop in the dominant frequency corresponding to the transition to longer syllables. Most sound energy is concentrated within the range 9.0–12.5 kHz. Sound intensity varies by a factor of 2 to 3 on the oscillogram scale.

Males sing both during the heat of the day and at dusk. Adults can often be plucked from grass stems while singing.

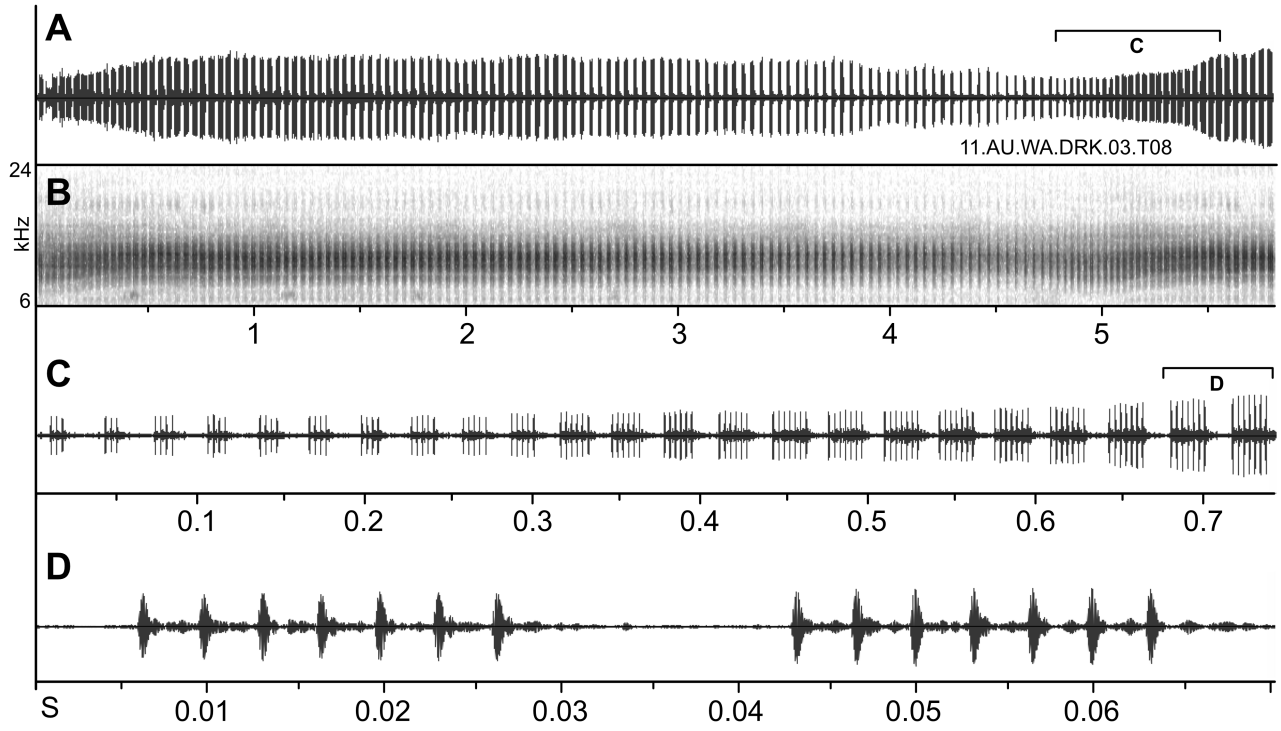



**FIGURE 23.** *Illyria viridis* **sp. n.**, male calling song. (23a, b) oscillogram and spectrogram of one song phrase from the WA.DRK paratype location (34°C); (23c, d) further detail of syllables and pulses.

**Subfamily Cicadettinae Buckton, 1890**

**Tribe Pictilini Moulds & Hill in Marshall *et al.*, 2018**

***Chrysocicada* Boulard, 1989**

Boulard (1989, 1990) described the genus *Chrysocicada* for the single species *franceaustralae* Boulard, 1989, a description that was later enhanced by Moulds (2012). We here slightly broaden the concept of *Chrysocicada* to include the new species described below as *C. trophis* **sp. n.**

*Chrysocicada trophis* **sp. n.** differs from *C. franceaustralae* in having a head that is narrower than the mesonotum instead of about equal, 5 hindwing apical cells instead of 6, and tergites 2 and 3 just a little wider along midline than any of tergites 4–7 instead of being about equal. These are not reliable characters for justifying generic separation as they are sometimes variable within genera. One further attribute needs comment: vein $CuA_1$ is divided by crossvein m-cu so that the proximal section is longest in *C. trophis,* an uncommon attribute in the subfamily Cicadettinae, but this feature is variable in *C. franceaustralae* from being either shorter, longer or about equal to the distal section. Thus, we modify the generic definition of *Chrysocicada* to incorporate this variability.

*Chrysocicada* is distinguished from all other genera in having, in combination, forewing veins M and CuA unfused at the basal cell, the male genitalia in having claspers and having the ventral rib of the basal plate attached only at its extremities, and lacking a dorsal beak, an uncus, and pseudoparameres.

A molecular phylogeny by Marshall *et al.* (2016: fig. 2) places *Chrysocicada trophis* **sp. n.** (represented in their tree by '*Chrysocicada* nr. *franceaustralae*') in a clade that is sister to *Pictila occidentalis* (Goding & Froggatt, 1904), *Pictila* being the type-genus of the tribe Pictilini Moulds & Hill, 2018. The tribe currently contains only *Pictila* and *Chrysocicada* (Marshall *et al.* 2018).

***Chrysocicada trophis* sp. n.**
urn:lsid:zoobank.org:act:E3190B16-8D44-4798-B2A0-2D053C615D13
(Figs 3, 16, 24–26)

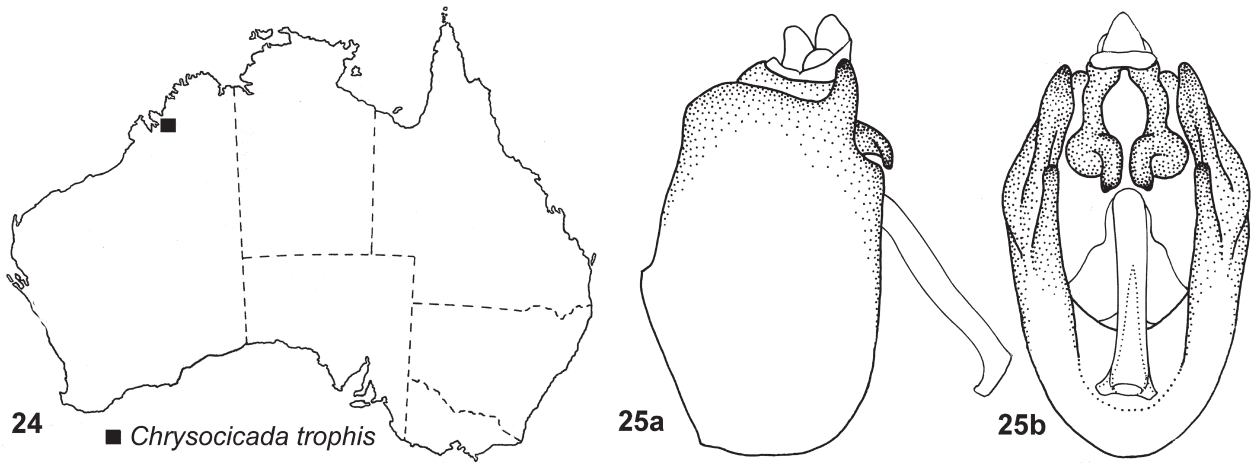
**Synonymy**. *Chrysocicada* nr. *franceaustralae* Marshall *et al.* 2016: fig. 2.

**Etymology.** Named from the Greek adjective *trophis* meaning well-fed, fat, stout, and pertaining to the inflated male abdomen of this species.

**Tribe.** Pictilini, Moulds & Hill, in Marshall *et al.*, 2018.

**Types**. *Holotype* male (Simon Lab. molecular voucher 06.AU.WA.MDE.01, song recorded), Meda Stn, 53 km E of Derby, Western Australia, 17º25.090'S 124º05.825'E, 24 m, 7.ii.2006, Hill, Marshall, Moulds (WAME 113425) (WAM). *Paratypes* as follows : **WESTERN AUSTRALIA:** 2 males, 1 female, same data as holotype (DE). 2 males, same data as holotype (LP). 6 males, 2 females (2 males genitalia preps. CHR3 and CHR4), same data as holotype (MSM). 1 male, same data as holotype (PH).1 male, same data as holotype (molecular voucher 06.AU.WA.MDE.02) (UCONN). 5 males, same data as holotype (WAME113426-113430) (WAM).

**Distribution and habitat** (Figs 16b, 24). Far western Kimberleys where it is known from grasses at just one locality on Meda Station.




**FIGURES 24–25.** *Chrysocicada trophis* **sp. n.** (24) distribution; (25a) male genitalia in lateral view; (25b) same in ventral view.

**Adult description.** *Male* (Figs 3a, 16a, 25a–b). *Head* pale yellowish (straw coloured). Eyes in life pale brown with a small black 'pupil'. Postclypeus pale yellowish. Anteclypeus pale yellowish partly covered by a light blackish suffusion. Rostrum pale yellowish with black suffusion at base, a narrow black midline and black distally; reaching to near apices of mid coxae. *Thorax* pale yellowish with subtle brown markings. Pronotum pale yellowish with hints of brown in paramedian and lateral fissures, along midline, along lateral extremities, and on parts of pronotal collar especially at lateral angles. Mesonotum pale yellowish with submedian and lateral sigilla showing hints of brown, a brown midline, and brown scutal depressions; cruciform elevation pale yellowish with a brown fascia on midline. Metanotum pale yellowish with a broad brown midline. *Forewings* hyaline with distinct light brown suffusion in apical area; venation pale yellow becoming black on $RA_2$, RP, and $M_1$, and on crossveins r and r-m; costa pale yellow to pale brown; apical cells 1–3 lightly overlaid with brown to blackish infuscation; basal cell hyaline; basal membrane very pale grey to very pale brown. *Hindwings* hyaline; venation pale yellow with blackish plaga along 3A. *Legs* pale yellowish with suffused light brown markings variable in extent. *Opercula* pale yellow. *Abdomen* with tergites pale yellowish; some or all of tergites 1–3 sometimes a little darker than remainder; dorsal midline weakly marked blackish from about tergite 1 to 7. Sternites yellow, without markings. *Timbals* with ribs as in generic description; anterior margin edged black and usually the long ribs and intercalary ribs brown or black along line of intercalary ribs.

*Male genitalia* (Figs 25a–b). See generic description above.

*Female* (Figs 3b, 16a). Similar to male but with tergites pale brown paling distally towards pale yellowish. Abdominal segment 9 pale yellowish to pale brown but usually pale yellow apically and along lateral margin. Ovipositor sheath black, not projecting beyond apical spine.

**Measurements.** Range and mean (in mm) for 10 males and 3 females (includes smallest and largest of available specimens). *Length of body* (including head): male 13.9–15.8 (14.9); female (including ovipositor) 13.2–14.2 (13.8). *Length of forewing*: male 13.4–15.7 (14.7); female 14.5–16.2 (15.2). *Width of head* (including eyes): male 3.4–3.7 (3.6); female 3.2–3.7 (3.5). *Width of pronotum* (across lateral angles): male 3.8–4.5 (4.1); female 3.3–4.0 (3,7).

**Distinguishing features.** Males of *Chrysocicada trophis* **sp. n.** can be distinguished from all other Australian species by their brown suffused wing tips, small size (forewing less than 16 mm long) swollen abdomen (clearly wider than thorax), narrow head (narrower than the mesonotum), and lack of fusion of forewing veins M and CuA at the basal cell. Further, forewing vein $CuA_1$ is divided by crossvein m-cu so that proximal portion is consistently longest. Females are more difficult to distinguish but their brown suffused wing tips and small size (forewing less than 16.2 mm long), narrow head and forewing veins M and CuA unfused at basal cell, in conjunction with forewing vein $CuA_1$ being divided by crossvein m-cu so that proximal portion is longest separate them from all others.

*Chrysocicada trophis* **sp. n.** differs from *C. franceaustralae* in having a head that is narrower than the mesonotum instead of about equal, five hindwing apical cells instead of six, and tergites 2 and 3 just a little wider along their midline than any of tergites 4–7 instead of being about equal.

**Song** (Figs 26a–d). Recordings were examined from the type locality, including song from the holotype male which is illustrated.

The calling song consists of a smooth, whining buzz that is produced for indefinite periods of time, usually while the male faces head upward with the wings angled outwards alongside the body and with the abdomen distinctly elevated. The song contains closely spaced or coalesced 4–5 pulse syllables repeated at about 150/s. The within-syllable pulse rate is approximately 700/s. In some samples the syllables cannot be distinguished and the pulse rates become irregular, yet the spectral profile does not change markedly. Most sound energy is contained within the range 7–12 kHz, and the peak sound frequency is about 9.5 kHz. The sound spectrum is not modulated over time, except that the pitch may drop with the approach of a recordist. Males occasionally hesitate in song production for ca. 0.1–0.2 s.

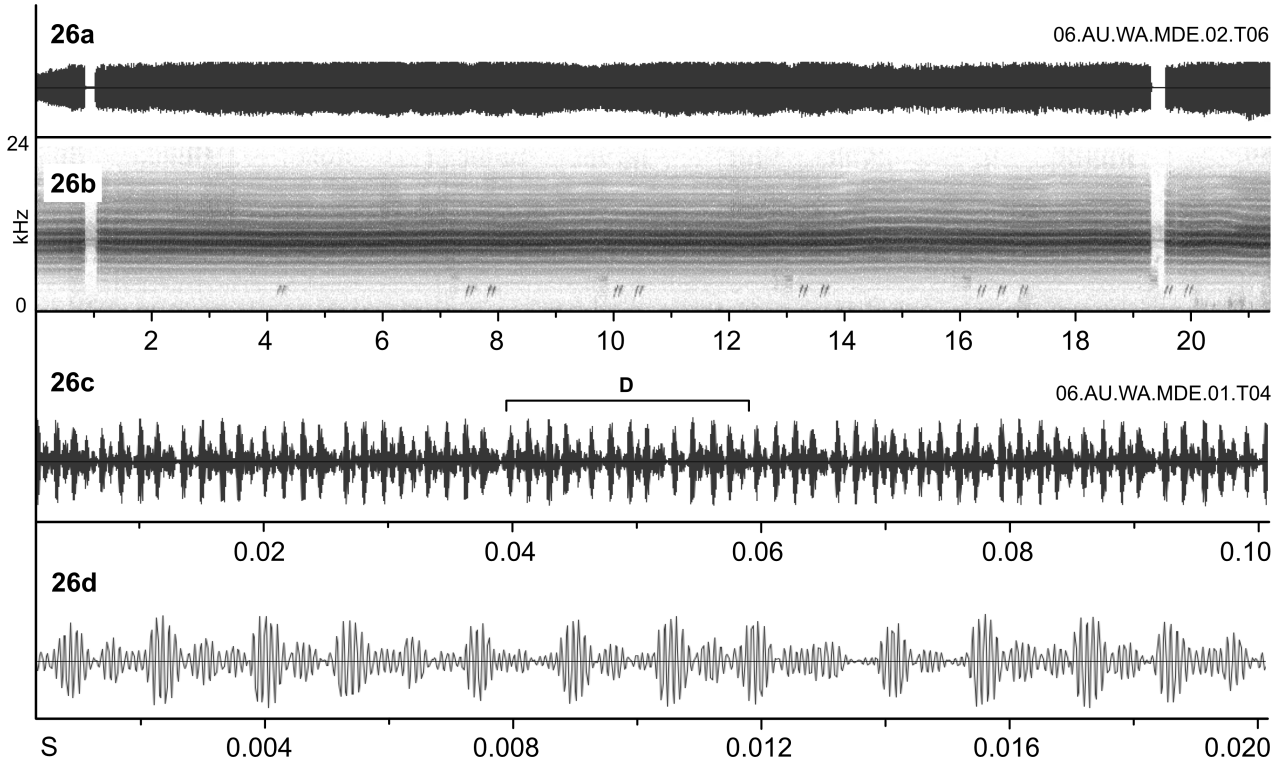



**FIGURE 26.** *Chrysocicada trophis* **sp. n.**, male calling song from the holotype locality. (26a, b) oscillogram and spectrogram of long segment from a paratype male (33°C) – some birdsong overlaps at lower frequencies; (26c, d) further detail of syllables and pulses shown from the holotype male.

The song of *Chrysocicada trophis* **sp. n.** is similar to that reported for the type species *C. franceaustralae*, which

sings from grasses with a similar posture (Boulard 1989). *C. trophis* differs in having a somewhat lower frequency spectrum (dominant frequency ca. 10 kHz instead of 12 kHz in *franceaustralae*). Additional very low frequency sound components reported by Boulard for the type (< 2.2 kHz, and a fundamental signal band at 0.1–1.3 kHz) are not present in the song of *C. trophis*. A spectrogram generated from an unfiltered sample is shown in Fig. 26b to demonstrate this. Such spectral frequencies are not usually found in the songs of small-bodied Cicadettinae and they might have been caused by the likely teneral (newly emerged) condition of the singers, reported by Boulard, or by microphone distortion. The two spectrograms published for *C. franceaustralae* do not allow unambiguous measurement of the underlying pulse and/or syllable rates.

**Ecology.** Males sing from within grass tussocks. A female was observed ovipositing in a live grass stem, facing head downwards. Individuals produce an alarm call when handled, but they are reluctant to fly and instead will drop to the base of a grass clump and remain still when disturbed.

One instance of pair-formation was observed, in which a female walked toward a singing male, stopping when the male stopped singing. The male moved toward the female when she was near, eventually found a way to her grass stem and began copulation. No wing-flicking was observed from the female. A perched male would often begin moving toward the hand of a careful collector, as if mistaking it for an approaching female.

## Subfamily Cicadettinae Buckton, 1890

## Tribe Cicadettini Buckton, 1890

### *Pedana* gen. n.

urn:lsid:zoobank.org:act:663DE68B-A66D-4EF0-B3CB-7AB45020715A
(Figs 2, 17, 27–29)

**Type species.** *Pedana hesperia* **sp. n.**, here designated.

**Included species.** *Pedana hesperia* **sp. n.**

**Etymology.** Named from the Greek *pedanos* meaning short, and referring to the short wings of this species. Feminine.

**Distribution** (Figs 17b, 27). Drier regions of southern Western Australia and South Australia and north-western Victoria.

**Diagnosis** (Figs 2, 28). *Head* including eyes narrower than mesonotum; distance between supra-antennal plate and eye about equal to length of supra-antennal plate; postclypeus broadly rounded transversely across ventral midline, in lateral profile angulate between 'top' and 'sides'. *Thorax*: pronotum in dorsal view parallel-sided or widening towards posterior; 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. *Forewings* hyaline; short, no longer than length of body including head; with eight apical cells; subapical cells absent; ulnar cell 3 angled to radial cell; radial cell shorter than cubital cell; basal cell long and narrow; costal vein (C) clearly higher than R+Sc; costa parallel-sided to node; costa of male gently and evenly curved; pterostigma present; vein CuA only weakly bowed so that cubital cell no wider than medial cell; veins M and CuA unfused at basal cell but very close, rarely meeting; vein $CuA_1$ divided by crossvein m-cu so that proximal portion shortest; distance between crossveins r and r-m much less than between r-m and m except in aberrant specimens; radial cell very short (shorter than cubital cell); wing outer margin developed for its total length, never reduced to be contiguous with ambient vein. *Hindwings* with 6 apical cells; no infuscation on ambient vein; width of 1st cubital cell at distal end more than twice that of 2nd cubital cell; anal lobe of medium width with vein 3A curved, long, and separated from wing margin. *Foreleg* femoral primary spine erect. *Male opercula* more or less reaching margin of tympanal cavity, directed towards distomedial margin of tympanal cavity, apically broadly rounded, not meeting. *Male abdomen* wider than thorax; in cross-section with sides of tergites straight or weakly convex; epipleurites reflexed ventrally from junction with tergites; tergite 2 wide along midline, wider than any other of tergites 3–7; sternites III–VII convex in cross-section not unusually swollen. *Timbals* with three long ribs, two long and one short but ill-defined; anterior part of timbal mostly occupied by ribs; basal plate large; timbals extended below the level of the wing bases; posterior margin of timbal cavity rounded and completely lacking a ridge on lower half or so.

*Male genitalia* (Figs 28a–d). Pygofer in ventral view ovoid to sub ovoid, distal portion of upper pygofer lobes not the widest point, not strongly tapered from upper pygofer lobes to base; pygofer with distal shoulders not developed; upper lobes flat, small to moderately developed, set well away from dorsal beak, rounded; basal lobes undivided, moderately developed, broadly rounded in lateral view, abutted against or partly tucked behind pygofer margin; dorsal beak present as a pointed apex (visible in dorsal view) and a part of chitinized pygofer. Uncus small, short, flattened, more or less duck-bill shaped. Claspers well developed, large, dominant; restraining aedeagus; wide in both ventral and lateral views, outer face with a deep overhanging lip along margin; unfused; distally diverging but their apices not widely separated, markedly less than the widest dimensions of the claspers. Aedeagus not trifid, with basal plate in lateral view undulated, weakly depressed on dorsal midline, in dorsal view longer than broad, apically broadened with 'ears'; ventral rib completely fused with basal plate; junction between theca and basal plate with a functional 'hinge' that possesses a chitinous back; thecal shaft gently and evenly curved; pseudoparameres long, slender, dorsal of theca and originating at its base, unfused throughout their length, parallel in dorsal view, in lateral view aligned with thecal shaft for much of its length; endotheca concealed; ventral support absent; flabellum absent; conjunctival claws absent; vesical opening apical on theca.

*Female* sternite VIII deeply incised in a V shape; abdominal segment 9 about as long as wide; dorsal beak with a developed apical spine (visible in dorsal view).

**Distinguishing features and relationships**. A small cicada. Differs from all genera in having, in combination, forewing veins M and CuA unfused at basal cell but very close, rarely meeting; the paranota confluent with adjoining pronotal sclerites and without a mid lateral tooth, a very short forewing radial cell (shorter than the cubital cell), and forewings that are very short (no longer than the length of the body including the head). The male genitalia have an aedeagus that is *not* trifid, with long pseudoparameres that are dorsal of the theca and ori**g**inate at its base.

The wings and body are similar in many ways to those of *Noongara issoides* (Distant, 1905) but the male genitalia show marked differences. The aedeagus of *N. issoides* is typically trifid whereas that of *Pedana* lacks a ventral support and has long slender pseudoparameres that originate at the thecal base. Unlike in *Noongara,* the timbals of *Pedana* are extended below the level of the wing bases.

A molecular phylogeny by Marshall *et al.* (2016: fig. 2) places *Pedana hesperia* **sp. n.** (the type species of *Pedana* and represented in their tree by "false quintilia") in a clade that is sister to *Noongara issoides.* These two genera are in turn sister to *Calipsalta* **gen. n.** (represented by "spinifex rattler" and "false hermannsburgensis"), all genera with a strong presence in Western Australia.

### ***Pedana hesperia* sp. n.**

urn:lsid:zoobank.org:act:3412DD9C-69BE-466A-8A75-39CCC4FD8CE4
(Figs 2, 17, 27–29)

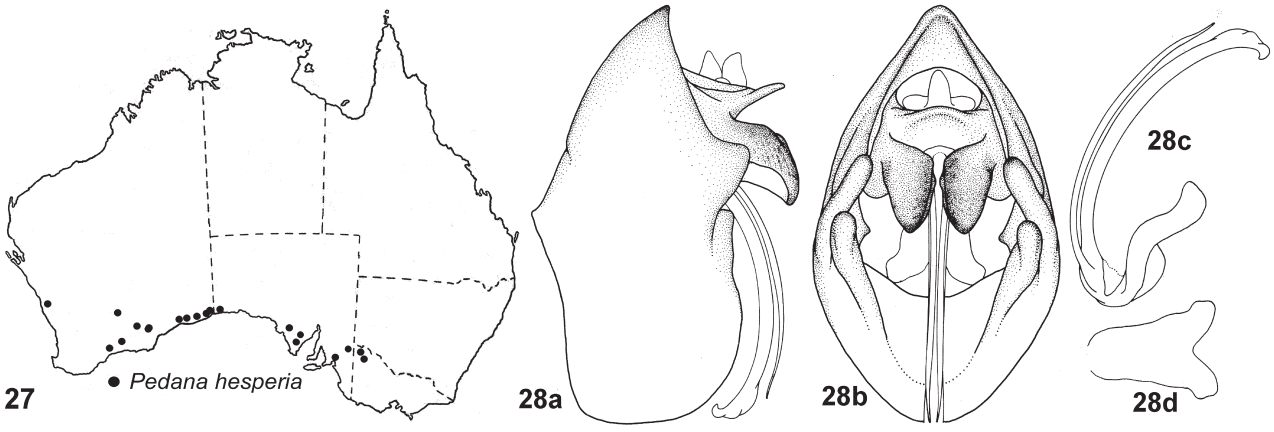
**Synonymy**. "false quintilia" Marshall *et al.* 2016: fig. 2.

**Etymology.** Named from the Greek *hesperios* meaning western land and pertaining to the mainly western distribution of this cryptic species.

**Types**. *Holotype* male (Simon Lab. voucher AU.WA.NUE), 13.2 km E of Cocklebiddy, Western Australia, 32°00.692'S 126°14.208'E, 72 m, 21.ii.2006, Hill, Marshall, Moulds (WAME 113437) (WAM). *Paratypes* as follows: **WESTERN AUSTRALIA:** 4 males, 1 female, 61 km E of Norseman on Eyre Highway, 32°2'S 122°21'E, 11.xi.1999, Rentz, D.C.F., Su, Y.N., Stop 191; 1 female, Hampton Tableland, 2 km N of Mundrabilla Motel, 31°48'S 128°13'E, 12.x.1984, Rentz, D.C.F., Stop 30; 1 male, Peak Charles NP, 7.x.2010, 32°51'34"S 121°09'35"E, 245-0002, L.W. Popple (ANIC). 1 male, Eucla, Nullarbor Plain, 7.xii.1978, M.S. & B.J. Moulds (DE). 2 males, 1 female, Balladonia Rd, 11.x.2010, 33°16'59"S 123°23'32"E, 245-0006 to 245-0008, L.W. Popple; 4 males, Peak Charles NP, 7.x.2010, 32°51'34"S 121°09'35"E, 245-0001 (song recorded), 245-0003 to 245-0005, L.W. Popple (LP). 1 male, WAU.EEN, 18 km E of Eneabba, 262 m, 29°45.4'S 115°25.9'E, 21.i.2003, Moulds, Hill, Marshall & Vanderpool; 7 males (one genitalia prep. Q4), Ravensthorpe, 8.xii.1985, M.S. & B.J. Moulds; 6 males, 1 female, Lake Douglas, 12 km SW of Kalgoorlie, 13.i.1989, M.S. & B.J. Moulds; 1 male (genitalia prep. Q7), Lake Douglas, 12 km SW of Kalgoorlie, 31.x.1986, A.J. Graham; 1 male, 25 km S of Balladonia Roadhouse, 32°33.65'S 123°37.10'E, 16.xii.1995, M.S. & B.J. Moulds; 2 males (one genitalia prep. Q5; Simon Lab. vouchers 06.AU.WA.BAL.01, 06.AU.

WA.BAL.03), Balladonia Roadhouse, 32°21.285'S 123°37.089'E, 177 m, 20.ii.2006, Hill, Marshall, Moulds; 3 males (one genitalia prep. Q8), 1 female, AU.WA.MAW, 24 km WSW of Madura, 31°55.788'S 126°46.737'E, 98 m, 21.ii.2006, Hill, Marshall, Moulds; 1 male, AU.WA.MUE, 7.7 km E of Mundrabilla, 31°49.164'S 128°18.356'E, 17 m, 6.ii.2009, K. Hill & D. Marshall; 3 males, AU.WA.NUE, same data as holotype; 7 males (two genitalia preps Q2, Q6), 1 female, Eucla, Nullarbor Plain, 7.xii.1978, M.S. & B.J. Moulds; 8 males, Eucla sand hills, 31°44'S 128°51'E, 14.xii.1995, M.S. & B.J. Moulds & K. Kopestonsky; 1 male, AU.WA.EUW, dunes ~8 km SW of Eucla, 31°43.321'S 128°50.857'E, 14 m, 22.ii.2006, Hill, Marshall, Moulds (MSM). 1 male, 6 km E. of Eucla, 13.i.1998, P. Hutchinson, on Melaleuca, PMH Coll #CIC 0885; 1 female, Eucla, found dead, 20,xi.1996, P. Hutchinson, PMH Coll #CIC 0887 (PH). 1 male, AU.WA.NUE, same data as holotype (WAME 113432); 1 male, Eucla sand hills, 31°44'S 128°51'E, 14.xii.1995, M.S. & B.J. Moulds & K. Kopestonsky (WAME 113433); 1 male, 1 female, AU.WA.MAW, 24 km WSW of Madura, 31°55.788'S 126°46.737'E, 98 m, 21.ii.2006, Hill, Marshall, Moulds (WAME 113434-113435); 1 male, Eucla, Nullarbor Plain, 7.xii.1978, M.S. & B.J. Moulds (WAME 113436) (WAM). **SOUTH AUSTRALIA:** 5 males, 15 km N. Tailem Bend, 35°07'01"S 139°27'56"E, 21.x.2019, 35°[C], sunny/windy, on shrubs, A. Stolarski; 2 males, Pilepudla, near Yeltana Rd, 32°56'00"S 136°25'37"E, 18.x.2011, A. Stolarski; 1 male, Hincks CP, 33°52'04"S 135°53'44"E. 28.xi.2021, A. Stolarski; 1 male, 30 km E by N of Swan Reach, 34°30.909'S 139°54.934'E, Mark A. Hura (LP). 6 males, 1 female, 55 km E of WA/SA border, Eyre Hwy, 25.i.1989, M.S. & B.J. Moulds; 1 male, AU.SA.MIN, 0.5 km SE of Minnipa, 32°51.932'S 135°09.696'E, 143 m, 5.ii.2009, K. Hill & D. Marshall, Simon Lab. voucher 09.AU.SA.MIN.01 (MSM). 2 males, 30 km E by N of Swan Reach, 34$^0$30.909'S, 139$^0$54.934'E, 14.x.2020, Mark A. Hura, 11:00 hrs, found calling from low bush, PMH Coll #CIC 0883, 0884; 2 males, 29 km ENE Kimba, 33°04'S, 136°43'E, 9.ix.2007, M. Hura, calling from dead branches on ground, PMH Coll #CIC 0886, 0888 (PH). **VICTORIA:** 1 male (genitalia prep. Q3), 18 km S Ouyen, 7.xii.1978, G. Daniels (MSM). 1 male (DNA voucher 04.AU.VI.MSP.01), Bambill South Rd, 20.5 km S. of Bambill, 74 m, 34°35.692'S, 141°29.845E, 02.iii.2004, J. Cooley, D. Marshall, K. Hill, M. Moulds, B. Moulds, S. Cowan (UCONN).

**Distribution and habitat** (Figs 17b, 27). Drier regions of southern Western Australia between Eneabba and Eucla, in South Australia near the Western Australian border on the Eyre Highway, the Eyre Peninsula south from Minnipa, in the vicinity of the Murray River near Tailem Bend and Swan Reach (A. Stolarski), and in far north-western Victoria near Ouyen (G. Daniels) and Bambill. Most records from Western Australia are from along the Eyre Highway between Balladonia and Eucla but there are also records from Lake Douglas near Kalgoorlie, Ravensthorpe, Peak Charles (L.W. Popple) as well as near Eneabba south of Geraldton. Adults frequent low dense shrubs growing in harsh environments. There are records from mid September to late February.




**FIGURES 27–28.** *Pedana hesperia* **sp. n.** (27) distribution; (28a) male genitalia in lateral view; (28b) same in ventral view; (28c) dissected aedeagus in lateral view; (28d) basal plate in dorsal view.

**Adult description**. *Male* (Figs 2, 17a). *Head* black; a small pale yellow patch between supra-antennal plate and eye, and a less distinct dull yellow spot on posterior midline. Postclypeus black with the lateral margins partially indistinct dull yellow, and a pale yellow spot at most anterior part. Anteclypeus black, sometimes with a dull yellow mark. Rostrum dark brown to black; reaching to near apices of mid coxae. *Thorax* dark brown and black. Pronotum predominantly dark brown with a dull pale yellow dorsal midline terminating in a black spot at pronotal collar. Mesonotum with submedian and lateral sigilla black; usually one or two brown or dull yellow patches anterior of

cruciform elevation; cruciform elevation brown with black between arms. Metanotum brown. *Forewings* hyaline; venation accentuated by very narrow dark brown to blackish edging; apical cells 3–6 mostly a little shorter than ulnar cells; basal cell opaque dull white; basal membrane bright orange or reddish. *Hindwings* with veins RP and M with a very long fused stem; venation mostly pale on basal half and black on distal half; plaga brown becoming white distally, reaching to distal end of vein 3A. *Legs* brown to dull yellow with black linear fascia on femora; meracantha pale yellow. *Opercula* pale dull yellow lightly suffused with black except for base (remnant of epimeron 3). *Abdomen* with tergites predominantly black; tergites with a narrow, dark brown posterior margin, often confined to segments 3–7. Sternite II mainly dull pale yellow, sternites II–VIII with varying degrees of dull yellow suffusion usually most extensive on III, VII and VIII. *Timbals* as in generic description above.

*Male genitalia* (Figs 28a–d). See generic description above.

*Female*. Similar to male. Abdominal sternites dull pale yellow with a broad, diffused, black midline; Abdominal segment 9 short, about as long as wide; black with a broad pale yellow ventral margin; apical spine black. Ovipositor sheath dark brown to black, not projecting beyond apical spine.

**Measurements**. Range and mean (in mm) for 10 males, 5 females (includes smallest and largest specimens). *Length of body* (including head): male 13.0–15.8 (14.2); female (including ovipositor) 14.4–15.7 (15.0). *Length of forewing*: male 11.5–13.7 (12.7); female 13.7–14.6 (14.0). *Width of head* (including eyes): male 3.8–4.7 (4.2); female 4.4–4.7 (4.5). *Width of pronotum* (across lateral angles): male 4.3–5.2 (4.8); female 5.0–5.5 (5.2).

**Distinguishing features**. Differs from all other species by the distinguishing features listed in the generic description above.

**Song** (Figs 29a–d). Recordings were examined from the holotype locality and the WA.BAL, SA.MIN, and VI.MSP paratype locations.

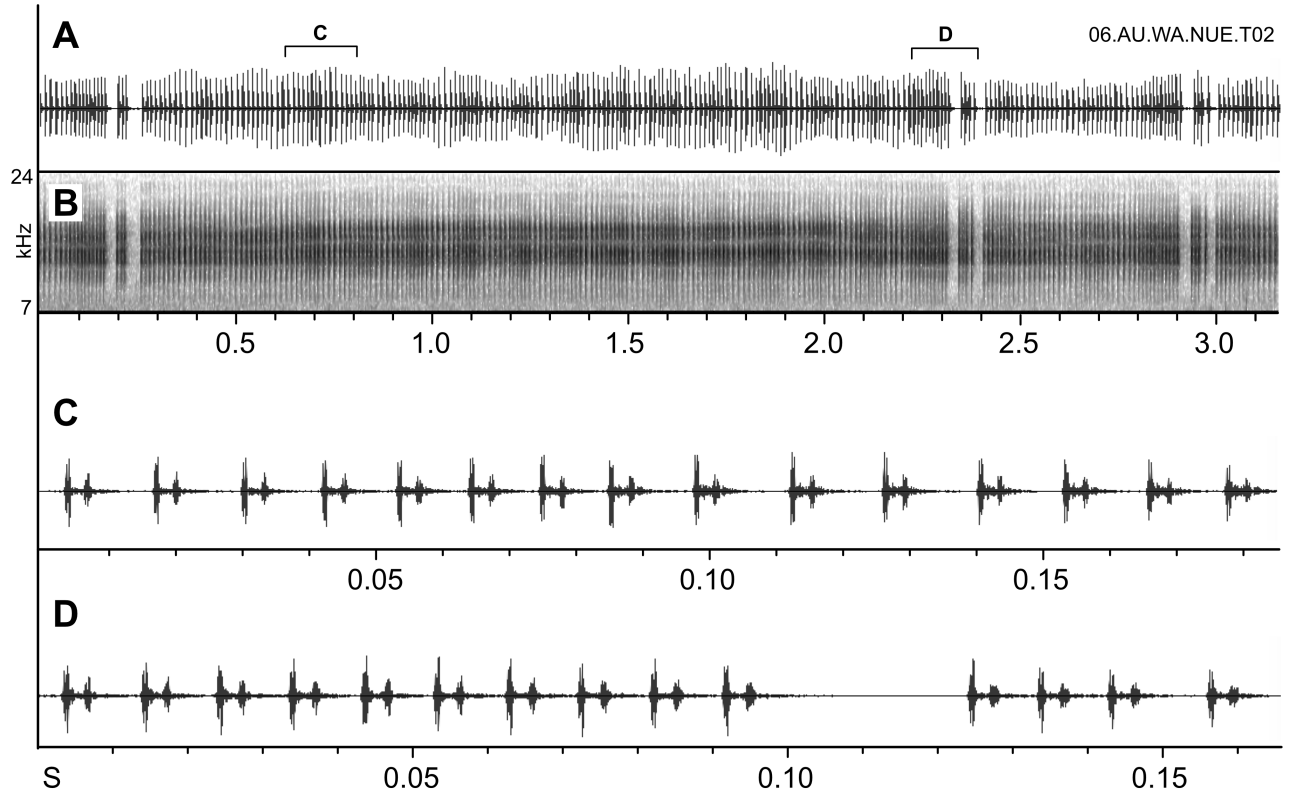



**FIGURE 29.** *Pedana hesperia* **sp. n.**, male calling song. (29a, b) oscillogram and spectrogram of a short segment from the holotype locality (ca. 27°C); (29c, d) further detail of pulse structure.

The male calling song consists of trains of pulses or clicks (often doublets, as shown) that oscillate between faster and slower pulse rates, at about 5–7 oscillations per s. Pulse rates vary from approximately 50–100/s. These trains are occasionally punctuated by single 0.03–0.05 s syllables preceded and followed by short silent gaps of about 0.02–0.06 s duration. The isolated short syllables contain clicks produced at the faster rate, sometimes with one ending click or doublet isolated from the rest. The beginning of a song may contain a warming-up section last-

ing many seconds in which the clicks are produced at a steady rate. The sound spectrum is broad with most sound energy contained within the range 11–18 kHz and with a peak intensity at around 14 kHz. There is little to no frequency modulation. The fundamental clicks vary considerably in form across recordings.

Despite its complex structure, the song of *Pedana hesperia* is strikingly similar to species of *Calipsalta* **gen. n.**, as discussed in the section on *C. fumosa* **sp. n.** below.

When finger-snaps or mouth-clicks are produced immediately after the short syllables, males move toward the responder, indicating that females probably produce wing-flick replies after these song elements. One male was captured from a perch less than 10 cm above the ground.

### *Kalarko* gen. n.

urn:lsid:zoobank.org:act:ED583F6C-8660-4B3F-BA41-08F4A20E8424
(Figs 7, 30–32)

**Type species.** *Kalarko ferruginosus* **sp. n.**, here designated.

**Included species.** Monotypic, *Kalarko ferruginosus* **sp. n.**

**Etymology.** An arbitrary combination of letters. Masculine.

**Distribution.** Drier parts of south-western Western Australia, mostly within a relatively narrow band receiving approximately 350–400 mm mean annual rainfall.

**Diagnosis** (Figs 7, 31). *Head* including eyes about as wide as mesonotum; supra-antennal plate meeting or nearly meeting eye; postclypeus broadly rounded transversely across ventral midline, in lateral profile angulate between 'top' and 'sides'. *Thorax*: pronotum in dorsal view parallel-sided or widening towards posterior; pronotal collar width at dorsal midline much less than diameter of eyes; paranota weakly ampliate, with a mid lateral tooth; cruciform elevation wider than long; epimeral lobe not reaching operculum. *Forewings* hyaline; 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, costa of male gently and evenly curved; pterostigma present; vein CuA only weakly bowed so that cubital cell no larger than medial cell; veins M and CuA meeting basal cell independently but close together, occasionally fused for a short distance; vein $CuA_1$ divided by crossvein m-cu so that proximal portion shortest; distance between cross veins r and r-m less than distance between r-m and m; radial cell clearly shorter than the distance from its apex to wing tip (about three quarters the length or more); wing outer margin developed for its total length, never reduced to be contiguous with ambient vein. *Hindwings* with 6 apical cells; no infuscation on ambient vein; width of 1st cubital cell at distal end more than twice that of 2nd cubital cell; anal lobe broad with vein 3A curved distally, separated from wing margin. *Foreleg* 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; base (remnant of epimeron 3) much swollen and bubble-like. *Male abdomen* basally as wide as thorax, thereafter tapering to apex; tergites in cross-section with sides straight or weakly convex, epipleurites reflexed ventrally from junction with tergites; tergite 1 narrow along dorsal midline; tergite 2 about as wide as tergite 3 along dorsal midline; sternites IV–VII in cross-section convex, not unusually swollen. *Timbal covers* absent; posterior margin of timbal cavity ridged on lower half or so.

*Male genitalia* (Figs 30a–d). Pygofer in ventral view ovoid to sub ovoid; pygofer with distal shoulders not developed; upper lobes flat, moderately developed, set well away from dorsal beak, apically rounded in lateral view; basal lobes undivided, moderately developed, rounded in lateral view, abutted against or partly tucked behind pygofer margin; dorsal beak present as a pointed apex and a part of chitinized pygofer. Uncus small, short, flattened, more or less duck-bill shaped. Claspers well developed, large, dominant, lobe-like, excavated ventrally, restraining aedeagus; unfused; with a rounded, inward-facing swelling on inner margin; distally diverging. Aedeagus trifid; with basal plate in lateral view undulated, weakly depressed on dorsal midline, in dorsal view short and broad, apically broadened with 'ears', basal portion of basal plate directed forwards away from thecal shaft, ventral rib completely fused with basal plate; junction between theca and basal plate with a semi-functional 'hinge' that possesses a chitinous back; thecal shaft nearly straight; pseudoparameres dorsal of theca and originating distal of thecal base, unfused throughout their length, in dorsal view straight then gradually diverging, in lateral view aligned with thecal shaft for much of its length; endotheca exposed, mostly chitinous; endothecal ventral support present, long (almost as long as pseudoparameres); flabellum absent; conjunctival claws absent; vesical opening apical on theca.

*Female* (Fig. 7b) abdominal segment 9 long and slender; dorsal beak with a developed apical spine (visible in dorsal view).

**Distinguishing features and relationships**. Small to medium sized cicadas. Distinguished from all other genera in having, in combination, forewing veins M and CuA meeting the basal cell independently (except in a few aberrant specimens where these veins are fused for a short distance); the forewings lacking infuscations, the paranota with a small mid lateral tooth, the base of the male opercula much swollen and bubble-like, and the male genitalia have a trifid aedeagus in which the endotheca is mostly chitinous and the ventral support is almost as long as the pseudoparameres.

A molecular phylogeny by Marshall *et al.* (2016, fig. 2) places *Kalarko* **gen. n.** (as 'flying red snapper') in a clade with *Pegapsaltria* **gen. n.** (as 'flying yellow fairy'), *Birrima, Yoyetta* and *Plerapsalta,* which in turn is sister to *Marteena* plus *Auscala,* but in morphology *Kalarko* is closest to *Plerapsalta, Marteena* and *Auscala*. The latter three genera share with *Kalarko* (but not with *Pegapsaltria*, *Birrima* or *Yoyetta*) a small mid lateral tooth on the paranota (not always on *Plerapsalta*), a short basal plate and, more significantly, a trifid aedeagus. *Kalarko* shares with *Marteena* and *Auscala* forewing veins M and CuA unfused at the basal cell (although partly fused in some *Kalarko*).

*Kalarko* differs from *Plerapsalta* in having forewing veins M and CuA unfused at the basal cell, and in having an aedeagus with a much longer ventral support, almost as long as the pseudoparameres. *Kalarko* differs from *Marteena* in its more slender body shape that tapers throughout its length, much larger eyes, and in having the node near mid length of the wing rather than well beyond mid length, and it differs from *Auscala* in having a sharply angled and ridged margin to the male timbal cavity and in the male genitalia in which the aedeagus has the ventral support almost as long as the pseudoparameres. *Kalarko* differs significantly from *Pegapsaltria* **gen. n.**, *Birrima* and *Yoyetta* not only in having forewing veins M and CuA unfused at the basal cell, but in having very different male genitalia that are trifid, unlike those of *Pegapsaltria, Birrima* and *Yoyetta* that lack a basal hinge and have either very thin pseudoparameres originating basally or none at all.

***Kalarko ferruginosus* sp. n.**
urn:lsid:zoobank.org:act:F53AFA60-96F7-49DE-AA9B-AF095CF1E4BD
(Figs 7, 30–32)

**Synonymy**.'flying red snapper' Marshall *et al.* 2016: text-fig. 2.

**Common name**. Flying red snapper.

**Etymology.** From the Latin adjective *ferruginus* meaning rust coloured, rusty, and pertaining to the reddish brown colour of the adult.

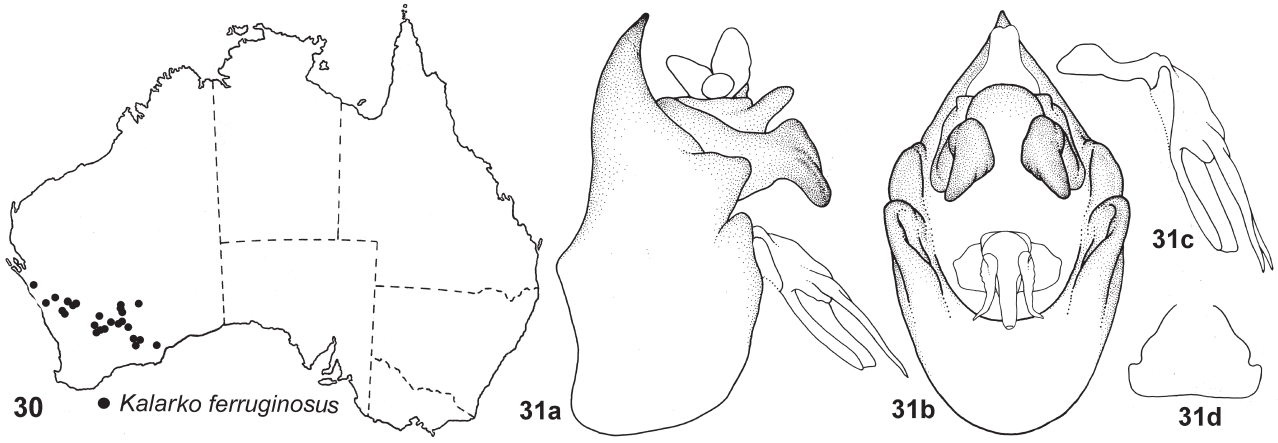
**Types**. *Holotype* male (Simon Lab. voucher 09.AU.WA.GIL.04), 56 km S of Norseman, 0.8 km SW of Esperance Hwy, Western Australia, 32°37.714'S 121°32.354'E, 7.ii.2009, K. Hill & D. Marshall (WAME 113437) (WAM). *Paratypes* as follows: **WESTERN AUSTRALIA:** 1 female, Dundas Tock S of Norseman 32°24'S 121°36'E, 12.i.1993, E.D. Edwards, E.S. Nielsen (ANIC). 1 male, WMC offices Kambalda, 31°11'31.4"S 121°40'24.6"E, 15.xi.1996. J.S. Reeve; 1 male, 1 female, 10 km W Menzies, 28.i.2016, P. Hutchinson; 1 female, 23.4 km S Paynes Find, 27.i.2006, P. Hutchinson; 1 male, 10 km W Yellowdine Rd Hse, 26.i.2016, P. Hutchinson (DE). 1 male, AU.WA.MLG, 60.5 km E of Mullewa, 28°25.657'S 116°06.277'E, 339 m, 19.ii.2009, K. Hill & D. Marshall; 1 male, 54.4 km S of Menzies, 30.1527°S 121.15131°E, 21.ii.2016, hand coll., D. Marshall & L. Popple (LP). 1 male, 2 km E of Dedari, 27.i.2005, D. Knowles; 1 male, AU.WA.NOE, 27 km NW of Balladonia, 32°13.526'S 123°22.660'E, 237 m, 20.ii.2006, Hill, Marshall, Moulds; 3 males (1 genitalia prep RD1; 1 male Simon Lab. voucher 06.AU.WA.NON.01), 1 female, 26 km N of Norseman, 32°01.264'S 121°40.520'E, 287 m, 19.ii.2006, Hill, Marshall, Moulds; 2 males (Simon Lab. vouchers 09.AU.WA.GIL.03), 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; 7 males (one genitalia prep. YO31), AU.WA.MLG, 60.5 km E of Mullewa, 28°25.657'S 116°06.277'E, 339 m, 19.ii.2009, K. Hill & D. Marshall; 1 male, 4.5 km E Southern Cross, 31.i.1993, T. Lundstrom; 1 male, 57 km S Norsemen, 32°38'S 121°32'E, 31.xii.1985, G. & A. Daniels; 1 male, 1 female, 29 km S Menzies, 9.ii.2006, M. Hanlon & M. Powell; 1 female, 10 km N of Kookynie, 10.ii.2006, M. Hanlon & M. Powell; 1 male, 3 km S of Yellowdine, 8.ii.2006, D. Knowles & M. Powell; 2 males,

Lake Douglas, 12 km SW of Kalgoorlie, 20.i.1991, M.S. & B.J. Moulds; 2 males, Goodlands Rd, 60 km N Wubin, 7.ii.2011, P. Hutchinson; 3 males, 2 females, 10 km W of Menzies, 5.ii.2006, 10.ii.2007, 9.ii.2012, P. Hutchinson; 1 female, Mt Gibson Stn, N Wubin, 4.iii.2006, P. Hutchinson; 2 males, 37 km N Bullfinch, 30.i.2000, P. Hutchinson; 1 male, 36 km N Bullfinch, 12.i.2002, P. Hutchinson (MSM). 8 males, Goodlands Rd, 3 km E Grt N Hwy, 60 km N Wubin, 3,5,9,10,27.ii.2009, 12.i.2010, 7.ii.2011, P. Hutchinson, PMH Coll #CIC 1069, 1079, 1080, 1091, 1092, 1093, 1094, 1102; 1 male, 23.4 km S of Paynes Find, 27.i.2006, P. Hutchinson, PMH Coll #CIC 1065; 7 males, 3 females, 10 km W Menzies, 5.ii.2003, 5.ii.2006, 10.ii.2007, 4.i.2014, 13.i.2015, 28.i.2016, P. Hutchinson, PMH Coll #CIC 1066, 1073, 1074, 1075, 1076, 1078, 1095, 1097, 1100, 1101; 7 males, 1 female, 10 km W Menzies, 9.ii.2012, P. Hutchinson, to mv light, PMH Coll #CIC 1083, 1085, 1086, 1087, 1088, 1089, 1090, 1082; 1 male, 14 km E of Coolgardie, 23.i.2009, T.M. & L.M. Hanlon, PMH Coll #CIC 1998; 1 male, 10 km N Bullabulling, 13.i.2002, P. Hutchinson, PMH Coll #CIC 1096; 1 female, Mt Gibson Stn, N Wubin, 4.iii.2006, P. Hutchinson, PMH Coll #CIC 1077; 1 male, 35.4 km N of Galena Bridge, Murchison River, 2.iii.2001, on mallee trunk, P. Hutchinson, PMH Coll #CIC 1071; 2 males, 37 km N. Bullfinch, 30.i.2000, P. Hutchinson, PMH Coll #CIC 1067, 1068; 1 male, 1 female, 36 km N Bullfinch, 12.i.2002, P. Hutchinson, PMH Coll #CIC 1099, 1072; 1 male, Camel Soak, Perenjori–Rothsay Rd, 16.ii.2021, P. Kay, to uv light, PMH Coll #CIC 1070; 1 male, 1 female, Pianto Rd., 23 km S Menzies, 8.ii.2012, P. Hutchinson, to mv light, PMH Coll #CIC 1084, 1081 (PH). 1 male, 54.4 km S of Menzies, 30.1527°S 121.15131°E, 21.ii.2016, Hand coll., D. Marshall & L. Popple (QM). 2 males, 3.75 km NE Cometvale siding, 29°57'S 121°07'E, 7–15.iii.1979, T.F. Houston *et al.*, 256-8, at light at night, WAM Entomology Reg. nos 72625, 72627; 1 female, 3.75 km NE Cometvale siding, 29°57'S 121°07'E, 7-15.iii.1979, T.F. Houston *et al.*, 256-8, at light at night, WAM Entomology Reg. no. 72626, Barcode of Life DNA voucher specimen Sample CCDB-27057-B06 Bold Proc ID WAM A588-15; 2 males, 1 female, 3.75 km NE Cometvale siding, 29°57'S 121°07'E, 7–15.iii.1979, T.F. Houston *et al.*, 256–8, at light at night, WAM Collection 88/1343, 88/1344, 88/1346, WAM Entomology Reg. nos 72628, 72629, 72631; 1 female, 3.75 km NE Cometvale siding, 29°57'S 121°07'E, 7-15.iii.1979, T.F. Houston *et al.*, 256-8, at light at night, WAM Collection 88/1345, WAM Entomology Reg. no. 72630, Barcode of Life DNA voucher specimen Sample CCDB-27057-B08 Bold Proc ID WAM A590-15; 1 female, 3.8 km NE of Comet Vale siding, 29°57'S 121°07'E, 7–15.iii.1979, T.F. Houston *et al.*, 256-8, WAM Dept. Biol. survey site GG Camp, WAM Entomology Reg. no. 72632, Barcode of Life DNA voucher specimen Sample CCDB-27057-B05 Bold Proc. ID WAM A587-15; 1 female, 3.8 km NE of Comet Vale siding, 29°57'S 121°07'E, 7–15.iii.1979, T.F. Houston *et al.*, 256-8, at light at night, WAM Dept. Biol survey site GG Camp, WAM Entomology Reg. no. 72633, Barcode of Life DNA voucher specimen Sample CCDB-27057-B07 Bold Proc. ID WAM A589-15; 1 male, 1 female, 3.8 km NE of Comet Vale siding, 29°57'S 121°07'E, 7-15.iii.1979, T.F. Houston *et al.*, 256-8, WAM Dept. Biol survey site GG Camp, WAM Entomology Reg. no. 72634,72636; 1 male, 46 km ENE Norseman, 19–20.i.1982, B. Hanich, T.F. Houston, 431-1, at light at night, WAM Reg. no. 72635, Barcode of Life DNA voucher specimen Sample CCDB-27057-B04 Bold Proc. ID WAM A586-17; 1 male, Moorine Rock, 21.1.78, R.P. McMillan, WAM Entomology Reg. no. 72637; 1 male, Charles Darwin Reserve, 2.9 km N White Wells HS, 29°33'29"S 116°57'54"E, 5–6.iii.2008, T.F. Houston, 1255-1, T.F.H 1255-1, at fluorescent lantern at night (8.00–10.00 pm) among Eucalyptus woodland; 1 male, 39-1353, Mt Jackson, A.M. Douglas, WAM Entomology Reg. no. 72638; 1 female, 39-456 Mt Jackson, A.M. Douglas, WAM Entomology Reg. no. 73291; 1 male, 2.5 km N of Mt Linden, 29°19'S 122°25'E, 17–23.iii.1979, T.F. Houston *et al.*, 259-7, on trunks of Gimlet Eucalyptus, WAM Dept. Biol. Survey site YM Camp; 1 female, Pallotine (8) Mission, Tardun, 28°47'S 115°45'E, 27.ii.1992, Bro. W.H. van Yeen. (WAM). 1 male (DNA voucher 03.WAU.LKA.03), nr. Lk. Douglas, ~12 km SW of Kalgoorlie, 30.8443°S 121.3846°E, 15.i.2003, Vanderpool, Marshall, Hill, M. & B. Moulds (UCONN).

**Distribution and habitat** (Fig. 30). Drier parts of south-western Western Australia from 35 km north of Galena Bridge on the Murchison River south-east to near Balladonia, with the most inland record being from Mount Linden to the east of Menzies. This distribution falls mostly within a relatively narrow band receiving approximately 350–400 mm mean annual rainfall. Most records are from between Southern Cross and Kalgoorlie but it can be locally common throughout its distribution. Adults have been taken from mid November to late March.

**Adult description**. *Male* (Figs 7a, 31a–d). *Head* brown, usually dark brown; irregular black markings surrounding ocelli and around margin of postclypeus, considerably variable in extent between individuals, and a small black spot near back of each eye; ventrally usually a little darker than dorsally and sometimes black including lorum. Postclypeus dark brown, often with the most anterior part and extreme ventral base paler (as in holotype); transverse ridges dark brown or black. Anteclypeus dark brown or black. Rostrum dark brown becoming black distally;

reaching bases of hind coxae. Eyes brown in life with a hint of pink. *Thorax* reddish brown, usually dark reddish brown. Pronotum with a black fascia either side of a light brown dorsal midline, expanded laterally at anterior end and sometimes a little so at posterior end but not reaching pronotal collar; sometimes broken irregular black markings in or near sutures; anterior margin narrowly edged light brown; pronotal collar dark with a black spot on anterior of midline. Mesonotum with submedian and lateral sigilla black to varying degrees, sometimes entirely so on submedian sigilla, less so on lateral sigilla; scutal depressions black, and black at base of cruciform elevation between anterior arms; cruciform elevation usually light brown. Metanotum similar in colour to cruciform elevation. *Wings* hyaline, without infuscations. Forewing apical cells 3–6 about equal to ulnar cells; basal cell tinted light to dark brown; basal membrane reddish brown. Hindwings with plaga brown, reaching almost to distal end of vein 3A. *Legs* a mixture of light to dark brown, considerably variable between individuals; fore femora black on outer face adjacent to spines; meracantha black with a narrow pale yellow margin. *Opercula* light brown on distal half or so, usually black on basal half except for dark brown basal dome but sometimes entirely dark brown on basal half. *Abdomen* mid to dark brown; tergites sometimes with small, irregular black patches sublaterally; posterior margin of tergite 2 usually edged pale yellow; sternites diffused black along midline variable between individuals. *Timbals* with four long ribs all similar in length and spanning the full height of the timbal membrane, the three most posterior ribs fused dorsally, and sometimes a fifth anterior rib usually ill-defined; spaced with intermediate short ribs; basal spur small; anterior part of timbal mostly occupied by ribs.




**FIGURES 30–31.** *Kalarko ferruginosus* **sp. n.** (30) distribution; (31a) male genitalia in lateral view; (31b) same in ventral view; (31c) dissected aedeagus in lateral view; (31d) basal plate in dorsal view.

*Genitalia* (Figs 31a–d). See generic description above.

*Female* (Fig. 7b) Similar to male. Abdominal segment 9 dark brown but usually a little paler than other abdominal segments; usually a pair of paramedian black fascia never reaching dorsal spine, sometimes indistinct and occasionally absent; apical spine black; sometimes a black spot mid laterally on distal half. Ovipositor sheath black, projecting beyond apical spine between 2=3 mm.

**Measurements**. Range and mean (in mm) for 10 males and 8 females (includes largest and smallest specimens). *Length of body* (including head): male 24.6–27.9 (26.3); female (including ovipositor) 32.0–36.5 (34.2). *Length of forewing*: male 30.2–33.9 (32.3); female 37.1–39.8 (38.2). *Width of head* (including eyes): male 7.3–7.9 (7.6); female 8.4–9.1 (8.7). *Width of pronotum* (across lateral angles): male 7.8–9.1 (8.3); female 9.3–10.6 (9.8).

**Distinguishing features**. Body colour largely uniform reddish brown that, together with its few markings and long slender body and wings, make this species unlikely to be confused with any other. It differs from all other species by the distinguishing features listed in the generic description above.

**Song** (Figs 32a–b). Recordings were obtained at the WA.GIL and WA.NON paratype locations, from Lake Douglas (30° 50.655' S 121° 23.077' E), and from a site ~50 km W. of Balladonia. Males produce a calling song during sustained flight in evening dusk conditions. The song is a rapid train of two-pulse syllables, with the pulses of each syllable separated by about 0.01 s and with the syllables produced at 10.0–11.5/sec. In some syllables the pulses appear as doublets, with each having a weak secondary pulse. The song is somewhat high-pitched for the body size, concentrated around 9.5–15.5 kHz with a peak of 11–12 kHz. There is no frequency modulation. A male can be attracted by rapid finger snapping as it passes nearby. One male thus attracted landed on the arm of the re-

sponding investigator. Males were not observed to produce sounds while perched on vegetation as in some *Yoyetta* species that also sing in flight.

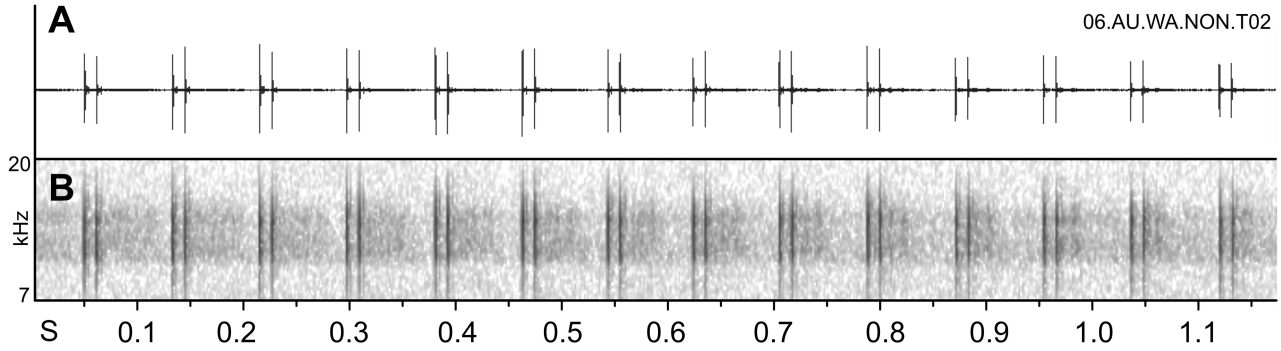



**FIGURE 32.** *Kalarko ferruginosus* **sp. n.**, male calling song. (32a) oscillogram (23°C); (32b) spectrogram.

***Pegapsaltria* gen. n.**
urn:lsid:zoobank.org:act:F496969A-3AE5-4C53-A4C9-406721E7EA0B
(Figs 6, 33–35)

**Type species.** *Pegapsaltria lutea* **sp. n.**, here designated.

**Included species.** Monotypic, *Pegapsaltria lutea* **sp. n.**

**Etymology.** Derived from *Pegasus,* the mythical winged horse of the Muses, those Greek goddesses of poetic inspiration, and referring to the horse-head shape of the theca of the type species. Feminine.

**Distribution** (Fig. 33). West Kimberleys, Western Australia.

**Diagnosis** (Figs 6, 34). *Head* including eyes about as wide as mesonotum; supra-antennal plate meeting or nearly meeting eye; postclypeus broadly rounded transversely across ventral midline, in lateral profile angulate between 'top' and 'sides'. *Thorax*: pronotum in dorsal view parallel-sided or widening towards posterior; pronotal collar width at dorsal midline much less than diameter of eyes; paranota weakly ampliate, lacking a mid lateral tooth; cruciform elevation wider than long; epimeral lobe not reaching operculum. *Forewings* hyaline; 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, costa of male gently and evenly curved; pterostigma present; vein CuA only weakly bowed so that cubital cell no larger than medial cell; veins M and CuA meeting basal cell with their stems completely fused as one; vein $CuA_1$ divided by crossvein m-cu so that proximal portion shortest; distance between cross veins r and r-m about equal to distance between r-m and m; wing outer margin developed for its total length, never reduced to be contiguous with ambient vein. *Hindwings* with 6 apical cells; no infuscation on ambient vein; width of 1st cubital cell at distal end more than twice that of 2nd cubital cell; anal lobe broad with vein 3A curved distally, separated from wing margin. *Foreleg* femoral primary spine erect. *Male opercula* in part reaching margin of tympanal cavity, directed towards distomedial margin of tympanal cavity, apically rounded, clearly not meeting, not encompassing base of meracanthus, clearly raised above level of tympanal cavity on its outer half or so; base (remnant of epimeron 3) not swollen or bubble-like. *Male abdomen* very long, about one third longer than head and thorax combined; basally as wide as thorax, thereafter tapering to apex; tergites in cross-section with sides straight or weakly convex, epipleurites reflexed ventrally from junction with tergites; tergite 1 narrow along dorsal midline; tergite 2–7 all similar in width along dorsal midline; sternite I convex and considerable protruding in lateral view; sternites IV–VII in cross-section flat. *Timbals* with six long ribs all similar and spanning the full height of the timbal membrane; basal spur very small; anterior part of timbal devoid of ribs; posterior margin of timbal cavity ridged on lower half or so.

*Male genitalia* (Figs 34a–d). Pygofer in ventral view widest on lower half; distal shoulders not developed; upper lobes flat but with slightly thickened margin, well developed, dominating pygofer between basal lobes and dorsal beak; basal lobes undivided, small, tending to be broadly rounded in lateral view; dorsal beak present and a part of chitinized pygofer, well developed. Uncus small, short, flattened, broadly rounded, more or less duck-bill shaped. Claspers well developed, large, dominant, claw-like, broad dorsally, restraining aedeagus. Aedeagus with basal plate in lateral view gently arched; in dorsal view distally abruptly widened to a broadly rounded apex; basal portion of

basal plate directed forwards away from thecal shaft; ventral rib completely fused with basal plate; junction between theca and basal plate rigid, without a 'hinge', without an obvious junction between the two; thecal shaft curved in a gentle arc, the apical quarter or so turned through 120°; pseudoparameres absent; distal theca substantially fleshy with vesica partially extruded, retractable, gonopore at apex; flabellum absent; conjunctival claws absent.

*Female* with sternite VIII deeply incised in a broad V shape; abdominal segment 9 about as long as wide (excluding dorsal beak); dorsal beak with a developed apical spine (visible in dorsal view).

**Distinguishing features and relationships**. Small cicadas. Distinguished from all other genera in having, in combination, forewing veins M and CuA meeting the basal cell with their stems completely fused as one; the forewings lacking infuscations, the paranota lacking a small mid lateral tooth, the male abdomen very long, about half as long again than head and thorax combined, and the male genitalia lacking pseudoparameres.

A molecular phylogeny by Marshall *et al.* (2016, fig. 2) places *Pegapsaltria* **gen. n.** (as "flying yellow fairy") in a weakly supported clade with *Birrima, Yoyetta, Plerapsalta* and *Kalarko* **gen. n.**, which in turn is sister to *Marteena* plus *Auscala*.

The male aedeagus bears close similarities with that of *Yoyetta* and *Birrima,* particularly in the structure of the theca and the partially extruded vesica along its upper margin. But it differs significantly from both those genera in lacking pseudoparameres. The only other Cicadettini known to lack pseudoparameres are the distantly related Australian endemic genus *Samaecicada* and the Palaearctic species *Melampsalta musiva* (Germar, 1830) and its congeners (Popple & Emery 2010, Dugdale 1972, Stéphane Puissant pers. comm.). It is remarkable that *Pegapsaltria* **gen. n.** lacks pseudoparameres when other features of the aedeagus are so similar to its close relatives *Yoyetta* and *Birrima,* both of which have long, well developed pseudoparameres. Pseudoparameres in *Yoyetta* and *Birrima* originate basally on the theca as long filiform structures and their position should be indicative of the placement of pseudoparameres in *Pegapsaltria,* but no indication of them could be found. The loss of pseudoparameres in *Pegapsaltria*, *Samaecicada* and *Melampsalta*, three genera distantly related (see Marshall *et al.* 2016), implies independent loss of these structures in genera that are otherwise not unusually different from their closest relatives.

*Pegapsaltria* **gen. n.** differs from *Kalarko* **gen. n.**, *Plerapsalta, Marteena,* and *Auscala* in having no mid lateral tooth on the paranota, a long basal plate and, more significantly, an aedeagus that is *not* trifid.

### *Pegapsaltria lutea* sp. n.

urn:lsid:zoobank.org:act:A232925E-E2A1-4E34-BE0E-71E9965E0CFE
(Figs 6, 33–35)

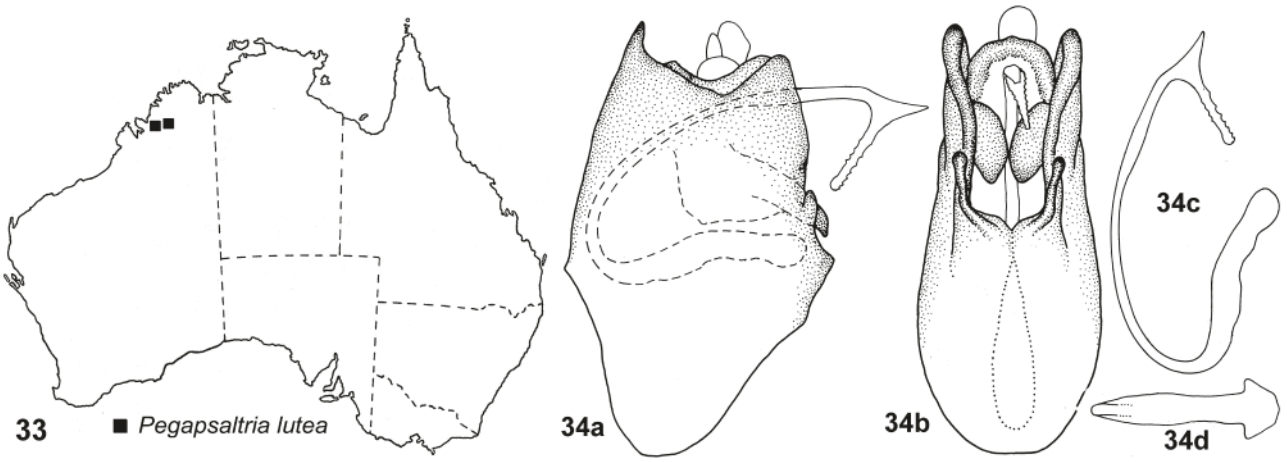
**Synonymy**. "flying yellow fairy" Marshall *et al.* 2016: fig. 2.

**Common name.** Flying yellow fairy.

**Etymology.** From the Latin adjective *luteus* meaning yellow and pertaining to the yellow colour of this species.

**Types**. *Holotype* male (song recorded, molecular voucher 11.AU.WA.BAR.01), Barnett River xing on Gibb River Road, Western Australia, 16°42.589'S 125°56.143'E, 433 m, 20.xi.2011, K. Hill, D. Marshall (WAME 113438) (WAM). *Paratypes* as follows: **WESTERN AUSTRALIA:** 2 males, AU.WA.BAR, Barnett River xing on Gibb River Road, 16°42.589'S 125°56.143'E, 433 m, 20.xi.2011, K. Hill, D. Marshall (AMS). 2 males, AU.WA.BAR, Barnett River xing on Gibb River Road, 16°42.589'S 125°56.143'E, 433 m, 20.xi.2011, K. Hill, D. Marshall (DE). 2 males, AU.WA.BAR, Barnett River xing on Gibb River Road, 16°42.589'S 125°56.143'E, 433 m, 20.xi.2011, K. Hill, D. Marshall (LP). 1 male (Simon Lab. voucher 10.AU.WA.LEN.02), Lennard R., Gibb River Rd, 17°23.525'S 124°45.304'E, 78 m, 20.i.2010, Hill, Marshall, Moulds; 22 males (1 genitalia prep. FLY 1), 4 females, AU.WA.BAR, Barnett River xing on Gibb River Road, 16°42.589'S 125°56.143'E, 433 m, 20.xi.2011, K. Hill, D. Marshall (MSM). 2 males, AU.WA.BAR, Barnett River xing on Gibb River Road, 16°42.589'S 125°56.143'E, 433 m, 20.xi.2011, K. Hill, D. Marshall (PH). 15 males, 1 female, AU.WA.BAR, Barnett River xing on Gibb River Road, 16°42.589'S 125°56.143'E, 433 m, 20.xi.2011, K. Hill, D. Marshall (WAME 113439-113454) (WAM).

**Distribution** (Fig. 33). Kimberley region of Western Australia where it is known from just two localities, the Lennard River and Barnett River crossings, Gibb River Road. Adults have been taken in November and January. Adults are found in monsoonal open woodland.




**FIGURES 33–34.** *Pegapsaltria lutea* **sp. n.** (33) distribution; (34a) male genitalia in lateral view; (34b) same in ventral view; (34c) dissected aedeagus in lateral view; (34d) basal plate in dorsal view.

**Adult description**. *Male* (Figs 6, 34). *Head* dull light brownish yellow to light tan; irregular blackish markings surrounding ocelli and around margin of postclypeus, considerably variable in extent between individuals; ventrally usually a little paler and usually an indistinct black patch at base of antennae. Eyes in life dull light yellowish brown. Postclypeus ventral midline deeply grooved and a broad, glossy black band running full length ventrally, the most anterior part usually vaguely yellowish brown. Anteclypeus glossy black. Rostrum yellowish brown becoming black distally; reaching a little beyond bases of hind coxae. *Thorax* light yellowish brown to light tan. Pronotum with a small, blurred black patch either side of midline against anterior margin and two adjacent, very small, black dots on midline against pronotal collar. Mesonotum with submedian and lateral sigilla unmarked or barely so; scutal depressions black and usually a little black at base of cruciform elevation between anterior arms. Metanotum with a blurred black mark across dorsal midline and usually a very small black spot laterally. *Forewings* hyaline, without infuscations; apical cells 3–6 mostly a little shorter than ulnar cell; basal cell tinted light brown; basal membrane orange. *Hindwings* hyaline; with plaga pale brown, reaching almost to distal end of vein 3A. *Legs* light yellowish brown often with femora partially black; meracantha pale yellowish brown. □ *Opercula* pale yellowish brown. *Male abdomen* with tergites dull light yellowish brown to light tan; sternites a little paler, glossy. *Timbals* as in generic description above.

*Male genitalia* (Figs 34a–d). See generic description above.

*Female*. Similar to male. Abdominal segment 9 similarly coloured to abdomen; usually a pair of paramedian black fascia never reaching dorsal spine; apical spine black; ventral margin blackish on distal half or so. Ovipositor sheath black, barely projecting beyond apical spine.

**Measurements**. Range and mean (in mm) for 10 males and 5 females (includes largest and smallest specimens). *Length of body* (including head): male 15.1–17.0 (16.0); female (including ovipositor) 15.4–17.9 (17.0). *Length of forewing*: male 17.7–20.0 (18.6); female 20.3–23.4 (21.6). *Width of head* (including eyes): male 4.2–4.7 (4.4); female 4.7–5.1 (4.9). *Width of pronotum* (across lateral angles): male 4.2–4.9 (4.5); female 4.9–5.6 (5.1).

**Distinguishing features**./ Readily distinguished by its yellow body colour and the long slender body of the males. No other Australian species is similar. It differs from all other species by the distinguishing features listed in the generic description above.

**Song** (Figs 35a–c). Males sing a high-pitched tzik-tzik-tzik calling song of repeated short syllables while flying. We did not obtain a recording of free-flying song or note the rate of production of the syllables. However, two caged males (one from WA.LEN and one from WA.BAR) each produced a few short syllables about 3.1–3.6 s ms in duration at 1–2 syllables per second, during a few seconds of recorded sample. Each syllable consists of four pairs of pulses (sometimes more than two pulses), with the first and third paired pulses partly to entirely coalesced. The sound energy is concentrated in two frequency peaks, one 8–10 kHz and the other 16–20 kHz. The spectrogram shows that the low frequency peak is mainly produced by the first and third pulse pair, while all four contribute to the higher frequency sound.

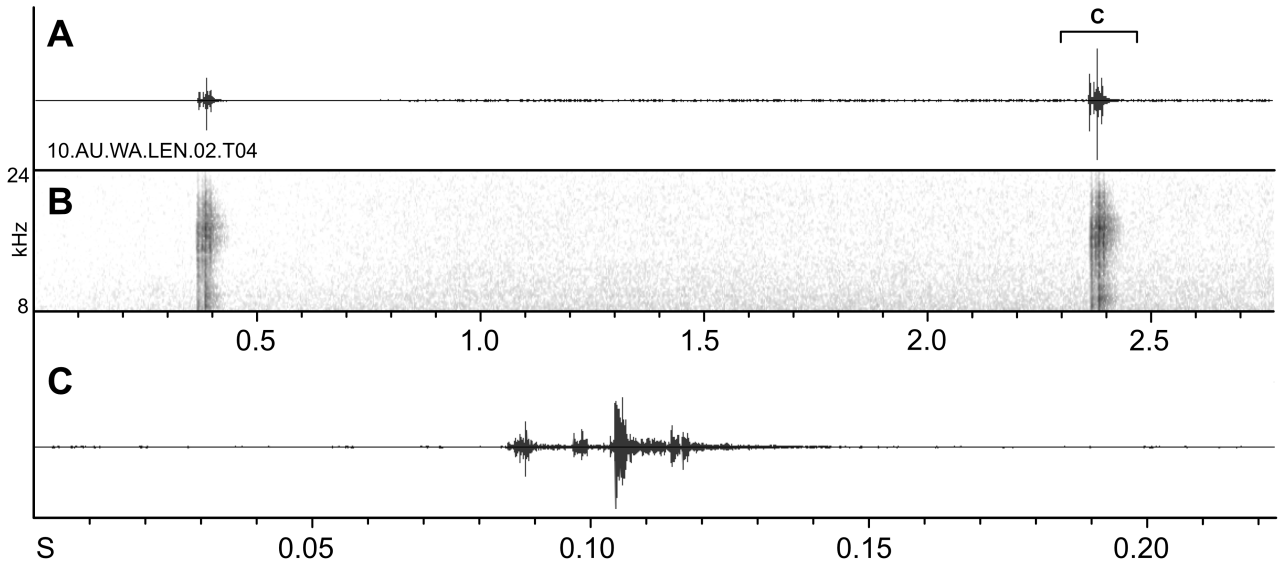



**FIGURE 35.** *Pegapsaltria lutea* **sp. n.**, male calling song. (35a, b) oscillogram and spectrogram showing two isolated syllables from a caged male; (35c) further detail of pulse structure. Temperature not recorded.

***Parvopsalta* gen. n.**

urn:lsid:zoobank.org:act:B0C146E2-485E-4BFA-BBF0-CFA4B21805A8

(Figs 4, 36–38)

**Type species:** *Parvopsalta victoriae* **sp. n.**, here designated.

**Included species.** Monotypic, *Parvopsalta victoriae* **sp. n.**

**Etymology.** From the Latin *parvus* meaning little and referring to the size of this species, and from psalta, a traditional ending for cicada generic names (which probably originates from the Latin *psaltria* meaning a female harpist). Feminine.

**Distribution** (Fig. 36). Inland districts of southwest Western Australia southwest from Coolgardie.

**Diagnosis** (Figs 4, 37). *Head* including eyes as wide as mesonotum; supra-antennal plate almost meeting eye; postclypeus broadly rounded transversely across ventral midline, in lateral profile rounded between 'top' and 'sides'. *Thorax*: pronotum in dorsal view parallel-sided or widening towards posterior; 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. *Forewings* hyaline; 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; costa of male gently and evenly curved; pterostigma present; vein CuA only weakly bowed so that cubital cell no wider than medial cell; veins M and CuA with their stems completely fused as one; vein $CuA_1$ divided by crossvein m-cu so that proximal portion shortest; distance between crossveins r and r-m about equal to or a little shorter than between r-m and m; wing outer margin developed for its total length, never reduced to be contiguous with ambient vein. *Hindwings* with five apical cells; no infuscation on ambient vein; width of 1st cubital cell at distal end more than twice that of 2nd cubital cell; anal lobe of medium width with vein 3A curved, long, and separated from wing margin. *Foreleg* femoral primary spine unusually large, erect. *Male opercula* more or less reaching margin of tympanal cavity, directed towards distomedial margin of tympanal cavity, apically broadly rounded, not meeting. *Male abdomen* wider than thorax; in cross-section with sides of tergites straight or weakly convex; epipleurites reflexed ventrally from junction with tergites; tergite 2 wide along midline, about as wide as any other of tergites 3–7; sternites III–VII convex in cross-section, not unusually swollen. *Timbals* with four long ribs and one anterior one short; basal dome large; timbals extended below the level of the wing bases; posterior margin of timbal cavity rounded and completely lacking a ridge on lower half or so.

*Male genitalia* (Figs 37a–d). Pygofer in ventral view ovoid to sub ovoid, distal portion of upper pygofer lobes not the widest point, not strongly tapered from upper pygofer lobes to base; pygofer with distal shoulders not de-

veloped; upper lobes flat, small to moderately developed, set well away from dorsal beak, rounded; basal lobes undivided, moderately developed, broadly rounded in lateral view, abutted against or partly tucked behind pygofer margin; dorsal beak present as a pointed apex (visible in dorsal view) and a part of chitinized pygofer. Uncus small, short, flattened, more or less duck-bill shaped. Claspers well developed; restraining aedeagus; wide in lateral view, outer face with a deep overhanging lip along margin; unfused; distally diverging but their apices not widely separated. Aedeagus with basal plate in lateral view undulated, weakly depressed on dorsal midline, in dorsal view longer than broad, apically broadened with 'ears'; ventral rib completely fused with basal plate; junction between theca and basal plate with a functional 'hinge' that possesses a chitinous back; thecal shaft gently and evenly curved; pseudoparameres long, much longer than theca, slender, lateral of theca and originating at its base, unfused throughout their length, gradually diverging in dorsal view, in lateral view aligned with thecal shaft for its length; endotheca concealed; no ventral support; flabellum absent; conjunctival claws absent; vesical opening apical on theca.

*Female* with sternite VIII deeply incised in a V shape; abdominal segment 9 a little wider than long (excluding dorsal beak); dorsal beak with a developed apical spine.

**Distinguishing features and relationships**. Small cicadas. Distinguished from all other genera in having, in combination, forewing veins M and CuA meeting the basal cell with their stems completely fused as one; the hindwings with 5 apical cells and without infuscation; the paranota lacking a small mid lateral tooth, the male abdomen wider than the thorax and male genitalia with pseudoparameres much longer than the theca (almost half as long again).

A molecular phylogeny by Marshall *et al.* (2016: fig. 2) placed *Parvopsalta* **gen. n.** (as "podgy black") in a clade with four other undescribed Western Australian species, that in turn was sister to the monotypic genus *Urabunana* Distant, 1905 from Queensland and New South Wales. *Parvopsalta* **gen. n.** differs most notably from *Urabunana* in having the head including eyes no wider than the pronotum (wider in *Urabunana*) and pseudoparameres that arise from the thecal base, are unfused throughout their length, and almost half as long again as the theca (in *Urabunana* the pseudoparameres arise distal of the thecal base, are only a little longer than the theca, and are dorsally fused almost to their apices).

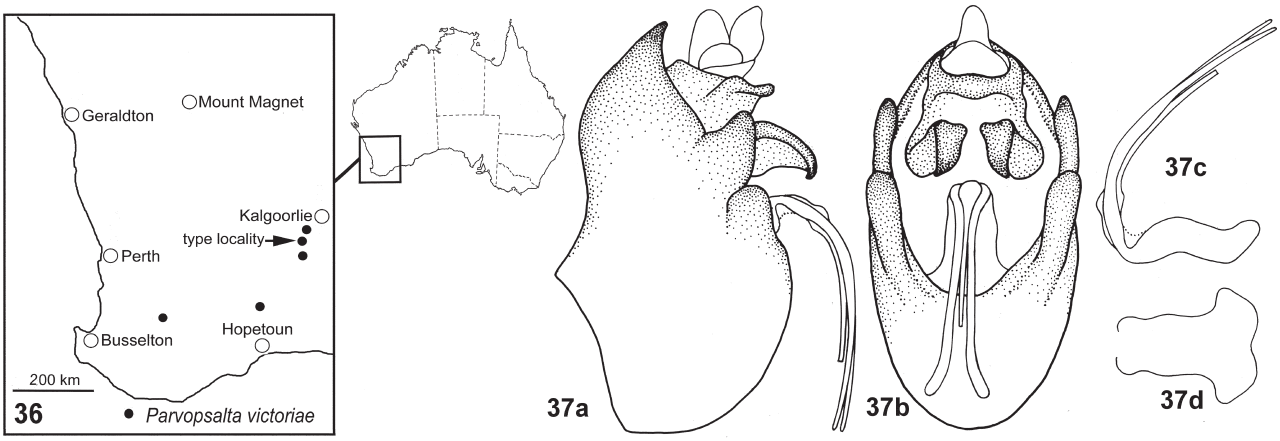
***Parvopsalta victoriae* sp. n.**
urn:lsid:zoobank.org:act:C555F409-D11E-4251-BEEC-98C704DF70BC
(Figs 4, 36–38)

**Synonymy**. "podgy black" Marshall *et al.*, 2016: fig. 2b.

**Etymology.** Named after Queen Victoria of England for whom the type locality, Queen Victoria Rock, is named; noun in genitive case.

**Types.** *Holotype* male, (Simon Lab. voucher 03.AU.WAU.VIC.06), Queen Victoria Rock, Western Australia, 31°17'S 120°56'E, 444 m, 17.i.2003, Moulds, Hill, Marshall & Vanderpool (WAME 113455) (WAM). *Paratypes* as follows: **WESTERN AUSTRALIA:** 2 males, 85 km SSW of Coolgardie, 20.i.1991, M.S. & B.J. Moulds (DE). 2 males, 85 km SSW of Coolgardie, 20.i.1991, M.S. & B.J. Moulds (LP). 12 males, 2 females, 85 km SSW of Coolgardie, 20.i.1991, M.S. & B.J. Moulds; 2 males (1 genitalia prep. POD 20), Queen Victoria Rock, 31°17'S 120°56'E, 444 m, 17.i.2003, Moulds, Hill, Marshall & Vanderpool; 3 males (1 genitalia prep. POD 1), WAU. LKK, Lake King, 33°05'S 119°40'E, 335 m, 18.i.2003, Moulds, Hill, Marshall & Vanderpool; 2 males (Simon Lab. vouchers 09.AU.WA.CGB.01, 09.AU.WA.CGB.02), 38 km W of Coolgardie, 31°3.852'S 120°47.632'E, 419 m, 8.ii.2009, K. Hill & D. Marshall; 1 male (Simon Lab. voucher 10.AU.WA.WOR.01), 28 km NE of Calingiri, 30°57.127'S 116°39.501'E, 237 m, 13.i.2010; Hill, Marshall Moulds (MSM). 2 males, 85 km SSW of Coolgardie, 20.i.1991, M.S. & B.J. Moulds (PH). 1 male, same data as holotype (WAME 113456); 2 males, WAU.LKK, Lake King, 33°05'S 119°40'E, 335 m, 18.i.2003, Moulds, Hill, Marshall & Vanderpool (WAME 113457-113458); 1 male, 38 km W of Coolgardie, 31°3.852'S 120°47.632'E, 419 m, 8.ii.2009, K. Hill & D. Marshall (WAME 113459) (WAM).

**Distribution and habitat** (Fig. 36). Southwest of Western Australia northeast from Wongan Hills to within 40 km of Coolgardie. All specimens have been taken in mid January but adults almost certainly occur at other times. Adults frequent low shrubs in open dry eucalypt woodland with a shrub understory.




**FIGURES 36–37.** *Parvopsalta victoriae* **sp. n.** (36) distribution; (37a) male genitalia in lateral view; (37b) same in ventral view; (37c) dissected aedeagus in lateral view; (37d) basal plate in dorsal view.

**Adult description.** *Male* (Figs 4, 37). *Head* black, with supra-antennal plates partly marked dull yellow or brown and usually a spot of similar colour on anterior and posterior midline. Postclypeus black, often with a dull yellow or brown patch on most anterior part sometimes extending to vertex; lateral ventral margin indistinctly yellow or brown. Anteclypeus black. Rostrum dark brown becoming black distally; reaching apices of mid coxae. *Thorax* with pronotum black, its dorsal midline sometimes partly marked yellow or brown and sometimes also along anterior margin; pronotal collar usually edged yellow or brown along its posterior margin between lateral angles. Mesonotum black with a pair of yellow or brown markings from between submedian and lateral sigilla to anterior arms of cruciform elevation, considerably variable in extent, often much reduced but always straight along their outer margins; cruciform elevation of similar colour but with anterior arms black distally. Metanotum dull yellow. *Wings* hyaline; without infuscations. *Forewing* venation black except for pale brown CuA and C; basal cell hyaline; basal membrane blackish. *Hindwing* venation pale brown becoming black on about distal third; plaga dull white sometimes tending pale brownish mainly in jugum. *Legs* yellowish, with black markings of variable extent, most extensive on forelegs, least on hindlegs. *Opercula* very pale yellow with a little black at base; epimeron 3 swollen. *Abdomen* with tergites black usually with narrow yellow or brown banding; tergite 1 black, sometimes with narrow brown lateral marking; tergite 2 with a narrow dull yellow or brown posterior margin sometimes broken on dorsal midline; tergites 3–7 with a narrow yellow posterior margin; tergite 8 black except for an indistinct orange brown patch in posterior sublateral corner. Sternites pale yellow with black variable in extent; sternite I black; sternite II yellow with a broad black midline; sternites III–VII yellow, each with a broad, blackish centre sometimes extending to lateral extremities but never reaching distal margin; sternite VIII blackish. *Timbals* with ribs as in generic description above; *timbal cavity* sharply angled along posterior margin and barely ridged.

*Male genitalia* (Figs 37a–d). See generic description above.

*Female*. The single known female similar to male. Abdominal segment 9 long, in dorsal view a little longer than wide; black dorsally, otherwise brown except for a small sublateral patch distally and a narrow black anterior margin. Ovipositor sheath brown becoming black distally, barely projecting beyond anal styles.

**Measurements**. Range and mean (in mm) for 10 males, 1 female (includes smallest and largest males). *Length of body* (including head): male 11.3–13.8 (12.9); female (including ovipositor) 13.4. *Length of forewing*: male 11.8–13.6 (13.0); female 13.7. *Width of head* (including eyes): male 3.4–3.9 (3.7); female 3.8. *Width of pronotum* (across lateral angles): male 3.5–4.0 (3.8); female 3.9.

**Distinguishing features**. Differs from all other species by the distinguishing features listed in the generic description above. Among Australian small black cicadas males differ from nearly all in having the abdomen a little wider than the thorax and in having 5 apical cells in the hindwing.

**Song** (Figs 38a–c). Recordings were examined from the holotype location as well as the WA.CGB and WA.WOR paratype locations.

Male calling song is composed of alternating short and long syllables containing simple pulses or doublets (with the first pulse louder, if doublets). Pulses are produced at a steady rate of around 185–300 pulses/s. In the typical song, the gap preceding the shorter syllable is somewhat longer than the gap following it, with the overall syllable

repetition rate ranging between 2–3.5/s. Short syllables consist of around 8–16 pulses (30–75 ms duration) and long syllables consist of about 15–25 pulses (60–105 ms duration). Sometimes multiple short syllables are produced in series, and our recordings suggest that this can occur as a male flies to a new station. In the recordings from WA.VIC the occasional syllable is broken into two parts when one or a few pulses drop out. Most sound energy is contained in the range 8–13 kHz, and the peak frequency is around 10.5 kHz. There is no frequency modulation.

Males are extremely wary and tend to sing from short shrubs, knee-height to chest-height.

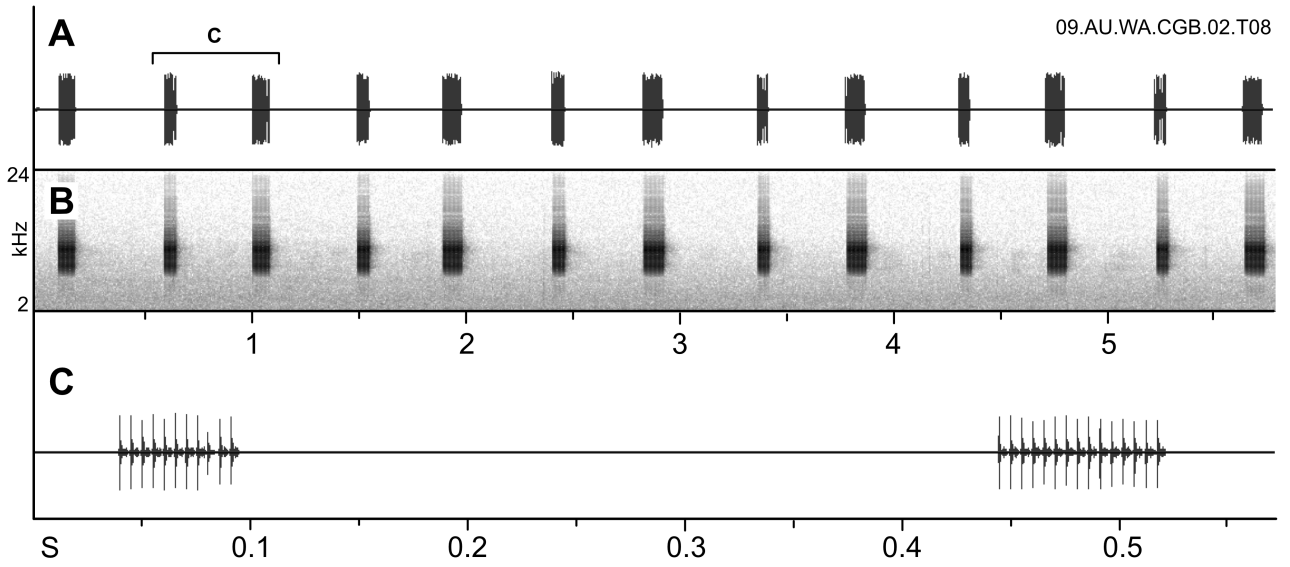



**FIGURE 38.** *Parvopsalta victoriae* **sp. n.**, male calling song. (38a, b) oscillogram and spectrogram showing several short-long syllable pairs from a caged male (23°C); (38c) further detail of syllable structure.

### *Ewartia* Moulds, 2012

The genus was originally described by Moulds (2012) to accommodate three species, *E. oldfieldi* (Distant, 1883), *E. brevis* (Ashton, 1912), and *E. cuensis* (Distant, 1913). Popple (2017b) revised the *E. oldfieldi* species group and added five additional species. We now describe a further species belonging to the genus but not to any of the current species groups.

### *Ewartia adusta* sp. n.

urn:lsid:zoobank.org:act:684EA9C0-1857-482C-AD31-688D55A8914B
(Figs 5, 18, 39–41)

**Synonymy**. 'sporty cicada' Marshall *et al.* 2016: text-fig. 2.

**Etymology.** From the Latin adjective *adustus* meaning burnt colour, browned, tanned, and referring to the orange brown and black colour of this species suggestive of it having survived extreme heat where it occurs through some of the hottest and driest parts of Australia.

**Types.** *Holotype* male, AU.WA.MES, 10 km S of Meekatharra on Great Northern Hwy, Western Australia, 26°41.008'S 118°27.202'E, 484 m, 14.ii.2006, Hill, Marshall, Moulds (WAME 113460) (WAM). *Paratypes* as follows: **WESTERN AUSTRALIA:** 1 male, 2 females, AU.WA.CAP, ~3 km S of Capricorn Rdhouse. 17 km S of Marble Bar rd on Great N. Hwy, 23°31.091'S 119°46.216'E, 12.ii.2006, Hill, Marshall, Moulds (AMS). 2 males, Ophthalmia Dam turnoff, Nullagine, Marble Bar Rd, Pilbara, iii.2009, P. Hutchinson; 1 female, Cathedral Gorge, 18 km W Newman, 5.iii.2004, P. Hutchinson; 1 female, Gaseoyne R., Sth Branch, 146 km N Meekatharra, 14.iii.2015, P. Hutchinson (DE). 1 male, AU.WA.TNC, 11.5 km N of Cue, 431 m, 27°20.267'S 117°56.566'E, 18.ii.2009, K. Hill & D. Marshall; 1 female, AU.WA.CAP, ~3 km S of Capricorn Rdhouse. 17 km S of Marble Bar rd on Great N. Hwy, 23°31.091'S 119°46.216'E, 12.ii.2006, Hill, Marshall, Moulds; 1 male. 7.8 km SSE of Menzies, 29.75448°S 121.05988°E, 22.ii.2016, Hand coll., D. Marshall & L. Popple; 1 female, 94.4 km SE of Meekatharra, 27.25761°S

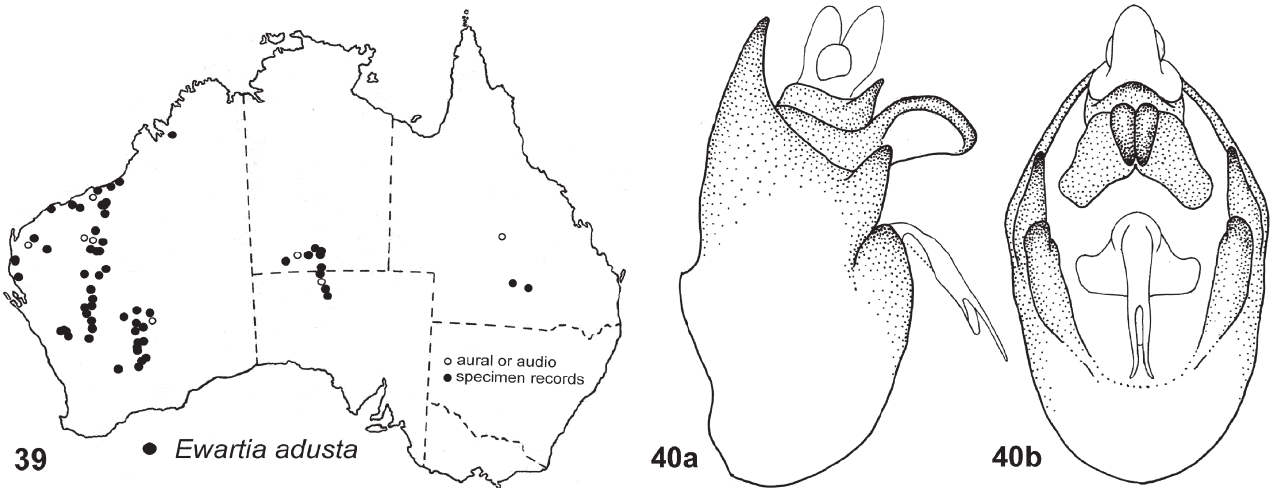
118.95301°E, 24.ii.2016, at light, D. Marshall & L. Popple; 4 males, 2 females, 23.5 km SW of Kumarina, 24.8739°S 119.46872°E, 25.ii.2016, D. Marshall & L. Popple, at light; 1 female, 94.4 km NNE. Of Newman, 22.66754°S 119.94951°E, 26.ii.2016, D. Marshall & L. Popple, at light (LP). 1 male, 10 females, AU.WA.DEH, De Grey R x-ing, Shay Gap Rd, ~85 km NNE of Marble Bar, 20°37.279'S 120°04.226'E, 17.i.2010, Hill, Marshall, Moulds; 2 males, AU.WA.GIB, Gibb River Rd, ~81 km E of Derby Hwy, 17°26.566'S 124°24.657'E, 19.i.2010, Hill, Marshall, Moulds; 1 female, AU.WA.WWG, Muccan Shay Gap Rd, ~60 km NE of Marble Bar, 20°50.906'S, 120°02.635'E, 17.i.2010, Hill, Marshall, Moulds; 6 females, AU.WA.HOU, House Ck, ~60 km E of Nanutarra roadhouse, 22°27.970'S 116°02.240'E, 13.ii.2009, Hill Marshall, Moulds; 7 males, 1 female, AU.WA.TNC, 11.5 km N of Cue, 431 m, 27°20.267'S 117°56.566'E, 18.ii.2009, K. Hill & D. Marshall; 1 male, AU.WA.COC, 12.5 km W of Coolgardie, 30°58.321'S 121°02.55'E, 418 m, 22.ii.2009, K. Hill & D. Marshall; 1 male, 1 female, AU.WA.NIC, Nickol River crossing, W of Roebourne, 20°46.225'S 116°56.805'E, 16.ii.2009, K. Hill, D. Marshall; 3 males, 2 females, AU.WA.NSF (includes Simon Lab. vouchers 06AU.WA.NSF.01, 06AU.WA.NSF.02, 06AU.WA.NSF.09, 06AU.WA.NSF.10), 5 km NE of Sandfire Roadhouse, 19º46.262'S 121º08.666'E, 15 m, 9.ii.2006, Hill, Marshall, Moulds; 1 male, AU.WA.SFS, 18 km W of Sandfire Roadhouse, 19º49.657'S 120º56.002'E, 30 m, 9.ii.2006, Hill, Marshall, Moulds; 1 male, 3 females, AU.WA.SFC, 74 km W of Sandfire Roadhouse on Great Northern Hwy, 19°55.828'S 120°25.082'E, 30 m, 9.ii.2006, Hill, Marshall, Moulds; 1 male, AU.WA.WPR, 147 km ENE of Port Headland, 20º04.940'S 119º46.205'E, 14 m, 10.ii.2006, Hill, Marshall, Moulds; 3 females, AU.WA.YAN, ~110 km S of Port Hedland, 21°14.911'S 118°41.795'E, 177 m, 10.ii.2006, Hill, Marshall, Moulds; 3 males, AU.WA.PCS, Pinga Ck South, 300 km N of Newman [on Great Northern Hwy], 21°29.889'S 118°43.935'E, 222 m, 11.ii.2006, Hill, Marshall, Moulds; 3 females, AU.WA.MUN, 261 km S of Port Hedland, 22°22.849'S 118°41.484'E, 475 m, 11.ii.2006, Hill, Marshall, Moulds; 1 male, 2 females, AU.WA.HAM, 291 km S of Port Hedland, 22°37.771'S 118°42.106'E, 707 m, 11.ii.2006, Hill, Marshall, Moulds; 1 male, 1 female, AU.WA.EMM, 45 km E of Mt Magnet, 28°11.328'S 118°17.020'E, 457 m, 16.ii.2006, Hill, Marshall, Moulds; 2 males, AU.WA.OPH, 67 km NW of Newman, 23°08.264'S 119°11.021'E, 702 m, 12.ii.2006, Hill, Marshall, Moulds; 1 male, AU.WA.OPS, 19 km NW of Newman on Great Northern Hwy, 23°15.204'S 119°36.350'E, 629 m, 12.ii.2006, Hill, Marshall, Moulds; 5 males, 15 females, AU.WA.CAP, ~3 km S of Capricorn Rdhouse. 17 km S of Marble Bar rd on Great N. Hwy, 23°31.091'S 119°46.216'E, 12.ii.2006, Hill, Marshall, Moulds; 2 males, AU.WA.KSC, ~210 km S of Newman, 25°01.126'S 119°24.560'E, 559 m, 13.ii.2006, Hill, Marshall, Moulds; 1 male, AU.WA.MRN, 56 km N of Meekatharra on Great Northern Hwy, 26°07.835'S 118°41.685'E, 489 m, 14.ii.2006, Hill, Marshall, Moulds; 2 males (one genitalia prep. EW1), 10 females, AU.WA.MES, 10 km S of Meekatharra on Great Northern Hwy, 26°41.008'S 118°27.202'E, 484 m, 14.ii.2006, Hill, Marshall, Moulds; 1 male, AU.WA.TUC, 42 km NE of Cue on Great Northern Hwy, 27°06.630'S 118°06.537'E, 494 m, 15.ii.2006, Hill, Marshall, Moulds; 5 females, AU.WA.SOC, 45 km S of Cue on Great Northern Hwy, 27°47.610'S 117°55.248'E, 436 m, 15.ii.2006, Hill, Marshall, Moulds; 1 male, AU.WA.NWL, 9 km W of Leinster, 27°58.407'S 120°38.230'E, 527m, 17.ii.2006, Hill, Marshall, Moulds; 1 male, AU.WA.ALL, 37 km E of Leonora, 28°53.043'S 121°40.895'E, 401 m, 18.ii.2006, Hill, Marshall, Moulds; 3 females, AU.WA.LLC, 94 km S of turnoff to Leinster, 36.5 km N of Leonora, 28°34.856'S 121°11.941'E, 427 m, 18.ii.2006, Hill, Marshall, Moulds; 3 males, WAU.VIC, Queen Victoria Rock, 31°17'S 120°56'E, 17.i.2003, Moulds, Hill, Marshall & Vanderpool; 1 male, 47 km W of Yalgoo, 11.ii.2001, M. Powell & D. Knowles; 1 male, 1 female, Ashburton Rv, Nanutarra, 7.iii.2004, P. Hutchinson; 2 males, 10 km N of Kookynie, 10.ii.2006, M. Hanlon & M. Powell; 1 female, 11 km W of Yellowdine, 20.x.2006, on Eremophila bush, T.M. Hanlon & M. Powell; 1 male, 5 females, Cathedral Gorge, 18 km W Newman, 5.iii.2004, P. Hutchinson; 2 males, 4 females, Ashburton Rv., Nanutarra, 7.iii.2004, P. Hutchinson; 1 male, 1 female, Milly Soak, 16 km N Cue, 28.i.2000, P. Hutchinson; 1 female, 30 km E of Yalgoo, 11.ii.2001, M. Powell & D. Knowles; 1 male, Fortescue, 21.ii.1985, K. & E. Carnaby; 1 female, Marble Bar, 27.ii.1973, Gordon R. Jones; 1 male, 1 female, 53 km S Minilya, 17.iii.1994, M. Golding; 2 males, 2 females, Rocky Pool, 42 km E Carnarvon, 5.iii.2008, P. Hutchinson; 1 male, 3 females, 17 km ENE of Agnew, 27°59'S 120°41'E, 17.i.1989, M.S. & B.J. Moulds; 1 male, 3 females, 55 km ESE of Mount Magnet, 18.i.1989, M.S. & B.J. Moulds; 8 males, 6 females, 110 km S of Mount Magnet, 19.i.1989, M.S. & B.J. Moulds; 2 females, Lake Douglas, 12 km SW of Kalgoorlie, 13.i.1989; M.S. & B.J. Moulds; 6 females, Leonora, 15.i.1989, M.S. & B.J. Moulds; 1 male, W. Peawah River, 90 km SW of Port Hedland, K. & E. Carnaby; 1 female, N. Sandfire Flat, 24.ii.1985, K. & E. Carnaby; 1 female, Sherlock River, 22.ii.1985, K. & E. Carnaby (MSM). 2 males, 1 female, Milly Soak, 16 km N Cue; 28,29.i.2006, P. Hutchinson, to light, PMH Coll #CIC 2374, 2355, 2403; 8 males, 11 females, Rocky Pool, 42 km E Carnarvon, 5.iii.2008, P. Hutchinson, on Acacia, PMH Coll #Cic 2379, 2378, 2382, 2383, 2386, 2387, 2370, 2369, 2375, 2388,

2372, 2371, 2389, 2391, 2392, 2393, 2400, 2401, 2405, 2399, 2402; 2 females, Rocky Pool, 42 km E Carnarvon, 5.iii.2008, P. Hutchinson, to light, PMH Coll #CIC 2399, 2402. 1 female, Gascoyne Rv. Sth Br., 146 km N Meekatharra, 12.iii.2011, P. Hutchinson, on Acacia, PMH Coll #CIC 2376. 7 females, Cathedral Gorge, 18 km W Newman, 5.iii.2004, P. Hutchinson, to light, PMH Coll #CIC 2377, 2380, 2384, 2385, 2390, 2397, 2398. 3 females, Ashburton Rv., Nanutarra, 7.iii.2004, P. Hutchinson, to light, PMH Coll #CIC 2381, 2394, 2404; 2 females, 23 km S of Menzies, 6.ii.2006, P. Hutchinson, on Acacia, PMH Coll #CIC 2361, 2395; 2 males, 3 females, 10 km W of Menzies, 5.ii.2006, P. Hutchinson, to light, PMH Coll #CIC 2363, 2354, 2396, 2365, 2357; 2 males, 2 females, 25 km E of Pindar, 3.i.2011, M. Hanlon & M. Powell, in Acacia scrub, PMH Coll #CIC 2364, 2365, 2366, 2368; 1 female, 26 km E of Pindar, 23.i.2011, M. Hanlon & M. Powell, on Acacia leaves, PMH Coll #CIC 2367. 1 male, 1 female, Camel Soak, Perenjori–Rothsay Rd, 16.ii.2021, P. Kay, to mv light, PMH Coll #CIC 2362, 2373. 3 females, 10 km N of Mt Magnet, 5,7.iii.2006, P. Hutchinson, to light, PMH Coll #CIC 2358, 2359, 2360 (PH). 1 male, 1 female, 23.5 km SW of Kumarina, 24.8739°S 119.46872°E, 25.ii.2016, D. Marshall & L. Popple, at light (QM). 1 male, AU.WA.OPH, 67 km NW of Newman, 23°08.264’S 119°11.021’E, 702 m, 12.ii.2006, Hill, Marshall, Moulds; 1 male, WAU.VIC, Queen Victoria Rock, 31°17’S 120°56’E, 17.i.2003, Moulds, Hill, Marshall & Vanderpool (UCONN). 2 females, Wurarga, ii.67, A. Douglas, WAM Entomology Reg. nos 73205, 73206, 73207, 73208; 1 female, 37-336, Canegrass, A.M. Douglas, WAM Entomology Reg. no. 73209; 1 male, 7.5 km SE Banjiwarn HS, 27°42’S 121°37’E, 22–28.ii.1980, T.F. Houston *et al.*, 316-2, ex aggregation in Acacia tree, WAM, Dept. of Biological Survey site BW Camp, WAM Collection 88/1413, WAM Entomology Reg. no. 73210; 1 female, 7.5 km SE Banjiwarn HS, 27°42’S 121°37’E, 22–28.ii.1980, T.F. Houston *et al.*, 316-2, ex aggregation in Acacia tree, WAM, Dept. of Biological Survey site BW Camp, WAM Entomology Reg. no. 73211, Barcode of Life DNA voucher specimen Sample CCD-27057-E12 Bold Proc. ID WAM A630-15; 1 male, 1 female, 7.5 km SE Banjiwarn HS, 27°42’S 121°37’E, 22–28.ii.1980 T.F. Houston *et al.*, 316-2, ex aggregation in Acacia tree, WAM, Dept. of Biological Survey site BW Camp, WAM Collection 88/1412 & 88/1411, WAM Entomology Reg. nos 73212 & 73215; 1 male, 1 female, 7.5 km SE Banjiwarn HS, 27°42’S 121°37’E, 22–28.ii.1980 T.F. Houston *et al.*, 316-2, ex Aggregation in Acacia tree, WAM, Dept. of Biological Survey site BW Camp, WAM Entomology Reg. nos 73213, 73214; 1 female, 7.5 km SE Banjiwarn HS, 27°42’S 121°37’E, 22–28.ii.1980, T.F. Houston *et al.*, 316-2, ex aggregation in Acacia tree, WAM, Dept. of Biological Survey site BW Camp, WAM Collection 88/1410, WAM Entomology Reg. no. 73215, Barcode of Life DNA voucher specimen Sample CCD-27057-E11 Bold Proc. ID WAM A629-15; 1 female, 3.75 km NE of Comet Vale siding, 29°57’S 121°07’E, 7–15.iii.1979, T.F. Houston *et al.*, 256-8, at light at night, WAM Entomology Reg. no. 73217; 1 male, 13.8 km ENE of Comet Vale siding, 29°57’S 121°07’E, 7–15.iii.1979, T.F. Houston *et al.*, 256-8; 1 female, Cathedral Gorge, 18 km W Newman, 5.iii.2004, to light, P. Hutchinson (WAM). **NORTHERN TERRITORY:** 2 males, 1 female, Mt Ebenezer Rdhse, 250 km W Alice Springs, 25°10.774’S 132°40.632’E, 10.xii.2005, D. Freier (DE). 1 male, 1 female, Mt Ebenezer Rdhse, 250 km W Alice Springs, 25°10.774’S 132°40.632’E, 10.xii.2005, D. Freier, flew to lights (LP). 1 female, AU.NT.LJB, Luritja Road, 19 km N of Lasseter Hwy, 25°02.849’S 132°15.634’E, 1.ii.2010, Hill, Marshall, Moulds; 2 males, AU.NT.ERL, ~5 km S of Erldunda Roadhouse, 69.5 km N of Kulgera on Stuart Hwy, 25º14.026’S 133º12.231’E, 403 m, 29.i.2007, D. Marshall, K. Hill; 1 male, 1 female, AU.NT.MKG, 84.4 km S of Stuart Well on Stuart Hwy, 24º58.744’S 133º11.743’E, 410 m, 1.ii.2007, K. Hill, D. Marshall; 2 males, (1 Simon Lab. voucher 07.AU.NT.SAB.04), just N of the SA/NT border, on Stuart Hwy, 25º59.835’S 133º11.811’E, 527 m, 29.i.2007, K. Hill & D. Marshall, 1 female, Ayers Rock, 3.ii.1984, M.S. & B.J. Moulds; 1 female, Henbury Meteorite Craters, 140 km SW of Alice Springs, 30.i.1984, M.S. & B.J. Moulds (MSM). **SOUTH AUSTRALIA:** 1 male, AU.SA.SUN, 27 km [S] of NT border on Stuart Hwy, 461 m, 26°13.963’S 133°11.228’E, 28.i.2015, D. Marshall; 2 males, 1 female, 17 km S of Chandler railway siding, 5.ii.1984, M.S. & B.J. Moulds; 1 male, 1 female, 6 km S of Wintinna Hsd, 5.ii.1984, M.S. & B.J. Moulds (MSM). **QUEENSLAND:** 1 male, 1 female, 3 km E of Charleville, 26°24’S 146°16’E, 15.iii.1990, Edwards & Fisk (ANIC). 1 male, AU.QL.MVN, ~13 km NNW of Morven, 26º20.611’S 147º00.535’E, 400 m, 9.ii.2008, K. Hill, D. Marshall, M. Moulds, C. Owen, M. Humphrey, Simon Lab. voucher 08.AU.QL.MVN.06 (MSM).

**Aural and audio records (without vouchers)**. **WESTERN AUSTRALIA:** 09.AU.WA.PBB, 148.7 km E of Northwest Coastal Hwy on road to Tom Price, 22º50.976’S 116º43.837’E, 253 m, 14.ii.2009, K. Hill, D. Marshall, audio only; 06.AU.WA.GOL, 1 km NE of the Pardoo River, 40.8 km SW of Pardoo Roadhouse on Great Northern Hwy. NE of Goldsworthy (abandoned town), 20º16.770’S 119º31.278’E, 38 m, 10.ii.2006, Hill, Marshall, Moulds, aural only; 06.AU.WA.PHJ, Port Hedland, N of town centre on side of main road in unused, junky weedy land,

20º19.033’S 118º37.334’E, 9 m, 10.ii.2006, Hill, Marshall, Moulds, aural only; 06.AU.WA.PHT, ~20 km S of Port Hedland, 13 km N of the Turner River on Great Northern Hwy, 20º26.008’S 118º33.317’E, 16 m, 10.ii.2006, Hill, Marshall, Moulds, aural only; 06.AU.WA.MJN, ~221 km N of Newman, 31 km N of Munjina Roadhouse on Great Northern Hwy, 22º08.097’S 118º47.270’E, 464 m, 11.ii.2006, Hill, Marshall, Moulds, aural only; 06.AU.WA.ROB, Rest area at Mt Robinson on Great Northern Hwy, 108 km NW of Newman, 23º02.691’S 118º51.004’E, 752 m, 12.ii.2006, Hill, Marshall, Moulds, aural only; 06.AU.WA.MRS, Near Mt Robinson on Great Northern Hwy, 112 km NW of Newman, 23º03.386’S 118º51.977’E, 744 m, 12.ii.2006, Hill, Marshall, Moulds, aural only; 06.AU.WA.LAV, 1.7 km W of Laverton on road to Leonora, 28º36.644’S 122º23.890’E, 454 m, 18.ii.2006, Hill, Marshall, Moulds, aural only; 09.AU.WA.NTE, 3.4 km E of Northwest Coastal Hwy on road to Tom Price, 22º30.038’S 115º32.792’E, 91 m, 13.ii.2009, K. Hill, D. Marshall, aural only; 09.AU.WA.NEN, 34 km N of Newman, 23º13.758’S 119º29.423’E, 708 m, 17.ii.2009, K. Hill, D. Marshall, aural only; 10.AU.WA.SHY, Shay Gap, jct with railway line, ~43 km N of Warrawagine Rd on Shay Gap Rd. ~103 km NNE of Marble Bar, 20º32.123’S 120º10.367’E, 147 m, 18.i.2010, Hill, Marshall, Moulds, aural only. **NORTHERN TERRITORY:** 10.AU.NT.MLE, Gintys Lookout, 27 km NE of Kings Canyon Resort on Mereenie Loop Road, 24º03.658’S 131º24.505’E, 772 m, 31.i.2010, Hill, Marshall, Moulds, audio only; 10.AU.NT.ULH, NW side of Uluru/Ayers Rock, 25º20.454’S, 131º01.393’E, 518 m, 1.ii.2010, Hill, Marshall, Moulds, audio only. **SOUTH AUSTRALIA:** 07.AU.SA.MRA, Marryat Rest Area at Agnes Ck, Stuart Hwy. ~75 km S of SA/NT border, 26º38.308’S 133º16.713’E, 400 m, 1.ii.2007, D. Marshall & K. Hill, aural only. **QUEENSLAND:** 08.AU.QL.SAB, 9.7 km S of Barcaldine on the Landsborough Hwy, 23º38.958’S 145º16.915’E, 265 m, 7.ii.2008, K. Hill, D. Marshall, C. Owen, M. Moulds, M. Humphrey, aural only.

**Distribution and habitat** (Figs 18b, 39). Throughout much of the western half of Western Australia south from near Derby to the Perth and Coolgardie districts, in the Northern Territory south of the Western McDonnell Ranges to just over the border into South Australia, and in Queensland from near Barcaldine, Charleville and Morven. There are many records from Western Australia south from Sandfire, the most southern records being Queen Victoria Rock some 45 km south-west of Coolgardie, while the most inland records are Agnew and Laverton. Records from the Northern Territory are clustered together in the south-western corner of the state including Uluru (Ayers Rock) and Gintys Lookout near Kings Canyon and Henbury Meteorite Crater. From South Australia there are records from along the Stuart Highway south to Wintinna. The distribution of the species is probably continuous across inland central Australia but lacks records from the Gibson and Great Victoria Deserts. Adults are mostly found in *Acacia* trees and have been recorded from late October to mid March but their appearance largely follows good rainfall.




**FIGURES 39–40.** *Ewartia adusta* **sp. n.** (39) distribution; (40a) male genitalia in lateral view; (40b) same in ventral view.

**Adult description**. *Male* (Figs 18a, 40). *Head* black, usually with supra-antennal plates partly or entirely yellowish or orange brown and often a spot of similar colour on posterior midline; eyes red in life. Postclypeus black with yellowish or orange brown margin ventrally; sometimes with an anterior spot of similar colour that occasionally extends to dorsal surface. Anteclypeus black. Rostrum black sometimes with brown basally; reaching apices of mid coxae. *Thorax* with pronotum orange brown, rarely tending black, with a black fascia either side of an orange brown dorsal midline expanded laterally at anterior end and at posterior end tending circular with an angular pro-

jection either side; pronotal collar orange brown with a black anterior margin dorsally. Mesonotum yellowish or orange brown but dominated by black submedian and lateral sigilla and a black dorsal midline outwardly angled to incorporate scutal depressions; cruciform elevation dark brown to black except for yellowish or orange brown arms. Metanotum yellowish or orange brown. *Wings* hyaline. Forewing venation black; a bold zigzag subapical infuscation overlying crossveins r and r-m and that part of vein RP joining them; lesser infuscation along vein $RA_2$ and along ambient vein and distal ends of veins forming apical cells 1–7; basal cell hyaline; basal membrane orange. Hindwing venation pale brown; without infuscations; plaga white, inconspicuous. *Legs* orange brown; fore coxae black on outer face; fore and mid femora blackish on inner lateral surface; meracantha pale yellow, long, reaching to mid length of opercula. Opercula pale yellow with blackish base; reaching distal margin of tympanal cavity but far from meeting each other; raised along outer lateral margin leaving a wide opening between operculum and tympanal cavity on outer half. *Abdomen* with tergites black with orange or yellowish markings; tergite 2 with a broad orange posterior margin confined to dorsal and subdorsal region and usually interrupted at dorsal midline; tergites 3–7 with narrow orange posterior margins usually extending to sternite but usually interrupted at dorsal midline; tergite 8 similarly marked but the orange variable in width from narrow to very broad. Sternites orange or yellowish with a broad black midline usually reaching to sternite VII where it contracts distally and fails to reach the distal margin; sternite VIII orange or yellowish usually with a diffused black parch on basal midline. *Timbal cavity* rounded along posterior margin. *Timbals* with four long ribs spanning the the timbal membrane, the posterior three fused dorsally; spaced with short intermediate ribs; anterior of timbal membrane mostly occupied by ribs.

*Male genitalia* (Figs 40a–b). Pygofer black to dark brown with dull orange or brownish on basal and upper lobes and a diffused patch of similar colour against margin between upper lobe and dorsal beak; basal lobes large, in lateral view broadly rounded; upper lobes similar in size to basal lobes but narrower, tapering; claspers with apices bluntly rounded (not bi-lobed). Aedeagus with pseudoparameres barely curved in lateral view, curved inwards subapically in dorsal view.

*Female* (Fig. 5). Similar to male. Abdominal segment 9 short, in dorsal view only a little longer than wide; black with a broad orange ventral margin and an orange patch below a black dorsal beak. Ovipositor sheath black, not projecting beyond dorsal beak.

**Measurements**. Range and mean (in mm) for 10 males, 10 females (includes smallest and largest specimens). *Length of body* (including head): male 14.4–18.0 (16.0); female (including ovipositor) 15.0–19.4 (17.7). *Length of forewing*: male 17.0–21.2 (18.9); female 18.8–24.3 (20.8). *Width of head* (including eyes): male 4.8–6.0 (5.2); female 5.1–6.1 (5.7). *Width of pronotum* (across lateral angles): male 5.0–6.1 (5.4); female 5.2–6.4 (5.9).

**Distinguishing features**. Distinguished from all other species by having, in combination, forewing veins M and CuA fused for a length equal to at least the length of the basal cell, the forewings infuscated on crossveins r and r-m, and in having dominating black sigilla on the mesonotum with the black extending to the cruciform elevation. The male genitalia are closely similar to other *Ewartia* species and not particularly useful for separating closely allied species.

**Song** (Figs 41a–f). Recordings were examined from the WA.LAV, WA.MRS, WA.NSF, WA.PBB, WA.SHY, WA.VIC, NT.LJB, and NT.ULH paratype locations, along with additional sites in Western Australia and Northern Territory.

*Ewartia* males exhibit two calling song modes, a complex song and a simple song (see Popple 2017b). Each mode can be continued for extended periods. Two song modes are also produced in *Ewartia adusta* **sp. n.** Both vary considerably in form within a single male's song. Most of the recordings obtained here contained only the simple song mode. Based on the limited available sample, the main section of the complex song (Figs 41a–c) consists of a phrase lasting approximately 1.5–3 s that contains approximately 2–5 repeated echemes and concludes with a modified echeme that ends with a short isolated syllable that probably serves as a cue for a receptive female to reply (the "accentuated" syllable of Popple 2017b). Each echeme other than the final one consists of a long (0.2–0.5 s) syllable followed by a series of short syllables that gradually decrease and then increase in repetition rate (from about 25–50 syllables/s). Near the end of these echemes, the short syllables begin to coalesce and may form an intermediate-length syllable. In the final echeme, the short syllables do not increase in rate at the end, and instead the isolated cueing syllable is produced. The final echeme is sometimes considerably shortened, and the whole phrase can be preceded by a series of short syllables that vary in rate. The cueing syllable is 0.04–0.05 s in duration and is preceded and followed by silent gaps of about 0.15 and 0.1 s, respectively.

The simple song mode (Figs 41d–f) consists of long syllables of about 0.15–0.2 s duration (or, in some cases,

macrosyllables formed by coalesced syllables) repeated at about 2.5–3 per s. Often these syllables become broken to varying degrees into composite syllable pairs or threes. The underlying pulse rate of both song modes varies from around 500–1250/s and is difficult to discern apparently due to shifting relationships of the timbal contractions. Both modes have sound energy focused in the range 11.5–18.5 kHz, with a peak of about 14.5 kHz. There is little frequency modulation.

Certain other *Ewartia* species have songs that are similar to that of *E. adusta* **sp. n.**, but none exhibit a pattern in which long syllables are normally following by steadily decreasing-rate short syllables in the complex song (Popple 2017b). *Ewartia etesia* and *E. thamna*, for example, have the pattern reversed, with short syllables increasing in rate towards a final long syllable that may precede the song cue.

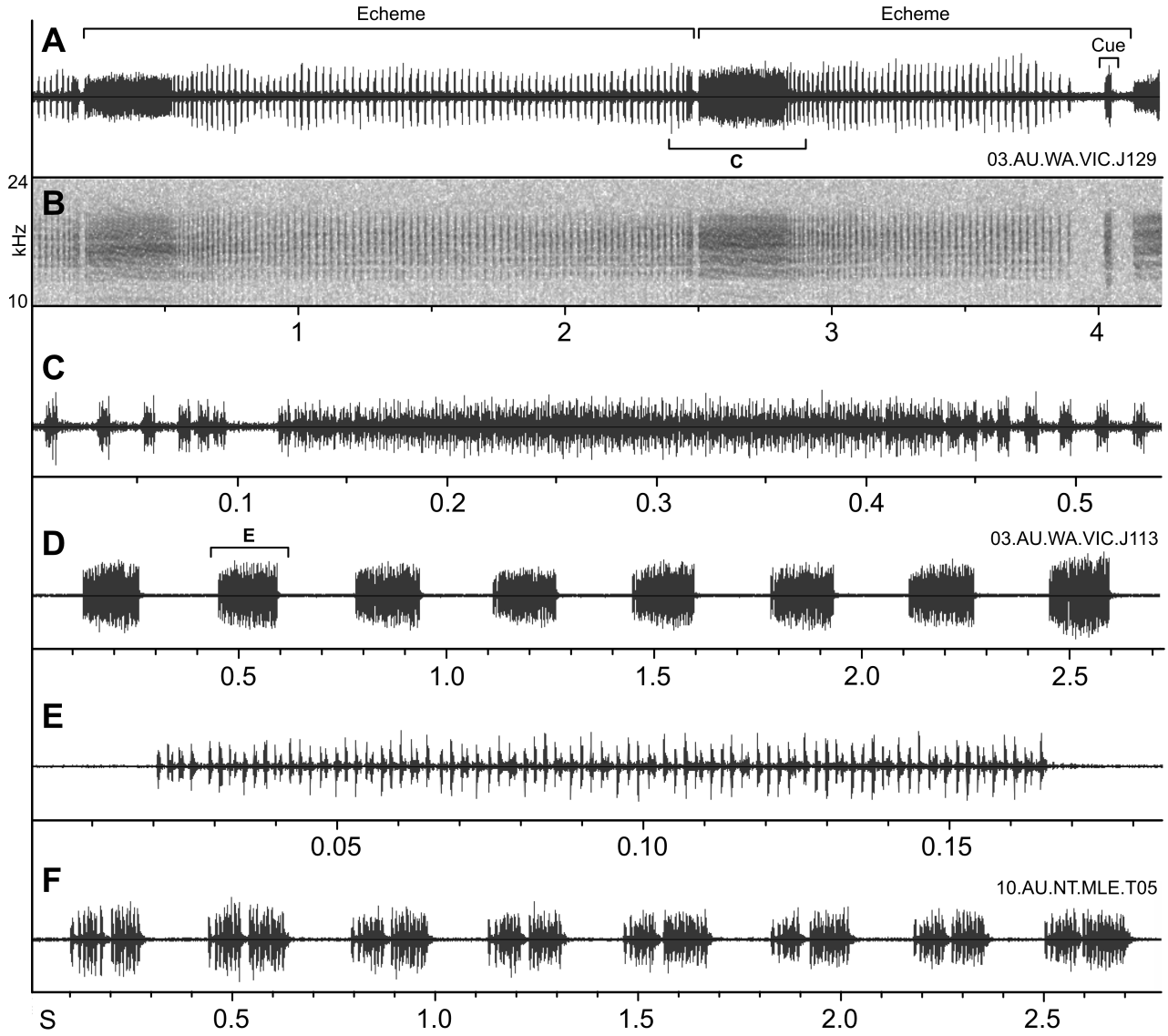



**FIGURE 41.** *Ewartia adusta* **sp. n.**, male song modes. (41a, b) oscillogram and spectrogram of the complex calling song mode showing the final two echemes of a song phrase, the second echeme ending with a probable song cue; (41c) oscillogram showing further detail of the transition between echemes; (41d–f) two examples of the simple song mode. Air temperature: (41a–e) 31–36°C; (41f) not recorded.

**Discussion and phylogenetic relationships.** Of all the *Ewartia* species *Ewartia adusta* **sp. n.** has been the most successful at exploiting an arid environment, inhabiting some of the driest and harshest regions across a very wide area of Central Australia. All other species inhabit high rainfall regions except for *E. cuensis* that has a very restricted distribution in a semi arid area around Cue in Western Australia and *E. lapidosa* whose distribution extends into lesser rainfall areas through the eastern half of Queensland and New South Wales. In a molecular study of Cicadettini, Marshall *et al.* (2016) found *Ewartia adusta* **sp. n.** was sister to three other species of *Ewartia* in their

study, *E. brevis, E. cuensis* and *E. oldfieldi* (as *E*. nr. *oldfieldi*). As *E. oldfieldi* represents a complex of closely related species (Popple 2017b) the molecular tree is a reasonable representation of all species in the genus. This suggests that *E. adusta* has been the only extant *Ewartia* species to successfully adapt to an arid environment when Australia dried during the early to mid Miocene.

### *Calipsalta* gen. n.

urn:lsid:zoobank.org:act:065C8F75-F005-49DC-BB1A-DCC716A7619C
(Figs 9–11, 20, 42–50)

**Type species.** *Calipsalta fumosa* **sp. n.**, here designated.

**Included species.** *Calipsalta fumosa* **sp. n.**, *C. viridans* **sp. n.,** *C. brunnea* **sp. n.**

**Etymology.** From the Latin adjective *calidus* meaning warm, hot, and referring to the warm to hot climate inhabited by the species of this genus, and from *psalta*, a traditional ending for cicada generic names which probably originates from the Latin *psaltria* meaning a female harpist. Feminine.

**Distribution** (Figs 42, 45, 48). Arid regions of Western Australia, Northern Territory, South Australia and far south-western Queensland. The females of all species are readily attracted to light, the males far less so.

**Diagnosis** (Figs 9–11, 20a, 43, 46, 49)./ *Head* including eyes as wide as mesonotum; supra-antennal plate almost meeting eye; postclypeus broadly rounded transversely across ventral midline, in lateral profile angulate between 'top' and 'sides'. *Thorax*: pronotum in dorsal view parallel-sided or widening towards posterior; 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. *Forewings* hyaline; 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 except for a slight swelling basally; costa of male gently and evenly curved; pterostigma present; vein CuA only weakly bowed so that cubital cell no wider than widest part of medial cell; veins M and CuA meeting basal cell abutted (never spaced apart) or with their stems completely fused for a short distance; vein $CuA_1$ divided by crossvein m-cu so that proximal portion shortest; distance between crossveins r and r-m about equal to or a little shorter than between r-m and m; wing outer margin developed for its total length, never reduced to be contiguous with ambient vein. *Hindwings* with six apical cells; no infuscation on ambient vein; width of 1st cubital cell at distal end more than twice that of 2nd cubital cell; anal lobe wide with vein 3A curved, long, and separated from wing margin. *Foreleg* femoral primary spine unusually large, erect. *Male opercula* more or less reaching margin of tympanal cavity, directed towards distomedial margin of tympanal cavity, apically broadly rounded, not meeting. *Male abdomen* about as wide as thorax; in cross-section with sides of tergites straight or weakly convex; epipleurites reflexed ventrally from junction with tergites; tergite 2 wide along midline, about as wide as any other of tergites 3–7; sternites III–VII convex in cross-section not unusually swollen. *Timbals* with three long ribs and one anterior one short; basal dome large; timbals extended below the level of the wing bases; posterior margin of timbal cavity either rounded and completely lacking a ridge or weakly ridged on lower half or so.

*Male genitalia* (Figs 43, 46, 49). Pygofer in ventral view ovoid to sub ovoid, distal portion of upper pygofer lobes not the widest point, not strongly tapered from upper pygofer lobes to base; pygofer with distal shoulders not developed; upper lobes flat, small to moderately developed, set well away from dorsal beak, rounded; basal lobes undivided, moderately developed, broadly rounded in lateral view, adjacent to upper pygofer lobe, partly tucked behind pygofer margin; dorsal beak present as a pointed apex (visible in dorsal view) and a part of chitinized pygofer. Uncus small, short, flattened, more or less duck-bill shaped. Claspers well developed; restraining aedeagus; wide in lateral view, outer face with a deep overhanging lip along upper margin; unfused; not notably diverging. Aedeagus trifid; with basal plate in lateral view undulated, weakly depressed on dorsal midline, in dorsal view shorter than broad, apically broadened with 'ears'; ventral rib completely fused with basal plate; junction between theca and basal plate with a functional 'hinge' that possesses a chitinous back; thecal shaft short; pseudoparameres about as long as theca, slender, unfused throughout their length, gradually converging and then diverging in dorsal, in lateral view aligned with or slightly angled upwards from thecal shaft; ventral support long (longer than half the length of pseudoparameres); flabellum absent; conjunctival claws absent.

*Female* (Fig. 10) with sternite VIII deeply incised in a V shape; abdominal segment 9 a little wider than long (excluding dorsal beak); dorsal beak with a developed apical spine.

**Distinguishing features and relationships**. Small cicadas. Distinguished from all other genera in having, in combination, forewing veins M and CuA meeting the basal cell with their stems completely fused as one or abutted (never separated); the hindwings with 6 apical cells and without infuscation; the paranota lacking a small mid lateral tooth; claspers that do not diverge; and a trifid aedeagus with a very long ventral support and a non-sclerotised hinge.

Two species of *Calipsalta* **gen. n.** were included in a molecular study by Marshall *et al.* (2016), these described below as *C. brunnea* **sp. n.** and *C. viridans* **sp. n.** Together they were sister to *Noongara issoides* Distant, 1905 and "false quintilia" (described above as *Pedana hesperia* **gen. et sp. n.**). *Calipsalta* is most similar to *Noongara* in morphology, especially in having a trifid aedeagus and claspers that do not diverge, although the two species do look very different in outward appearance. They are best separated by the length of the forewing discal cell that is very short in *Noongara*, about equal to half the length of the distance from its apex to wing tip, but far more in *Calipsalta*. Further, male tergite 1 is narrower than tergite 2 along the dorsal midline in *Calipsalta* but as wide in *Noongara. Calipsalta* clearly differs from *Pedana* in the male genitalia that are trifid in *Calipsalta* but not trifid in *Pedana.*

*Calipsalta* shows superficial similarities to *Erempsalta* in colour and size, and in favouring an arid environment. However, there are notable differences in body proportions and in the male genitalia that have a very long ventral support (short in *Erempsalta*) and claspers that are not diverging. These genera are widely separated in the molecular tree of Cicadettini genera by Marshall *et al.* (2016).

### *Calipsalta fumosa* sp. n.

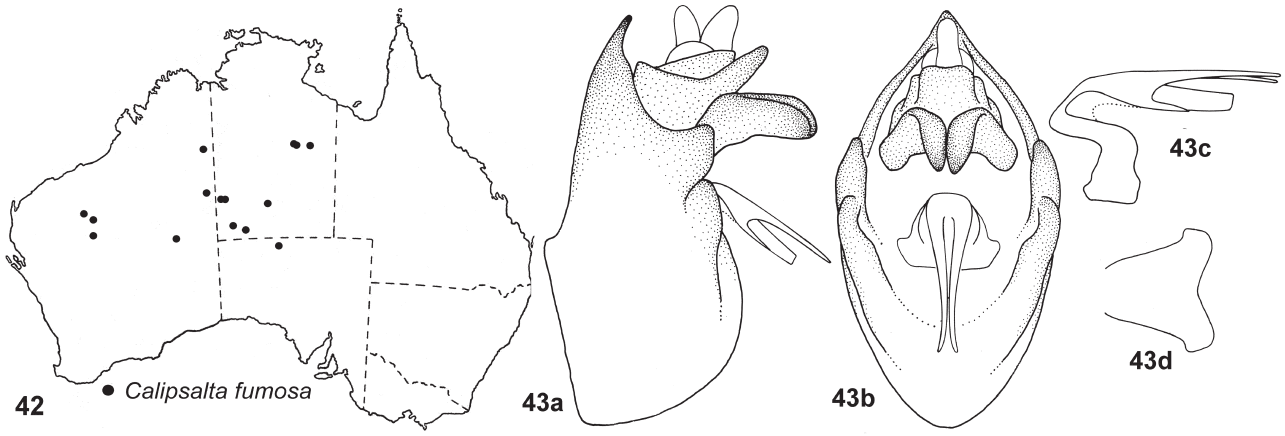
urn:lsid:zoobank.org:act:4035BE4C-9F12-4AD0-BF37-2A34BA62657D
(Figs 9, 42–44)

**Etymology.** From the Latin adjective *fumosus* meaning smoky and pertaining to the smoky infuscation on the subapical forewing.

**Types**. *Holotype* male (Simon Lab voucher 06.AU.WA.OPH.06), 67 km NW of Newman, 702 m, Western Australia, 23°08.264'S 119°11.021'E, 12.ii.2006, Hill, Marshall, Moulds (WAME 113461) (WAM). *Paratypes* as follows: **WESTERN AUSTRALIA:** 1 male (Simon Lab voucher 06.AU.WA.CAP.06), 13 km SE of Newman, 568 m, 23°31.091'S 119°46.216'E, 12.ii.2006, Hill, Marshall, Moulds; 1 male, AU.WA.KSC, ~210 km S of Newman, 559 m, 25°01.126'S 119°24.560'E, 13.ii.2006, Hill, Marshall, Moulds; 1 male, AU.WA.KRR, Kiwirrkurra, at Len Beadell Truck [a monument], 430 m, 22°45.716'S 127°45.716'E, 24.i.2015, D. Marshall; 1 female, 40 km W of Warburton, 26°13'S 126°19'E, 29.xii.1995, M.S. & B.J. Moulds & K.A. Kopestonsky (MSM). **NORTHERN TERRITORY:** 2 males, 3 females, 70 km E of The Three Ways, nr Tennant Creek township, 21.i,1984, M.S. & B.J. Moulds (AMS). 1 male, 32 km S by E of Alice Springs, 23°59'S 133°56'E, 23.ix.1978, M.S. Upton (ANIC). 2 males, 2 females, 70 km E of The Three Ways, nr Tennant Creek township, 21.i.1984, M.S. & B.J. Moulds (DE). 1 male, AU.NT.ESJ, 48 km E of Shaw Ck on Tjukaruru Road, 579 m, 25°7.254'S 130°11.602'E, 21.i.2015, D. Marshall; 1 male (Simon Lab voucher 06.AU.NT.BHW.02), 66 km NW of Barkly Hmstd, 237 m, 19°23.663'S 135°18.720'E, 30.1.2006, Hill, Marshall, Moulds; 1 male (Simon Lab voucher 10.AU.NT.ULG.01), ~2 km W of Ayres Rock, 535 m, 25°21.112'S 131°00.580'E, 1.ii.2010, Hill, Marshall, Moulds; 1 male, AU.NT.KIV, 10 km W of rd to Kintore on Gary Junction Road, 436 m, 23°11.384'S 129°17.765'E, 24.i.2015, D. Marshall; 1 male, AU.NT.ELB, 230 km W Papunya, 13 km E of Sandy Blight Trck Jct, 485 m, 23°11.752'S 129°41.099'E, 24.i.2015, D. Marshall; 21 males, 35 females, 70 km E of The Three Ways, nr Tennant Creek township, 21.i.1984, M.S. & B.J. Moulds; 1 male, 20 females, junction Tablelands & Barkly Hwys, 21.xii.1986, M.S. & B.J. Moulds; 2 females, Yalara Resort, Ayers Rock, 2.ii.1984, M.S. & B.J. Moulds (MSM). 2 males, 2 females, 70 km E of The Three Ways, nr Tennant Creek township, 21.i.1984, M.S. & B.J. Moulds (LP). 2 males, 2 females, 70 km E of The Three Ways, nr Tennant Creek township, 21.i. 1984, M.S. & B.J. Moulds (PH). 2 males, 2 females, 70 km E of The Three Ways, nr Tennant Creek township, 21.i.1984, M.S. & B.J. Moulds (WAME 113462-113465) (WAM). **SOUTH AUSTRALIA:** 1 female, 27.34S 134.07E, Wintinna H.S. (Wintinna Ck), 16.i.1982, Rentz, D.C.F. & B.G.F. & Honeycutt, R., stop 4 (ANIC). 1 female, Stuart Hwy, 56 km S of N.T. border, 4.ii.1984, M.S. & B.J. Moulds (MSM).

**Distribution and habitat** (Fig. 42). Arid inland regions of Western Australia, Northern Territory and South Australia. Records from Western Australia fall between the Newman district to the west and Warburton and Kiwirrkurra to the east. It is widespread across the southern half of the Northern Territory with records from along the

Barkly Highway in the north to Uluru (Ayers Rock) in the south. There are just two records from South Australia, one 56 km south of the Northern Territory border on the Stuart Highway, the other a little further south at Wintinna Homestead. Adults are found from late December to early February but probably occur at other times after heavy rains during warmer months of the year. They inhabit shrubland/grassland often with spinifex present, though males were only observed singing from herbaceous plants.




**FIGURES 42–43.** *Calipsalta fumosa* **sp. n.** (42) distribution; (43a) male genitalia in lateral view; (43b) same in ventral view; (43c) dissected aedeagus in lateral view; (43d) basal plate in dorsal view.

**Adult description**. *Male* (Figs 9, 43). Light green, but often tending partly or entirely yellow or light brownish on discoloured dried specimens. *Head,* including postclypeus and anteclypeus, light green; antennae brown except for partly green scape; rostrum brown, reaching to about mid length of mid coxae. *Thorax* light green, the mesonotum with submedian and lateral sigilla, pale brown to varying extent. *Forewing* venation green becoming black distally, with infuscations overlaying crossveins r to r-m and apical cell 1; basal membrane orange. *Hindwing* venation green becoming black on distal half, without infuscations; plaga white. *Legs* light green with tarsi tending pale greenish brown; meracanthus short, broad, similar in colour to opercula. *Opercula* pale yellowish, almost colourless. *Abdomen* green except for pale yellowish brown sternite VIII. *Timbals* with cavity broadly rounded along posterior margin; with three long ribs spanning the the timbal membrane and joined at their dorsal ends, and usually one or two short ribs in anterior membrane.

*Male genitalia* (Figs 43a–d). Pygofer green; basal lobes well developed but in lateral view mostly hidden; upper lobes broad, near an equilateral triangle, directed slightly upwards, apex bluntly pointed; dorsal beak very wide and confluent with pygofer margin. Claspers in lateral view broad, gently curved along upper margin, less so along ventral margin, bluntly pointed, with a wide overhanging rim along upper margin; in ventral view broad, tapering to a bluntly pointed apex, barely diverging along their inner margins near apex. Aedeagus trifid, the pseudoparameres long (much longer than length of thecal shaft), pointed, diverging distally in dorsal view; ventral support moderately developed (shorter than half length of pseudoparameres). Basal plate in dorsal view gently incurved across distal margin with rounded 'ears' slightly back-turned.

*Female*. Similar to male. Green becoming pale orange ventrally. Ovipositor sheath distally pale green, terminating about level with anal styles and dorsal beak.

**Measurements**. Range and mean (in mm) for 10 males, 10 females (includes smallest and largest of available specimens). *Length of body* (including head): male 16.8–19.7 (18.1); female (including ovipositor) 16.3–21.5 (19.2). *Length of forewing*: male 18.5–21.4 (20.0); female 18.0–22.9 (21.1). *Width of head* (including eyes): male 5.1–5.5 (5.4); female 4.9–5.9 (5.5). *Width of pronotum* (across lateral angles): male 6.1–7.0 (6.4); female 5.8–7.2 (6.6).

**Distinguishing features**. Light green cicadas in life. The forewing is lightly infuscated subapically, the venation is green becoming black distally, and the rostrum reaches about mid length of *mid* coxae. The male genitalia have pseudoparameres that are much longer than the length of the thecal shaft and a ventral support that is shorter than half the length of the pseudoparameres. The female ovipositor sheath is green in life and terminates about level with the anal styles and caudal beak.

*Calipsalta fumosa* **sp. n.** can be distinguished from the closely similar *C. viridans* **sp. n.** by its infuscated forewings

(lacking in *C. viridans*). Discoloured individuals of *C. fumosa* that have turned brown after death might be confused with *C. brunnea* **sp. n.** but can be distinguished by their pale forewing costa that is dark brown to black in *C. brunnea*.

This species is morphologically very similar to Cicadetta sp. F of Ewart & Popple (2001) and Ewart (2009), but distinguishable by its song (see below).

**Song** (Figs 44a–d). Recordings were examined from the type locality and the following paratype localities: NT.BHW, NT.ELB, NT.ESJ, NT.KIV, NT.ULG, and WA.KRR.

The calling song consists of a train of sharp clicks or doublets that oscillates between slower and faster click rates at about 4.4–7.2 cycles/s and ends, after a brief silent gap of 0.03–0.04 s, with an isolated syllable lasting about 0.03 s. Click rates vary from 100–30/s. Phrases may last longer than a minute. Most sound energy is found within the range 9–16 kHz, with a peak around 12 kHz. There is no frequency modulation.

This song of *Calipsalta fumosa* is remarkably similar to that of *Pedana hesperia* **sp. n.**, which it substantially overlaps in all song parameters that we have measured. A more detailed study should examine the sharpness of the transition between slow and fast pulse rates, which may be reduced in *Pedana*. *Calipsalta fumosa* can be distinguished from its two congeners by the rate of oscillation between fast- and slow-pulse sections, which is slower in *C. viridans* **sp. n.** and faster in *C. brunnea* **sp. n.** Males call both during the day and at dusk.

The morphologically similar "Cicadetta sp. F" described by Ewart & Popple (2001) and Ewart (2009) oscillates between fast- and slow-click song sections at about twice the rate of *C. fumosa*, approximately 12.5 cycles/s.

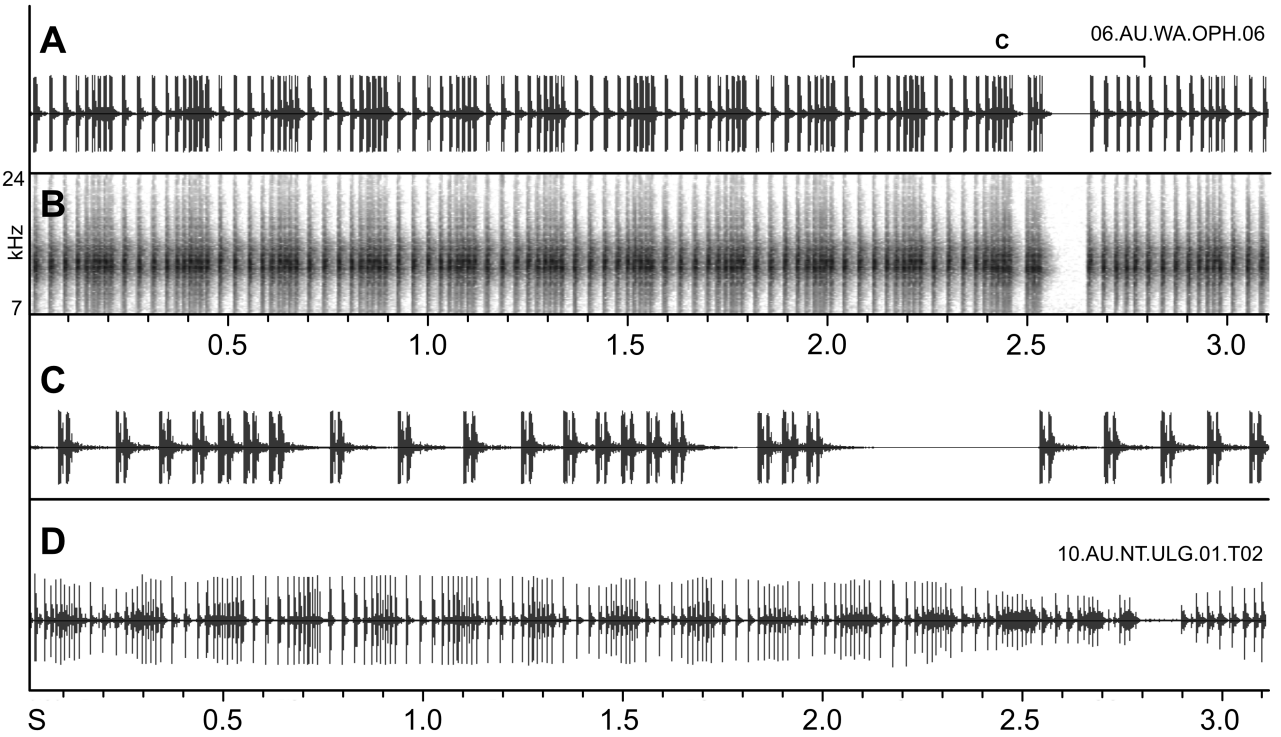



**FIGURE 44.** *Calipsalta fumosa* **sp. n.**, male calling song. (44a, b) oscillogram and spectrogram of ending portion of song phrase and the beginning of the next, from the holotype male, recorded in a cage in a vehicle (temperature not recorded); (44c) further detail of syllables at end of phrase; (44d) song from the NT.ULG paratype locality showing more fast-rate pulses per oscillation (temperature not recorded).

### *Calipsalta viridans* sp. n.

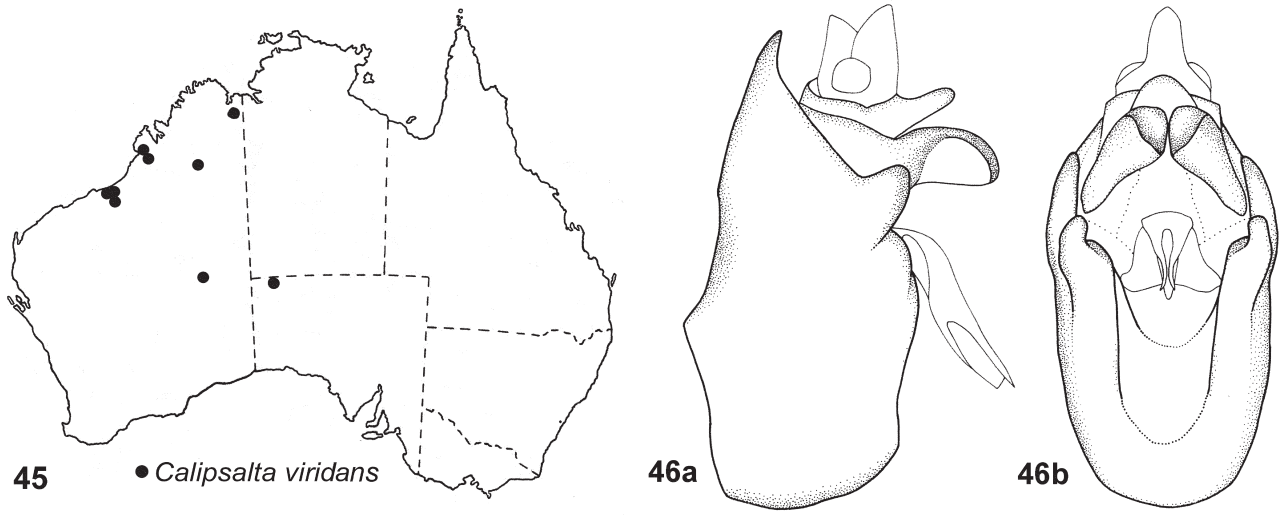
urn:lsid:zoobank.org:act:E54D5F06-432A-4728-A3C7-3AD9F4DA8553
(Figs 10, 45–47)

**Synonymy**. "false hermannsburgensis" Marshall *et al.* 2016: fig. 2.

**Etymology.** From the Latin verb *virido* meaning to make or become green, and pertaining to the colour of this species.

**Types**. *Holotype* male (Simon Lab. voucher 06.AU.WA.BMS.01), Great Northern Hwy, ~88 km SE of Broome, Western Australia, 18°14.326'S 122°25.764'E, 9.ii.2006, Hill, Marshall, Moulds (WAME 113466) (WAM). *Paratypes* as follows: **WESTERN AUSTRALIA:** 2 females, AU.WA.SFC, 74 km W of Sandfire Rdhouse, 30 m, 19°55.828'S 120°25.082'E, 9.ii.2006, Hill, Marshall, Moulds; 1 female, Hidden Valley, Kununurra, 15.736°S 128.743°E, 23.iii.2021, S. Ong (DE). 2 males, AU.WA.SHN, 27 km N of Shay Gap, NNE of Marble Bar, 20°13.861'S 120°12.523'E, 18.i.2010, Hill, Marshall, Moulds; 7 males (1 Simon Lab. voucher 10.AU.WA.GNE.01), 3 females, 100 km SE [of] Fitzroy Crossing, Great Northern Hwy, 18°44.829'S 126°08.442'E, 309 m, 21.i.2010, Hill, Marshall, Moulds; 1 female (Simon Lab. voucher 06.AU.WA.ROE.01), roadhouse ~34 km E of Broome, 53 m, 17°51.030'S 122°30.059'E, 8.ii.2006, Hill, Marshall, Moulds; 1 female (Simon Lab voucher 06.AU.WA.ROE.01), roadhouse, ~35 km E of Broome, 53 m, 17°51.030'E, 122°30.059'E, 8 Feb. 2006, Hill, Marshall, Moulds; 1 male (Simon Lab. voucher 10.AU.WA.DEH.03), De Grey R. xing, Shay Gap Rd, ~85 km NNE of Marble Bar, 20°37.279'S 120°04.226'E, 18.i.2010, Hill, Marshall, Moulds; 2 males, 6 females, AU.WA.SFC, 74 km W of Sandfire Rdhouse, 30 m, 19°55.828'S 120°25.082'E, 9.ii.2006, Hill, Marshall, Moulds; 8 females, 50 km SW of Sandfire Flat, between Broome and Port Headland, 15.ii.1977, M.S. & B.J. Moulds; 2 males (1 genitalia prep. CI 140), 3 females, 40 km W of Warburton, 26°13'S 126°19'E, 29.xii.1995, M.S. & B.J. Moulds & K.A. Kopestonsky (MSM). 2 females, AU.WA.SFC, 74 km W of Sandfire Rdhouse, 30 m, 19°55.828'S 120°25.082'E, 9 .ii.2006, Hill, Marshall, Moulds; 1 male, Wuggubun Indig. Community, 15°57'40"S 128°22'28"E, 7.ii.2020, S. Ong; 1 male, Durack, 16°01'41"S 128°25'09"E, 8.ii. 2020, S. Ong; 1 male, 1 female, Great Northern Highway, 16.064°S 128.410°E, 23.i.2020, S. Ong; 1 male, Valentine Springs Road, 15.673°S 128.666°E, 17.xii.2020, S. Ong (LP). 2 females, AU.WA.SFC, 74 km W of Sandfire Rdhouse, 30 m, 19°55.828'S 120°25.082'E, 9.ii.2006, Hill, Marshall, Moulds (PH). 1 male, 3 females, AU.WA.SFC, 74 km W of Sandfire Rdhouse, 30 m, 19°55.828'S 120°25.082'E, 9.ii.2006, Hill, Marshall, Moulds (WAME 113467-113470); 3 females, 50 km SW of Sandfire Flat, between Broome and Port Headland, 15.ii.1977, M.S. & B.J. Moulds (WAME 113471-113473) (WAM). **NORTHERN TERRITORY:** 1 male, 1 female, 26°09'S 130°35'E, 56 km W. of Amata, Musgrave Ranges, S.A., 20–21.i.1982, D.C.F. & B.G. F. Rentz & R. Honeycutt, Stop 14 (ANIC).

**Distribution and habitat** (Fig. 45). Arid and semi-arid regions of Western Australia and north-eastern South Australia. Records from Western Australia fall within the north-eastern quarter of the State south to 74 km west of Sandfire Roadhouse at the western edge of the Great Sandy Desert and to Warburton near the northern edge of the Great Victoria Desert. From South Australia the only record is from near the western end of the Musgrave Ranges. From Western Australia most records are from between Broome and Sandfire Flat. Elsewhere in Western Australia there are several records from around Kununurra (S. Ong) and from 100 km south-east of Fitzroy Crossing. No doubt the species occurs in many other localities including in the Northern Territory but by inhabiting these remote regions and possibly with a sporadic appearance, the species is not often encountered. There are records from mid December to mid February. Associated with herbaceous plants, not spinifex.




**FIGURES 45–46.** *Calipsalta viridans* **sp. n.** (45) distribution; (46a) male genitalia in lateral view; (46b) same in ventral view.

**Adult description**. *Male* (Fig. 46). Green, but often tending partly or entirely yellow or light brownish on discoloured dried specimens. *Head,* including postclypeus and anteclypeus, green; antennae brown except for partly

green scape; rostrum brown, reaching to about mid length of mid coxae. *Thorax* green, the mesonotum with submedian and lateral sigilla pale brown to varying extent. *Forewing* venation green, without infuscations; basal membrane pale brown. *Hindwing* venation green; without infuscations; plaga white. *Legs* green with tarsi tending pale greenish brown; meracanthus short, broad, similar in colour to opercula. *Opercula* pale yellowish, almost colourless. *Abdomen* green except for pale yellowish brown sternite VIII. *Timbals* with cavity broadly rounded along posterior margin (also partly weakly ridged in some specimens); with three long ribs spanning the the timbal membrane and joined at their dorsal ends, and usually two short ribs in anterior membrane.

*Male genitalia* (Figs 46a–b). Pygofer green; basal lobes well developed but in lateral view mostly hidden; upper lobes broad, in lateral slightly upturned, apex broadly rounded; dorsal beak very wide and confluent with pygofer margin. Claspers in lateral view gently curved along upper margin, straight along lower margin, bluntly pointed, with a wide overhanging rim along upper margin, in ventral view broad, tapering to a bluntly pointed apex, not diverging along their inner margins, their apices abutted. Aedeagus trifid, the pseudoparameres about the length of thecal shaft, pointed, barely diverging in dorsal view; ventral support well developed (about half the length of pseudoparameres). Basal plate in dorsal view gently incurved across distal margin with rounded 'ears' slightly backturned.

*Female* (Fig. 10). Similar to male. Green becoming a little pale orange ventrally. Ovipositor sheath distally pale green, terminating about level with anal styles and dorsal beak.

**Measurements**. Range and mean (in mm) for 10 males, 10 females (includes smallest and largest of available specimens). *Length of body* (including head): male 17.8–20.6 (19.3); female (including ovipositor) 18.9–21.9 (20.3). *Length of forewing*: male 20.0–22.7 (21.6); female 20.6–23.4 (22.1). *Width of head* (including eyes): male 5.3–6.1 (5.7); female 5.5–6.5 (5.9). *Width of pronotum* (across lateral angles): male 6.2–7.2 (6.8); female 6.6–7.8 (7.2).

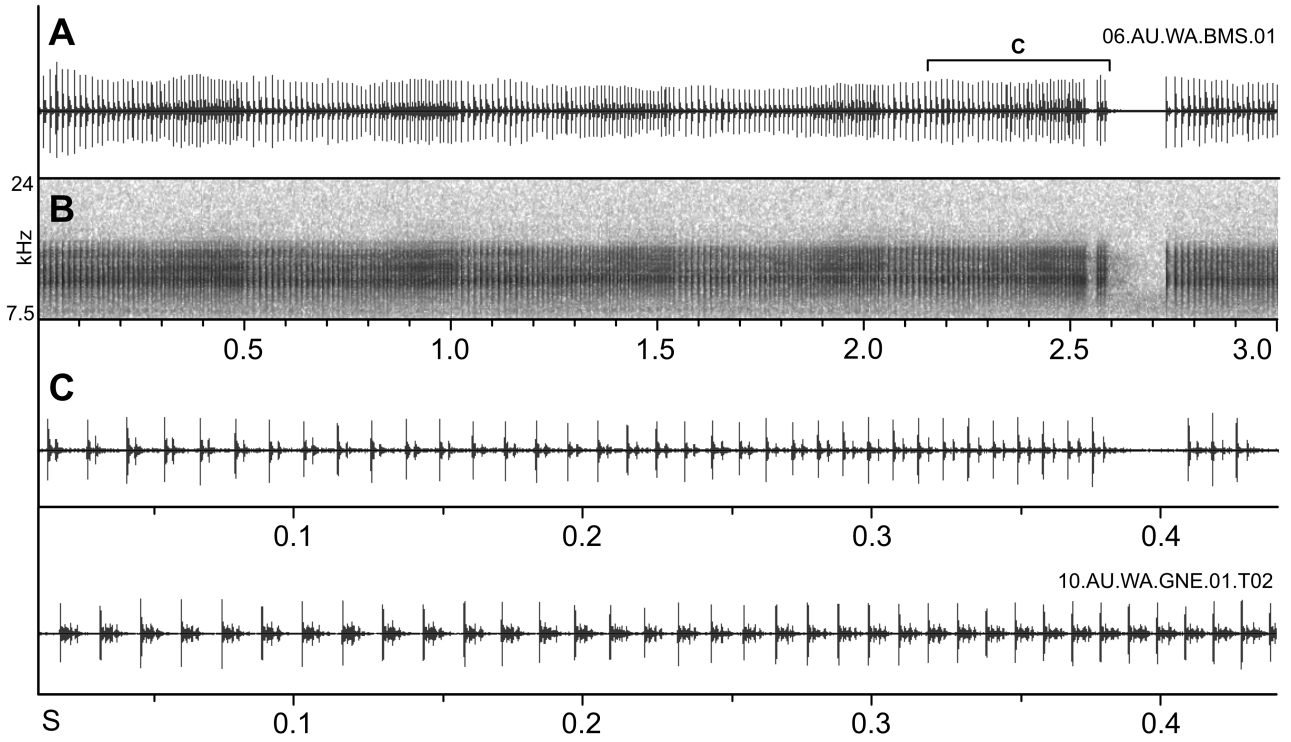



**FIGURE 47.** *Calipsalta viridans* **sp. n.**, male calling song. (47a, b) oscillogram and spectrogram of ending portion of song phrase and beginning of the next, from the holotype male (30°C); (47c) further detail of pulses at end of phrase; (47d) example of pulses within a phrase from the WA.GNE paratype locality (temperature not recorded, warm conditions).

**Distinguishing features**. Light green cicadas in life. The forewings are not infuscated, the venation is green, and the rostrum reaches about mid length of the *mid* coxae. Forewing veins M and CuA are either fused at the basal

cell for a short distance or unfused but abutted together. The male genitalia have pseudoparameres that are about half the length of the thecal shaft and a ventral support that is about half the length of the pseudoparameres. The female ovipositor sheath is light brown in life and terminates about level with the anal styles and caudal beak.

*Calipsalta viridans* **sp. n.** differs from *C. fumosa* **sp. n.** in lacking forewing subapical infuscations. It might also be confused with *Erempsalta hermannsburgensis* that is also green, without wing infuscations, and inhabits an arid environment. *Calipsalta viridans* **sp. n.** differs from *Erempsalta hermannsburgensis* in having a rostrum that only reaches to mid length of the mid coxae whereas in *E. hermannsburgensis* it reaches the bases of the hind coxae.

**Song** (Figs 47a–d). Recordings were examined from the type locality and the WA.GNE and WA.SHN paratype localities.

The male calling song consists of a train of sharp clicks or doublets that oscillates between slower and faster click rates at about 1.8–1.9 cycles/s and ends, after a brief silent gap of 0.02–0.036 s, with an isolated syllable lasting about 0.025 s. The entire phrase may last less than one second or up to nearly a minute. Click rates vary from 110–65/s. Most sound energy is found within the range 9–16 kHz, with a peak around 12 kHz. There is no frequency modulation.

The song of *Calipsalta viridans* **sp. n.** can be distinguished from those of its congeners and that of *Pedana hesperia* **sp. n.** by its much slower rate of oscillation between fast- and slow-pulse sections, which is 2/s or less in *C. viridans* and > 4/s in the other species.

### ***Calipsalta brunnea*** **sp. n.**

urn:lsid:zoobank.org:act:4E756A06-EFF0-4F79-8279-3615E7558CFD
(Figs 11, 20, 48–50)

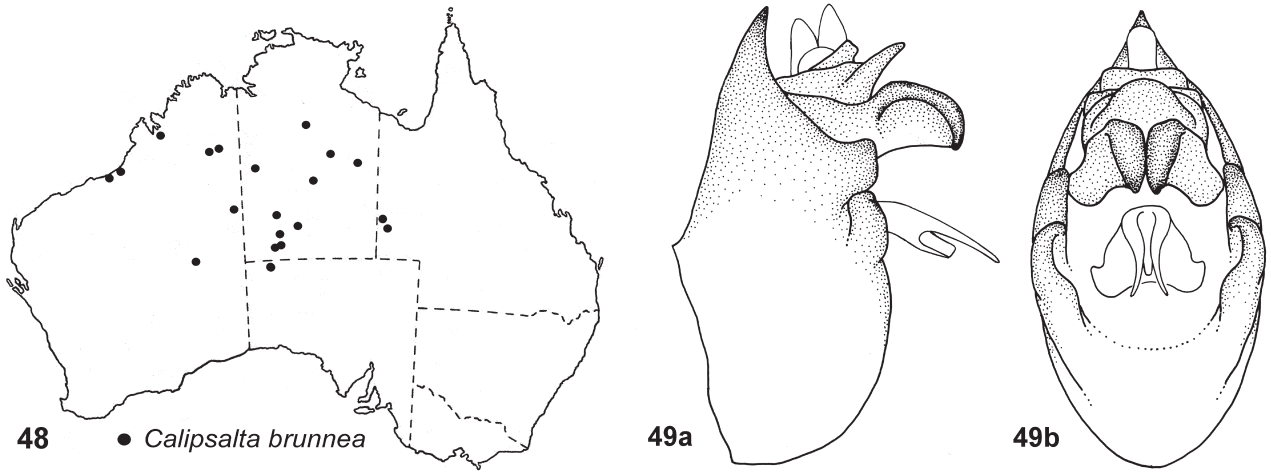
**Synonymy**. *Cicadetta* sp. A brown sandplain cicada Ewart 2009: 123–124; Pl. 1, fig. C.
"spinifex rattler" Marshall *et al.* 2016: fig. 2.

**Etymology.** From the Latin *brunneus* meaning dusky, tawny, and referring to the tawny brown colour of this species.

**Types**. *Holotype* male (Simon Lab. voucher 10.AU.WA.WOL.03), near Wolfe Creek Meteorite Crater, Western Australia, 19°10.908'S 127°46.636'E, 25.i.2010, Hill, Marshall, Moulds (WAME 113474) (WAM). *Paratypes* as follows: **WESTERN AUSTRALIA**: 2 males, 3 females, AU.WA.WOL, near Wolfe Creek Meteorite Crater, Western Australia, 19°10.908'S 127°46.636'E, 25.i,2010, Hill, Marshall, Moulds; 1 male, AU.WA.NSR, 23 km NE of Sandfire Rd house, 19°40.741'S 121°16.042'E, 16 m, 9.ii.2006, Hill, Marshall, Moulds; 1 male, 50 km SW of Sandfire Flat, between Broome and Port Hedland, 15.ii.1977, M.S. & B.J. Moulds; 6 males (2 Simon Lab. vouchers 11.AU.WA.DEE.01, 11.AU.WA.DEE.02), 60 km ESE of Derby on Gibb River Rd, 46 m, 17°26.224'S 124°10.046'E, 22.xi.2011, K. Hill, D. Marshall; 1 female, 40 km W of Warburton, 26°13'S 126°19'E, 29.xii.1995, M.S. & B.J. Moulds, K.A. Kopestonsky; 2 females, Mary R. x-ing, 100 km SW of Halls Creek township, 1.i.1986, M.S. & B.J. Moulds; 1 male, 6 females, Lake Mackay, ca 100 km ENE Kiwirrkurra Agrimin Camp, 22°42'06.9"S 128°38'49.8"E (GDA 49), 14.xi.2017, T.A. Moulds (MSM). 1 male, 1 female, same data as holotype (WAME 113475-113476) (WAM). **NORTHERN TERRITORY:** 2 females, nr Caseys Bore NT, ESE Ringwood Stn, xii.1968, U.N.E. Explor. Soc. (ANIC). 1 female, Taylors Creek, 47 km N of Barrow Creek township, 22.i.1984, M.S. & B.J. Moulds (DE). 1 male (Simon Lab. voucher 10.AU.NT.HME.01), edge of Hermannsburg, 591 m, 23°56.382'S 132°47.413'E, 29.i.2010, Hill, Marshall, Moulds; 5 males, 1 female (2 Simon Lab. vouchers 04.NTR.PCK.11, 04.NTR.PCK.11), 32 km S of Elliot, 240 m, 17°49.3'S 133°40.5'E, 26.i.2004, Cooley, Hill, Marshall, Moulds; 1 female, AU.NT.LJA, Luritja Road, 99 km N of Lasseter Hwy, 24°29.898'S 132°03.944'E 31.i.2010, Hill, Marshall, Moulds [at light]; 3 males (genitalia prep. ERE 7), 11 females, 70 km E of The Three Ways, nr Tennant Creek township, 21.i,1984, M.S. & B.J. Moulds; 3 males (2 genitalia prep. CI 112, ERE 2, ERE 8), 14 females, Taylors Creek, 47 km N of Barrow Creek township, 22.i,1984, M.S. & B.J. Moulds; 3 females, Barkly Hwy, 75 km ESE of junction with Tablelands Hwy, 4.i.1987, M.S. & B.J. Moulds; 3 males, 1 female, 27 km S of Rabbit Flat, 12.i.2002, 20°22'52"S 130°08'54"E, M.S. & B.J. Moulds; 1 male, 1 female, Newhaven Stn, Tanami Desert, ii.2010, J. & D. Schofield; 1 male, 3 females, 29 km ENE of Ayers Rock, 2.ii.1984, M.S. & B.J. Moulds; 1 female, Yulara Resort, Ayers Rock, 2.ii.1984, M.S. & B.J. Moulds (MSM). 1 female, Taylors Creek, 47 km N of Barrow Creek township, 22.i,1984, M.S. & B.J. Moulds (LP). 1 female, Taylors Creek, 47 km N of Barrow Creek town-

ship, 22.i,1984, M.S. & B.J. Moulds (PH). 1 female, Taylors Creek, 47 km N of Barrow Creek township, 22.i.1984, M.S. & B.J. Moulds (WAME 113477) (WAM). **SOUTH AUSTRALIA**: 1 female, 26°09'S 130°35'E, 56 km W of Amata, Musgrave Ranges, 19.i.1982, D.C.F. & B.G.F. Rentz & R. Honeycutt, stop 14 (ANIC). **QUEENSLAND:** 4 females, Ethabuka Res., 23°51.565'S 138°28.855'E, 12.ii.2007, S. Morrison (MSM).

**Distribution and habitat** (Figs 20b, 48). Widely distributed through arid and semi-arid regions of Western Australia and Northern Territory, and from near Amata at the western end of the Musgrave Ranges in the far north-west of South Australia and from Cravens Peak Reserve (Ewart 2009) and Ethabuka Reserve (S. Morrison) in far south-western Queensland. Records from Western Australia include near Derby and Wolfe Creek Meteorite Crater in the north, Sandfire Flat at the western extremity of the Great Sandy Desert, Lake Mackay at the eastern extremity of the Gibson Desert, and near Warburton near the northern edge of the Great Victoria Desert. In the Northern Territory it is widely distributed south from Elliot to Uluru (Ayers Rock) but records are lacking from the south-eastern quarter. There are records from mid November to mid February. Adults are often associated with herbaceous plants in open shrubland with spinifex and other grasses.




**FIGURES 48–49.** *Calipsalta brunnea* **sp. n.** (48) distribution; (49a) male genitalia in lateral view; (49b) same in ventral view.

**Adult description**. *Male* (Figs 11, 20a, 49). Light brown. *Head* light brown; postclypeus light brown with lateral grooves a little darker; anteclypeus light brown but darker laterally; antennae dark brown; rostrum dark brown tending black distally, reaching to about mid length of mid coxae. *Thorax* light brown; pronotal collar and submedian and lateral sigilla dark brown to varying extents. *Forewing* venation brown becoming black distally, with infuscations overlaying crossveins r to r-m; basal membrane orange. *Hindwing* venation brown becoming black on distal half, without infuscations; plaga white to pale brown. *Legs* brown; meracanthus short, broad, pointed, similar in colour to opercula. *Opercula* pale yellowish brown. *Abdomen* light brown. *Timbals* with cavity broadly rounded along posterior margin, on some specimens tending partly weakly ridged; with three long ribs spanning the the timbal membrane and joined at their dorsal ends, and usually one or two short ribs in anterior membrane.

*Male genitalia* (Figs 49a–b). Pygofer brown; basal lobes well developed but in lateral view mostly hidden with slight out-curve apically; upper lobes broad, directed slightly upwards, apex broadly rounded; dorsal beak very wide and mostly confluent with pygofer margin. Claspers in lateral view broad, gently curved along upper margin, less so along ventral margin, bluntly pointed, with a wide overhanging rim along upper margin; in ventral view broad, tapering to a bluntly pointed apex, not diverging along their inner margins, their apices abutted. Aedeagus trifid, the pseudoparameres long (much longer than length of thecal shaft), pointed, diverging distally in dorsal view; ventral support about half the length of pseudoparameres; basal plate in dorsal view gently incurved across distal margin with rounded 'ears' slightly back-turned.

*Female*. Similar to male. Light brown. Ovipositor sheath dark brown, projecting a little beyond dorsal beak no more than 0.3 mm.

**Measurements**. Range and mean (in mm) for 10 males, 10 females (includes smallest and largest of available specimens). *Length of body* (including head):-male 18.9–24.6 (21.4); female (including ovipositor) 19.6–25.6 (22.8). *Length of forewing*: male 20.9–27.6 (23.9); female 21.9–27.4 (24.7). *Width of head* (including eyes): male 5.8–7.6 (6.6); female 6.1–7.6 (6.7). *Width of pronotum* (across lateral angles):-male 7.1–9.0 (7.8); female 7.1–9.4 (7.9).

**Distinguishing features**. Light brown cicadas in life. The forewing is lightly infuscated subapically, the venation is brown, and the rostrum reaches about mid length of *mid* coxae. Forewing veins M and CuA are either fused at the basal cell for a short distance or unfused but abutted together. The male genitalia have pseudoparameres that are longer than the length of the thecal shaft and a ventral support that is about half the length of the pseudoparameres. The female ovipositor sheath barely protrudes beyond the anal styles and caudal beak.

*Calipsalta brunnea* **sp. n.** is most likely to be confused with discoloured individuals of *C. fumosa* **sp. n.** that have turned brown after death; the mid brown to black forewing costa of *C. brunnea* distinguishes it from the pale brown or pale greenish costa of *C. fumosa*.

**Song** (Figs 50a–d). Recordings were examined from the type locality and the following paratype localities: NT.HME, NT.PCK, WA.DEE, WA.NSR.

The calling song consists of a train of sharp clicks or doublets that oscillates between slower and faster click rates at about 14–23 cycles/s and ends, after a brief silent gap of 0.045–0.065 s, with an isolated syllable lasting about 0.02 s (sometimes containing only a single click). Click rates vary from 140–31/s. This oscillation is so rapid that normally only one slow-rate click is produced per cycle, and only two or three fast-rate clicks. Phrases may last longer than a minute. Most sound energy is found within the range 8–14 kHz, with a peak around 10 kHz. There is no frequency modulation. The song has been previously recorded from Cravens Peak Reserve in Queensland by Ewart (2009, p. 143–144, "Cicadetta sp. A"), who described the song structure as repeated 4-syllable macrosyllables.

The song of *Calipsalta brunnea* is similar to those of *C. viridans* **sp. n.**, *C. fumosa* **sp. n.,** and *Pedana hesperia* **sp. n.,** but is clearly distinguishable by its more rapid rate of oscillation between fast- and slow-rate sections, over 14 cycles/s compared to less than 7 cycles/s for the other species. Males call both during the day and at dusk. but tend to restrict calling to dusk when day temperatures are exceedingly high.

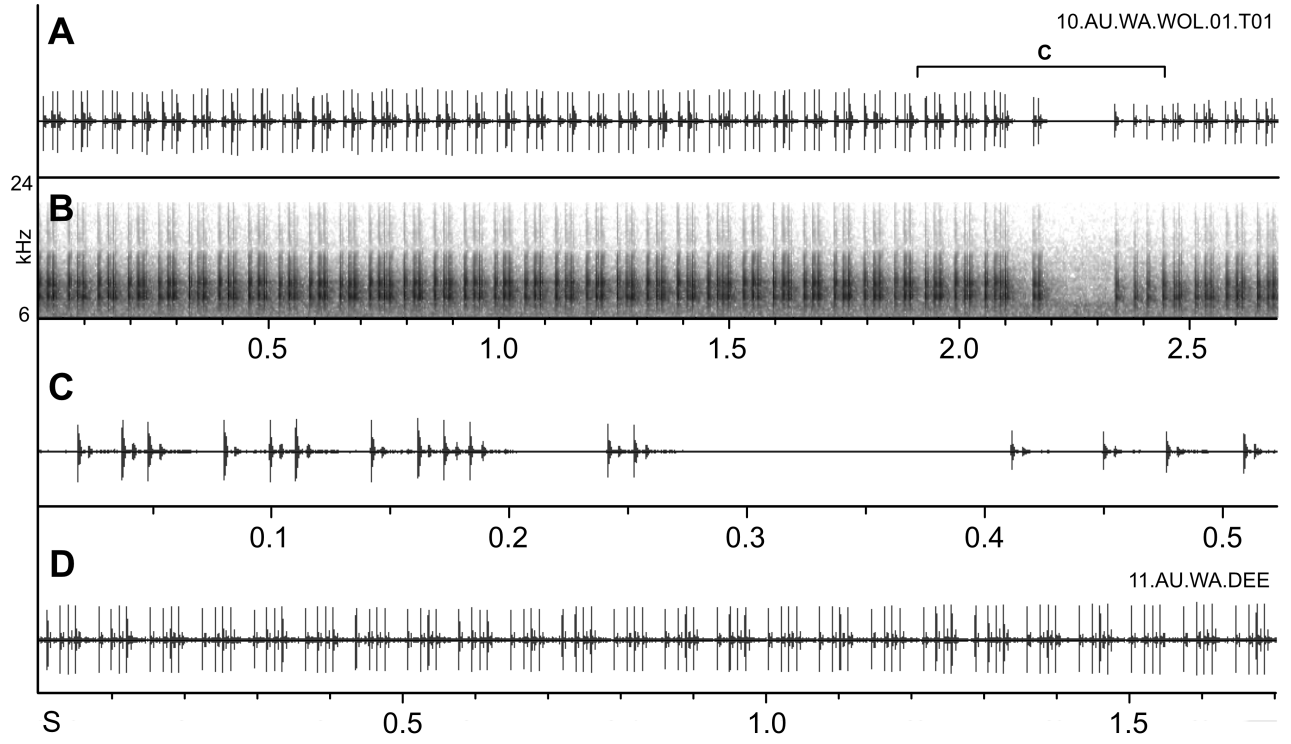



**FIGURE 50.** *Calipsalta brunnea* **sp. n.**, male calling song. (50a, b) oscillogram and spectrogram of ending portion of song phrase and beginning of the next, from the holotype male (30.4°C); (50c) further detail of syllables at end of phrase; (50d) song variant from the WA.DEE paratype location with more fast-rate pulses per oscillation (31.4°C).

## *Erempsalta* Moulds, 2012

The genus *Erempsalta* was established by Moulds (2012) to accommodate a single species *Erempsalta hermannsburgensis* (Distant, 1907). The species has remained unknown beyond its brief original description and the male genitalia figured by Moulds (2012). Its only known locality was the remote Central Australian community of Hermannsburg, from which the species takes its name. We now redescribe the species, analyse its song and confirm its distribution across arid regions of five States.

*Erempsalta hermannsburgensis* remains the only known species in the genus but green species of *Calipsalta* **gen. n.** could possibly be confused. While superficially similar in appearance, the two genera are in fact quite different, both in their molecular makeup (Marshall *et al.* 2016, fig 2) and in morphology as discussed above under *Calipsalta* **gen. n.**

*Erempsalta hermannsburgensis* was included in the molecular study of Cicadettini genera by Marshall *et al.* (2016) where it was found to be part of an unresolved clade at the very top of their molecular tree along with genera such as *Heliopsalta* Moulds, 2012, *Chelapsalta* Moulds, 2012, *Pipilopsalta* Ewart, 2005 and *Simona* Moulds, 2012, conclusions largely similar to the results of the morphological study of Moulds (2012). All these genera have claspers that in ventral view are diverging and sharply pointed. *Erempsalta* differs from all those genera in having, in combination, a head clearly narrower than the width of the mesonotum between the wings and a basal pygofer lobe that is not tucked behind the base of the upper lobe.

### *Erempsalta hermannsburgensis* (Distant, 1907)

(Figs 8, 19, 51–53)

**Synonymy**. Species D (near *Cicadetta hermannsburgensis*) Ewart & Popple (2001): 63; Figs 6D [not C, error, L. Popple pers comm.], 9B.

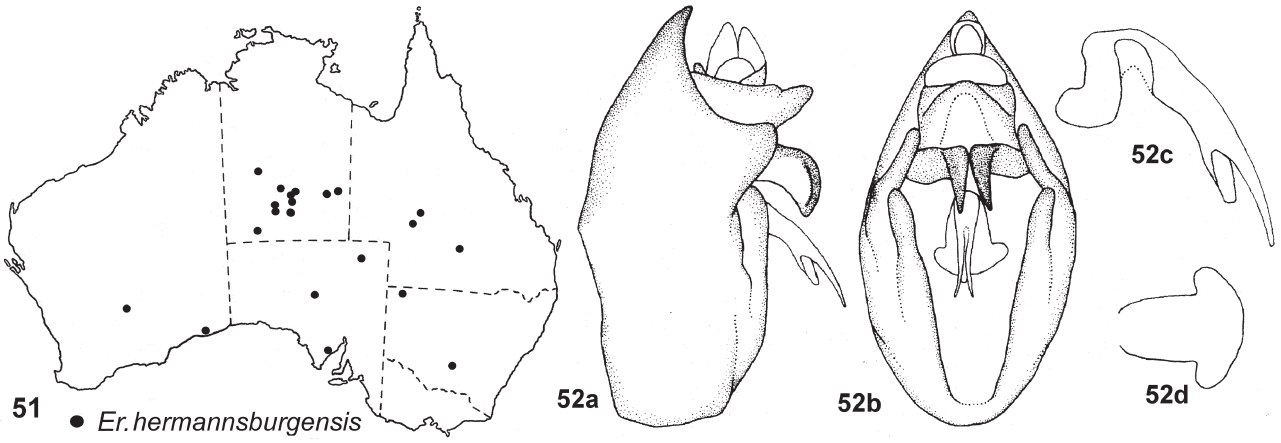
**Types**. One *syntype* female, labelled as follows: (1) handwritten ‘Melampsalta / hermansburgensis / type Dist.’; (2) printed ‘Hermansburg. / N.T., S.Australia. / H.J.Hillier. / 1907—233.’; (3) handwritten ‘15’; (4) printed, circular with a red border ‘Type’; (5) printed with a QR image and ‘NHMUK010392425’. Six male syntypes and another female syntype, conspecific with the syntype female labelled type, each with a single printed label different in format from the above mentioned female ‘type’, that reads ‘Hermansburg / Central Australia / H.J.Hillier / 1907-233’ All in NHMUK, examined from photographs. Note that when Distant (1907) described the species he spelt *hermannsburgensis* with one ‘n’, and the syntypes are similarly labelled. However, the locality is spelt with a double ‘n’ and following Article 32.5.1 of the *Code* the spelling should be corrected (Moulds 2012: 103).

The original description implies that only the female was described and measurements were given only for the female sex. That Distant had more than one female is suggested in the original description by including a range of 17–18 mm for the female body length. There is only one other female bearing similar locality data, and with an identical registration number 1907-233, in NHMUK, although the format of its printed label is different from that on the female labelled as type, suggesting it was labelled at a different time. In addition to the second female there are six males in NHMUK each with a printed label identical in format and data to that on the second female. If the second female is to be accepted as a syntype then it seems logical to accept these six males also as syntypes. Whether all these specimens are syntypes or not is debatable, but in the absence of evidence to the contrary we accept them as syntypes. Regardless, we base our identification on the species solely on the female labelled as the type.

*Other material examined*: **WESTERN AUSTRALIA:** 1 male, 19 km S of Menzies, 29.i.1992, T.M.S. Hanlon; 1 male, AU.WA.CBE, 58.5 km E of Cocklebiddy, 31°57.283’S 126°41.811’E, 105 m, 6.ii.2009, K. Hill, D. Marshall (MSM). **NORTHERN TERRITORY:** 8 males, 56 km S by E of Alice Springs, 24°11’S 134°01’E, 3.x.1978, Upton & Barrett; 3 males, 23°32’S 133°38’E, 30 km NW by W of Alice Springs, 7.x.1978, Upton & Barrett; 2 males, 62 mi NNW of Alice Springs, 12.ii.1966, Britton, Upton & McInnes; 6 males, 30 mi N of Alice Springs, 13.i.1958, N. Forde (ANIC). 2 males, AU.NT.PLD, 59 km E of Stuart Hwy on Plenty Hwy, NE of Alice Springs, 22°57.723’S 134°07.683’E, 31.i.2007, K. Hill, D. Marshall; 3 males, AU.NT.YNC, 39 km NW of Yuendumu on Tanami Rd, 22°09.805’S 131°28.010’E, 30.i.2007, K. Hill, D. Marshall; 1 male, AU.NT.TWS, 27 km SE of Tilmouth Well on Tanami Rd, 23°01.534’S 132°42.152’E, 30.i.2007, K. Hill, D. Marshall; 4 males (1 genitalia prep. ERE 2; 1 Simon Lab. voucher 10.AU.NT.HMW.01), SW edge of Hermannsburg, 23°56.953’S 132°46.827’E, 569 m, 29.i.2010, Hill, Marshall, Moulds; 1 male, AU.NT.ULF, 3 km S of Ayers Rock, 531 m, 25°22.385’S 131°02.278’E, 1.ii.2010, Hill, Marshall, Moulds; 2 males, AU.NT.TAP, Tanami Road, 3.5 km S of Tilmouth Well, 22°50.412’S 132°36.967’E,

28.i.2010, Hill, Marshall, Moulds; 1 male (DNA voucher 2), Plenty Hwy, ~45km E of Marshall River, 22°43.603'S 136°28.586'E, 6.ii.2010, Hill, Marshall (UCONN). 1 female, AU.NT.NJD, 17 km E of Glen Helen Resort, W of Alice Springs, 23°44.924'S 132°54.157'E, 30.i.2010, Hill, Marshall, Moulds; 2 males, AU.NT.YNF, Tanami Road, 13 km NW of Tilmouth Well, 22°45.275'S 132°29.394'E, 27.i,2010, Hill, Marshall, Moulds; 1 female, AU.NT. NAP, ~126 km N of Alice Springs on Stuart Hwy, 22°42.46'S 133°22.707'E, 4.ii.2010, Hill, Marshall, Moulds; 2 males, AU.NT.PNE, 11 km NE of Stuart Hwy on Plenty Hwy, 23°2.364'S 133°43.702'E, 691 m, 26.i.2015, D. Marshall (MSM). **QUEENSLAND:** 1 male (genitalia prep. ERE 1; Simon Lab. voucher 09.AU.QL.NBE.03), 1.7 km NNE of Noonbah Hsd, 24°5.88'S 143°11.44'E, 180 m, 1.ii.2009, K. Hill & D. Marshall; 10 males, 1 female, Noonbah Stn, 24°07'S 143°11'E, 13.i.1999, M.S. & B.J. Moulds; 8 males, 4 females, "Hickleton" Stn, SW of Longreach, 23°59'19"S 143°03'17"E 15.iii.2003, A.J. Emmott, R.&V. Ballard; 1 male, Lochern N.P., nr Noonbar Stn, ix.2005, H. Ctoss & A.J. Emmott; 1 male, AU.QL.SSD, 68 km N of Windorah, 24°56.688'S 142°51.096'E, 147 m, 1.ii.2009, K. Hill & D. Marshall; 6 males, Charleville, 1.xi.1996, 20.ii.1996, Colin Dollery; 1 male, Currawynia, N.P., 29.x.1998, C. Dollery (MSM). **NEW SOUTH WALES:** 2 males, 11 km S of Mount Hope, 33°56'34"S 145°52'49"E, 20.xi.2010, L.W. Popple, D. Emery (DE). 1 male, 11 km S of Mount Hope, 33°56'34"S 145°52'49"E, 20.xi.2010, L.W. Popple, D. Emery (LP). 1 male (DNA voucher 09.AU.NS.TIB.01), Caravan park on S. side of Tibooburra, 29°26.185'S 142°0.501'E, 3.ii.2009, Hill, Marshall (UCONN). **SOUTH AUSTRALIA:** 2 males, 1 female, Birdsville Track, E of Clifton Hills, 27°00'16"S 139°18'08"E, 15.i.2007, L. Popple, J. Hereward (LP). 2 males, AU.SA.WOH, 60 km NW of Glandambo, on Stuart Hwy, 30°33.395'S 135°22.227'E, 2.ii.2007, K. Hill, D. Marshall; 2 males, 20 km SSW of Arno Bay, Eyre Pen. 21.xi.1985, M.S. & B.J. Moulds (MSM).

**Distribution and habitat** (Figs 19b, 51). Widely distributed through arid and semi-arid regions mostly in the central part of the continent. There are only two records from Western Australia, 19 km south of Menzies (T.M.S. Hanlon) and 58.5 km east of Cocklebiddy. It is a far more common species in the Northern Territory where it extends south from 39 km north-west of Yuendumu on the Tanami Road to Uluru (Ayers Rock) and in the east to 45 km east of the Marshall River on the Plenty Highway. The type locality, Hermannsburg, (as inferred by the species' name) is some 120 km WSW of Alice Springs. From South Australia there are records from the Birdsville Track some 130 km south of Birdsville (L. Popple & J. Hereward), 60 km north-west of Glandambo, and near Arno Bay on the Eyre Peninsula. Queensland records are mostly from or near Noonbah Station (some 160 km south-west of Longreach), and from Charleville (C. Dollery) and 68 km north of Windorah. There are just two records from New South Wales, Tibooburra in the far north-west of the State and near Mount Hope (L. Popple & D. Emery). Adults have been recorded from early October to mid March but emergence is closely associated with the occurrence of good rainfall. The species inhabits arid to semi-arid shrubland.




**FIGURES 51–52.** *Erempsalta hermannsburgensis* (51) distribution; (52a) male genitalia in lateral view; (52b) same in ventral view; (52c) dissected aedeagus in lateral view; (52d) basal plate in dorsal view.

**Adult description.** *Male* (Figs 8, 19a, 52). Green, sometimes tending partly yellow or light brownish on discoloured dried specimens. *Head,* including postclypeus and anteclypeus, green; antennae yellowish except for partly green scape; eyes of live adults light pink; rostrum greenish yellow with black stylets, reaching bases of hind coxae. *Thorax* green, the mesonotum with submedian and lateral sigilla with hints of pale orange. *Forewing* venation green, without infuscations; basal sclerites and basal membrane pale orange. *Hindwing* venation green, without infuscations; plaga white. *Legs* green with pale orange knees at the junction of femur and tibia; tarsi light brown.

*Opercula* green. *Abdomen* green with a narrow dull pale orange edge along posterior margin of sternite II. *Timbals* with cavity broadly rounded along posterior margin; with three long ribs spanning the the timbal membrane and joined at their dorsal ends.

*Male genitalia* (Figs 52a–b). Pygofer green; basal lobes well developed but in lateral view mostly hidden; upper lobes broad, in lateral view slightly upturned, apex broadly rounded; dorsal beak very wide and confluent with pygofer margin. Claspers in lateral view gently curved, bluntly pointed, with a narrow overhanging rim along upper margin, in ventral view slender, tapering to a sharply pointed apex, slightly diverging with their apices not widely separated. Aedeagus trifid, the pseudoparameres short (less than length of thecal shaft), pointed, gently diverging in dorsal view; ventral support of medium length (less than half length of pseudoparameres). Basal plate in dorsal view broadly rounded across distal margin with broadly rounded 'ears'.

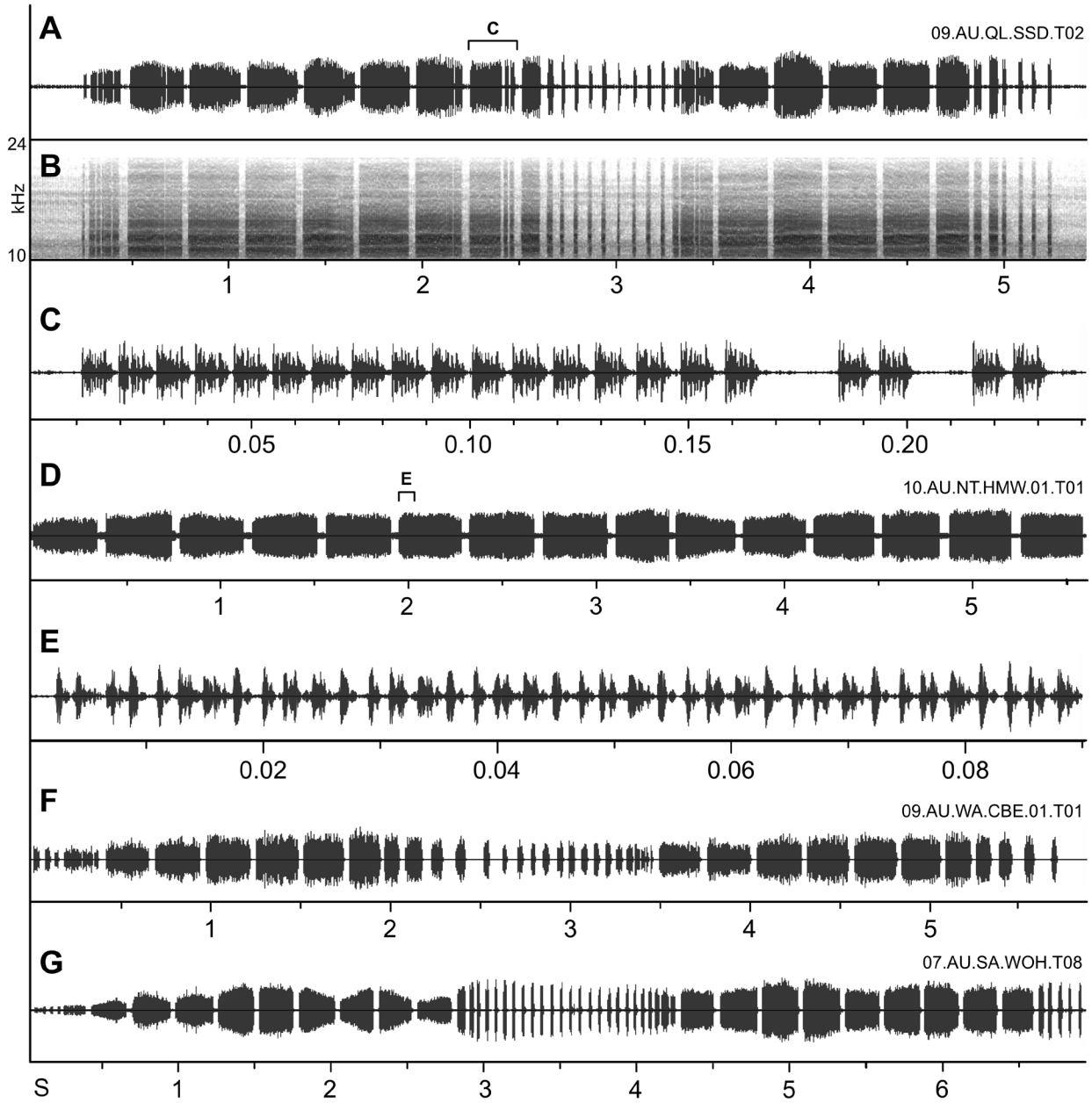



**FIGURE 53.** *Erempsalta hermannsburgensis*, male calling song. (53a, b) oscillogram and spectrogram showing two calling song phrases, temperature not recorded, warm evening conditions; (53c) detail of echeme in transitional section of song phrase; (53d, e) oscillograms showing echemes and detailed structure from the dusk song form, temperature not recorded, cool evening conditions; (53f, g) examples of the calling song from additional locations (WA.CBE, 28.2°C; SA.WOH, ca 40°C).

*Female*. Similar to male. Sternite VIII deeply incised in a V shape. Abdominal segment 9 short, in dorsal view its length shorter than its width; green becoming pale orange ventrally. Ovipositor sheath distally pale orange, projecting a little beyond dorsal beak no more than 0.3 mm.

**Measurements**. Range and mean (in mm) for 10 males, 7 females (includes smallest and largest available specimens). *Length of body* (including head): male 14.0–17.1 (15.3); female (including ovipositor) 14.8–17.2 (16.3). *Length of forewing*: male 17.6–20.2 (18.9); female 17.7–21.1 (20.0). *Width of head* (including eyes): male 4.4–5.2 (4.7); female 4.6–5.2 (4.95). *Width of pronotum* (across lateral angles): male 5.3–6.4 (5.9); female 5.4–6.7 (6.2).

**Distinguishing features**. *Erempsalta hermannsburgensis* could be confused with *Calipsalta viridans* **sp. n.** as both are green, without wing infuscations, and inhabit an arid regions of Australia. *Erempsalta hermannsburgensis* is perhaps best separated by its rostrum that reaches the bases of hind coxae (only to mid length of mid coxae in *C. viridans*). Forewing veins M and CuA are always fused on joining the apex of the basal cell in *E. hermannsburgensis* but often unfused or abutted in *C. viridans*. Males have a shorter abdomen, its length similar to that of the head plus thorax (clearly longer in *C. viridans*). The male genitalia clearly differ from *C. viridans* (and all *Calipsalta* species) in having the inner margins of the claspers diverging, the pseudoparameres unusually short (less than half the length of the thecal shaft), and the ventral support very short.

**Song** (Figs 53a–g). Recordings were examined from a location near the type locality of Hermannsburg (NT. HMW) and the following paratype sites: QL.SSD, NS.TIB, NT.TAP, NT.PLR , NT.ULF, SA.WOH, WA.CBE.

The main calling song consists of phrases lasting approximately 2–5 s. Phrases are often concatenated but can be produced singly. Each phrase contains around 5–10 closely spaced long echemes (0.2–0.5s) that are preceded and followed by sets of much shorter echemes (ca. 0.02 s) that vary in number and duration. The echemes consist of short syllables produced at about 5/s, or the syllables may be coalesced to form a continuous series of pulses. The underlying pulse rate varies from ca. 500–900/s depending on the degree of coalescence. In dusk conditions, males sometimes produce a continuous song containing long series of regularly repeated long echemes. Most song energy is found within the range 10–15 kHz, with a peak intensity at about 11–13 kHz. There is little to no frequency modulation.

Males inhabit leafy shrubs (Fig 19), sometimes perching within a few centimetres of the ground. Males call with head facing downwards (K. Hill, pers. comm.).

### *Pyropsalta* Moulds, 2012

*Pyropsalta* is an endemic genus confined to south-western Western Australia. When first established it included only the type species, *Pyropsalta melete* (Walker, 1850), that has remained the only described species in the genus. We now describe three additional species.

These three additional species largely conform to the generic description of Moulds (2012) although there are differences in male timbal morphology and small differences in the male genitalia, the latter not considered significant. The timbals of all three new species have an unusually large timbal cavity that is most extreme in *P. patula* **sp. n.**, each with three long ribs and an expansive anterior membrane largely devoid of structures apart from a short thin rudimentary rib at its dorsal posterior corner, another similar rib tight against the anterior margin and a securitised basal area. This differs from the type species that has a timbal cavity of usual proportions, four long ribs, and a small anterior membrane area with one rudimentary short rib at its dorsal anterior.

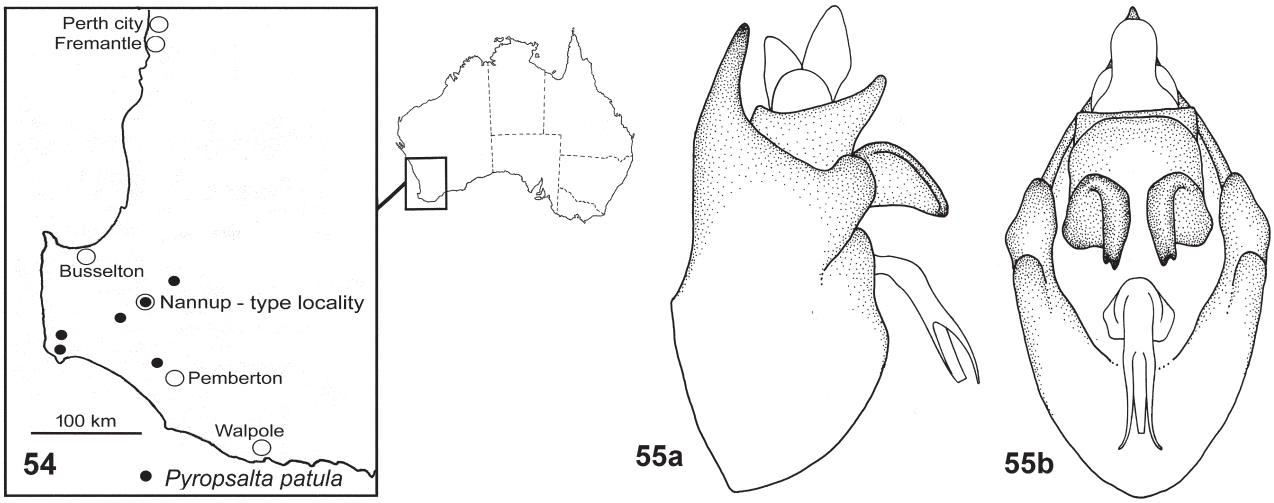
In a molecular study by Marshall *et al.* (2016: fig. 2) species of *Pyropsalta* and *Physeema* Moulds, 2012 were found to form a single clade with strong support. However, one of the new species of *Pyropsalta* described below, *Py. rhythmica* **sp. n.**, was found to be not sister to the type species of *Pyropsalta,* but separated from it in a sister clade together with *Physeema convergens* (Walker, 1850). This suggests that *Py. rhythmica* **sp. n.** (together with the two other species described below) possibly represent a new genus. However, we refrain from taking that action without further evidence, because the support for these relationships in the molecular tree is not entirely conclusive (0.94 Bayesian posterior probabilities, 74 and 69 percent ML bootstrap support). We therefore treat the differences in timbal morphology as indicative of species attributes rather than generic attributes, and because all other attributes are compatible with *Pyropsalta* with include them in that genus.

***Pyropsalta patula* sp. n.**
urn:lsid:zoobank.org:act:F155D7BA-92A8-4FC8-9FC6-13D7F5FFC86D
(Figs 12, 54, 55)

**Etymology.** From the Latin adjective *patulus* meaning broad, wide open, and referring to the greatly enlarged timbal cavity of this species.

**Types**. Holotype male, Nannup, Western Australia, 13.i.1991, M.S. & B.J. Moulds (WAME 113478) (WAM). *Paratypes* as follows: **WESTERN AUSTRALIA:** 2 males, 1 female, same data as holotype (AMS). 3 males, Donnelly R., Vasse Hwy, NNW of Pemberton, 12.xii.1985, M.S. & B.J. Moulds; 2 males, 1 female, same data as holotype (DE). 3 males, Donnelly R., Vasse Hwy, NNW of Pemberton, 12.xii.1985, M.S. & B.J. Moulds; 2 males, 1 female, same data as holotype (LP). 76 males, Donnelly R., Vasse Hwy, NNW of Pemberton, 12.xii.1985, M.S. & B.J. Moulds; 12 males, 2 females, Chapman Pool, Blackwood River, 12.i.1991, M.S. & B.J. Moulds; 58 males (one genitalia prep. PHY 15), 14 females, same data as holotype; 3 males, 25 km SW of Nannup, 13.i.1991, M.S. & B.J. Moulds; 10 males, Nannup, 23.xi, 12.x.1984, S. Lamond; 4 males, 1 female, Karridale, 12.i.1991, M.S. & B.J. Moulds; 9 males, Balingup, 13.xii.1985, M.S. & B.J. Moulds (MSM). 3 males, Donnelly R., Vasse Hwy, NNW of Pemberton, 12.xii.1985, M.S. & B.J. Moulds; 2 males, 1 female, same data as holotype (PH). 3 males, Donnelly R., Vasse Hwy, NNW of Pemberton, 12.xii.1985, M.S. & B.J. Moulds (WAME 113479-1134781); 2 males, 1 female, same data as holotype (WAME 113482-113484) (WAM).

**Distribution and habitat** (Fig. 54). The far southwest corner of Western Australia where all records are from within 65 km of Nannup (type locality). It is at times a common species around Nannup, at the Donnelly River north-west of Pemberton, and at Chapman Pool on the Blackwood River. There are records from late November to mid January. Adults are usually found in grass.




**FIGURES 54–55.** *Pyropsalta patula* **sp. n.** (54) distribution; (55a) male genitalia in lateral view; (55b) same in ventral view.

**Adult description.** *Male* (Figs 12a, 55). *Head* black, with supra-antennal plates partly or entirely yellowish and usually a spot of similar colour near posterior margin adjacent to eye and a partly yellowish midline. Postclypeus black with yellowish margin ventrally, a patch of similar colour on most anterior part and often also dorsally. Anteclypeus black, often with a small yellowish patch on anterior midline. Rostrum dark brown becoming black distally; reaching bases of hind coxae. *Thorax* with pronotum a mixture of brown and black suffusion; midline and anterior margin partly yellowish; pronotal collar yellowish brown tending black except for yellowish lateral margins. Mesonotum yellowish with bold black submedian and lateral sigilla; a large black patch encompassing anterior arms of cruciform elevation and extending along midline to submedian sigilla; midline of cruciform elevation also black; wing grooves tending blackish. Metanotum yellowish with black midline and tending black at lateral extremities. *Forewings* hyaline; without infuscations; venation brown tending black distally; basal cell hyaline; basal membrane blackish. *Hindwings* with venation brown becoming black distally, without infuscations; plaga light brown with a dark brown steak in jugum. *Legs* yellow with longitudinal black markings of variable extent but mostly absent on hind tibiae. *Opercula* pale yellow; unusually large, broad, almost meeting, extending distally a little beyond a large

tympanal cavity. *Abdomen* with tergites a mixture of black and yellowish brown; tergite 1 dark brown with hints of yellowish brown, becoming black around perimeter of timbal cavity; tergite 2 with a narrow black perimeter, a black auditory capsule, and a black anterior pointed projection dorsally; tergite 3 yellowish brown with a black dorsal midline and black anterior lateral extremity; tergites 4–7 black with dark brown centre laterally; tergite 8 yellowish with black lateral extremity. Sternites I and II black; sternites III and IV orange except for a broad black patch on posterior midline of IV; sternites V–VII black; sternite VIII black on anterior half, yellow on distal half. *Timbal cavity* exceptionally large so that its length comprises about one-third of the abdominal length; its posterior margin sharply angled and weakly ridged. *Timbals* with three long ribs spanning the timbal membrane and joined dorsally, the most anterior one considerably widened on its lower half, a 4th rudimentary long rib on dorsal quarter, the anterior third of the timbal membrane devoid of ribs except for a 5th very thin rib tight against the most anterior part of timbal membrane; a large subtriangular sclerotised plate on lower timbal membrane that may be the fused basal portions of ribs 4 and 5.

*Male genitalia* (Figs 55a–b). Pygofer yellow with a large black patch dominating lateral surface and a black posterior margin that sometimes extends across much of dorsal surface. Claspers in lateral view broadly rounded distally, in ventral view very slightly turned outwards with apex minutely toothed on inner margin. Aedeagus with pseudoparameres in dorsal view wide apart and barely diverging throughout their length, in lateral view directed upwards compared to thecal shaft with proximal half or so diverging from ventral support.

*Female* (Fig. 12b). Different to male in colour and markings. *Head* light brown with a green tinge; black around lateral ocelli extending anteriorly towards supra-antennal plates; black around median ocellus extending to post-clypeus. Postclypeus light brown with a black band either side from anterior of dorsal surface but fading before anteclypeus. Anteclypeus light brown with a small black spot on midline. Rostrum light brown becoming black distally. *Thorax* with pronotum dull green with brown tinges; black along furrows and either side of a green midline; pronotal collar dull green, sometimes with a little black mainly on lateral angles. Mesonotum dull green with black submedian and lateral sigilla, the latter often with green infiltrating their inner margins; scutal depressions black, and sometimes a black edging against anterior arms of green cruciform elevation. Metanotum dull green tending partly black laterally. *Wings* and *legs* as in male. *Opercula* as in male except for much smaller size. *Abdomen* with tergites brown with green tinges; tergites 1 and 2 largely without black markings; tergites 3–7 with black anterior margins widest around dorsal midline and adjacent to epipleurites. Sternites orange with an irregular black midline, variable in extent between individuals and sometimes ill-defined.

Abdominal segment 9 in dorsal view a little longer than wide; dull green tending brown dorsally; with a sub-dorsal black fascia on basal two thirds that is widest at its base but otherwise slender, and usually an irregular black anterior margin and a black spot laterally near apex; in some individuals the black much reduced or partially absent except for the sublateral fasciae. Ovipositor sheath black, projecting a little beyond anal styles no more than 1 mm.

**Measurements**. Range and mean (in mm) for 10 males, 10 females (includes smallest and largest available specimens). *Length of body* (including head): male 14.3–17.8 (16.1); female (including ovipositor) 16.2–20.9 (18.8). *Length of forewing*: male 17.3–21.9 (19.7); female 18.7–22.6 (21.4). *Width of head* (including eyes): male 4.6–5.8 (5.2); female 4.9–6.1 (5.7). *Width of pronotum* (across lateral angles): male 5.1–6.6 (5.8); female 5.5–7.0 (6.5).

**Distinguishing features**. Males are readily distinguished by their unusually large timbals and large opercula. The length of the timbal cavity comprises about one-third of the abdominal length, far more than in any other Australian cicada species and perhaps more so than in any other cicada worldwide. Females are more difficult to distinguish. They are most likely to be confused with species of *Physeema* (tick-tock cicadas), but are easily distinguished by their orange sternites. While most specimens of *Pyropsalta patula* **sp. n.** have some degree of fusion of forewing veins M and CuA on meeting the basal cell, some specimens have these veins only abutted at the basal cell, a feature not widely found within the Cicadettini.

The male genitalia have close similarities with those of *Physeema*. In particular the trifid aedeagus of both has an unsclerotised hinge, pseudoparameres that rise high above the theca and a long ventral support that is longer than half the length of the pseudoparameres.

**Song**. This species' song has not been recorded.

***Pyropsalta rhythmica* sp. n.**
urn:lsid:zoobank.org:act:B76DDD25-2E5E-4314-B7C6-6A40EE9627CB
(Figs 14, 56–58)

**Synonymy**. *Pyropsalta* nr. *melete* Marshall *et al.* (2016): fig. 2.

**Common name**. Sprinkler cicada

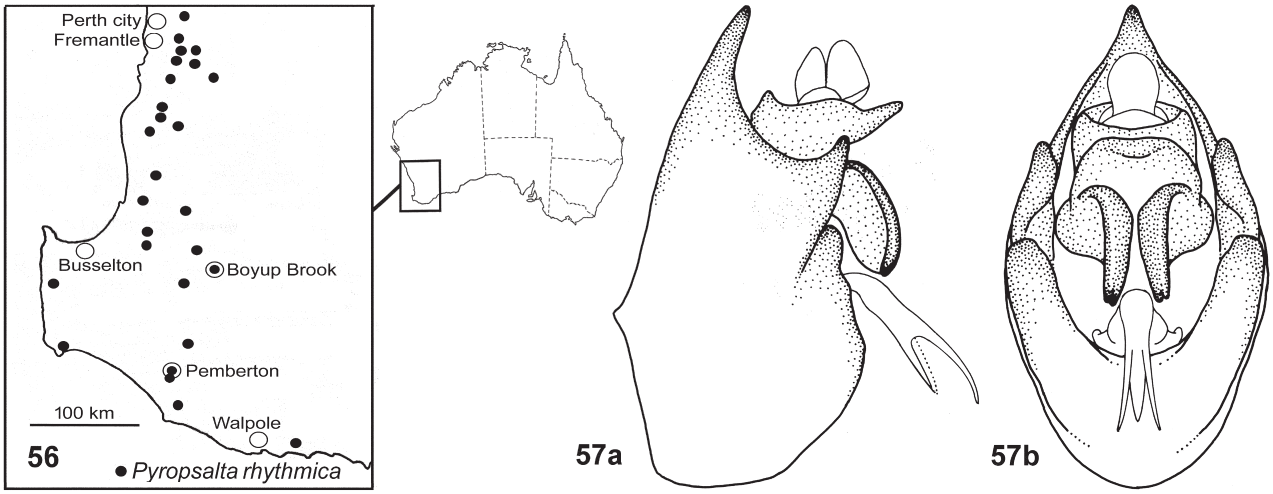
**Etymology.** From the Greek derived Latin adjective *rhythmicus* meaning regular recurring motion or measure and referring to the rhythmical quality of the song.

**Types**. *Holotype* male (Simon Lab. voucher 02.AU.WAU.SSD.01), S of South Dandalup, Western Australia, 32°36'S 115°55'E, 23m, 31.xii.2002, Marshall, Moulds, Hill & Vanderpool (WAME 113485) (WAM). *Paratypes* as follows: **WESTERN AUSTRALIA:** 2 males, 2 females, WAU.MAN, jctn of Graphite & Ralston Rds, 3 km NW of Manjimup, 3.i.2003, 34°13'S 116°08'E, 274 m, Moulds, Marshall, Hill, & Vanderpool (AMS). 2 males, Brunswick Junctn., Perth, 13.i.1994, D. Emery; 31 males 8 females, Canning R. & RL4 (jnctn), Kelmscott, 1.xii.97, D. Emery (emerging on grass 0530h); 3 females, Dwellingup, M.R. Williams & K. Whitford, 2.i.93; 1 male, Gosnells, Perth, M.R. Williams & D. Emery, 2.xii.1997; 2 males, 2 females, Albany H'way, 25 km S Armadale, 27.xi.2013, A. Mitchell; 1 male, 1 female, Routes Rd., Lesmurdie, 32°00'56"S 116°13'32"E, 5.i.2013, A. Mitchell (DE). 2 males, S of South Dandalup, 32°36'S 115°55'E, 23m, 31.xii.2002, Marshall, Moulds, Hill & Vanderpool; 2 males, 2 females, Donnybrook, 13.xii.1985, M.S. & B.J. Moulds; 1 male, 1 female, Canning R. & RL4 (jnctn), Kelmscott, 1.xii.97, D. Emery (LP). 13 males, 1 female, S of South Dandalup, 32°36'S 115°55'E, 23m, 31.xii.2002, Marshall, Moulds, Hill & Vanderpool; 4 males, 1 female, WAU.BOY, nr Boyup Brook, 210 m, 33°48'S 116°27'E, 5.i.2003, Marshall, Moulds, Hill & Vanderpool; 2 males, 1 female, AU.WA.BJP, Bridgetown, Jarrah Pk, off Brockman Hwy, 2.i.2003, 34.029[°]S, 115.984[°]E. 300 m, Hill, Marshall, Moulds, Vanderpool; 1 male, 1 female (in copula), WAU. MGR, Margaret River, 85 m, 33:57S 115:04E, 2.i.2003, Marshall, Moulds, Hill & Vanderpool; 5 males, WAU. HWK, jctn of Old Vasse Rd. & Hawke Rd, nr Pemberton, 200 m, 34°29'S 115°57'E, 4.i.2003, Moulds, Hill, Marshall & Vanderpool; 8 males, 8 females, WAU.PMB, Pemberton, 126 m, 34°27'S 116°02'E, 3.i.2003, Moulds, Marshall, Hill, & Vanderpool; 24 males (1 genitalia prep. PYR 1), 9 females, WAU.MAN, jctn of Graphite & Ralston Rds, 3 km NW of Manjimup, 34°13'S 116°08'E, 274 m, 3.i.2003, Moulds, Marshall, Hill, & Vanderpool; 42 males, 26 females, Donnybrook, 13.xii.1985, M.S. & B.J. Moulds; 2 males, Collie, 11.xii.1985, M.S. & B.J. Moulds; 1 male (genitalia prep. CI 4), Collie, 4.i.1991, M.S. & B.J. Moulds; 10 males, 6 females, Harvey, 4.ii.1991, M.S. & B.J. Moulds; 1 males, Dwellingup, 8.i.1991, M.S. & B.J. Moulds; 1 male, 1 female, Kent River, 10 km E of Bow Bridge, 16.i,1991, M.S. & B.J. Moulds; 1 male, Augusta, 20.i,1985, S. Lamond; 4 males, 2 females, Pinjarra, 9.i.1991, M.S. & B.J. Moulds; 1 male, Pinjarra, xii.1990, A. Johnson; 4 females, Wilga, 22.xii.1986, K. & E. Carnaby; 6 males, 4 females, Pemberton, 14.i.1991, M.S. & B.J. Moulds; 2 males, 1 female, Warren River Western Hwy, nr Pemberton, 14.i.1991, M.S. & B.J. Moulds; 24 males (2 genitalia preps CI 3, PRY 3), 6 females, Roelands E of Bunbury, 4.i.1991, M.S. & B.J. Moulds; 2 males, Brookton Hwy, 7 km SE Kelscott, 19.xii.2014, P. Hutchinson; 5 males, 7 females, Albany Hwy, 25 km S Armadale, 28.xii.2012, 21.i.2012, 21,29.xii.2014, P. Hutchinson; 2 males, 1 female, Gleneagle S.F., S of Armadale, 2,15.xii.2011, P. Hutchinson & P. Kay (MSM). 6 males, Brookton Hwy, 7 km SE Kelmscott, 19.xii.2014, P. Hutchinson, to mv light, PMH Coll #CIC 1796, 1797, 1842, 1822, 1823, 1884; 1 male, 1 female, Brookton Hwy, 26 km SE Kelmscott, 15.xii.2017, P. Hutchinson, to mv light, PMH Coll #CIC 1804, 1805; 1 male, 2 females, Brookton Hwy, 50 km SE Kelmscott, 14.xi.2015, P. Hutchinson, to mv light, PMH Coll #CIC 1803, 1806, 1807; 1 male, Albany Hwy, 7 km S Armadale, 11.xii.2014, P. Hutchinson, to light, PMH Coll #CIC 1824; 24 males, 2 females, Albany Hwy, 25 km S Armadale, 30.xii.2011, 28.xii.2012, 6,21.i.2012, 27.xi.2013, 5.xii.2013, 11,29.xii.2014, 18.i.2014, P. Hutchinson, to mv light, PMH Coll #CIC 1798, 1800, 1801, 1802, 1809, 1811, 1813, 1815, 1816, 1819, 1820, 1821, 1827, 1828, 1830, 1829, 1843, 1846, 1851, 1854, 1856, 1855, 1872, 1880, 1881, 1882; 7 males, Albany Hwy, 25 km S Armadale, 28.xii.2011, 21,26.xii.2014, P. Kay, to mv light, PMH Coll #CIC 1799, 1812, 1857, 1859, 1883, 1875, 1873; 1 female, Ashendon, 10 km S Mt Dale, 6.ii.2014, P. Kay, to mv light, PMH Coll #CIC 1808; 1 female, Red Hill Res., E of Midland, Perth, 12,xi.2000, P. Hutchinson, on Allocasuarina hugeliana, PMH Coll #CIC 1810; 1 male, 1 female, Beckenham, Perth, 5.xii.2011, 31.i.2015, P. Hutchinson, to uv light, PMH Coll #CIC 1814, 1869; 2 males, Scarp Rd, Dwellingup, 29.xii.2020, P. Kay, to light, PMH Coll #CIC 1818, 1847; 1 male, Glen Mervyn, 25 km S Collie, 26.xii.2011, P. Kay, to mv light, PMH Coll #CIC 1950; 2 females, Mt Chudarup, N Windy Harbour, 6.i.2010, P. Hutchinson, to light. // PMH Coll #CIC 1848, 1849; 5 males,

Churchman's Brook Dam, S Armadale, 15,18.i.2012, P. Kay, to mv light, PMH Coll #CIC 1879, 1877, 1860, 1876, 1878; 4 males, Gleneagle SF, [25 km] S of Armadale, 15.xii.2011, P. Hutchinson & P. Kay, to mv light, PMH Coll #CIC 1861, 1864, 1865, 1868 (PH). 18 males, 9 females, WAU.MAN, jctn of Graphite & Ralston Rds, 3 km NW of Manjimup, 3.i.2003, 34:13S 116:08E, 274 m, Moulds, Marshall, Hill, & Vanderpool (WAME 113486-113512); 4 males, 4 females, WAU.PMB, Pemberton, 126 m, 34:27S 116:02E, 3.i.2003, Moulds, Marshall, Hill, & Vanderpool (WAME 113513-113520) (WAM).

**Distribution and habitat** (Fig. 56). The far southwest of Western Australia south from Red Hill near Midland, Perth (P. Hutchinson) to the Kent River east of Walpole. All records are within 85 km of the coast, although none are strictly coastal. The most inland known locality is Boyup Brook.

There are records from mid November to early February. Adults frequent *Eucalyptus* trees, although they are sometimes found on *Allocasuarina* and other trees. They prefer the smaller branches and often occur in huge numbers. Nymphs may feed on grass roots as well as those of trees. Nymphs were found emerging in numbers in the early morning on kikuyu grass (D. Emery pers. comm.).




**FIGURES 56–57.** *Pyropsalta rhythmica* **sp. n.** (56) distribution; (57a) male genitalia in lateral view; (57b) same in ventral view.

**Adult description.** *Male* (Figs 14a, 57). *Head* black, with supra-antennal plates partly or entirely orange or yellowish and usually a spot of similar colour on posterior margin near eye and a partly orange midline. Postclypeus black with orange margin ventrally and often also dorsally; sometimes with an orange ventral midline. Anteclypeus usually black, often with a small orange patch at base on midline, rarely orange with a black centre. Rostrum dark brown becoming black distally; reaching apices of hind coxae. *Thorax* with pronotum either black or a mixture of black and orange in variable proportions but usually with the black dominating; dorsal midline usually with an orange or yellowish fascia; pronotal collar black or dark brownish to varying degrees. Mesonotum black with a pair of orange markings from between submedian and lateral sigilla to anterior arms of cruciform elevation considerably variable in extent, sometimes fusing at midline but always straight along their outer margins; cruciform elevation orange or dull yellowish brown, usually with some black, rarely entirely black. Metanotum brown with a black dorsal midline and mostly black laterally. *Forewing* venation black, sometimes tending brown on basal half; costal margin orange to nearly black; basal cell usually tinted light brown, sometimes hyaline; basal membrane often orange on about anterior half, otherwise blackish, sometimes entirely blackish. *Hindwing* venation black; without infuscations; plaga white to light brown with a black steak in jugum. *Legs* orange or yellowish, with black markings of variable extent, the black mostly confined to the forelegs and mid and hind femora. *Opercula* usually dark brown to blackish, sometimes yellow or yellowish brown, always black or tending so at base (epimeron 3). *Abdomen* with tergites black with orange banding; tergite 1 glossy black with narrow orange anterior margin; tergite 2 orange (tending yellow if teneral) with a narrow black anterior margin and black dorsal midline; tergites 3 and 4 black on anterior half and dorsal midline, orange (tending yellow if teneral) on posterior half; tergites 5–7 entirely black or nearly so; tergite 8 black on anterior portion to varying degrees, otherwise orange. Sternites I and II black; sternites III and IV orange, usually with black spanning midline; sternites V and VI predominantly black usually with narrow orange distal margin; sternite VII predominantly black with orange or yellow distal portion; sternite VIII yellow.

*Timbal cavity* sharply angled along posterior margin and barely ridged. *Timbals* with three long ribs spanning the timbal membrane and fused dorsally, the most anterior one considerably widened on its lower half, and a fourth rudimentary long rib missing much of its central portion; the anterior third of the timbal membrane devoid of ribs except for one very thin rib tight against the most anterior part of timbal membrane.

*Male genitalia* (Figs 57a–b). Pygofer often orange with black in varying proportions on basal half, sometimes predominantly black or dark brown except for dull orange basal and upper lobes and between upper lobe and dorsal beak. Basal lobes well developed but in lateral view mostly hidden; upper lobes large, in lateral view gradually tapering, slightly upturned, bluntly pointed. Claspers in lateral view broadly rounded distally, in ventral view with apex blunt but minutely and equally bi-lobed. Aedeagus with pseudoparameres curved in lateral view, almost straight and diverging in dorsal view.

*Female* (Fig. 14b). Similar to male. Abdominal segment 9 long, in dorsal view at least half as long again as width of its base; orange, usually with a subdorsal black fascia on basal two thirds that is widest at its base but otherwise slender, and usually a black ventral margin and a black spot laterally; in some individuals the black more extensive with extreme cases entirely black except for apical region. Ovipositor sheath black, projecting beyond dorsal beak no more than 1 mm.

**Measurements**. Range and mean (in mm) for 10 males, 10 females (includes smallest and largest available specimens). *Length of body* (including head): male 16.3–21.5 (19.7); female (including ovipositor) 19.3–26.5 (21.9). *Length of forewing*: male 18.1–28.0 (24.3); female 22.8–30.9 (26.3). *Width of head* (including eyes): male 5.0–7.0 (6.3); female 6.2–7.5 (6.8). *Width of pronotum* (across lateral angles): male 5.4–7.9 (6.8); female 6.2–7.9 (7.1).

**Distinguishing features**. Males of *Pyropsalta rhythmica* **sp. n.** are difficult to separate from those of *P. amnica* **sp. n.** and are best distinguished by the black markings on tergites 5–7. In *P. rhythmica* these are either entirely black or if partly orange then the black always bisects the orange along the dorsal midline of each segment; in *P. amnica* all these segments are partly or entirely orange and are never completely bisected by black on any segment. Further, sternites III and IV in *P. rhythmica* nearly always have distinct areas of black centrally, these missing in *P. amnica.*

Females can be distinguished by the length of the ovipositor sheath. In *P. rhythmica* the ovipositor sheath protrudes no more than 1 mm beyond the dorsal beak but in *P. amnica* it protrudes close to 2 mm.

**Song** (Figs 58a–c). Song recordings were obtained from the WAU.SSD, WAU.BOY, and WAU.MAN paratype locations plus the following sites: S. of Serpentine (32º31.400’S 115º58.244’E); N. of Boyup Brook (33º48.391’S 116º26.742’E); N. of Bunbury (WA.GCC, 33º20.237’S 115º40.784’E), Brunswick Junction (33º15.108’S 115º50.456’E), Pinjarra (32º38.413’S 115º52.12’E), Porongurup National Park (WA.PNP, 34º40.539’S 117º52.266’E), and Manjimup (34º14.094’S 116º8.546’E).

Because males usually sang from high stations, often out of sight of the recordist, we recorded only uncollected males. However, one male was captured singing on the ground near a mercury vapour light trap, so we are confident that the song below is produced by *P. rhythmica*.

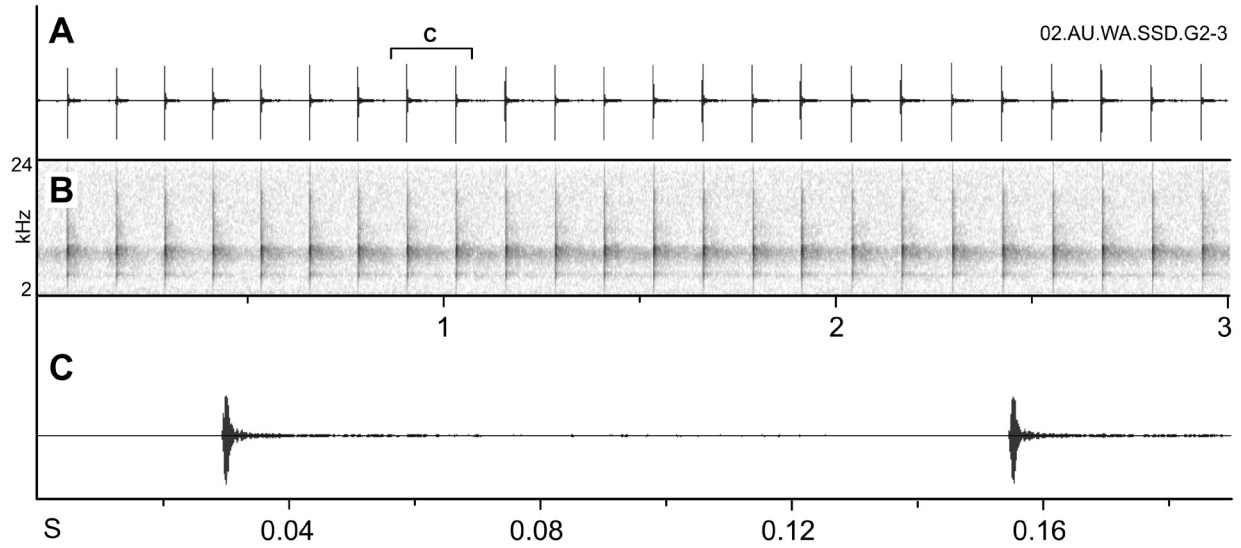



**FIGURE 58.** *Pyropsalta rhythmica* **sp. n.,** male calling song. (58a, b) oscillogram and spectrogram of a short segment from the holotype locality (23°C); (58c) further detail of pulse structure.

This is the first *Pyropsalta* song to be described. Males sing a continuous song consisting of a train of extremely resonant clicks produced at about 6–8 per second. The clicks are very sharp, with most of the sound energy contained within a single pulse around 1–2.5 ms long. Measuring this parameter was difficult because males in close proximity synchronize their songs with remarkable precision, such that it is sometimes difficult to distinguish the song of a nearby focal male from the background of conspecifics. Most sound energy is concentrated in the range 6–10.5 kHz, with a peak intensity around 8–9.6 kHz. There is no frequency modulation.

A few recordings suggest that males skip one pulse occasionally while remaining in synch with the chorus. This is a possible mechanism by which the male might cue replies from receptive females, but additional confirmation is needed.

***Pyropsalta amnica* sp. n**

urn:lsid:zoobank.org:act:542EACBC-D7F1-47DC-A7C5-6AE99A59DC6F

(Figs 13, 59, 60)

**Etymology.** From the Latin adjective *amnicus* meaning associated with a stream, and referring to the association of this species with trees growing in the vicinity of streams.

**Types**. *Holotype* male, Greenmount, Perth, Western Australia, 25.xi.1978, M.S. & B.J. Moulds (WAME 113521) (WAM). *Paratypes* as follows: **WESTERN AUSTRALIA:** 4 males, 2 females, Greenmount, Perth, 25,26.xi.1978, M.S. & B.J. Moulds; 2 males, 1 female, Canning R. & Rt.4, Kelmscott, Perth, 1.xii.[19]97, D. Emery (DE). 4 males, 2 females, Greenmount, Perth, 25,26.xi.1978, M.S. & B.J. Moulds (LP). 48 males (3 genitalia preps CI 6, CI 7, PRY 4), 19 females, Greenmount, Perth, 25,26.xi.1978, M.S. & B.J. Moulds (MSM). 3 males, 2 females, Kelmscott, Perth, xii.1990, P. Hutchinson, PMH Coll #CIC 1825, 1826, 1850, 1839, 1840; 1 female, Brookton Hwy, 7 km SE Kelmscott, 19.xii.2014, P. Hutchinson, to mv light, PMH Coll #CIC 1837; 1 male, 1 female, Beckenham, Perth, 13.xi.2015, 17.xi.2017, P. Hutchinson, to uv light, PMH Coll #CIC 1817, 1835; 1 female, Beckenham, Perth, xii.1991, P. Hutchinson, PMH Coll #CIC 1848; 1 female, Walyunga N.P., N Perth, 12.xii.2013, P. Kay, to mv light, PMH Coll #CIC 1841; 1 female, Mt Cook, 50 km S Armadale, 25.xi.2016, P. Hutchinson, to mv light, PMH Coll #CIC 1844; 1 male, 6 females, Albany Hwy, 25 km S Armadale, 28.xii.2012, 6,21.i.2012, 29.xii.2014, P. Hutchinson, to mv light, PMH Coll #CIC 1836, 1845, 1849, 1834, 1838, 1870, 1874; 1 male, 5 females, Albany Hwy, 25 km S Armadale, 28.xii.2011, 10,15.i.2012,, 21.xii.2014, P. Kay, to mv light, PMH Coll #CIC 1831, 1832, 1853, 1858, 1852, 1871; 4 females, Churchman's Brook Dam, S Armadale, 18.i.2012 P.Kay, to mv light, PMH Coll #CIC 1862, 1866, 1867, 1863; 1 female, White Hills Rd., S Mandurah, 25,xi.2014, P. Hutchinson, to light. // PMH Coll #CIC 1833 (PH). 4 males, 2 females, Greenmount, Perth, 25,26.xi.1978, M.S. & B.J. Moulds (WAME 113522-113527) (WAM).

**Distribution and habitat** (Fig. 59). Known only from the Perth hinterland from Walyunga National Park some 35 km north-east of Perth (P. Kay) to 50 km south of Armadale (P. Hutchinson). In the vicinity of Perth it is found at Beckenham, Kelmscott, Churchmans Brook Dam and Greenmount. The only locality near the coast is White Hills Road south of Mandurah (P. Hutchinson). There are records from mid November to mid January but adults appear to be most common during December. Adults favour *Eucalyptus* trees usually growing in the vicinity of water, where they tend to prefer the smaller branches. Mass emergences may not be unusual.

This species is found sympatrically with the closely similar *Pyropsalta rhythmica* sp. n. at Beckenham, Kelmscott, Churchmans Brook Dam, and 25 km and 50 km south of Armadale (P. Hutchinson).

**Adult description**. *Male* (Figs 13a, 60). *Head* black, with supra-antennal plates partly or entirely orange or yellowish and usually a spot of similar colour on posterior margin near eye and a partly orange midline. Postclypeus black with orange margin ventrally and often also dorsally; usually with a partially orange ventral midline that is sometimes reduced to a spot. Anteclypeus usually entirely black. Rostrum dark brown becoming black distally; reaching apices of hind coxae. *Thorax* with pronotum either black or a mixture of black and orange in variable proportions, the dorsal midline entirely or partially orange or yellowish; pronotal collar black or dark brownish to varying degrees. Mesonotum black with a pair of orange markings from between submedian and lateral sigilla to anterior arms of cruciform elevation considerably variable in extent, sometimes fused at midline but always straight along their outer margins; cruciform elevation black or orange brown. Metanotum brown with a black dorsal midline and a narrow black streak laterally. *Wings* hyaline; without infuscations. *Forewing* venation black, sometimes tending brown on basal half; costal margin orange to nearly black; basal cell usually tinted light brown, sometimes hyaline;

basal membrane orange but sometimes partly blackish. *Hindwing* venation black; without infuscations; plaga white to light brown with a black streak in jugum. *Legs* orange or yellowish, with black markings of variable extent, the black mostly confined to the forelegs and mid and hind femora and coxae. *Opercula* usually dark brown to blackish, occasionally yellow or yellowish brown, always black or tending so at base (epimeron 3). *Abdomen* with tergites black with orange banding dominating; tergite 1 glossy black with narrow orange anterior margin; tergite 2 black with a broad orange posterior margin not reaching auditory capsule and usually interrupted at dorsal midline; tergites 3–8 predominantly orange with black anterior margin to variable extents but often widest at dorsal midline. Sternites I and II black; sternites III and IV orange; sternites V and VI predominantly black with narrow distal margin; sternite VII predominantly black with yellow distal portion; sternite VIII yellow. *Timbal cavity* sharply angled along posterior margin and barely ridged. *Timbals* with three long ribs spanning the timbal membrane and fused dorsally, the most anterior one considerably widened on its lower half, and a fourth rudimentary long rib missing much of its central portion; the anterior third of the timbal membrane devoid of ribs except for one very thin rib tight against the most anterior part of timbal membrane.

*Male genitalia* (Figs 60a–b). Pygofer orange to yellowish. Basal lobes well developed but in lateral view mostly hidden; upper lobes large, in lateral view gradually tapering, slightly upturned, bluntly pointed. Claspers in lateral view broadly rounded distally, in ventral view with apex blunt but minutely bi-lobed, the outer lobe usually slightly longer than the other and sharply pointed. Aedeagus with pseudoparameres curved in lateral view, almost straight and diverging in dorsal view.

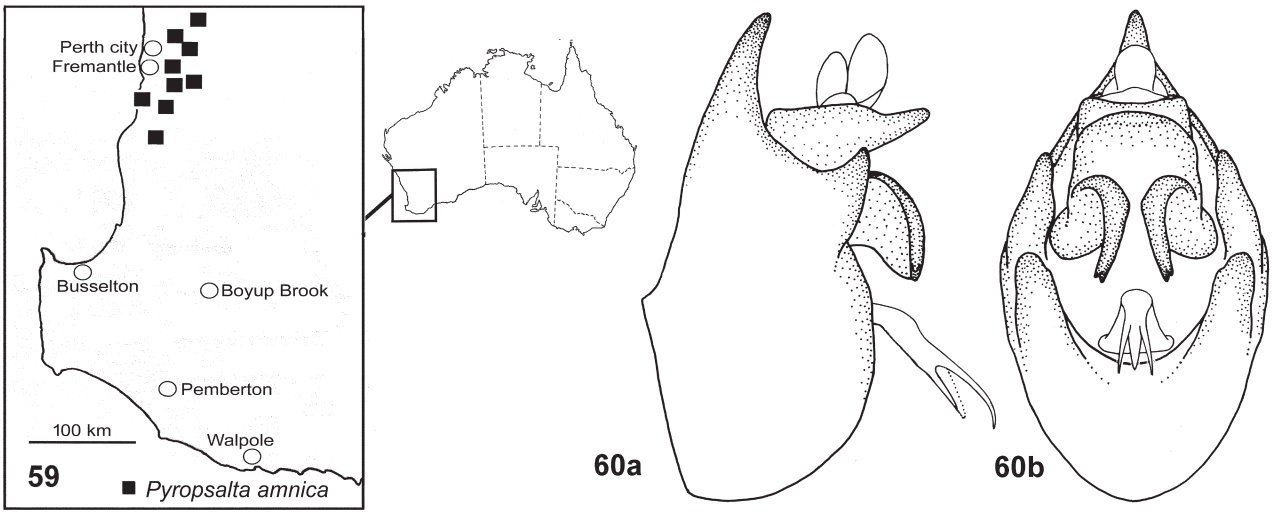
*Female* (Fig. 13b ). Similar to male. Abdominal segment 9 long, in dorsal view at least half as long again as width of its base; orange with a subdorsal black fascia on basal two thirds that is widest at its base but otherwise slender usually with a small knobbed apex, and usually also a blurred black lateral patch below caudal beak. Ovipositor sheath black, projecting beyond dorsal beak by almost 2 mm.

**Measurements**. Range and mean (in mm) for 10 males, 10 females (includes smallest and largest of available specimens). *Length of body* (including head): male 16.7–20.7 (18.4); female (including ovipositor) 20.2–24.4 (23.0). *Length of forewing*: male 21.0–25.4 (23.4); female 25.1–29.6 (27.4). *Width of head* (including eyes): male 5.7–7.2 (6.3); female 6.5–7.8 (7.1). *Width of pronotum* (across lateral angles): male 5.7–7.3 (6.4); female 6.7–8.0 (7.4).

**Distinguishing features**. Males of *Pyropsalta amnica* **sp. n.** are difficult to separate from those of *P. rhythmica* **sp. n.** and are best distinguished by the black markings on tergites 5–7. In *P. amnica* all these are partly or entirely orange and are never completely bisected by black on any segment; in *P. rhythmica* these segments are either entirely black or if partly orange then the black always bisects the orange along the dorsal midline of each segment. Further, sternites III and IV in *P. amnica* lack distinct areas of black centrally, but in *P. rhythmica* these sternites have distinct central black markings.

Females can be distinguished by the length of the ovipositor sheath. In *P. amnica* the ovipositor sheath protrudes almost 2 mm beyond the dorsal beak, but in *P. rhythmica* it protrudes no more than 1 mm.

**Song**. This species' song has not been recorded.




**FIGURES 59–60.** *Pyropsalta amnica* **sp. n.** (59) distribution; (60a) male genitalia in lateral view; (60b) same in ventral view.

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