

**A REVISION OF THE ENDEMIC AUSTRALIAN CICADA GENUS
JASSOPSALTRIA ASHTON, 1914
(CICADIDAE: CICADINAE: JASSOPSALTRIINI)**

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Abstract

The single described species of *Jassopsaltria*, *J. ruffifacies* Ashton is re-described, four new species of *Jassopsaltria* Ashton, 1914 are described from Western Australia (*J. aeroides* sp. n., *J. cinnamomea* sp. n., *J. minilyaensis* sp. n., *J. gracilens* sp. n.) and one new species is described from the Northern Territory (*J. danielsorum* sp. n.). A key is provided to the six known species, and the male calling songs of all Western Australian species are presented.

Keywords: Cicadoidea, cicada songs, Western Australia, Northern Territory

Introduction

The genus *Jassopsaltria* Ashton, 1914 was established by Ashton to accommodate just one species, *J. ruffifacies* Ashton, 1914. He did not allocate the genus to a tribe or subfamily, even though Distant (1906) had previously established a higher classification for the Cicadidae. Metcalf (1963) placed *Jassopsaltria* in the tribe Parnisini Distant, subfamily Tibicininae (now Cicadettinae), apparently from Ashton's description and without seeing a specimen. This classification was followed by Burns (1957), Duffels and van der Laan (1985) and Moulds (1990). Moulds (2005) erected the tribe Jassopsaltriini and simultaneously transferred it from the subfamily Cicadettinae to the subfamily Cicadinae, a change later supported by the molecular study of Marshall *et al.* (2018). The original misplacement by Metcalf was no doubt due to Ashton's statement that the genus lacked timbal covers, but *Jassopsaltria* does have timbal covers although much reduced (Moulds 2005, 2012).

We here describe an additional five species of *Jassopsaltria* (Figs 1–12), four from Western Australia and one from the Northern Territory, although the latter's known distribution lies very close to the Western Australian border. While additional collecting may clarify distributions further, all six species appear to have small distributions with four at least qualifying as narrow range endemics. Three species, *J. aeroides* sp. n., *J. danielsorum* sp. n. and *J. minilyaensis* sp. n., are only known from very small areas (Figs 19, 20). *Jassopsaltria gracilens* sp. n. has by far the widest distribution of the six species, with populations at either end of the Great Sandy Desert from the Western Australian coast to Wolfe Creek Meteorite Crater near the Northern Territory border (Fig. 20).

A key is provided to all six species and the songs of the five Western Australian species are described.

The following abbreviations are used for collections housing specimens: **AM**, Australian Museum, Sydney; **ANIC**, Australian National Insect Collection, Canberra; **DE**, collection of David Emery; **KG**, collection of Kees Green; **LP**, collection of Lindsay Popple; **MSM**, first author's collection; **PMH**, collection of Paul M. Hutchinson; **SAM**, South Australian Museum, Adelaide; **WAM**, Western Australian Museum, Perth. Specimens listed in the material examined sections with voucher codes given from the C. Simon laboratory, University of Connecticut (**UCONN**), may have one or more legs stored separately in ethanol for DNA preservation at that institution.

Terminology for morphological features follows that of Moulds (2005, 2012). Terminology for male calling song descriptions is as follows: A *pulse* is a burst of sound energy containing multiple sound *waves* (waves are the primary pressure-amplitude oscillation, which dampens to zero if not followed by another sound burst). This definition does not assume a specific mechanism, so a pulse could be created by one timbal collapsing or rebounding, both timbals collapsing/rebounding in synchrony, or one or more ribs of one or both timbals collapsing/rebounding (e.g. Fleming, 1975). A *syllable* is a group of pulses repeated at an approximately uniform rate. A *macrosyllable* is a group of repeated syllables.

Measurements of acoustic features were made in Raven version 1.5 Pro (Cornell Lab of Ornithology, Ithaca, NY). 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. Recordings were filtered to remove sound energy below about 8 kHz. Sound pitch/frequency measurements were made from power spectra generated with the following parameter settings: Hann window, window size 256 samples, 23 decibels (dB) filter bandwidth 270 Hz, DFT size 256 samples, grid spacing 188 Hz, overlap 50%, hop size 128 samples, averaging 1 spectrum, with no clipping. The peak frequency of a song or song segment was identified as the sound pitch at which maximum sound amplitude was observed over a time segment of 1 s in duration, and the main song frequency band was delimited by the frequency values above and below the peak frequency at which sound intensity first dropped by more than 10 dB. Air temperatures were recorded with an Omega HH-25KF temperature meter and type K thermocouple (OMEGA Engineering, Stamford, CT), or in some cases with an ordinary household digital thermometer. Voucher or example recordings for each species will be deposited at the online repository BioAcoustica (<http://bio.acousti.ca>).

Key to species of *Jassopsaltria*

1. Rostrum reaching to bases of hind coxae 2
 - Rostrum extending much further than bases of hind coxae 3
2. Forewing less than 14 mm long; dark reddish brown
 - cicadas *J. danielsorum* sp. n.
 - Forewing more than 15 mm long; light to mid brown
 - cicadas, never reddish brown *J. gracilens* sp. n.

3. Postclypeus reddish brown or dark brown 4
 — Postclypeus pale, either with or without narrow black
 lateral grooves 5
4. Postclypeus reddish brown; in life body light green or rarely
 red *J. rufifacies* Ashton
 — Postclypeus dark brown; in life body light to mid brown
 *J. cinnamomea* sp. n.
5. Postclypeus entirely lacking markings *J. aeroides* sp. n.
 Postclypeus with black lateral grooves *J. minilyaensis* sp. n.

Jassopsaltria rufifacies Ashton

(Figs 2, 7, 13, 19)

Jassopsaltria rufifacies Ashton, 1914: 350, pl. 17, figs 4, 4a, 4b.

Material examined. WESTERN AUSTRALIA: *Holotype* ♂, bearing three labels (1) Cue WA/ H.W. Brown (printed); (2) Type (on red circle); (3) *Jassopsaltria rufifacies* Asht./ TYPE; examined (the type locality is doubtful, see comment below under ‘Distribution and habitat’) (in SAM). *Other material*: 2 ♂♂, Star Swamp, nr Perth, 31°51.20’S, 115°45.50’E, 8.ii.2015, K. Green (KG). 1 ♂, AU.WA.KBB, 34 km SE of Kalbarri, 244 m, 27°53.021’S 114°31.511’E, 20.ii.2009, K. Hill & D. Marshall; 3 ♂♂ (2 Simon Lab. vouchers 10.AU.WA.GRE.01, 10.AU.WA.GRE.02), ~9 km SE of Greenough, 12 m, 29°00.864’S 114°46.956’E, 14.i.2010, Hill, Marshall. Moulds; 1 ♀, Geraldton, 10.v.1984, K. & E. Carnaby; 6 ♂♂ (2 Simon Lab. vouchers 03.AU.WA.CAT.02, 03.AU.WA.CAT.10), Catby, 144 m, 30°44’S 115°33’E, 19.i.2003, Moulds, Marshall, Hill & Vanderpool; 2 ♂♂, AU.WA.MOX, ~4 km NW of Wongan Hills, 350 m, 30°51.545’S 116°41.374’E, 13.i.2010, Hill, Marshall, Moulds; 4 ♂♂ (1 genitalia prep. J1), 1 ♀, Woodridge, 11.ii.1985, K. & E. Carnaby (MSM). 21 specimens Chapman River, Geraldton, 7.i.1966 (Natural History Museum, London). 1 ♂, AU.WA.CAT, Catby, 144 m, 30°44’S 115°33’E, 19.i.2003, Moulds, Marshall, Hill & Vanderpool (UConn). 2 ♂♂, AU.WA.CAT, Catby, 144 m, 30°44’S 115°33’E, 19.i.2003, Moulds, Marshall, Hill & Vanderpool (WAM).

Distribution and habitat (Fig. 19)

Coastal and subcoastal districts of Western Australia between Kalbarri and Perth. The most northern locality is 34 km SE of Kalbarri and the most southern record is Star Swamp, Perth. The most inland confirmed record is Wongan Hills some 100 km NNE of Perth. The type locality is Cue but this falls far beyond the confirmed habitat for this species and the locality is here considered erroneous. The type was collected by H.W. Brown who is known for other questionable records (e.g. the type locality of *Froggattoides typicus* Distant (Moulds 1990, 2012)). Adults have been taken in January, February and May.

Adults inhabit low shrubland (often growing on white sand), where they are usually found on *Acacia spathulifolia* Maslin upon which the species breeds (Moulds 1990). The yellowish green colour of this *Acacia* provides excellent camouflage for the similarly coloured adults.

Adult morphology (Figs 2, 7, 13)

In life light green with pale orange markings; rarely in a red form. Dried collection specimens often light yellowish brown. The single known red specimen is uniformly coloured orange red without markings. we describe here only the usual green form.

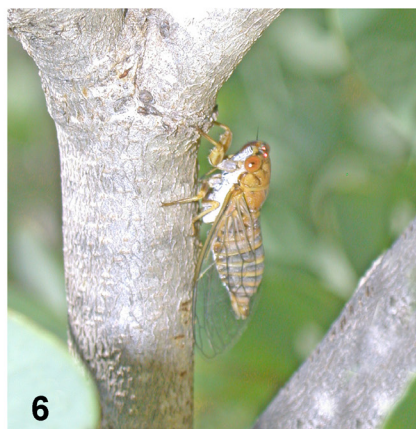
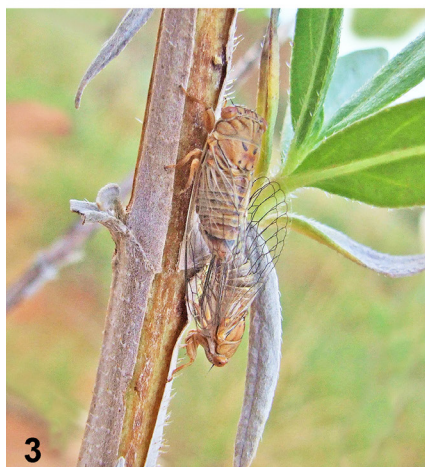
Male (Figs 2, 7, 13). *Head*. Light green, sometimes with a little brown near ocelli; postclypeus and anteclypeus dark reddish brown; lorum green with shades of grey distally and a narrow black edge against lower postclypeus and upper anteclypeus; rostrum long, extending much further than bases of hind coxae, pale green becoming black distally. Eyes of live specimens light brown. *Thorax* light green, with pale orange markings. Pronotum sometimes with pale orange in fissures and along anterior margin between bases of fissures. Mesonotum with a broad band of pale orange either side and hints of pale orange on submedian sigilla; rarely with a narrow dark reddish-brown fascia near wing groove; in fresh specimens a line of silver pubescence along upper margin of wing groove reaching cruciform elevation. *Wings* hyaline. Forewing venation tending blue in vicinity of clavus, otherwise green on a little more than basal half except for basal portion of M and CuA tending pale orange, distally venation black; basal cell translucent bluish; basal membrane pale greenish grey. Hindwing venation very pale tending translucent. *Legs* with coxae, trochanters and femora green but darkest on coxae, foretibiae and tarsi brown, midtibiae pale orange at proximal end thereafter bluish becoming brown distally, mid- and hindtarsi brown. Meracantha greenish. *Opercula* pale green; in life usually covered in silver pubescence. *Timbal covers* small, tending triangular, reaching less than halfway across timbal cavity and substantially reduced along upper margin; timbals with five long ribs spanning timbal membrane, ribs 1 and 2 (the two longest) joined dorsally. *Abdomen* with tergites green tending blue on tergite 8; sternites I–VI pale orange, sternites VII–VIII green, in life sternites I–VII usually with silver pubescence along lateral margins.

Genitalia (Fig. 13). Pygofer basal lobe lying tight against upper lobe, broad and apically rounded in lateral view, long and slender in ventral view; distal shoulders acutely pointed, distally directed; dorsal beak absent. Uncus long and slender, a little wider on its distal half in dorsal view, apically rounded, concave below. Aedeagus broadly curved through 180° at about mid length so that the distal half is almost parallel with much of proximal half, expanded distally on underside with the expansion gradually reducing towards apex.

Female. Similar to male. Abdominal segment 9 green, the same as body. Ovipositor sheath green, barely protruding beyond anal styles.

Measurements

Range and mean (in mm) for 10 males, 2 females (includes smallest and largest specimens). *Length of body* (including head): male 11.0–14.5 (13.5); female (including ovipositor) 14.6–14.6 (14.6). *Length of forewing*: male 12.8–15.9



Figs 1–6. *Jassopsaltria* species, live in natural habitat: (1) *J. minilyaensis* **sp. n.**; (2) *J. rufifacies*; (3) *J. gracilens* **sp. n.**, mating pair, female uppermost; (4) *J. aeroides* **sp. n.**; (5) *J. cinnamomea* **sp. n.**; (6) *J. gracilens* **sp. n.**, in song.

(15.2); female 16.6–17.0 (16.8). *Width of head* (including eyes): male 4.6–5.5 (5.2); female 5.8–5.9 (5.85). *Width of pronotum* (across lateral angles): male 4.7–5.7 (5.4); female 6.2–6.2 (6.2).

Distinguishing features

Differs from all other *Jassopsaltria* species in having, in combination, a rostrum that extends well beyond the bases of the hind coxae, and a postclypeus that is uniformly reddish brown. The male genitalia have a slender uncus that is slightly wider on its distal half in dorsal view, and an aedeagus that is expanded distally on underside, the expansion gradually reducing towards apex.

Jassopsaltria aeroides sp. n.

(Figs 4, 9, 14, 19)

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Types. *Holotype* ♂ (Simon Lab. voucher 09.AU.WA.OVM.01, song recorded) (WAM reg. No. E109775), Western Australia, 43 km N of Overlander Roadhouse, NW Coastal Hwy, 26°1.602'S 114°19.092'E, 15.i.2010, Hill, Marshall, Moulds (WAM). *Paratypes as follows:* WESTERN AUSTRALIA: 1 ♂, AU.WA.OVN, 31.9 km N of Overlander Roadhouse, 26°8.333'S 114°21.644'E, 12.ii.2009, K. Hill & D. Marshall (DE). 1 ♂, same data as previous (LP). 4 ♂♂ (1 genitalia prep. JAS5; 1 Simon Lab. voucher 09.AU.WA.OVN.02), 1 ♀, same data as previous; 4 ♂♂ (2 Simon Lab. vouchers 10.AU.WA.OVM.01, 10.AU.WA.OVM.02), 1 ♀, same data as holotype (MSM). 1 ♂, AU.WA.OVN, 31.9 km N of Overlander Roadhouse, 26°8.333'S 114°21.644'E, 12.ii.2009, K. Hill & D. Marshall (PMH). 3 ♂♂ (WAM reg. Nos E109776–109778), AU.WA.OVN, 31.9 km N of Overlander Roadhouse, 26°8.333'S 114°21.644'E, 12.ii.2009, K. Hill & D. Marshall; 2 ♂♂ (WAM reg. Nos E109779–109780), AU.WA.OVM, same data as holotype (WAM).

Etymology

From the Latin *aeroides* and referring to the blue colour of the eyes and wing veins of this species.

Distribution and habitat (Fig. 19)

Known from just two localities in the far west of Western Australia, 32 km and 43 km north of the Overlander Roadhouse (near Shark Bay). There are records for mid January and mid February only. Adults inhabit *Acacia* bushes in semi-arid open shrubland.

Adult morphology (Figs 4, 9, 14)

In life light green with a blue tinge and few markings. Dried collection specimens often light yellowish brown.

Male (Figs 4, 9, 14). *Head* light green; postclypeus and anteclypeus pale brown with a broad medial area; lorum green with shades of pale brown distally; rostrum long, extending much further than bases of hind coxae, pale brown basally becoming black distally. Eyes of live specimens bluish. *Thorax* light green. Pronotum with fissures pale brown and along anterior margin between bases of fissures. Mesonotum sometimes with submedian sigilla a little darkened with



7



10



8



11



9



12

Figs 7–12. *Jassopsaltria* species, dorsal: (7) *J. ruffacies*; (8) *J. cinnamomea* **sp. n.**; (9) *J. aeroides* **sp. n.**; (10) *J. minilyaensis* **sp. n.**; (11) *J. danielsorum* **sp. n.**; (12) *J. gracilens* **sp. n.** Approximately 3x natural size.

brown, occasionally black at apex; in fresh specimens a line of silver pubescence along upper margin of wing groove reaching cruciform elevation. *Wings* hyaline. Forewing venation bluish becoming black on distal half; basal cell translucent bluish; basal membrane pale bluish grey. Hindwing venation very pale tending

translucent on basal half or more, becoming black distally. *Legs* with coxae, trochanters and femora green, foretibiae and tarsi brown, midtibiae pale orange at proximal end thereafter bluish becoming brown distally, mid- and hindtarsi brown. *Meracantha* greenish. *Opercula* very pale green; in life usually covered in silver pubescence. *Timbal covers* greatly reduced to not much more than a narrow ridge that is partly sloping forwards; timbals with five long ribs spanning timbal membrane, ribs 1 and 2 (the two longest) joined dorsally. *Abdomen* with tergites green tending blue on tergite 8; sternites I–VI pale orange, sternites VII–VIII green, in life sternites I–VII usually with silver pubescence along lateral margins.

Genitalia (Fig. 14). Pygofer basal lobe lying tight against upper lobe, broad and apically rounded in lateral view, long and slender in ventral view; distal shoulders acutely pointed, distally directed; dorsal beak absent. Uncus widest a little before mid length, apically rounded, concave below. Aedeagus slender, tubular, broadly curved through almost 180° at about mid length so that the distal half is almost parallel with much of proximal half, slightly swollen distally, the apex in lateral view slightly sloping backwards.

Female. Similar to male. Abdominal segment 9 green, the same as body. Ovipositor sheath green, barely protruding beyond anal styles.

Measurements

Range and mean (in mm) for 10 males, 2 females (includes smallest and largest specimens). *Length of body* (including head): male 12.6–14.3 (13.3); female (including ovipositor) 11.5–13.3 (12.4). *Length of forewing*: male 17.0–18.3 (17.5); female 16.7–18.3 (17.5). *Width of head* (including eyes): male 5.4–5.9 (5.6); female 5.3–5.8 (5.55). *Width of pronotum* (across lateral angles): male 5.4–6.0 (5.6); female 5.4–6.0 (5.6).

Distinguishing features

Differs from all other *Jassopsaltria* species in having the postclypeus uniformly pale and entirely without markings. The rostrum extends far beyond the base of hind coxae and in life adults are pale blue in colour. The male genitalia have a slender uncus that is widest a little before mid length in dorsal view.

***Jassopsaltria danielorum* sp. n.**

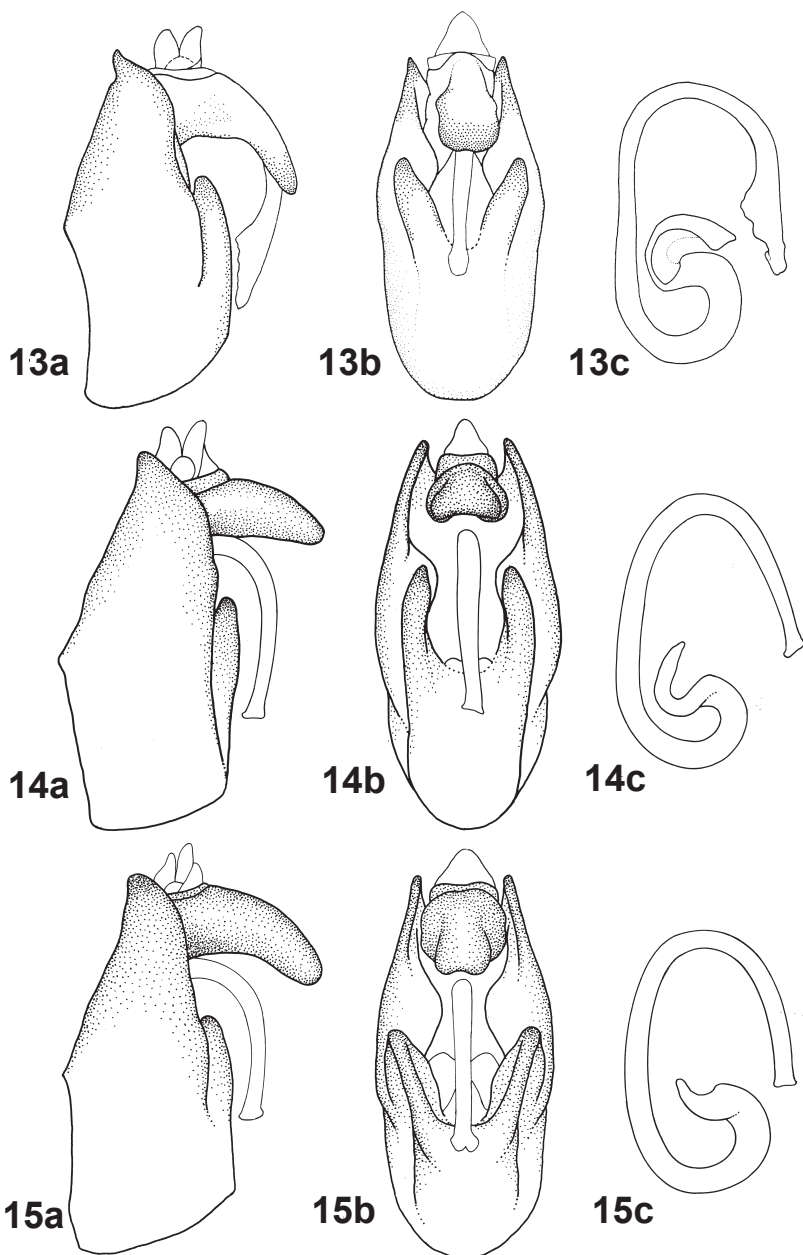
(Figs 11, 16, 19)

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Types. *Holotype* ♂ (WAM reg. No. E109817), Northern Territory, Gurrandalng [= Goorrandalng] camping area, Keep River Nat. Park, 100 m, 15°52'S 129°03'E, 3.i.1993, G. & A. Daniels (WAM). *Paratypes* as follows: NORTHERN TERRITORY: 2 ♂♂ (1 genitalia prep. JAS 4), 2 ♀♀, same data as holotype (MSM).

Etymology

Named for Greg and Alice Daniels who collected the type series and who have contributed enormously to Australian entomology through their extensive collecting spanning more than 50 years.



Figs 13–15. Male genitalia of *Jassopsaltria* species, (a) lateral view, (b) ventral view and (c) aedeagus: (13) *J. ruffacies*; (14) *J. aeroides* sp. n.; (15) *J. cinnamomea* sp. n.

Distribution and habitat (Fig. 19)

Known only from the upper reaches of the Keep River, Northern Territory, where the only recorded specimens were taken in early January. Adults were found in an area of scattered eucalypts with a ground cover of mostly spinifex (*Triodia* sp.) (G. Daniels, pers. comm.).

Adult morphology (Figs 11, 16)

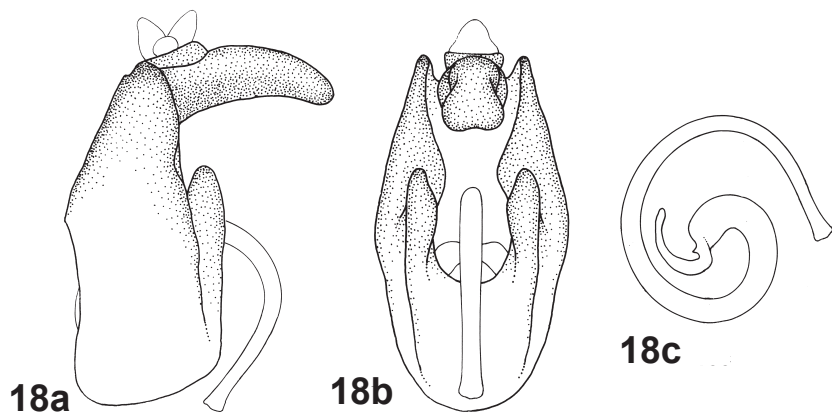
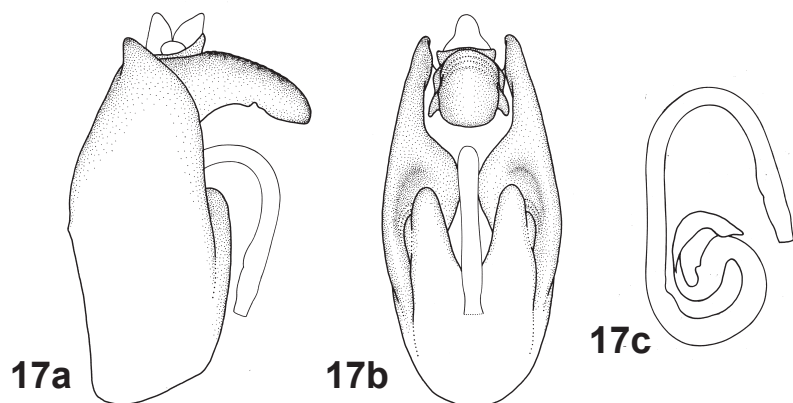
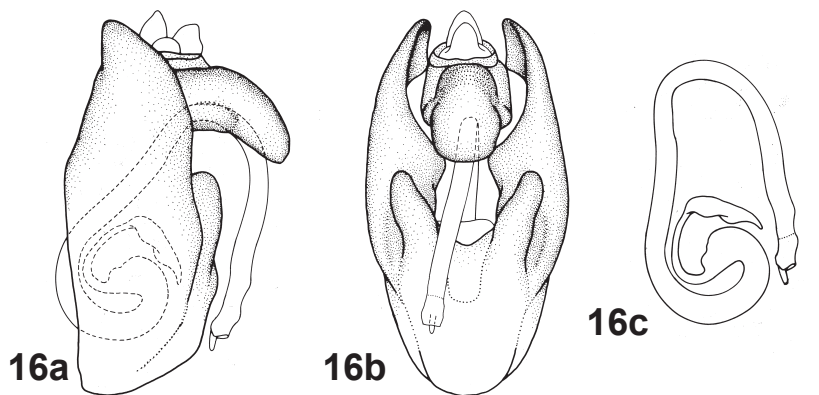
Male (Figs 11, 16). *Head* reddish brown with a little black edging the ocelli, along furrows between lateral ocelli and postclypeus and as a small spot near back of eyes, all variable; supra-antennal plates orange brown; postclypeus glossy brown to reddish brown; anteclypeus black with a broad dark brown midline; lorum black; rostrum reaching to bases of hind coxae, light brown becoming black distally. *Thorax* reddish brown, with a few black markings. Pronotum tending black along midline, along fissures and along anterior margin between bases of fissures. Mesonotum with submedian sigilla partly or entirely black and sometimes a little black at bases of lateral sigilla; scutal depressions brown or black. *Wings* hyaline. Forewing with vein 3A black, otherwise venation brown becoming black at apical cells; basal cell translucent light brown; basal membrane grey. Hindwing venation pale brown tending translucent through medial area. *Legs* light brown to reddish brown. *Meracantha* pale yellowish brown with blackish base. *Opercula* very pale brown suffused black along inner margin to apex; in life usually covered in silver pubescence. *Timbal covers* greatly reduced to not much more than a narrow ridge that is partly sloping forwards; timbals with five long ribs spanning timbal membrane, ribs 1 and 2 (the two longest) joined dorsally. *Abdomen* with tergites reddish brown; sternites brown with medial part of sternite II black; in life sternites I–VII usually with silver pubescence along lateral margins.

Genitalia (Fig. 16). Pygofer basal lobe lying tight against upper lobe, broad and apically rounded in lateral view, long and slender in ventral view; distal shoulders acutely pointed, distally directed; dorsal beak absent. Uncus slender, parallel-sided in dorsal view, apically broadly rounded, concave below. Aedeagus slender, tubular without taper, turned through approximately 180° basally and at about mid length so that distal half is tending parallel with much of proximal half, the apex square-cut.

Female. Similar to male. Abdominal segment 9 light brown, darker on dorsal surface and upper half of lateral anterior margin, black along ventral margin and lower half of lateral anterior margin, the dorsal beak dark brown. Ovipositor sheath dark brown, extending no further than anal styles.

Measurements

Range with mean (in mm) for 3 males, 2 females (includes all available specimens). *Length of body* (including head): male 9.9–10.9 (10.3); female (including ovipositor) 10.1–10.3 (10.2). *Length of forewing*: male 13.3–13.9 (13.5); female 14.5–14.7 (14.6). *Width of head* (including eyes): male 3.9–4.2



Figs 16–18. Male genitalia of *Jassopsaltria* species, (a) lateral view, (b) ventral view and (c) aedeagus: (16) *J. danielsorum* sp. n.; (17) *J. gracilens* sp. n.; (18) *J. minilyaensis* sp. n.

(4.1); female 4.0–4.2 (4.1). *Width of pronotum* (across lateral angles): male 3.8–4.1 (4.0); female 3.9–4.1 (4.0).

Distinguishing features

Distinguished from all other *Jassopsaltria* species in having, in combination, a rostrum that reaches to bases of hind coxae (rather than far beyond), and a forewing length *less than* 14 mm. In life they are dark reddish cicadas. The male genitalia have a slender uncus that is parallel-sided in dorsal view, and an aedeagus that has the apex square-cut.

Jassopsaltria cinnamomea sp. n.

(Figs 5, 8, 15, 20)

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Types. *Holotype* ♂ (Simon Lab. voucher 03.AU.WA.EEE.01) (WAM reg. No. E109781), Western Australia, 16 km E of Eneabba, 29°45.392'S 115°24.789'E, 237 m, 21.i.2003, Moulds, Hill, Marshall, Vanderpool (WAM). *Paratypes as follows:* WESTERN AUSTRALIA: 1 ♂, same data as holotype (DE). 1 ♂, same data as holotype (LP); 3 ♂♂ (1 genitalia prep. JAS7), Red Bluff, near coast N of Geraldton, 26.ix.1971, N. McFarland; 7 ♂♂, 2 ♀♀, Red Bluff, Kalbarri, 22.ix.1978, M.S. & B.J. Moulds; 5 ♂♂, 1 ♀, Hawatharra Hill Reserve, 30 km NNE of Geraldton, 28°33'S 114°40'E, 7.xii.1973, 23.i.1974, N. McFarland; 7 ♂♂ (1 genitalia prep. JAS1); 1 ♀, same data as holotype (MSM). 1 ♂, Red Bluff, Kalbarri, 22.ix.1978, M.S. & B.J. Moulds (PMH). 6 ♂♂ (WAM reg. Nos E109782–E109787), 1 female (WAM reg. No. E109788), same data as holotype (WAM).

Etymology

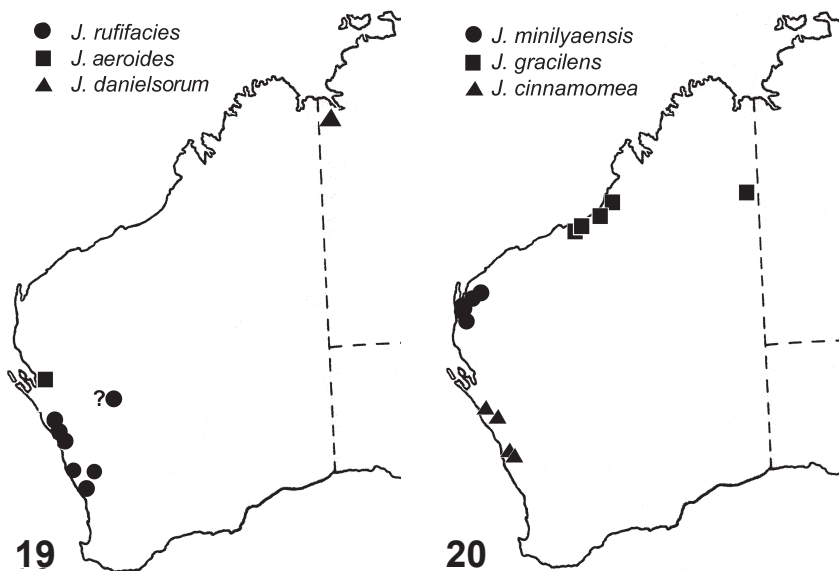
From the Latin *cinnamum* and referring to the cinnamon-like colour of this species.

Distribution and habitat (Fig. 20)

Subcoastal districts of Western Australia between Kalbarri and Eneabba. There are only three known localities, Red Bluff near Kalbarri, Hawatharra Hill Reserve near Geraldton, and 16 km east of Eneabba. There are records from late November to late January. Adults inhabit shrubs in open shrubland and are probably associated with *Acacia*.

Adult morphology (Figs 5, 8, 15)

Male (Figs 5, 8, 15). *Head* dark brown, sometimes a little paler near eyes; supra-antennal plates dark brown; postclypeus dark brown with a broad slightly paler midline; anteclypeus and lorum dark brown; rostrum long, extending much further than bases of hind coxae, mid brown basally becoming black distally. *Thorax* light to mid brown, with few darker markings. Pronotum tending dark brown along midline and fissures, and usually with a black patch on anterior of lateral angles that rarely extends to eye. Mesonotum with submedian and lateral sigilla partly or entirely dark brown; scutal depressions dark brown or black; cruciform elevation sometimes dark brown at anterior and posterior margin; in fresh specimens a line of silver pubescence along upper margin of wing groove reaching cruciform elevation. *Wings* hyaline. Forewing with vein 3A black,



Figs 19, 20. Distribution of *Jassopsaltria* species: (19) *J. ruffacies*, *J. aeroides* sp. n. and *J. danielsorum* sp. n.; (20) *J. minilyaensis* sp. n., *J. gracilens* sp. n. and *J. cinnamomea* sp. n.

otherwise venation brown becoming darker at apical cells; basal cell translucent, in part lightly tinted brown; basal membrane pale brown. Hindwing venation brown, the anal lobe tinted brown on basal half to three quarters. *Legs* brown, but yellowish at the joint between mid and hind femur and tibia. *Meracantha* brown tending yellowish towards apex. *Opercula* pale yellowish to light brown on basal half, black on distal half. *Timbal covers* greatly reduced to not much more than a narrow ridge that is partly sloping forwards; timbals with five long ribs spanning timbal membrane, ribs 1 and 2 (the two longest) joined dorsally. *Abdomen* with tergites mid to dark brown, suffused black sublaterally, the epipleurites pale yellowish to mid brown; sternites pale yellowish to mid brown; sternite II a mixture of mid and dark brown with auditory capsule dark brown to blackish; sternite VIII with midline partly suffused dark brown.

Genitalia (Fig. 15). Pygofer basal lobe lying tight against upper lobe, broad and apically rounded in lateral view, long and slender in ventral view; distal shoulders bluntly pointed, distally directed; dorsal beak absent. Uncus slender, almost parallel-sided in dorsal view but a little swollen on distal half or less, apically broadly rounded, concave below. Aedeagus gradually tapering throughout its length becoming slender distally, tubular, broadly curved through almost 180° at about mid length so that the distal half is almost parallel with much of proximal half, the apex a little expanded with a gently sloping end.

Female. Similar to male. Abdominal segment 9 light brown, darker on basal half or so, the dorsal beak dark brown. Ovipositor sheath brown, extending no further than anal styles.

Measurements

Range and mean (in mm) for 10 males, 4 females (includes smallest and largest specimens). *Length of body* (including head): male 10.7–13.5 (12.4); female (including ovipositor) 11.6–12.9 (12.1). *Length of forewing*: male 13.8–15.7 (14.8); female 14.0–14.8 (14.5). *Width of head* (including eyes): male 4.9–5.6 (5.2); female 4.9–5.4 (5.2). *Width of pronotum* (across lateral angles): male 5.0–5.9 (5.5); female 5.6–5.7 (5.65).

Distinguishing features

Differs from all other *Jassopsaltria* species in having, in combination, a rostrum that extends much further than the base of hind coxae, and a dark brown postclypeus. In life they are brown cicadas with slightly darker brown eyes. The male genitalia have a slender uncus slightly swollen on its distal half or less, and an aedeagus that has the apex a little expanded with a gently sloping end.

Jassopsaltria gracilens sp. n.

(Figs 3, 6, 12, 17, 20)

urn:lsid:zoobank.org:act:55BB8D72-7E2D-46DC-8726-E82C0959DBDB

Types. *Holotype* ♂ (Simon Lab. voucher 06.AU.WA.NSR.02, song recorded) (WAM reg. No. E109789), Western Australia, 23 km NE of Sandfire Rdhouse, 16 m, 19°40.741'S 121°16.042'E, 9.ii.2006, Hill, Marshall, Moulds (WAM). [GPS values from 2006 were taken using the map datum Geodetic Datum 49.] *Paratypes* as follows: WESTERN AUSTRALIA: 1 ♂, 1 ♀, near Wolfe Creek Meteorite Crater, 19°10.908'S 127°46.636'E, 25-26.i.2010, Hill Marshall Moulds (DE). 10 ♂♂, 1 ♀, Wolfe Creek, WA, 19°11'S 127°46'E, 19.x.2009, L.W. Popple; 1 ♂, 1 ♀, near Wolfe Creek Meteorite Crater, 19°10.908'S 127°46.636'E, 25.26.i.2010, Hill Marshall Moulds (LP). 3 ♂♂, 06.AU.WA.NSR same data as holotype; 12 ♂♂ (1 Simon Lab. voucher 06.AU.WA.EPR.01), 1 ♀, 180 km NE of Port Hedland, 11 m, 19°59.298'S 120°04.919'E, 10.ii.2006, Hill, Marshall, Moulds; 1 ♂, AU.WA.WPR, 147 km ENE of Port Hedland, 14 m, 20°04.940'S 119°46.205'E, 10.ii.2006; Hill, Marshall, Moulds; 4 ♂♂, 160 km ENE of Port Hedland, 20°00'S 120°00'E, 9.ix.1978, M.S. & B.J. Moulds; 3 ♂♂ (1 genitalia prep. JAS 2), 2 ♀♀, 80 km N of Sandfire Flat, nr Nita Hsd, 29.xii.1985, M.S. & B.J. Moulds; 2 ♂♂, AU.WA.TMH, Tanami Rd, 13 km SE of Bililuna, 312 m, 19°37.796'S 127°44.431'E, 26.i.2010, Hill, Marshall, Moulds; 9 ♂♂ (1 genitalia prep. JAS 3), 4 ♀♀, near Wolfe Creek Meteorite Crater, 19°10.908'S 127°46.636'E, 25.26.i.2010, Hill Marshall Moulds; 1 ♂, 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 (MSM). 1 ♂, near Wolfe Creek Meteorite Crater, 19°10.908'S 127°46.636'E, 25-26.i.2010, Hill Marshall Moulds (PMH). 1 male (Simon Lab. voucher 06.AU.WA.NSR.01), same data as holotype (UCONN). 1 male (WAM reg. No. E109790), AU.WA.WPR, 147 km ENE of Port Hedland, 14 m, 20°04.940'S 119°46.205'E, 10.ii.2006; Hill, Marshall, Moulds; 2 ♂♂ (WAM reg. Nos E109791–E109792), 80 km N of Sandfire Flat, nr Nita Hsd, 29.xii.1985, M.S. & B.J. Moulds; 5 ♂♂ (WAM reg. Nos E109793–E109797), AU.WA.EPR, 180 km NE of Port Hedland, 11 m,

19°59.298'S 120°04.919'E, 10.ii.2006, Hill, Marshall, Moulds; 8 ♂♂ (WAM reg. Nos E109798–E109805), 2 ♀♀ (WAM reg. Nos E109806–E109807), AU.WA.WOL, near Wolfe Creek Meteorite Crater, 19°10.908'S 127°46.636'E, 25.26.i.2010, Hill Marshall Moulds (WAM).

Etymology

From the Latin *gracilis* meaning slender, and referring to the slender body of this species, a feature shared only with *J. danielsorum* **sp. n.**

Distribution and habitat (Fig. 20)

Western margin of the Great Sandy Desert, Western Australia, mostly along the Great Northern Highway between 160 and 375 km ENE of Port Hedland, and at the eastern extremity of the same desert near the Northern Territory border within 60 km of Wolfe Creek Meteorite Crater. There are records from mid October to mid February. Adults inhabit semi arid shrublands with taller *Acacia* growing on red soils or sand.

Adult morphology (Figs 3, 6, 12, 17)

Male (Figs 3, 6, 12, 17). *Head* with vertex light to mid brown, sometimes tending yellowish on lateral vertex; a wavy black fascia (rarely dark brown) between eyes passing around median ocellus and a black spot against outer margin of lateral ocelli that is sometimes merged with the wavy black fascia; a small black spot at back of vertex touching or near eye; supra-antennal plates pale yellow; postclypeus glossy mid brown sometimes partly pale yellowish on dorsal surface and around most anterior part; lorum black; anteclypeus dark brown; rostrum reaching to bases of hind coxae, mid to dark brown basally becoming black distally. Eyes in life variable in colour from light brown to orange brown to pink. *Thorax* light to mid brown, with few darker markings, ventrally largely overlaid with white pubescence. Pronotum black or sometimes dark brown along midline and in midline and fissures, and as a short bar against anterior margin either side of midline; anterior of lateral angles of pronotal collar with a black patch that sometimes extends to eye. Mesonotum with submedian sigilla black along their outer margin but occasionally more extensively black; lateral sigilla usually with hints of dark brown, rarely with black; scutal depressions dark brown or black; usually a dark brown match anterior of scutal depressions; cruciform elevation black between anterior arms. *Wings* hyaline. Forewing venation usually pale brown to yellowish on basal half or so becoming black on distal half, rarely all black; basal cell translucent without pigmentation; basal membrane grey. Hindwing venation mostly pale brown to yellowish becoming black only about distal half of apical cells. *Legs* a mixture of light to mid brown, the distal ends of mid and hind femora nearly always light brown. Meracantha pale yellowish with nearly black base. *Opercula* pale yellowish with inner margin from near meracanthus and apex suffused black. *Timbal covers* greatly reduced to not much more than a narrow ridge that is partly sloping forwards; timbals with five long ribs spanning timbal membrane, ribs 1 and 2 (the two longest) joined dorsally. *Abdomen* with tergites mid brown, partly suffused with black variable between

individuals but usually along anterior margins of segments; sternites laterally pale yellowish to mid brown overlaid with white pubescence, broadly suffused black medially; sternite I dark brown; sternite VIII black medially.

Genitalia (Fig. 17). Pygofer basal lobe lying tight against upper lobe, broad and apically rounded in lateral view, long and slender in ventral view; distal shoulders bluntly pointed, distally directed; dorsal beak absent. Uncus slender, parallel-sided in dorsal view, apically broadly rounded, concave below. Aedeagus slender, turned through approximately 180° basally and at about midlength so that distal half is tending parallel with proximal half, tubular with almost no taper, the apex tending concave when viewed from above.

Female (Fig. 3). Similar to male. Abdominal segment 9 light brown, darker on dorsal surface and lateral anterior margin, the dorsal beak dark brown to black. Ovipositor sheath dark brown, extending no further than anal styles.

Measurements

Range and mean (in mm) for 10 males, 10 females (includes smallest and largest specimens). *Length of body* (including head): male 11.8–12.8 (12.3); female (including ovipositor) 10.9–12.4 (11.7). *Length of forewing*: male 14.9–16.3 (15.7); female 15.3–17.3 (16.3). *Width of head* (including eyes): male 4.7–5.3 (5.0); female 4.7–5.3 (5.1). *Width of pronotum* (across lateral angles): male 4.7–5.3 (5.1); female 4.8–5.6 (5.2).

Distinguishing features

Distinguished from all other *Jassopsaltria* species in having, in combination, a rostrum that reaches to bases of hind coxae (instead of far beyond), and a forewing length more than 15 mm. In life they are light brown cicadas. The male genitalia have a slender uncus that is parallel-sided in dorsal view, and an aedeagus that has the apex tending concave when viewed from above.

***Jassopsaltria minilyaensis* sp. n.**

(Figs 1, 10, 18, 20)

urn:lsid:zoobank.org:act:A8296EBD-32D4-41CE-AB46-32B8C5A3603F

Types. *Holotype* ♂ (Simon Lab. voucher AU.WA.MYS.05, song recorded) (WAM reg. No. E109808), Western Australia, 36 km S of Minilya Rdhse, 98 km N of Carnarvon, 24°8.171'S 114°2.878'E, 22 m, 13.ii.2009, K. Hill & D. Marshall (WAM). *Paratypes* as follows: WESTERN AUSTRALIA: 1 male 09.AU.WA.MYS, same data as holotype (DE). 1 male 09.AU.WA.MYS, same data as holotype (LP). 1 ♂, AU.WA.MYM, 140 km NNE of Minilya R., NW Coast Hwy, 22°53.329'S 114°48.907'E, 85 m, 16.i.2010, Hill, Marshall, Moulds; 2 ♂♂ (1 genitalia prep. JAS6), AU.WA.MYN, 39 km N of Minilya Rdhse, 41m, 23°33.38'S 114°14.073'E, 13.ii.2009, K. Hill & D. Marshall; 9 ♂♂ (1 Simon Lab. voucher 09.AU.WA.MYS.02), 1 ♀, same data as holotype; 3 ♂♂ (2 Simon Lab. vouchers 09.AU.WA.CPX.01, 09.AU.WA.CPX.02), 125 km N of Minilya Roadhouse, 22°57.343'S 114°40.028'E, 13.ii.2009, K. Hill & D. Marshall; 1 ♂, AU.WA.NAS, 26.7 km S of Nanutarra Roadhouse, 22 42.462'S 115 19.388'E, 13.ii.2009, K. Hill, D. Marshall (MSM). 1 ♀ 09.AU.WA.MYS, same data as holotype (PMH). 1 male (WAM reg. Nos

88/395 and also 38324), 27 km NE of Giralda Hs, 16.xii.1978, D. Knowles & M. Hanlon; 1 male (WAM reg. No. E109809), AU.WA.CPX, 125 km N of Minilya Roadhouse, 22°57.343'S 114°40.028'E, 79 m, 13.ii.2009, K. Hill & D. Marshall; 7 ♂♂ (WAM reg. Nos E109810–E109816), AU.WA.MYS., same data as holotype (WAM).

Etymology

Named from the locality near which all known specimens have been found.

Distribution and habitat (Fig. 20)

Known only from a small area extending from 36 km south to 140 km north of Minilya (around 125 km north of Carnarvon), Western Australia. There are records from mid December to mid February. Adults inhabit open shrubland growing on red sand dunes. They can be found in all kinds of *Acacia* shrubs and on other random small plants.

Adult morphology (Figs 1, 10, 18)

Male (Figs 1, 10, 18). *Head* light green, sometimes with a little brown edging ocelli, along furrows between lateral ocelli and postclypeus and as a small spot near back of eyes, all variable; postclypeus glossy light brown with brown or black midline and transverse grooves; anteclypeus dark brown with light brown centre; lorum dark brown; rostrum long, extending much further than bases of hind coxae, brown becoming black distally. Eyes of live specimens light to mid brown. *Thorax* green with hints of pale orange. Pronotum with fissures pale brown and along anterior margin between bases of fissures. Mesonotum sometimes with submedian sigilla a little darkened, tending brown with a pale orange margin; scutal depressions sometimes brown or black; in fresh specimens a line of silver pubescence along upper margin of wing groove reaching cruciform elevation. *Wings* hyaline. Forewing with vein 3A black, otherwise venation pale green becoming black at apical cells; basal cell hyaline; basal membrane pale grey. Hindwing venation very pale tending translucent on basal half or more, becoming black distally. *Legs* mostly light brownish yellow or green and some brown markings. Forelegs with coxae, trochanters and femora green partly with brown overtones, the femora with longitudinal brown markings sometimes extensive. Mid- and hindlegs with coxae, trochanters and femora brownish yellow, the femora each with two or three distinct longitudinal brown fascia; tibiae and tarsi brown. Meracantha very pale brown. *Opercula* very pale brown; in life usually covered in silver pubescence. *Timbal covers* small, tending triangular, reaching a little beyond halfway across timbal cavity and substantially reduced along upper margin; timbals with five long ribs spanning timbal membrane, ribs 1 and 2 (the two longest) joined dorsally. *Abdomen* with tergites green tending blue on tergite 8; sternites pale brown, in life sternites I–VII usually with silver pubescence along lateral margins.

Genitalia (Fig. 18). Pygofer basal lobe lying tight against upper lobe, broad and apically rounded in lateral view, long and slender in ventral view; distal shoulders bluntly pointed, distally directed; dorsal beak absent. Uncus slender, tending a little wider on distal half or more, apically broadly rounded, concave

below. Aedeagus slender, tubular, spiralled, very gently tapered throughout its length, the apex a little expanded with a nearly square-cut end.

Female. Similar to male. Abdominal segment 9 green, the same as body. Ovipositor sheath dark brown, extending no further than anal styles.

Measurements

Range and mean (in mm) for 10 males, 1 female (includes smallest and largest specimens). *Length of body* (including head): male 11.8–13.0 (12.5); female (including ovipositor) 12.7. *Length of forewing*: male 15.7–17.3 (16.4); female 17.4. *Width of head* (including eyes): male 5.0–5.4 (5.2); female 5.6. *Width of pronotum* (across lateral angles): male 5.3–5.9 (5.5); female 5.8.

Distinguishing features

Differs from all other *Jassopsaltria* species in having a pale postclypeus with clearly defined black lateral grooves. In life they are green cicadas and the rostrum extends much further than bases of hind coxae. The male genitalia have a slender uncus that is slightly wider on its distal half or more, and an aedeagus that is spiralled in shape and very different in that respect from all other *Jassopsaltria* species.

Song variation in *Jassopsaltria*

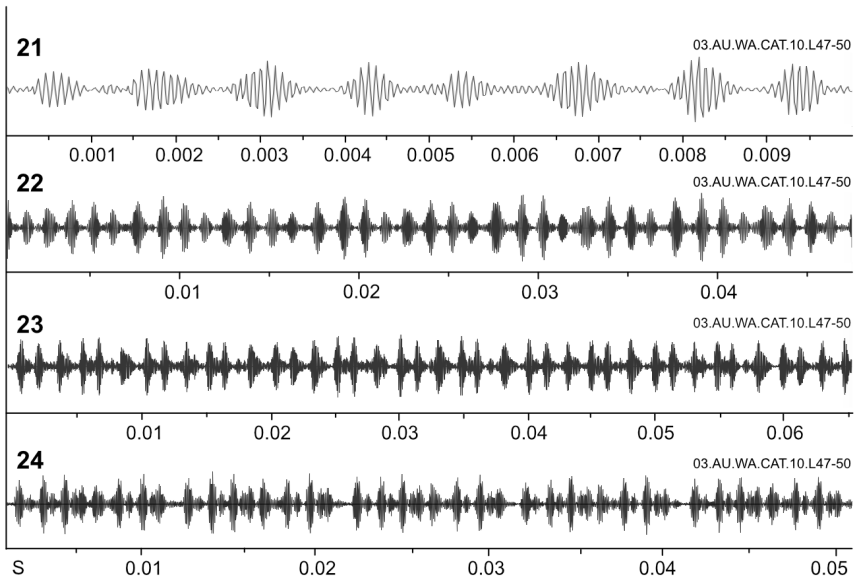
As most of the *Jassopsaltria* species have been audio recorded from only one or a few locations, and fine-scale structure is often variable within song samples as discussed below, the descriptions and conclusions on song structure and differences below should be viewed with this in mind. Additional recordings will likely expand the observed range of the song parameters measured.

Males of all species sing from low perches in vegetation and produce songs from a given position for at least many minutes at a time. They do not readily take to flight when carefully approached, and instead appear to rely on cryptic colouration for concealment. See the Types section for location details of specimen codes referenced below for each species.

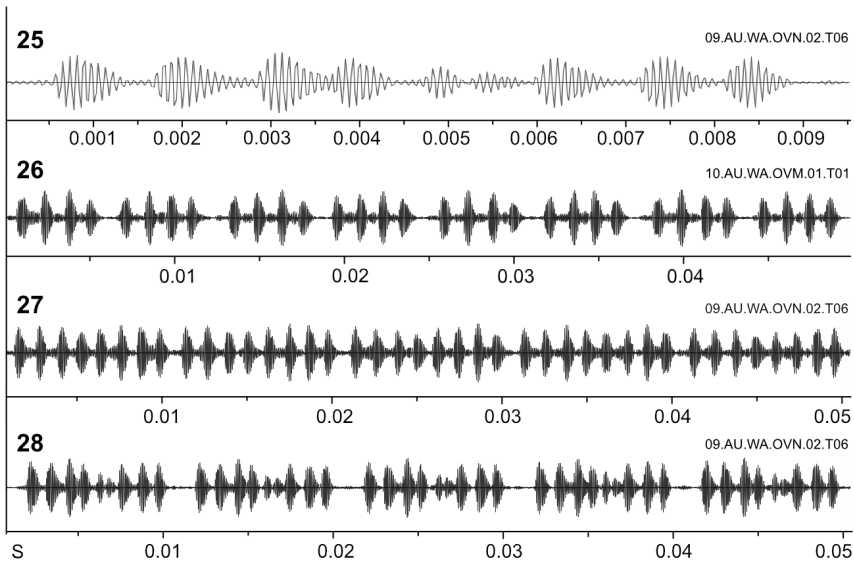
***Jassopsaltria rufifacies* (Figs 21–24)**

Song-recorded specimens. 03.AU.WA.CAT uncollected males (218 s, 24.3 °C); 09.AU.WA.KBB.01 (70 s, 39 °C); 10.AU.WA.GRE.02 (100 s, 27.5 °C); 10.AU.WA.MOX.01 (90 s, temp. not recorded, very hot), 10.AU.WA.MOX site uncollected male (100 s).

Song in *Jassopsaltria rufifacies* consists of pulses of up to about 0.9 ms duration repeated at approximately 740–910/sec (when produced in distinguishable syllables), with minor amplitude variation (Fig. 21), creating a smooth whining buzz of indefinite duration. Pulses are sometimes subtly grouped in 2+1+2 or 4-pulse patterns, and sometimes with 4-pulse syllables subtly grouped into pairs (Figs 22–24). Often in our recordings, pulses appear in extremely irregular patterns for extended periods (e.g., in cage recordings), with the pulse structure itself difficult to consistently distinguish, perhaps due to asynchronous and shifting-phase timbal action; field observations suggest that disturbance may



Figs 21–24. Oscillograms showing song structure and variation in *Jassopsaltria ruffacies* sp. n. Vertical axis is linear amplitude. The code shown for each is the recording track number.



Figs 25–28. Oscillograms showing song structure and variation in *Jassopsaltria aeroides* sp. n. Vertical axis is linear amplitude. The code shown for each is the recording track number.

induce this behaviour. The sound frequency profile is not modulated over time in our recordings; the highest amplitude frequencies are found within the range 10.3–12.7 kHz, and the sound energy is strongest in a frequency band ranging from 9.3–14 kHz (the window within which the amplitude remains within 10 dB of the maximum intensity).

Jassopsaltria aeroides **sp. n.** (Figs 25–28)

Song-recorded specimens. 09.AU.WA.OVN.02 (55 s, 39 °C); 09.AU.WA.OVN uncollected males (53 s, 39 °C); 09.AU.WA.OVM.01 (temp. not recorded, very hot conditions).

Song similar to that of *Jassopsaltria rufifacies* in the structure of its fundamental pulses (Fig. 25). Steadily repeated 4-pulse syllables (Fig. 26) and 2-syllable macrosyllable arrangements (Figs 27–28) appear most common in our recorded sample, but more data will be needed to confirm this. All of these forms yield a similar overall pulse rate of about 770–940/s. Unlike all other *Jassopsaltria* studied so far, males of *J. aeroides* **sp. n.** often irregularly and sometimes rhythmically modulate the sound frequency spectrum up and down, with the upsweep faster than the downsweep, producing revving waves occurring approximately every 1–3 s. This behaviour may be associated with either disturbance or courtship. Occasional frequency modulation in the other species studied, if present, is erratic and less pronounced. Measurements of the sound spectrum yield similar results to those of *J. rufifacies* at the upper end of the oscillations, with a shift of approximately 0.5–1 kHz in the peak frequency down to the lower range of the oscillation.

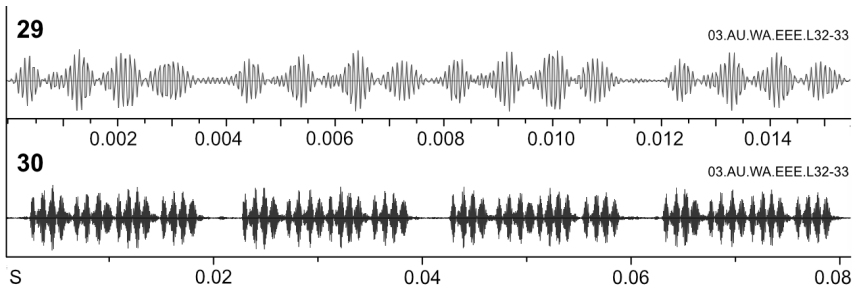
Jassopsaltria danielsorum **sp. n.**

Song not recorded.

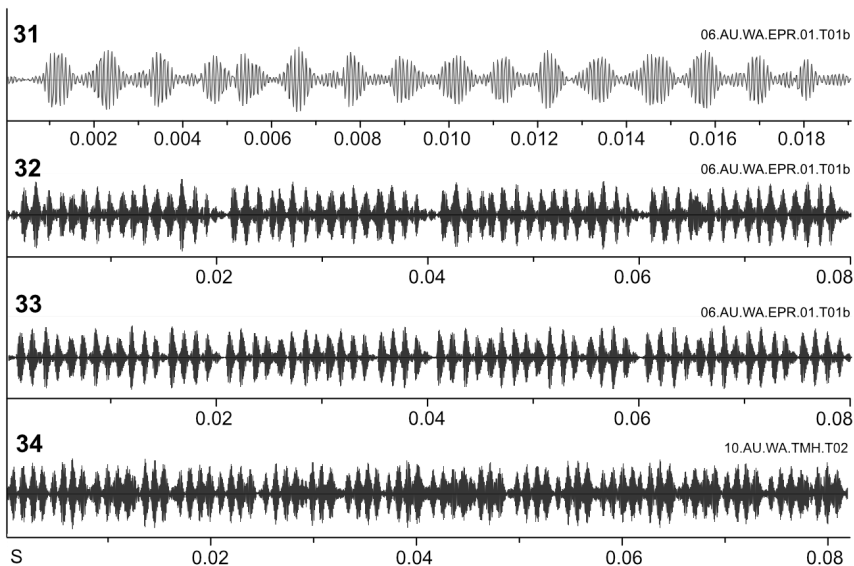
Jassopsaltria cinnamomea **sp. n.** (Figs 29–30)

Song-recorded specimens. 03.AU.WA.EEE uncollected male (71 s, 37.1 °C).

Song again similar to that of *Jassopsaltria rufifacies* in the structure of its fundamental pulses (Fig. 29) and, also as in *J. rufifacies*, produced as a steady whining buzz of indefinite duration. In its higher order structure, *J. cinnamomea* **sp. n.** differs from both *J. rufifacies* and *J. aeroides* **sp. n.** in that the pulses are grouped into sets of four syllables, each with four pulses (Fig. 30). The pulses are produced at about 1100–1200/s, the syllables are produced at about 250/s, and the macrosyllables themselves at about 51/s (keeping in mind that all of these measurements are presumably temperature-dependent, and that only one recording was obtained). The peak frequency varies from 10.8–12.8 kHz, with the main (+/- 10 dB) sound energy ranging from 10.3–13.3 kHz and showing no frequency modulation. The buzz is coarser in quality than in either *J. rufifacies* or *J. aeroides* **sp. n.** In most of the 4-syllable macrosyllables, the gap between the second and third syllables is slightly shorter (as figured), but sometimes the first or third gaps are shorter.



Figs 29, 30. Oscillograms showing song structure in *Jassopsaltria cinnamomea* **sp. n.** Vertical axis is linear amplitude. The code shown for each is the recording track number.



Figs 31–34. Oscillograms showing song structure in *Jassopsaltria gracilens* **sp. n.** Vertical axis is linear amplitude. The code shown for each is the recording track number.

Jassopsaltria gracilens **sp. n.** (Figs 31–34)

Song-recorded specimens. 06.AU.WA.EPR.01 (19 s, 31.5 °C); 06.AU.WA.EPR uncollected male (32 s, 31.5 °C); 10.AU.WA.WOL.02 (75 s, < 8:40 AM); 10.AU.WA.WOL uncollected male tracks (13 s, 50 s, 38 s, < 8:40 AM); 10.AU.WA.TMH uncollected male tracks (10 s, 5 s, mid-30's °C).

Song with fundamental pulses structured as in the preceding species (Fig. 31). Higher order structure sometimes similar to that of *J. cinnamomea* **sp. n.**, with 4-syllable macrosyllables consisting of 4-pulse syllables (Figs 32–33). Other recordings lack clear macrosyllable structure, and some sections exhibit repeated

single or double syllables (Fig. 34). Repetition rates of pulses and syllables are about 760–1000/s and 180–230/s respectively, for the 4-syllable song form, somewhat slower than in *J. cinnamomea* **sp. n.**, but the only *J. cinnamomea* recording was made at a much higher temperature. Notably, the macrosyllable repetition rate is again around 50/s (40–60), in part due to their closer spacing. Peak frequencies range from about 9.9–12.3 kHz, with the main sound energy found within the range 9–12.9 kHz. Unlike the preceding species, song is regularly produced in bouts of usually 2–9 seconds in length, separated by silent gaps of about 1–5 seconds. Males sometimes utter little buzzes after the main call (K. Hill pers comm.).

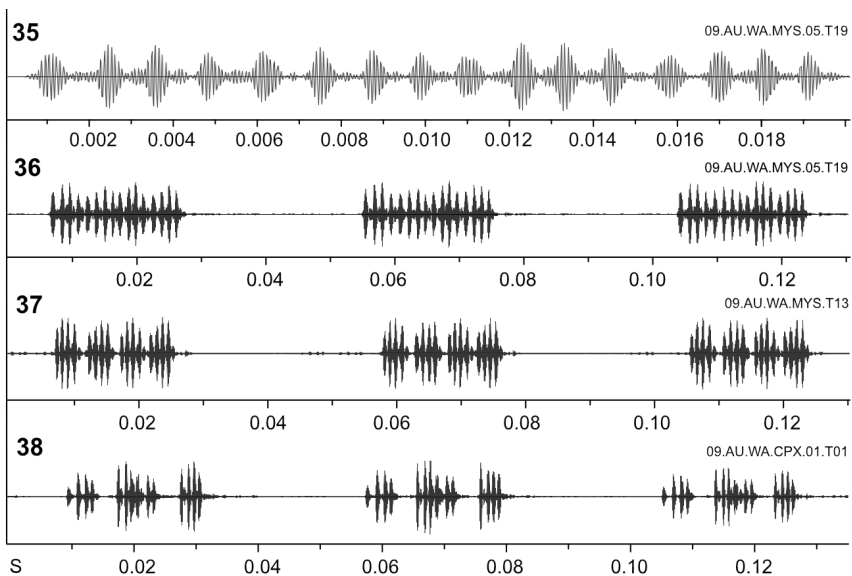
Jassopsaltria minilyaensis **sp. n.** (Figs 35–38)

Song-recorded specimens. 09.AU.WA.CPX.01 (60 s, $\approx 40^{\circ}\text{C}$); 09.AU.WA.CPX.01 (45 s; $\approx 40^{\circ}\text{C}$). 09.AU.WA.NAS.01 (36 s). 09.AU.WA.MYS.02 (95 s); 09.AU.WA.MYS.05 (73 s); 09.AU.WA.MYS uncollected male tracks (80 s, 49 s, 15 s, 52 s). (All WA.MYS recordings 9:20–11:40AM, with temperature 38°C by 11:40AM.)

Song pulse, 4-pulse syllable, and 4-syllable macrosyllable structure resembling *J. cinnamomea* **sp. n.** and *J. gracilens* **sp. n.**, but distinctive in having the macrosyllables widely separated and produced at a rate of about 18–22/s, with the gaps between them longer than the macrosyllables themselves (Figs 35–38). This allows the separate macrosyllables to be easily distinguished by the human ear. Pulses within syllables are also sometimes produced with a markedly decreasing rate. Despite the much slower macrosyllable repetition rate, the syllable repetition rates within macrosyllables and the pulse repetition rates within syllables are approximately 900/s (700–1100) and 190/s (160–220), about the same as in *J. gracilens* **sp. n.** Thus, temperature differences alone are unlikely to account for the slow macrosyllable repetition rate in *J. minilyaensis* **sp. n.** Song bouts continue for indefinite periods. Peak frequencies range from about 10.5–12.4 kHz, with the main sound energy found within the range 9.5–13.7 kHz.

Discussion

The song descriptions, while based on the limited material available, are sufficient to show that the songs are minimally divergent in most cases (Figs. 21–38) (*Jassopsaltria danielsorum* **sp. n.** has not yet been recorded). The considerable variation in pulse pattern observed within some song bouts of individual males is a contributing factor. Only the song of *J. minilyaensis* **sp. n.**, with its staccato song caused by widely spaced macrosyllables, differs to a degree that makes it easily distinguishable from all recordings of the other species in its fundamental pattern of syllables and macrosyllables (keeping in mind that only few localities have been examined). In addition to this, the species that produce 4-syllable macrosyllables (*J. cinnamomea* **sp. n.**, *J. minilyaensis* **sp. n.**, and *J. gracilens* **sp. n.** in some recordings) can be distinguished as a group from *J. rufifacies* and *J. aeroides* **sp. n.**, which exhibit either no syllable



Figs 35–38. Oscillograms showing song structure in *Jassopsaltria minilyaensis* sp. n. Vertical axis is linear amplitude. The code shown for each is the recording track number.

grouping or macrosyllables with fewer syllables. *J. aeroides* can be distinguished by its often-rhythmic frequency modulation, and *J. gracilens* is distinguishable by its habit of producing short song bouts separated by silent gaps. *J. rufifacies* and *J. cinnamomea* are the most similar, but a careful ear can detect the coarser quality of the buzz in the latter species, created by the macrosyllable structure. Because none of the species have yet been found in sympatry, it remains possible that none of the song differences are sufficient to confer premating reproductive isolation, a situation that has been observed in some parapatric cicada species and subspecies complexes (e.g., Popple 2013, Hertach *et al.* 2015, Marshall & Hill, 2017). Further work should focus on areas of potential contact between the species.

Acknowledgements

For access to the type of *Jassopsaltria rufifacies* in the SAM we thank Jane Forrest. We are especially grateful to David Rentz for photographing the specimens used in Figs 7–12. For the genitalia drawings of *Jassopsaltria rufifacies* we thank Kyra Kopestonsky, for the wing drawings we thank Hannah Matthews, while all other drawings of genitalia were done by Ivan Nozaic; to all three people we express our sincere thanks. Kathy Hill participated in field collection efforts and took the photographs of live specimens. We thank Paul Hutchinson, David Emery and Lindsay Popple for helpful comments on the manuscript. Specimens were collected under permits to MSM, DM and K. Hill (permit numbers SF007173,

CE002260, SF006180, SF005275 and SF003997) from the Western Australian Department of Environment and Conservation. Financial support was provided by NSF grants DEB1655891, DEB0955849, DEB0720664, DEB0529679, and DEB0089946 to C. Simon, D. Marshall, J. Cooley, M. Villet and M. Moulds.

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