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## Revision of *Leades* Jacobi with the description of a new genus, *Yamirrina* gen. nov., and notes on the absence of *Iolania* Kirkaldy from Australia (Hemiptera: Auchenorrhyncha: Fulgoromorpha: Cixiidae: Cixiini)

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### Abstract

The transfer of two species renders *Iolania* Kirkaldy, 1902 absent from Australia and endemic to Hawaii. *Iolania clypealis* Muir, 1931 is transferred into *Leades* Jacobi, 1928, resulting in the new combination *Leades clypealis* (Muir). The new genus *Yamirrina* gen. nov. is created to accommodate *Iolania vittipennis* Muir, 1931, which leads to the new combination *Yamirrina vittipennis* (Muir). Another species, *Yamirrina concolor* sp. nov., is added to the genus. The hitherto monotypic genus *Leades* is revised, and with the addition of four new species, *Leades grandis* sp. nov., *L. ginginensis* sp. nov., *L. centralis* sp. nov., *L. warro* sp. nov., and with *L. clypealis* and *L. rufinus* Jacobi, 1928, *Leades* now contains six species in total. *Leades* and *Yamirrina* are endemic to Australia. Redescriptions are provided for *Leades rufinus*, *L. clypealis* and *Y. vittipennis*. Identification keys to the genera of Australian Cixiini, and to all species of *Leades* and *Yamirrina*, are presented and host plant relationships are discussed.

**Key words:** Homoptera, Fulgoroidea, planthopper, south-west Australia, Hawaii, host plant

### Introduction

Cixiini is one of eight tribes in the family Cixiidae recorded from Australia. Due to their plant feeding behaviour, cixiids are able to transmit plant pathogens, e.g., the Cixiini species *Cixius wagneri* (China, 1942) putatively transmits *Candidatus Phlomobacter fragariae*, a bacterium causing marginal chlorosis in strawberries in France (Danet *et al.* 2003). The Australian Cixiini fauna is not sufficiently studied to know whether it harbours vectors of plant diseases, although no native species have been found to be important vectors in agriculture to date. Until recently, the Australian cixiid fauna was understudied. For example, the Australian members of the genera treated within this paper have not been revised for almost a century. Along with revisions of other Australian Cixiini genera (Löcker 2014a, 2014b, 2015; Löcker & Holzinger 2019) this paper aims at increasing our knowledge of the Australian planthopper fauna.

In 1902 Kirkaldy created the genus *Iolania* to accommodate its type species *I. perkinsi* Kirkaldy, 1902 (from Oahu and Hawaii). A further four species from Hawaii were added by Giffard (1925). Even though Muir (1931) remarked that his two new Australian species, *I. clypealis* Muir, 1931 and *I. vittipennis* Muir, 1931, show very little affinity with each other or with the Hawaiian species, he nevertheless assigned them to the genus *Iolania*, based on the erroneously assumed absence of lateral spines on the hind tibia. The placement of the two Australian species within *Iolania* was subsequently questioned by several authors such as Zimmermann (1948), Asche (1997) and Emeljanov (2000). Hoch (2006), whilst studying the systematics and evolution of *Iolania*, described a new species from Hawaii and showed that the six Hawaiian species form a monophyletic clade, whilst the Australian species do not share the synapomorphies of the Hawaiian species, differing in major features such as the configuration of the vertex and the frontoclypeal suture and are therefore not congeneric. Consequently, Hoch (2006) regarded the two Australian species as *incertae sedis*. Further, Asche (1997) noted that *I. clypealis* and *I. vittipennis* differ in major features and appear to represent different evolutionary lines. This view was shared by Löcker (2007), who indicated that *I. clypealis* should be transferred to *Leades* Jacobi, 1928, and a new genus created for *I. vittipennis*. Results of a comprehensive examination of the type material, as well as other material of the two Australian species, are presented in this paper.

The monotypic genus *Leades* was proposed by Jacobi (1928) to accommodate the Western Australian species *Leades rufinus* Jacobi, 1928. Several undescribed species of *Leades* have been uncovered from across Australia by the author whilst studying material from Australian and overseas collections. These new species are illustrated and described here.

## Material and methods

Males were dissected by softening the entire specimen for 1–2 days in a humid chamber: a plastic box containing a paper towel soaked with vinegar to prevent mould. Mounted specimens were pinned on a piece of Styrofoam and put in the humid chamber. After softening, the specimens were demounted and the pygofer carefully removed using forceps and pins. The specimens were then remounted and the pygofer transferred to a beaker containing hot soapy water for few minutes to be softened further before examination. For the short-term, genitalia were stored in cavity slides (square piece of plexiglass, with a hole drilled into it, glued onto a microscopic slide) containing glycerol. For long-term storage, the genitalia were transferred into micro-vials with glycerol.

Insects were examined and measured using an Olympus SZH10 stereo microscope with an eyepiece graticule. Photographs were taken with a digital SLR camera (Canon EOS 5D Mark III, 65mm macro lens with up to five times zoom; Canon Utility Software) through different dissecting microscopes (Leica M165, Olympus BX50 and SZX16) and later stacked using Helicon Focus. Photographs taken with the digital SLR camera attached to an Olympus BX50 dissecting microscope were used as a base for line illustrations.

All specimens illustrated (line art and photographs) are male specimens apart from Figures 1, 6B–D, 6F, 9A and 9C.

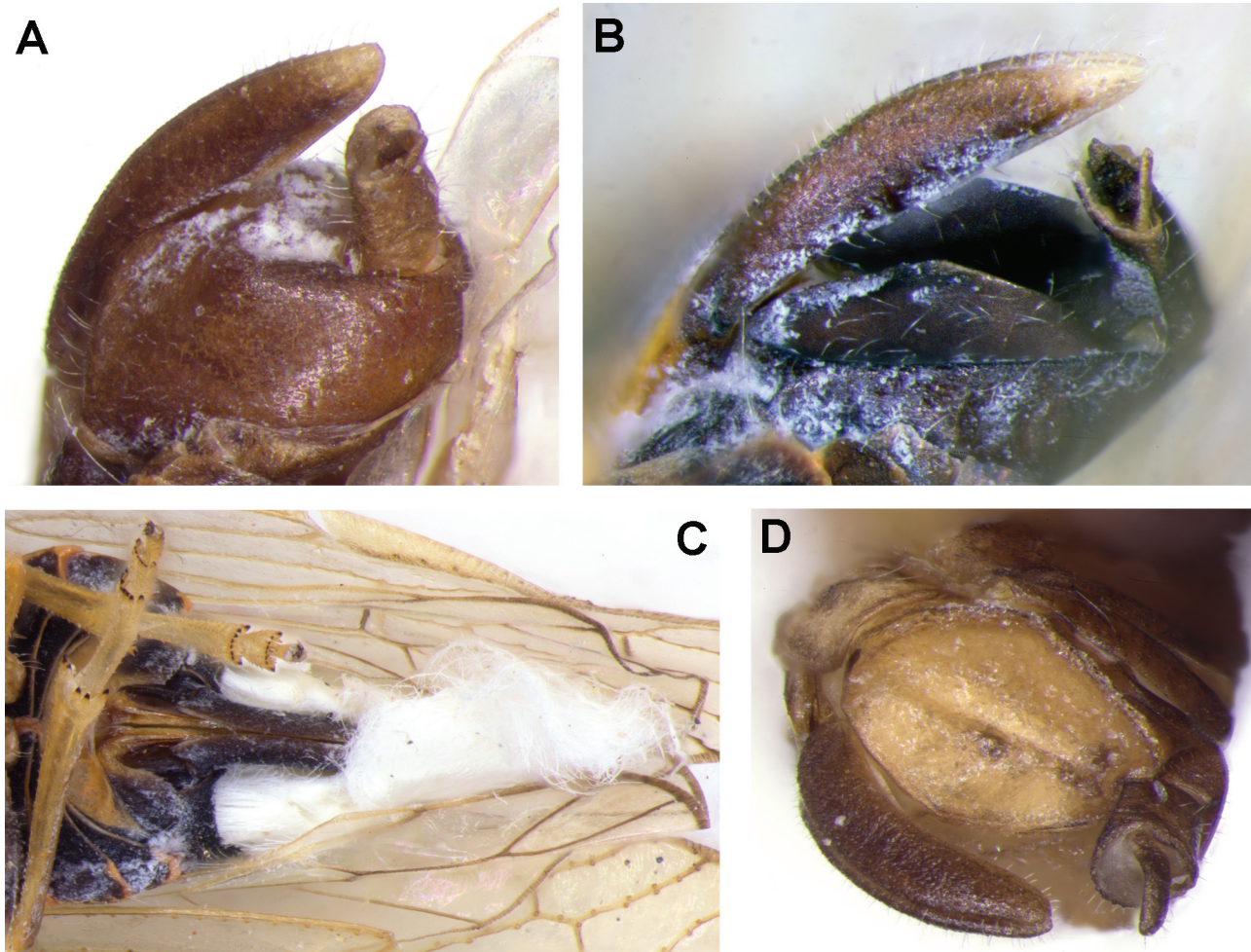
The morphological terms applied here follow Löcker *et al.* (2006); terminology of tegminal veins follows Bourgoin *et al.* (2015) and Löcker & Holzinger (2019). The following is a list of the measurements taken in this study:

- Body length: tip of head to posterior margin of forewing
- Length of vertex: distance between basal emargination and apical carina in midline
- Width of vertex: at level of basal emargination
- Length of frons: apical transverse carina to frontoclypeal suture, in midline
- Width of frons: at level of frontoclypeal suture
- Width of forewing: at level of apex of clavus
- Length of forewing: base to posterior margin of forewing

## Abbreviations

AMS	Australian Museum, Sydney, Australia
ANIC	Australian National Insect Collection, CSIRO, Canberra, Australia
ASCU	Agricultural Scientific Collections Unit (Biosecurity Collections), NSW Department of Primary Industries, Orange, Australia
BMNH	British Museum of Natural History, London, United Kingdom
BPBM	Bernice Pauahi Bishop Museum, Honolulu, United States of America
CAS	California Academy of Sciences, San Francisco, USA
MLM	Melinda L. Moir Private Collection, Perth, Australia
MTD	Museum für Tierkunde, Staatliche Naturhistorische Sammlungen, Dresden, Germany
NHRS	Naturhistoriska Riksmuseet, Stockholm, Sweden
NSW	New South Wales
NT	Northern Territory
QDPI	Queensland Department of Primary Industries, Brisbane, Australia
Qld	Queensland
QM	Queensland Museum, Brisbane, Australia
RBINS	Royal Belgian Institute of Sciences, Brussels, Belgium
SA	South Australia
SS	Suction Sampling (Vacuum sampling)

SAMA South Australian Museum, Adelaide, Australia  
 UDCC University of Delaware, Newark, United States of America  
 UQIC University of Queensland Insect Collection, Brisbane, Australia (now part of the QM collection)  
 Vic Victoria  
 WA Western Australia  
 WADA Department of Primary Industries and Regional Development, Perth, Australia  
 WAM Western Australian Museum, Perth, Australia



**Figure 1.** Female genitalia: **A**, *Leades clypealis* caudo-lateral; **B–C**, *Leades rufinus*: (B) caudo-lateral, (C) ventral; **D**, *Yamirrina vittipennis* caudo-lateral.

## Results

### Key to genera of Australian Cixiini

1. Median carina of frons forked (Löcker 2015: Figs 6C, 6E).....2
- Median carina of frons unforked (Fig. 2C) .....3
2. Vertex in midline at least twice as long as pronotum; lateral carinae of pronotum C-shaped, lateral parts directed towards head (Löcker 2015: Fig. 6D); angle formed by hind margin of pronotum rectangular or moderately obtuse; first hind tarsomere with eight apical teeth and four setae ..... *Yanganaka* Löcker, 2015
- Vertex in midline about as long as pronotum; lateral carinae of pronotum S-shaped, second bend turning towards mesonotum (Löcker 2015: Fig. 6B); angle formed by hind margin of pronotum broadly obtuse; first hind tarsomere with 5–7 apical teeth and no setae ..... *Aka* White, 1879
3. Second hind tarsomere without platellae but with three or fewer very fine setae (Fig. 8E) .....4
- Second hind tarsomere with four or more platellae (Fig. 7E) .....6
4. Apical transverse carina deeply U-shaped ..... *Monomalpha* Emeljanov, 2000
- Apical transverse carina V-shaped, shallowly U-shaped or almost straight (Figs 3E, 5C, 6C, 7B, 8B).....5

- 5 Basal compartment of vertex about as long as wide (Figs 8B, 9B,E) ..... *Yamirrina* **gen. nov.**
- Basal compartment of vertex no more than half as long as wide (Löcker 2014a: Fig. 4B) ..... *Leptolamia* Metcalf, 1936
- 6 Forewing with  $CuA_2$  reaching the margin of forewing in its entire thickness (Figs 6A, 18A); second hind tarsomere with two fewer platellae than apical teeth (Fig. 7E).....7
- Forewing with  $CuA_2$  either ending well before it reaches the margin of the forewing or reaching the margin but with slightly reduced thickness (Löcker 2014b: Fig. 1); second hind tarsomere with four fewer platellae than apical teeth ..... *Calamister* Kirkaldy, 1906
- 7 Forewing with crossvein r-m<sub>1</sub> usually distad (Löcker & Holzinger 2019: Fig. 28H) or at same level as fork  $MP_{1+2}$  and  $MP_{3+4}$ ; RA forked or unforked; male anal tube with ventral lobe in lateral view narrow near base, widening towards apex; male anal style about as long as remainder of 11<sup>th</sup> segment (Löcker & Holzinger 2019: Fig. 23E)..... *Chidaea* Emeljanov, 2000
- Forewing with crossvein r-m<sub>1</sub> usually distinctly basad of fork  $MP_{1+2}$  and  $MP_{3+4}$  (Figs 7A, 18A), RA unforked (Figs 2A, 7A, 18A); male anal tube with ventral lobe in lateral view tapering (widest near base) (Fig. 10E); male anal style distinctly longer than remainder of 11<sup>th</sup> segment (remainder of 11<sup>th</sup> segment about 2/3–3/4 as long as anal style) (Fig. 11E)..... *Leades* Jacobi, 1928

## Genus *Leades* Jacobi, 1928

*Leades* Jacobi, 1928: 38.

**Type species.** *Leades rufinus* Jacobi, 1928, by monotypy.

**Amended diagnosis.** The body shape of *Leades* is short and stout. The frons is usually wider than long in midline (rarely as wide as long) and lacks a median ocellus. The frontoclypeal suture is strongly semicircular, bent upwards with the median part reaching at least the lower margin of antennal scape (Fig. 3C). The pronotum is very short (Fig. 3B). Five or more platellae are found on the second hind tarsomere (Fig. 7E).

**Differential diagnosis.** *Leades* is endemic to Australia and can be distinguished from all other Australian Cixiini by the following combination of characters: median carina of frons unforked (Fig. 2A); radius anterior (RA) unforked (Figs 2A, 7A, 18A); second hind tarsomere with five or more platellae (always two fewer platellae than apical teeth) (Fig. 7E); male anal style distinctly longer than remainder of 11<sup>th</sup> segment (Fig. 11E).

**Description.** Body length: ♂ 3.1–5.8 mm; ♀ 3.8–6.4 mm.

**Head.** Vertex slightly wider at base than at apical carina; apical and subapical carina about equal in width; lateral carinae strongly elevated; angle formed by caudal border of vertex obtuse (rarely acute); vertex divided into apical and subapical compartment by subapical carina; apical carina V-shaped, subapical carina V- or U-shaped; median carina absent in apical compartment; median carina covering 1/3 to entire length of subapical compartment. Frons hidden in dorsal view; usually wider than long; maximum width no more than twice apical width (rarely more than twice width); median carina complete; lateral carinae slightly to moderately elevated, foliaceous, moderately extending laterally, concealing base of antennae. Median ocellus of frons absent. Frontoclypeal suture strongly semicircular, bent upwards, median part reaching at least lower margin of antennal scape. Postclypeus with well-developed median carina, sometimes less developed near anteclypeus (in *L. clypealis* median carina moderately to well developed or evanescent); lateral carinae well developed. Lateral carina of anteclypeus absent. Apical and subapical rostrum segments more or less equal in length.

**Thorax.** Pronotum with median carina weakly developed; pronotum shortest in middle only slightly longer laterally or about same length; submedian carinae running parallel to eyes. Mesonotum with well-developed lateral carinae; median carina well developed near anterior margin, evanescent near posterior margin. Forewings moderately tectiform; surpassing tip of abdomen; widest at same level or distad of apex of clavus; concavity at costal border absent (apart from a very weakly developed concavity in *L. centralis*, *L. clypealis* and *L. warro*); veins except marginal ones granulate (with tubercles); tubercles on costal margin in single row; tubercles in pterostigma arranged in 1–2 rows or scattered; no tubercles in cells at apex of wing, only along veins; pterostigma subtriangular; ScP+R+M forming a minute, short or moderately long common stem distad of basal cell; crossvein r-m<sub>1</sub> distinctly basad (sometimes at same level or slightly distad in *L. centralis*) of fork  $MP_{1+2}$  and  $MP_{3+4}$ ; icu distinctly distad of (in *L. centralis* sometimes at same level as) apex of clavus; RA apically unforked; additional subapical cell between branches of RP absent (only present in *L. grandis*); nodus of y-vein central to slightly basad within clavus; vein delimiting subapical cell C4 (m-cu<sub>2</sub>) distinctly distad of vein delimiting C5 (icua); subapical cell C5 distinctly longer (slightly longer in *L. ginginensis*) than C4. Hind leg: tibia with 0–four minute to medium sized lateral spines, with either six (rarely seven) apical spines (grouped in two groups with small to large gap in between) or 8–11 apical spines (arranged in one row without gap); 1<sup>st</sup> tarsomere with 7–15 apical teeth and either without platellae or with 1–11 (rarely 12) platellae; 2<sup>nd</sup> tarsomere with 8–13 (rarely seven or 14) apical teeth and with platellae (two less than number of apical teeth).

*Male terminalia.* With the exception of *Leades rufinus* all species of *Leades* have two spines inserting near the apex of phallosome and a bifurcate ventral process at midlength or just below midlength of phallosome. *Leades rufinus* possesses a single spine and no bifurcated ventral process. All species of *Leades* with a moveable, unarmed (without spines) flagellum.

*Female genitalia.* Ovipositor, wax plate and anal tube as in Fig. 1A–C: Ovipositor sabre-shaped (curved upwards), protruding about as far as anal style (rarely less or more). Wax plate and anal tube of varying size: In *L. grandis* and *L. rufinus* waxplate large, consisting of 2 oval shaped, concave discs that merge in the centre to form a strongly raised dividing wall (Figs 1B–C). No carinae present in the centre of each disc. Anal tube in ventral view rectangular, longer than wide. Anal style short (about half as long as dorsal length of anal tube), slightly longer than remainder of 11<sup>th</sup> segment. In *L. centralis*, *L. clypealis*, *L. ginginensis* and *L. warro* segment IX strongly convex, bearing a very small, undivided waxplate (Fig. 1A). Anal tube in ventral view about as long as wide. Anal style short (about half as long as dorsal length of anal tube), slightly longer than remainder of 11<sup>th</sup> segment.

**Distribution.** Australia (all states and territories except for Australian Capital Territory and Tasmania).

### Checklist of species of *Leades Jacobi*

<i>Leades centralis</i> sp. nov.	(WA)
<i>Leades clypealis</i> (Muir, 1931) comb. nov.	(NSW, NT, Qld, SA)
<i>Leades ginginensis</i> sp. nov.	(WA)
<i>Leades grandis</i> sp. nov.	(NSW, Qld)
<i>Leades rufinus</i> Jacobi, 1928	(WA)
<i>Leades warro</i> sp. nov.	(NSW, SA, Vic, WA)

### Key to species of *Leades Jacobi*

**Note.** This key is mainly based on male specimens; depending on the species, females can only be identified to a certain level.

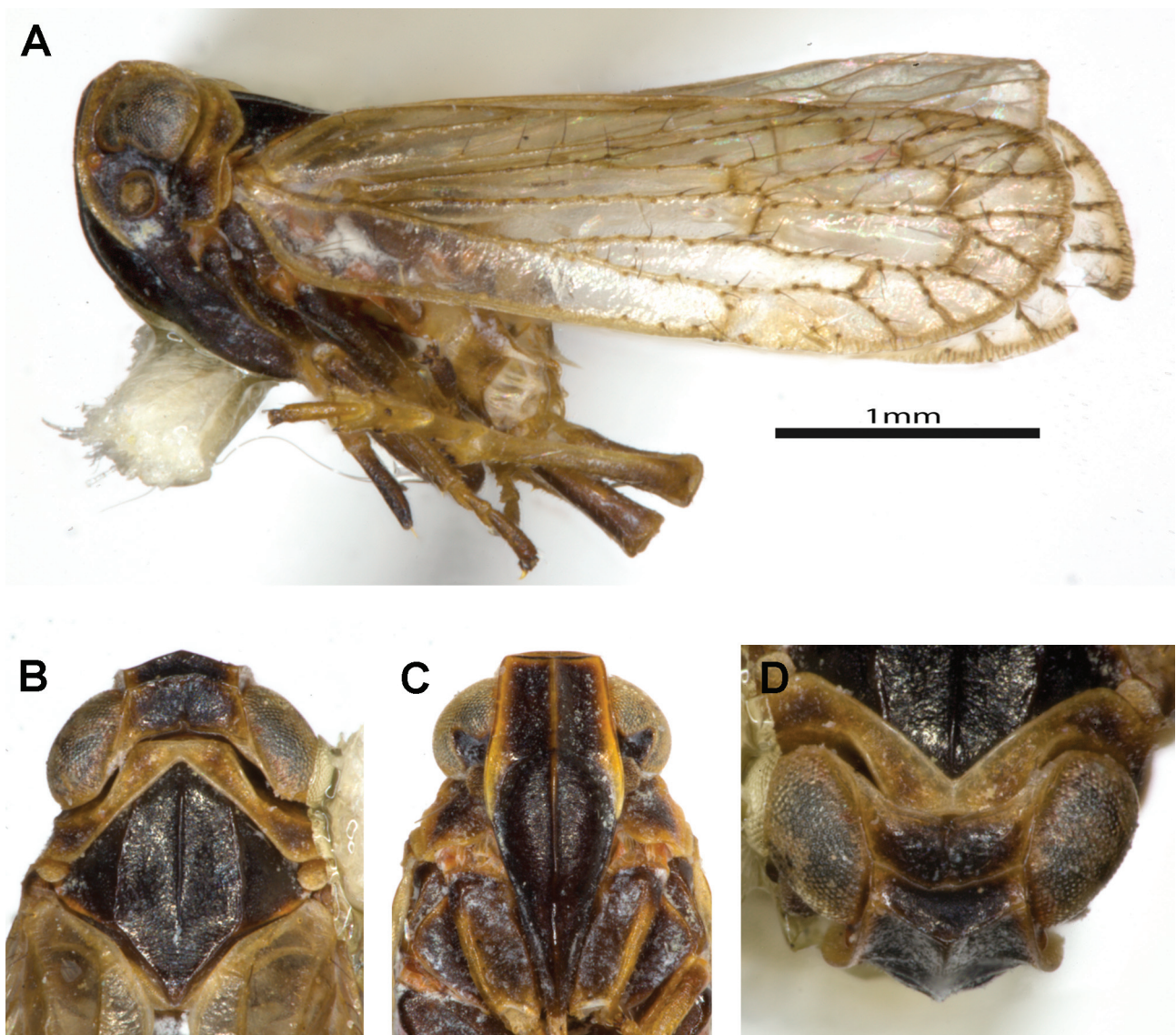
- 1 Hind tibia apically with a row of seven or less spines (Fig. 8E); spines arranged in two groups separated by a small to large gap (Fig. 8E).....2
- Hind tibia apically with a row of eight or more spines; all spines arranged in a row without a gap (Fig. 7E).....5
- 2 First hind tarsomere apically with one or more platellae (Fig. 7E).....3
- First hind tarsomere apically without platellae (Fig. 8E).....4
- 3 Face long and narrow; lateral carinae of frons more or less straight (Fig. 4C); tubercles on forewing slightly to distinctly darker than veins; fork of ScP+RA and RP at same level as CuA<sub>1</sub> and CuA<sub>2</sub> fork or slightly basad (by about the length of crossvein r-m<sub>1</sub> or less) (Fig. 4A); second hind tarsomere with 8–10 apical teeth; aedeagus with two spines (Figs 12 A–C) ..... *Leades ginginensis* sp. nov.
- Face shorter and wider; lateral carinae of frons convex or S-shaped (Fig. 6D); tubercles on forewing concolorous with veins; fork of ScP+RA and RP in most cases distinctly basad of CuA<sub>1</sub> and CuA<sub>2</sub> fork (by about twice the length of crossvein r-m<sub>1</sub>) (Fig. 6A), rarely slightly basad; second hind tarsomere with 7–8 apical teeth; aedeagus with one spine only (Figs 14A–B).....  
..... *Leades rufinus* Jacobi
- 4 Males more than 5.5 mm, females more than 5.7 mm long; lateral carinae on vertex and frons reddish-orange (Fig. 5D).....  
..... *Leades grandis* sp. nov.
- Males less than 4.5 mm, females less than 5.5 mm long; lateral carinae on vertex and frons yellowish-orange or light brown (Figs. 3C,F)..... *Leades clypealis* (Muir)
- 5 Males 3.8–4.9 mm, females 4.6–6.0 mm; aedeagus in ventral view with tip of spine (a) pointing outwards (Fig. 15B) .....  
..... *Leades warro* sp. nov.
- Males 3.2–4.2 mm, females 3.8–4.7 mm; aedeagus in ventral view with tip of spine (a) pointing inwards towards centre of phallosome (Fig. 10B)..... *Leades centralis* sp. nov.

### *Leades centralis* sp. nov. (Figs 2, 10)

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**Types.** *Holotype*, 1♂, AUSTRALIA, WA: Vancouver Peninsula, Albany, 35.058°S, 117.922°E, DNA OAI 1379, beating, ex *Banksia brownii*, 9.x.2015 (M.L. Moir) (WAM E106326, originally MLM). *Paratypes*, WA: 3♂, 4♀, Melaleuca Park, 39km N Perth, 28.x.1987 (Mike E. Irwin & Evert I. Schlinger) (2♂, 3♀ CAS; 1♂, 1♀ originally CAS, donated to ASCU); 1♀, same data except for 21.x.1987 (CAS); 1♂, Yallingup, Caves, 7.xi.1987 (M.E. Irwin & E.I. Schlinger) (CAS); 5♂, Cape Naturaliste, 5m, 27.ix.1962 (E.S. Ross & D.Q. Cavagnaro) (4♂ CAS; 1♂ originally

CAS, donated to ASCU); 1♂, locality unknown [no locality label attached to specimen] (AMS); 1♂, Mt Toolbrunup, Stirling Range NP, site 6b, 34°23.027'S, 118°02.937'E, 860m, vac[uum] sampling 03, DNA OAI 1382 and OAI 1383, ex *Calothamnus crassus*, 9.xi.2007 (M.L. Moir) (MLM); 1♂, same data except for vac[uum] sampling 07, ex *Kunzea montana*, 9.ix.2007 (WADA, originally MLM); 1♂, same data except for beat[ing] 1, 15.ix.2007 (MLM); 3♂, Stirling Range NP, site 2, 34°19.477'S, 118°12.502'E, 285m, vac[uum] sampling 04, ex *Hakea trifurcata*, 21.ix.2007 (M.L. Moir) (MLM); 3♂, Mt Trio, Stirling Range NP, site 9, 34°21.116'S, 118°06.309'E, 730m, vac[uum] sampling 03, ex *Leucopogon atherolepis*, 3.xi.2007 (M.L. Moir) (MLM); 1♀, same data except for vac[uum] sampling 15, ex *Dryandra hirsute* [= *Banksia hirta*], 7.xi.2007 (MLM); 1♀, same data except for beat[ing] 6, ex *Leucopogon lasiophyllus*, 1.xi.2007 (MLM); 1♀, same data except for beat[ing] 7, ex *Leucopogon atherolepis*, 1.xi.2007 (WADA, originally MLM); 1♂, southern Stirling Range NP, site 15, 34.50315°S, 118.25518°E, 151m, beating, ex *Grevillea nudiflora*, 5.x.2008 (M.L. Moir) (MLM); 1♂, Mt Hassel[[]], Stirling Range NP, site 4, 34°22.779'S, 118°04.582'E, 558m, beat[ing] 2, ex *Aotus genistoides*, 21.ix.2007 (M.L. Moir) (MLM); 1♀, same data except for beat[ing] 1, 21.ix.2007 (M.L. Moir) (MLM); 1♀, same data except for beat[ing] 4, 21.ix.2007 (WAM, originally MLM); 1♂, Walbinga Nature Reserve, 31°23.946'S, 115°35.400'E, ex *Melaleuca* sp., 11.x.2014 (M.L. Moir) (MLM); 1♂, East of Lake Wilson, 34°35'24"S, 115°45'11"E, DNA OAI 1381, beat[ing], 5.x.2012 (M.L. Moir) (MLM); 1♂, Nornalup-Walpole NP, beat[ing], on *Melaleuca densa*, xi.2005 (M.L. Moir) (MLM).



**Figure 2.** *Leades centralis* (holotype, except for Fig. 2C): **A**, habitus; **B–D**, head.

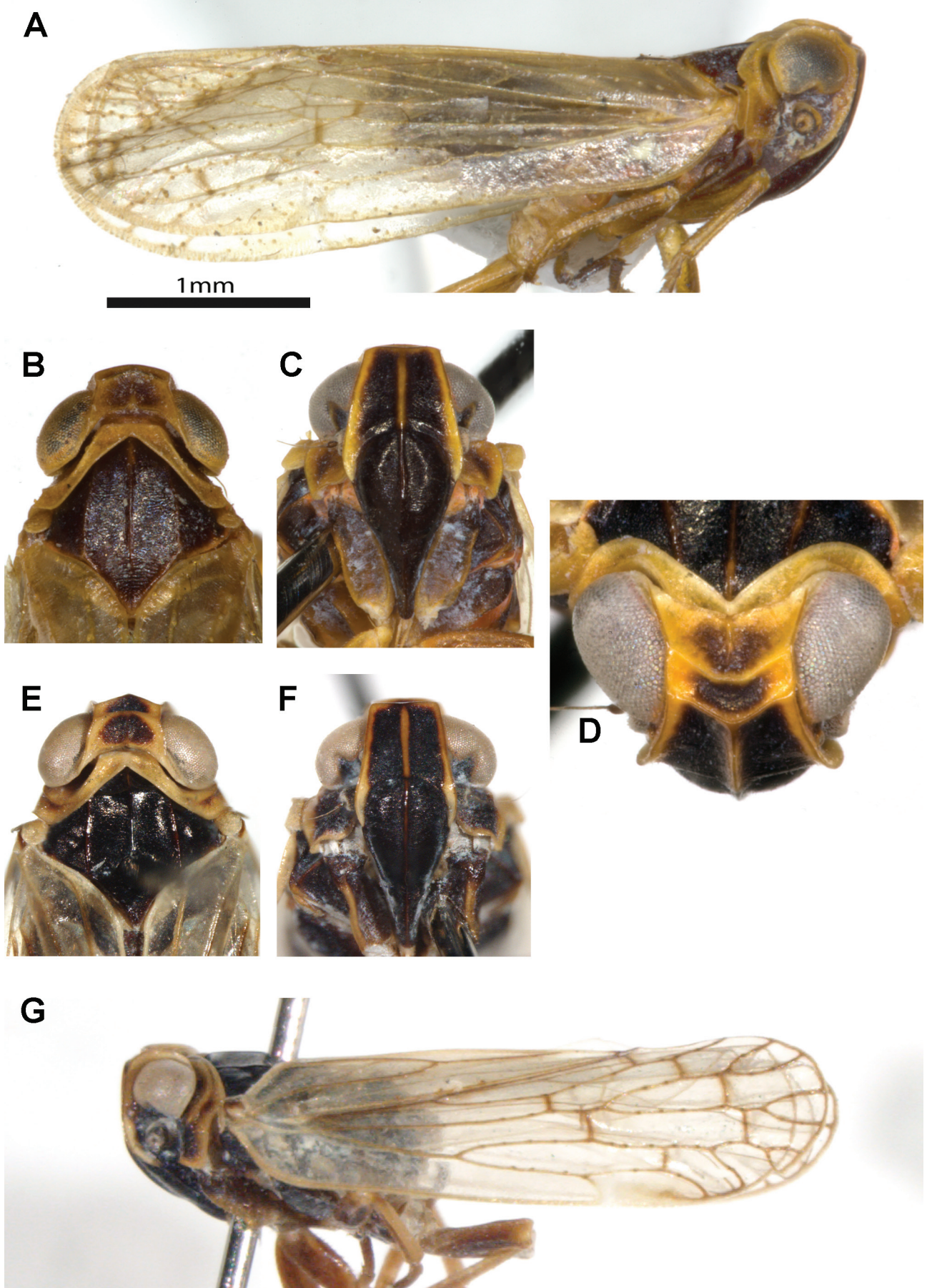


Figure 3. *Leades clypealis*: A, G, habitus; B–F, head.

**Notes:** The females listed as paratypes have been associated with this species because they have been collected in the same collecting event as males of that species. However, because there are no diagnostic external features to differentiate between *L. centralis* and *L. warro*, there remains the possibility that some of these females may be *L. warro*.

**Etymology.** The Latin term ‘centralis’ means ‘in the middle, centre’. Named after the direction of the tip of aedeagal spine (a), which is pointing inwards towards the centre of the phallosome.

**Colour.** Head dark brown to black apart from yellowish-orange or light brown lateral carinae and sometimes median and transverse carinae; pronotum light brown; mesonotum dark brown or black. Forewings light brown, tubercles and veins concolorous with cells or slightly to distinctly darker (i.e. crossveins or near apex of forewing), cells often with darker patches around crossveins. Body dark brown. Legs light brown, base of legs darker.

**Description.** Body length: ♂ 3.2–4.2 mm; ♀ 3.8–4.7 mm.

**Head.** Vertex 1.5–1.9 x wider than long; median carina of vertex covering 1/3 to entire length of basal compartment. In dorsal view head including eyes narrower than pronotum. Frons 1.1–1.4 x wider than long; position of maximum width distinctly ventrad of centre of frontoclypeal suture; lateral carinae of frons in facial view convex, rectilinear apically or sinuate, S-shaped. Anteclypeus with median carina moderately developed. Rostrum reaching hind coxae.

**Thorax.** Hind margin of pronotum more or less rectangular or strongly obtusely angled. Forewing 2.9–3.1 x longer than wide; costal margin with 11–14 tubercles; ScP+R+M forming a short to moderately long common stem distad of basal cell; fork of ScP+RA and RP slightly to moderately basad, same level or slightly to distinctly distad of fork CuA<sub>1</sub> and CuA<sub>2</sub>; tubercles of forewing dark or pale, in some areas concolorous with veins in other areas darker, slightly to distinctly in contrast with paler coloured veins; RP bifid; MP<sub>1+2</sub> unforked or bifid, MP<sub>3+4</sub> unforked or bifid; CuA<sub>1</sub> apically unforked or bifid. Hind leg: tibia with 1–4 minute or small lateral spines and nine (rarely eight, ten or 11) apical spines, all apical spines similar in length apart from outermost spine which is the largest, all spines arranged in one row without a gap, outermost spine largest, other spines smaller but often varying in size; 1<sup>st</sup> tarsomere with 10–15 apical teeth and 5–10 platellae; 2<sup>nd</sup> tarsomere with 10–13 apical teeth and 8–11 platellae.

**Male terminalia.** Anal tube as in Figs 10D–E. Pygofer and genital styles as in Figs 10F–G. Aedeagus (Figs 10A–C): Phallosome with two curved spines arising ventrally near apex of phallosome: spine (a) very large, with its tip pointing inwards towards centre of phallosome in ventral view; spine (b) much shorter and thinner, in lateral view strongly curved, often like a hook with its tip slightly recurved towards the apex of phallosome. Phallosome in its basal third with a bifurcate ventral process on a large stalk. Aedeagal spines not reaching bifurcate ventral process. Phallosome with two slightly sclerotised ridges, ending in a pointed process: a small or medium sized one right laterally, a larger one dorso-laterally.

**Diagnosis.** This species shares many features with *L. warro*, such as the large number (8–11) of apical spines on the hind tibia and the lack of a gap in the row of those spines. Further the configuration of aedeagal spines is very similar, with spines originating in the same position on the aedeagus, however *L. centralis* can be distinguished from *L. warro* by the direction in which the tip of aedeagal spine (a) is pointing in ventral view (in *L. centralis* it is pointing inwards, in *L. warro* outwards).

The arrangement of aedeagal spines in *L. centralis* closely resembles that of *L. ginginensis*. For information on how to distinguish these two species see the diagnosis section of *L. ginginensis*.

### ***Leades clypealis* (Muir, 1931) comb. nov. (Figs 3, 11)**

*Iolania clypealis* Muir, 1931: 67.

**Types.** *Holotype*, ♂ (missing), AUSTRALIA, Qld: Brisbane, 18.xi.1911 (H. Hacker) (BMNH). *Paratypes* (examined), Qld: 2♂, same data as holotype (BMNH).

**Notes:** Two specimens are glued onto one cardboard. Residue of glue and the word ‘type’ written next to it indicate that a third specimen, the holotype, was glued onto the same cardboard but is now missing. There is evidence of a fourth specimen which may have gone missing prior to Muir’s examination. Article 75.1 of the International Code of Zoological Nomenclature (Fourth Edition) states that a neotype should only be designated where “a name bearing type is necessary to define the nominal taxon objectively”. Since the two remaining male paratypes provide sufficient definition of *Leades clypealis*, it is not considered necessary to designate a neotype for this species. Article 75.2 goes further to emphasise that “a neotype is not to be designated as an end in itself”.

**Other material examined.** AUSTRALIA, NSW: 1♂, Booti Booti NP, 32:14:28 152:32:50, BBC02/02B, ex *Leptospermum laevigatum*, 9.x.1997 (L. Wilkie) (AMS); 1♂, same data except for ex *Cassinia uncata* (AMS); 1♀, Booti Booti NP, 32:14:44, 152:32:33, BBC01/06, 9.x.1997 (L. Wilkie) (AMS); 2♀, same data except for 32:16:47,



152:31:28, ex *Leptospermum laevigatum*, BB101/08F (AMS). NT: 2♀, Glen Helen, 16.viii.1959 (E.M. Exley) (QM, formerly UQIC). Qld: 3♂, 2♀, Brisbane, 4.ix.1914 (H. Hacker) (2♂, 2♀ QM; 1♂ originally QM, donated to ASCU); 2♂, 5♀, 1 pair in copula, same data except for 18.ix.1911 (1♀ originally QM, donated to ASCU; remainder QM); 2♂, 6♀, Sunnybank, Brisbane, 9.vi.1919 (F. Muir) (BPBM); 1♂, Coolangata, viii.1919 (F. Muir) (BPBM); 4♂, 1♀, Stanthorpe, 21.x.1918 (E. Sutton) (QM); 2♂, 2♀, same data except for 7.x.1928 (QM); 1♂, 2♀, Bribie Island, 29.viii.1918 (H. Hacker) (QM); 3♂, Wallum Reserve, N of Cordalba, 9.ix.1977 (H. Frauca) (ANIC); 1♂, N. Bundaberg, ix.1972 (H. Frauca) (ANIC); 1♂, 2♀, Mt Walsh NP, Biggenden, viii.1972 (H. Frauca) (ANIC); 1♀, Bluff Range, Biggenden, 16.viii.1972 (H. Frauca) (ANIC); 1♂, Redland Bay, 6777 7.ix.1941 (A.R.B[rimblecombe]) (BMNH). SA: 1♀, Musgrave Ra, NGOO, 0.5km W Ngarutjara homeland, malaise trap, 26°13'97"S, 131°47'95"E, Pitjantjatjara Lands survey, 12–17.x.1994 (SAMA).

**Colour.** Vertex with yellowish-orange or light brown carinae, disc of vertex light, mid or dark brown. Frons with yellowish-orange carinae (median carina sometimes slightly darker, rarely concolorous with disc), disc of frons mid to dark brown. Clypeus mid to dark brown with concolorous carinae. Pronotum light brown. Mesonotum mid brown or dark brown, carinae sometimes slightly paler. Forewings light brown, tubercles and veins concolorous with cells or slightly darker (i.e. crossveins or near apex of forewing), cells often with darker patches around crossveins. Body mid to dark brown. Legs light brown.

**Description.** Body length: ♂ 3.5–4.1 mm; ♀ 3.9–5.2 mm.

**Head.** Vertex 1.3–2.3 x wider than long; median carina covering about ½ to entire length of basal compartment. In dorsal view head including eyes as wide as pronotum or narrower. Frons 1.2–1.3 x wider than long; position of maximum width distinctly ventrad of frontoclypeal suture; lateral carinae of frons in facial view convex, rectilinear apically or slightly sinuate, S-shaped. Anteclypeus with median carina moderately evanescent or absent. Rostrum reaching or surpassing hind coxae.

**Thorax.** Hind margin of pronotum slightly acutely angled, more or less rectangular or obtusely angled. Forewing 2.9–3.3 x longer than wide; costal margin with 17–18 tubercles; ScP+R+M forming a short common stem distad of basal cell; fork of ScP+RA and RP slightly or moderately basad or at same level as fork CuA<sub>1</sub> and CuA<sub>2</sub>; tubercles of forewing dark or pale, in some areas concolorous with veins in other areas darker, slightly in contrast to paler coloured veins; RP bifid; MP<sub>1+2</sub> bifid or trifid, MP<sub>3+4</sub> unforked or bifid; CuA<sub>1</sub> apically unforked. Hind leg: tibia with up to 4 small lateral spines and six (rarely seven) apical spines, separated in two groups by a small to large gap, outermost spine of tibia largest, followed by two smaller spines, the three innermost spines of tibia similar in length to the latter but extending almost as far as outermost spine; 1<sup>st</sup> tarsomere with 7–8 apical teeth and no platellae; 2<sup>nd</sup> tarsomere with eight (rarely nine) apical teeth and six (rarely seven) platellae.

**Male genitalia.** Anal tube as in Figs 11D–E. Pygofer and genital styles as in Figs 11F–G. Aedeagus (Figs 11A–C): Phallosome with two long, curved spines, inserting near apex of phallosome: in ventral view spine (a) slightly longer than spine (b). Phallosome just below midlength with a bifurcate ventral process on a large stalk. Spine (a) sometimes reaching base of bifurcate ventral process. Phallosome dorsally with two ridges, one of which ends in a pointed process.

**Diagnosis.** With six (rarely seven) apical spines on the hind tibia and no platellae on the first hind tarsomere, this species has a similar chaetotaxy to *L. grandis*, but is much smaller (males 3.5–4.1 mm in *L. clypealis* compared to 5.6–5.8 mm in *L. grandis*). These two species can also be distinguished by the colour of the lateral carinae on vertex and frons (yellow or light brown in *L. clypealis*; orange in *L. grandis*).

The configuration of spines and ridges on the aedeagus matches that of *L. warro*, however, these two species can be separated by the number of apical spines on the hind tibia (6–7 in *L. clypealis*; 8–10 in *L. warro*).

**Remarks.** Based on characters such as the shape and carination of the head (in particular of the vertex, e.g. posterior margin of vertex deeply incised in *I. perkinsi* but shallowly incised in *L. clypealis*), the venation of the forewing and the chaetotaxy of the hind leg, *Iolania clypealis* is transferred into *Leades*. The need to transfer this species has already been indicated in the author's PhD thesis (Löcker 2007), however, it is now formally published.

***Leades ginginensis* sp. nov.** (Figs 4, 12)

urn:lsid:zoobank.org:act:B5362A6E-EEB8-41FD-BA42-D8DD1273FCAC

**Types.** *Holotype*, 1♂, AUSTRALIA, WA: N. Gingin, 17.ix.1969 (K.T. Richards) (WADA 15695). *Paratypes*, WA: 1♀, same data as holotype (WADA); 1♂, 1♀, Pingelly (J.W. & F. Evans) (ASCU); 2♂, 1♀, 15km N of Wanneroo, 24.x.1987 (Mike E. Irwin) (CAS); 1♀, same data except for 5.xi.1987 (M.E. Irwin & E.I. Schlinger) (CAS); 6♂, Darling range, Martin, 32°05'18.59"S, 116°01'39.17"E, on *Calothamnus quadrifidus*, beating, vii.2004 (M.L. Moir)

(6♂ MLM); 2♂, Martin, 32°05'10"S, 116°01'28"E, 115m, on *Calothamnus quadrifidus*, beating, 9.x.2012 (M.L. Moir) (MLM); 1♂, Kalbarri, 27°46.859'S, 114°07.687'E, sweep[ing], ex *Astroloma serratifolium* (= *Styphelia serratifolia*), 1.viii.2014 (D.A. Young) (MLM); 1♂, Eagle Gorge, Kalbarri National Park, Kalbarri, 27°46.819'S, 114°07.656'E, ex *Astroloma serratifolium* (= *Styphelia serratifolia*), 4.viii.2014 (D.A. Young) (MLM); 2♀, same data except for ex *Boronia nurdiana* [*Boronia purdieana*?], 28.xii.2014 (MLM); 1♂, 1♀, Jitarning, 30.ix.1965 (E. Britton) (ANIC)\*; 1♂, Jerramungup reserve, 33°56'56"S, 118°54'45"E, sweep[ing], ex *Leucopogon* sp., DNA OAI 1376, 6.ix.2017 (D.A. Young) (MLM)\*; 4♂, West Kamballup, site 3, 34°34.945'S, 117°51.922'E, 202m, Vac[uum sampling] 1, ex *Leucopogon cucullatus*, 23.ix.2007 (M.L. Moir) (2♂ MLM, 1♂, WAM, 1♂ WADA, all originally MLM)\*; 1♂, same data except for, ex *Dryandra polycephala* (= *Banksia polycephala*), (MLM)\*; 1♂, 1♀, same data except for Vac[uum sampling] 3, ex *Leucopogon cucullatus*, (MLM)\*; 1♀, same data except for ex *Hibbertia gracilipes*, 29.ix.2007 (MLM)\*; 2♀, same data except for Vac[uum sampling] 04, ex *Astroloma pallidum* (= *Styphelia pallida*), 25.ix.2007 (MLM)\*; 1♂, same data except for Vac[uum sampling] 5, ex *Leucopogon cucullatus*, 23.ix.2007 (MLM)\*; 1♀, same data except for, ex *Astroloma epacridis* (= *Styphelia epacridis*), 25.ix.2007 (MLM)\*; 1♂, same data except for Vac[uum sampling] 6, ex *Dryandra polycephala* (= *Banksia polycephala*), 23.ix.2007 (MLM)\*; 1♂, same data except for Vac[uum sampling] 7, ex *Astroloma pallidum* (= *Styphelia pallida*)\*, 25.ix.2007 (MLM)\*; 1♀, same data except for ex *Dryandra polycephala* (= *Banksia polycephala*), (MLM)\*; 1♂, Stirling Range NP, site 2, 34°19.477'S, 118°12.502'E, 285m, beat[ing] 04, ex *Leptospermum erubescens* 20.ix.2007 (M.L. Moir) (MLM)\*; 1♂, same data except for, Vac[uum sampling] 04, ex *Leucopogon australis*, (MLM)\*; 1♂, same data except for ex *Grevillea* sp. 'Stirling', 7.ix.2007 (MLM)\*; 1♂, 1♀, same data except for, Vac[uum sampling] 05, (ASCU, originally MLM)\*; 1♂, same data except for, Vac[uum sampling] 06, ex *Leucopogon australis*, 20.ix.2007 (MLM)\*; 1♂, SE sand plains, Stirling Range NP, site 8b, 34°22.992'S, 117°17.599'E, 285m, beat[ing] 5, ex *Jacksonia grevilleoides*, DNA OAI 1378, 20.xi.2007 (M.L. Moir) (MLM)\*; 1♂, Stirling Range NP, site 6b, Mt Toolbrunup, 34°23.927'S, 118°02.937'E, 860m, Vac[uum sampling] 2, ex *Billardiera drummondii*, 9.xi.2007 (M.L. Moir) (MLM)\*; 1♀, Ravensthorpe Range Ridge (WAM19), 33°43'36"S, 120°14'05"E, beat[ing], ex *Calothamnus* sp., 19.v.2007 (M.L. Moir & M.C. Leng) (WAM)\*; 2♀, 1km N Grasspatch, 33°13'04"S, 121°42'50"E, sweep[ing], ex *Microcybe* sp., 4.ix.2017 (D.A. Young) (MLM)\*; 1♀, 55km E of Mullewa, 12.vii.1983 (H. & A. Howden) (ANIC)\*; 1♀, Stirling [Range] NP, 22.ix.1965 (E. Britton & Uther-Baker) (ANIC)\*; 1♂ or ♀ (abdomen missing), Lake Grace – Newdegate Rd, 18.x.1965 (Uther-Baker) (ANIC)\*; 1♀, Stirling Range Dr, Stirling Range NP, site 1, 34°21.505'S, 118°02.367'E, 308m, beat[ing] 108, ex *Grevillea* sp. 'Stirling Range', 5.ix.2007 (M.L. Moir) (MLM)\*; 1♀, northern Stirling Range NP, site 12, 34°19.282'S, 117°58.243'E, 247m, beat[ing] 6, ex *Dryandra pseudoplumosa* (= *Banksia pseudoplumosa*), 2.x.2008 (M.L. Moir) (MLM).

**Notes:** Specimens listed in the type section followed by a star sign (\*), show a slightly different aedeagal configuration, in that the tip of spine (a) is either straight (pointing cephalad) or directed outwards (away from the phallosome). In Fig. 19C (Known distribution of *Leades ginginensis*) these are represented by a red dot with a white inner circle. For specimens followed by a degree sign (°), the aedeagal configuration could not be determined because they are either unassociated females, or males missing their abdomen. These are represented in Fig. 19C by a red dot with a white question mark. The differences observed are likely to have evolved due to geographical isolation, since specimens with the spine directed inwards occur further west than specimens with the other aedeagal configuration. Both groups meet in an area SE of Perth. Further research is needed to clarify whether these represent two different subspecies.

**Etymology.** Named after the type locality Gingin.

**Colour.** Head black apart from yellowish-orange or light brown lateral carinae; pronotum light brown; mesonotum black. Forewings light brown, tubercles and veins concolorous with cells or slightly to distinctly darker (i.e. crossveins), cells often with darker patches around crossveins. Body dark brown or black. Legs light brown, base of legs darker.

**Description.** Body length: ♂ 3.1–3.9 mm; ♀ 3.2–4.6 mm.

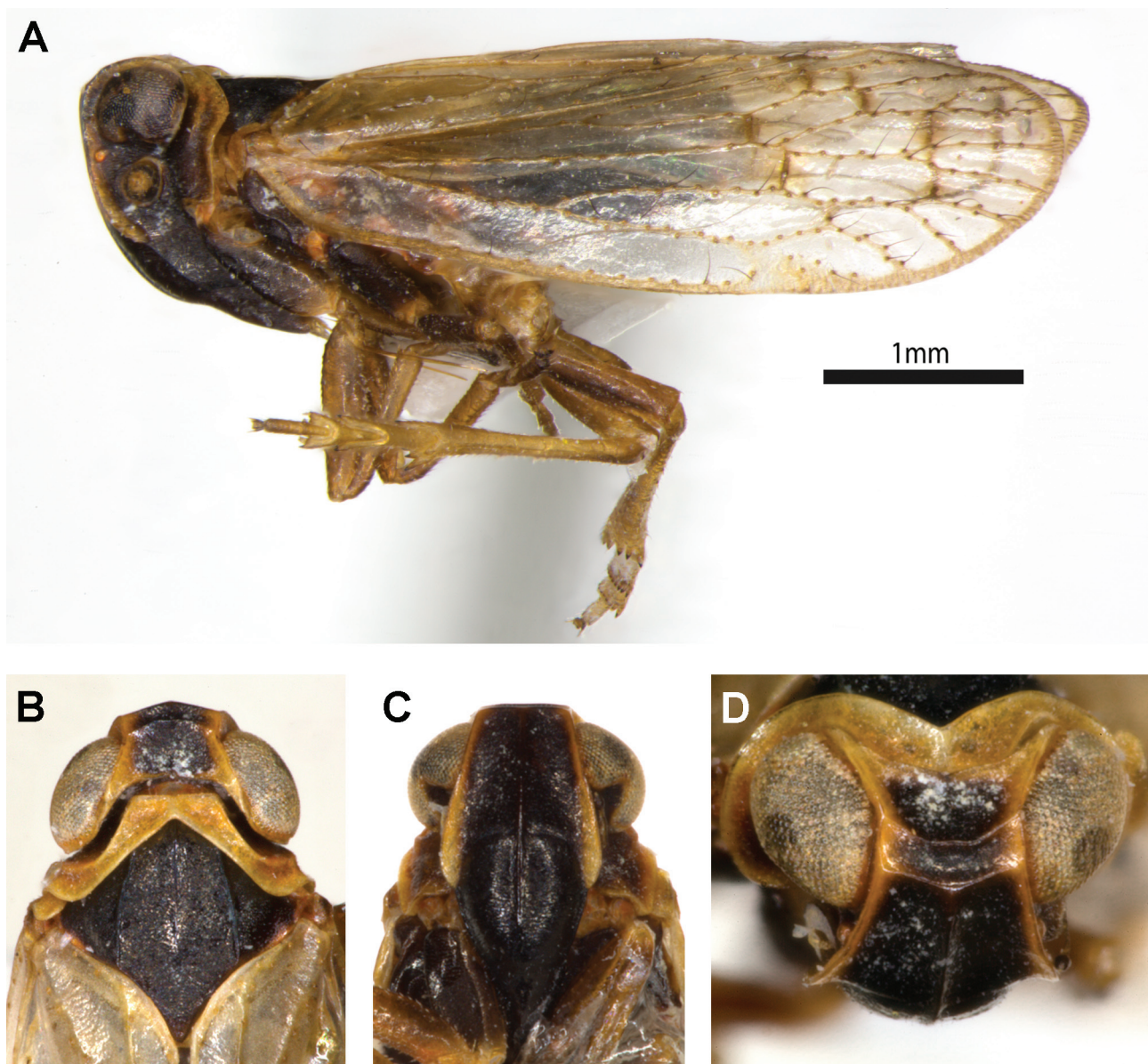
**Head.** Vertex 1.5–1.8 x wider than long; median carina of vertex covering ½–¾ of length of basal compartment. In dorsal view head including eyes narrower than pronotum or as wide as pronotum. Frons 1.0–1.3 x wider than long; position of maximum width distinctly ventrad of centre of frontoclypeal suture; lateral carinae of frons in facial view more or less straight throughout. Postclypeus sometimes swollen (inflated). Anteclypeus with median carina evanescent or absent. Rostrum reaching or only just surpassing hind coxae.

**Thorax.** Hind margin of pronotum more or less rectangular or strongly obtusely angled. Forewing 3.0–3.4 x longer than wide; costal margin with 15–20 tubercles; ScP+R+M forming a short common stem distad of basal cell; fork of ScP+RA and RP slightly basad or at same level as fork CuA<sub>1</sub> and CuA<sub>2</sub>; tubercles of forewing dark or pale, in some areas almost concolorous with veins in other areas darker, slightly to distinctly in contrast to paler coloured veins; RP bifid; MP<sub>1+2</sub> and MP<sub>3+4</sub> unforked or bifid; CuA<sub>1</sub> apically unforked or bifid. Hind leg: tibia with 1–three minute or small

lateral spines and six apical spines, separated in two groups by a small to medium sized gap, outermost spine of tibia largest, followed by two smaller spines, the three innermost spines of tibia similar in length to the latter but extending almost as far as outermost spine; 1<sup>st</sup> tarsomere with 8–9 (rarely ten) apical teeth and 1–6 platellae; 2<sup>nd</sup> tarsomere with 8–9 (rarely ten) apical teeth and 6–7 (rarely eight) platellae.

*Male terminalia.* Anal tube as in Figs 12D–E. Pygofer and genital styles as in Figs 12F–G. Aedeagus (Figs 12A–C): Phallotheca with two curved spines arising ventrally near apex of phallotheca: spine (a) very large; spine (b) much shorter and thinner, in lateral view slightly S-shaped. Phallotheca in its basal third with a bifurcate ventral process on a large stalk. Aedeagal spines not reaching bifurcate ventral process. Phallotheca with two slightly sclerotised ridges, each ending in a pointed process: one right laterally, one dorso-laterally.

**Diagnosis.** In regards to the male genitalia this species is very similar to *L. centralis* (position and arrangement of aedeagal spines and ridges; shape of anal tube and genital styles); however, both species can be separated by the number of spines on the apex of the hind tibia, six in *L. ginginensis* and eight or more spines in *L. centralis*. Further, the colouration of the frons differs in both species: in *L. ginginensis* the median carina is concolorous with the dark disc of frons (only sometimes the median carina is slightly paler near the vertex) whereas in *L. centralis* the median carina is distinctly paler throughout the frons compared to the disc of frons. In general, spine (b) of *L. centralis* is more hook-shaped (tip re-curved, upwards towards apex of phallotheca) in lateral view, whereas in *L. ginginensis* the tip of spine (b) is facing downwards (towards the base of phallotheca) in lateral view. Rarely, an intermediate condition, with the tip of spine (b) at a 90 degree angle in relation to the aedeagus shaft, can be observed in both species.



**Figure 4.** *Leades ginginensis*: A, habitus; B–D, head.

*Leades ginginensis* and *L. rufinus* have a similar chaetotaxy with six apical spines on the hind tibia and the presence of one or more platellae on the first hind tarsomere. For information on how to distinguish these two species see the diagnosis section of *L. rufinus*.

***Leades grandis* sp. nov.** (Figs 5, 13)

urn:lsid:zoobank.org:act:CADF50D6-191D-433E-B0DB-3EEE58022A84

**Types.** *Holotype*, 1♂, **AUSTRALIA, NSW:** Dharug Nat. Park, NW of Sydney, 19.x.1978 (M.J. Fletcher) (ASCU ASCTHE025960). *Paratypes*, **NSW:** 2♀, ‘The Palms’, Munmorah S.R.A., near Newcastle, 31.x.1987 (J.A. Macdonald) (ASCU); 1♀, Wallingat S.F., nr Forster, 32.18S, 152.25E, sweeping foliage incl. eucalypts, 7.xii.1986 (M.M. Stevens & F.E. Frindle) (ASCU); 1♀, Newry nr Urunga, 30.32S, 152.59E, 2.x.1987 (M.M. Stevens) (ASCU); 1♀, Royal NP, site IV, ex *Angophora*, 20.ix.1981 (B.J. Loudon) (ASCU). **Qld:** 1♂, Bundaberg, viii.1919 (F. Muir) (BPBM); 1♀, Sunshine Coast, nr Landsborough, at jct rts 63 & 64, 26°47.733’S, 152°59.710’E, sweeping, 10.viii.2004 (C.R. Bartlett) (UDCC).

**Etymology.** The Latin term ‘grandis’ means ‘large’. This is the largest species within *Leades*.

**Colour.** Head black apart from reddish-orange lateral and transverse carinae; pronotum reddish-orange; mesonotum black. Forewings yellowish-orange, tubercles and veins concolorous with cells. Sternites and tergites reddish-orange, often with dark brown or black patches. Legs yellowish-orange.

**Description.** Body length: ♂ 5.6–5.8 mm; ♀ 5.8–6.4 mm.

**Head.** Vertex 1.6–1.7 x wider than long; median carina of vertex covering 3/4 of length of basal compartment. In dorsal view head including eyes as wide as or slightly wider than pronotum. Frons 1.4–1.5 x wider than long; position of maximum width distinctly ventrad of centre of frontoclypeal suture; lateral carinae of frons in facial view convex, rectilinear apically. Anteclypeus with median carina moderately developed or evanescent. Rostrum reaching hind coxae.

**Thorax.** Hind margin of pronotum more or less rectangular or slightly obtusely angled. Forewing 3.2 x longer than wide; costal margin with 22–26 tubercles; ScP+R+M forming a minute common stem distad of basal cell; fork of ScP+RA and RP distinctly basad of fork CuA<sub>1</sub> and CuA<sub>2</sub>; tubercles of forewing dark or pale, concolorous with veins; RP trifid; MP<sub>1+2</sub> trifid, MP<sub>3+4</sub> bifid; CuA<sub>1</sub> apically unforked. Hind leg: tibia with 3–4 medium sized lateral spines and six apical spines separated in two groups by a small to large gap, outermost spine of tibia largest, followed by two smaller spines, the three innermost spines of tibia similar in length to the latter but extending almost as far as outermost spine; 1<sup>st</sup> tarsomere with eight apical teeth and no platellae; 2<sup>nd</sup> tarsomere with eight apical teeth and six platellae.

**Male terminalia.** Anal tube as in Figs 13C–D. Pygofer and genital styles as in Figs 13E–F. Aedeagus (Figs 13A–B): Phallosome with two long, thin spines: spine (a) left laterally; spine (b) right laterally. Phallosome ventrally with a large sclerotised ridge that ends in a bifurcate ventral process around midlength of phallosome. Aedeagal spines reaching base of bifurcate ventral process. Phallosome narrow near apex, widest around midlength.

**Diagnosis.** This is the largest species within *Leades* with males reaching a body length of 5.6–5.8 mm. In all other species of *Leades* (apart from *L. warro*) males are less than 4.5 mm long. *Leades grandis* can be distinguished from other *Leades* in having an almost symmetrical arrangement of the two aedeagal spines in ventral view (Fig. 13A). In ventral view the distal, outermost part of the genital styles is slightly depressed and abruptly bent dorsad, therefore appearing to be missing in ventral view (Fig. 13E).

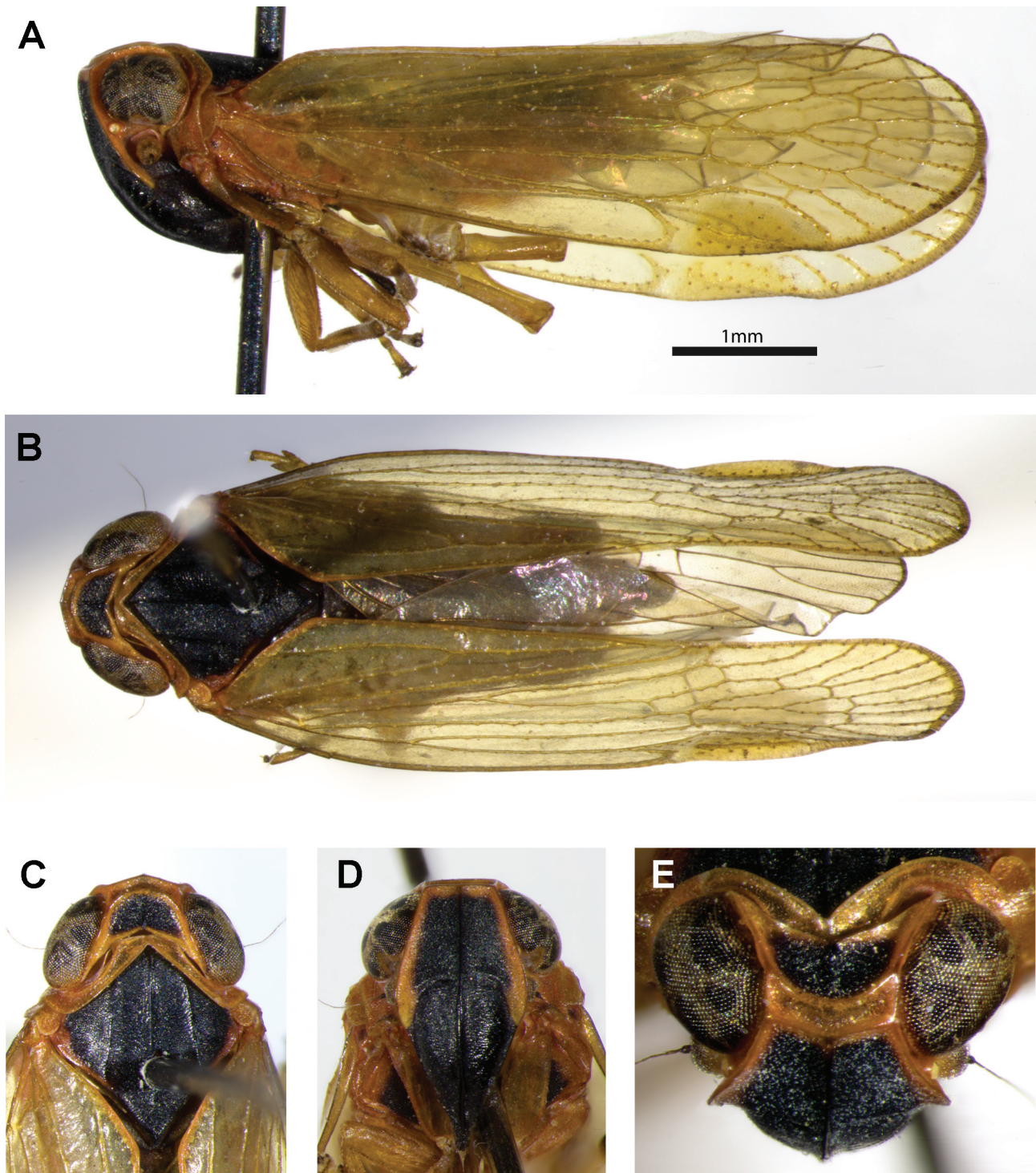
***Leades rufinus* Jacobi, 1928** (Figs 6, 14, 18A)

*Leades rufinus* Jacobi, 1928: 38.

**Types (examined).** *Syntypes*, 2♀, **AUSTRALIA, WA:** Geraldton X (1♀ NHRS, 1♀ MTD).

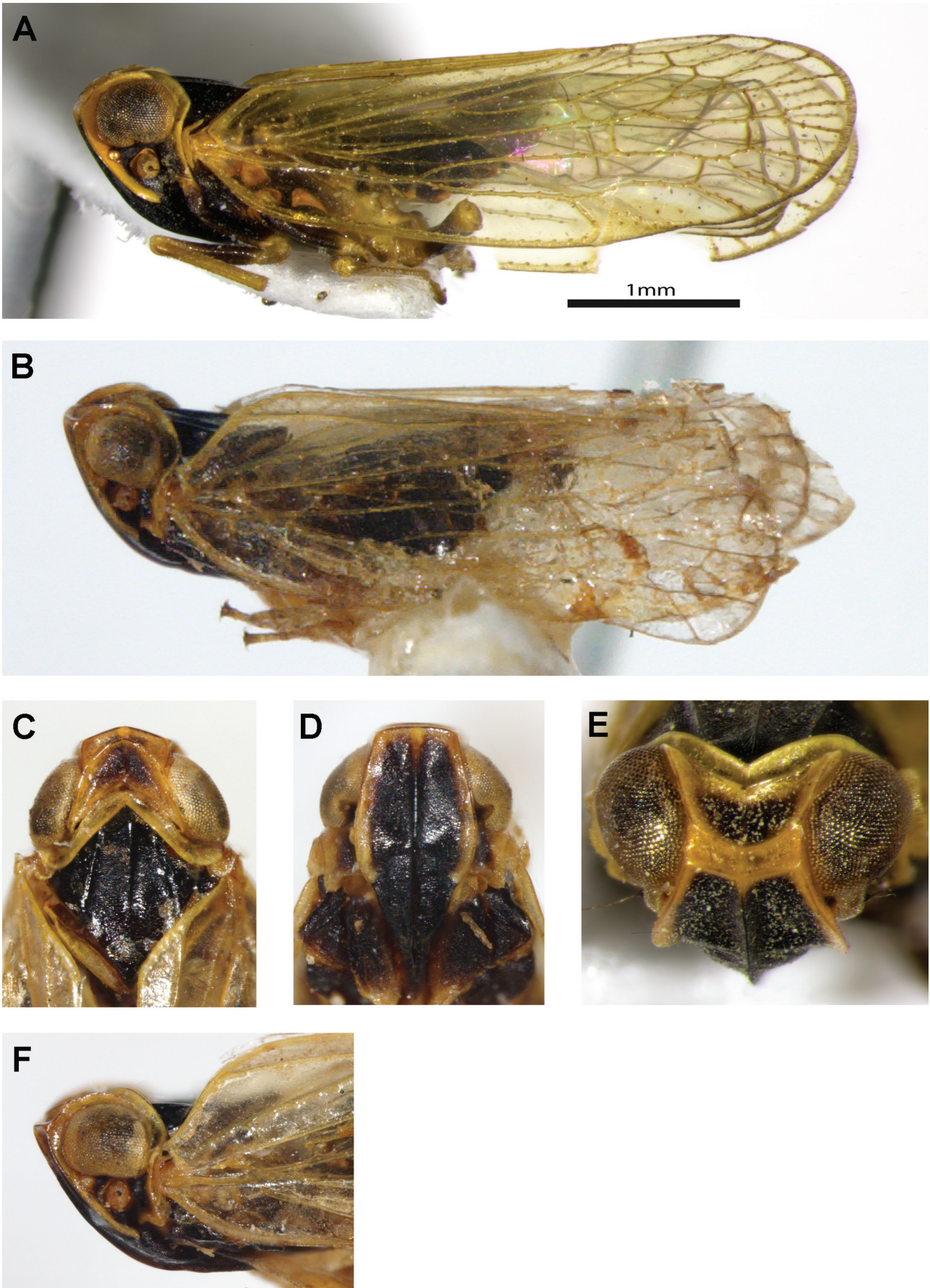
**Notes.** The type series consist of two females, one labelled ‘Typus’ located in the Naturhistoriska Riksmuseet in Stockholm (NHRS), the other labelled ‘Co-Typus’ in the Museum für Tierkunde in Dresden (MTD). Because the original description does not specify which one is the holotype and it is unclear whether the Typus and Co-Typus labels were attached by Jacobi himself or have been added in subsequent years by another person, both specimens are regarded as syntypes. A lectotype has not been designated because all syntypes are females and selecting one of them will not necessarily improve taxonomic stability.

Neither the specimen label nor the original description details the year in which the type specimens were collected. It is possible, however, to narrow down the time frame, because Dr E. Mjöberg’s Expedition took place in the years 1910–1913, according to Jacobi (1928).



**Figure 5.** *Leades grandis* (holotype): A–B, habitus; C–E, head.

Although the types are females it is possible to separate them from other species, such as *L. ginginensis* and *L. centralis*, that share similar external features. Due to the presence of six apical spines on the hind tibia the type specimens are not conspecific with *L. centralis*, which has 8–9 spines. Based on the following characters the type specimens are also not conspecific with *L. ginginensis*: On the forewings of the type specimens fork ScP+RA and RP is distinctly basad of fork  $CuA_1+CuA_2$ , in *L. ginginensis* fork ScP+RA and RP is slightly basad of or at same level as fork  $CuA_1+CuA_2$ . In the type specimens the frons is widest dorsad of the frontoclypeal suture, in *L. ginginensis* the maximum width of frons is always ventrad. Using the features listed above amongst others allows us to assign the males and females listed in the other material examined to this species.



**Figure 6.** *Leades rufinus* (female syntype, except for Figs 6A, 6E): A–B, habitus; C–F, head.

A male specimen from Mt Chudalup (see other material examined) has been designated as a holomorphotype. Although a holomorphotype does not have nomenclatural authority, it points the reader to a specimen that represents the male characteristics of that species well, considering that the type series consists of females only. The concept of holomorphotypes, more commonly used for morphotyping fossils, has been previously used by e.g. Beamer (1946) for extant delphacids to highlight a macropterous specimen that best represents the characteristics of that species when a brachypterous specimen was designated as the holotype of that particular species.

**Other material examined. AUSTRALIA, WA:** 1 ♂ (*Holomorphotype* AMS K.570467), 1 ♀, Mt Chudalup, 34°45'45"S, 116°04'54"E, 28.xi.1998 (B.J. Day & D.K. McAlpine) (AMS); 2 ♀, Jarrahdale, M91R1a, xi. 2000 (S[uction]S[ampling]) (M. Moir) (MLM); 1 ♂, 1 ♂ or ♀, Jarrahdale, M91R1d, xi. 2000 (SS) (M. Moir) (MLM); 1 ♀, Jarrahdale, on *Sollya heterophylla* [= *Billardiera heterophylla*], xi. 2001 (SS) (M. Moir) (MLM); 3 ♀, Jarrahdale, on *L.[asiopetalum] floribundum*, xi. 2001 (SS) (M. Moir) (MLM); 1 ♂, Jarrahdale, M91R2f, xi. 2001 (SS) (M. Moir) (MLM); 6 ♂, Jarrahdale, M91R2c/M91R2d, xi. 2001 (SS) (M. Moir) (MLM); 3 ♀, M91R2d, xi. 2001 (SS) (M. Moir) (MLM); 1 ♂, 1 ♀, Jarrahdale, on *B.[ossiaea] aquifolium*, xi.2001 (SS) (M. Moir) (MLM); 13 ♂, 13 ♀, Jarrahdale, on *L.[europogon] nutans*, (SS) xi. 2001 (M. Moir) (MLM); 1 ♂, North Walpole, 162m, 34°53'33"S 116°42'27"E, beating, 30.ix.2012 (M.L. Moir) (MLM); 3 ♂, Vancouver Peninsula, Albany, 35.058°S 117.922°E, beating, ex *Banksia brownii*, 9.x.2015 (M.L. Moir) (MLM); 2 ♂, Meelup Beach, Cape Naturaliste, 33°34'18"S 115°05'39"E, beating, ex *Spyridium globulosum*, 30.viii.2014 (M.L. Moir) (MLM); 1 ♀, Torndirrup Natl Pk, Eclipse Rd, site 3, 35°05'18"S 117°53'44"E, beating, 17.x.2008 (M.L. Moir & J.M. Waldock) (WAM); 4 ♀, Walpole-Nornalup NP, Monastery Landing, site 1, 34°59'00"S 116°47'56"E, beat[ing], 27.x.2006 (M.L. Moir & A. Sampey) (MLM); 2 ♂, 2 ♀, Torndirrup Natl. Pk, Limeburner Rd, site 4, 35°05'25"S 117°54'38"E, beating, ex *Leucopogon* sp., 17.x.2006 (M.L. Moir & J.M. Waldock) (WAM); 3 ♂, Torndirrup NP, site 19, 23m, beating, ex *Banksia brownii*, 35.057°S, 17.922°E, 7.x.2008 (M.L. Moir) (MLM); 1 ♀, same data, ex *Banksia quercifolia* (M.L. Moir) (MLM); 2 ♂, 1 ♀, Vancouver Peninsula, site 20, 23m, 35.057°S, 17.922°E, beating ex *Banksia brownii*, 17.x.2012 (M.L. Moir & M.C. Leng) (MLM); 1 ♂, 1 ♀, Mt Shadforth, site 1, 34°58'04"S 117°16'47"E, beating, 6.xi.2006 (M.L. Moir & D. Jolly) (MLM); 2 ♂, 1 ♀, William Bay Natl Pk, Overton Hill, site 1, 35°00'12"S 117°15'11"E, beating, ex *Leucopogon* sp., 30.x.2006 (M.L. Moir) (MLM); 1 ♀, William Bay Natl Pk, site 2, 35°00'06"S 117°13'45"E, beating, 30.x.2006 (M.L. Moir & A. Sampey) (MLM); 1 ♀, William Bay Natl Pk, Tower Hill, site 3, 35°01'01"S 117°14'14"E, beating, 30.x.2006 (M.L. Moir & A. Sampey) (MLM); 2 ♂, 2 ♀, Walpole-Nornalup NP, Knoll Drive, Walpole, site 1, 34°59'43"S 116°43'12"E, beating, ex *Leucopogon* sp., 29.x.2006 (M.L. Moir & A. Sampey) (MLM); 4 ♂, 5 ♀, Porongorup Natl Pk, Devils Slide, site 3, 34°40'53"S 117°51'02"E, ex *Billardiera* sp. on *Leucopogon* sp., 15.x.2006 (M.L. Moir & J. M. Waldock) (1 ♂, 1 ♀ MLM; 1 ♂, 1 ♀ WADA; 1 ♂, 1 ♀ ASCU; 1 ♂, 2 ♀ MLM; all originally MLM); 1 ♂, 2 ♀, nr Quarrum Nat. Res., site 1, 35°02'39"S 117°09'22"E, beating, 29.xi. 2006 (M.L. Moir & K.E.C. Brennan) (MLM); 2 ♀, nr Quarrum Nat. Res., site 2, 35°02'55"S 117°09'05"E, beating, 29.xi. 2006 (M.L. Moir & K.E.C. Brennan) (MLM); 2 ♂, 1 ♀, Porongorup Natl Pk, Millinup Pass, site 1, 34°41'45"S 117°54'00"E, beating, ex *Billardiera* sp., 15.x.2006 (M.L. Moir & J.M. Waldock) (WAM); 2 ♀, Two Peoples Bay Nat. Res., Robinsons gully, site 5, 34°59'43"S 118°11'54"E, beating, ex *Leucopogon* sp., 14.x.2006 (M.L. Moir & J.M. Waldock) (WAM); 1 ♀, Two Peoples Bay Nat. Res., Robinsons gully, site 4a, 34°51'41"S 118°11'58"E, beating, ex *Leucopogon* sp., 14.x.2006 (M.L. Moir & J.M. Waldock) (WAM); 2 ♂, 2 ♀, North Sister, site 2, 34°47'17"S 118°08'51"E, beating, ex *Leucopogon* sp., 24.x. 2006 (M.L. Moir & A. Sampey) (MLM); 2 ♂, 2 ♀, Mt Melville, Albany, 35°01'11"S 117°52'16"E, beating, 5.xi.2006 (M.L. Moir) (MLM); 2 ♀, about 12km S Wellstead, West Cape Riche, by stream, site 2, 34°39'03"S 118°41'59"E, beating, ex *Billardiera fusiformis*, 4.xi.2006 (M.L. Moir & I. Kelly) (MLM); 1 ♀, Bremer Bay, end of Pt Gordon rd, site 4, 34°27'30"S 119°23'24"E, beating, ex *Acacia* sp., 21.xi.2006 (M.L. Moir) (MLM); 1 ♀, Fitzgerald River Natl Pk., Gairdiner River, site 5, 34°15'03"S 119°24'47"E, beating, ex *Billardiera fusiformis*, 23.xi.2006 (M.L. Moir) (MLM); 1 ♀, Mt Barker hill, 34°21'07"S 117°32'25"E, beating, ex *Acacia* sp., 29.xi.2014 (M.L. Moir) (MLM); 1 ♀, West Cape Howe Natl Pk, site 2, 35°05'47"S 117°35'41"E, beating, 23.x.2006 (M.L. Moir & A. Samprey) (MLM); 1 ♂, Windy Harbour, 11m, 34°50'06"S 116°01'34"E, beating, ex *Leucopogon* sp., 5.x.2012 (M.L. Moir & A. Samprey) (MLM); 1 ♂, 1 ♀, Snottygobble camp, Donnelly River, 41m, 34°25'37"S 115°48'16"E, beating ex grass, 4.x.2012 (M.L. Moir) (MLM); 4 ♂, 2 ♀, Conspicuous Beach, Walpole-Nornalup NP, 10km E of Nornalup, 35°02'14"S 116°50'39"E, 30m, [97–58], ex *Agonis flexuosa*, 17.xii.1997 (Schuh, Cassis, Brailovsky) (2 ♂, 1 ♀ AMS; 2 ♂, 1 ♀ originally AMS, donated to ASCU); 3 ♂, 2 ♀, same data except for ex *Pimelea clavata* (1 ♂, 1 ♀ AMS; 2 ♂, 1 ♀ originally AMS, donated to ASCU); 1 ♀, same data except for ex *Rhagodia baccata* (AMS); 1 ♀, Walpole-Nornalup NP, at The Knoll, 35.00S, 116.49E, 11.xi.1969 (E.B. Britton) (ANIC); 4 ♂, 1 ♀, F[ield] T[rip] 55, 348-1 [5.8 miles west of Pemberton, ex karri (*Eucalyptus diversicolor* (F. Muell., 1863))], 24.xi.1960 (M.M.H. Wallace) (ANIC); 1 ♂, Warren NP, near Pemberton, 16.xii.1970 (G.A. Holloway & H. Hughes) (AMS); 1 ♂, 12km W by S Pemberton, 34.28S, 115.55E, 6.x.1981 (I.D. Naumann & J.C. Cardale) (ANIC); 2 ♂, Karri Gully, SW

of Nannup on Brockman Hwy, 8.xi.1987 (M.E. Irwing & E.I. Schlinger) (CAS); 1♂, Murray Riv SSE Dwellingup, riv. veg., pans, 31.x.1991 (D. Bickel) (AMS); 1♂, Marri St Dunsborough, 33°36'45", 115°06'01"E, 22.xi.1998 (B.J. Day & D.K. McAlpine) (AMS); 1♂, Porongorup Ra NP; northern rd, pans, seepage off granite, 5.xi.1991 (D. Bickel) (AMS); 2♂, Porongorup Nat. Park, Site 1, 11.x.1970 (D.H. Colless) (ANIC); 1♀, Porongorup NP, Mira Flores Hut, 10.xi.1987 (M. E. Irwin, & E. I. Schlinger) (CAS); 1♀, Porongorup NP, Yate Flats, 9.xi.1987 (Mike E. Irwin, & Evert I. Schlinger) (CAS); 1♂, 2♀, Cape Naturaliste NP, 33°32'25"S, 115°00'44"E, 50m, [97–49], ex *Rhagodia baccata*, 14.xii.1997 (Schuh, Cassis, Brailovsky) (AMS); 1♂, Cape Naturaliste, Bunker Bay, pans, shrubs on headland, 11.xi.1991 (D. Bickel) (AMS); 1♂, Waroona, 30.ix.1965 (E. Britton & U. Baker) (ANIC); 1♂, Dongar[r]a, B.M. 1935–240, 23.viii.–5.ix.1935 (R.E. Turner) (BMNH); 1♂, Yalgorup NP, nr Lake Hayward, pans, dry scler[ophyll] forest, 2.xi.1991 (D. Bickel) (AMS); 3♂, 1♀, Hamelin Bay, 2m, 26.ix.1962 (E.S. Ross & D.Q. Cavagnaro) (CAS); 3♀, Point Rd Campgr[ou]nd, Leeuwin Naturaliste NP, 34°05'37"S, 115°01'27"E, 74 m, ex *Cassytha racemosa*, 3.xii, 1998 (G. Cassis) (AMS); 14♀, same data except for 34°05'37"S, 115°00'59"E, 50m, ex *Pimelea sylvestris*, 2.xii.1998 (AMS); 1♀, same data except for sweeping [on unknown host] (ASCU); 1♀, Salmon Beach (headland), D'Entrecasteaux NP, Windy Harbor, 34°48.9565'S, 116°0.4575'E, 70m, (99–65), ex *Hibbertia cuneiformis*, 3.xii.1999 (R.T. Schuh, G. Cassis & R. Silveira) (AMS); 1♀, Kevill Rd, 4 km W of Margaret River, 34°56'46"S, 115°02'12"E, 120m, ex *Kunzea* aff. *ciliata* 2.xii.1998 (G. Cassis) (AMS); 1♀, Yanchep Forest Reserve, Wilbinga Grove, 5.xi.1987 (M.E. Irwin & E.I. Schlinger) (CAS); 1♀, Yanchep Beach, dunes, 24.x.1987 (Mike E. Irwin) (CAS); 2♀, 3km S of Dawesville, Tim's Thicket Road, 27.x.1987 (M.E. Irwin & E.I. Schlinger) (CAS); 1♀, Augusta, x.1966 (J.W. & F. Evans) (ASCU); 1♀, Walpole, 28.x.1976 (F.H. Uther-Baker) (ASCU); 1♀, Watheroo NP, 12km NW Watheroo, ex *Melaleuca* flowers, 20–23.viii.1987 (C. Reid) (AMS).

**Notes:** The abbreviation SS means suction sampling (= vacuum sampling). Codes such as M91R2c are site codes, with 'M91' referring to mined and restored forest sites from 1991 and 'R2' meaning replicate mine pit number 2.

**Colour.** Head black apart from yellowish-orange or light brown lateral and transverse carinae; pronotum light brown; mesonotum black. Forewings light brown, tubercles and veins concolorous with cells. Body dark brown or black. Base of legs dark brown to black, apex of legs light brown.

**Description.** Body length: ♂ 3.6–4.3 mm; ♀ 4.1–5.3 mm.

**Head.** Vertex 1.6–2.2 x wider than long; median carina of vertex covering 1/3 – 3/4 of length of basal compartment. In dorsal view head including eyes as wide as or slightly wider than pronotum. Frons 1.1–1.3 x wider than long; position of maximum width more or less around centre of frontoclypeal suture or slightly ventrad or dorsad; lateral carinae of frons in facial view S-shaped or convex, rectilinear apically. Anteclypeus with median carina moderately to well developed. Rostrum reaching hind coxae or surpassing hind coxae and only just reaching femur.

**Thorax.** Hind margin of pronotum acutely angled or more or less rectangular or strongly obtusely angled. Forewing 2.8–2.9 x longer than wide; costal margin with 16–28 tubercles; ScP+R+M forming a short common stem distad of basal cell; fork of ScP+RA and RP distinctly basad of fork CuA<sub>1</sub> and CuA<sub>2</sub>; tubercles of forewing dark or pale, concolorous with veins; RP bifid; MP<sub>1+2</sub> bifid (rarely trifid), MP<sub>3+4</sub> bifid; CuA<sub>1</sub> apically unforked or bifid. Hind leg: tibia with 3–4 small to medium sized lateral spines and six apical spines, separated in two groups by a small to large gap, outermost spine of tibia largest, followed by two smaller spines, the three innermost spines of tibia similar in length to the latter but extending almost as far as outermost spine; 1<sup>st</sup> tarsomere with eight apical teeth and 1–4 platellae; 2<sup>nd</sup> tarsomere with eight (rarely seven) apical teeth and six (rarely five) platellae.

**Male terminalia.** Anal tube as in Figs 14C–D. Pygofer and genital styles as in Figs 14E–F. Aedeagus (Figs 14A–B): Phallosome dorsally with one very large, strongly curved spine (a). Phallosome ventro-laterally with an indistinct ridge. Phallosome without a bifurcate ventral process.

**Diagnosis.** Male specimens of this species can be uniquely identified within *Leades* by having only one spine on the aedeagus (Figs 14A–B) — all other species have two spines. Furthermore, the spine is located dorsally, whereas all other *Leades* have their spines on the ventral side of the phallosome.

Diagnosis of females is more difficult as *L. rufinus* shares most external features, such as six apical spines on the hind tibia and the presence of platellae on the first hind tarsomere, with *L. ginginensis*. Only very subtle differences in the shape of the face (face short and wide, lateral carinae convex or S-shaped in *L. rufinus* — versus face long and narrow, lateral carinae more or less straight in *L. ginginensis*) and colour contrast of tubercles in regards to forewing veins (concolorous in *L. rufinus*, slightly to distinctly darker in *L. ginginensis*) allow differentiation from *L. ginginensis*. The best character to use, in case of females, is the position of the ScP+RA and RP fork in relation to the CuA<sub>1</sub> and CuA<sub>2</sub> fork. In *L. rufinus* (Fig. 18A) the fork of ScP+RA and RP is distinctly basad of the CuA<sub>1</sub> and CuA<sub>2</sub> fork (by about twice the length of crossvein r-m<sub>1</sub>). In *L. ginginensis* the fork of ScP+RA and RP is at the same level or only slightly basad (by about the length of crossvein r-m<sub>1</sub> or less).



**Remarks.** Because both syntypes are females, the male specimen from Mt Chudalup has been selected as a holomorphotype to provide a reference point for this species.

***Leades warro* sp. nov.** (Figs 7, 15)

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**Types.** *Holotype*, 1♂, AUSTRALIA, NSW: 40km E of Wanaaring T., 30.viii.1987 (Woolley) (AMS K.559601). *Paratypes*, NSW: 2♂, 1♀, 40km E of Wanaaring T., 30.viii.1987 (Woolley) (1♂, 1♀ AMS; 1♂ originally AMS, donated to ASCU); 4♀, Wanaaring, 17km SW Fords Bridge (J. Woolley) (3♀ AMS; 1♀ originally AMS, donated to ASCU). SA: 1♂, Great Vict[orian] Desert, 145km N Cook, 29°29', 130° 10', dune crest, beating *Thryptomene* sp., 18.viii.1980 (J. Forrest) (SAMA); 1♀, same data except for *Eremoph[il]la*, 20.viii.1980 (P. Greenslade) (SAMA); 1♂, 175km W Vokes Hill Cnr, 28°30', 129°01', sweeping *Dodonea* sp., 267, 25.viii.1980 (G.J. Baker) (SAMA); 2♀, Great Vict[orian] Desert, 17km W Vokes Hill Cnr, on seismic line, on *Cassia* sp., 23.viii.1980 (S. Doyle) (SAMA). Vic: 2♂, Hattah Kulkynne NP, 15.6km ENE Hattah, 34°43' 14"S, 142°17'E, malaise [trap] on sand dune; 23.ix – 4.x.2001 (N.T. Starick) (ANIC). WA: 1♂, 3♀, 11km NE Connie Sue Hwy, 28°25', 128°59', interdune, 26.viii.1980 (J. Forrest) (SAMA); 1♂, 2♀, same data except for W side Serpentine Lakes, beating *Dodonea* in interdune (SAMA).

**Notes:** The females listed as paratypes have been associated with this species because they have been collected in the same collecting event as males of that species. However, because there are no diagnostic external features to differentiate between *L. warro* and *L. centralis*, there remains the possibility that some of these females may be *L. centralis*.

**Etymology.** The term 'warro' means 'outside' in Kurna, an Aboriginal language spoken in the Adelaide Plains (Thieberger & McGregor 1994). Named after the direction that the tip of aedeagal spine (a) is pointing towards.

**Colour.** Vertex with yellowish-orange or light brown carinae, disc of vertex black (rarely dark brown). Frons with yellowish-orange carinae, disc of frons black. Clypeus dark brown or black with concolorous carinae (sometimes median carina slightly paler). Pronotum light brown. Mesonotum black, carinae sometimes slightly paler. Forewings light brown, tubercles and veins concolorous with cells or slightly or distinctly darker (i.e. crossveins or near apex of forewing), cells sometimes with darker patches around crossveins. Body dark brown or black. Legs light brown, darker near base.

**Description.** Body length: ♂ 3.8–4.9 mm; ♀ 4.6–6.0 mm.

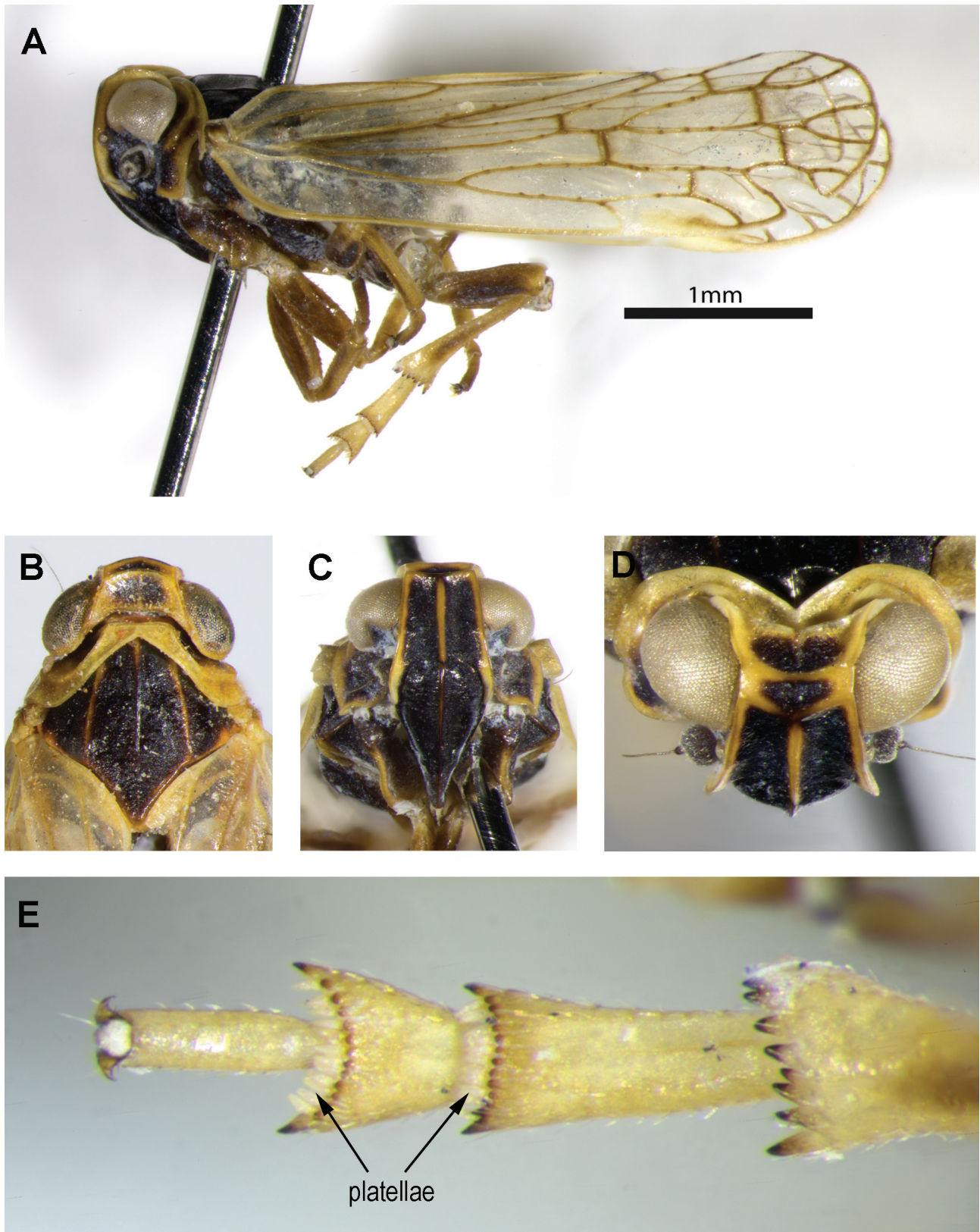
**Head.** Vertex 1.4–2.2 x wider than long; median carina of vertex covering 1/3 to entire length of basal compartment. In dorsal view head including eyes narrower than pronotum. Frons 0.9–1.2 x as wide as long; position of maximum width distinctly ventrad of centre of frontoclypeal suture; lateral carinae of frons in facial view convex, rectilinear apically or slightly sinuate, S-shaped. Anteclypeus with median carina moderately developed or absent. Rostrum reaching hind coxae.

**Thorax.** Hind margin of pronotum more or less rectangular or strongly obtusely angled. Forewing 2.8–3.5 x longer than wide; costal margin with 3–4 tubercles; ScP+R+M forming a minute or short common stem distad of basal cell; fork of ScP+RA and RP distinctly distad of fork CuA<sub>1</sub> and CuA<sub>2</sub>; tubercles of forewing dark or pale, in some areas concolorous with veins in other areas darker, slightly to distinctly in contrast with paler coloured veins; RP bifid or trifold; MP<sub>1+2</sub> and MP<sub>3+4</sub> unforked or bifid; CuA<sub>1</sub> apically unforked or bifid. Hind leg: tibia with up to two minute to small lateral spines and 8–9 (rarely ten) apical spines, all apical spines similar in length apart from outermost spine which is the largest, all spines arranged in one row without a gap, outermost spine largest, other spines smaller but often varying in size; 1<sup>st</sup> tarsomere with 13–15 apical teeth and 8–12 platellae; 2<sup>nd</sup> tarsomere with 11–13 (rarely 14) apical teeth and 9–11 (rarely 12) platellae.

**Male terminalia.** Anal tube as in Figs 15D–E. Pygofer and genital styles as in Figs 15F–G. Aedeagus (Figs 15A–C): Phallosome with two long, curved spines, inserting near apex of phallosome: in ventral view spine (a) slightly longer than spine (b). Tip of spine (a) pointing outwards, away from phallosome. Phallosome just basad of midlength with a bifurcate ventral process on a large stalk. Spine (a) sometimes reaching base of bifurcate ventral process. Phallosome dorsally with two ridges, one of which ends in a pointed process.

**Diagnosis.** This species resembles *L. centralis* in regard to chaetotaxy. For further information on how to distinguish these two species see diagnosis section of *L. centralis*.

*Leades warro* and *L. clypealis* share a very similar configuration of aedeagal spines. See diagnosis section of *L. clypealis* for information on how to separate these two species.



**Figure 7.** *Leades warro* (holotype, except for Fig. 7B): **A**, habitus; **B–D**, head; **E**, hind leg with platellae on first and second hind tarsomere.

**Genus *Yamirrina* gen. nov.**

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**Type species.** *Yamirrina concolor* **sp. nov.**, here designated.

**Amended diagnosis.** The most important diagnostic features of *Yamirrina* are: frons longer than wide, lacking a median ocellus. Head including eyes much narrower than pronotum in dorsal view. Frontoclypeal suture only slightly semicircular, bent upwards, median part by far not reaching lower margin of antennal scape. The pronotum is very short. Forewing with  $r-m_1$  at same level or basad of fork MP1 and MP2 (Fig. 18B). Second hind tarsomere without platellae but up to three very fine setae. Anal tube with extremely long anal style (more than twice as long as remainder of 11<sup>th</sup> segment). The innermost spine of the row of apical spines on the hind tibia is the shortest.

**Differential diagnosis.** *Yamirrina* is endemic to Australia and can be separated from all other Australian Cixiini by a combination of the following characters: head with apical transverse carina V-shaped, shallowly U-shaped or almost straight; basal compartment of vertex about as long as wide; median carina of frons unforked; second hind tarsomere without platellae but with 3 or fewer very fine setae.

**Etymology.** The term ‘yamirrina’ means ‘shallow’ in Paakantyi, an Aboriginal language spoken along the Darling river (Thieberger & McGregor 1994). Named after the shallow curvature of the frontoclypeal suture. Gender: feminine.

**Description.** Body length: ♂ 4.6–5.5 mm; ♀ 5.3–6.1 mm.

**Head.** Vertex widest at base, and narrowest at subapical carina; vertex divided into apical and subapical compartment by subapical carina; median carina absent in apical compartment; median carina covering 3/4 to entire length of subapical compartment; apical carina U- or V-shaped, subapical carina U-shaped; lateral carinae strongly elevated; angle formed by caudal border of vertex obtuse. In dorsal view head including eyes much narrower than pronotum. Frons invisible in dorsal view. Frons 1.3–1.5 x longer than wide; maximum width of frons distinctly dorsad of centre of frontoclypeal suture; maximum width of frons about 2x apical width, steadily broadening. Median carina on frons complete. Lateral carinae of frons slightly elevated, foliaceous, moderately extending laterally, concealing base of antennae. Median ocellus of frons absent. Frontoclypeal suture slightly semicircular, bent upwards, median part not reaching lower margin of antennal scape. Postclypeus with moderately to well developed median carina and well developed lateral carinae. Anteclypeus lacking lateral carinae; median carina evanescent.

**Thorax.** Pronotum with median carina weakly developed; pronotum shortest in middle; submedian carinae running parallel to eyes. In dorsal view head including eyes much narrower than pronotum. Forewings surpassing tip of abdomen; concavity at costal border absent; veins except marginal ones granulate (with tubercles); tubercles on costal margin in single row; tubercles in pterostigma arranged in 1–2 rows or scattered; no tubercles in cells at apex of wing, only along veins; pterostigma subtriangular; ScP+R+M forming a minute, short or long common stem distad of basal cell; crossvein  $r-m_1$  at same level or basad of fork MP<sub>1+2</sub> and MP<sub>3+4</sub>;  $icu$  distinctly distad of apex of clavus; ScP+RA apically unforked; additional subapical cell between branches of RP absent; RP, MP<sub>1+2</sub> and MP<sub>3+4</sub> bifid; CuA<sub>1</sub> apically unforked; nodus of y-vein more or less central within clavus. Hind leg: tibia with up to four minute lateral spines, with six (rarely five) apical spines, grouped in two groups with a small to medium sized gap in between, outermost spine of tibia largest, followed by two smaller spines, the 2<sup>nd</sup> and 3<sup>rd</sup> innermost spines of tibia similar in length to the latter but extending almost as far as outermost spine, innermost spine smallest (minute in *Y. vittipennis* and very small in *Y. concolor*); 1<sup>st</sup> tarsomere with seven (rarely six) apical teeth and no platellae; 2<sup>nd</sup> tarsomere with seven apical teeth and no platellae, but up to three very fine setae.

**Male terminalia.** Anal tube in lateral view slender, with long and narrow apical lobes. Anal style extremely long (more than twice as long as remainder of 11<sup>th</sup> segment). Phallosome with 2 long spines. Phallosome without a bifurcate ventral process, but with a distinct ridge in ventral view below midlength (m-shaped in *Y. concolor*, U-shaped in *Y. vittipennis*). Flagellum moveable; unarmed (without spines).

**Female genitalia.** Ovipositor, wax plate and anal tube as in Fig. 1D: Ovipositor sabre-shaped (curved upwards), protruding about as far as anal style. Segment IX bearing a very large wax plate that consists of 2 oval shaped, concave discs that merge in the centre to form a strongly raised dividing wall. Each oval shaped disc in the centre with a longitudinal carina, covering about 2/3 of length of waxplate. Anal tube in ventral view either rectangular or trapezoid (widening towards apex); wider than long, rarely about as long as wide. Anal style very long (about as long, or longer, than dorsal length of anal tube).

**Distribution.** Australia (New South Wales, Queensland)

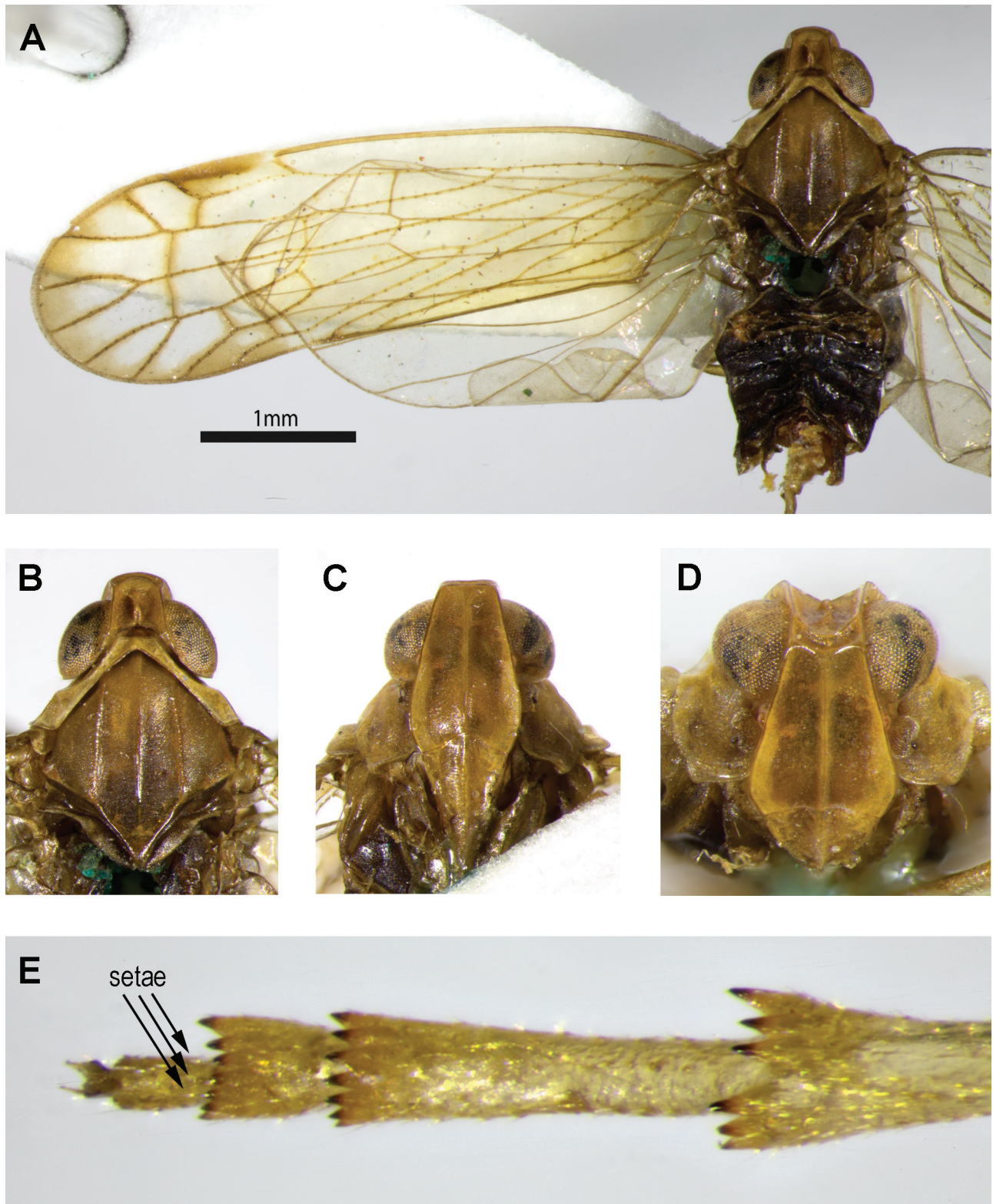
### Key to species of *Yamirrina*

- 1 Distinct contrast of yellow head and pronotum versus dark brown to black mesonotum (Figs 9B,E).. *Yamirrina vittipennis* (Muir)
- Head and mesonotum concolorous mid brown, pronotum slightly paler (Fig. 8B).....*Yamirrina concolor* sp. nov.

*Yamirrina concolor* sp. nov. (Figs 8, 16, 18B)

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**Types.** *Holotype*, 1♂, AUSTRALIA, Qld: [Lamington] National Pk., xii.1921 (H. Hacker) (QM T245909). *Paratypes*: NSW: 1♀, Border Ranges NP, 28°24'54"S, 153°07'15E, 1021m, beating, 22 Dec 2008 (M.L. Moir & K.E.C. Brennan) (originally MLM, donated to ASCU). Qld: 1♀, Great Sandy National Park, Cooloola entry, 25°54'39"S, 153°5'44"E, mv light, 7 Dec 2019 (M.L. Moir, L. Semeraro, J. Constant, F. Martoni) (MLM).



**Figure 8.** *Yamirrina concolor* (holotype): A, habitus; B–D, head; E, hind leg with 3 setae on second hind tarsomere.

**Etymology.** The Latin term ‘concolor’ means ‘same colour’. In *Y. concolor* head and mesonotum are of the same colour.

**Colour.** Head and mesonotum mid brown, pronotum slightly paler. Forewings light brown, tubercles and veins concolorous with cells or slightly darker (i.e., crossveins and near apex of forewing), cells with darker patches around crossveins and near apex of forewing. Body dark brown, legs light brown.

**Description.** Body length: ♂ 5.4 mm, ♀ 5.6–5.9 mm.

**Head.** Vertex 1.0 as wide as long; apical and subapical carina U-shaped; median carina of vertex covering 3/4 of basal compartment. Frons 0.7 x as wide as long; lateral carinae of frons in facial view convex, rectilinear apically.

**Thorax.** Hind margin of pronotum more or less rectangular to slightly obtusely angled. Mesonotum with well-developed lateral carinae; median carina well developed near anterior margin, evanescent near posterior margin. Forewing 3.2 x longer than wide; widest distad of apex of clavus; costal margin with 6–8 tubercles; ScP+R+M forming a minute or short common stem distad of basal cell; fork of ScP+RA and RP distinctly basad of fork CuA<sub>1</sub> and CuA<sub>2</sub>; crossvein r-m<sub>1</sub> at same level as fork MP<sub>1+2</sub> and MP<sub>3+4</sub>; tubercles of forewing dark or pale, in some areas concolorous with veins in other areas darker, slightly to distinctly in contrast with paler coloured veins; vein delimiting subapical cell C4 (m-cu<sub>2</sub>) distinctly distad of vein delimiting C5 (icua); subapical cell C5 distinctly longer than C4. Hind leg: tibia with three minute lateral spines and with six apical spines, separated in two groups by a small to medium sized gap; 1<sup>st</sup> tarsomere with seven apical teeth and no platellae; 2<sup>nd</sup> tarsomere with seven apical teeth and no platellae, but three very fine setae.

**Male terminalia.** Anal tube as in Figs D–E. Pygofer and genital styles as in Figs F–G. Aedeagus (Figs A–C): Phallosome with two large spines arising near apex: spine (a) strongly curved, arising dorso-laterally; spine (b) slightly curved, reaching down below midlength. Phallosome dorsally with a long, spine-like sclerotised ridge. Phallosome with an m-shaped ventral ridge. In ventral view phallosome very narrow around midlength; greatly widening below midlength, then tapering towards base.

**Diagnosis.** This species differs from *Y. vittipennis* in the colour contrast between head, pro- and mesonotum. In *Y. concolor* these three parts are almost concolorous, with the pronotum being just slightly paler. In *Y. vittipennis* there is a stark colour contrast between yellow head and pronotum versus a dark brown to black mesonotum. Further differences can be found in the male genitalia: in *Y. vittipennis* both spines are visible for their entire length in ventral view, in *Y. concolor* the tip of spine (a) is concealed by the phallosome in ventral view; spines are much thinner in *Y. vittipennis* than in *Y. concolor*.

***Yamirrina vittipennis* (Muir, 1931) comb. nov.** (Figs 9, 17)

*Iolania vittipennis* Muir, 1931: 66.

**Types.** *Holotype*, ♀ (examined), AUSTRALIA, Qld: 1904 (Dodd) (BMNH). *Paratype* (examined), Qld: 1♂ or ♀ (abdomen missing), same data as holotype (BMNH).

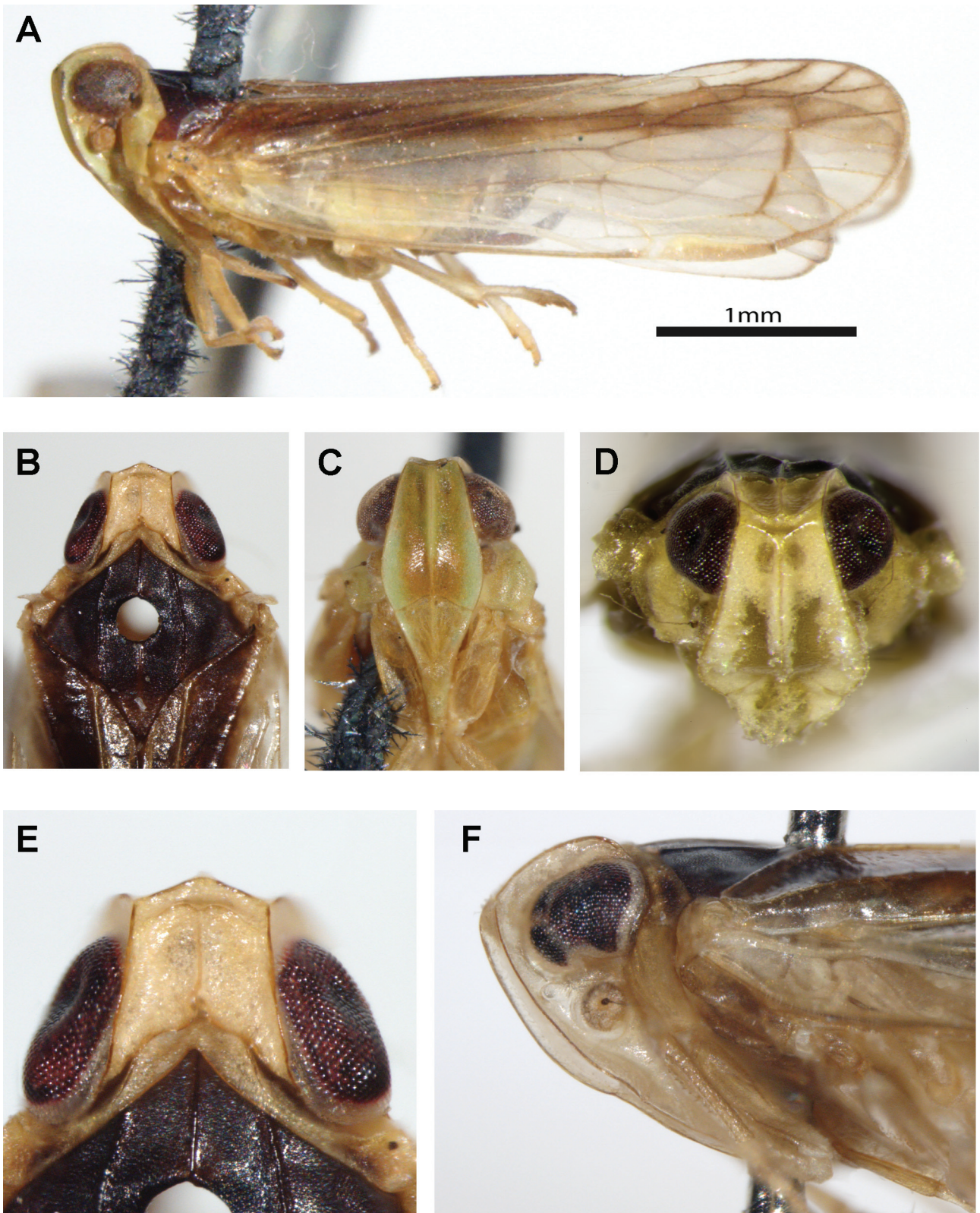
**Other material examined.** AUSTRALIA, Qld: 2♂, 4♀, Windsor Tableland via Mt. Carbine, N.Qld, 4–29.xii.1980, malaise trap (1♂, 4♀ QDPI; 1♂ originally QDPI, donated to ASCU); 1♂, same data except for 29.xii.1980–27.i.1981 (QDPI); 1♀, Summit TV Station, Bellenden-Ker Range, NE Qld, 1560m, pyrethrum knockdown in rainforest, 28.x.1963 (Monteith, Yates and Thompson) (QM).

**Notes:** The original description (Muir 1931) lists the deposition of a paratype in the Australian Museum. This specimen could not be located. Although no male genitalia were available in the type series, the description and illustration of the male genitalia provided by Muir (1931) was sufficiently detailed to match this name with three male specimens from the Windsor Tablelands in North Queensland as well as the other specimens listed in the Other material examined section.

**Colour.** Head and pronotum yellow. Mesonotum dark brown to black. Forewings light brown, almost colourless near costal border, distinctly darker (mid to dark brown) in claval area, slightly outside of claval area, near MP<sub>1+2</sub> and MP<sub>3+4</sub> fork and near apex of forewing; tubercles and veins concolorous with cells, crossveins sometimes darker. Body light or mid brown, often darker on dorsal side than on ventral side. Legs light brown.

**Description.** Body length: ♂ 4.6–5.5 mm; ♀ 5.3–6.1 mm.

**Head.** Vertex 1.2–1.3 x wider than long; apical carina V-shaped; subapical carina U-shaped; median carina of vertex covering 3/4 to entire length of basal compartment of vertex. Frons 0.7–0.8 x as wide as long; lateral carinae of frons in facial view convex, rectilinear apically or slightly sinuate, S-shaped. Rostrum reaching hind coxae; apical and subapical rostrum segments more or less equal in length.



**Figure 9.** *Yamirrina vittipennis* (female holotype, except for Figs 9B, 9D–F): **A**, habitus; **B–F**, head.

*Thorax.* Hind margin of pronotum strongly obtusely angled. Mesonotum with well-developed median and lateral carinae. Forewings moderately tectiform; 3.0–3.8 x longer than wide; widest at same level or distad of apex of clavus; costal margin with up to five tubercles; ScP+R+M forming a short or long common stem distad of basal cell; fork of ScP+RA and RP distinctly basad, slightly or distinctly distad or at same level as fork CuA<sub>1</sub> and CuA<sub>2</sub>; crossvein r-m<sub>1</sub> distinctly distad or at same level as of fork MP<sub>1+2</sub> and MP<sub>3+4</sub>; tubercles of forewing dark or pale, concolorous with veins. Hind leg: tibia with up to four minute lateral spines and with six (rarely five) apical spines, separated in two groups by

a small gap; 1<sup>st</sup> tarsomere with seven (rarely six) apical teeth and no platellae; 2<sup>nd</sup> tarsomere with seven apical teeth and no platellae, but up to three very fine setae.

**Male terminalia.** Anal tube as in Figs D–E. Pygofer and genital styles as in Figs F–G. Aedeagus (Figs A–C): Phallosome with two long and narrow spines: spine (a) inserting left laterally; spine (b) inserting ventrally near apex. Phallosome with a large bulging U-shaped ridge.

Female genitalia: Ovipositor, wax plate and anal tube as in Fig. 1D: Ovipositor sabre-shaped (curved upwards), protruding about as far as anal style. Segment IX bearing a very large wax plate that consists of two oval shaped, concave discs that merge in the centre to form a strongly raised dividing wall. Each oval shaped disc in the centre with a longitudinal carina, covering about 2/3 of length of waxplate. Anal tube in ventral view either rectangular or trapezoid (widening towards apex); wider than long, rarely about as long as wide. Anal style very long (about as long, or longer, than dorsal length of anal tube).

**Diagnosis.** *Yamirrina vittipennis* is characterised by a stark colour contrast between yellow head and pronotum versus dark brown to black mesonotum. For information on how to separate *Y. vittipennis* from *Y. concolor* see Diagnosis section of *Y. concolor*.

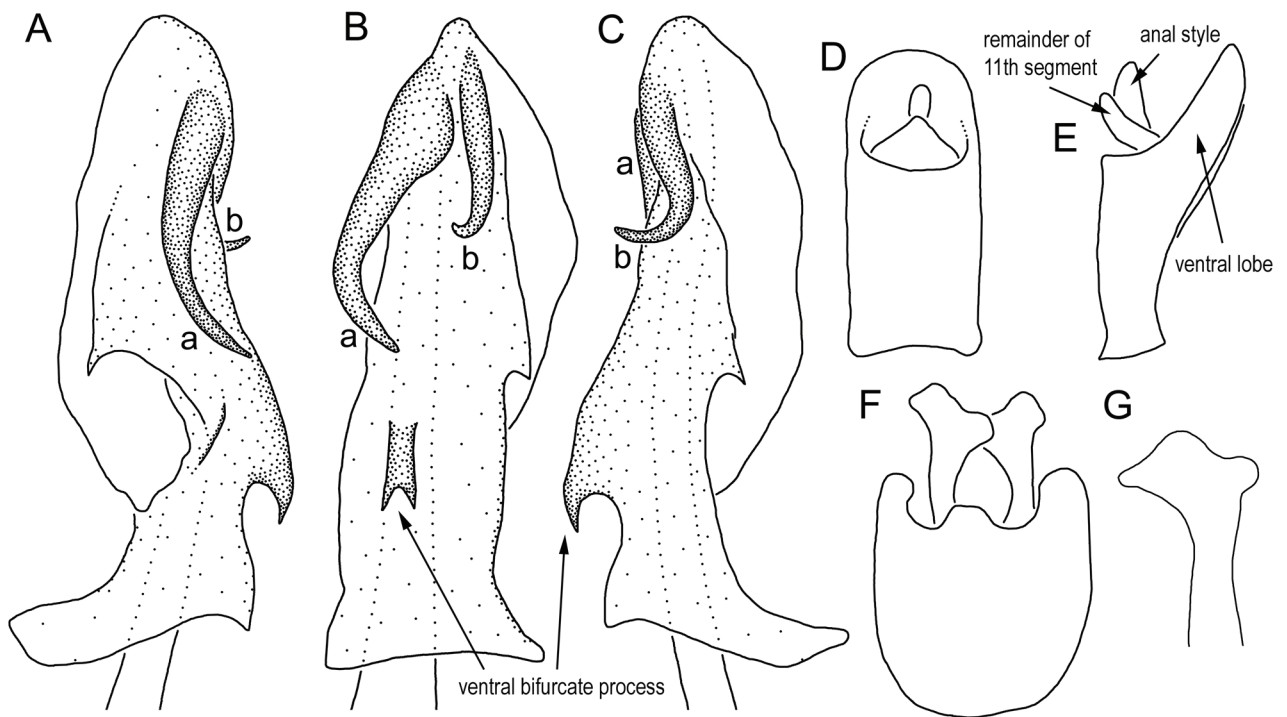
**Remarks.** Major differences observed by the author in the shape and carination of the vertex (e.g. width of basal emargination of vertex only slightly wider than apical transverse carina of vertex in *Y. vittipennis*; but about 3x wider in *I. perkinsi*) and the configuration of the male genitalia (shape of anal tube; absence or presence of spines on aedeagus and flagellum) confirm that *Y. vittipennis* is not congeneric with *I. perkinsi* and it is hereby transferred to the genus *Yamirrina*.

*Yamirrina vittipennis* greatly differs from *L. clypealis* in chaetotaxy (second hind tarsomere without platellae but with three very fine setae in *Y. vittipennis*, but with 6–7 platellae in *L. clypealis*), shape of vertex, curvature of the frontoclypeal suture, shape of the male anal tube and absence/presence of a bifurcate ventral process.

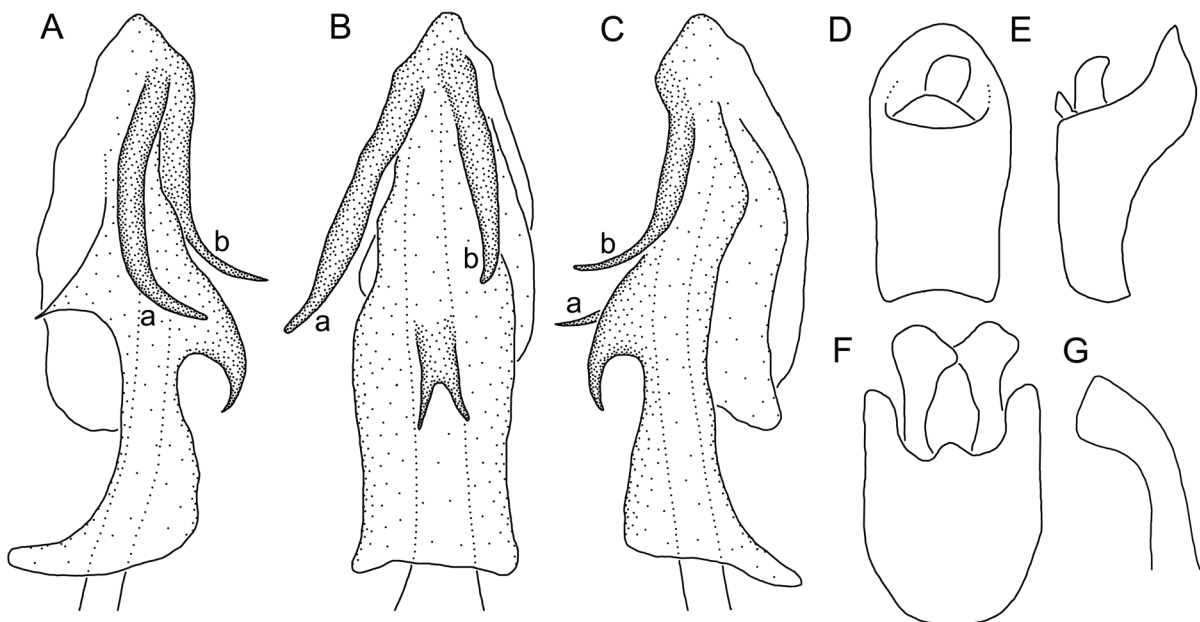
## Discussion

Muir's (1931) reason for placing *Y. vittipennis* and *L. clypealis* in *Iolania* was the absence of lateral spines on the hind tibiae. Ironically, Hoch (2006) recorded three minute lateral spines on the hind tibia of all Hawaiian *Iolania* species and the author observed 1–four minute spines on the tibia of the two Australian taxa. However, number and size of lateral spines on the hind tibia are not the most reliable characters in Cixiidae to determine generic placement. Characters that are more stable are the shape and carination of the vertex, the movability of the flagellum in relation to aedeagus shaft (flagellum rigid, not movable against aedeagus shaft in Hawaiian species of *Iolania*, versus flagellum movable in Australian species, previously in *Iolania*) and the presence of apical spines or setae on the second tarsomere. The use of these characters, as done in this paper and by previous authors (e.g. Hoch 2006), has led to a more robust placement of the two Australian species, originally described in *Iolania*. This means *Iolania* is now considered absent from Australia and consists of six species endemic to Hawaii (*I. perkinsi* Kirkaldy, *I. koolauensis* Giffard, *I. oahuensis* Giffard, *I. lanaiensis* Giffard, *I. mauiensis* Giffard and *I. kraussohana* Hoch). This also supports the patterns observed in other Fulgoromorpha groups that, apart from introduced species e.g. the flatid *Siphanta acuta* (Walker, 1851) and the delphacid *Peregrinus maidis* (Ashmead, 1890), the Australian and Hawaiian fauna are not closely related (Asche 1997).

*Leades* is endemic to Australia and much more widespread than previously recorded, being present in all states and territories except for the Australian Capital Territory and Tasmania (Fig. 19). This may simply be an artefact of under sampling of the Cixiidae fauna within these regions. The presence of specimens that fit none of the species profiles described in this paper indicates there are likely to be further new species of *Leades* discovered in Australia. A female specimen, currently labelled as *Leades* sp., from Burrum Heads in Queensland (located in QM differs in wing venation and chaetotaxy but shares some characters of the head and forewings with *L. rufinus*, and others with *L. ginginensis*). However, the latter two species are restricted to Western Australia. Further material is needed to verify whether this specimen represents a new species or if the distribution of *L. rufinus* or *L. ginginensis* is much larger than currently recorded.

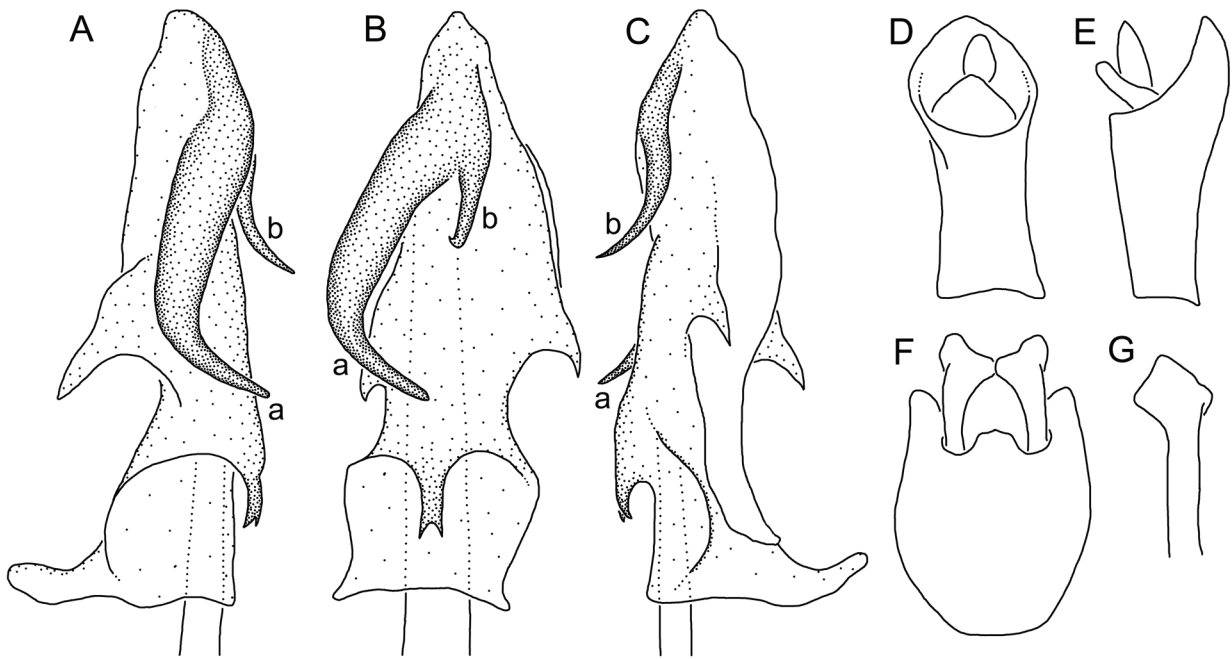


**Figure 10.** *Leades centralis* (holotype, except for 10B–C, 10F–G): **A**, aedeagus left lateral; **B**, aedeagus ventral; **C**, aedeagus right lateral; **D–E**, anal tube; **F–G**, genital styles.

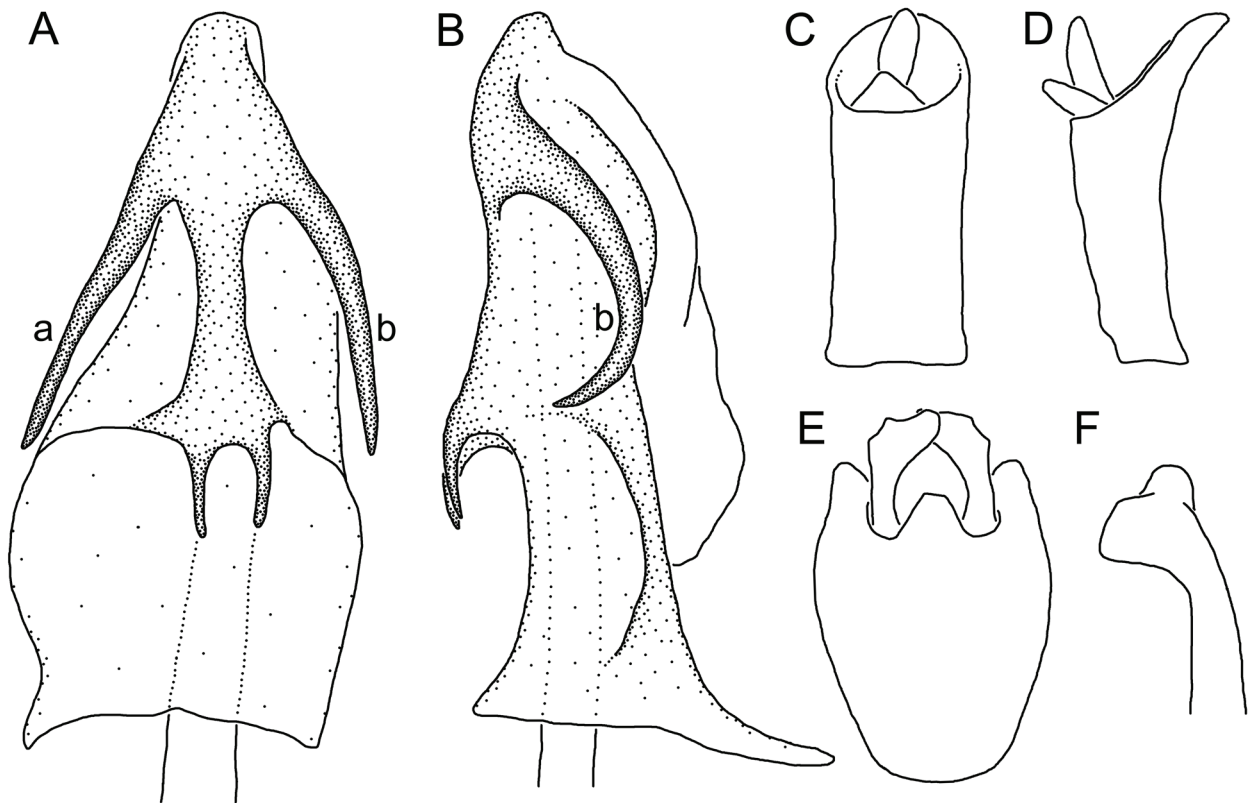


**Figure 11.** *Leades clypealis*: **A**, aedeagus left lateral; **B**, aedeagus ventral; **C**, aedeagus right lateral; **D–E**, anal tube; **F–G**, genital styles.

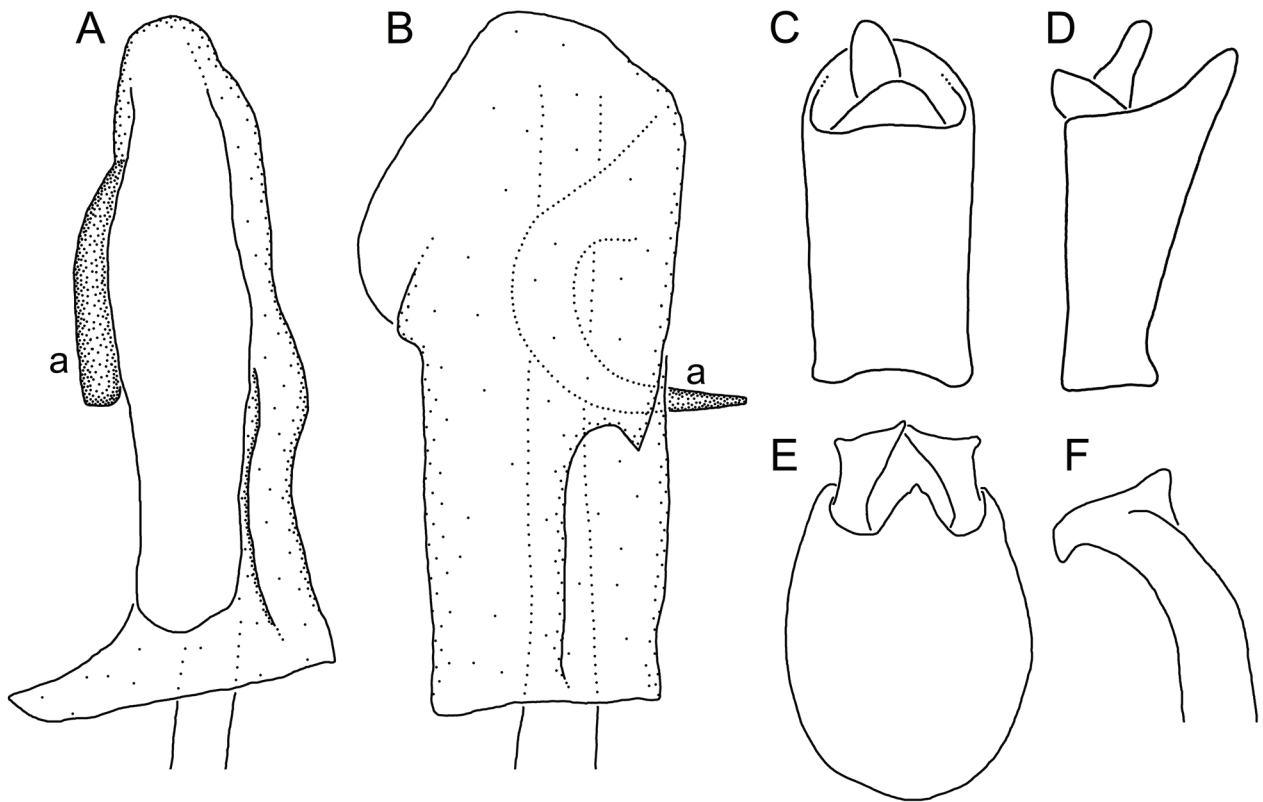




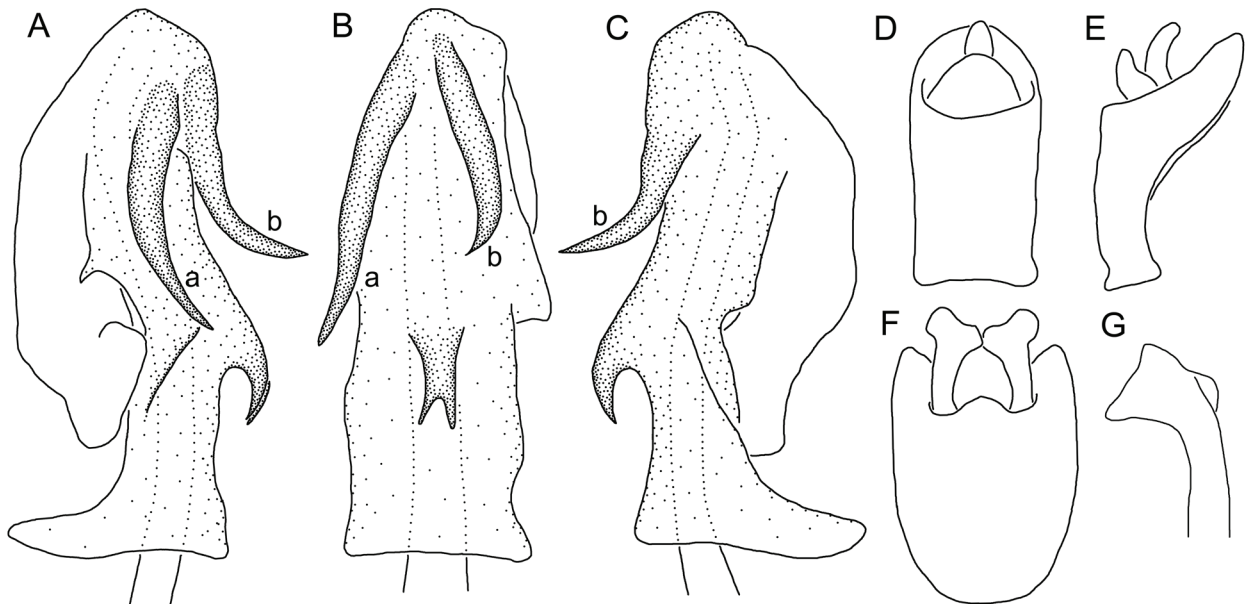
**Figure 12.** *Leades ginginensis* (holotype): **A**, aedeagus left lateral; **B**, aedeagus ventral; **C**, aedeagus right lateral; **D–E**, anal tube; **F–G**, genital styles.



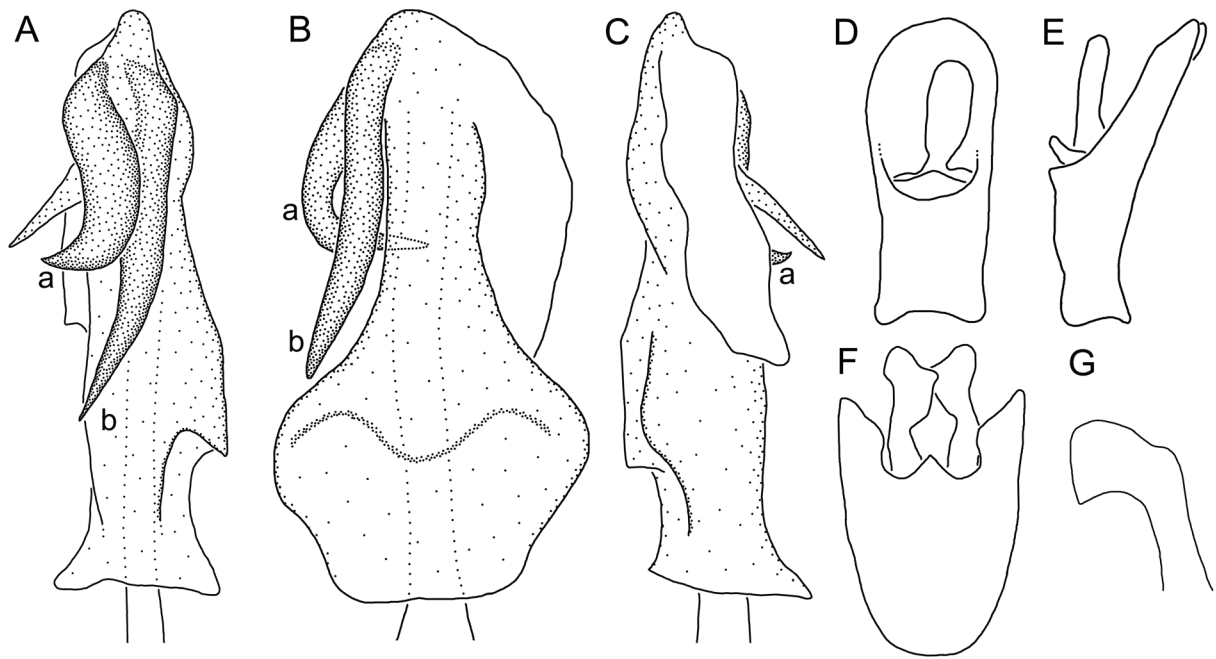
**Figure 13.** *Leades grandis*: **A**, aedeagus ventral; **B**, aedeagus right lateral; **C–D**, anal tube; **E–F**, genital styles.



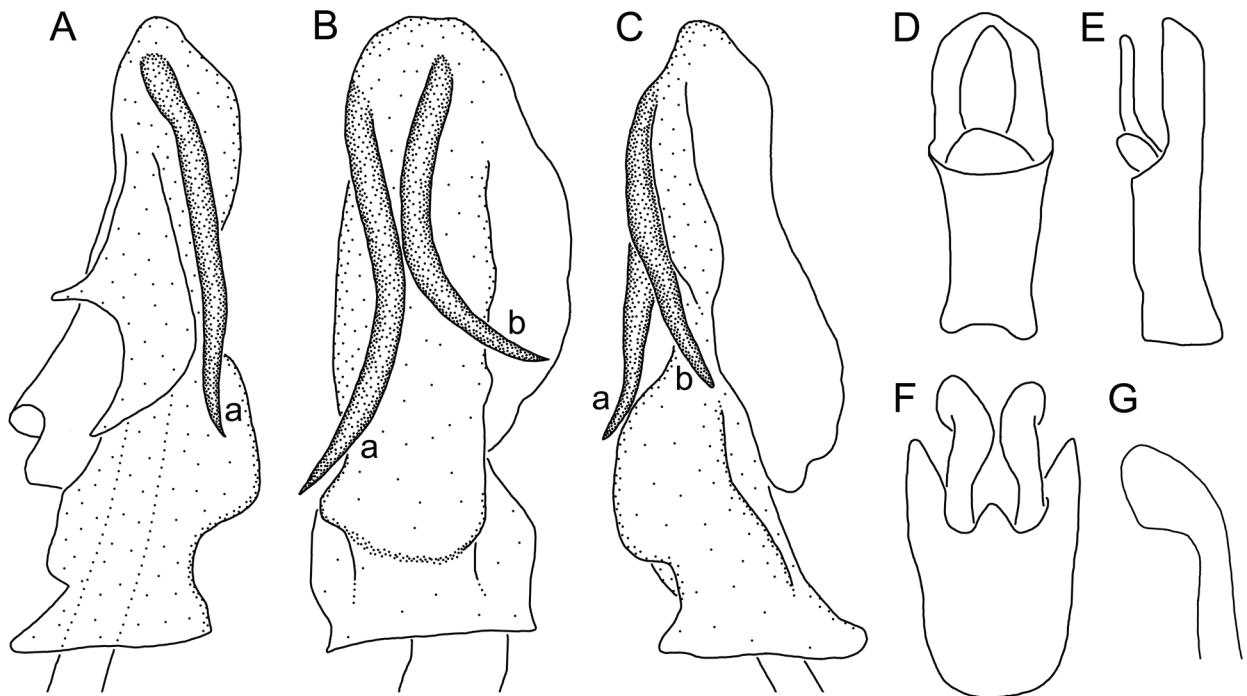
**Figure 14.** *Leades rufinus* (holomorphotype): **A**, aedeagus left lateral; **B**, aedeagus ventral; **C–D**, anal tube; **E–F**, genital styles.



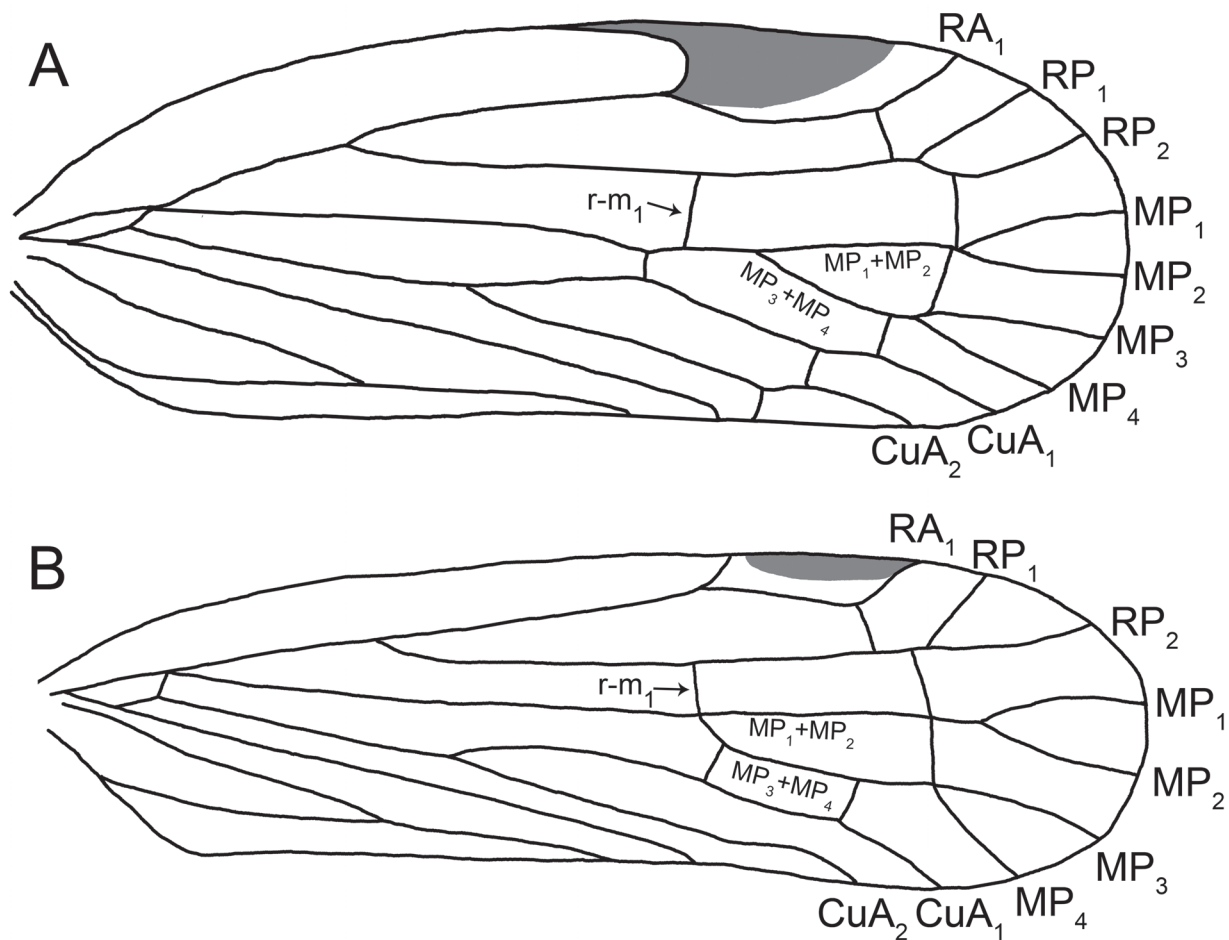
**Figure 15.** *Leades warro* (holotype): **A**, aedeagus left lateral; **B**, aedeagus ventral; **C**, aedeagus right lateral; **D–E**, anal tube; **F–G**, genital styles.



**Figure 16.** *Yamirrina concolor* (holotype): **A**, aedeagus left lateral; **B**, aedeagus ventral; **C**, aedeagus right lateral; **D–E**, anal tube; **F–G**, genital styles.



**Figure 17.** *Yamirrina vittipennis*: **A**, aedeagus left lateral; **B**, aedeagus ventral; **C**, aedeagus right lateral; **D–E**, anal tube; **F–G**, genital styles.



**Figure 18.** Forewing: **A**, *Leades rufinus* (holomorphyte); **B**, *Yamirrina concolor* (holotype).

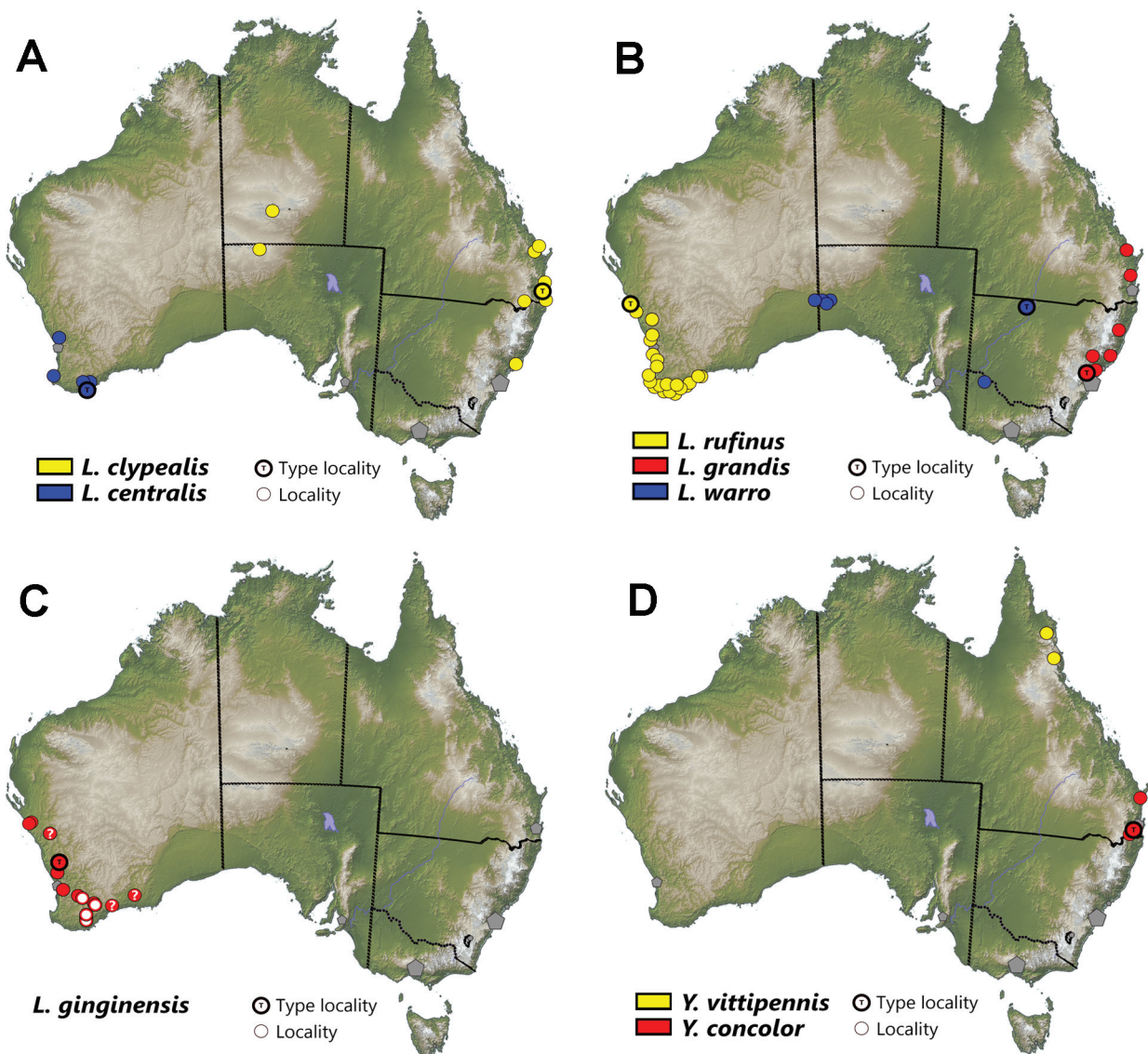
One specimen from Western Australia (10mi E of Southern Cross), currently identified as *Leades* sp. and located in the California Academy of Science collection (CAS), has a configuration of aedeagal spines in between *L. centralis* and *L. warro*, but a dark median carina on frons (concolorous with disc of frons) as in *L. ginginensis*. It has the following chaetotaxy: eight apical spines on the hind tibia, not separated by a gap; 1<sup>st</sup> hind tarsomere with 11 apical teeth seven platellae and 2<sup>nd</sup> tarsomere with 11 apical teeth and nine platellae. Further investigation and material are needed to verify whether this specimen represents a new species.

*Yamirrina* has only been recorded from Queensland and the most northerly parts of NSW (see Fig. 19). Numbers of specimens caught of this genus are very low despite the eastern regions of Australia having been comparatively well sampled, no host plant associations have been found to date, and most specimens have been collected via malaise trapping and one via pyrethrum knockdown. This could imply one or more of the following: species in this genus are very host specific, and the host plant is not one that is commonly sampled; the species prefers less accessible regions of the host plant, e.g. high up in trees; collecting has just not occurred at the right place at the right time. Therefore its actual distribution could be much more widespread than currently known, or it is actually restricted by its host plant or its own physiology to tropical and subtropical regions of Australia.

Within Cixiidae, in general, male genitalia seem to harbour the most useful characters to distinguish between species. Even within a genus, whilst species often look very similar externally (thus females can often only be identified to generic level), they usually display very distinct differences in the number, and arrangement of aedeagal spines and ridges on the phallosome. Interestingly this pattern does not fully apply to *Leades*. Whilst two species in this genus (*L. rufinus*, *L. grandis*) have a very unique aedeagal configuration, *L. ginginensis* and *L. centralis* have almost matching male genitalic features. However, other characters such as the chaetotaxy of the hind tibia differ (6 spines on the tibia in *L. ginginensis* and eight spines in *L. centralis*). Differences of such a degree are not commonly observed as intraspecific variation in Cixiidae. Further information on the similarities and differences between these species can

be found in the Diagnosis section of *L. ginginensis*. Geographical isolation cannot be blamed for these differences as both species have an overlapping distribution range. A similar situation is observed in the species *L. clypealis* and *L. warro*. The male genitalia look almost identical, whereas the chaetotaxy differs greatly (presence of platellae on the first tarsomere in *L. warro*, whereas absence in *L. clypealis*). DNA analysis of the COI sequence of *L. ginginensis* and *L. centralis* confirmed the morphological assessment that these species are not conspecific and therefore the same is assumed for the situation of *L. clypealis* and *L. warro*.

Based on characters such as the carination and general shape of the head and the configuration of the male genitalia, i.e., the aedeagus with two aedeagal spines and the presence of a bifurcate ventral process on the phallosome (with the exception of *L. rufinus*) *Leades* appears to be closely related to the Australian endemic genus *Chidaea*. *Yamirrina* shares some of these characteristics but shows major differences in the shape and carination of the head and the shape of the anal tube, which bears an extremely long anal style. A phylogenetic analysis is needed to verify the assumed monophyly of each of these genera and to investigate their relationships further.



**Figure 19.** Known distribution of *Leades* and *Yamirrina* species in Australia.

Whilst no plant associations records exist for *Yamirrina*, *Leades* has been collected from native plant species of fifteen different plant families (Table 1). With the exception of *Cassytha racemosa*, a parasitic climbing vine and climbers in the genus *Billardiera*, all of these are shrubs or small trees. Due to research projects studying hemipteran assemblages, mainly on understory plants in jarrah (*Eucalyptus marginata*) forests (Moir *et al.* 2005, 2010) as well as collecting trips in the Stirling Range National Park and other areas, large numbers of plant association records exist for

*Leades* species occurring in Western Australia. Data for species inhabiting other areas of Australia are, however, sparse, and with some of those records (e.g. *Angophora* sp., *Cassinia uncata*, *Cassia* sp., *Thryptomene* sp. and *Eremophila* sp.) only one specimen was collected from that plant which leaves uncertainty whether this specimen just happened to be on that plant at the time of collecting or actually lives and feeds on that particular plant. Interestingly, whilst different species of *Leades* have been recorded from the same plant genus (e.g. three different species of *Leades* have all been collected from *Leucopogon*), each insect species seems to specialise on a few plant species within that genus, e.g. *L. centralis* has been found on *Leucopogon atherolepis* and *Leuc. lasiophyllus*, *L. ginginensis* on *Leuc. australis* and *Leuc. cucullatus* and *L. rufinus* on *Leuc. nutans*. Similar patterns are found in the plant genera *Billardiera*, *Banksia* and *Hibbertia*. None of the plants listed in Table 1 have more than one species of *Leades* recorded. For a monophagous species this would not be surprising, however for polyphagous species, which *L. centralis*, *L. ginginensis* and *L. rufinus* clearly are, this is unexpected. Further data is needed for the remaining species of *Leades* and of the genus *Yamirrina*, to gain a clear picture of their feeding patterns.

**Table 1.** Associated plant records of *Leades* Jacobi.

Plant family	Plant species	Insect species
<b>Asteraceae</b>		
	<i>Cassinia uncata</i>	<i>L. clypealis</i>
<b>Chenopodiaceae</b>		
	<i>Rhagodia baccata</i>	<i>L. rufinus</i>
<b>Dilleniaceae</b>		
	<i>Hibbertia cuneiformis</i>	<i>L. rufinus</i>
	<i>Hibbertia gracilipes</i>	<i>L. ginginensis</i>
<b>Ericaceae</b>		
	<i>Leucopogon atherolepis</i>	<i>L. centralis</i>
	<i>Leucopogon australis</i>	<i>L. ginginensis</i>
	<i>Leucopogon cucullatus</i>	<i>L. ginginensis</i>
	<i>Leucopogon lasiophyllus</i>	<i>L. centralis</i>
	<i>Leucopogon nutans</i>	<i>L. rufinus</i>
	<i>Leucopogon</i> sp.	<i>L. ginginensis</i> , <i>L. rufinus</i>
	<i>Styphelia epacridis</i> (formerly <i>Astroloma epacridis</i> )	<i>L. ginginensis</i>
	<i>Styphelia pallida</i> (formerly <i>Astroloma pallidum</i> )	<i>L. ginginensis</i>
	<i>Styphelia serratifolia</i> (formerly <i>Astroloma serratifolium</i> )	<i>L. ginginensis</i>
<b>Fabaceae</b>		
	<i>Acacia</i> sp.	<i>L. rufinus</i>
	<i>Aotus genistoides</i>	<i>L. centralis</i>
	<i>Cassia</i> sp.	<i>L. warro</i>
	<i>Bossiaea aquifolium</i>	<i>L. rufinus</i>
	<i>Jacksonia grevilleoides</i>	<i>L. ginginensis</i>
<b>Lauraceae</b>		
	<i>Cassytha racemosa</i>	<i>L. rufinus</i>
<b>Malvaceae</b>		
	<i>Lasiopetalum floribundum</i>	<i>L. rufinus</i>
<b>Myrtaceae</b>		
	<i>Agonis flexuosa</i>	<i>L. rufinus</i>
	<i>Angophora</i> sp.	<i>L. grandis</i>
	<i>Calothamnus lateralis</i> var. <i>crassus</i>	<i>L. centralis</i>
	<i>Calothamnus quadrifidus</i>	<i>L. ginginensis</i>
	<i>Calothamnus</i> sp.	<i>L. ginginensis</i>
	<i>Kunzea</i> aff. <i>ciliata</i>	<i>L. rufinus</i>
	<i>Kunzea montana</i>	<i>L. centralis</i>

...continued on the next page

**Table 1.** (Continued)

Plant family	Plant species	Insect species
	<i>Leptospermum erubescens</i>	<i>L. ginginensis</i>
	<i>Leptospermum laevigatum</i>	<i>L. clypealis</i>
	<i>Melaleuca densa</i>	<i>L. centralis</i>
	<i>Thryptomene</i> sp.	<i>L. warro</i>
<b>Pittosporaceae</b>		
	<i>Billardiera drummondii</i>	<i>L. ginginensis</i>
	<i>Billardiera fusiformis</i>	<i>L. rufinus</i>
	<i>Billardiera heterophylla</i> (= formerly <i>Sollya heterophylla</i> )	<i>L. rufinus</i>
	<i>Billardiera</i> sp. [on <i>Leucopogon</i> sp.]	<i>L. rufinus</i>
<b>Proteaceae</b>		
	<i>Banksia brownii</i>	<i>L. rufinus</i>
	<i>Banksia hirta</i> (formerly <i>Banksia hirsuta</i> )	<i>L. centralis</i>
	<i>Banksia polycephala</i> (formerly <i>Dryandra polycephala</i> )	<i>L. ginginensis</i>
	<i>Banksia pseudoplumosa</i> (formerly <i>Dryandra pseudoplumosa</i> )	<i>L. ginginensis</i>
	<i>Banksia quercifolia</i>	<i>L. rufinus</i>
	<i>Grevillea nudiflora</i>	<i>L. centralis</i>
	<i>Grevillea</i> sp. ‘Stirling’	<i>L. ginginensis</i>
	<i>Hakea trifurcata</i>	<i>L. centralis</i>
<b>Rhamnaceae</b>		
	<i>Spyridium globulosum</i>	<i>L. rufinus</i>
<b>Rutaceae</b>		
	<i>Boronia purdieana</i> *	<i>L. ginginensis</i>
	<i>Microcybe</i> sp.	<i>L. ginginensis</i>
<b>Sapindaceae</b>		
	<i>Dodonea</i> sp.	<i>L. warro</i>
<b>Scrophulariaceae</b>		
	<i>Eremophila</i> sp.	<i>L. warro</i>
<b>Thymelaeaceae</b>		
	<i>Pimelea clavata</i>	<i>L. rufinus</i>
	<i>Pimelea sylvestris</i>	<i>L. rufinus</i>

\*‘*Boronia nurdiana*’ as found on the data label of a specimen of *L. ginginensis* is assumed to be a misspelling of *Boronia purdieana*.

## Acknowledgements

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