Zootaxa 4691 (5): 401–443
https://www.mapress.com/j/zt/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)
https://doi.org/10.11646/zootaxa.4691.5.1
http://zoobank.org/urn:lsid:zoobank.org:pub:5B0FFE9A-AF71-49E3-85D4-5F0CF3C07CF7

Revision of the Australian planthopper genus *Chidaea* Emeljanov with a redescription of *Cixius sidnicus* Stål, 1859 (Hemiptera: Auchenorrhyncha: Fulgoromorpha: Cixiidae)

BIRGIT LÖCKER[1] & WERNER E. HOLZINGER[2]
[1]*Department of Primary Industries, Orange Agricultural Institute, Orange, NSW 2800 Australia. E-mail: birgit.loecker@gmx.at*
Birgit Löcker: http://zoobank.org/urn:lsid:zoobank.org:author:87E250D9-9A17-4E97-8D3B-E8A72F1DEB24
[2]*Oekoteam-Institute for Animal Ecology and Landscape planning, Bergmanngasse 22, 8010 Graz, Austria, and Institute for Biology, Karl-Franzens-University Graz, Austria. E-mail: holzinger@oekoteam.at*
http://zoobank.org/Authors/99CD5AE9-A6F3-426A-A7DF-2E6892FC0257

Table of content

Abstract

As part of the ongoing revision of the Australian Cixiidae, here we revise the endemic genus *Chidaea* Emeljanov, 2000. Examination of the holotype of *Cixius sidnicus* Stål, 1859 revealed that it is not congeneric with *Cixius nervosus* (Linnaeus, 1758) but belongs to the hitherto monotypic genus *Chidaea* resulting in the new combination *Chidaea sidnicus* (Stål, 1859). *Chidaea dayi* Emeljanov, 2000 is redescribed and thirteen new species are described: *Chidaea algida* **sp. nov.**, *Ch. armidalensis* **sp. nov.**, *Ch. belairensis* **sp. nov.**, *Ch. bobadeenensis* **sp. nov.**, *Ch. carinata* **sp. nov.**, *Ch. crassa* **sp. nov.**, *Ch. dickinsonorum* **sp. nov.**, *Ch. etelis* **sp. nov.**, *Ch. kimbaensis* **sp. nov.**, *Ch. orangensis* **sp. nov.**, *Ch. pulyonna* **sp. nov.**, *Ch. punctata* **sp. nov.**, and *Ch. wilarra* **sp. nov.** An identification key to species of *Chidaea* and to Australian genera of Cixiini is presented. Host plant relationships and distribution are discussed. *Chidaea* is endemic to Australia and occurs in all states and territories apart from the Northern Territory.

Key words: Australia, identification, morphology, distribution, Cicadina, Fulgoroidea, endemic planthopper

Accepted by J. Szwedo: 24 Sept. 2019; published: 4 Nov. 2019

Introduction

The planthopper family Cixiidae has a worldwide distribution, with some of its members having an economic impact on agricultural crops due to their ability to transmit plant pathogens (phytoplasmas, bacteria), e.g. *Hyalesthes obsoletus* Signoret, 1865 on grapevine and sugar beet, *Cixius wagneri* (China, 1942) on strawberry and *Haplaxius crudus* (Van Duzee, 1907) in coconut palms (Bressan *et al.* 2008; Danet *et al*. 2003; Jović *et al.* 2019; Howard *et al.* 1983; Salar *et al*. 2010). The Australian Cixiidae fauna is rich and diverse, but still insufficiently known. As part of the ongoing family revision (Löcker *et al.* 2006a, 2006b, 2007a, 2007b, 2007c, 2010; Löcker 2007, 2014a, 2014b, 2015), here we focus on the endemic genus *Chidaea* Emeljanov, 2000.

Cixius sidnicus Stål, 1859 was the first Cixiidae species described from Australia. At that time only seven cixiid genera had been described worldwide of which *Cixius* Latreille, 1804 was the obvious choice for placement of the species, as the mesonotum has three longitudinal carinae. Today more than 2500 Cixiidae species in about 230 genera are known worldwide (Bourgoin, 2019). The genus *Cixius* itself is divided into 15 subgenera and contains more than 300 species (Bartlett, 2019; Bourgoin, 2019). They occur in the Palaearctic, Nearctic, Ethiopian and Oriental regions, but the monophyly of this diverse group in its recent interpretation is not proven. The presence of "true" *Cixius* in Australia is in doubt today. In his important contribution to the knowledge of Australian Cixiidae, Emeljanov (2000) says that the genus *Cixius* (in its current taxonomic concept) is not represented in Australia. However, he does not state the generic placement of *C. sidnicus*. Whilst examining Australian cixiid material from different collections, we found and re-examined the type of *C. sidnicus* and studied a large number of specimens belonging to closely related, but undescribed taxa. The results of these studies are presented in this paper.

Materials 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 containing 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 5 times zoom; Canon Utility Software) using a lightbox (ORTECH Photo e-Box Plus Professional Lighting 1419) and later stacked using Helicon Focus. Photographs taken with the digital SLR camera attached to a Leica MZ12.5 dissecting microscope were used as a base for line illustrations.

The morphological terms (except for wing venation) applied here follow Löcker *et al.* (2006b); terminology of the carinae and compartments on the head follows Löcker (2014a). The following measurements were 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

The terminology of wing venation in Fulgoromorpha has changed recently due to the discoveries by Bourgoin *et al.* (2015). Main differences (e.g. for identification keys) concern the interpretation of the veins Radius and Media. We follow Bourgoin *et al.* (2015) in this paper. Following abbreviations and names are used (see also Fig. 28H):

Longitudinal veins
A = Anal vein
C = Costa (Costa anterior)
CuA = Cubitus anterior
CuP = Cubitus posterior
M = Media. The anterior part (MA) is fully fused with RP, thus only MP = Media posterior is observable.
Pcu = Postcubitus
R = Radius, divided in RA = Radius anterior and RP = Radius posterior.
ScP = Subcosta posterior
Y-vein = vein formed by Pcu and A1 (as they fuse distally)
Crossveins
icu = connecting CuA2 and CuP
icua = connecting CuA1 and CuA2
im = connecting MP1+2 and MP3+4
ir = connecting RA and RP (+fused MA)
m-cu = connecting MP and CuA
r-m = connecting RP(+fused MA) and MP
Cells (red letters in Fig. 28H)
bc = basal cell
pcc = postcostal cell
mc = median cell
rc = radial cell
cuc = cubital cell
C1–C5 = nodal cells
C... = postnodal cells
Other terms used
T = Tegula
PT = Pterostigma
Clavus = Wing region with the Y-vein, delimited by CuP

Abbreviations

ACT	Australian Capital Territory
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, United States of America
NENH	University of New England, Natural History Museum, Armidale, Australia
NHRS	Naturhistoriska Riksmuseet, Stockholm, Sweden
NSW	New South Wales
QDPI	Queensland Department of Primary Industries, Brisbane, Australia
SA	South Australia
SAMA	South Australian Museum, Adelaide, Australia
Tas	Tasmania
TAIC	Tasmanian Agricultural Invertebrate Collection, Department of Agriculture, Hobart, Australia
QM	Queensland Museum, Brisbane, Australia
UQIC	University of Queensland Insect Collection, Brisbane, Australia (now part of the QM collection)
VAIC	Victorian Agricultural Insect Collection, Agriculture Victoria, Melbourne, Australia
Vic	Victoria
WA	Western Australia

Results

Key to genera of Australian Cixiini

1 Median carina of frons forked. 2
- Median carina of frons unforked (Fig. 5C). 3
2(1) First hind tarsomere with 8 apical teeth and 4 setae; angle formed by hind margin of pronotum rectangular or moderately obtuse; lateral carinae of pronotum in dorsal view c-shaped, lateral parts directed towards head; vertex in midline at least twice as long as pronotum. . . . . Genus *Yanganaka* Löcker, 2015
- First hind tarsomere with 5–7 apical teeth and no setae; angle formed by hind margin of pronotum broadly obtuse; lateral carinae of pronotum in dorsal view s-shaped, second bend turning towards mesonotum; vertex in midline about as long as pronotum. . . . . Genus *Aka* White 1879
3(1) Second hind tarsomere without platellae but with three or fewer very fine setae. 4
- Second hind tarsomere with four or more platellae. 6
4(3) Apical transverse carina of vertex deeply u-shaped. . . . . Genus *Monomalpha* Emeljanov, 2000
- Apical transverse carina of vertex v-shaped, shallowly u-shaped or almost straight. 5
5(4) Basal compartment of vertex about as long as wide. . . . . ‘*Iolania*’ *vittipennis* Muir, 1931
[Note: *Iolania* Kirkaldy, 1902 is a genus restricted to the Hawaiian Islands (Hoch 2006); the generic placement of ‘*Iolania*’ *vittipennis* will be resolved at a later stage during this research project. ‘*Iolania*’ *clypealis* Muir, 1931, keys out under *Leades* Jacobi, 1928, as it appears to be closely related to this genus (Löcker, 2007).]
- Basal compartment of vertex no more than half as long as wide. . . . . Genus *Leptolamia* Metcalf, 1936
6(3) Second hind tarsomere with two fewer platellae than apical teeth; forewing with CuA2 reaching the margin of forewing in its entire thickness. 7
- Second hind tarsomere with four fewer platellae than apical teeth; forewing with CuA2 either ending well before it reaches the margin of the forewing or reaching the margin but with slightly reduced thickness. . . . . Genus *Calamister* Kirkaldy, 1906
7(6) Male anal style about as long as 11th segment (Fig. 23E). Male anal tube with ventral lobe in lateral view usually narrow near base, widening towards apex (Fig. 23E). Forewing with crossvein r-m_1 usually distad or at same level as fork MP1+2 and MP3+4 (Fig. 15E, 28H). Radius anterior (RA) forked or unforked. . . . . Genus *Chidaea* Emeljanov
- Male anal style distinctly longer than 11th segment (11th segment about 2/3–3/4 as long as anal style). Male anal tube with ventral lobe in lateral view tapering (widest near base). Forewing with crossvein r-m_1 usually distinctly basad of fork MP1+2 and MP3+4. Radius anterior (RA) unforked. . . . . Genus *Leades* Jacobi, 1928

Genus *Chidaea* Emeljanov

Chidaea Emeljanov, 2000: 13
Type species: *Chidaea dayi* Emeljanov, 2000, by original designation and monotypy.

Description. *Chidaea* species are characterised by a mesonotum with three carinae; apex of hind tibia with 6 spines, the distal one largest, ScP+R fused distad of basal cell in fore wing (Fig. 28H); wings in resting position tectiform, but distal parts not touching each other. The most important diagnostic features of *Chidaea* are: Aedeagus with two movable spines at the distal end of the phallotheca, one on each side; phallotheca with a ventral ridge, at its base always with a rigid bifurcate projection pointing cephalad (‘bifurcate ventral process’) as in Figs 23A–C; anal segment almost symmetrical in dorsal view; anal tube with a distinct ventral lobe at its end that in lateral view is usually narrow at the base and widening towards the apex (Fig. 23E); anal style about as long as remainder of 11th segment(sometimes marginally shorter or longer). Apex of head with two straight or almost straight, transverse carinae (apical transverse carina and subapical carina). Frons without median ocellus, with one median carina, neither forked nor vanishing. Vertex (= coryphe *sensu* Emeljanov) at least about twice as wide as long, apical border more or less parallel to basal border, straight, slightly rounded or shallowly angulate. Pronotum narrow. Forewing without concavity at costal border; crossvein r-m_1 usually distad of fork MP1+2 and MP3+4; RA often forked apically. Females bearing a small or large wax plate at segment IX.

Differential Diagnosis: *Chidaea* is endemic to Australia and can be distinguished from all other genera of Australian Cixiidae by a combination of the following characters: Pronotum lacking ovoid inflated areas; apex of head with two transverse carinae (apical transverse carina and subapical carina); median carina of frons unforked; forewing with subcostal and radial vein (and for a very short section even medial vein) united near basal cell to form a distinct stem; second hind tarsomere with two platellae less than number of apical spines; frons without a median ocellus, postclypeus convex but not distinctly swollen and prominent; male anal tube with ventral lobe in lateral view narrow near base, widening towards apex.

Chidaea differs from the New Zealand species that were originally placed in *Cixius*, but have since been transferred to *Cermada* Emeljanov, 2000 in the shape of the vertex and features of the male genitalia: In *Chidaea* the vertex is very wide (about twice as wide as long or wider) whereas in *Cermada* the vertex is as wide as long or longer than wide. The aedeagus in *Cermada* lacks a bifurcate ventral process and doesn't have the typical arrangement of 2 moveable spines.

According to Emeljanov (2000) *Macrocixius* Matsumura, 1914, a genus occurring in the Oriental region, can be separated from *Chidaea* by the presence of a median ocellus (absent in *Chidaea*).

Morphology. Body length: ♂ 3.9–6.9 mm; ♀ 4.7–9.6 mm.

<u>Head:</u> Vertex widest at base, and narrowest at subapical carina; lateral carinae moderately elevated; angle formed by caudal border of vertex broadly obtuse; apical and subapical carina slightly to moderately v- or u- shaped or almost straight; median carina covering parts of or the entire length of basal compartment of vertex, absent in apical compartment (apart from a rudimentary presence in some specimens of *Ch. carinata* and *Ch. punctata*). In dorsal view head (including eyes) narrower than pronotum. Frons invisible in dorsal view. Maximum width of frons no more than 2x apical width, sometimes almost the same width. Median carina on frons complete, sometimes evanescent near frontoclypeal suture. Lateral carinae of frons foliaceous, moderately extending laterally, concealing base of antennae. Median ocellus absent. Postclypeus with well developed lateral carinae except for *Ch. belairensis* where it is weakly developed. Anteclypeus lacking lateral carinae apart from *Ch. orangensis* and *Ch. algida* which sometimes have evanescent lateral carinae. Apical and subapical rostrum segments more or less equal in length.

<u>Thorax:</u> Pronotum with median carina weakly developed (with the exception of *Ch. carinata*, *Ch. punctata* and *Ch. kimbaensis* with well developed median carina); pronotum shortest in middle; submedian carinae running parallel to eyes. Forewings moderately tectiform; surpassing tip of abdomen; widest at same level or distad of apex of clavus; concavity at costal border absent (apart from *Ch. carinata* and *Ch. punctata*); veins except marginal ones granulate (with tubercles); tubercles on costal margin in single row; tubercles in pterostigma arranged in 1–2 rows; no tubercles in cells at apex of wing, only along veins; pterostigma subtriangular; basal cell subtransverse apically; ScP+R+M usually forming a minute or small common stem distad of basal cell (see Fig. 28H); crossvein r-m_1 distad of fork MP1+2 and MP3+4 (basad only in a few specimens of *Ch. dayi*); icu distinctly distad (rarely slightly distad) of apex of clavus; additional subapical cell C3a between branches of MP1 and MP2 present; CuA apically unforked (rarely bifid); nodus of y-vein more or less central within clavus (rarely slightly basad of centre of clavus); vein delimiting subapical cell C4 (m-cu_2) distinctly distad of vein delimiting C5 (icua); subapical cell C5 distinctly longer than C4. Hind leg: tibia with 0–7 minute to small lateral spines, with 6 (rarely 5 or 7) apical spines, grouped in two groups with a large (rarely small) gap in between; outermost spine of tibia largest, followed by 2 smaller spines with their tips well separated; the 3 innermost spines of tibia almost as long as outermost spine, with their tips in close proximity to each other; 1st tarsomere with 8–14 (rarely 7) apical teeth and either without platellae or with 5–9 (rarely 4 or 10) platellae; 2nd tarsomere with 9–13 (rarely 14–15) apical teeth and with platellae (two less than number of apical teeth).

<u>Male genitalia</u>: Phallotheca with a bifurcate ventral process (Figs 23A–C). Movable apical part (called endosoma or flagellum by authors) unarmed (but sometimes with a few more sclerotised sections that may appear to be spines at first glance). Anal segment almost symmetrical in dorsal view; ventral lobe of anal tube in lateral view narrow at base, widening towards the apex; anal style about as long as remainder of 11th segment (length of 11th segment about 5/6–7/6 of length of anal style).

<u>Female genitalia</u>: Ovipositor, wax plate and anal tube as in Fig. 1: Ovipositor sabre-shaped (curved upwards), sometimes protruding further than anal tube. Segment IX bearing wax plate, ranging from large, circular shaped to small ovoid. Anal tube varying in length from slightly longer than wide (e.g. *Ch. etelis*), about as long as wide (e.g. *Ch. punctata*) to shorter than wide (e.g. *Ch. orangensis* and *Ch. kimbaensis*). Anal style very short, about same length as 11th segment or slightly shorter.

Distribution: Australia (all states and territories except for Northern Territory), see Fig. 31.

Notes. Emeljanov (2007) refers to *Chidaea* as an Australian-New Zealand genus. This cannot be confirmed by the authors. The species number "3" for *Chidaea* given by Holzinger *et al*. (2002) was erroneous. Prior to this paper only one species of *Chidaea* has been described which is restricted to Australia.

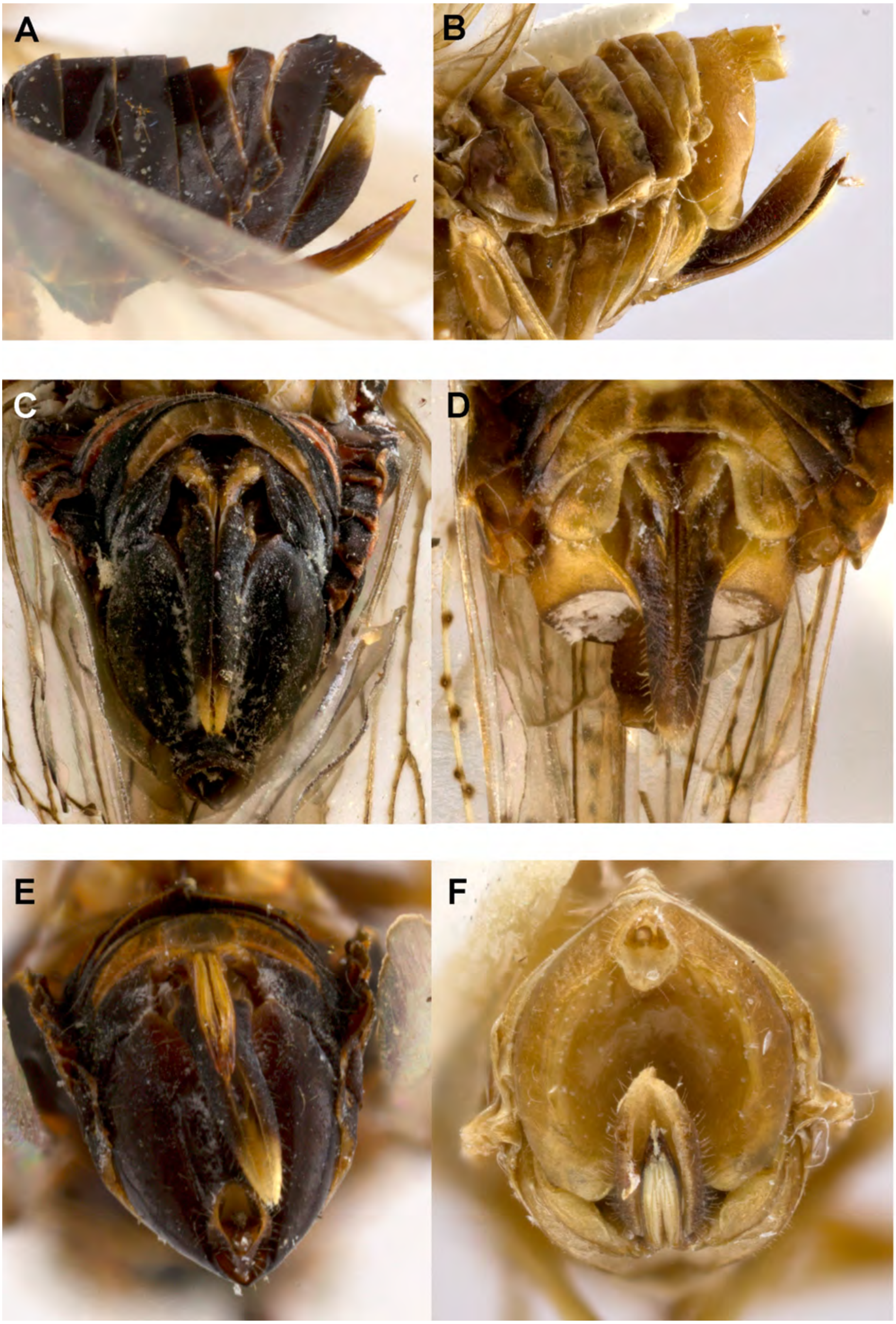

FIGURE 1. Female genitalia: *Chidaea pulyonna*: A lateral, C caudoventral, E caudal; *Chidaea armidalensis*: B lateral, F caudal; *Chidaea etelis*: D caudoventral.

Checklist of species of *Chidaea* Emeljanov

Chidaea algida **sp. nov.**	(NSW, Qld)
Chidaea armidalensis **sp. nov.**	(ACT, NSW, Tas, Vic)
Chidaea belairensis **sp. nov.**	(SA)
Chidaea bobadeenensis **sp. nov.**	(NSW)
Chidaea carinata **sp. nov.**	(NSW, Qld)
Chidaea crassa **sp. nov.**	(NSW, Qld)
Chidaea dayi Emeljanov, 2000	(ACT, NSW, Tas, Vic)
Chidaea dickinsonorum **sp. nov.**	(NSW, Qld)
Chidaea etelis **sp. nov.**	(WA)
Chidaea kimbaensis **sp. nov.**	(SA)
Chidaea orangensis **sp. nov.**	(NSW, Qld, SA, Vic)
Chidaea pulyonna **sp. nov.**	(NSW)
Chidaea punctata **sp. nov.**	(Qld)
Chidaea sidnicus (Stål, 1859) **comb. nov.**	(NSW)
Chidaea wilarra **sp. nov.**	(NSW)

Key to species of *Chidaea* Emeljanov

Notes. This key is mainly based on male specimens, depending on the species, females can only be identified to a certain level. Numerous females were found in material located at the following collections (AMS, ANIC, ASCU, BPBM, QDPI, QM and SAMA) that based on morphological characters alone could not be identified to species level. *Chidaea sidnicus* is also excluded from the key as the only known specimen is a female.

1 First hind tarsomere apically with a row of at least 4 platellae. 2
- First hind tarsomere apically without platellae. 9
2(1) Tubercles of forewing dark and distinctly contrasted to paler coloured veins (Figs 5A, 7A, 10A, 11A). 3
- Tubercles of forewing dark or pale and concolorous with veins (Figs 2A, 4A, 6A, 12A). 6
3(2) Aedeagus with left lateral spine (a) distinctly longer (almost twice as long) than right lateral spine (b) (Fig. 26B). . . . . *Ch. kimbaensis* **sp. nov.**
- Aedeagus with both spines about the same length or right lateral spine (b) longer (Figs 22B, 25B). 4
4(3) Aedeagal spines reaching or surpassing bifurcate ventral process. (Figs 22B, C). . . . . *Ch. crassa* **sp. nov.**
- Aedeagal spines not reaching bifurcate ventral process (Figs 20B–C, 25B–C). 5
5(4) Base of bifurcate ventral process symmetrical (Fig. 25B). . . . . *Ch. etelis* **sp. nov.**
- Base of bifurcate ventral process asymmetrical (Fig. 20B). . . . . *Ch. bobadeenensis* **sp. nov.**
6(2) Pronotum very long (median carina of pronotum as long or longer than length of basal compartment of vertex) as in Fig. 6B; carinae on pronotum and head extremely well developed and in distinct colour contrast to adjacent darker areas (Figs 6B–D). . . . . *Ch. carinata* **sp. nov.**
- Pronotum short (median carina of pronotum usually much shorter than length of basal compartment of vertex) as in Fig. 2B; carinae on pronotum and head not in such clear contrast to adjacent areas (Figs 2B–D, 4B–D, 12B–D). 7
7(6) Aedeagus with entire length of spines visible in ventral view (Fig. 17B); aedeagus with two long spines that cross over ventrally (Fig. 17B). . . . . *Ch. algida* **sp. nov.**
- Aedeagus with spines partly or completely concealed by phallotheca in ventral view (Figs 19B, 27B). 8
8(7) Aedeagal spines by far not reaching bifurcate ventral process (Figs 27A–C). Body length of males 5.7 mm or more, females 6.6 mm or more. . . . . *Ch. orangensis* **sp. nov.**
- Aedeagal spines reaching, or almost reaching bifurcate ventral process (Figs 19A–C). Body length of males 4 mm or less, females 5 mm or less. . . . . *Ch. belairensis* **sp. nov.**
9(1) Mesonotum with a prominent black central stripe (area between lateral carinae) in distinct contrast to pale area outside of carinae, often with extreme lateral areas of mesonotum also darkened (Figs 13B,D). . . . . *Ch. pulyonna* **sp. nov.**
- Mesonotum dark or lightly coloured but without a distinctly contrasted, darker central area (Figs 14C–D). 10
10(9) Forewings with a u-shaped pattern consisting of 6 dark brown spots (Fig. 14A). . . . . *Ch. punctata* **sp. nov.**
- Forewings without such u-shaped pattern. 11
11(10) Aedeagus ventrally with a spine with a large base (Figs 18B, 23B). 12
- Aedeagus laterally or ventro-laterally with a spine with a small to moderate base (Figs 24A–C, 30A–C). 13
12(11) Ventral spine (b) of aedeagus with its tip directed left laterad (Fig. 23B). . . . . *Ch. dayi* Emeljanov
- Ventral spine (b) of aedeagus with its tip directed right laterad (Fig. 18B). . . . . *Ch. armidalensis* **sp. nov.**

13(11) Aedeagus in lateral view with both spines equally strongly curved (Figs 30A,C). *Ch. wilarra* **sp. nov.**
- Aedeagus in lateral view with left lateral spine (a) moderately to strongly curved and right lateral spine (b) almost straight (Figs 24A,C). . . . . *Ch. dickinsonorum* **sp. nov.**

***Chidaea algida* sp. nov.**

(Figs 2, 17, 31A)
Zoobank Registration:
http://zoobank.org/urn:lsid:zoobank.org:act: 9A29BCBD-2C3D-47EC-B8E7-7F3DEAE8A5C1

Types. *Holotype*, ♂, **AUSTRALIA, NSW:** Newry SF nr Urunga, 30[°]32[’]S, 152[°]59[’]E, 29.ix.1987 (M.M. Stevens) (ASCU ASCTHE031070). *Paratypes*, **NSW:** 2 ♂, same data as holotype (ASCU); 2 ♂, same data as holotype except for 2.x.1987 (ASCU); 2 ♂, Lorien Ref., 3km N Lansdowne nr Taree; rainforest margin; malaise trap, 23.viii.–6.ix.1987 (G. Williams) (AMS); 10 ♂, same data except for 6.–13.ix.1987 (AMS); 23 ♂, same data except for 14–27.ix.1987 (AMS); 2 ♂, same data except for 27.ix–4.x.1987 (AMS); 5 ♂, same data except for 1–11.x.1987 (AMS); 7 ♂, same data except for 11–18.x.1987 (AMS); 1 ♂, same data except for 19–25.x.1987 (AMS); 2 ♂, Mt Gibraltar NP, 72 mi W of Grafton, 13.xi.1964 (D.D. McAlpine) (AMS). **Qld:** 1 ♂, Enoggera, 15.ix.1941 (H. Hacker) (QDPI); 1 ♂, Caloundra, 20.viii. 1939 (W. Bryan) (QM, formerly UQIC); 5 ♂, Cougal Creek, Upper Tallebudgera, 28º 12’S, 153º 21’E, 80m, rainforest, 12–14.x.1990 (G. Daniels) (QM, formerly UQIC); 1 ♂, Willowburn, 14.ix.1920 (J.A. Beck) (QM, formerly UQIC); 1 ♂, Brisbane, (8.), 8.x.1922 (H. Hacker) (BPBM); 1 ♂, Brisbane, 13.ix.1923 (H. Hacker) (QM); 1 ♂, same data except for 30.ix.1923 (QM); 1 ♂, same data except for 2.ix.1925 (QM); 1 ♂, Beerwah, 22.ix.1956 (Kirkpatrick) (QM, formerly UQIC); 1 ♂, Glen Aplin, 4.xii.1964 (P. Kerridge) (QM, formerly UQIC); 1 ♂, Mt Glorious, 25.x.1966 (B. Cantrell) (QM, formerly UQIC); 1 ♂, Sunnybank, 18.ix.1926 (H. Hacker) (QM).

Other material examined. AUSTRALIA, NSW: 1 ♀, Newry SF nr Urunga, 30[°]32[’]S, 152[°]59[’]E, 29.ix.1987 (M.M. Stevens) (ASCU); 1 ♀, same data except for 2.x.1987); 3 ♀, Lorien Ref., 3km N Lansdowne nr Taree; rainforest margin; malaise trap, 23.viii.–6.ix.1987 (G. Williams) (AMS); 8 ♀#, same data except for 6.–13.ix.1987 (AMS); 6 ♀, same data except for 14–27.ix.1987 (AMS); 1 ♀, same data except for 27.ix–4.x.1987 (AMS); 3 ♀, same data except for 1–11.x.1987 (AMS); 7 ♀, same data except for 11–18.x.1987 (AMS); 1 ♀, same data except for 19–25.x.1987 (AMS); 1 ♀, Mt Gibraltar NP, 72 mi W of Grafton, 13.xi.1964 (D.D. McAlpine) (AMS). **Qld:** 1 ♀, Brisbane, 5.ix.1922 (QM); 1 ♀, Brisbane, 8.x.1922 (H. Hacker) (QM); 5 ♀, same data except for 13.xi.1923 (QM); 1 ♀, same data except for 26.xiii.1925 (QM); 1 ♀, same data except for 2.ix.1925 (QM); 1 ♀, Sunnybank, 8.ix.1928 (QM, formerly UQIC); 2 ♀, Willowburn, 14.ix.1920 (J.A. Beck) (QM, formerly UQIC); 3 ♀, Alderley, Brisbane, 30.ix.1923 (H. Hacker) (QM); 1 ♀, Brisbane, 3.ix.1915 (H. Hacker) (QM); 1 ♀, Brisbane, ix.1925 (G.H. Hardy) (QM, formerly UQIC); 1 ♀, Brisbane, 1.x.1962 (E.A. Bernays) (QM, formerly UQIC).

Notes. The females listed under ‘Other material examined’ 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 *Ch. algida* and *Ch. orangensis*, and these two species have an overlapping distribution range, there remains the possibility that some of these females may be *Ch. orangensis*.

Etymology. The Latin term ‘algidus’ means ‘cold’. Named after the ventral view of the aedeagus resembling a person with her arms held as if she was feeling cold.

Colour. Entire specimen including carinae light brown, rarely with darker patches. Pronotum often slightly darker than head and pronotum. Forewings light brown, tubercles and veins light brown, concolorous with cells. Pterostigma, crossveins and apical parts of veins often slightly darker.

Morphology. Body length: ♂ 5.6–6.8 mm; ♀ 6.6–7.3 mm.

Head: Vertex 2.2–2.8 x wider than long; median carina of vertex covering 1/5–3/4 of basal compartment of vertex; absent in apical compartment. Frons 1.0–1.2 x as long as wide; position of maximum width distinctly dorsad of centre of frontoclypeal suture; lateral carinae of frons in facial view convex, rectilinear apically or convex, evenly rounded. Frontoclypeal suture strongly semicircular, bent upwards, median part reaching at least lower margin of antennal scape. Postclypeus with median carina well developed or evanescent. Anteclypeus with median carina evanescent or absent. Rostrum reaching or surpassing hind coxae.

Thorax: Hind margin of pronotum acutely angled. Mesonotum with weak to evanescent median and lateral carinae. Forewing 3.1–3.4 x longer than wide; concavity at costal border absent; costal margin with 8–13 tubercles;

fork of ScP+RA and RP basad, slightly distad or at same level as fork CuA1 and CuA2; tubercles of forewing dark or pale, concolorous with veins; ScP+RA apically bifid; RP trifid; additional subapical cell between branches of MP1 and MP2 absent; MP1+2 trifid (rarely 4 branches), MP3+4 bifid or trifid; 10–12 apical cells; 6 subapical cells. Hind leg: tibia with 6 apical spines; 1st tarsomere with 11–12 (rarely 10) apical teeth and 5–7 platellae; 2nd tarsomere with 10–12 (rarely 9) apical teeth and 7–9 (rarely 10) platellae.

Male genitalia: Anal tube as in Figs 17D–E. Pygofer and genital styles as in Figs 17F–G. Aedeagus as in Figs 17A–C. Phallotheca with two very long, strongly curved (in lateral and ventral view) spines (a) and (b). Both spines cross the phallotheca ventrally and their tips point in opposite directions. Phallotheca with a bifurcate ventral process on a large stalk near base of phallotheca. Aedeagal spines not reaching bifurcate ventral process. Sclerotised sections of phallotheca very wide at base, very narrow in apical two thirds of phallotheca. Phallotheca with wide unsclerotised sections in apical two thirds of phallotheca.

Diagnosis. This species can be easily distinguished from other species of *Chidaea* in having two very long spines that cross over ventrally.

Associated plant records:

Distribution: NSW, Qld.

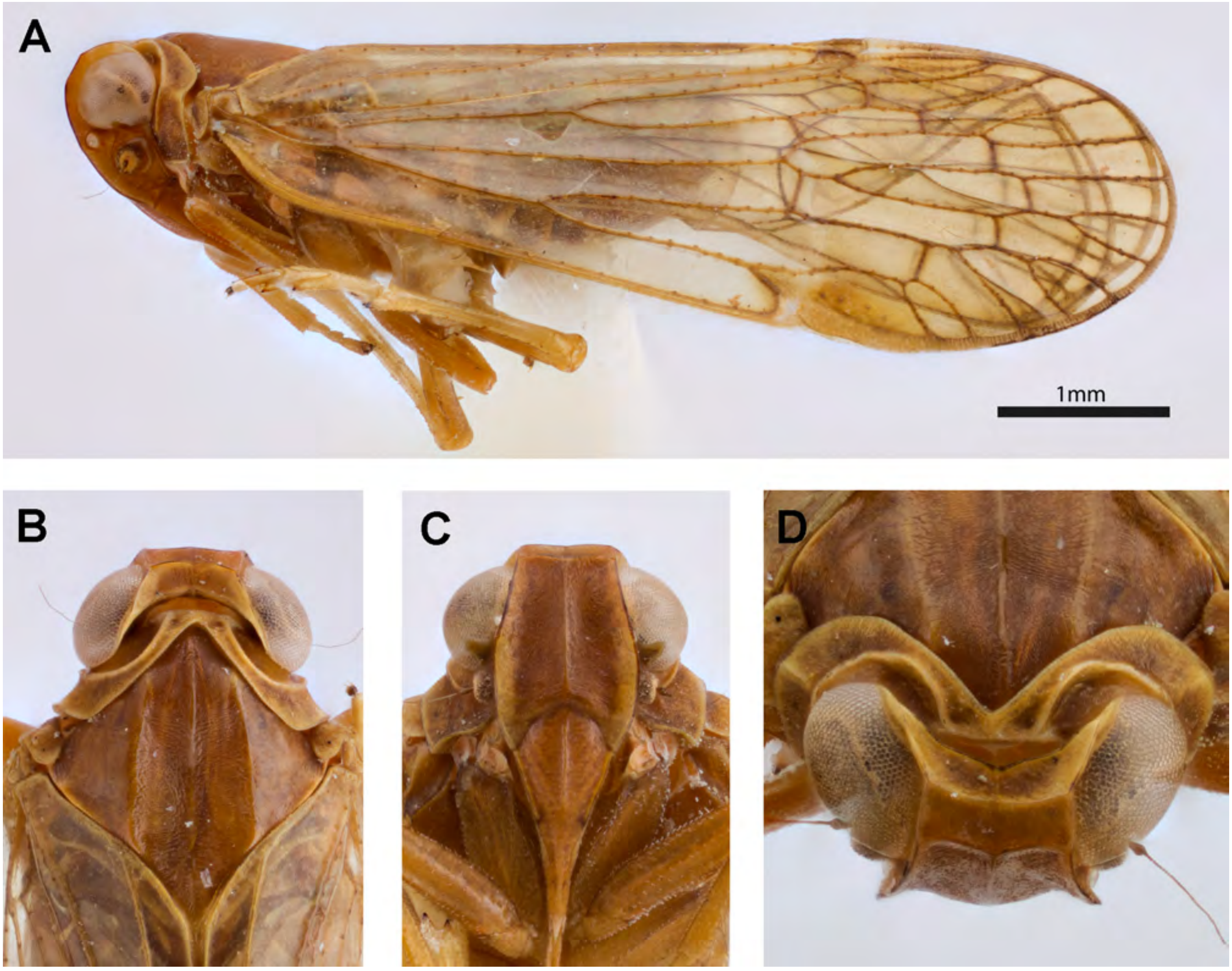

FIGURE 2. *Chidaea algida*: A habitus; B–D head.

Chidaea armidalensis **sp. nov.**

(Figs 3, 18, 31B)

Zoobank Registration: http://zoobank.org/urn:lsid:zoobank.org:act: 44C0753A-8656-42FF-9BE6-1FF2868AFB72

Types. *Holotype*, ♂, **AUSTRALIA, NSW:** New England Uni[versity], Armidale, 18.xi.1971 (C.W. Frazier) (ASCU ASCTHE016825). *Paratypes*, **ACT:** 2 ♂, Black Mtn, on *Euc[alyptus] blakelyi*, 15.i.1971 (S.M. Khan) (ANIC); 1

♂, Black Mountain, 35.16S, 149.06E, *Acacia buxifolia*, ix.1989 (C. Reid) (ANIC). **NSW**: 1 ♂, 2km W of Thirlmere Lakes NP, 25.ix.1988 (G.R. Brown & M.A. Terras) (ASCU); 3 ♂, Orange, Cadia Valley Gold Mine, Tunbridge Wells Farm, Four Mile Creek Road, 33 º38.S, 149 º12'E, sticky trap, 21.xi.2003 (H. Löcker & L. Pilkington) (ASCU); 1 ♂, 4 N Bateman[s] Bay, 12.x.1956 (E.F. Riek) (ANIC); 1 ♂, Cambewarra, 12.xii.1985 (D.J. Scambler) (ASCU); 1 ♂, Warrumbungle NP, White Gum Lookout, -31.3023S, 149.0351E, sticky trap, 23.x.2004 (D.J. Bickel) (AMS); 1 ♂, Orange, summit of Young Man Canobolas, 28.xii.2017 (S. Loecker) (ASCU). **Tas**: 1 ♂, Hobart (Lea) (TAIC); 3 ♂, Site 147 Warra LTER site [W of Geeveston], malaise trap, 14.i.1998 (R. Bashford) (ASCU); 4 ♂, same data except for Site 59 (ASCU); 3 ♂, same data except for Site 663, 12.xii.1997 (ASCU); 7 ♂, Celer[y] Top is[lands], Bathurst Harbour, 43[º]22[']S, 146[º]09[']E, 4.xii.1990 (I.D. Naumann) (ANIC). **Vic**: 1 ♂, 1.6km SW Halls Gap Grampians NP, 37º 08' 31"S, 142º 30' 13"E, malaise [trap], dry ravine in dell *Eucalyptus*, 27.ix–2.x.2001 (CNH J.D. & J.S. Lambkin, N.T. Starick) (ANIC); 1♂, Delley's Dell, 4km SSW of Halls Gap, Grampions NP, 37:11S 142:31E, 30.xi.1992 (Moulds, McEvey, McAlpine) (AMS); 1 ♂, Hall's Gap, Grampian Ra. W., 2.i.1966 (T. Weir) (QM, formerly UQIC).

Other material examined. AUSTRALIA, NSW: 1 ♀, Cambewarra, 12.xii.1985 (D.J. Scambler) (ASCU); 2 ♀, Orange, Cadia Valley Gold Mine, Tunbridge Wells Farm, Four Mile Creek Road, 33 º38.S, 149 º12'E, sticky trap, 21.xi.2003 (H. Löcker & L. Pilkington) (ASCU); 1 ♀, New England Uni[versity], Armidale, 18.xi.1971 (C.W. Frazier) (ASCU); 1 ♀, 4 N Bateman[s] Bay, 12.x.1956 (E.F. Riek) (ANIC). **Tas:** 5 ♀, Site 147 Warra LTER site [W of Geeveston], malaise trap, 14.i.1998 (R. Bashford) (ASCU); 2 ♀, same data except for Site 663, 12.xii.1997 (ASCU).

Notes. The females listed under 'Other material examined' 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 *Ch. armidalensis* and *Ch. dayi*, which is also known from New South Wales and Tasmania, there remains the possibility that some of these females may be *Ch. dayi*.

Etymology. Named after the type locality, Armidale.

Colour. Head mid brown, dark brown or black with paler carinae; post- and anteclypeus often slightly darker than frons. Pronotum light brown, often with darker patches. Mesonotum mid or dark brown with concolorous or paler carinae. Forewings light brown, tubercles and veins light brown, concolorous with cells. Pterostigma, crossveins and apical parts of veins often slightly darker. Legs light or mid brown, abdominal sternites usually darker.

Morphology. Body length: ♂ 5.1–6.4 mm; ♀, 6.4–6.9 mm.

<u>Head:</u> Vertex 2.1–3.0 x wider than long; median carina of vertex covering 1/3–3/4 of basal compartment of vertex; absent in apical compartment. Frons 1.0–1.2 x longer than wide; position of maximum width more or less around centre of frontoclypeal suture or distinctly dorsad; lateral carinae of frons in facial view convex, rectilinear apically or convex, evenly rounded. Frontoclypeal suture strongly semicircular, bent upwards, median part reaching at least lower margin of antennal scape. Postclypeus with median carina well developed or evanescent. Anteclypeus with median carina moderately developed or evanescent. Rostrum reaching hind coxae.

<u>Thorax:</u> Hind margin of pronotum rectangular. Mesonotum with median carina moderately developed, evanescent near posterior end; lateral carinae moderately developed. Forewing 3.1–3.8 x longer than wide; concavity at costal border absent; costal margin with 8–12 tubercles; fork of ScP+RA and RP basad, slightly distad or at same level as fork CuA1 and CuA2; tubercles of forewing dark or pale, concolorous with veins; ScP+RA apically bifid or unforked; RP trifid; additional subapical cell between branches of MP1 and MP2 present; MP1+2 trifid; MP3+4 trifid (rarely bifid); 11–12 apical cells; 7 subapical cells. Hind leg: tibia with 6 apical spines; 1st tarsomere with 8–9 (rarely 10) apical teeth and no platellae; 2nd tarsomere with 10–11 (rarely up to 13) apical teeth and 8–9 (rarely up to 11) platellae.

<u>Male genitalia:</u> Anal tube as in Figs 18D–E. Pygofer and genital styles as in Figs 18F–G. Aedeagus as in Figs 18A–C. Phallotheca near base with a bifurcate ventral process at the end of a long ventral ridge; left lateral with a sclerotised ridge; phallotheca ventrally with a strongly curved spine (a) with a large base, tip of spine (a) directed right laterad; right lateral with a long, straight spine (b), in ventral view mostly concealed by phallotheca.

Diagnosis. This species resembles *Ch. bobadeenensis* in having a strongly curved (at least in dorsal/ventral view) spine (a) and a straight spine (b), however in *Ch. armidalensis* spine (a) arises ventrally in the centre of phallotheca whereas in *Ch. bobadeenensis* this spine arises left laterally and runs near the flagellum (endosoma) and is entirely concealed by the phallotheca. *Chidaea armidalensis* resembles *Ch. wilarra*, *Ch. dickinsonorum*, *Ch. dayi* and *Ch. pulyonna* in certain external features. See diagnosis section of *Ch. pulyonna* for details.

Distribution: ACT, NSW, Tas, Vic.

Associated plant records: *Acacia buxifolia*, *Eucalyptus blakelyi*, *Eucalyptus* sp.

Remarks. In some specimens aedeagal spine (a) is more strongly curved than illustrated in Figs 18A–B.

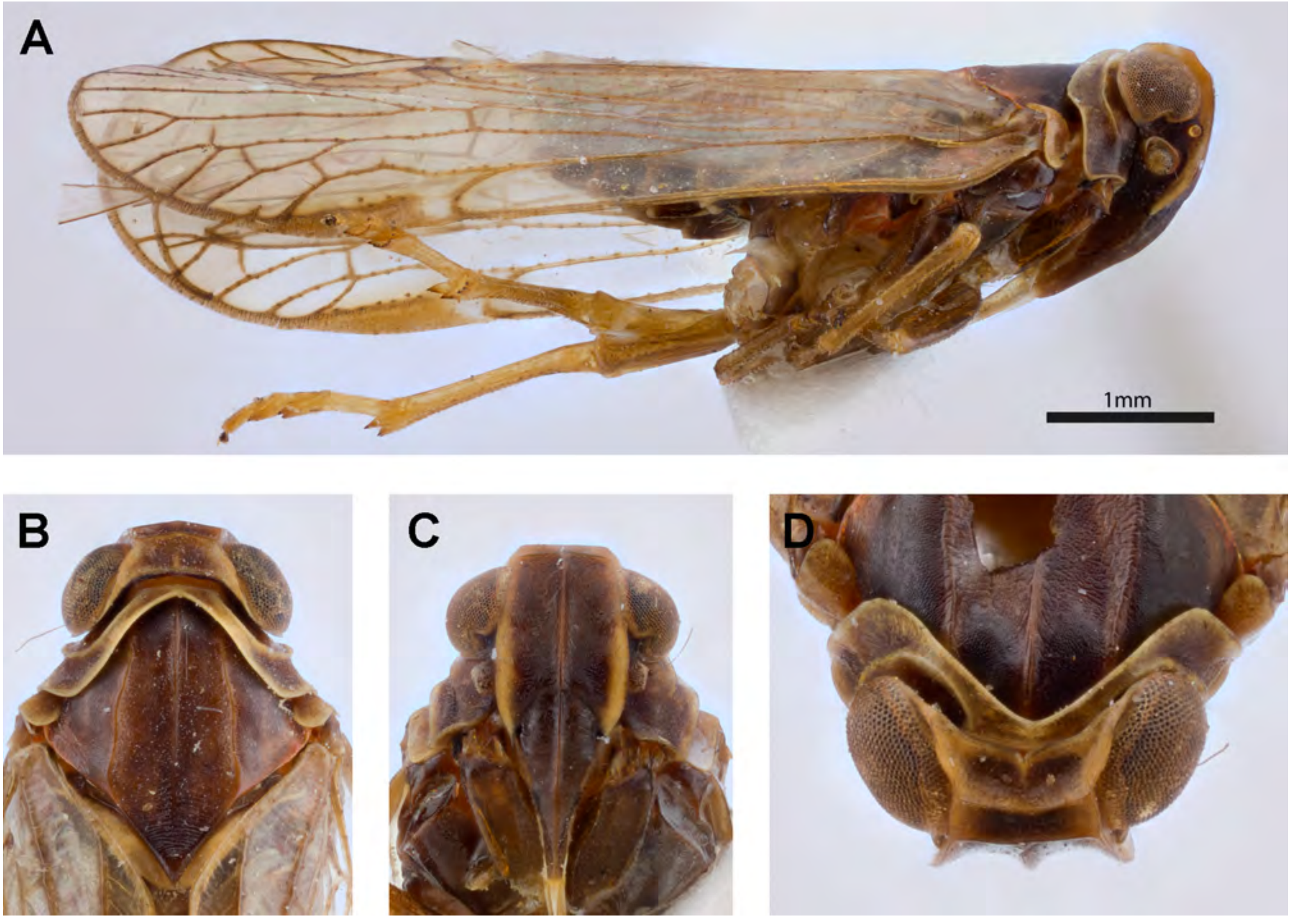

FIGURE 3. *Chidaea armidalensis*: A habitus; B–D head.

Chidaea belairensis sp. nov.

(Figs 4, 19, 31A)

Zoobank Registration: http://zoobank.org/urn:lsid:zoobank.org:act: 28004C96-61BE-4F8F-912F-804AEC37712D

Types. *Holotype*, ♂, **AUSTRALIA, SA:** Belair National Pk, malaise trap, 6.–20.x.1996 (J.T. Jennings) (ASCU ASCTHE032872). *Paratypes*, **SA**: 1 ♂, 1 ♀, same data as holotype (ASCU); 1 ♀, same data except for 9.–22.ix.1996 (ASCU).

Etymology. Named after the type locality, Belair National Park.

Colour. Head mid brown or dark brown with pale carinae. Pronotum light brown, with darker patches. Mesonotum mid brown, carinae concolorous or slightly paler. Forewings light brown, tubercles and veins concolorous light brown. Legs and body light brown.

Morphology. Body length: ♂ 3.9–4.0 mm; ♀ 4.7–4.9 mm.

Head: Vertex 2.0–2.5 x wider than long; median carina of vertex covering about 1/4–1/2 of basal compartment of vertex; absent in apical compartment. Frons 0.8 x longer than wide; position of maximum width more or less around centre of frontoclypeal suture; lateral carinae of frons in facial view sinuate, s-shaped. Frontoclypeal suture strongly semicircular, bent upwards, median part reaching at least lower margin of antennal scape. Postclypeus with median carina evanescent. Anteclypeus with median carina evanescent or absent. Rostrum reaching hind coxae.

Thorax: Hind margin of pronotum acutely angled or rectangular Mesonotum with median carina weakly to moderately developed; lateral carinae weakly developed, evanescent or absent. Forewing 3.3 x longer than wide; concavity at costal border absent; costal margin with about 17 tubercles; fork of ScP+RA and RP basad or slightly distad of fork CuA1 and CuA2; tubercles of forewing dark or pale, concolorous with veins; ScP+RA apically unforked; RP bifid; MP1+2 trifid; MP3+4 bifid; 10 apical cells; 6 subapical cells. Hind leg: tibia with 6 apical spines; 1st tarsomere with 10 apical teeth and 5 platellae; 2nd tarsomere with 9 apical teeth and 7 platellae.

Male genitalia: Anal tube as in Figs 19D–E. Pygofer and genital styles as in Figs 19F–G. Aedeagus as in Figs 19A–C. Phallotheca almost transparent, slightly asymmetrical, wider in basal two thirds, narrower in apical third; with a bifurcate ventral process near base of phallotheca; laterodorsally with two very long, slightly curved to almost straight spines (a,b), reaching or surpassing base of bifurcate ventral process. In ventral view phallotheca concealing all of spine (a) and most of spine (b), only about 1/8 of spine is visible. Spine (a) in right lateral view with its tip curved slightly dorsal.

Diagnosis. This species shares the following combination of characters with *Ch. orangensis* and *Ch. algida*: presence of platellae on the first hind tarsomere and tubercles on forewing that are concolorous with veins. *Chidaea algida* can be easily separated from *Ch. belairensis* by the two long spines that cross over ventrally. *Chidaea orangensis* can be distinguished from *Ch. belairensis* in the shape of the phallotheca: in *Ch. orangensis* it is about the same width throughout, whereas in *Ch. belairensis* the phallotheca is widest around midline and much narrower in apical and basal quarter.

Distribution: SA.

Remarks. The only two specimens known from this species are in a very poor condition (e.g. crinkled wings, deformed body, potential loss of colouration), probably because they were caught in a malaise trap. This means character states listed above and in the keys need to be interpreted with caution.

Two *Chidaea* sp. specimens collected in the Brisbane area have a striking resemblance in the male genitalia to *Ch. belairensis*, however they lack platellae. See Remarks section of *Ch. dickinsonorum* for further details.

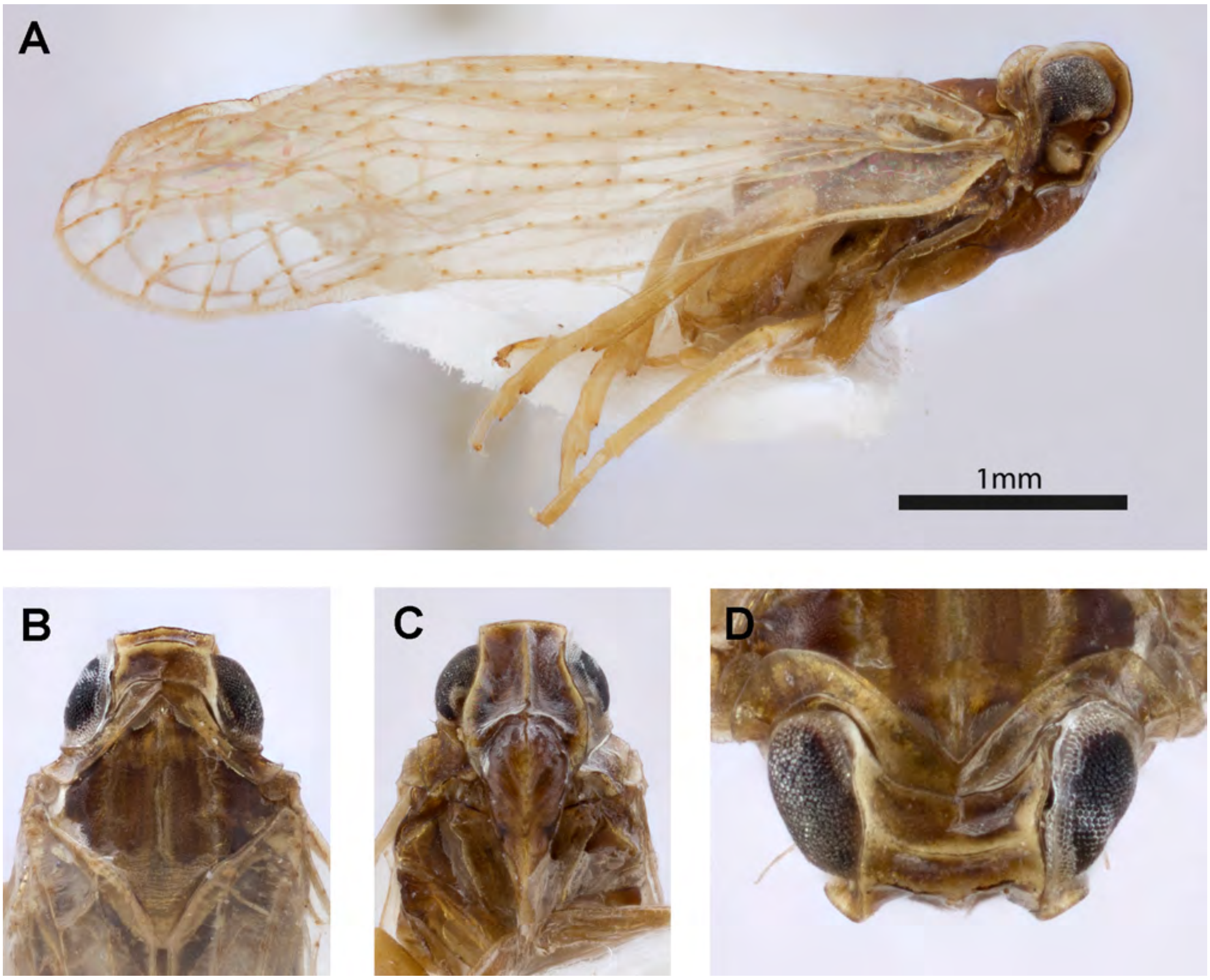

FIGURE 4. *Chidaea belairensis*: A habitus; B–D head.

***Chidaea bobadeenensis* sp. nov.**
(Figs 5, 20, 31A)
Zoobank Registration: http://zoobank.org/urn:lsid:zoobank.org:act: D3219004-A1D5-4D72-9889-B9614D1619E4

Types. *Holotype*, ♂, **AUSTRALIA, NSW:** Bobadeen Aboriginal Lease, 17km NE of Ulan, near Goulburn River, 1.–2.x.2005 (H. & B. Löcker) (ASCU ASCTHE030119). *Paratypes*, **NSW:** 1 ♂, same data as HT (ASCU); 1 ♂, in woodland, 10km NE of Ulan, 32º 13'S, 149º 50'E, 1.x.2005 (M.J. Fletcher) (ASCU); 1 ♂, Shoalhaven S.F., Nowra, *Acacia falcata*, (coll. code FT03, vial H1337), viii.2000 (Nigel Andrew) (NENH); 1 ♂, same data except for (coll. code FT05, vial H1344) (NENH); 1 ♂, same data except for *Acacia longifolia*, (coll. code SH15, vial H2971) (NENH); 1 ♂, same data except for (coll. code SH11, vial H2964) (NENH); 1 ♂, Windsor, Mitchell Park, Cattai NP, *Acacia falcata*, (coll. code MP04, vial H2842), viii.2001 (Nigel Andrew) (NENH); 1 ♂, Benandarah S.F., Batemans Bay, *Acacia binervata*, (coll. code IR12, vial 1854), x.2000 (Nigel Andrew) (NENH); 1 ♂, Hornsby, (H.33), 3.x.1917 (ANIC); 1 ♂, Auburn nr Sydney, 33º 14'E, 150º 45'S [coordinates as given on specimen label, see notes below], 8.x.1987 (G.R. Brown) (ASCU); 1 ♂, Ryde, 25.x.1903 (W.B. G[urney]) (ASCU); 1 ♂, King Falls near Appin, sweeping in bush, 10.x.1964 (M.I. Nikitin) (ASCU); 1 ♂, Broulee, 2.ix.1969 (E.F. Riek) (ANIC); 1 ♂, Sydney, (Helms Collection) ix.1905 (BPBM); 1 ♂, Royal NP, site iv, on *Angophora*, 20.ix.1981 (B.J. Loudon) (ASCU); 1 ♂, Ku-ring-gai Chase NP, 19.ix.1970 (G. Daniels) (AMS).

Notes. The coordinates of the specimen from Auburn appear incorrect. Even after swapping the obviously mis-typed 'E' and 'S' they still do not refer to a location in Auburn. A potential locality where they may have been collected are the Auburn Botanic Gardens (33º 51'S, 151º 01'E)—these coordinates were used for the creation of distribution maps for this species. The specimens from the Bobadeen Aboriginal Lease were collected as part of a Community Biodiversity Survey organised by the National Parks Association of NSW.

Etymology. Named after the type locality, Bobadeen Aboriginal Lease near Ulan.

Colour. Head mid brown, dark brown or black with paler carinae. Pronotum light brown, with darker patches. Mesonotum mid to dark brown with paler carinae; central area of mesonotum (in between carinae) often lighter coloured. Forewings light brown or whitish sometimes with a few dark patches, veins light brown or whitish, concolorous with cells, tubercles dark, in distinct contrast with lighter coloured veins. Pterostigma, crossveins and apical parts of veins often slightly darker. Body and legs light brown or mid brown.

Morphology. Body length: ♂ 5.6–6.9 mm.

<u>Head:</u> Vertex 2.1–2.7 x wider than long; median carina of vertex covering 1/3–3/4 of basal compartment of vertex; absent in apical compartment. Frons 1.0–1.1 x longer than wide; position of maximum width more or less around centre of frontoclypeal suture or slightly dorsad; lateral carinae of frons in facial view convex, rectilinear apically or sinuate, s-shaped. Frontoclypeal suture strongly semicircular, bent upwards, median part reaching at least lower margin of antennal scape. Postclypeus with median carina well developed. Anteclypeus with median carina moderately developed or evanescent. Rostrum reaching or surpassing hind coxae.

<u>Thorax:</u> Hind margin of pronotum acutely angled or rectangular. Mesonotum with median carina weakly to moderately developed, evanescent near posterior end; lateral carinae moderately developed. Forewing 2.8–3.4 x longer than wide; concavity at costal border absent; costal margin with 19–22 tubercles; fork of ScP+RA and RP distinctly basad of fork CuA1 and CuA2; tubercles of forewing dark, distinctly contrasted to paler coloured veins; ScP+RA apically bifid; RP trifid (rarely 4 branches); additional subapical cell between branches of MP1 and MP2 absent; MP1+2 trifid (rarely bifid); MP3+4 trifid; 11–12 apical cells; 6 subapical cells. Hind leg: tibia with 6 (rarely 7) apical spines; 1st tarsomere with 10–12 (rarely 13) apical teeth and 5–6 (rarely up to 9) platellae; 2nd tarsomere with 9–11 apical teeth and 7–9 platellae.

<u>Male genitalia:</u> Anal tube as in Figs 20D–E. Pygofer and genital styles as in Figs 20F–G. Aedeagus as in Figs 20A–C. Phallotheca highly sclerotized, especially on left lateral side where it forms a ridge that ends in a bifurcate ventral process near base of phallotheca; phallotheca wide in apical half, slightly narrower in basal half; phallotheca asymmetrical, especially near bifurcate ventral process; phallotheca left lateral with a long spine (a), strongly curved in dorsal view, almost straight in lateral view, entirely concealed by phallotheca in ventral view (basal part of the spine concealed by a very thin, transparent layer of the phallotheca); right lateral with a long, almost straight spine (b).

Diagnosis. In *Ch. bobadeenensis* aedeagal spine (a) is distinctly longer than spine (b). This condition is also present in *Ch. dickinsonorum*, *Ch. wilarra* and *Ch. dayi*. However the latter three have tubercles on the forewing that are concolorous to veins and lack platellae, whereas *Ch. bobadeenensis* has dark contrasting tubercles and possesses numerous platellae on the first hind tarsomere (usually 5–6).

Chidaea bobadeenensis shares the wide phallotheca with *Ch. crassa*, for details on how to distinguish these two species see diagnosis section of *Ch. crassa*. *Chidaea bobadeenensis* resembles *Ch. orangensis* in having the aedeagal spines mostly or entirely concealed in ventral view, see diagnosis section of *Ch. orangensis* for details. *Chidaea bobadeenensis* shares the dark, contrasting tubercles on the forewing and the presence of platellae on the first tarsomere with *Ch. orangensis*, *Ch. kimbaensis* and *Ch. etelis*. See diagnosis section of these species for further details on how to distinguish these species.

Distribution: NSW.

Associated plant records: *Acacia binervata*, *Ac. falcata*, *Ac. longifolia*, *Angophora* sp.

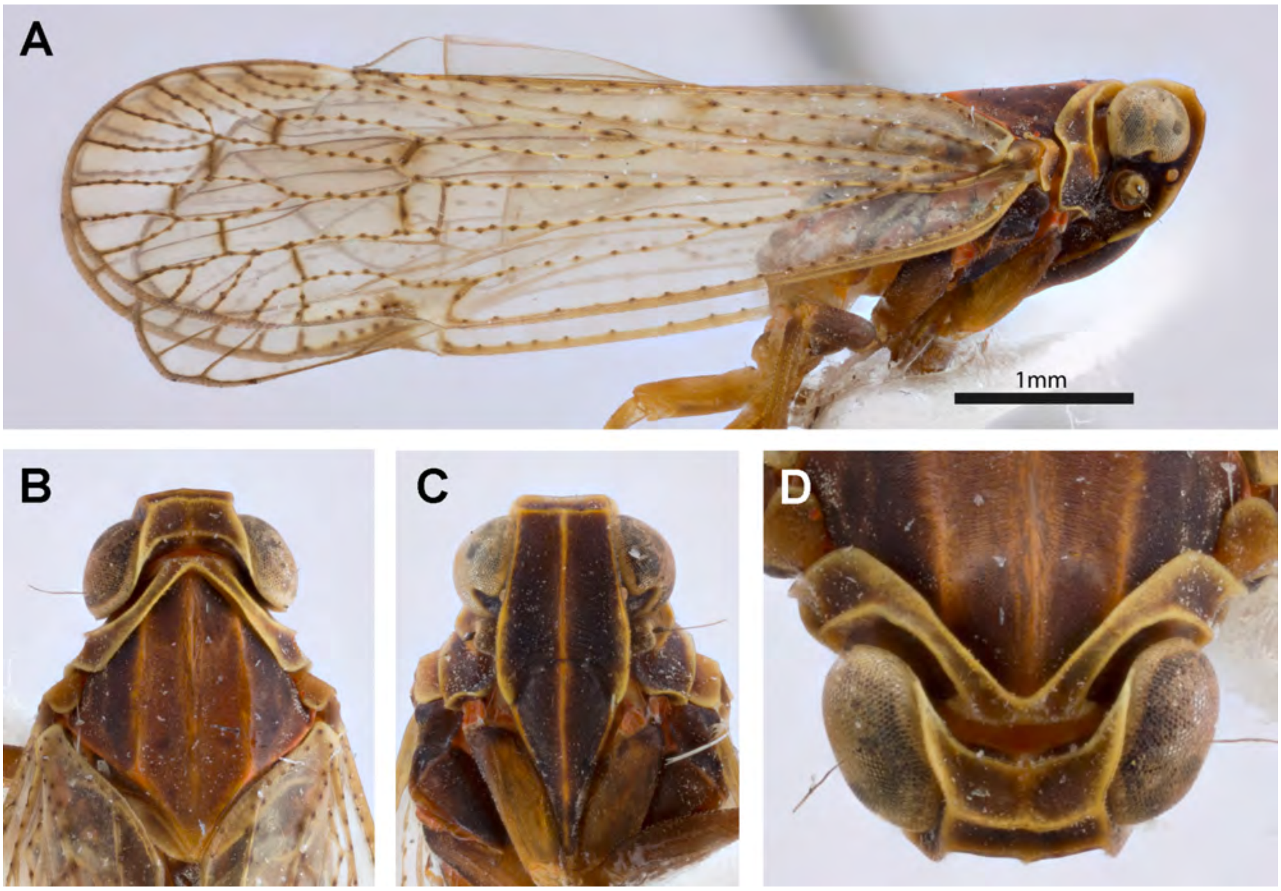

FIGURE 5. *Chidaea bobadeenensis*: A habitus; B–D head.

***Chidaea carinata* sp. nov.**

(Figs 6, 21, 31C)

Zoobank Registration:

http://zoobank.org/urn:lsid:zoobank.org:act: C7055836-4FB0-44C4-A8AA-0C0EF92FB6B7

Types. *Holotype*, ♂, **AUSTRALIA, Qld:** Willowburn, 14.ix.1920 (J.A. Beck) (QM T244827, formerly UQIC). *Paratypes*, **Qld:** 1 ♀, 9km W Goondiwindi, ex *Eremophila mitchellii*, 24.ix.1973 (P. Allsopp) (QDPI). **NSW:** 1 ♂, Lightning Ridge, 14.x.1989 (R.O. Buddle) (AMS); 1 ♀, Mt Kaputar, 3000ft, at light, 30.x.1967 (C.W. Frazier) (ASCU).

Etymology. Named after the distinct carinae on the head.

Colour. Head and pronotum mid or dark brown with distinctly contrasting pale carinae. Mesonotum mid or dark brown laterally, central area between carinae sometimes paler; carinae pale. Forewings light brown often with a weakly to moderately developed pattern of 6 mid brown spots (3 on each wing: near y-fork in claval area, near CuA1 and CuA2 fork and on MP basad of MP1+2 andMP3+4 fork); forewing sometimes with darker patches near crossveins and apex of wing; forewing veins light to mid brown, tubercles concolorous with veins; pterostigma light to mid brown. Body and legs light or mid brown.

Morphology. Body length: ♂ 6.2–6.7 mm; ♀, 8.7–9.6 mm.

Head: Vertex 2.1–2.2 x wider than long; median carina of vertex covering entire length of basal compartment of vertex; evanescent in apical compartment. Frons 1.0 x as long as wide; position of maximum width more or less around centre of frontoclypeal suture or distinctly ventrad; lateral carinae of frons in facial view slightly s-shaped. Frontoclypeal suture strongly semicircular, bent upwards, median part reaching at least lower margin of antennal scape. Postclypeus with median carina well developed. Anteclypeus with median carina well developed. Rostrum by far not reaching hind coxae.

Thorax: Median carina of pronotum extremely well developed and very long. Hind margin of pronotum obtuse. Mesonotum with median and lateral carinae well developed. Forewing 3.3–3.6 x longer than wide; concavity at costal border well developed; costal margin with 1–2 indistinct tubercles; fork of ScP+RA and RP slightly to moderately basad of or almost at same level as fork CuA1 and CuA2; tubercles of forewing dark or pale, concolorous with veins; ScP+RA apically bifid; RP trifid; additional subapical cell between branches of MP1 and MP2 absent or present; MP1+2 trifid; MP3+4 bifid or trifid; 11–12 apical cells; 6 subapical cells. Hind leg: tibia with 6 (rarely 7) apical spines; 1st tarsomere with 11–13 apical teeth and 6–8 platellae; 2nd tarsomere with 12 (rarely 13) apical teeth and 10 (rarely 11) platellae.

Male genitalia: Anal tube as in Figs 21D–E. Pygofer and genital styles as in Figs 21F–G. Aedeagus as in Figs 21A–C. Phallotheca below midlength with a bifurcate ventral process; left lateral with a long, curved spine (a); right lateral with long, curved spine (b), in lateral view spine (b) not reaching down as far as spine (a) because it is more strongly curved.

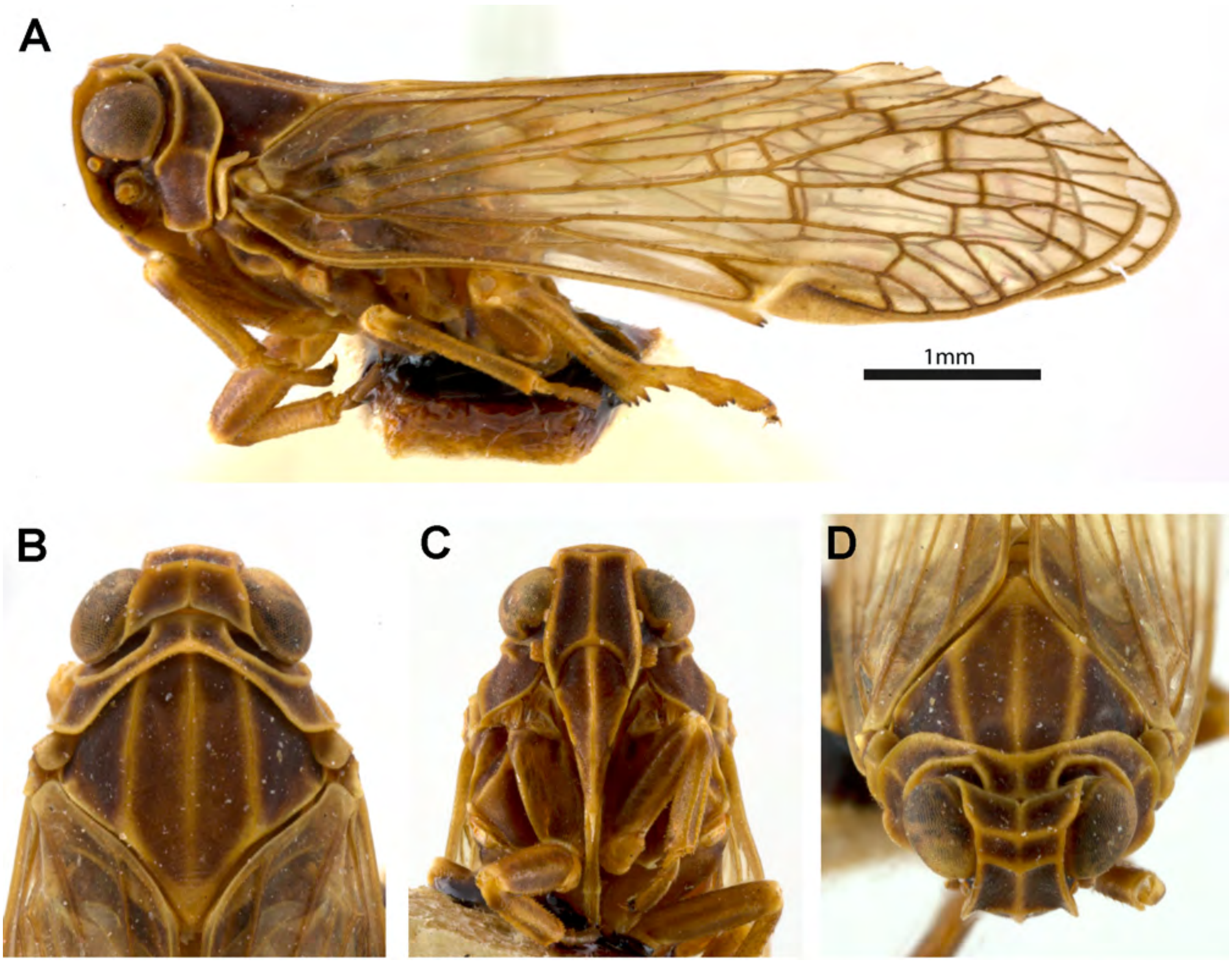

FIGURE 6. *Chidaea carinata*: A habitus; B–D head.

Diagnosis. This species can be uniquely identified within *Chidaea* by the following combination of characters: extremely well developed carinae on head and pronotum which are distinctly contrasting in colour to adjacent areas and the presence of platellae on the first tarsomere.

This species shares a number of characteristics such as a u-shaped pattern of dark spots on the forewings (often weakly developed, rarely absent) and a very long pronotum (length of median carina) with *Ch. punctata*. For further details see diagnosis section of *Ch. punctata*. The male genitalia of *Ch. kimbaensis* resemble that of *Ch. carinata* in length and curvature of spines, however in *Ch. kimbaensis* the spines are much thicker and the phallotheca is bulging laterally, which is not the case in *Ch. carinata*. Further, *Ch. kimbaensis* has dark contrasting tubercles on the forewing, whereas *Ch. carinata* has tubercles concolorous with veins.

Distribution: NSW, Qld.

Associated plant records: *Eremophila mitchellii*.

***Chidaea crassa* sp. nov.**
(Figs 7, 22, 31D)
Zoobank Registration:
http://zoobank.org/urn:lsid:zoobank.org:act: 7EA414D6-5F46-4BCF-A34C-91341CCE09D7

Types. *Holotype*, ♂, **AUSTRALIA, NSW:** Mt Kaputar, 2000ft, 5.ix.1962 (C.W. Frazier) (ASCU ASCTHE016821). *Paratypes*, **NSW:** 3 ♂, Mount Kaputar, 3000ft, at mercury vapour lamp, 1.x.1966 (C.W. Frazier) (ASCU); 2 ♂, Pisgah Ridge, Blue Mountains NP, 150º 35'E, 33º 30'S, 210m, 18.x.1987 (G. Brown, P. Gillespie, J. Macdonald) (ASCU); 3 ♂, Murwillumbah, 8.iv.1919 (F. Muir); 1 ♂, Gosford, on *L[antana] camara*, 24.x.1967 (K.M. Moore) (ASCU); 2 ♂, Ophir, ex *Cassinia* sp., 25.x.1998 (McNeil, Gillespie) (ASCU); 1 ♂, Ophir, ex *Pomaderris* sp. flowers, 5.x.1998 (P. Gillespie, B.C. McNeil) (ASCU); 1 ♂, Devines S.F., Grafton, *Acacia falcata*, (coll. code DV02, vial H2620), v.2001 (Nigel Andrew) (NENH); 1 ♂, same data except for v.2000 (coll. code DV01, vial H967) (NENH); 1 ♂, Lennox Bridge, 28.ix.1958 (M.I. Nikitin) (BMNH); 1 ♂, New England Uni[versity] Armidale, 18.xi.1991 (C.W. Frazier) (ASCU); 3 ♂, 10 km NE of Ulan, 32º 13'S, 149º 50'E, in woodland, 1.x.2005 (M.J. Fletcher) (ASCU); 1 ♂, Kemps Creek, sweeping in shrubs, 25.x.1970 (C.E. Chadwick) (ASCU). **Qld**: 1 ♂, Bingera, 9 mi S of Bundaberg, 24.54S, 152.12E, eucalypt w[oo]dl[an]d, 17.vii.1971 (H. Frauca) (ANIC); 1 ♂, North Pine R. South East Queensland, 24.viii.1964 (G. Montheith) (QM, formerly UQIC); 13 ♂, Cooloola National Park, 26–28.viii.1985 (A. Kotze, H. Rose, D. Rugg, L. Sanchez, J.R. Woodward) (ASCU); 2 ♂, Halifax, N[orth] Q[ueensland], iv.1924 (F. Muir) (BPBM); 1 ♂ Beaudesert (3.iii.1956) (Kirkpatrick) (UQIC, formerly QM); 1 ♂, Watalgan Ra[nge], ca. 35 mi N of Bundaberg, 3.vii.1971 (H. Frauca) (ANIC); 2 ♂, Coolangat[t]a, viii.1919 (F. Muir) (BPBM); 1 ♂, Sandgate, ix.1919 (F. Muir) (BPBM); 1 ♂, St Marys S.F., Gympie, *Acacia leptostachys*, (coll. code SM15, vial H1692), viii.2000 (Nigel Andrew) (NENH); 1 ♂, same data except for *Acacia falcata*, (coll. code SM05, vial H1633) (NENH); 1 ♂, Neerdie S.F., Gympie, *Acacia falcata*, (coll. code NE08, vial H3193), viii.2001 (Nigel Andrew) (NENH); 1 ♂, Corella S.F., Gympie, *Acacia falcata*, (coll code CO07, vial H3224), viii.2001 (Nigel Andrew) (NENH); 1 ♂, Toowoomba, 1?.xi.1953 (J.R. Pollock) (QM, formerly UQIC); 1 ♂, Bribie I[sland], Moreton Bay (Lea & Hacker) (SAMA); 1 ♂, Mt Coot-tha, Brisbane, sweeping grass, vii.1971 (R. Monroe) (QM); 1 ♂, Brisbane, 4.iii.1962 (E.A. Bernays) (QM, formerly UQIC); 1 ♂, Tinaroo Ck Rd, E. Mareeba, r[ain]forest, 1.vii.1980 (B.K Cantrell) (QDPI); 2 ♂, Chelsea Rd, Bushland Res., 27º 29.0'S, 153º 11.3'E, 15m, sweeping, ironbark open forest, (51161), 23 April 2003 (E. Volschenk) (QM); 1 ♂, same data except for hand coll[ecting], (51162) (QM); 2 ♂, Cooloola, open forest, to light, 17–28.viii.1970 (E.C. Dahms) (QM); 1 ♂, Brisbane, 1.i.1956 (J. Martin) (QM, formerly UQIC); 1 ♂, Brisbane, (9.), 22.iv.1913 (H. Hacker) (BPBM); 1 ♂, Brisbane, 12.vi.1926 (SAMA); 1 ♂, Brisbane, 9.ix.1957 (B.R. Grant) (QM, formerly UQIC); 1 ♂, Beerwah, 17.ix.1957 (DJT?) (QM, formerly UQIC); 1 ♂, Mt Coot-tha, 4.x.1997 (P. Gillespie) (ASCU).

Other material examined. Australia, Qld: 2 ♀, Bingera, 9 mi S of Bundaberg, 24.54S, 152.12E, eucalypt w[oo]dl[an]d, 17.vii.1971 (H. Frauca) (ANIC); 7 ♀, Coolangat[t]a, viii.1919 (F. Muir) (BPBM); 1 ♀, Bundaberg, grass, 10.vi.1956 (I.C. Yeo) (QM, formerly UQIC); 1 ♀, same data except for 30.v.1956 (QM, formerly UQIC); 1 ♀, Corella S.F., Gympie, *Acacia concurrens*, (coll. code CO15, vial H3234), viii.2001 (Nigel Andrew) (NENH); 1 ♀, same data except for *Acacia falcata* (coll. code CO02, vial H8216) (NENH); 1 ♀, Mt Coot-tha, 4.x.1997 (P. Gillespie) (ASCU); 4 ♀, Mt Cootha, 2.ix.1923 (H. Hacker) (QM); 1 ♀, Ransome Reserve, 27º 29.6'S, 153º 11.1'E, 10m, sweeping *Casuarina* woodland, (51155), 23.iv.2003 (E. Volschenk) (QM); 3 ♀, Chelsea Rd, Bushland Res., 27º 29.0'S, 153º 11.3'E, 15m, sweeping, ironbark open forest, (51161), 23 April 2003 (E. Volschenk) (QM); 3 ♀, same data except for hand coll[ecting], (51162) (QM); 5 ♀, Cooloola, open forest, to light, 17–28.viii.1970 (E.C. Dahms) (QM); 3 ♀, Cooloola National Park, 26–28.viii.1985 (A. Kotze, H. Rose, D. Rugg, L. Sanchez, J.R. Woodward) (ASCU); 1 ♀, Acacia Ridge, Brisbane, 15.vii.1962 (E.C. Dahms) (QM); 1 ♀, Brisbane, 18.viii.1914 (H. Hacker) (QM); 1 ♀, Brisbane, 17.ix.1925 (SAMA); 1 ♀, Brisbane, 20.v.1946 (J. Rosser) (QM, formerly UQIC); 1 ♀, Brisbane, 26.x.1954 (J.R. Pollock) (QM, formerly UQIC); 1 ♀, same data except for 9.x.1954 (QM, formerly UQIC); 1 ♀, same data except for 10.x.1954 (QM, formerly UQIC); 1 ♀, Brisbane, iv.1964 (J.E. Dunwoody) (QM, formerly UQIC); 1 ♀, Brisbane, 4.ix.1964 (H.E. Rose) (QM, formerly UQIC); 1 ♀, Brisbane, i.1956 (D. Nunn) (QM, formerly UQIC); 1 ♀, Brisbane, 22.vii.1956 (H. J. Lavery) (QM, formerly UQIC); 1 ♀, Central Station, Fraser Island, 14–15.x.1978 (G.B. Monteith) (QM); 1 ♀, Lake Broadwater nr Dalby, 27º 21'S, 151º 06'E, site A, mv lamp, 27.ix.1986 (G. and A. Daniels) (QM, formerly UQIC); 3 ♀, Alderley, Brisbane, 30.ix.1923 (H. Hacker) (QM); 1 ♀, Mount Tinbeerwah, nr Cooroy, 26º 24'S, 152º 58'E, 29.ix.1985 (G. and A. Daniels) (QM, formerly UQIC); 1 ♀, Fletcher, South Queensland, on *Acacia*, 22.ix.1966 (ANIC); 1 ♀, Bin-Bin Ra E of Didcot, 13.viii.1974 (Frauca) (ANIC); 4 ♀, Willowburn, 14.ix.1920 (J.A. Beck) (QM, formerly UQIC); 1 ♀, 5km N Leyburn, 27º 58'S, 151º 38'E, 21.ix.1986 (G. and A. Daniels) (QM, formerly UQIC); 1 ♀, Yarraman, 19.iv.1957 (S. Sekhon) (QM, formerly UQIC); 1 ♀, Albert River, 9.iv.1939 (W. Bryan) (QM, formerly UQIC); 1 ♀, 8.2km E of Mungallala, 26º 27' 50"S, 147º 37' 29"E, 560m, ex *Cassinia* sp., 98–07, 31.x.1998 (Schuh, Cassis, Silveira) (AMS).

Notes. There are no diagnostic external features to differentiate between females of *Ch. crassa* and *Ch. bobadeenensis*. However, *Ch. crassa* is the only species with dark tubercles that occurs in Queensland, *Ch. bobadeenensis* only occurs in New South Wales with Ulan being its most northerly record, which is quite distant from the Queensland border. Therefore females from Queensland with dark tubercles are listed under 'Other material examined'. Numerous females collected in NSW were amongst material studied in this project, however, due to the fact that the distribution of *Ch. crassa* and *Ch. bobadeenensis* partly overlaps within NSW, and the lack of diagnostic characters to distinguish them, they could not be assigned with certainty to a species and are therefore not listed here. They can be found in the following collections: BPBM, ASCU, AMS, ANIC, QM.

Etymology. The Latin term 'crassus' means 'thick, stout'. Named after the very wide phallotheca.

Colour. Vertex light, mid or dark brown with paler carinae. Frons mid to dark brown with paler carina (lateral carinae palest near frontoclypeal suture). Post- and anteclypeus same colour or slightly darker than frons with pale carinae. Pronotum light brown, sometimes with darker patches. Mesonotum mid to dark brown with concolorous or slightly paler carinae; central area of mesonotum (in between carinae) often lighter coloured. Forewings light brown or whitish, veins light brown or whitish, concolorous with cells, tubercles dark, in distinct contrast with lighter coloured veins. Pterostigma, crossveins and apical parts of veins often slightly darker. Body and legs light brown, (sometimes mid brown or dark brown).

Morphology. Body length: ♂ 5.8–6.6 mm; ♀ 6.3–8.2 mm.

<u>Head:</u> Vertex 2.1–2.3 x wider than long; median carina covering 1/3 to full length of basal compartment of vertex; absent in apical compartment. Frons 1.0–1.1 x as long as wide; position of maximum width more or less around centre of frontoclypeal suture or slightly dorsad; lateral carinae of frons in facial view convex, rectilinear apically or convex, evenly rounded or sinuate, s-shaped. Frontoclypeal suture strongly semicircular, bent upwards, median part reaching at least lower margin of antennal scape. Postclypeus with median carina moderately or well developed. Anteclypeus with moderately developed, evanescent or absent median carina. Rostrum surpassing hind coxae.

<u>Thorax:</u> Hind margin of pronotum acutely angled. Mesonotum with median carina moderately developed, evanescent near posterior end; lateral carinae moderately developed. Forewing 3.1–3.3 x longer than wide; concavity at costal border absent; costal margin with 10–19 tubercles; fork of ScP+RA and RP slightly basad or slightly distad of fork CuA1 and CuA2; tubercles of forewing dark, distinctly contrasted to paler coloured veins; ScP+RA apically bifid; RP trifid; additional subapical cell between branches of MP1 and MP2 absent; MP1+2 trifid; MP3+4 trifid (rarely 4 branches); 12 (rarely 13) apical cells; 6 subapical cells. Hind leg: tibia with 6 (rarely 5) apical spines; 1st tarsomere with 11–13 apical teeth and 5–9 platellae; 2nd tarsomere with 9–11 (rarely 12) apical teeth and 7–10 platellae.

<u>Male genitalia:</u> Anal tube as in Figs 22D–E. Pygofer and genital styles as in Figs 22F–G. Aedeagus as in Figs 22A–C. Phallotheca very wide (widest around midline) with a bifurcate ventral process that are attached to the phallotheca with a minute or without a stalk in ventral view; phallotheca on each side with a very long, in ventral view

almost straight (in lateral view slightly curved) spine (a,b) reaching down aedeagus shaft as far as tip of the bifurcate ventral process or surpassing it.

Diagnosis. This species shares the wide phallotheca with *Ch. bobadeenensis* and *Ch. etelis*. In *Ch. bobadeenensis* and *Ch. etelis* the phallotheca is usually widest in the apical half and narrow in the basal third of the phallotheca whereas in *Ch. crassa* the phallotheca is rather wide throughout, but is usually widest around midline. In *Ch. crassa* the phallotheca forms a symmetrical ridge, which bears the bifurcate ventral process which are attached to the ridge without an obvious stalk in ventral view. In *Ch. bobadeenensis*, the end of the ridge that bears the bifurcate ventral process is irregularly shaped and strongly tapers towards the bifurcate ventral process. There are further differences between these two species in the aedeagal spines: in *Ch. crassa* spine (a) is more or less straight in dorsal view (in *Ch. bobadeenensis* it is strongly curved), in *Ch. crassa* spine (a) is visible in its entire length in ventral view whereas in *Ch. bobadeenensis* spine (a) is entirely covered by the phallotheca (although it appears to be visible in its most basal part, where it is, however, covered by a thin, transparent layer of the phallotheca). The male genitalia of *Ch. crassa* resembles that of *Ch. dickinsonorum* in certain aspects, however, these species can easily be distinguished by the presence (*Ch. crassa*) or absence (*Ch. dickinsonorum*) of platellae on the first hind tarsomere.

Distribution: NSW, Qld.

Associated plant records: *Acacia concurrens*, *Ac. falcata*, *Ac. leptostachys*, *Ac*. sp., *Cassinia* sp., *Lantana camara*, *Pomaderris* sp.

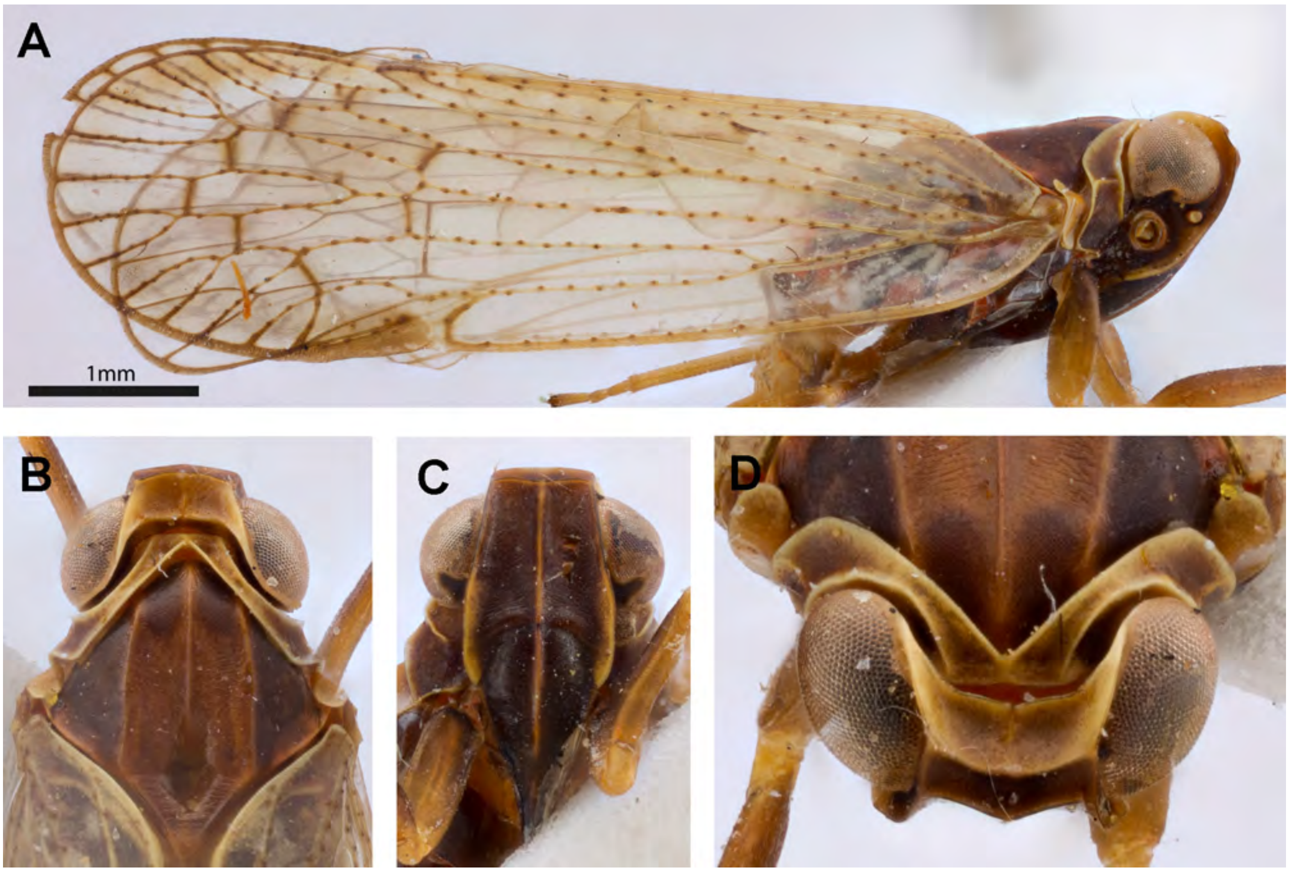

FIGURE 7. *Chidaea crassa*: A habitus; B–D head.

Chidaea dayi Emeljanov
(Figs 8, 23, 31D)

Chidaea dayi Emeljanov, 2000: 14.

Types (not examined). *Holotype*, ♂, **AUSTRALIA, ACT:** Canberra, Black Mt., 25.ix.1979 (V. Zaitzev) (ANIC). *Paratypes*, 2 ♂, 3 ♀, same data as holotype (ZIN).

Other material examined. AUSTRALIA, NSW: 4 ♂, 4 ♀, Mt Kosciuszko, Wilsons Valley, i.1965 (J.W. &

F. Evans) (ASCU). **Tas:** 2 ♂, Hartz Mtns, 24.xii.1974 (F. McDonald) (ASCU); 1 ♂, Ellendale, ex *E[ucalyptus] regnans*/*E. nitens*, 24.ii.2004 (V. Patel) (ASCU); 2 ♂, 3 ♀, 4km S Gt. Oakleigh, 41.51S, 146.03E, 800m, closed forest, malaise trap, 8.i.–12.ii.1991 (A. Calder & W. Dressler) (ANIC); 1 ♂, 2 ♀, Mt Field NP, Lake Dobson Rd, 42.41S, 146.40E, 710m, 31.i.1980 (Lawrence & Weir) (ANIC). **Vic:** 1 ♂, Otway Ra[nge]s, 7–9.i.1966 (T. Weir) (QM, formerly UQIC).

Notes. The females listed under 'Other material examined' 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 *Ch. dayi* and *Ch. armidalensis*, which is also known from New South Wales and Tasmania, there remains the possibility that some of these females may be *Ch. armidalensis*. One male listed in the 'Other material examined' as having been collected on Mt Kosciuszko does not have a locality label, but because it was mounted in the same style as the other specimens from that area and it is assumed to have been collected there.

Colour. Vertex mid or dark brown (rarely light brown) with paler carinae. Frons mid to dark brown with paler carina (lateral carinae palest near frontoclypeal suture). Post- and anteclypeus darker than frons with slightly paler carinae. Pronotum light brown, sometimes with darker patches. Mesonotum midbrown (rarely dark brown) with concolorous or slightly paler carinae. Forewings light brown, tubercles and veins light or mid brown, concolorous with cells. Pterostigma, crossveins and apical parts of veins often slightly darker. Body and legs mid brown, rarely light brown.

Morphology. Body length: ♂ 4.9–6.7 mm; ♀ 6.1–7.4 mm.

<u>Head:</u> Vertex 2.0–2.7 x wider than long; median carina of vertex covering ¼–

¾ of basal compartment of vertex; absent in apical compartment. Frons 1.0–1.2 x longer than wide; position of maximum width distinctly dorsad of centre of frontoclypeal suture; lateral carinae of frons in facial view convex, rectilinear apically or convex, evenly rounded. Frontoclypeal suture strongly semicircular, bent upwards, median part just or just not reaching lower margin of antennal scape. Postclypeus with median carina well developed, but sometimes evanescent near frontoclypeal suture. Anteclypeus with median carina moderately developed, evanescent or absent. Rostrum reaching hind coxae.

<u>Thorax:</u> Hind margin of pronotum obtusely angled or rectangular. Mesonotum with median carina evanescent or moderately developed and lateral carinae weakly developed to evanescent. Forewing 3.1–3.4 x longer than wide; concavity at costal border absent; costal margin with 17–25 tubercles; fork of ScP+RA and RP slightly basad, slightly distad or at same level as fork CuA1 and CuA2; tubercles of forewing dark or pale, concolorous with veins; ScP+RA apically bifid or unforked; RP trifid; additional subapical cell between branches of MP1 and MP2 absent or present; MP1+2 and MP3+4 bifid (rarely trifid); 9–11 apical cells; 6 (rarely 7) subapical cells. Hind leg: tibia with 6 (rarely 5) apical spines; 1st tarsomere with 7–9 apical teeth and no (rarely 1) platellae; 2nd tarsomere with 9–11 apical teeth and 7–9 platellae.

<u>Male genitalia:</u> Anal tube as in Figs 23D–E. Pygofer and genital styles as in Figs 23F–G. Aedeagus (Figs 23A–C): Phallotheca narrow; dorsally with a short, moderately bent spine (a) with its curvature best seen in left lateral view; spine (a) only partly visible in ventral view; phallotheca ventrally with a very long, prominent spine (b) with a large triangular base, tip of spine (b) directed left laterad; phallotheca near base with a bifurcate ventral process. Aedeagal spines not reaching bifurcate ventral process.

Diagnosis. Many species in *Chidaea* have very similar male genitalia but this species stands out in having a very large, prominent spine (b) which arises on the ventral side of the phallotheca and which has a very large base that covers more than half of the width of the phallotheca and which has the tip directed left laterad. There is a slight resemblance in genitalia with *Ch. wilarra*, however in *Ch. wilarra* spine (b) is not as prominent, it only has a slightly enlarged base and it arises more ventro-laterally, whereas in *Ch. dayi* spine (b) arises in the centre of the phallotheca in ventral view. In most cases the two species can easily be distinguished by the length of spine (a) versus spine (b). In *Ch. wilarra* spine (b) reaches only slightly further down the aedeagus shaft than spine (a). In most specimens of *Ch. dayi* spine (b) reaches down about twice as far as spine (a). *Chidaea dayi* shares the presence of a ventral spine with a large base with *Ch. armidalensis*. In *Ch. armidalensis* the tip of this spine is directed right laterad, in *Ch. dayi* it is directed left laterad. *Ch. dayi* resembles *Ch. dickinsonorum*, *Ch. armidalensis* and *Ch. pulyonna* in certain external characters, see diagnosis section of *Ch. pulyonna* for details on how to distinguish these four species.

Distribution: ACT, NSW, Tas, Vic.

Associated plant records: *Eucalyptus* sp.

Remarks. During this research project ten specimens from Tasmania, Victoria and NSW have been studied, that match the original description of *Ch. dayi* in all aspects, apart from the length of aedeagal spine (b). In those specimens spine (b) was slightly longer than it appears to be in the drawings of the original description, resulting in spine (b) reaching about twice as far down the aedeagus shaft than spine (a). Since the types, despite several attempts to get hold of them, were unavailable for comparison, it is for the moment assumed that these specimens are conspecific with *Ch. dayi*. Similar configurations with short- and long-spine-'morphotypes' are also known in other Cixiini-taxa, e.g. *Cixius nervosus* and *Cixius beieri* Wagner, 1939 (see Holzinger *et al*. 2003).

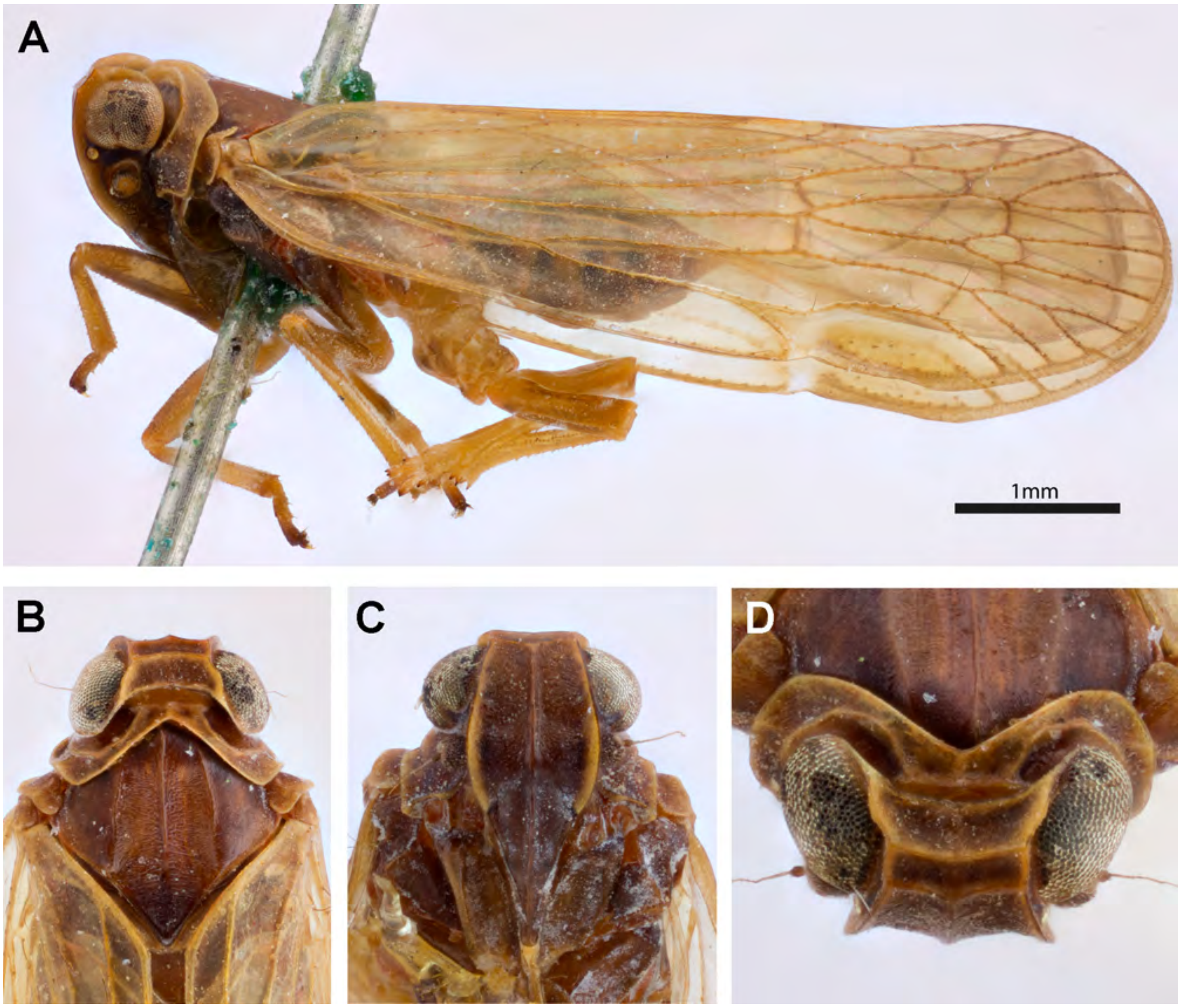

FIGURE 8. *Chidaea dayi*: A habitus; B–D head.

Chidaea dickinsonorum **sp. nov.**
(Figs 9, 24, 31B)
Zoobank Registration:
http://zoobank.org/urn:lsid:zoobank.org:act: 86DB3897-2D58-49CF-8F21-A11CD2A3B480

Types. *Holotype*, ♂, **AUSTRALIA, NSW:** Dawsons Spring, Mt Kaputar NP, 150:10E, 30:17S, 1420m, 1–10.xii.1987 (G.R. Brown) (ASCU ASCTHE016801). *Paratypes*, **NSW:** 2 ♂, same data as holotype (ASCU); 1 ♂, Nelsons Bay, Port Stephens, on leaves of *Doryanthes excelsa*, 27.viii.1920 (A. Musgrave) (BMNH). **Qld:** 1 ♂, National Park, 25.x.1923 (H. Hacker) (QM); 1 ♂, Nagarijoon Falls, Lamington NP, sweeping shrubs, 28.x.1955 (T.E. Woodward) (QM, formerly UQIC).

Other material examined. AUSTRALIA, NSW: 1 ♀, Dawsons Spring, Mt Kaputar NP, 150.10E, 30.17S, 1420m, 30.xi–10.xii.1987 (G.R. Brown) (ASCU); 1 ♀, same data except for 1.–10.xii.1987 (ASCU). **Qld:** 1 ♂, [Lamington] National Park, 25.x.1923 (H. Hacker) (QM).

Notes. One male specimen collected by H. Hacker has been excluded from the type series, because it appears that aedeagal spine (b) has its tip broken off. The females listed under 'Other material examined' 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 *Ch. dickinsonorum*, *Ch. dayi*, *Ch. armidalensis* and *Ch. wilarra*, and due to all these species occurring in New South Wales, there remains the possibility that some of these females may not be *Ch. dickinsonorum*.

Etymology. Named after the first author's friends Sandra and Bailey Dickinson to honour their great interest in insects.

Colour. Vertex mid or dark brown with paler carinae. Frons mid brown, dark brown or black with paler carina (lateral carinae palest near frontoclypeal suture). Post- and anteclypeus usually darker than frons with slightly paler carinae. Pronotum light brown, with dark patches. Mesonotum midbrown, dark brown or reddish brown with concolorous or slightly paler carinae. Forewings light brown, tubercles and veins light or mid brown, concolorous with cells. Pterostigma, crossveins and apical parts of veins often slightly darker. Body and legs light or mid brown.

Morphology. Body length: ♂ 5.5–6.1 mm; ♀ 6.7–7.3 mm.

Head: Vertex 2.2–2.5 x wider than long; median carina of vertex covering 1/3–3/4 of basal compartment of vertex; absent in apical compartment. Frons 1.0–1.2 x as long as wide position of maximum width distinctly dorsad of centre of frontoclypeal suture; lateral carinae of frons in facial view convex, rectilinear apically or convex, evenly rounded. Frontoclypeal suture strongly semicircular, bent upwards, median part just or just not reaching lower margin of antennal scape. Postclypeus with median carina moderately to well developed, sometimes evanescent near frontoclypeal suture. Anteclypeus with median carina moderately developed, evanescent or absent. Rostrum reaching hind coxae.

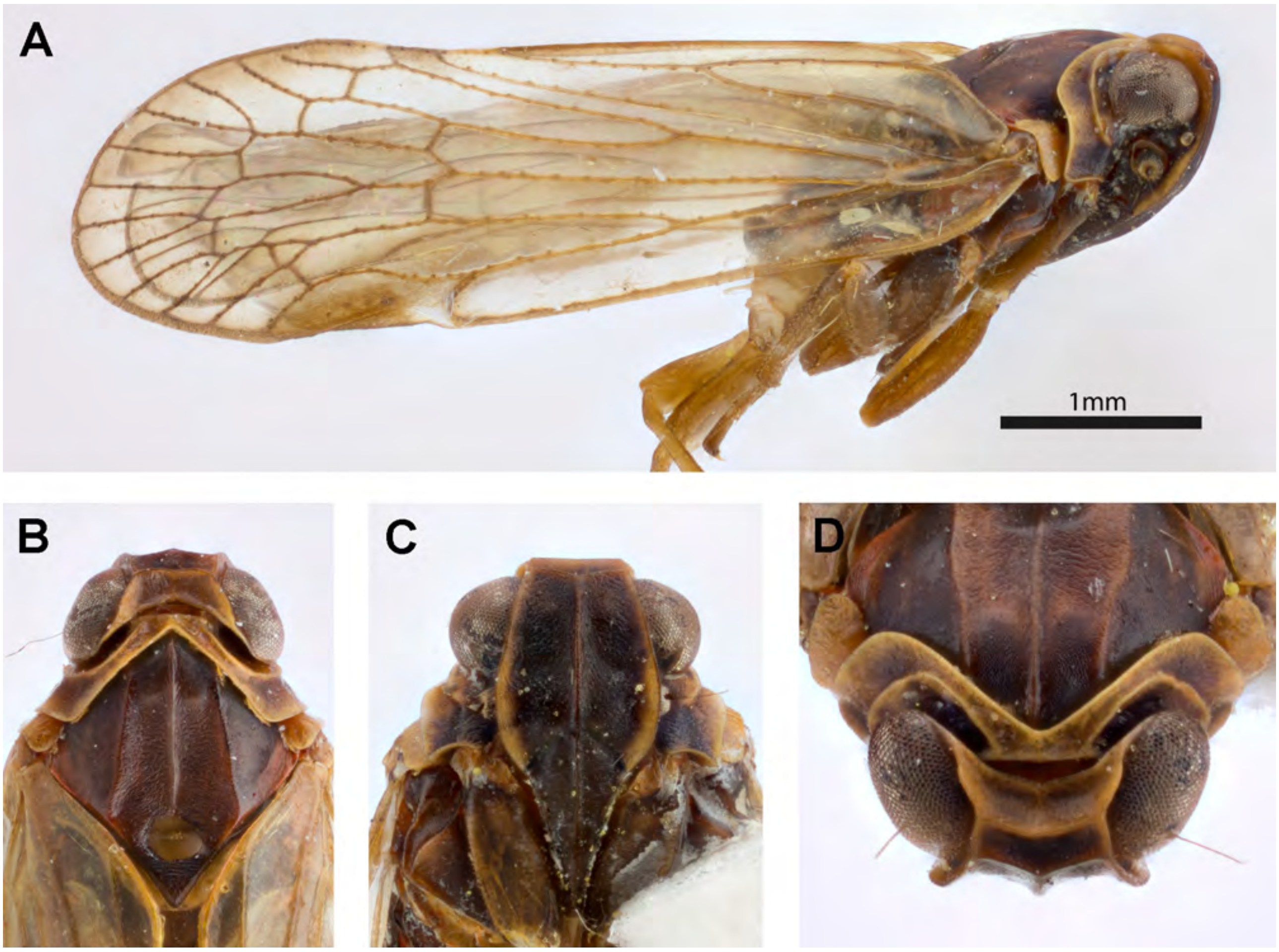

FIGURE 9. *Chidaea dickinsonorum*: A habitus; B–D head.

Thorax: Hind margin of pronotum obtusely angled or rectangular. Mesonotum with median carina moderately developed, evanescent near posterior end; lateral carinae moderately developed. Forewing 3.1–3.4 x longer than wide; concavity at costal border absent; costal margin with 12–19 tubercles; fork of ScP+RA and RP slightly basad, slightly distad or at same level as fork CuA1 and CuA2; tubercles of forewing dark or pale, concolorous with veins; ScP+RA apically bifid or unforked; RP trifid; additional subapical cell between branches of MP1 and MP2 absent or present; MP1+2 trifid (rarely bifid); MP3+4 trifid; 10–12 apical cells; 6–7 subapical cells. Hind leg: tibia with 6 apical spines; 1st tarsomere with 9–13 apical teeth and no platellae; 2nd tarsomere with 12 (rarely 13) apical teeth and 10 (rarely 8 or 11) platellae.

Male genitalia: Anal tube as in Figs 24D–E. Pygofer and genital styles as in Figs 24F–G. Aedeagus as in Figs 24A–C. Phallotheca narrow, near base with a bifurcate ventral process; phallotheca with spine (a) moderately to strongly curved, arising left lateral; spine (b) almost straight, arising right lateral; spine (b) inserts slightly further down the aedeagus shaft than spine (a) and its tip also reaches further down; in ventral view only small parts of spine (b) and sometimes spine (a) concealed by phallotheca. Aedeagal spines not reaching bifurcate ventral process.

Diagnosis. This species shares several features with *Ch. wilarra*, *Ch. dayi*, *Ch. armidalensis* and *Ch. pulyonna*. See diagnosis section of *Ch. wilarra* and *Ch. pulyonna* for further information. There is some resemblance in male genitalia between this species and *Ch. bobadeenensis* and *Ch. crassa*, however these species can be easily separated from *Ch. dickinsonorum* by the presence (*Ch. crassa*, *Ch. bobadeenensis*) or absence (*Ch. dickinsonorum*) of platellae on the first hind tarsomere. For further details see diagnosis section of *Ch. bobadeenensis*. The male genitalia of this species closely resembles *Ch. punctata*. For details of how to separate these two species see diagnosis section of *Ch. punctata*.

Distribution: NSW, Qld.

Associated plant records: *Doryanthes excelsa*.

Remarks. One specimen from Mt Kaputar collected on 1.x.1966 (located at ASCU ASCTHE016822) has similar male genitalia to *Ch. dickinsonorum*, however the length of spines is the exact opposite to *Ch. dickinsonorum*, with spine (a) being longer than spine (b). The genitalia is different to the specimens from the Brisbane area. Currently this specimen is labelled as *Chidaea* sp.

Chidaea etelis sp. nov.

(Figs 10, 25, 31D)
Zoobank Registration: http://zoobank.org/urn:lsid:zoobank.org:act: 231EE0BB-5698-446C-A060-31807DA80002

Types. *Holotype*, ♂, **AUSTRALIA, WA:** Leeuwin-Naturaliste NP, 20.xi.1986 (G.R. Brown) (ASCU ASCTHE016982). *Paratypes*, **WA:** 1 ♂, Point Rd Campground, Leeuwin-Naturaliste NP, 34º 05’ 37’S, 115º 00’ 59”E, 50m, *Pimelea sylvestris*, (98-L13), 2.xii.1998 (G. Cassis) (AMS); 1 ♂, Mt Chudalup, S of Northcliffe, karri forest, pan trap, 10.xi.1991 (D. Bickel) (AMS); 1 ♂, 1 ♀, Porongorup NP, Yate Flats, 9.xi.1987 (M.E. Irwing & E.I. Schlinger) (CAS); 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 ♂, 6 km E of Yellowdine, 31.18S 119.44E, 10.x.1981 (I.D. Naumann, J.C. Cardale) (ANIC); 1 ♂, 1 ♀ (in copula), Pimelia, near Pemberton, 5.x.1970 (D.H. Colless) (ANIC); 1 ♀, Warren NP, near Pemberton, 16.xii.1970 (G.A. Holloway, H. Hughes) (AMS); 1 ♀, 9 mi WSW of Fraser Range HS., Key’s field notes, Trip 156, Stop 4351.7, 12.x.1968 (Britton, Upton, Balderson) (ANIC); 1 ♀, Walyunga NP, 40km NE of Perth, 26–29.x.1987 (Mike E. Irwin) (CAS); 1 ♀, Karri Gully, SW of Nannup on Brockman Hwy, 8.xi.1987 (Mike E. Irwin, Evert, I. Schlinger) (CAS).

Other material examined. WA: 1 ♂, possibly Mt Chudalup, S of Northcliffe, karri forest, pan trap, 10.xi.1991 (D. Bickel) (AMS); 1 ♂, Walunga NP, 40km NE of Perth, 26–29.x.1987 (Mike E. Irwin) (CAS).

Notes. One specimen from WA had no locality data attached. But because it was part of the material from the Australian Museum and mounted in the same way as the specimen from Mt Chudalup, it is assumed to be from that location. The male specimen from Walunga NP is excluded from the type series because its male genitalia are damaged.

Etymology. ‘Etelis’ is the Greek term for a fish. Named after the fish-like shape of the phallotheca in ventral view.

Colour. Head mid brown or dark brown with pale carinae. Pronotum light brown, often with dark patches. Mesonotum mid brown or dark brown; carinae concolorous or paler; central area of mesonotum (in between carinae) often paler. Forewings light brown or whitish, veins light brown to whitish, concolorous with cells; tubercles dark brown in distinct contrast with light coloured veins. Pterostigma, crossveins and apical parts of veins slightly darker. Legs and body light brown or mid brown (rarely dark brown).

Morphology. Body length: ♂ 4.7–5.6 mm; ♀ 5.7–7.2 mm.

Head: Vertex 1.9–2.4 x wider than long; median carina of vertex covering about 1/2 to entire length of basal compartment of vertex; absent in apical compartment. Frons 1.0–1.1 x longer than wide; position of maximum width more or less around centre of frontoclypeal suture or slightly dorsad; lateral carinae of frons in facial view convex, rectilinear apically or sinuate, s-shaped. Frontoclypeal suture strongly semicircular, bent upwards, median part reaching at least lower margin of antennal scape. Postclypeus with median carina well developed, sometimes evanescent near anteclypeus. Anteclypeus with median carina well developed or evanescent. Rostrum reaching or surpassing hind coxae.

Thorax: Hind margin of pronotum obtusely angled, acutely angled or rectangular. Mesonotum with median carina moderately to weakly developed, evanescent near posterior end; lateral carinae moderately developed. Forewing 3.2–3.7 x longer than wide; concavity at costal border absent; costal margin with 14–19 tubercles; fork of ScP+RA and RP distinctly basad; tubercles of forewing dark, distinctly contrasted to paler coloured veins; ScP+RA apically bifid or unforked; RP bifid or trifid; additional subapical cell between branches of MP1 and MP2 absent; MP1+2 trifid (rarely bifid); MP3+4 bifid or trifid (rarely 4 branches); 11–12 apical cells; 6 subapical cells. Hind leg: tibia with 6 (rarely 5) apical spines; 1st tarsomere with 9–10 apical teeth and 4–5 platellae; 2nd tarsomere with 9 (rarely 10) apical teeth and 7 (rarely 8) platellae.

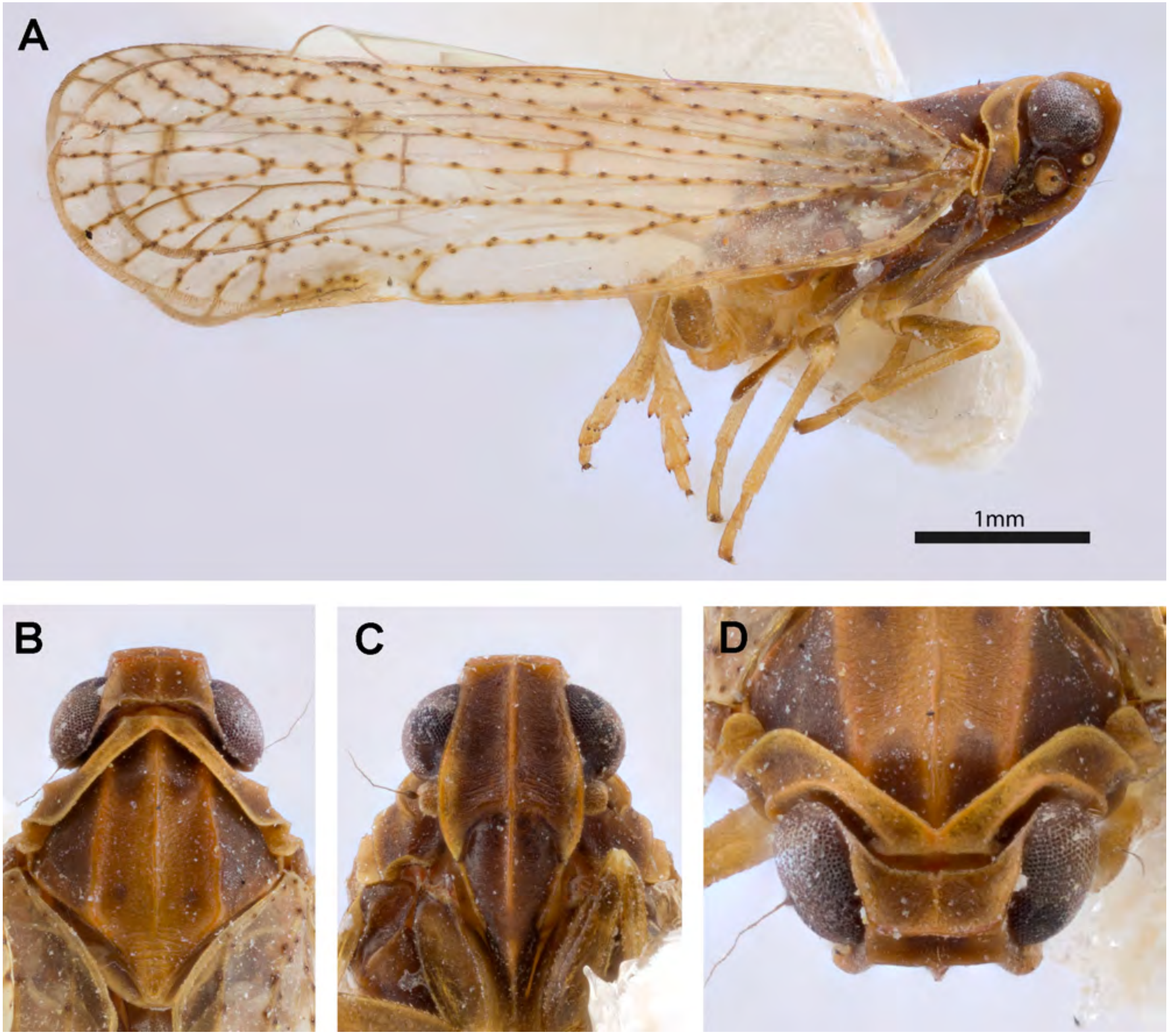

FIGURE 10. *Chidaea etelis*: A habitus; B–D head.

Male genitalia: Anal tube as in Figs 25D–E. Pygofer and genital styles as in Figs 25F–G. Aedeagus as in Figs 25A–C. Phallotheca with spines (a,b) about equal in length and curvature, not reaching bifurcate ventral process. In ventral view spines mostly concealed by phallotheca apart from apical section (1/3 to 1/5 of length of spine visible). Phallotheca in ventral view symmetrical, widest in apical quarter, narrowest in the section between tip of spines and bifurcate ventral process. Bifurcate ventral process situated about half way between base of phallotheca and midlength.

Diagnosis. Phallotheca in ventral view symmetrical, shaped like a fish reaching its greatest width in the apical quarter.

This species shares the following combination of characters with *Ch. crassa*, *Ch. bobadeenensis*, *Ch. kimbaensis* and *Ch. sidnicus*: dark, contrasting tubercles on the forewing and platellae on the first hind tarsomere. In *Ch. etelis* large parts of spine (a) are concealed by the phallotheca in ventral view (only the tip of the spine is visible), whereas in *Ch. crassa* all and in *Ch. kimbaensis* most of spine (a) is visible in ventral view. In *Ch. bobadeenensis*, however, spine (a) is entirely concealed in ventral view (although it appears that the base is visible, it is covered by a thin layer of phallotheca). In *Ch. bobadeenensis* and *Ch. etelis* the phallotheca is wide apically. Both species can easily be distinguished by the curvature of spine (a) in dorsal view: in *Ch. etelis* both spines are about equally curved, whereas in *Ch. bobadeenensis* spine (a) is more strongly curved than spine (b). Further, in *Ch. etelis* the section of phallotheca tapering into the bifurcate ventral process is symmetrical, in *Ch. bobadeenensis* asymmetrical.

Distribution: WA.

Associated plant records: *Eucalyptus diversicolor*, *Pimelea sylvestris*.

Chidaea kimbaensis sp. nov.

(Figs 11, 26, 31C)
Zoobank Registration:
http://zoobank.org/urn:lsid:zoobank.org:act: 0A8FA46C-B1E8-4544-828C-2D89326C3C1F

Types. *Holotype*, ♂, **AUSTRALIA, SA:** 45km E of Kimba, 30.ix.1977 (F.H.U. Baker) (ASCU ASCTHE026378). *Paratypes*, **SA:** 1 ♀, 8 mi. WNW of Nunjikompita, 1.x.1968 (Key, Upton, Balderson) (ANIC); 1 ♀, Brookfield Con. Pk, 34.19S, 139.32E, Site 7, under mallee bark, 3.–12.ix.1991 (Lawrence, Weir, Dressler) (ANIC).

Etymology. Named after the type locality, Kimba.

Colour. Head and pronotum dark brown to black with highly contrasting yellow or orange carinae. Mesonotum dark brown to black with orange carinae. Forewings whitish, veins light brown to whitish, concolorous with cells; tubercles dark brown in distinct contrast with light coloured veins. Pterostigma, crossveins and apical parts of veins slightly darker. Legs brown, dark near base, light near apex, body mid to dark brown.

Morphology. Body length: ♂ 5.6 mm; ♀ 6.2–6.7 mm.

Head: Vertex 2.3 x wider than long; median carina of vertex covering entire length of basal compartment of vertex; absent in apical compartment. Frons 1.4 x longer than wide; position of maximum width distinctly dorsad of frontoclypeal suture; lateral carinae of frons in facial view convex, rectilinear apically. Frontoclypeal suture strongly semicircular, bent upwards, median part just or just not reaching lower margin of antennal scape. Postclypeus with median carina well developed, evanescent near frontoclypeal suture. Anteclypeus with median carina moderately developed. Rostrum reaching hind coxae.

Thorax: Hind margin of pronotum rectangular. Mesonotum with median carina moderately developed, evanescent near posterior end; lateral carinae moderately to well developed. Forewing 3.6 x longer than wide; concavity at costal border absent; costal margin with about 10 tubercles; fork of ScP+RA and RP about same level as fork CuA1 and CuA2; tubercles of forewing dark, distinctly contrasted to paler coloured veins; ScP+RA apically bifid; RP trifid; additional subapical cell between branches of MP1 and MP2 absent; MP1+2 trifid; MP3+4 bifid; 11 apical cells; 6 subapical cells. Hind leg: tibia with 6 apical spines; 1st tarsomere with 9–10 apical teeth and 4–5 platellae; 2nd tarsomere with 9–10 apical teeth and 7–8 platellae.

Male genitalia: Anal tube as in Figs 26D–E. Pygofer and genital styles as in Figs 26F–G. Aedeagus as in Figs 26A–C. Phallotheca near base with a bifurcate ventral process at the end of a very large ventral ridge; phallotheca left lateral with a long spine (a), almost straight in ventral view, slightly curved in lateral view; right lateral with a short spine (b), almost straight in ventral view, strongly curved in lateral view; phallotheca forming a well sclerotised ridge right lateral.

Diagnosis. This species is the only species within *Chidaea* in which the left lateral spine (a) is distinctly longer (almost twice the length) than the other spine on the phallotheca. In all other species the spines are either about the same length or spine (b) is longer.

Distribution: SA.

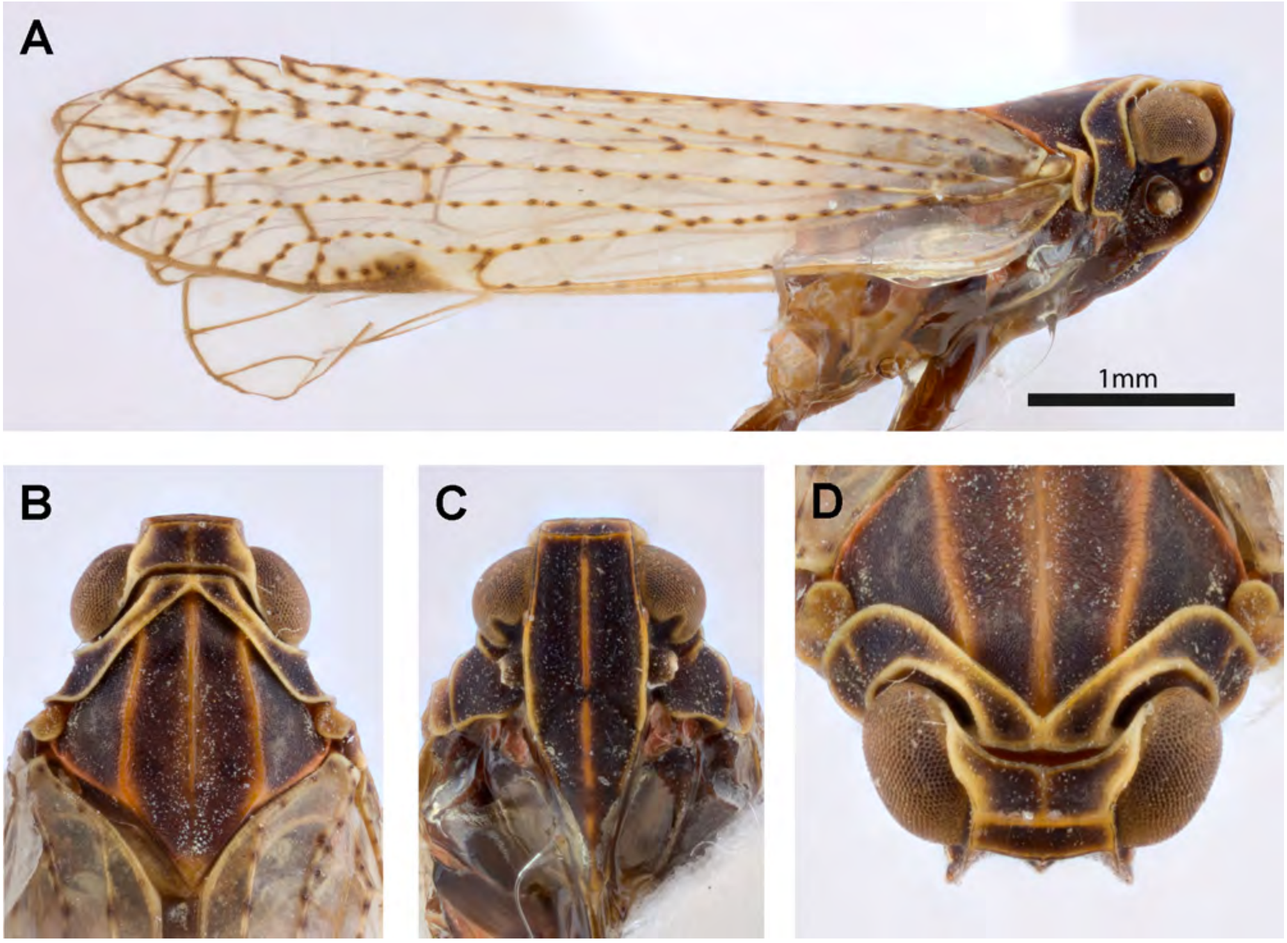

FIGURE 11. *Chidaea kimbaensis*: A habitus; B–D head.

***Chidaea orangensis* sp. nov.**
(Figs 12, 27, 31C)
Zoobank Registration:
http://zoobank.org/urn:lsid:zoobank.org:act: 84BDC46E-69C7-4AD2-8A28-C498ECF5D2BF

Types. *Holotype*, ♂, **AUSTRALIA, NSW:** Orange, Moulder Park, ex *Callistemon pityoides,* xii.2017 (B. Löcker) (ASCU ASCTHE026529). *Paratypes*, **NSW:** 1 ♂, Orange, Moulder St, xii.2017 (B. Löcker) (ASCU); 1 ♂, Orange, Moulder Park, xii.2017 (B. Löcker) (ASCU); 1 ♂, Orange, Moulder Park, ex *Casuarina,* 8.xi.2018 (B. Loecker) (ASCU); 2 ♂, New England Uni[versity] Armidale, 18.xi.1971 (C.W. Frazier) (ASCU); 4 ♂, Armours Ck, 35º 23'S, 150º 14'E, sweeping, 2.xi.1987 (L. Hill) (ASCU); 1 ♂, Sandy Flat, 20km S of Tenterfield, 30.x.1987 (D.J. Scambler) (ASCU); 1 ♂, Legume, 4.x.1964 (P. Kerridge) (QM, formerly UQIC); 3 ♂, Putty, xi.1964 (J. Evans) (ASCU). **Qld:** 1 ♂, Acacia Ridge, Brisbane, at light, 30.ix.1966 (E.C. Dahms) (QM); 1 ♂, Victoria Pt Brisbane, 11.ix.1954 (T. Woodward) (QM, formerly UQIC); 1 ♂, Woody Island, 9.ix.1953 (E.J. Reye) (QM); 1 ♂, Baffle Cr[ee]k, light on flowers *M[acadamia] integrifolia*, N3335, 12329, 15.viii.1969 (D.A. I[ronside]) (QDPI); 1 ♂, Brisbane, xii.1925 (SAMA); 1 ♂, Mt Molloy, Bakers Rd, 3.8km from Highway, 16º40'S, 145º16E, 385m, Stop 19, 25.iv.2013 (D.C.F. Rentz) (ASCU); 1 ♂, Eprapah, 11.ix.1954 (M. Wilson) (QM); 6 ♂, Penrith Island, 2–3.viii,1969 (H. Heatwole) (AMS); 3 ♂, Enoggera, 15.ix.1941 (H. Hacker) (QDPI). **SA:** 1 ♂, Loxton, ex sticky trap, 14.x.–29.x.2004 (P. Magarey) (ASCU); 1 ♂, same data except for 16.ix–28.ix.2004 (ASCU); 1 ♂, same data except for 29.ix–14.x.2004 (ASCU). **Vic:** 9 ♂, Hattah-Kulkyne NP, 16.8km ENE Hattah Chalka Creek (dry creek), 34º 43'

01”S, 142º 21’ 53”E, malaise trap, 23.ix–4.x.2001 (CNH J.D. & J.S. Lambkin & N.T. Starick) (ANIC); 1 ♂, Gol Gol, ex sticky trap in vinyard, 12.v.1999 (VAIC); 1 ♂, same data except for 28.ix.1999 (VAIC); 1 ♂, same data except for 5.x.1999 (VAIC).

Other material examined. AUSTRALIA, NSW: 2 ♀, Orange, Moulder St, *Fraxinus angustifolia*, xii.2017 (B. Loecker) (ASCU); 2 ♀, Orange, Moulder Park, ex *Casuarina*, 8.xi.2018 (B. Loecker) (ASCU ASCT00183059, ASCT00183060); 2 ♀, N[ew] E[ngland] University Armidale, 18.xi.1971 (C.W. Frazier) (ASCU); 1 ♀, Armours Ck, 35º 23’S, 150º 14’E, sweeping, 2.xi.1987 (L. Hill) (ASCU); 2 ♀, Putty, xi.1964 (J. Evans) (ASCU). **Qld:** 1 ♂, 8.2km E of Mungallala, 26º 27’ 50”S, 147º 37’ 29”E, 560m, ex *Cassinia* sp., 98-07, 31.x.1998 (Schuh, Cassis, Silveira) (AMS); 6 ♀, Penrith Island, 2–3.viii,1969 (H. Heatwole) (AMS); 2 ♀, Mt Molloy, Bakers Rd, 3.8km from Highway, 16º40’S, 145º16E, 385m, Stop 19, 25.iv.2013 (D.C.F. Rentz) (ASCU); 2 ♀, Victoria Pt Brisbane, 11.ix.1954 (T. Woodward) (QM, formerly UQIC). **Vic:** 10 ♀, Hattah-Kulkyne NP, 16.8km ENE Hattah Chalka Creek (dry creek), 34º 43’ 01”S, 142º 21’ 53”E, malaise trap, 23.ix–4.x.2001 (CNH J.D. & J.S. Lambkin & N.T. Starick) (ANIC); 2 ♀, Gol Gol, ex sticky trap in vineyard, 12.v.1999 (VAIC).

Notes. The male specimen from Qld excluded from the type series shows the characteristics of *Ch. orangensis*, but has the left lateral aedeagal spine shaped slightly different. The females listed under ‘Other material examined’ 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 *Ch. orangensis* and *Ch. algida,* and these two species have an overlapping distribution range, there remains the possibility that some of these females may be *Ch. algida.* These two species have been found to live in close proximity, e.g. of four male specimens, collected by Hacker in Enoggera and mounted on one cardboard, three specimens were *Ch. orangensis* and one turned out to be *Ch. algida*. Further, three different species have been collected at the University of New England campus in Armidale (*Ch. orangensis*, *Ch. crassa* and *Ch. armidalensis*).

Etymology. This species was found in the first author’s backyard. Named after the type locality Orange, NSW.

Colour. Entire specimen including carinae light brown, rarely with darker patches. Pronotum slightly darker than head and pronotum. Forewings light brown, tubercles and veins light brown, concolorous with cells. Pterostigma, crossveins and apical parts of veins often slightly darker.

Morphology. Body length: ♂ 5.7–6.7 mm; ♀ 6.6–8.2 mm.

Head: Vertex 2.1–2.9 x wider than long; median carina of vertex covering 1/3 to full length of basal compartment of vertex; absent in apical compartment. Frons 1.0–1.2 x longer than wide; position of maximum width more or less around centre of frontoclypeal suture or distinctly dorsad; lateral carinae of frons in facial view convex, rectilinear apically. Frontoclypeal suture strongly semicircular, bent upwards, median part reaching at least lower margin of antennal scape. Postclypeus with median carina well developed, moderately developed or evanescent. Anteclypeus lacking median carina. Rostrum surpassing hind coxae.

Thorax: Hind margin of pronotum acutely angled or rectangular. Mesonotum with moderately developed median and lateral carinae. Forewing 3.0–3.4 x longer than wide; concavity at costal border absent; costal margin with 8–22 indistinct tubercles; fork of ScP+RA and RP basad (rarely distad) of fork CuA1 and CuA2; tubercles of forewing dark or pale, concolorous with veins; ScP+RA apically bifid (sometimes unforked); RP trifid; additional subapical cell between branches of MP1 and MP2 absent; MP1+2 trifid (rarely bifid), MP3+4 forking into 3 or 4 branches; 10–11 (rarely 12) apical cells; 6 subapical cells. Hind leg: tibia with 6 (rarely 5 or 7) apical spines; 1st tarsomere with 11–14 apical teeth and 6–9 (rarely 10) platellae; 2nd tarsomere with 11–13 (rarely 10 or 14) apical teeth and 9–12 platellae.

Male genitalia: Anal tube as in Figs 27D–E. Pygofer and genital styles as in Figs 27F–G. Aedeagus as in Figs 27A–C. Phallotheca near base with a bifurcate ventral process; phallotheca very narrow; dorsally with two, strongly curved spines (a,b), mostly concealed by phallotheca in ventral view (only the base of each spine visible).

Diagnosis. This species is unique within *Chidaea* in that the tips of both spines are concealed by the phallotheca in ventral view. *Chidaea bobadeenensis* and *Ch. belairensis* are a bit similar in ventral view, having the tip of spine (a) entirely concealed and only a small portion of the tip of spine (b) visible. However they can easily be distinguished from *Ch. orangensis* in having the base of spines concealed by a more or less transparent section of the phallotheca, whereas in *Ch. orangensis* the bases of both spines are visible in ventral view. Further, *Ch. orangensis* and *Ch. bobadeenensis* can easily be separated by the shape of the phallotheca (in *Ch. bobadeenensis* it is asymmetrical and much wider apically; in *Ch. orangensis* it is narrow and symmetrical). Further, in *Ch. orangensis* spines are equally curved and represent a mirrored image of each other, whereas in *Ch. bobadeenensis*, spine (a) is usually more strongly curved than spine (b), so the dorsal view appears asymmetrical.

Distribution: NSW, Qld, SA, Vic.

Associated plant records: *Callistemon pityoides*, *Cassinia* sp., *Casuarina* sp., *Fraxinus angustifolia*.

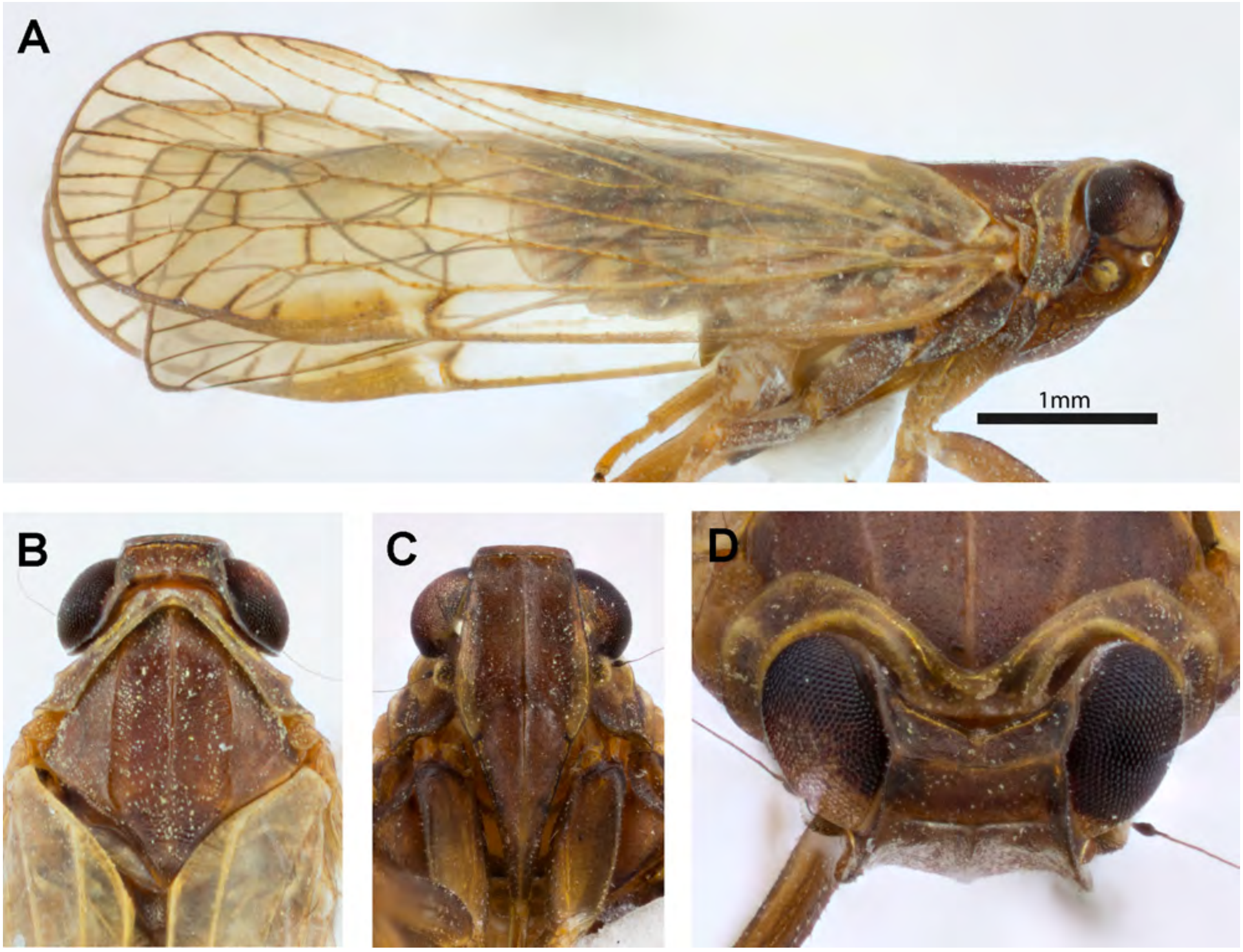

FIGURE 12. *Chidaea orangensis*: A habitus; B–D head.

Chidaea pulyonna **sp. nov.**
(Figs 13, 28, 31C)
Zoobank Registration:
http://zoobank.org/urn:lsid:zoobank.org:act: 1F4AB6C2-3E51-4357-AA7F-45A276DE9D1F

Types. *Holotype*, ♂, **AUSTRALIA, NSW**: N[ew] E[ngland] NP, near entrance, 4.xi.1960 (C. W. Frazier) (ASCU ASCTHE017097). *Paratypes*, **NSW**: 2 ♂, 1 ♀, same data as holotype (ASCU); 1 ♀, New England NP, road near entrance, mont. woodland, 1400m, on tree trunk, 7.xii.1992 (D. Bickel) (AMS).

Other material examined. NSW: 1 ♂, New England NP, road near entrance, mont. woodland, 1400m, on tree trunk, 7.xii.1992 (D. Bickel) (AMS).

Notes. One male specimen from New England NP is excluded from the type series because its male genitalia are damaged (tip of aedeagal spine broken off).

Etymology. The term 'pulyonna' means 'dark, black' in Kaurna, an Aboriginal language spoken in the Adelaide Plains (Thieberger & McGregor 1994). Named after the dark central stripe on the mesonotum.

Colour. Vertex dark brown or black with pale carinae (sometimes apical compartment of vertex paler than basal compartment). Face dark brown to black, median carina concolorous or slightly paler; lateral carinae very pale. Pronotum light brown, laterally with slightly darker patches. Mesonotum light brown apart from dark brown to black central area of mesonotum (in between carinae), often extreme lateral parts of mesonotum dark brown to black. Forewings light brown, tubercles and veins concolorous light brown (rarely mid brown). Legs brown, dark near base, light near apex, body mid to dark brown.

Morphology. Body length: ♂ 5.9–6.4 mm; ♀ 7.3 mm.

Head: Vertex 2.4–2.6 x wider than long; median carina of vertex covering 1/4–3/4 of basal compartment of vertex; absent in apical compartment. Frons 1.2 x longer than wide; position of maximum width distinctly dorsad of centre of frontoclypeal suture; lateral carinae of frons in facial view convex, rectilinear apically or convex, evenly rounded. Frontoclypeal suture slightly semicircular, bent upwards, median part just not reaching lower margin of antennal scape. Postclypeus with median carina well developed. Anteclypeus with median carina moderately developed or evanescent. Rostrum surpassing hind coxae.

Thorax: Hind margin of pronotum obtusely angled, acutely angled or rectangular. Mesonotum with median carina moderately developed, evanescent near posterior end; lateral carinae moderately to well developed. Forewing 2.9–3.4 x longer than wide; concavity at costal border absent; costal margin with 20–34 tubercles; fork of ScP+RA and RP basad or at same level as fork CuA1 and CuA2; tubercles of forewing dark or pale, concolorous with veins; ScP+RA apically bifid or unforked; RP trifid; additional subapical cell (C3a in Fig. 28H) between branches of MP present; MP1+2 and MP3+4 bifid or trifid; 11 apical cells; 6–8 subapical cells. Hind leg: tibia with 6 (rarely 7) apical spines; 1st tarsomere with 8 apical teeth and no platellae; 2nd tarsomere with 9 apical teeth and 7 platellae.

Male genitalia: Anal tube as in Figs 28D–E. Pygofer and genital styles as in Figs 28F–G. Aedeagus as in Figs 28A–C. Phallotheca symmetrical, with two long spines (a,b) reaching a bifurcate ventral process just below midline of phallotheca. In ventral view basal half of spines (a,b) covered by phallotheca. In lateral view spines (a,b) straight, apart from a strong bend halfway through the spine at which point the spine reaches its maximum width.

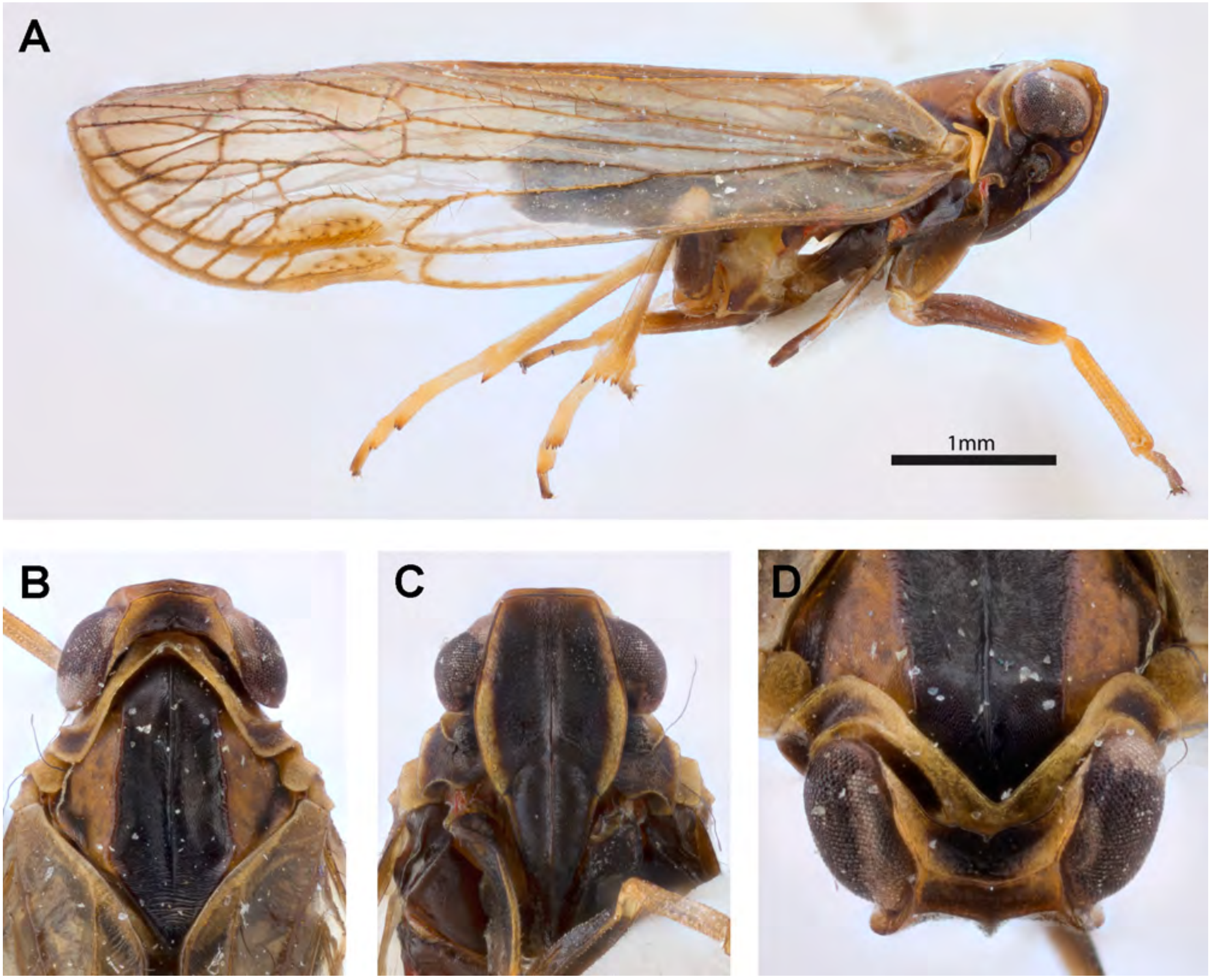

FIGURE 13. *Chidaea pulyonna*: A habitus; B–D head.

Diagnosis. *Chidaea pulyonna* can be easily distinguished from all other species of *Chidaea* by the presence of a prominent, central, dark stripe on the mesonotum. It covers the entire area between the lateral carinae and is in distinct contrast to adjacent areas of the mesonotum which are pale (light brown). Often extreme lateral parts of the mesonotum are darkened as well, but never the area just outside the lateral carinae. This species is very characteristic in having long aedeagal spines that in lateral view show their greatest width around midlength where they are strongly bent (in most other species spines are widest at their base). Because of the length of the spines and the bend their tips protrude considerably from the aedeagus in ventral direction. *Chidaea pulyonna* shares the following combination of characters with *Ch. wilarra*, *Ch. armidalensis*, *Ch. dickinsonorum* and *Ch. dayi*: absence of platellae on the first hind tarsomere and tubercles on the forewing that are concolorous with veins. *Chidaea dayi* and *Ch. armidalensis* can be separated from *Ch. pulyonna* by the asymmetrical arrangement of the aedeagal spines in ventral view (symmetrical in *Ch. pulyonna*). *Chidaea wilarra* and *Ch. dickinsonorum* can be distinguished from *Ch. pulyonna* by the shape of spine (a) which is evenly curved throughout as opposed to straight with a strong bend halfway through the spine in *Ch. pulyonna*.

Distribution: NSW.

Chidaea punctata sp. nov.

(Figs 14, 29, 31B)
Zoobank Registration:
http://zoobank.org/urn:lsid:zoobank.org:act: 693650D8-1AD0-4749-A5EA-97E7087676AF

Types. *Holotype*, ♂, **AUSTRALIA, Qld:** Brisbane, Mt Coot-tha Hilltopping, 27º 29'S, 152º 57'E, 170m, 16.ix.1997 (J. Skevington) (QM T244828, formerly UQIC). *Paratypes*, **Qld**: 1 ♀, same data as holotype (QM, formerly UQIC); 1 ♂, Gurgeena Plateau, 25º 27'S, 151º 22'E, open forest, F.I.T. 7266, 22.viii.–10.x.1998 (G.B. Monteith) (QM); 3 ♀, Willowburn, 14.ix.1920 (J.A. Beck) (QM, formerly UQIC); 1 ♂, Brisbane, 21.ix.1923 (SAMA); 3 ♀, Brisbane, 5.xi.1941 (H.H[acker]) (QDPI).

Etymology. Named after the characteristic spots on the forewing.

Colour. Head and pronotum mid or dark brown with distinctly contrasting pale carinae. Mesonotum mid or dark brown laterally, central area between carinae often much paler; carinae pale, often concolorous with central area. Forewings light brown with 3 distinct mid to dark brown spots on each wing (near y-fork in claval area, near CuA1 and CuA2 fork and on MP basad of MP1+2 and MP3+4 fork) with all 6 spots together forming a distinct u-shaped pattern; forewing with darker patches near crossveins; forewing veins varying in colour from light to mid or dark brown, tubercles concolorous with veins; pterostigma light brown. Body and legs light, mid or dark brown.

Morphology. Body length: ♂ 5.7–5.9 mm; ♀, 6.4–7.9 mm.

Head: Vertex 2.0–2.6 x wider than long; median carina of vertex covering almost entire length of basal compartment of vertex; absent or reduced to a very short section in basal compartment. Frons 1.0–1.2 x longer than wide; position of maximum width more or less around centre of frontoclypeal suture; lateral carinae of frons in facial view slightly s-shaped, almost straight apically. Frontoclypeal suture strongly semicircular, bent upwards, median part reaching at least lower margin of antennal scape. Postclypeus with median carina well developed. Anteclypeus with median carina well developed. Rostrum just not reaching hind coxae.

Thorax: Median carina of pronotum extremely well developed. Hind margin of pronotum obtuse. Mesonotum with median carina evanescent; lateral carinae weakly developed. Forewing 3.2 x longer than wide; concavity at costal border weakly developed; costal margin with 1–4 indistinct tubercles; fork of ScP+RA and RP slightly basad of or at same level as fork CuA1 and CuA2; tubercles of forewing dark, only slightly darker than veins; ScP+RA apically bifid; RP trifid; additional subapical cell between branches of MP1 and MP2 absent; MP1+2 and MP3+4 trifid; 12 apical cells; 6 subapical cells. Hind leg: tibia with 6 apical spines; 1st tarsomere with 9 apical teeth and no platellae; 2nd tarsomere with 13–15 apical teeth and 11–13 platellae.

Male genitalia: Anal tube as in Figs 29D–E. Pygofer and genital styles as in Figs 29F–G. Aedeagus (Figs 29A–C): Phallotheca below midlength with a bifurcate ventral process; phallotheca left laterally with a strongly curved spine (a); phallotheca right laterally with a long spine (b), partly concealed by phallotheca; in lateral view both spines in middle section strongly to moderately curved inwards; in ventral view phallotheca in middle section distinctly bulging left laterally, concealing about half of spine (a).

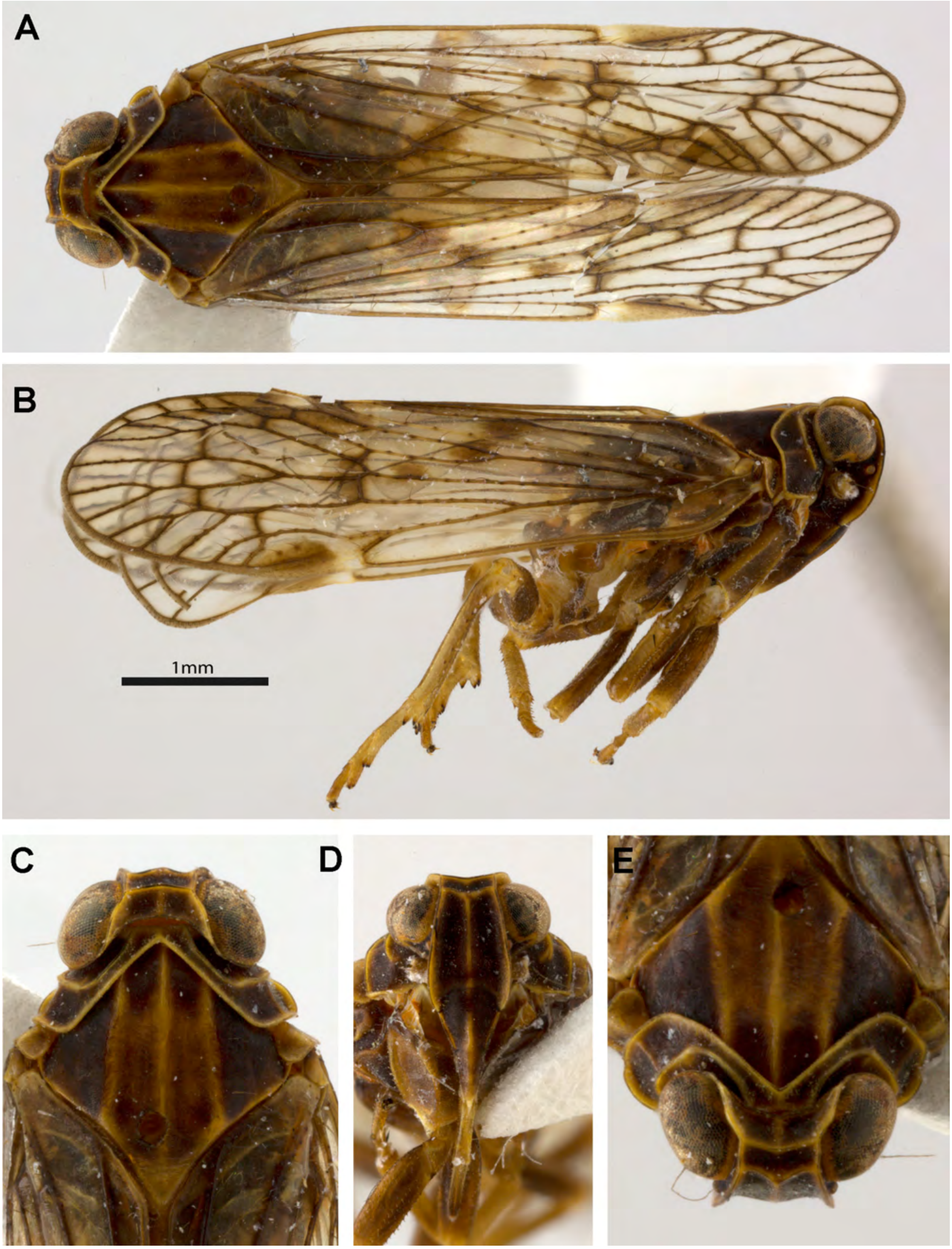

FIGURE 14. *Chidaea punctata*: A habitus dorsal; B habitus right lateral; C–E head.

Diagnosis. A u-shaped pattern of six dark brown spots on the forewings (three on each forewing) is a distinctive feature of this species. A weakly developed form of this pattern can be found in *Ch. carinata* (more strongly developed in females). *Chidaea punctata* shares a number of features with *Ch. carinata* such as a longer median section of pronotum compared to other species of *Chidaea*, a well developed median carina on pronotum, strongly developed carinae on head and pronotum that are clearly contrasted in colour to adjacent areas. Both species, however, can easily be separated by the presence (*Ch. carinata*) and absence (*Ch. punctata*) of platellae on the first tarsomere.

The male genitalia of this species resembles *Ch. dickinsonorum* in the length and arrangement of spines. Both species can be separated by the shape of the phallotheca in ventral view. In *Ch. punctata* the phallotheca is bulging extensively left lateral, thereby concealing about half of spine (a) in ventral view. In *Ch. dickinsonorum* the phallotheca bulges only slightly (if at all), thereby only marginally concealing small parts of spine (a). Further, in *Ch. punctata* the middle section of both spines is more strongly curved inwards in ventral view. In *Ch. dickinsonorum* spines are generally much straighter. These two species also differ in the length of spine (b). In *Ch. punctata* this spine is much longer almost reaching the tip of the bifurcate ventral process.

The bulging phallotheca (ventral view) is a feature shared with *Ch. bobadeenensis* and *Ch. belairensis*, however these species can easily be distinguished from *Ch. punctata* by the presence of platellae on the first hind tarsomere (absent in *Ch. punctata*).

Distribution: Qld.

Remarks. Interestingly, the female specimens from Willowburn were collected in the same collecting event as males of *Ch. carinata*, however due to the absence of platellae on the first hind tarsomere they can be assigned to *Ch. punctata*.

Chidaea sidnicus (Stål, 1859) comb. nov.
(Fig. 15, 31B)

Cixius sidnicus Stål, 1859: 273.

Types. *Holotype*, ♀ (examined), **AUSTRALIA, NSW:** Sydney, Kinb. (NHRS NHRS-GULI 000038154).

Colour. Vertex and pronotum light to mid brown with slightly paler carinae. Face mid brown with paler carinae. Mesonotum mid brown, central area (in between carinae) light brown. Forewings light brown, veins light brown, concolorous with cells, tubercles dark, in distinct contrast with lighter coloured veins. Pterostigma, crossveins and apical parts of veins slightly darker. Body mid brown, legs light to mid brown.

Morphology. Body length: ♀ 6.4 mm.

<u>Head:</u> Vertex 2.0 x wider than long; median carina covering about half of length of basal compartment of vertex; absent in apical compartment. Frons 1.2 x longer than wide; position of maximum width distinctly dorsad of frontoclypeal suture; lateral carinae of frons in facial view convex, rectilinear apically. Frontoclypeal suture strongly semicircular, bent upwards, median part just reaching lower margin of antennal scape. Median carina of post- and anteclypeus well developed. Rostrum reaching hind coxae.

<u>Thorax:</u> Hind margin of pronotum acutely angled. Mesonotum with weakly developed median and lateral carinae. Forewing 3.3 x longer than wide; concavity at costal border absent; costal margin with 20–22 tubercles; fork of ScP+RA and RP at same level or slightly basad of fork CuA1 and CuA2; tubercles of forewing dark, distinctly contrasted to paler coloured veins; ScP+RA apically bifid; RP trifid; additional subapical cell between branches of MP1 and MP2 absent; MP1+2 trifid; MP3+4 trifid; 12 apical cells; 6 subapical cells. Hind leg: tibia with 6 apical spines; 1st tarsomere with 11 apical teeth and 6 platellae; 2nd tarsomere with 10 apical teeth and 8 platellae.

Diagnosis and Remarks. Several characters prove that the female holotype of *Cixius sidnicus* is not congeneric with *Cixius nervosus*. The most striking are: A median ocellus is missing in *Ch. sidnicus*, but always present in true *Cixius*. All *Cixius* species have 2–3 large lateral spines on the hind tibia, whereas *Ch. sidnicus* only has 2 minute lateral spines.

The characters given above as diagnostic for *Chidaea* fit with the female type of *C. sidnicus*, thus we conclude that the specimen belongs to the genus *Chidaea*. In several *Chidaea* taxa, we are—on a morphological basis—at the moment unable to identify females to species level. Thus, we are also unable to decide if the female holotype of *C. sidnicus* is conspecific with males of a species described above or represents another species where males are as yet unknown .

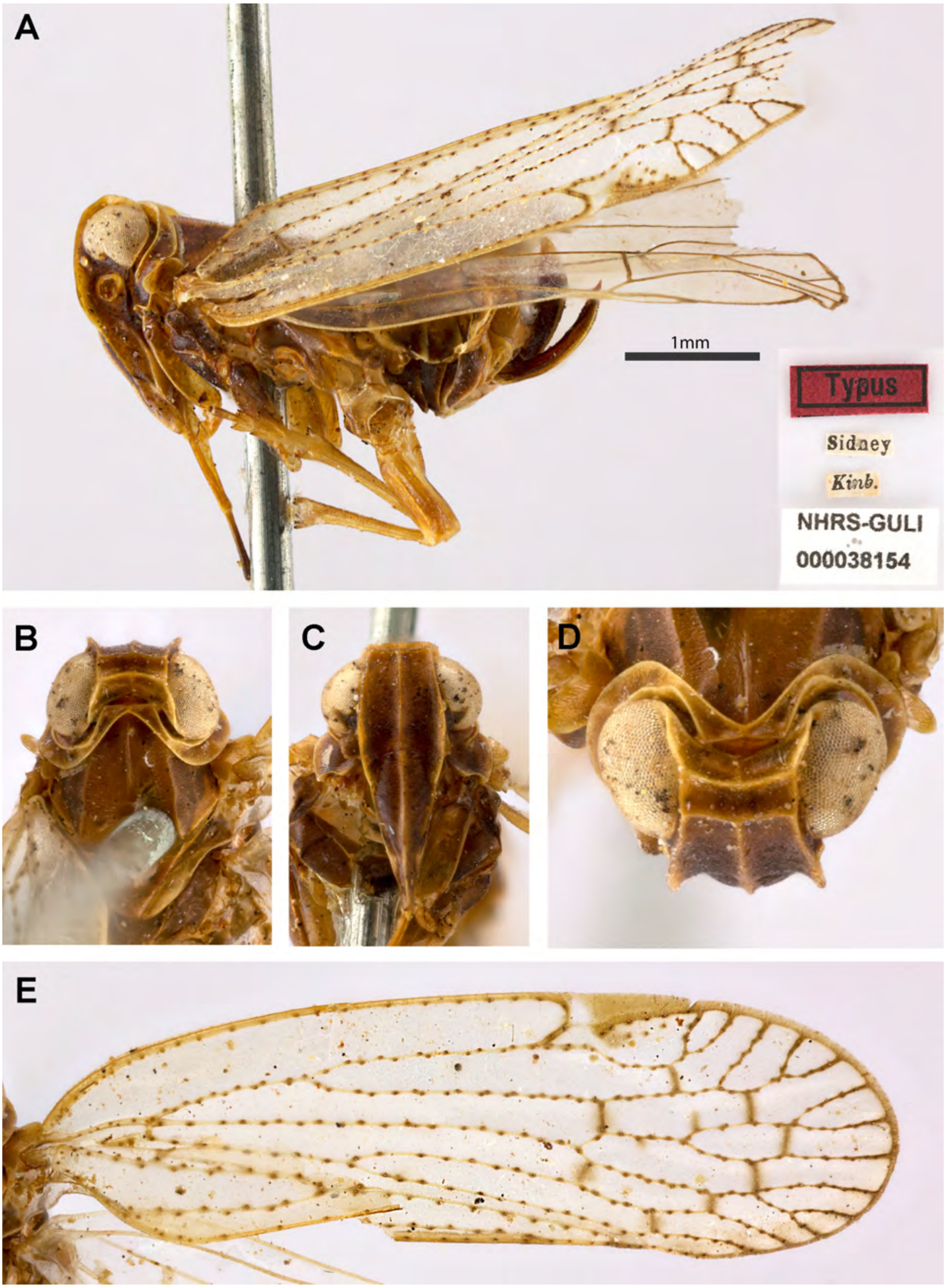

FIGURE 15. *Chidaea sidnicus*: A habitus and labels; B–D head; E forewing.

The examination of the female holotype revealed the presence of dark tubercles on the forewing in distinct contrast to lighter coloured veins. Four species of *Chidaea* are known to have dark tubercles. Based on the locality (the specimen was collected in Sydney), two of these species can be excluded (*Ch. kimbaensis* only occurs in South Australia and *Ch. etelis* is restricted to Western Australia). Therefore *Ch. sidnicus* Stål is likely to be conspecific with one of the two remaining species, either *Ch. crassa* or *Ch. bobadeenensis*, which have an overlapping distribution in New South Wales and Queensland, both occurring in the Sydney region. With the present state of knowledge it is impossible to associate the female holotype with certainty with one of these two species as differentiation between these species is entirely based on males. If an assignation will be possible in future—either by new characters or methods—one of the names given here might become a junior subjective synonym of *Ch. sidnicus* (Stål, 1859).

Distribution: NSW.

***Chidaea wilarra* sp. nov.**

(Figs 16, 30, 31D)

Zoobank Registration: http://zoobank.org/urn:lsid:zoobank.org:act: 49CCCC44-4D5F-4EB8-865B-460910583956

Types. *Holotype*, ♂, **AUSTRALIA, NSW:** Barren Ground[s], 16.xi.1958 (C.E. Chadwick) (ASCU ASCT00180039). *Paratypes*, **NSW**: 1 ♂, same data as holotype (ASCU); 1 ♂, Clyde Mountain (near top of highway pass), 28.xii.1994 (A. Sundholm, R. De Keyzer) (ANIC).

Etymology. The term 'wilarra' means 'moon or crescent' in Yindjibarndi, an Aboriginal language spoken in Western Australia (Thieberger & McGregor 1994). Named after the crescent-shaped aedeagal spines.

Colour. Entire specimen with a reddish brown tinge. Vertex mid or dark brown with slightly paler carinae. Frons mid brown, slightly darker near frontoclypeal suture; carinae concolorous or only slightly paler. Post- and anteclypeus darker than frons, dark brown to black with concolorous carinae. Pronotum light brown to reddish brown. Mesonotum slightly darker than pronotum, mid brown with concolorous carinae. Forewings light brown, tubercles and veins concolorous light brown. Legs and body light brown.

Morphology. Body length: ♂ 5.9–6.6 mm.

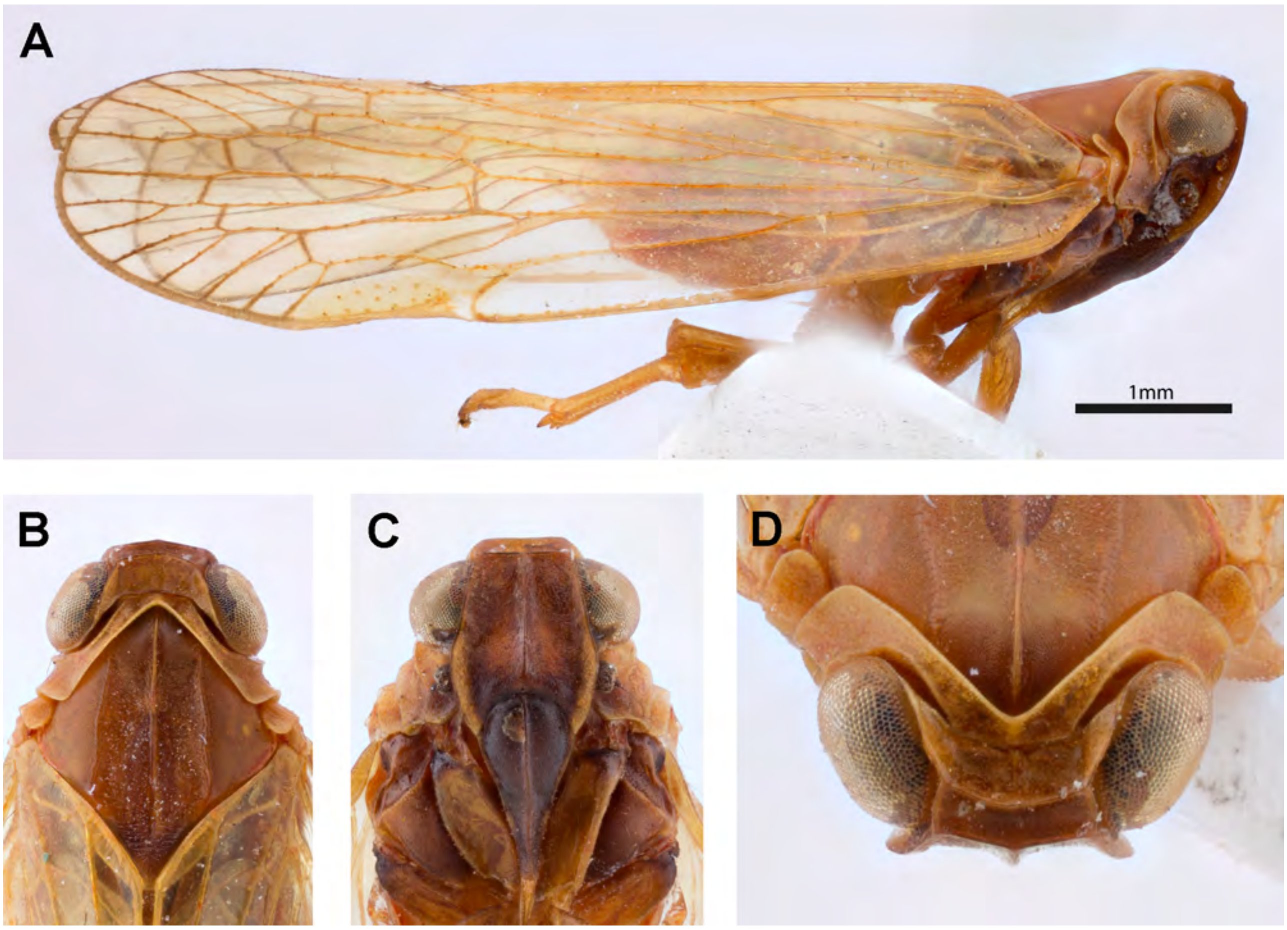

FIGURE 16. *Chidaea wilarra*: A habitus; B–D head.

Head: Vertex 2.2–2.3 x wider than long; median carina of vertex covering 1/3–3/4 of basal compartment of vertex; absent in apical compartment. Frons 1.0–1.1 x longer than wide; position of maximum width distinctly dorsad of centre of frontoclypeal suture; lateral carinae of frons in facial view convex, rectilinear apically or convex, evenly rounded. Frontoclypeal suture strongly semicircular, bent upwards, median part just or just not reaching lower margin of antennal scape. Postclypeus with median carina well developed. Anteclypeus with median carina moderately developed or evanescent. Rostrum reaching hind coxae.

Thorax: Hind margin of pronotum obtusely angled or rectangular. Mesonotum with median carina moderately developed, evanescent near posterior end; lateral carinae moderately developed. Forewing 3.3–3.5 x longer than wide; concavity at costal border absent; costal margin with 24–25 tubercles; fork of ScP+RA and RP basad of fork CuA1 and CuA2; tubercles of forewing dark or pale, concolorous with veins; ScP+RA apically bifid or unforked; RP trifid; additional subapical cell between branches of MP1 and MP2 absent; MP1+2 and MP3+4 trifid; 12 apical cells; 6 subapical cells. Hind leg: tibia with 6 apical spines; 1st tarsomere with 8 apical teeth and no platellae; 2nd tarsomere with 10 apical teeth and 8 platellae.

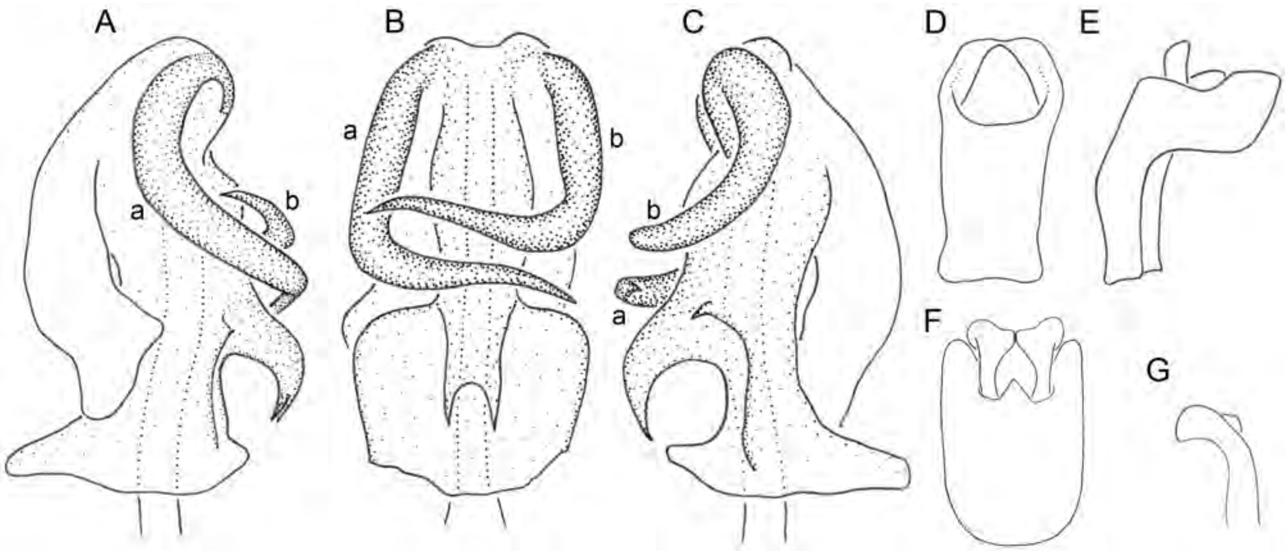

FIGURE 17. *Chidaea algida*: A aedeagus left lateral; B aedeagus ventral; C aedeagus right lateral; D–E anal tube; F–G genital styles.

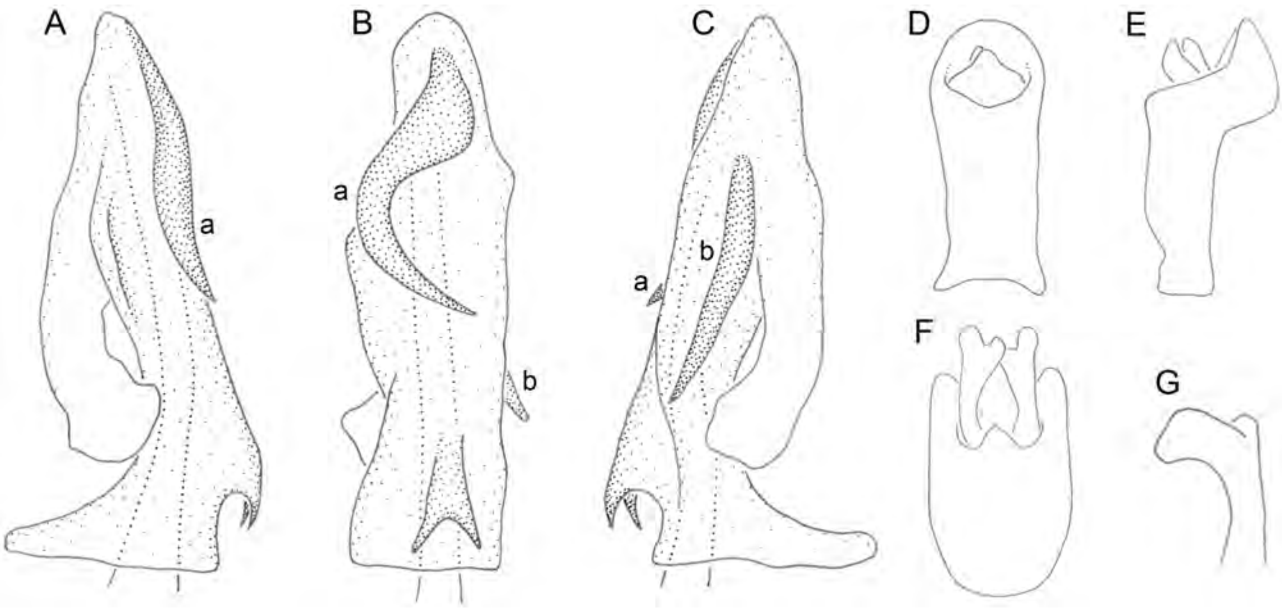

FIGURE 18. *Chidaea armidalensis*: A aedeagus left lateral; B aedeagus ventral; C aedeagus right lateral; D–E anal tube; F–G genital styles.

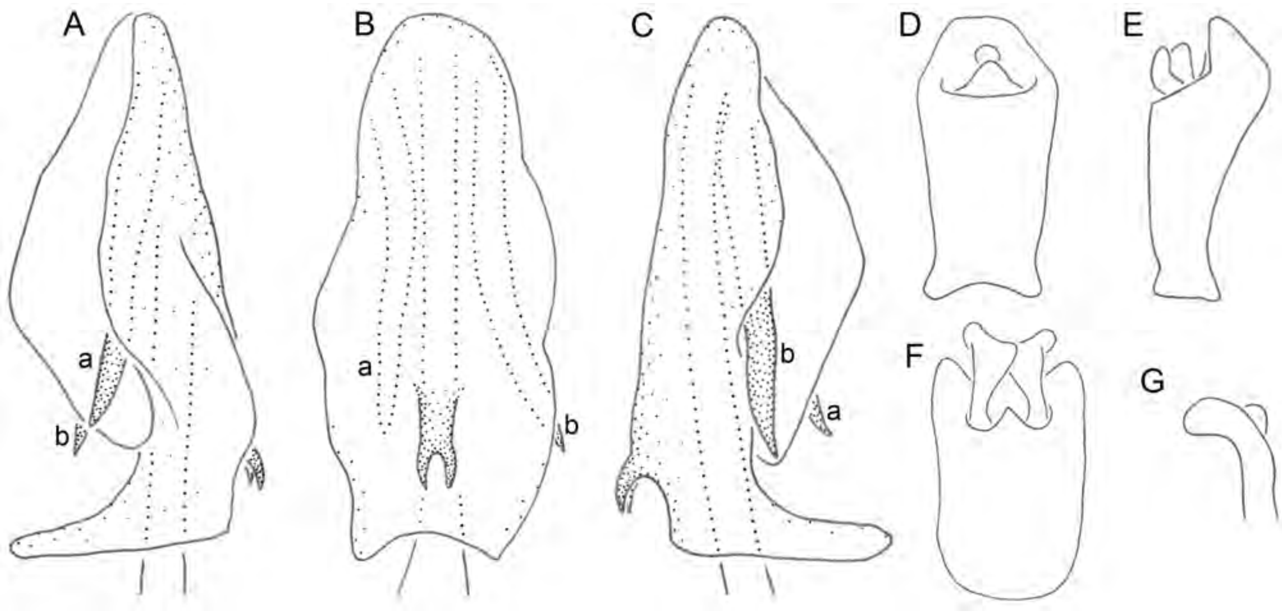

FIGURE 19. *Chidaea belairensis*: A aedeagus left lateral; B aedeagus ventral; C aedeagus right lateral; D–E anal tube; F–G genital styles.

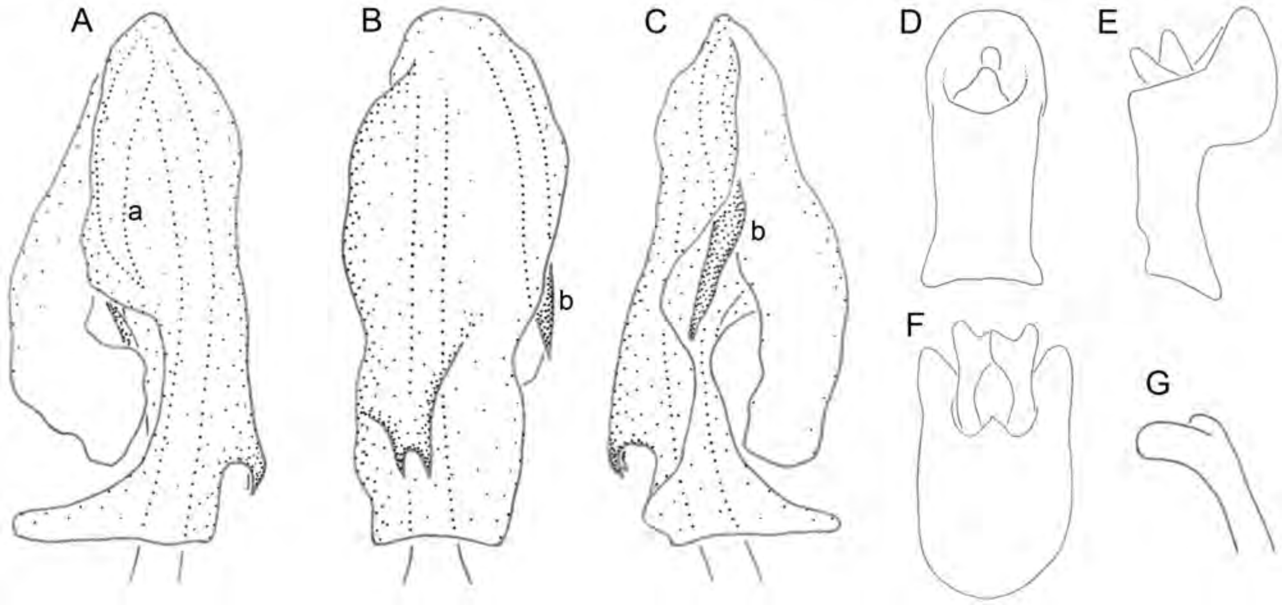

FIGURE 20. *Chidaea bobadeenensis*: A aedeagus left lateral; B aedeagus ventral; C aedeagus right lateral; D–E anal tube; F–G genital styles.

Male genitalia: Anal tube as in Figs 30D–E. Pygofer and genital styles as in Figs 30F–G. Aedeagus (Figs 30A–C): Phallotheca narrow, near base with a bifurcate ventral process on a prominent stalk that is strongly curved in lateral view; phallotheca left laterally with a medium sized, strongly curved (sickle-shaped) spine (a) that is partly concealed by the phallotheca in ventral view; phallotheca with a slightly longer, strongly curved (sickle-shaped) spine (b) that arises ventro-laterally. Aedeagal spines not reaching bifurcate ventral process.

Diagnosis. *Chidaea wilarra* shares the following combination of characters with *Ch. armidalensis*, *Ch. dickinsonorum*, *Ch. dayi* and *Ch. pulyonna*: absence of platellae on the first hind tarsomere and tubercles on the forewing that are concolorous with veins. See diagnosis section of *Ch. dayi* and *Ch. pulyonna* for details on how to differentiate these species from *Ch. wilarra*.

Both, *Ch. wilarra* and *Ch. dickinsonorum* have spine (b) arising a little bit further down the aedeagus shaft (closer to base of aedeagus) than spine (a) and its tip also reaching further down. This gives the aedeagus an asymmetrical appearance which resembles a person with uneven shoulders. These two species can be distinguished by the curvature of spine (b): in *Ch. wilarra* both spines are about equally strongly curved, whereas in *Ch. dickinsonorum* spine (a) is strongly curved whilst spine (b) is almost straight in lateral view. These species also differ in the insertion of spine (b): in *Ch. wilarra* spine (b) arises ventro-laterally, in *Ch. dickinsonorum* laterally.

Distribution: NSW.

Discussion

The male genitalia is very uniform throughout *Chidaea*. The aedeagus has two movable spines at the distal end of the phallotheca, usually one on each side. The anal tube bears a distinct ventral lobe at its end that in lateral view is usually narrow at the base and widening towards the apex. All species of *Chidaea* have a bifurcate ventral process on the phallotheca. In most species it is located near the base of phallotheca, in some species it has moved further up the aedeagus shaft, however it is always found below midlength of the phallotheca. The bifurcate process often sits at the end of a stalk or ridge that varies in size. A bifurcate ventral process on the phallotheca is also present in certain taxa of several different tribes of Australian Cixiidae such as Cixiini (some species of *Aka* White and *Leptolamia* Metcalf, some undescribed species of *Leades* Jacobi and *Monomalpha* Emeljanov), Gelastocephalini (only in *Carolus* Kirkaldy and *Rokebia* Löcker & Fletcher), Brixiini (some species of *Innobindus* Jacobi) and Cajetini (*Cajeta* Stål) but is absent in Andini, Eucarpiini, Mnemosynini and Pentastirini. Further, it is present in some African and Taiwanese species of *Cixius* (Tsaur *et al.* 1991; Van Stalle, 1988).

The length of the male anal style presents another important character: In *Chidaea* the anal style is about the same length as the remainder of the 11th segment (Fig. 23E). This feature is shared with another Australian endemic genus *Cajeta* and appears to be an intermediate stage between the condition observed in Gelastocephalini plus some representatives of *Andes* Stål, *Benna* Walker, *Cubana* Uhler and *Cubanella* Fennah, where the male anal style is short and entirely concealed by the remainder of the 11th segment, and the character state found in most other Cixiidae as well as species of Delphacidae and Achilidae, where the anal style is distinctly longer than the remainder of the 11th segment. Two hypotheses on the evolution of this character are described in Löcker *et al*. (2006a).

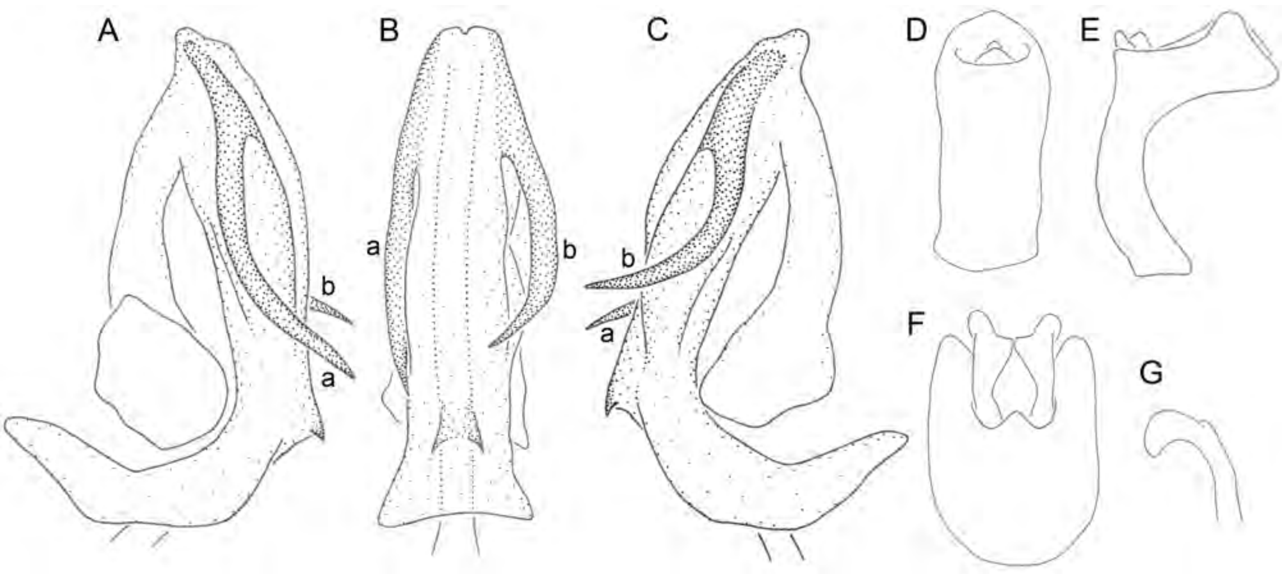

FIGURE 21. *Chidaea carinata*: A aedeagus left lateral; B aedeagus ventral; C aedeagus right lateral; D–E anal tube; F–G genital styles.

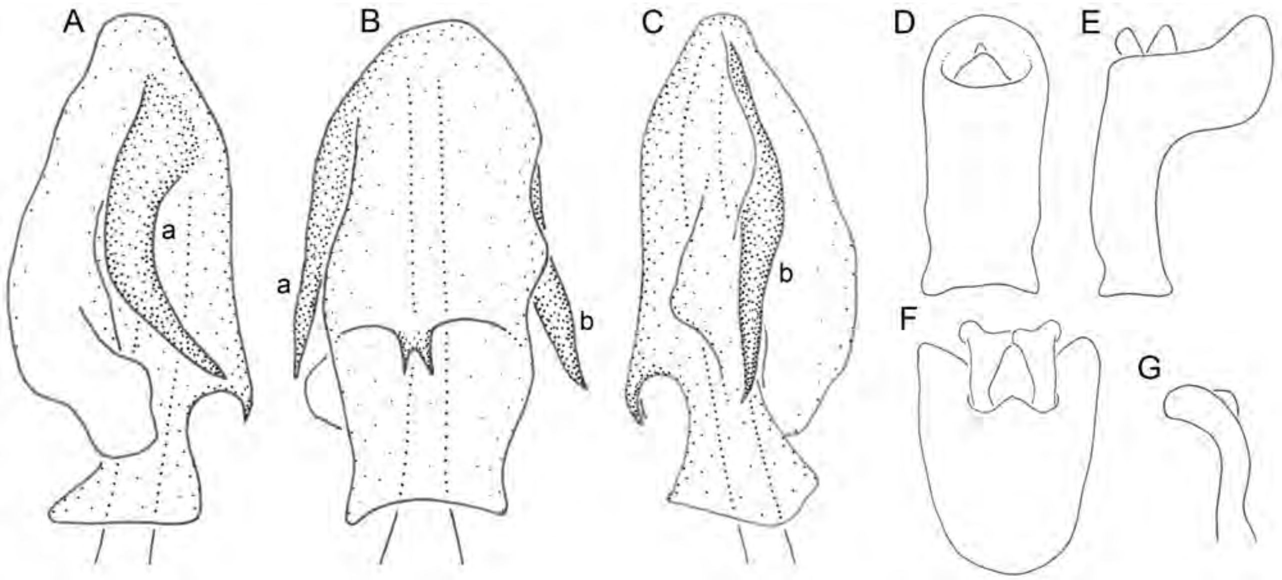

FIGURE 22. *Chidaea crassa*: A aedeagus left lateral; B aedeagus ventral; C aedeagus right lateral; D–E anal tube; F–G genital styles.

In Cixiidae, absence/presence, number and arrangement of platellae on hind tarsi are often convenient characters for classification at (sub)generic level. In *Chidaea*, however, we could not find any pattern supporting e.g. different lineages, as there is a wide variation both within and among species and we could not find consistencies between this character's state and other characters studied.

Another important character set on (sub)generic level is offered by the female genital segment (size and shape of ovipositor, size and proportions of segment IX, absence/presence and shape of wax plate). The variation of these characters within *Chidaea* seems to be high (see Fig 1), but again we could not find patterns to support clades within the genus.

Due to the homogeneity of several characters in all *Chidaea* species (phallotheca with two movable spines at the distal end and a bifurcate process ventrally, flagellum = endosoma unarmed, shape of anal tube), we assume monophyly of the genus as described here. Nevertheless, a justified identification of the polarity of these characters (synapomorphies or symplesiomorphies?) will be presented only at a later stage of the ongoing revision of the Australian Cixiini genera.

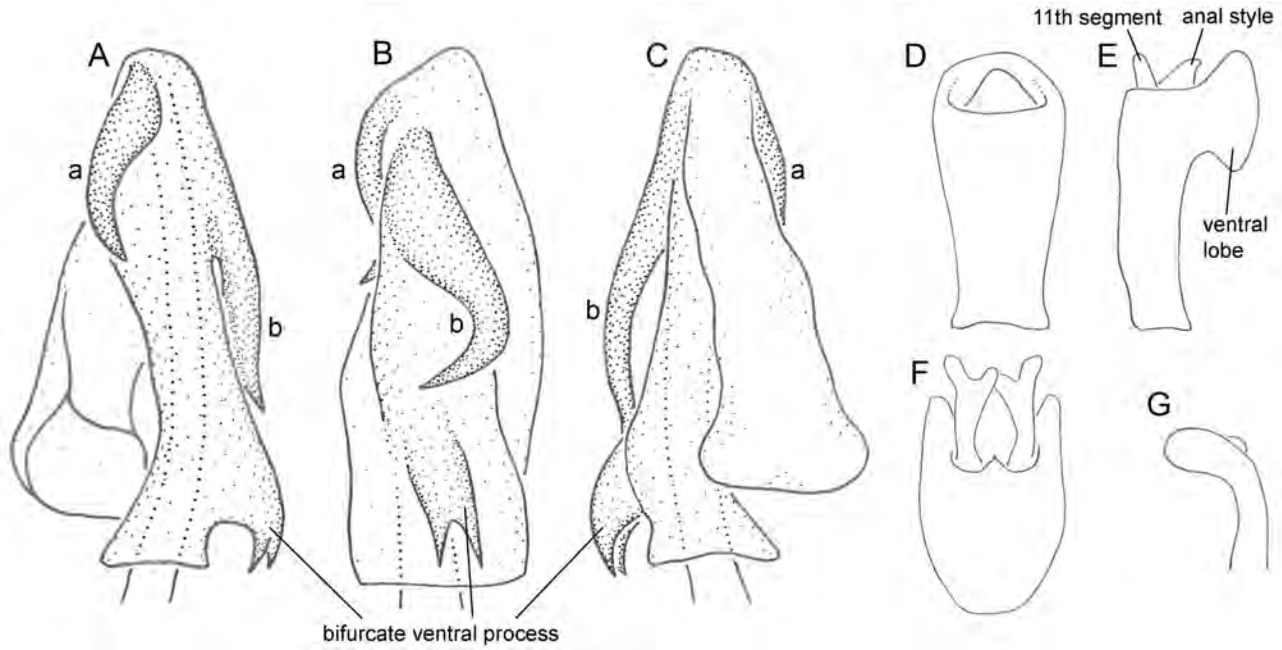

FIGURE 23. *Chidaea dayi*: A aedeagus left lateral; B aedeagus ventral; C aedeagus right lateral; D–E anal tube; F–G genital styles.

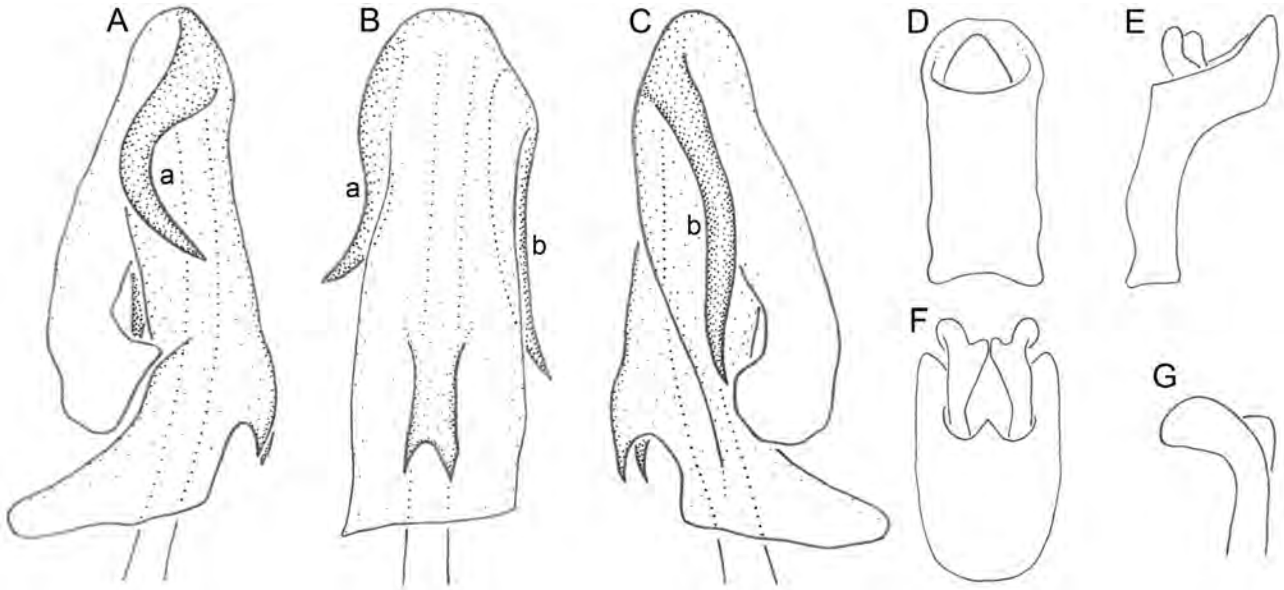

FIGURE 24. *Chidaea dickinsonorum*: A aedeagus left lateral; B aedeagus ventral; C aedeagus right lateral; D–E anal tube; F–G genital styles.

Host plant relationships in Australian Cixiidae are still poorly investigated, plant associations recorded for species of *Chidaea* are listed in Table 1. Species of *Chidaea* are mainly associated with native trees and shrubs, particularly of the families Fabaceae and Myrtaceae, but they have also been found on two exotic plants, *Lantana camara*, a weed of national significance in Australia, and *Fraxinus angustifolia*, a species commonly planted as a street tree, which has now become a weed in certain areas of Australia. One specimen of *Chidaea dickinsonorum* has been collected from leaves of the Gymea Lily (*Doryanthes excelsa*). This is a monocotyledon, endemic to the coast of Eastern Australia. Whether *Ch. dickinsonorum* actually feeds on this plant is unknown.

Alongside *Oteana* Hoch, *Chidaea* is the most commonly collected cixiid genus in Australia. It is present in all states and territories (see Fig. 31), apart from Northern Territory, however within those it appears to be restricted to the temperate and subtropical regions, only barely touching tropical regions (*Ch. orangensis* and *Ch. crassa*) or grassland (*Ch. etelis*). *Chidaea orangensis* has the largest distribution ranging from the northern parts of Queensland to New South Wales, Victoria and reaching into the eastern parts of South Australia. *Chidaea crassa* has a similar distribution but is absent from Victoria and South Australia. Two species (*Ch. dayi* and *Ch. armidalensis*) have been recorded in Tasmania, whereas only one species, *Ch. etelis*, is present in Western Australia.

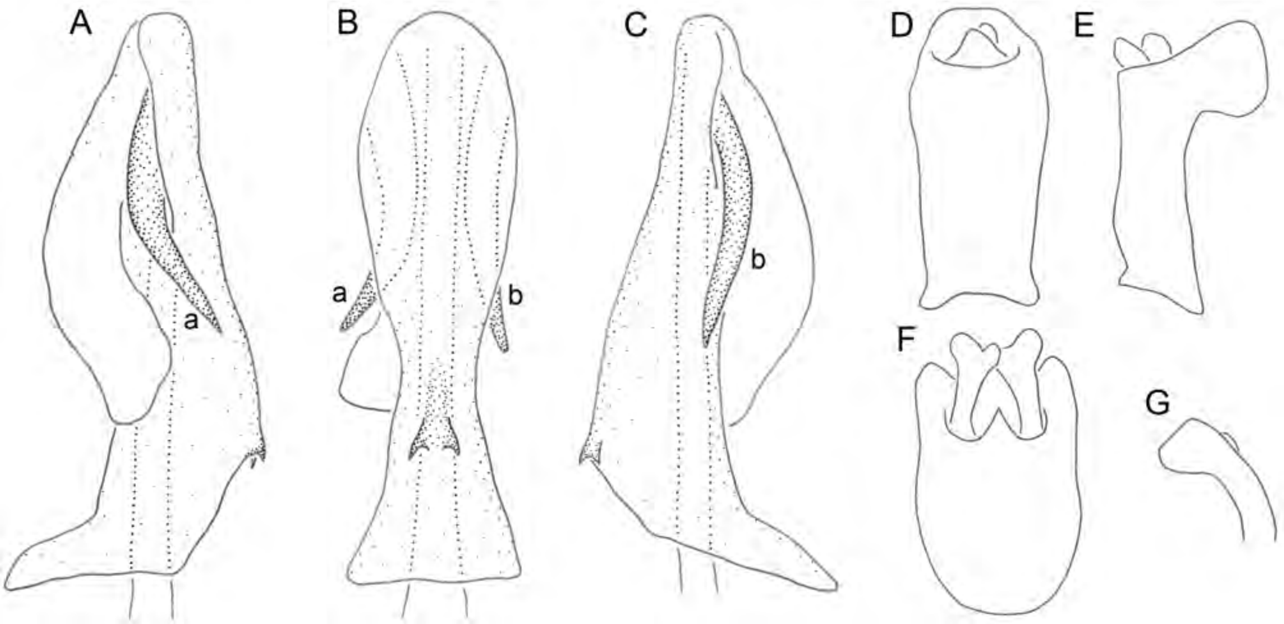

FIGURE 25. *Chidaea etelis*: A aedeagus left lateral; B aedeagus ventral; C aedeagus right lateral; D–E anal tube; F–G genital styles.

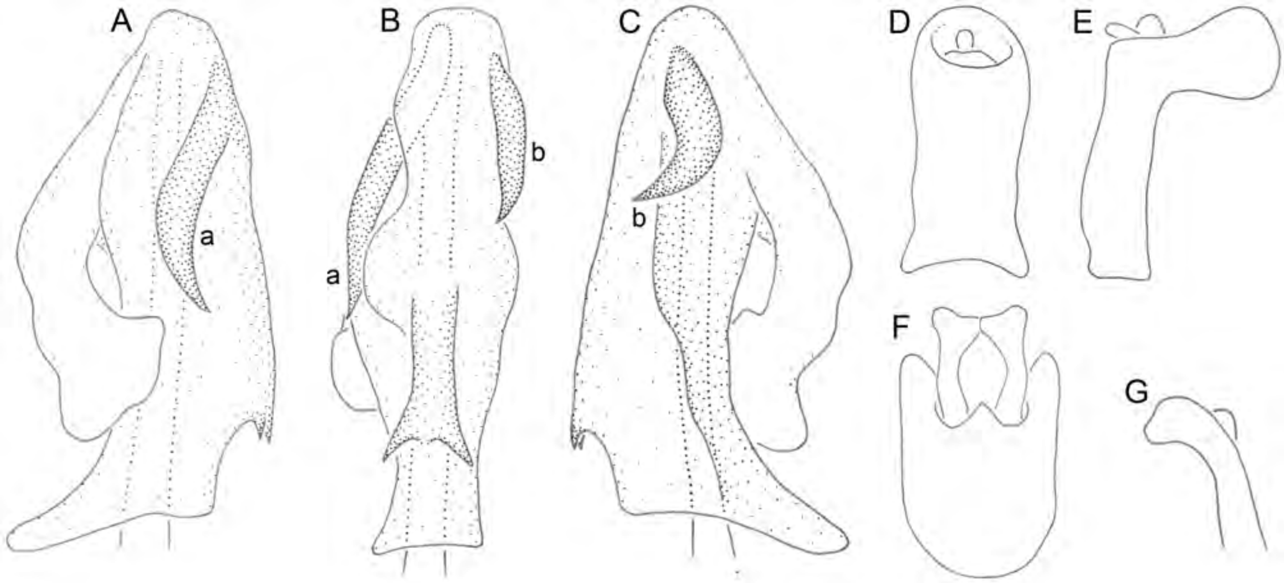

FIGURE 26. *Chidaea kimbaensis*: A aedeagus left lateral; B aedeagus ventral; C aedeagus right lateral; D–E anal tube; F–G genital styles.

TABLE 1. Associated plant records of *Chidaea* species

Plant family	**Recorded species**	**Insect species**
Asteraceae	*Cassinia* sp.	*Chidaea crassa*
		Chidaea orangensis
Casuarinaceae	*Casuarina* sp.	*Chidaea orangensis*
Doryanthaceae	*Doryanthes excelsa*	*Chidaea dickinsonorum*
Fabaceae	*Acacia binervata*	*Chidaea bobadeenensis*
	Acacia buxifolia	*Chidaea armidalensis*
	Acacia concurrens	*Chidaea crassa*
	Acacia falcata	*Chidaea bobadeenensis*
		Chidaea crassa
	Acacia leptostachys	*Chidaea crassa*
	Acacia longifolia	*Chidaea bobadeenensis*
	Acacia sp.	*Chidaea crassa*
Myrtaceae	*Angophora* sp.	*Chidaea bobadeenensis*
	Callistemon pityoides	*Chidaea orangensis*
	Eucalyptus blakelyi	*Chidaea armidalensis*
	Eucalyptus diversicolor	*Chidaea etelis*
	Eucalyptus sp.	*Chidaea armidalensis*
		Chidaea dayi
Oleaceae	*Fraxinus angustifolia*	*Chidaea orangensis*
Rhamnaceae	*Pomaderris* sp.	*Chidaea crassa*
Scrophulariaceae	*Eremophila mitchellii*	*Chidaea carinata*
Thymelaeaceae	*Pimelea sylvestris*	*Chidaea etelis*
Verbenaceae	*Lantana camara*	*Chidaea crassa*

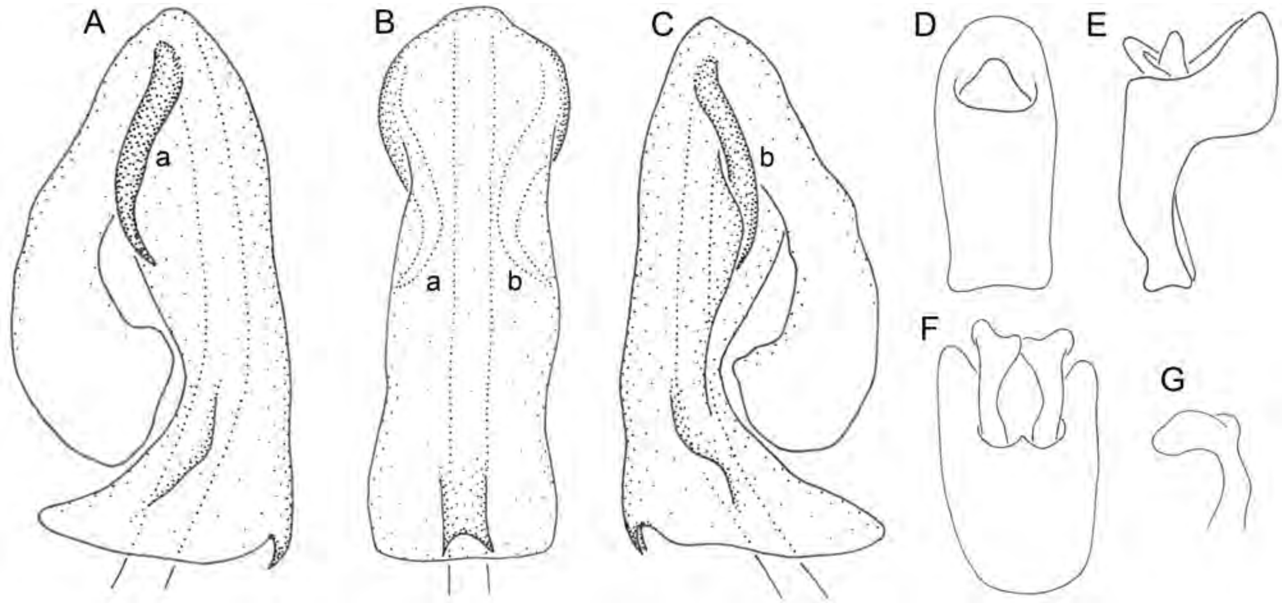

FIGURE 27. *Chidaea orangensis*: A aedeagus left lateral; B aedeagus ventral; C aedeagus right lateral; D–E anal tube; F–G genital styles.

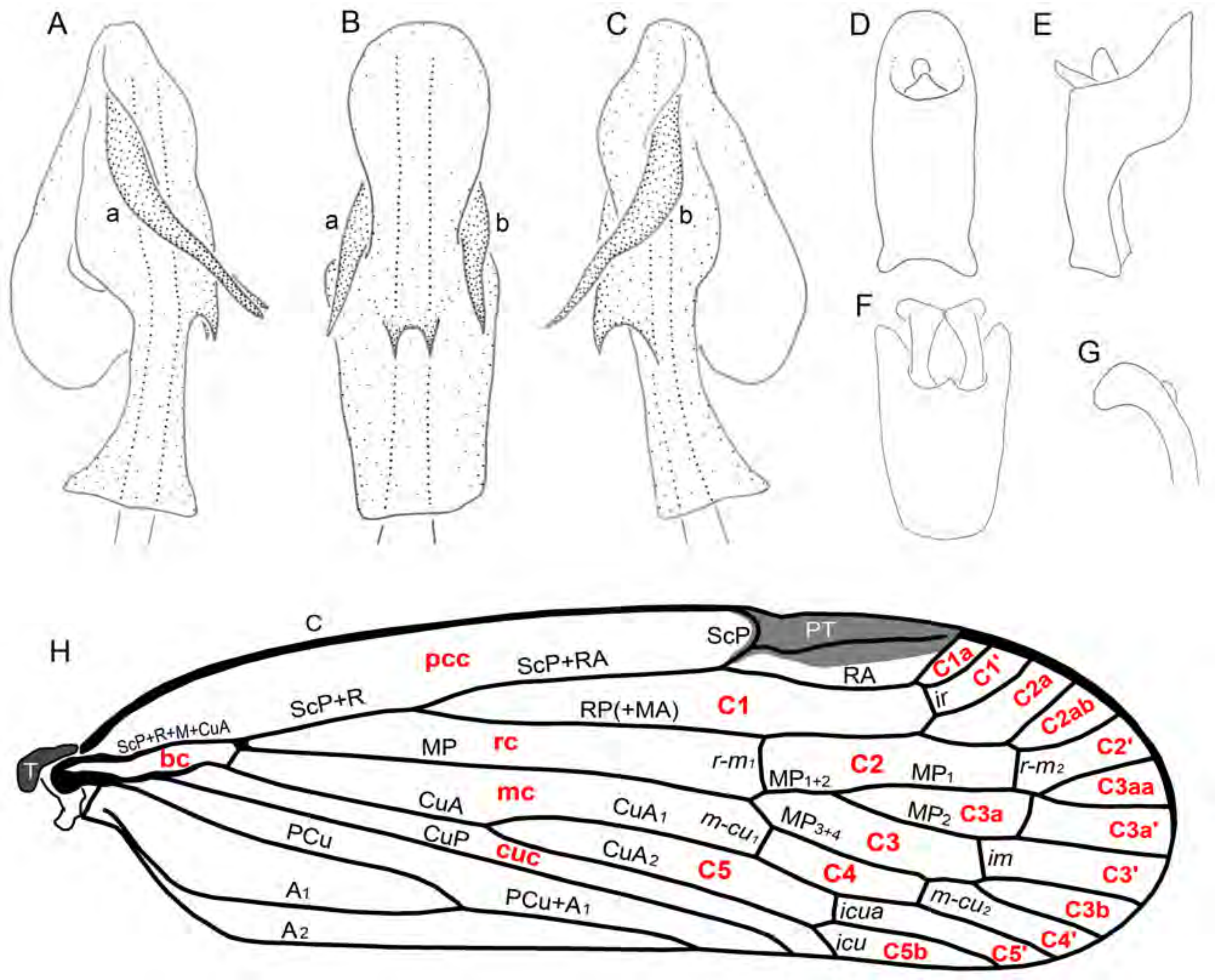

FIGURE 28. *Chidaea pulyonna*: A aedeagus left lateral; B aedeagus ventral; C aedeagus right lateral; D–E anal tube; F–G genital styles; H fore wing: abbreviations of longitudinal veins (black capital letters), crossveins (in italics), cell names (red letters) and other characters see chapter “Materials & Methods”.

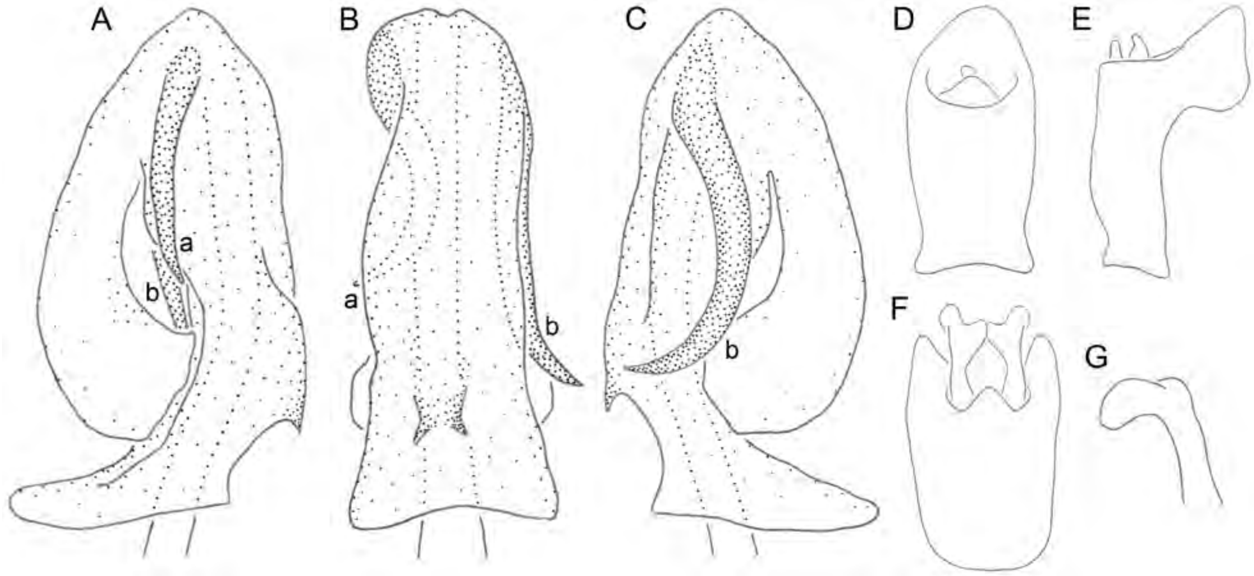

FIGURE 29. *Chidaea punctata*: A aedeagus left lateral; B aedeagus ventral; C aedeagus right lateral; D–E anal tube; F–G genital styles.

Acknowledgements

We owe our gratitude to Lauren Drysdale for taking, stacking and editing most of the photographs in this paper and to Jordan Bailey for helpful hints on image processing. We would like to express our gratitude to Lesley Cox, Peter Gillespie and Ainsley Seago for help in administrative and/or technical matters. For identifications of several host plants we are indebted to Michael Priest. We thank Murray Fletcher and Thierry Bourgoin for helpful comments on the manuscript and Murray Fletcher for giving us access to his extensive reprint collection. We are grateful to the collectors and curators of AMS, ANIC, BMNH, BPBM, CAS, NHRS, QDPI, SAMA, TAIC, NENH, QM, the former UQIC collection and VAIC. Bruce Halliday (ANIC) provided us with valuable information on M.M.H. Wallace's field trips. We would like to express our gratitude to Lesley Cox, Peter Gillespie and Ainsley Seago for help in administrative and/or technical matters. We thank Geoff Gurr (Charles Sturt University) for the loan of the stereomicroscope used throughout this project. The project 'Describing Australia's rich planthopper diversity in the economically important family Cixiidae' is supported through funding from the Australian Government's Australian Biological Resources Study National Taxonomy Research Grant Programme. In-kind support from the NSW Department of Primary Industries and Charles Sturt University is gratefully acknowledged.

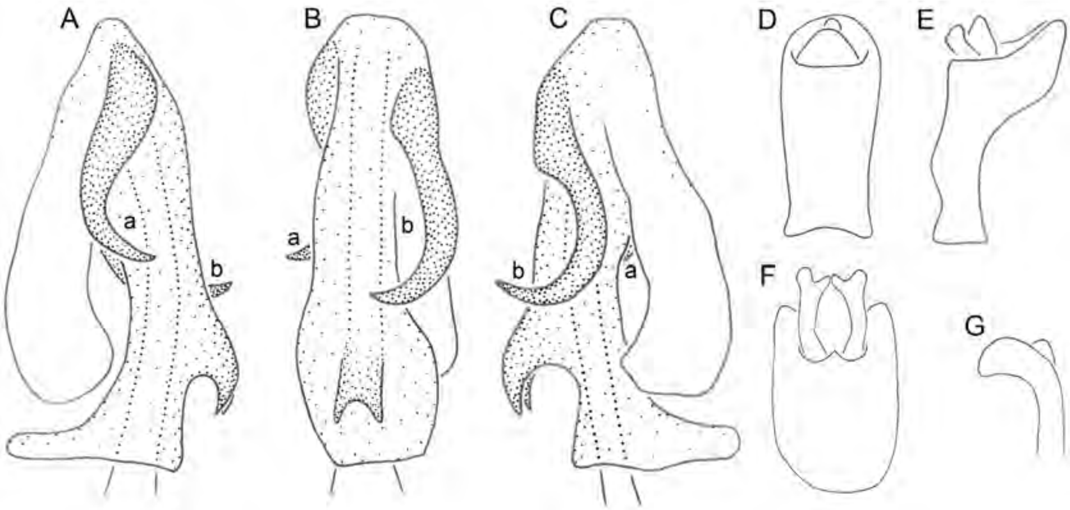

FIGURE 30. *Chidaea wilarra*: A aedeagus left lateral; B aedeagus ventral; C aedeagus right lateral; D–E anal tube; F–G genital styles.

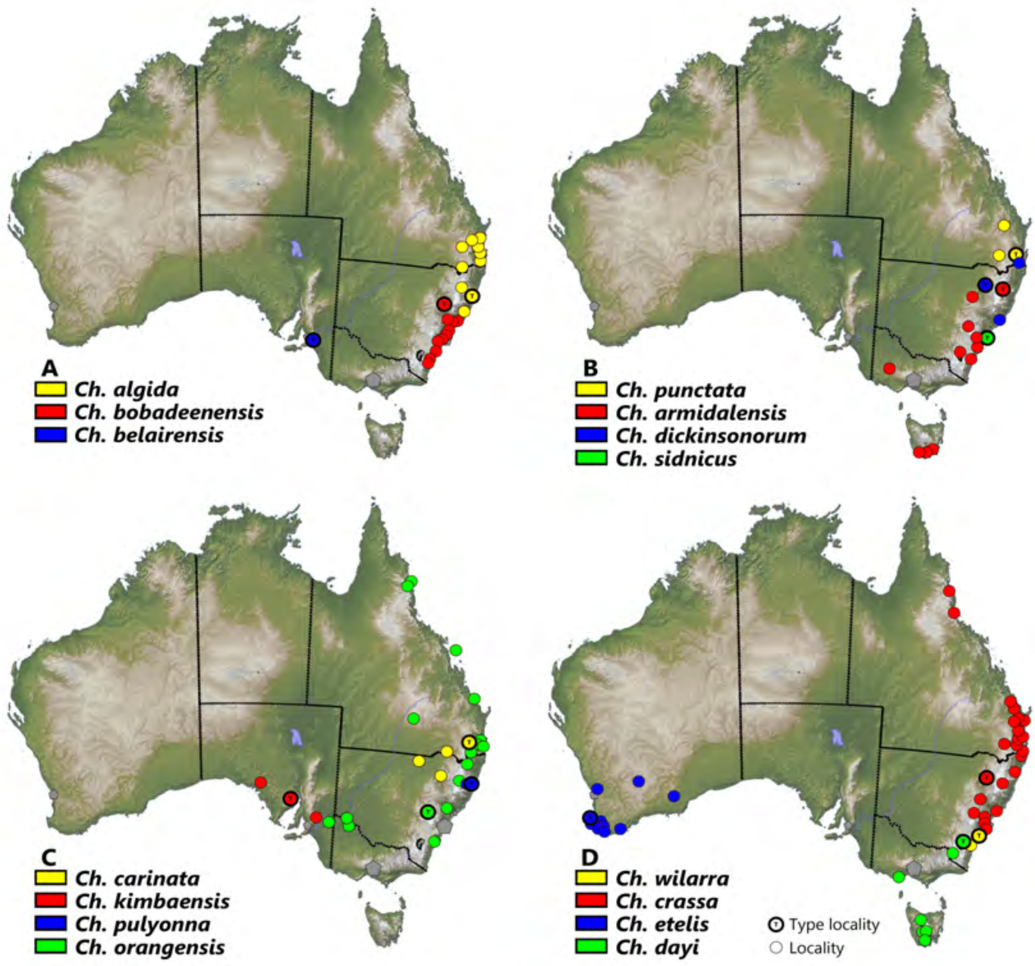

FIGURE 31. Known distribution of *Chidaea* species.

References

Bartlett, Ch. R. (2019 and updates) Planthoppers of North America. Available from: http://canr.udel.edu/planthoppers/ (accessed 25 Feburary 2019)

Bourgoin, Th. (2019 Version 8, updated 24.ii.2019) FLOW (Fulgoromorpha Lists on The Web): a world knowledge base dedicated to Fulgoromorpha. Available from: http://hemiptera-databases.org/flow/ (accessed 24 Feburary 2019)

Bourgoin, Th., Wang, R.R., Asche, M., Hoch, H., Soulier-Perkins, A., Stroiński, A., Yap, S. & Szwedo, J. (2015) From micropterism to hyperpterism: recognition strategy and standardized homology-driven terminology of the forewing venation patterns in planthoppers (Hemiptera: Fulgoromorpha). *Zoomorphology*, 134, 63–77. https://doi.org/10.1007/s00435-014-0243-6

Bressan, A., Sémétey, O., Nussilard, B., Clair, D. & Boudon-Padieu, E. (2008) Insect vectors (Hemiptera: Cixiidae) and pathogens associated with the disease syndrome "Basses Richesses" of Sugar Beet in France. *Plant Disease*, 92, 113–119. https://doi.org/10.1094/PDIS-92-1-0113

Danet, J.L., Foissac, X., Zreik, L., Salar, P., Verdin, E., Nourrisseau, J.G. & Garnier, M. (2003) "*Candidatus* Phlomobacter fragariae" is the prevalent agent of marginal chlorosis of strawberry in french production fields and is transmitted by the planthopper *Cixius wagneri* (China). *Phytopathology*, 93, 644–649. https://doi.org/10.1094/PHYTO.2003.93.6.644

Emeljanov, A.F. (2000) New Genera of the Family Cixiidae (Homoptera, Fulgoroidea) from Australia and Neighbouring Territories. *Entomological Review*, 80 (3), 251–270. [Translated from *Entomologicheskoe Obozrenie*, 79 (1), 12–34.]

Emeljanov, A.F. (2007) New and little-known taxa of the family Cixiidae (Homoptera, Fulgoroidea). *Entomological Review*, 87, 287–308. https://doi.org/10.1134/S0013873807030062

Hoch, H. (2006) Systematics and evolution of *Iolania* (Hemiptera: Fulgoromorpha: Cixiidae) from Hawai'i. *Systematic Entomology*, 31 (2), 302–320. https://doi.org/10.1111/j.1365-3113.2005.00312.x

Holzinger, W.E., Emeljanov, A.F. & Kammerlander, I. (2002) The family Cixiidae Spinola 1839 (Hemiptera: Fulgoromorpha)a

Review. *Denisia*, 4, 113–138.
Holzinger, W.E., Kammerlander, I. & Nickel, H. (2003) *The Auchenorrhyncha of Central Europe. Die Zikaden Mitteleuropas. Vol. 1. Fulgoromorpha, Cicadomorpha excl. Cicadellidae.* Brill, Leiden and Boston, 673 pp.
Howard, F.W., Norris, R.C. & Thomas, D.L. (1983) Evidence of transmission of palm lethal yellowing agent by a planthopper, *Myndus crudus* (Homoptera, Cixiidae). *Tropical Agriculture*, 60 (3), 168–171.
Jović, J., Riedle-Bauer, M. & Chuche, J. (2019) Vector Role of Cixiids and Other Planthopper Species. *In:* Bertaccini, A., Weintraub, P., Rao, G. & Mori, N. (Eds.), *Phytoplasmas: Plant Pathogenic Bacteria—II.* Springer, Singapore, pp. 1–345. https://doi.org/10.1007/978-981-13-2832-9_4
Löcker, B. (2007) Revision of the Australian Cixiidae (Hemiptera: Fulgoromorpha). PhD thesis at The University of Sydney, Faculty of Rural Management, 462pp.
Löcker, B. (2014a) Shedding light on Jacobi's types whilst discovering new species: a taxonomic revision of *Leptolamia* Metcalf, 1936 (Hemiptera: Fulgoromorpha: Cixiidae). *Austral Entomology*, 53 (4), 391–423. https://doi.org/10.1111/aen.12092
Löcker, B. (2014b) Taxonomic revision of *Calamister* Kirkaldy, 1906 (Fulgoromorpha: Cixiidae) with the description of a new species. *Zootaxa*, 3878 (1), 89–96. https://doi.org/10.11646/zootaxa.3878.1.7
Löcker, B. (2015) Revision of the Australian species of *Aka* White, 1879 (Fulgoromorpha: Cixiidae) with the description of a new genus. *Zootaxa*, 3956 (2), 199–223. https://doi.org/10.11646/zootaxa.3956.2.3
Löcker, B., Fletcher, M.J., Larivière, M.-C., Gurr, G.M., Holzinger, W.E. & Löcker, H. (2006a) Taxonomic and phylogenetic revision of the Gelastocephalini (Hemiptera: Cixiidae). *Invertebrate Systematics*, 20, 59–160. https://doi.org/10.1071/IS05005
Löcker, B., Fletcher, M.J., Larivière, M.-C. & Gurr, G.M. (2006b) The Australian Pentastirini (Hemiptera: Fulgoromorpha: Cixiidae). *Zootaxa*, 1290, 1–138.
Löcker, B., Fletcher, M.J. & Gurr, G.M. (2007a) First record of the planthopper tribe Mnemosynini in Australia with the description of two new species (Hemiptera: Fulgoromorpha: Cixiidae). *Russian Entomological Journal*, 15 (3), 287–294.
Löcker, B., Fletcher, M.J., Holzinger, W.E. & Gurr, G.M. (2007b) Revision of the Australian Andini (Hemiptera: Fulgoromorpha: Cixiidae) with a description of five new species. *Zootaxa*, 1475, 43–59.
Löcker, B., Fletcher, M.J. & Gurr, G.M. (2007c) Revision of the genus *Innobindus* Jacobi (Hemiptera: Fulgoromorpha: Cixiidae) with the description of six new species and comments on other Australian Brixiini genera. *Australian Journal of Entomology*, 46, 45–55. https://doi.org/10.1111/j.1440-6055.2007.00586.x
Löcker, B., Fletcher, M.J. & Gurr, G.M. (2010) Taxonomic revision of the Australian Eucarpiini (Hemiptera: Fulgoromorpha: Cixiidae) with the description of nine new species. *Zootaxa*, 2425 (1), 1–31. https://doi.org/10.11646/zootaxa.2425.1.1
Salar, P., Danet, J.L., Pommier, J.J. & Foissac, X. (2010) The biology of *Cixius wagneri*, the planthopper vector of '*Candidatus* Phlomobacter fragariae' in strawberry production tunnels and its consequence for the epidemiology of strawberry marginal chlorosis. *Julius-Kühn-Archiv*, 427, 24–26.
Stål, C. (1859) Hemiptera, Species novas descripsit. *Kongliga Svenska Fregatten Eugenies Resa Omkring Jorden*, Zoologi, 1, Insecta, 219–298.
Tsaur, S.-C, Hsu, T.-C. & Van Stalle, J. (1991) Cixiidae of Taiwan, Part VI. *Cixius*. *Journal of Taiwan Museum*, 44 (2), 169–306.
Thieberger, N. & McGregor, W. (1994) *Macquarie Aboriginal words.* The Macquarie Library Pty Ltd, Sydney, 724 pp.
Van Stalle, J. (1988) A revision of the afrotropical species of the genus *Cixius* Latreille, 1804 (Homoptera, Cixiidae). *Revue de Zoologie Africaine*, 102 (2), 223–252.