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Six new species in the genus *Innobindus* Jacobi 1928 (Hemiptera: Auchenorrhyncha: Fulgoromorpha: Cixiidae: Brixiini)

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Abstract. Six new species are described in the Australian planthopper genus *Innobindus* Jacobi, 1928. A new species group, the *artus* group, is created for *Innobindus artus* sp. nov., *I. kaanti* sp. nov. and *I. loriensis* sp. nov.; *Innobindus gimani* sp. nov. is added to the *licinus* group and *I. geminatus* sp. nov. to the *multimaculatus* group. Another new species, *Innobindus oppositus* sp. nov., could not be assigned to a species group as it shows unique features within *Innobindus* regarding forewing venation and chaetotaxy. A checklist and identification key to males of all 13 species of *Innobindus* is provided. *Innobindus* is endemic to the eastern parts of New South Wales and Queensland, distribution maps for each species are presented.

Keywords. Fulgoroidea, east Australia, New South Wales, Queensland, *artus* group.

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Introduction

Cixiidae Spinola, 1839 are sap-sucking insects in the order Hemiptera Linnaeus, 1758. The family is of economic importance, not because of direct feeding damage, but due its ability to transmit phytoplasmas, bacteria and viruses that can cause plant diseases. Important vectors include *Haplaxius crudus* (Van Duzee, 1907) transmitting *Candidatus* Phytoplasma palmae, which causes coconut lethal yellowing (Howard & Thomas 1980; Howard 1987) and *Hyalesthes obsoletus* Signoret, 1865 which is the primary natural vector of *Candidatus* Phytoplasma solani, the causal agent of Bois Noir on grapevines (Jović *et al.* 2019). No Australian cixiid has yet been reported as a vector of plant diseases, however the biology of Australian Cixiidae is still poorly understood.

Recently, Cixiidae together with Delphacidae Leach, 1815 and the fossil family Lalacidae Hamilton, 1990, have been transferred from the superfamily Fulgoroidea into the newly formed superfamily Delphacoidea (Bourgoin & Szwedo 2022, 2023). Australia boasts a rich Cixiidae fauna with 218 species described in 54 genera (ABRS 2009). Despite considerable efforts in revising Australian cixiid tribes and genera in recent years, there are still a number of undescribed species awaiting formal description. Seven tribes, Andini Emeljanov, 2002, Brixiini Emeljanov, 2002, Cajetini Emeljanov, 2002, Cixiini Spinola,

1839, Eucarpiini Emeljanov, 2002, Gelastocephalini Emeljanov, 2000, Mnemosynini Emeljanov, 1992 and Pentastirini Emeljanov, 1971, all belonging to the subfamily Cixiinae Spinola, 1839, are currently recorded from Australia.

Innobindus Jacobi, 1928 is one of nine genera in the planthopper tribe Brixiini Emeljanov 2002. Most species in the tribe (115 out of a total of 168) belong to a single genus, *Brixia* Stål, 1856 (Bourgoin 2023). Brixiini have been recorded from the Nearctic, Aftrotropical, Oriental and Australasian regions (Bourgoin 2023), and some taxa have quite a remarkable biology such as the Australian cavernicolous species of *Undarana* Hoch & Howarth, 1989 and *Solonaima* Kirkaldy, 1906 (Hoch 1988, 2002; Hoch & Asche 1988; Hoch & Howarth 1989a, 1989b, 1989c; Erbe & Hoch 2004; Soulier-Perkins 2005). The Indian species *Brixia albomaculata* Distant, 1906 has stunning forewing colouration that appears to mimic jumping spiders (Hill *et al.* 2019).

Australian Brixiini are characterised by a combination of the following characters: median carina of frons unforked or absent; pronotum without ovoid, inflated areas (as present in Cajetini); forewing with posterior subcosal (ScP), radial (R) and posterior medial (MP) veins forming a common stem that is at least more than 6 × the diameter of a tubercle; tubercles present only along veins (not in cells); presence of a median ocellus on the frons and/or an antennal pedicel that is at least 3 × longer than its diameter; absence of a denticle on the distal part of fore coxa (present in Oecleini). All three genera of Australian Brixiini are endemic to Australia. Whilst Soulier-Perkins (2005) provided a phylogenetic analysis of the genus *Solonaima*, the phylogeny of remainder of the tribe is still unknown.

Jacobi (1928) created *Innobindus* to accommodate his new species *Innobindus multimaculatus* Jacobi, 1928. In 2007 Löcker *et al.* revised the genus by adding six new species and describing the *licinus* and *multimaculatus* species groups based on frons characters.

Investigations in recent years of material held in Australian and overseas collections led to the discovery of six new species and a new species group of *Innobindus* which are described herein.

Material and methods

Preparation of male genitalia as described in Löcker *et al.* (2006a).

Insects were examined and measured using Olympus SZH10 and Leica M165 stereo microscopes with an eyepiece graticule. Photographs were taken with a digital SLR camera (Canon EOS 5D Mark III, 65 mm macro lens with up to 5 × zoom; Canon Utility Software) through a Leica M165 dissecting microscope and later stacked using Helicon Focus. Some photographs (not stacked) were used as a base for line illustrations.

The morphological terms applied here follow Löcker *et al.* (2006b); terminology of tegminal veins follows Bourgoin *et al.* (2015) as illustrated by Löcker & Holzinger (2019). The term ‘bifurcate ventral process’ on the phallotheca as used in this paper (marked as d’ in Figs 11A–B, 12 A–C) corresponds to ‘ventral with a pair of very small spines’ as used in Löcker *et al.* (2007).

The following is a list of the measurements taken in this study:

- body length: tip of head to posterior margin of forewing
- length of vertex: distance between basal emargination and subapical transverse 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 frons in widest part
- width of forewing: at level of apex of clavus
- length of forewing: base to apex of forewing

Institutional abbreviations

AMS = Australian Museum, Sydney, Australia
ASCU = Biosecurity Collections, NSW Department of Primary Industries, Orange, Australia
BMNH = The Natural History Museum, London, UK
BPBM = Bernice Pauahi Bishop Museum, Honolulu, USA
MLM = Melinda Moir Private Collection, Perth, Australia
QM = Queensland Museum, Brisbane, Australia
UQIC = University of Queensland Insect Collection, Brisbane, Australia (now part of the QM collection)

Further abbreviations

NSW = New South Wales, Australia
Qld = Queensland, Australia

Results

Taxonomy

Class Insecta Linnaeus, 1758
Order Hemiptera Linnaeus, 1758
Suborder Fulgoromorpha Evans, 1946
Superfamily Delphacoidea Leach, 1815
Family Cixiidae Spinola, 1839
Subfamily Cixiinae Spinola, 1839
Tribe Brixiini Emeljanov, 2002

Genus ***Innobindus*** Jacobi, 1928

Innobindus Jacobi, 1928: 31.

Type species

Innobindus multimaculatus Jacobi, 1928, by monotypy.

Diagnosis

Innobindus can be distinguished from all other Australian Cixiidae by a combination of the following characters: median carina of frons present (covering large parts of frons); pronotum without ovoid, inflated areas (as present in Cajetini); forewing with posterior subcostal (ScP), radial (R) and posterior medial (MP) veins forming a common stem that is at least more than 6× the diameter of a tubercle; tubercles present only along veins (not in cells); median ocellus on the frons present; denticle on distal part of fore coxa absent.

Description (amended from Löcker 2007)

Measurements. Body length: ♂ 5.0–7.4 mm; ♀ 5.7–7.7 mm.

Head. Vertex with u-or v-shaped basal emargination; lateral carinae strongly elevated (raised); vertex much wider at base (posterior end) than at apex; median carina absent or present; apical and subapical

carina well developed, straight or slightly u- or v-shaped. Maximum width of frons more than 2× apical width, evenly widening from apex to maximum width or broadening over a very short distance, therefore lateral carinae slightly to distinctly concave; maximum width of frons distinctly dorsad of centre of frontoclypeal suture; lateral carinae slightly to strongly foliaceous (except for *I. gimani*); median carina incomplete but covering large part of frons; frontoclypeal suture slightly semicircular bent upwards, median part below (not reaching level of) lower margin of antennal scape; median ocellus present. Median and lateral carinae of postclypeus well developed; median carina of anteclypeus well developed; lateral carinae absent. In dorsal view head including eyes much narrower than pronotum. Rostrum surpassing hind coxae (rarely only reaching hind coxae).

Thorax. Pronotum with hind margin acutely or obtusely angled or rectangular; median carina present; submedian carinae (= postocular carinae) running parallel to eye. Mesonotum with 3 carinae, lateral carinae moderately to well-developed, median carina weakly to well-developed, usually evanescent near posterior border. Forewing steeply tectiform, apices of wings touching; costal border with slight to moderate concavity; tubercles along veins; ScP+R+MP fused, forming long common stem; fork of ScP+RA and RP at same level as or basad of fork CuA1 and CuA2; crossvein r–m_1 slightly to distinctly basad of, or at same level as fork MP1+2 and MP3+4, rarely slightly distad; icu distad of apex of clavus; RP apically trifid; additional subapical cell between branches of RP present; MP1+2 trifid; MP3+4 bifid (rarely trifid); CuA1 and CuA2 apically unforked; nodus of y-vein (fork PCu and A1) moderately to distinctly distad of centre of clavus (rarely slightly distad or central within clavus); subapical cell C5 distinctly longer than subapical cell C4. Hind leg: tibia with 0–8 minute to medium sized lateral spines (= Laterometatibial spines) and with 6–7 apical spines either forming uninterrupted row of spines or with small gap, dividing spines in two groups of 3–4 spines; 4th spine (counted from the outer side) longer (= protruding further towards 2nd hind tarsomere) than 3rd spine; 1st tarsomere (Fig. 6E) with 7 (rarely 8) teeth; 2nd tarsomere with 8 (rarely 7); tarsomeres without platellae (except for *I. marginatus*); 2nd tarsomere with 0–3 fine setae underneath row of apical teeth (except for *I. marginatus*).

Male genitalia. Aedeagus with 1–4 spines of varying length, some of which arise on phallotheca, some on flagellum; bifurcate ventral process on phallotheca absent or present.

Female genitalia. Waxplate absent. Ovipositor very long, sabre-shaped, strongly curved upwards towards anal tube (Fig. 1).

Distribution

Australia (Qld, NSW).

Checklist of species of *Innobindus* Jacobi, 1928 and their distribution

***artus* group**

Innobindus artus sp. nov. (Qld)
Innobindus kaanti sp. nov. (Qld)
Innobindus loriensis sp. nov. (NSW)

***licinus* group**

Innobindus gimani sp. nov. (NSW)
Innobindus licinus Löcker, 2007:48 (NSW)
Innobindus marginatus Löcker, 2007: 49 (Qld)
Innobindus robinae Löcker, 2007: 50 (NSW)

***multimaculatus* group**

Innobindus alternans Löcker, 2007: 53 (Qld)

Innobindus collessi Löcker, 2007: 54 (Qld)
Innobindus geminatus sp. nov. (Qld)
Innobindus multimaculatus Jacobi, 1928: 31 (Qld)
Innobindus unicornis Löcker, 2007: 54 (Qld)

not assigned to a species group
Innobindus oppositus sp. nov. (NSW)

Key to species of Innobindus Jacobi, 1928

This key allows identification of males to species level. Females can be identified to species group level, with some females identifiable to species level. This key should be used in conjunction with the revision of the genus (Löcker *et al.* 2007) as characters relating to previously described species are illustrated in the above mentioned research paper.

1. Hind tibia with 7 apical spines. Forewing with radius anterior (RA) unforked ..... ***I. oppositus*** sp. nov.
– Hind tibia with 6 apical spines. Forewing with radius anterior (RA) mostly bifurcate apically (rarely unforked) 2

2. Frons near apical transverse carina very narrow (2–3 × as wide as median ocellus of frons) (Figs 2C, 3C, 4C) ..... *artus* group 3
– Frons near apical transverse carina wider (at least 5 × as wide as median ocellus of frons) (Figs 5C, 6C) 5

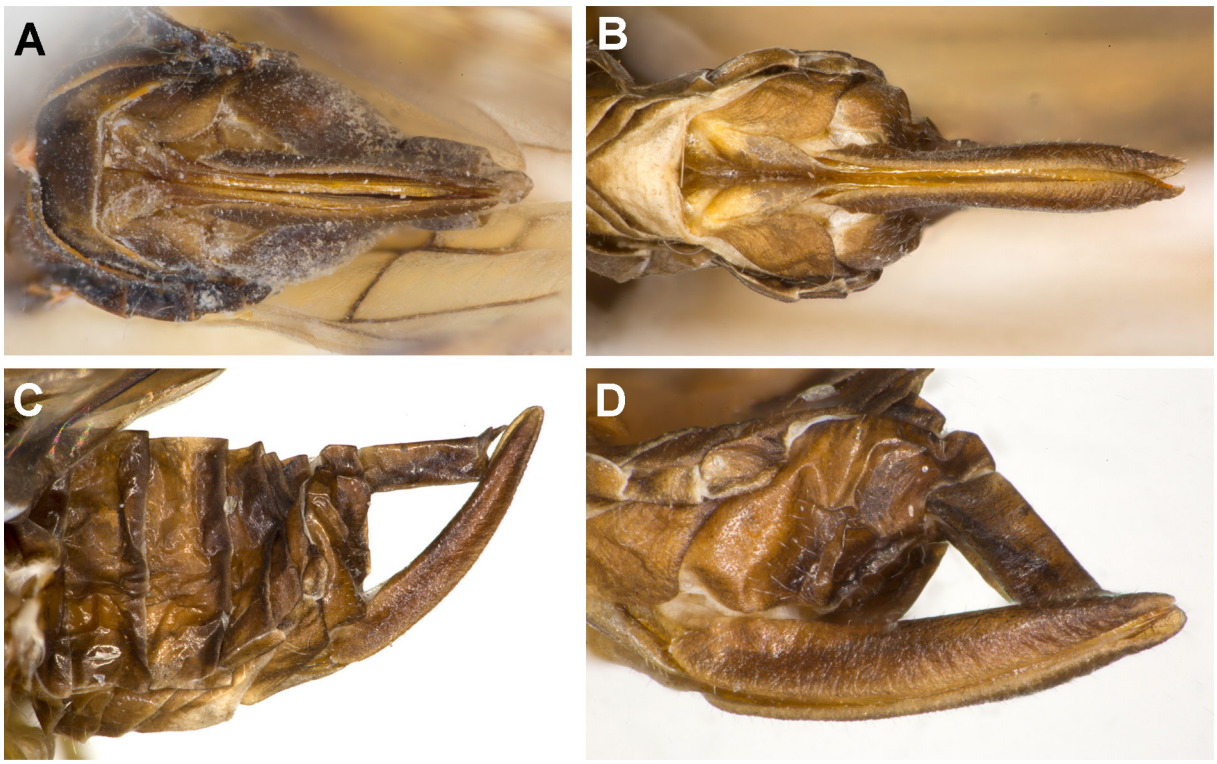

Fig. 1. Female genitalia. **A**. *Innobindus gimani* sp. nov., ♀, paratype (MLM MLM01006), ventral view. **B–D**. *I. loriensis*, ♀, paratype (ASCU ASCTHE017056). **B**. Ventral view. **C**. Lateral view. **D**. Caudolateral view.

3. Lateral parts of frons whitish (Figs 3C, 4C). In facial view, at least half of antennal pedicel covered by the extremely foliaceous lateral carinae of frons (Figs 3C, 4C). Aedeagus ventrally in centre of phallotheca with a medium-sized, slightly curved spine (c) (Figs 9B, 10B) 4
– Lateral parts of frons concolorous with brown central areas of frons, sometimes slightly paler brown (Fig. 2C). In facial view, at most one quarter of antennal pedicel covered by the slightly foliaceous lateral carinae of frons (Fig. 2C). Aedeagus ventrally in centre of phallotheca without a spine, but with several twisted sclerotised ridges (d') (Fig. 8B) ..... ***I. artus*** sp. nov.

4. Visible in ventral view: three strongly sclerotised spines (b, c, d) on phallotheca plus one less sclerotised spine (a) on flagellum (Fig. 10B). Phallotheca right lateral with a very long spine (d) covering almost the entire length of phallotheca (Fig. 10B–C) ..... ***I. loriensis*** sp. nov.
– Visible in ventral view: only one strongly sclerotised spine (c) on phallotheca (Fig. 9B). Phallotheca with several medium sized spines (b, c) but without a very long spine (Fig. 9A–B) ..... ***I. kaanti*** sp. nov.

5. Lateral carinae of frons strongly elevated (distinctly higher than median carina of frons); lateral carinae of frons continuous with those of clypeus (Fig. 6C; Löcker *et al.* 2007: figs 3c, 4b, 4f, 5c). Vertex always without median carina. Phallotheca with or without a bifurcate ventral process ..... *multimaculatus* group 6
– Lateral carinae of frons slightly to moderately elevated (slightly higher than median carina of frons); in most specimens lateral carinae of frons and clypeus not continuous but with a very slight indentation at junction of frons and clypeus (Fig. 5C; Löcker *et al.* 2007: figs 1c, 2b, 2f). Vertex with or without median carina. Phallotheca always with a bifurcate ventral process ..... *licinus* group 10

6. Phallotheca with a bifurcate ventral process (d') (Fig. 12A–C; Löcker *et al.* 2007: fig. 10a) 7
– Phallotheca without a bifurcate ventral process, but with a fringed ridge (Löcker *et al.* 2007: figs 11a, 12a, 13a) 8

7. Phallotheca with a short to medium-sized spine (a, b) on each side of the phallotheca (Fig. 12A–C) ..... ***I. geminatus*** sp. nov.
– Phallotheca with a short to medium-sized spine on one side (right lateral) of the phallotheca only (Löcker *et al.* 2007: fig. 10a) ..... ***I. alternans*** Löcker, 2007

8. Phallotheca left laterally with a very long spine, covering at least ¾ of length of phallotheca (Löcker *et al.* 2007: fig. 12a) ..... ***I. multimaculatus*** Jacobi, 1928
– Phallotheca left laterally with a medium-sized spine, covering about half of length of phallotheca (Löcker *et al.* 2007: figs 11a, 13a) 9

9. Flagellum laterally with a small spine on the left as in Löcker *et al.* 2007: fig. 13a. Phallotheca ventrally with a medium-sized ridge ..... ***I. unicornis*** Löcker, 2007
– Flagellum without a spine (unarmed). Phallotheca ventrally with a small ridge as in Löcker *et al.* 2007: fig. 11a ..... ***I. collessi*** Löcker, 2007

10. Phallotheca ventrally with a very long spine (b′) with its tip curved caudad (Löcker *et al.* 2007: fig. 7a) ..... ***I. licinus*** Löcker, 2007
– Phallotheca ventrally with a short or medium-sized spine with its tip curved dorsad or cephalad (Fig. 11A–B spine c) (Löcker *et al.* 2007: figs 8a, 9a–b spine b') 11

11. Phallotheca right laterally with a medium-sized spine (e') (Löcker *et al.* 2007: fig. 9a–b) ..... ***I. robinae*** Löcker, 2007
– Phallotheca right laterally without spine (Fig. 11B) 12

12. Phallotheca in left lateral view with spine (b) strongly bent (about 90 degrees) at midlength with its tip pointing ventrad (Fig. 11A) ..... ***I. gimani*** sp.nov.
– Phallotheca in left lateral view with spine (c') slightly bent with its tip pointing cephalad (Löcker *et al.* 2007: fig. 8a) ..... ***I. marginatus*** Löcker, 2007

artus group

Frons near apical transverse carina very narrow (about 2–3× the width of median ocellus of frons). Forewing with fork of y-vein distinctly distad of centre of clavus; Radius anterior apically bifid; at least one transverse brown band of varying width in basal half of wing and one transverse brown band with a few pale patches covering the apex of wing. In ventral view genital styles very long and narrow; shaft of genital styles with distinct indentation.

Innobindus artus sp. nov.
urn:lsid:zoobank.org:act:CDDFC6A9-D580-40FF-8E95-4D7E3D26AA68
Figs 2, 8, 14A

Diagnosis

Innobindus artus sp. nov. can be distinguished from all other species of *Innobindus* by the following combination of characters: frons near apical transverse carina very narrow (about 3× the width of median ocellus of frons); lateral areas of frons brownish (not whitish); at most one quarter of antennal pedicel covered by slightly foliaceous lateral carinae of frons (Fig. 2C). The latter two characters separate *I. artus* from the two similar looking species in the *artus* group, with whom it shares the very narrow frons (near apical transverse carina) and the colour pattern of the forewing. The forewing colour pattern of *I. artus* and *I. kaanti* is not as contrasting with pale areas as in *I. loriensis*. *Innobindus artus* has a prominent, thick, strongly sclerotised spine (c) on the flagellum (Fig. 8D). While other species in *Innobindus* have spines or spine-like ridges on the flagellum, they differ in the following: *I. unicornis* (very short and thin), *I. loriensis* (slightly sclerotised), *I. geminatus* (very short and slightly sclerotised) and *I. kaanti* (very long and wide spine-like ridge).

Etymology

The Latin term '*artus*' means 'narrow', 'tight'. Named after the narrow section of the frons near the apical transverse carina.

Material examined

Holotype

AUSTRALIA – **Qld** • ♂; [Lamington] National Park; [28.213º S, 153.165º E]; alt. "2000ft" [610 m]; 28 Dec. 1922; QM T258320.

Paratypes

AUSTRALIA – **Qld** • 1 spec., sex unknown (abdomen missing); same collection data as for holotype; 27 Dec. 1922; BPBM • 1 ♂, 1 ♀; Tamborine; [27.877º S, 153.134º E]; 6 Dec. 1940; A.J. Turner leg.; 6786; BMNH • 1 ♀; Lam.[ington] National Park; [28.213º S, 153.165º E]; 11–17 Feb. 1963; A. Macqueen leg.; QM (formerly UQIC reg. #55099) • 1 ♀; same collection data as for preceding; ASCU ASCT00238723 (formerly UQIC reg. #55098) • 1 spec., sex unknown; same collection data as for preceding; 17–21 Feb. 1964; G. Monteith and H.A. Rose leg.; QM (formerly UQIC reg. #55096) • 1 ♀; L[a]mington National Park; [28.213º S, 153.165º E]; alt. 800–1000 m; 16–18 Feb. 1964; J. Sedlacek leg.; BPBM • 1 ♀; Lower Ballunjui Falls Track, Lamington National Park; [28.201º S, 153.189º E]; 30 Oct. 1955; T.E. Woodward leg.; QM (formerly UQIC reg. #55103).

Description

Colour. Frons and postclypeus light to mid brown with concolorous carinae, sometimes lateral carinae of frons slightly paler. Anteclypeus slightly darker. Central area of vertex light brown, lateral areas mid to dark brown. Pronotum light brown. Mesonotum mid brown. Forewings hyaline colourless, with numerous mid and dark brown markings, including a transverse brown band of varying width (widest at fork CuA1 and CuA2) in basal half of wing and a transverse brown band with a few pale patches covering the apex of wing; veins light to mid brown, tubercles sometimes darker than veins, sometimes concolorous. Legs light brown. Body light to mid brown.

Measurements. Body length: ♂ 6.0–6.5 mm; ♀ 6.3–7.7 mm.

Head. Vertex 0.6–0.7 × as long as wide; apical transverse carina incised (v-shaped); subapical transverse carina more or less straight; median carina of vertex covering ⅓ to ½ of entire length of basal compartment. Frons about 2.3 × longer than wide at frontoclypeal suture, 1.9–2.1 × longer in widest part; maximum width of frons more than twice apical width, broadening over a short distance, lateral carinae slightly concave; frons near apical transverse carina very narrow (2–3 × as wide as median ocellus of frons);

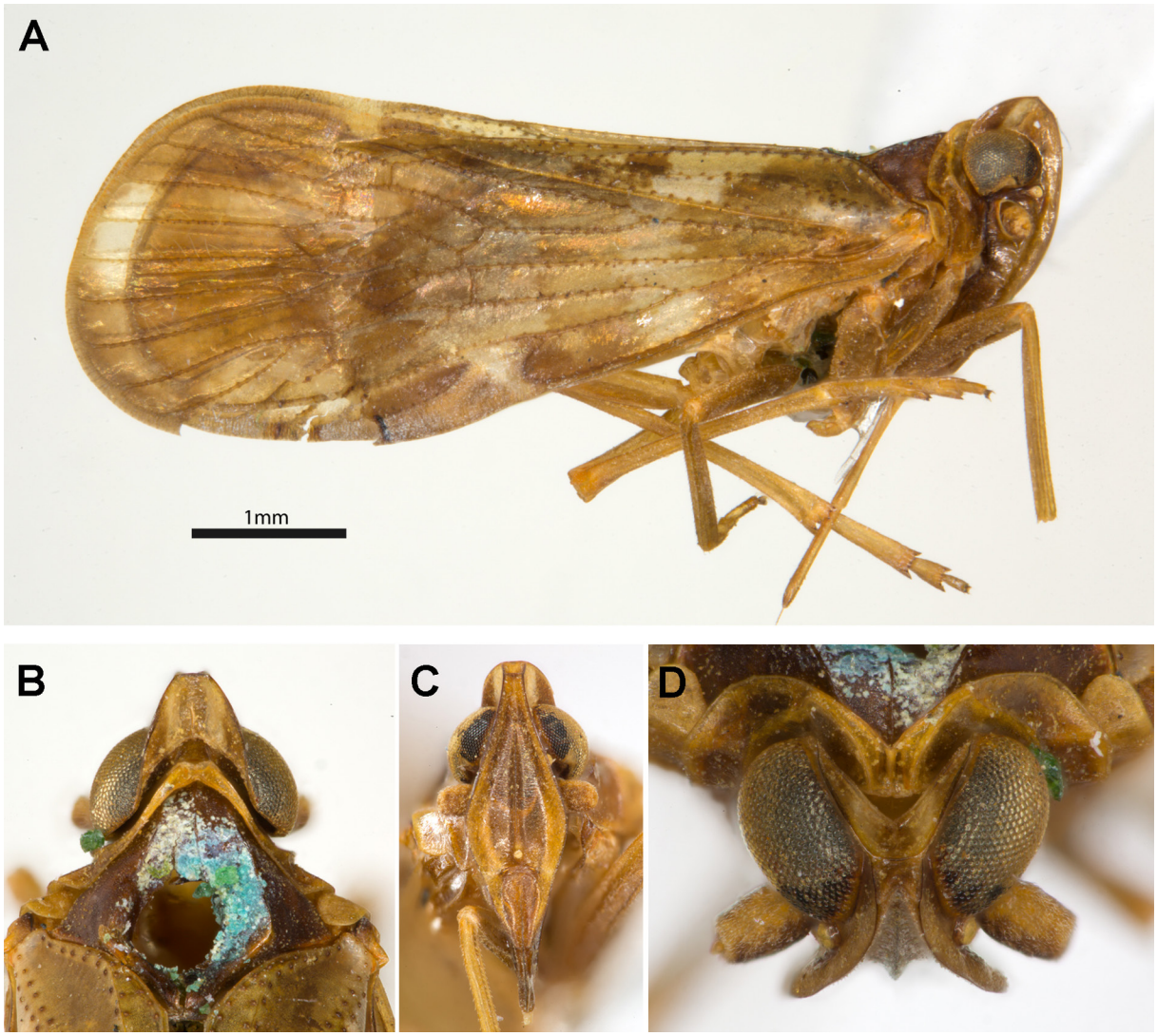

Fig. 2. *Innobindus artus* sp. nov., holotype, ♂ (QM T258320). **A**. Habitus. **B–D**. Head and thorax.

lateral carinae of frons in facial view convex, rectilinear apically or sinuate; slightly extending laterally; in facial view at most one quarter of antennal pedicel covered by slightly foliaceous lateral carinae.

Thorax. Hind margin of pronotum obtusely angled. Forewing 2.5–2.7 × longer than wide; costal margin with 21–29 tubercles; fork of ScP+RA and RP slightly basad of fork CuA1 and CuA2; crossvein r–m_1 slightly basad of, or at same level as fork MP1+2 and MP3+4; transverse veinlet m–cu_1 where it inserts at CuA slightly distad or slightly basad of transverse veinlet r–m_1; transverse veinlet m–cu_1 where it inserts at MP3+4 slightly distad of, or at same level as transverse veinlet r–m_1; icu, where it inserts at CuA, slightly distad of apex of clavus; RA bifid; MP3+4 bifid; crossvein m–cu_2 (delimiting subapical cell C4) distinctly distad of crossvein icua (delimiting subapical cell C5); nodus of y-vein distinctly distad of centre of clavus. Hind leg: tibia with 6 apical spines and up to 2 minute lateral spines; 1st tarsomere with 7 apical teeth and no platellae; 2nd tarsomere with 8 apical teeth, no platellae, but up to 3 very fine setae.

Male genitalia. Anal tube as in Fig. 8E–F. Pygofer and genital styles as in Fig. 8G–H: ventromedian process of pygofer narrow, subtriangular. Shaft of genital styles with a distinct, u-shaped indentation; in ventral view genital styles very long and narrow. Aedeagus (Fig. 8A–D): phallotheca left laterally with a medium sized, curved spine (a), right laterally with a very long, curved spine (b); ventrally with several twisted, sclerotised ridges (d').

Flagellum. With a prominent, strongly sclerotised spine (c).

Female genitalia. Segment IX rounded or truncate, with rounded edges, carinae absent. Anal tube short to medium length. Ovipositor protruding further caudally and dorsally than anal tube (including anal style).

Distribution

SE Qld (Fig. 14A).

Innobindus kaanti sp. nov.
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Figs 3, 9, 14A

Diagnosis

Innobindus kaanti sp. nov. can be distinguished from all other species of *Innobindus* by the following combination of characters: frons near apical transverse carina very narrow (about 3 × the width of median ocellus of frons); lateral areas of frons whitish; phallotheca ventrally with a single spine (c) (Fig. 9B). The shaft of the genital style has a very deep u-shaped indentation (Fig. 9E). Whilst an indentation can be seen in other species of *Innobindus*, e.g., *I. loriensis*, *I. artus* and *I. collessi*, it is usually not developed to such an extent.

Etymology

'Kaanti' means 'take away' or 'remove something far away' in Paakantyi, an Aboriginal language spoken along the Darling River (Thieberger & McGregor 1994). Named after the deeply indented shaft of the male genital style, which looks like a section has been taken away.

Material examined

Holotype

AUSTRALIA – **Qld** • ♂; Mt Glorious State Forest; [27.332º S, 152.768º E]; 27 Feb.–6 Mar. 1986; Y. Basset leg.; subtropical rainforest; *Argyrodendron actinophyllum* (F.M.Bailey) Edlin; ASCU ASCTHE016807.

Paratypes

AUSTRALIA – **Qld** • 1 ♂; same collection data as for holotype; 18–23 Dec. 1986; ASCU ASCTHE029135 • 1 ♀; same collection data as for holotype; 20–27 Mar. 1986; ASCU ASCT00180002 • 1 ♀; same collection data as for holotype; 4–12 Dec. 1986; ASCU ASCTHE016806.

Description

Colour. Head light brown apart from whitish lateral parts of frons and vertex and whitish areas on genae. Pronotum whitish. Mesonotum mid to dark brown, central area including carinae slightly paler. Forewings hyaline colourless, with numerous mid and dark brown markings including a transverse brown band of varying width in basal half of wing, and a transverse brown band with a few pale patches

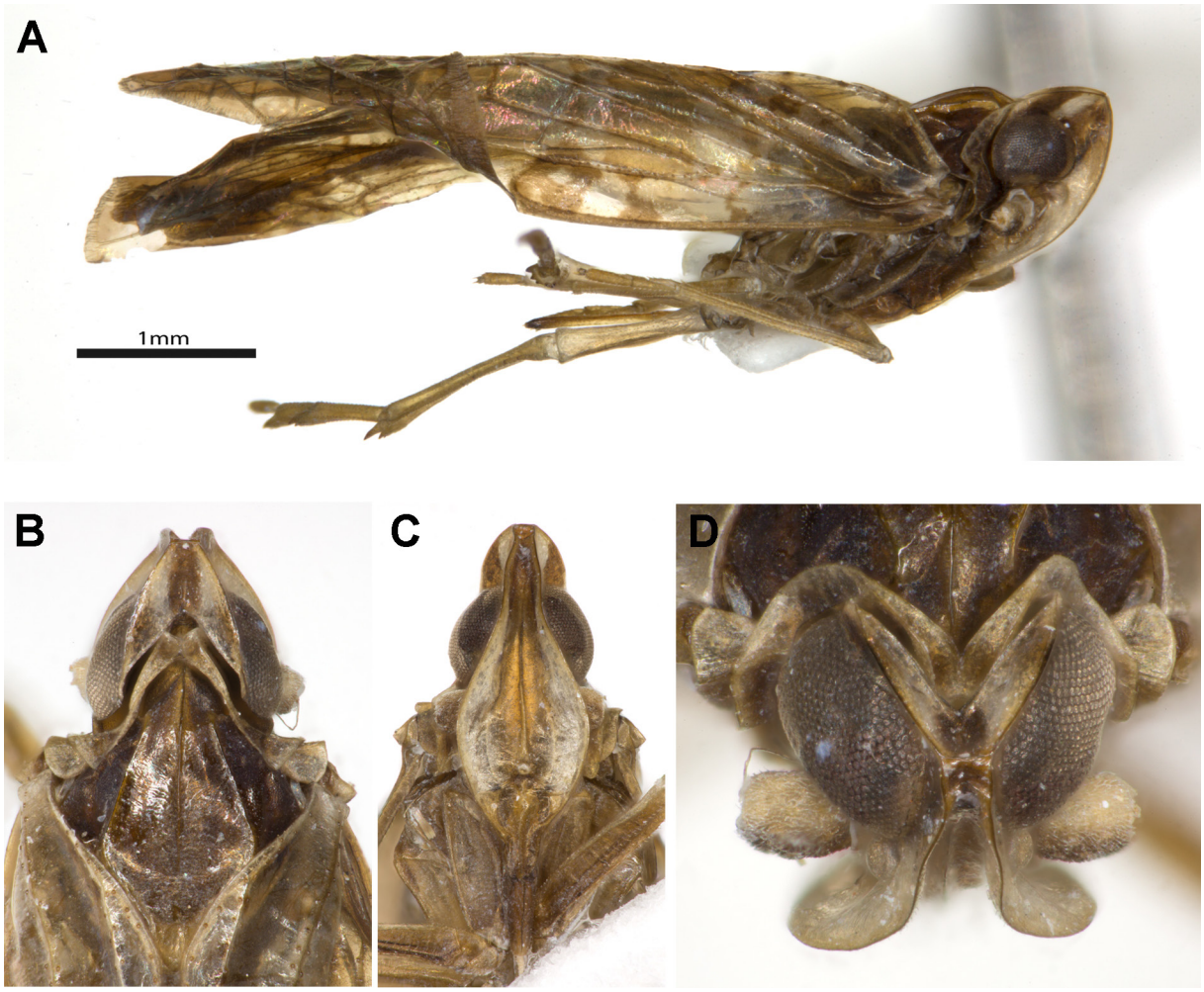

Fig. 3. *Innobindus kaanti* sp. nov., paratype, ♂ (ASCU ASCTHE029135). **A**. Habitus. **B–D**. Head and thorax.

covering the apex of wing; veins light to mid brown, tubercles concolorous with veins. Legs light brown. Body light to mid brown.

Morphology. Body length: ♂ 5.4–5.5 mm; ♀ 6.5mm.

Head. Vertex 0.7× as long as wide; apical transverse carina incised (v-shaped); subapical transverse carina straight; median carina of vertex covering ⅛ to ⅓ of entire length of basal compartment. Frons about 2.2–2.6× longer than wide at frontoclypeal suture, 1.8–2.1× longer in widest part; maximum width of frons more than twice apical width, broadening over a short distance, lateral carinae strongly concave; frons near apical transverse carina very narrow (2–3× as wide as median ocellus of frons); lateral carinae of frons in facial view sinuate; in facial view at least half of antennal pedicel covered by strongly foliaceous carinae that distinctly extend laterally.

Thorax. Hind margin of pronotum acutely angled. Forewing with costal margin with 18–25 tubercles; fork of ScP+RA and RP moderately to distinctly basad of fork CuA1 and CuA2; crossvein r–m_1 slightly distad of, or at same level as fork MP1+2 and MP3+4; transverse veinlet m–cu_1 where it inserts at CuA basad of transverse veinlet r–m_1; transverse veinlet m–cu_1 where it inserts at MP3+4 at same level as transverse veinlet r–m_1; icu, where it inserts at CuA, slightly to distinctly distad of apex of clavus; RA bifid; MP3+4 bifid; crossvein m–cu_2 (delimiting subapical cell C4) distinctly distad of crossvein icua (delimiting subapical cell C5); nodus of y-vein very distinctly distad of centre of clavus. Hind leg: tibia with 6 apical spines and 2–3 minute to small lateral spines; 1st tarsomere with 7 apical teeth and no platellae; 2nd tarsomere with 8 (rarely 7) apical teeth, no platellae, but up to 3 very fine setae.

Male genitalia. Anal tube as in Fig. 9C–D. Pygofer and genital styles as in Fig. 9E–F: ventromedian process of pygofer subtriangular, with a slight constriction near base. Shaft of genital styles with a deep u-shaped indentation; in ventral view genital styles very long and narrow. Aedeagus (Fig. 9A–B): phallotheca dorsally with a moderately sclerotized spine-like ridge (a') and a medium-sized, spirally twisted spine (b), ventrally with a medium-sized, slightly curved, strongly sclerotised spine (c). Flagellum with a large, moderately sclerotised, spine-like ridge (d').

Female genitalia. Segment IX truncate, with a disc bearing an elevated median carina running from ovipositor to anal tube. Anal tube long (about 2× longer than wide in lateral view). Ovipositor protruding further caudally and dorsally than anal tube (including anal style). Anal style slightly longer than remainder of 11th segment.

Distribution

SE Qld (Fig. 14A).

Associated plant

Argyrodendron actinophyllum (F.M.Bailey) Edlin (Malvaceae Juss.).

Innobindus loriensis sp. nov.
urn:lsid:zoobank.org:act:C1028AF0-8BC2-4538-8BCB-FE9BFAC47897
Figs 1B–D, 4, 10, 14A

Diagnosis

Innobindus loriensis sp. nov. can be distinguished from all other species of *Innobindus* by the following combination of characters: frons near apical transverse carina very narrow (about 3× the width of median

ocellus of frons); lateral areas of frons whitish; phallotheca right lateral with a spine covering almost the entire length of phallotheca (Fig. 10B–C).

Etymology

Named after the Lorien Wildlife Refuge, where the holotype was collected.

Material examined

Holotype

AUSTRALIA – **NSW** • ♂; Lorien [Wildlife] Ref.[uge], 3km N Lansdowne nr Taree; [31°45′10″ S, 152°32′20″ E]; r[ain]for[est] margin, malaise [trap]; ASCU ASCTHE017059.

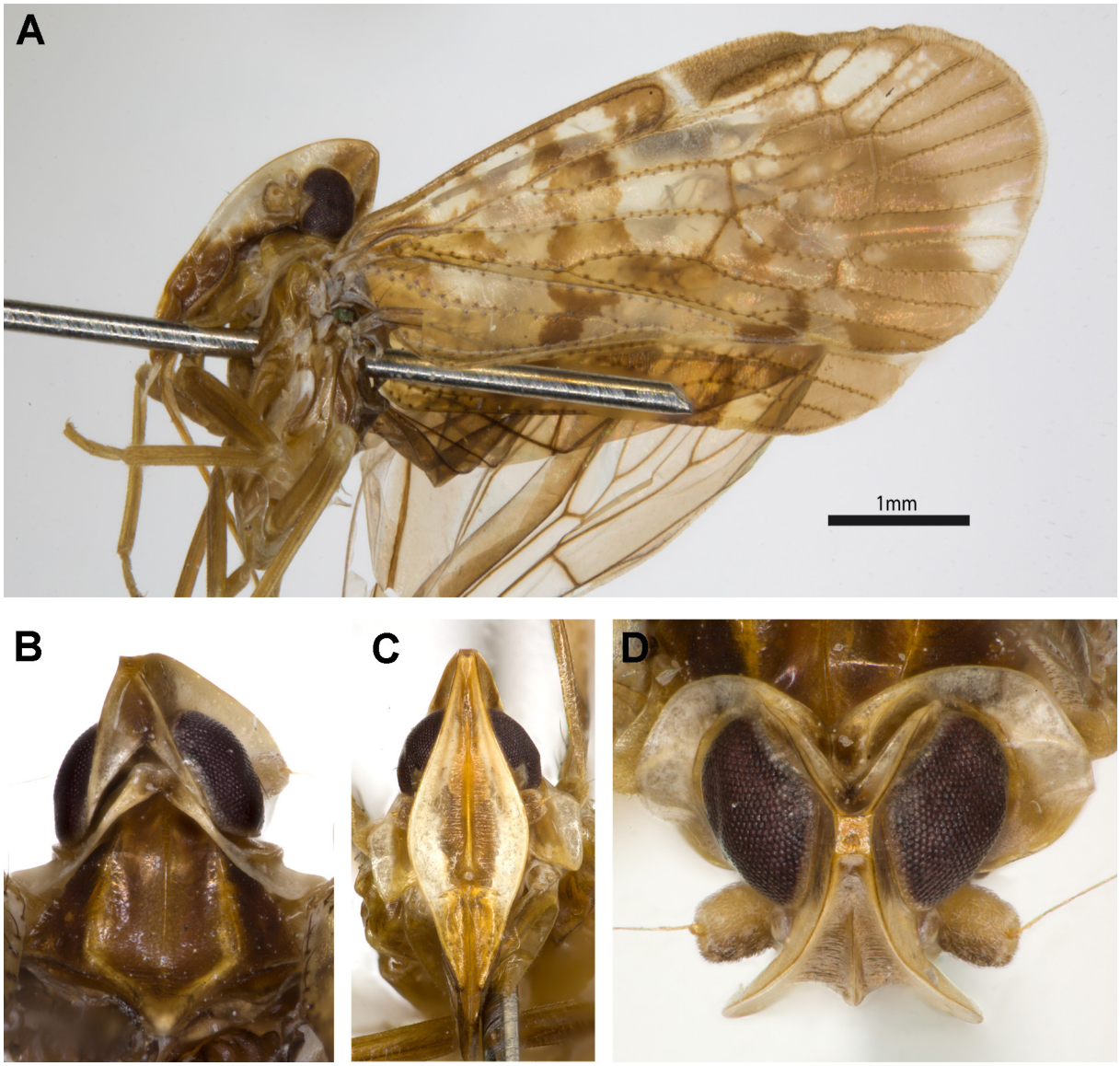

Fig. 4. *Innobindus loriensis* sp. nov., holotype, ♂ (ASCU ASCTHE017059). **A**. Habitus. **B–D**. Head and thorax.

Paratypes

AUSTRALIA – **NSW** • 1 ♂; same collection data as for holotype; ASCU ASCTHE017064 • 1 ♀; same collection data as for holotype; ASCU ASCTHE017056.

Description

Colour. Head light brown apart from whitish lateral parts of frons and vertex and whitish areas on genae. Pronotum whitish. Mesonotum mid brown, central area including carinae slightly paler. Forewings hyaline colourless, with numerous mid and dark brown markings, including a transverse brown band of varying width (widest at fork CuA1 and CuA2) in basal half of wing and a transverse brown band with a few pale patches covering the apex of wing; veins light to mid brown, tubercles generally darker than veins. Legs light brown. Body light to mid brown.

Measurements. Body length: ♂ 5.78–6.1 mm; ♀ 7.3 mm.

Head. Vertex about 1.1 × as long as wide; apical and subapical transverse carina straight; median carina of vertex covering ¼ to ½ of entire length of basal compartment. Frons 2.3–2.4 × longer than wide at frontoclypeal suture, 1.9–2.1 × longer at widest part; maximum width of frons more than twice apical width, broadening over a short distance, lateral carinae slightly concave; frons near apical transverse carina very narrow (2–3 × as wide as median ocellus of frons); lateral carinae of frons in facial view sinuate; in facial view at least half of antennal pedicel covered by strongly foliaceous lateral carinae that are distinctly extend laterally.

Thorax. Hind margin of pronotum acutely or obtusely angled or rectangular. Forewing 2.4–2.9 × longer than wide; costal margin with 15–20 tubercles; fork of ScP+RA and RP slightly basad of fork CuA1 and CuA2; crossvein r–m_1 basad of, or at same level as fork MP1+2 and MP3+4; transverse veinlet m–cu_1 where it inserts at CuA basad of transverse veinlet r–m_1; transverse veinlet m–cu_1 where it inserts at MP3+4 about same level as transverse veinlet r–m_1; icu, where it inserts at CuA, slightly distad of apex of clavus; RA bifid; MP3+4 bifid or trifid; crossvein m–cu_2 (delimiting subapical cell C4) distinctly distad of crossvein icua (delimiting subapical cell C5); nodus of y-vein distinctly distad of centre of clavus. Hind leg: tibia with 6 apical spines and 4–8 very small to medium-sized lateral spines; 1st tarsomere with 7 apical teeth and no platellae; 2nd tarsomere with 8 apical teeth, no platellae, but up to 3 very fine setae.

Male genitalia. Anal tube as in Fig. 10D–E. Pygofer and genital styles as in Fig. 10F–G: ventromedian process of pygofer wide, subtriangular. Shaft of genital style with a distinct indentation; in ventral view genital styles very long and narrow. Aedeagus (Fig. 10A–C): phallotheca left laterally with a short, strongly sclerotised spine (b), bending about 90 degrees in distal half, ventrally with a medium-sized, strongly sclerotised, slightly curved spine (c) and right laterally with a very long, strongly sclerotised spine (d), covering almost entire length of phallotheca. Flagellum with a slightly sclerotised spine (a).

Female genitalia (Fig. 1B–D). Segment IX truncate, with rounded edges, with a flat disc bearing a strongly elevated median carina and one semicircular carina on each side, running from ovipositor to anal tube. Anal tube long (2–3 × longer than wide in lateral view). Ovipositor protruding further caudally and dorsally than anal tube (including anal style). Anal style slightly longer than remainder of 11th segment.

Distribution

Mid north coast of New South Wales (Fig. 14A).

licinus group

Vertex with or without median carina. Lateral carinae of frons slightly to moderately elevated (slightly higher elevated than median carina of frons); in most specimens lateral carinae of frons and clypeus not continuous but with a very slight indentation at junction of frons and clypeus (Fig. 5C; Löcker *et al.* 2007: figs 1c, 2b, 2f). Phallotheca with a bifurcate ventral process (d') (Fig. 11B). Flagellum without spines or spine-like processes.

Innobindus gimani sp. nov.
urn:lsid:zoobank.org:act:DC674D54-5712-4CA9-B139-7E422C28DA7C

Figs 1A, 5, 11, 14B

Diagnosis

Innobindus gimani sp. nov. is the only species within *Innobindus* that does not have foliaceous lateral carinae, which means even the basal parts of the antennal pedicel are visible in facial view (Fig. 5C). Most other species of *Innobindus* have distinctly foliaceous lateral carinae that cover large parts of

Fig. 5. *Innobindus gimani* sp. nov., holotype, ♂ (ASCU ASCT00181701). **A**. Habitus. **B–D**. Head and thorax.

the antennal pedicel, e.g., *Innobindus kaanti* (Fig. 3C–D), whereas some species have only slightly foliaceous lateral carinae, e.g., *Innobindus oppositus* (Fig. 7C–D).

Etymology

'Gimani' means 'knee' in Gooniyandi, an Aboriginal language spoken in Western Australia (Thieberger & McGregor 1994). Named after the aedeagal spine (b) which in left lateral view resembles a leg bent at the knee.

Material examined

Holotype

AUSTRALIA – **NSW** • ♂; Ben Halls Gap State Forest; 31°37' S, 151°10' E; 27 Nov. 1990; R.V. Gunning leg.; vegetation type A; ASCU ASCT00181701.

Paratypes

AUSTRALIA – **NSW** • 1 ♂, Barrington Tops SF; 31.89402º S, 151.52615º E; alt. 1194m; 11 Dec. 2008; M.L. Moir and K.E.C. Brennan leg.; beat[ing]; MLM MLM02739 • 1 ♂; same collection data as for preceding; MLM MLM02737A • 2 ♀♀; same collection data as for preceding; MLM MLM02746 • 1 ♀, same collection data as for preceding; ASCU MLM02737B • 1 ♂; Gloucester Tops; [32.068º S, 151.591º E]; 28 Dec. 2005; M.L. Moir leg.; Antarctic Beech forest, ex spider web; MLM MLM01008 • 1 ♂, 1 ♀; Blue Mountains, Cataract Falls; 33°43.832′ S, 150°26.566′ E; alt. 647m; 17 Jan. 2008; M.L. Moir and K.E.C. Brennan leg.; mv light; MLM MLM01007 • 1 ♀; same collection data as for preceding; MLM01006.

Description

Colour. Carinae of head light brown; disc of face and vertex usually darker; central area of vertex mid brown, lateral parts of vertex dark brown, with a paler area in between. Pronotum light brown. Mesonotum mid brown; carinae sometimes slightly paler; sometimes area around lateral carinae darker. Forewings hyaline whitish with a dark brown spot in centre of clavus and at apex of clavus; often with further dark markings near apex of wing; pterostigma dark brown; veins alternating whitish and dark brown areas, giving it a speckled appearance; crossveins generally dark brown; tubercles concolorous with veins. Legs light brown. Body mid to dark brown.

Measurements. Body length: ♂ 5.4–6.0 mm; ♀ 6.0–6.3 mm.

Head. Vertex 0.7–0.8× as long as wide; apical transverse carina straight or slightly u- or v-shaped; subapical transverse carina more or less straight or slightly u-shaped; median carina of vertex covering ½ to ¾ of entire length of basal compartment. Frons 1.9–2.0× longer than wide at frontoclypeal suture, about 1.7× longer in widest part; maximum width of frons more than twice apical width, steadily broadening; frons near apical transverse carina wide (at least 5× as wide as median ocellus of frons); lateral carinae of frons in facial view convex, rectilinear apically or slightly sinuate; lateral carinae only slightly to moderately elevated (slightly higher elevated than median carina), not foliaceous; in most specimens lateral carinae of frons and clypeus not continuous but with a very slight indentation at junction of frons and clypeus.

Thorax. Hind margin of pronotum obtusely angled or rectangular. Forewing about 2.9× longer than wide; costal margin with 24–27 tubercles; fork of ScP+RA and RP slightly to moderately basad of fork CuA1 and CuA2; crossvein r–m_1 slightly basad of, or at same level as fork MP1+2 and MP3+4; transverse veinlet m–cu_1 where it inserts at CuA slightly distad of transverse veinlet r–m_1; transverse veinlet m–cu_1 where it inserts at MP3+4 slightly basad of, or at same level as transverse veinlet r–m_1; icu, where it inserts at CuA, slightly to moderately distad of apex of clavus; RA bifid (rarely unforked); MP3+4 bifid;

crossvein m–cu_2 (delimiting subapical cell C4) distinctly distad of crossvein icua (delimiting subapical cell C5); nodus of y-vein moderately distad of centre of clavus. Hind leg: tibia with 6 apical spines and 2–7 minute to medium-sized lateral spines; 1st tarsomere with 7 (rarely 9) apical teeth and no platellae; 2nd tarsomere with 8 apical teeth, no platellae, but up to 3 very fine setae.

Male genitalia. Anal tube as in Fig. 11C–D. Pygofer and genital styles as in Fig. 11E–F: ventromedian process wide, subtriangular, with a slight constriction near base. Shaft of genital style with a moderate to distinct indentation. Aedeagus (Fig. 11A–B): phallotheca dorsally with a long spine (a); left laterally with a thick, spine (b), strongly bent (about 90 degrees) at midlength with its tip pointing ventrad; ventrally with a short, curved spine (c) with its tip directed dorsad and a bifurcate process (d'). Flagellum without spines or spine-like ridges.

Female genitalia (Fig. 1A). Segment IX rounded, carina absent. Anal tube short (about 1–1.5 × as long as wide in lateral view). Ovipositor protruding as far caudally but not as far dorsally as anal tube (including anal style). Anal style slightly longer than remainder of 11th segment.

Distribution

Central upland NSW (Fig. 14B).

Remarks

Females appear darker in colour with numerous dark markings and transverse bands that are not present in males.

multimaculatus group

Vertex lacking median carina; lateral carinae of frons strongly elevated (distinctly higher elevated than median carina of frons); lateral carinae of frons continuous with those of clypeus (Fig. 6C; Löcker *et al.* 2007: figs 3c, 4b, f, 5c); phallotheca ventrally with a fringed ridge or a bifurcate ventral process; phallotheca laterally with medium-sized or very long spine; flagellum with or without spines.

Innobindus geminatus sp. nov.
urn:lsid:zoobank.org:act:1F81885E-7ED2-4577-95A1-BF39F130024A
Figs 6, 12, 14C

Diagnosis

The wide frons near the apical transverse carina (at least 5 × as wide as median ocellus) and the strongly elevated lateral carinae on the frons place *I. geminatus* sp. nov. in the *multimaculatus* group. *Innobindus geminatus* can be distinguished from all other species within the *multimaculatus* group by the presence of a medium sized spine on each side of the phallotheca (Fig. 12B). All other species in this species group possess a large or medium-sized spine on one side of the phallotheca only.

Etymology

The Latin term '*geminatus*' means 'double' or 'pair'. Named after the arrangement of the aedeagal spines in ventral view, with a medium-sized spine and a minute spine occurring in pairs on each side of the phallotheca.

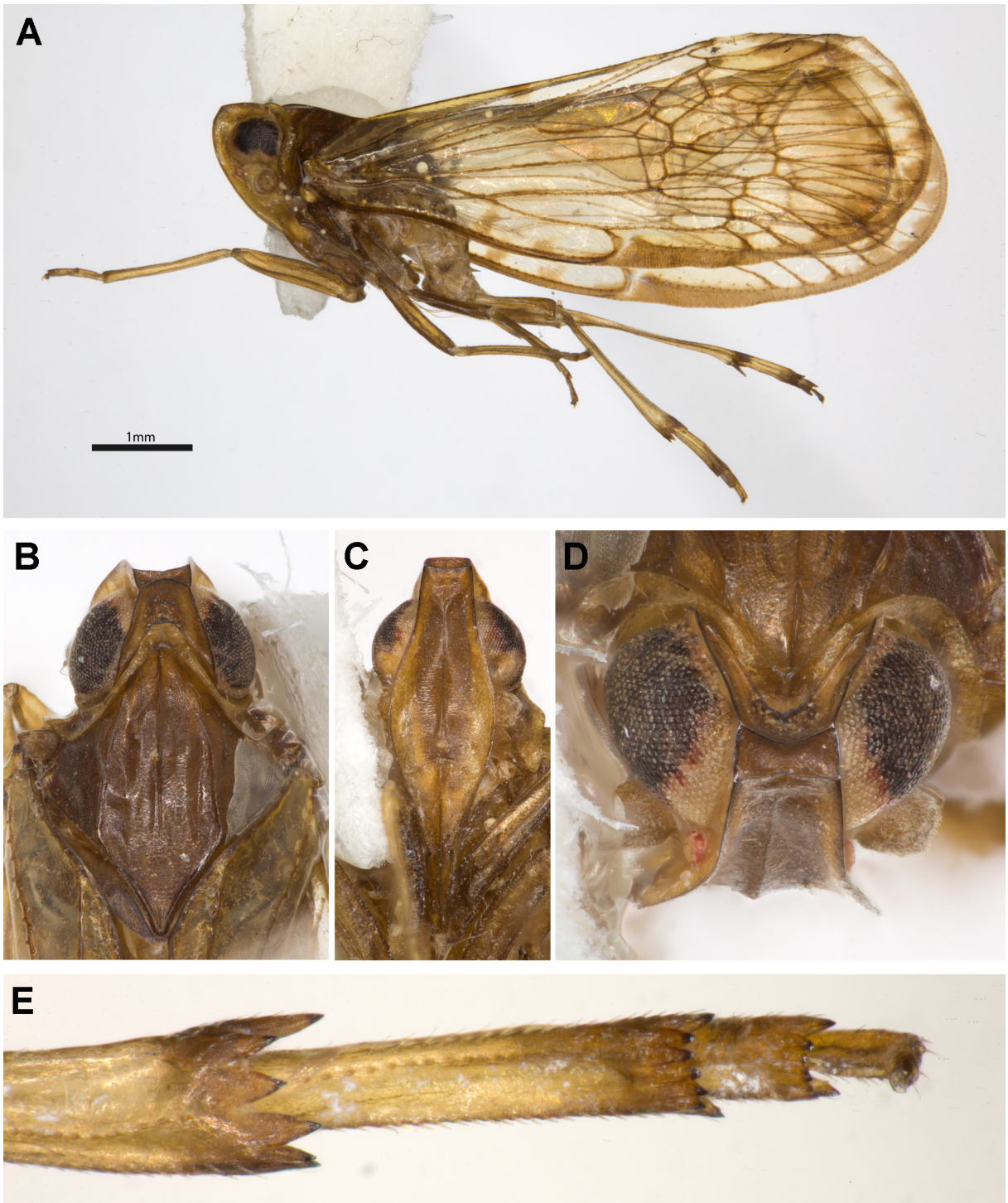

Fig. 6. *Innobindus geminatus* sp. nov. **A**. Paratype, ♂ (ASCU ASCT00179561), habitus. **B–D**. Holotype, ♂ (AMS K.594470), head and thorax. **E**. Paratype, ♂ (ASCU ASCT00179561), hind tibia and tarsi.

Material examined

Holotype

AUSTRALIA – **Qld** • ♂; Conondale Ra., Bundaroo Creek; [26.694º S, 152.612º E]; 3 Dec. 1985; G. Cassis and D. Bickel leg.; rainforest; AMS K.594470.

Paratypes

AUSTRALIA – **Qld** • 1 ♂; same collection data as for holotype; ASCU ASCT00179561 • 2 ♀♀; same collection data as for holotype; AMS • 1 ♀; same collection data as for holotype; ASCU ASCT00238752.

Description

Colour. Head light brown apart from mid brown central parts of frons and vertex. Pronotum light brown. Mesonotum mid brown. Forewings hyaline light brown, with dark markings in apical cells along the apical margin, one dark mark in the centre of clavus and usually two dark markings in the postcostal cell; veins slightly darker than cells; tubercles concolorous with veins. Legs light brown. Body mid to dark brown.

Measurements. Body length: ♂ 6.4–6.6 mm; ♀ 6.9–7.4 mm.

Head. Vertex about 0.7 × as long as wide; apical transverse carina straight or incised (u-shaped); subapical transverse carina straight or slightly u-shaped; median carina of vertex covering ⅓ to ½ of entire length of basal compartment. Frons 2.1–2.3 × longer than wide at frontoclypeal suture, about 1.9 × longer in widest part; maximum width of frons more than twice apical width, broadening over a short distance, lateral carinae strongly concave; frons near apical transverse carina wide (at least 5 × as wide as median ocellus of frons); lateral carinae of frons in facial view sinuate; strongly elevated (distinctly higher elevated than median carina of frons); foliaceous, very distinctly extending laterally; lateral carinae of frons continuous with those of clypeus.

Thorax. Hind margin of pronotum acutely angled or rectangular. Forewing 2.7–3.4 × longer than wide; costal margin with 31–32 tubercles; fork of ScP+RA and RP distinctly basad of fork CuA1 and CuA2; crossvein r–m_1 slightly to distinctly basad of fork MP1+2 and MP3+4; transverse veinlet m–cu_1 where it inserts at CuA distinctly distad of transverse veinlet r–m_1; transverse veinlet m–cu_1 where it inserts at MP3+4 slightly basad of transverse veinlet r–m_1; icu, where it inserts at CuA, slightly to moderately distad of apex of clavus; RA bifid; MP3+4 bifid; crossvein m–cu_2 (delimiting subapical cell C4) slightly to moderately distad of crossvein icua (delimiting subapical cell C5); nodus of y-vein moderately to distinctly distad of centre of clavus. Hind leg: tibia with 6 apical spines and up to 2 minute to medium-sized lateral spines; 1st tarsomere with 7 apical teeth and no platellae; 2nd tarsomere with 8 apical teeth, no platellae, but up to 3 very fine setae.

Male genitalia. Anal tube as in Fig. 12D–E. Pygofer and genital styles as in Fig. 12F–G: ventromedian process of pygofer narrow, 3-lobed, with a distinct constriction near base. Shaft of genital style slightly narrowed near base but without a distinct indentation. Aedeagus (Fig. 12A–C): phallotheca laterally with a short to medium-sized, slightly to moderately sclerotised, almost straight spine on each side (spines a, b), ventrally near base with a bifurcate process (d'); laterally on each side with a minute spine near level of ventral bifurcate process. Flagellum with a short, slightly sclerotised spine (c).

Female genitalia. Segment IX truncate, with a disc bearing an elevated median carina running from ovipositor to anal tube. Anal tube medium length (about 1.5–2 × longer than wide in lateral view). Ovipositor protruding slightly further caudally and as far dorsally as anal tube (including anal style). Anal style slightly longer than remainder of 11th segment.

Distribution

SE Qld (Fig. 14C).

Not assigned to a species group

Currently *I. oppositus* sp. nov. cannot be assigned to a species group. Whilst it shares the narrow frons (near the apical transverse carina) with the *artus* group, the nodus (fork) of the y-vein in the forewing is located only slightly distad of the centre of clavus, the radius anterior in the forewing is unforked and the hind tibia has 7 apical spines (6 apical spines in all other species of *Innobindus*) and the lateral carinae of frons are not foliaceous.

Innobindus oppositus sp. nov.
urn:lsid:zoobank.org:act:27B9B898-05EB-433E-B2DB-5AA5A11D3DD9
Figs 7, 13, 14A

Diagnosis

Innobindus oppositus sp. nov. can be distinguished from all other species of *Innobindus* by the presence of 7 apical spines on the hind tibia. The forewing colouration of *I. oppositus* is also unique within *Innobindus*; no other species has a dark longitudinal band along the anterior margin of the wing (formed by an entirely dark postcostal cell and dark pterostigma, and only interrupted by a pale stripe at base of pterostigma) (Fig. 7A). All other species either have an entirely colourless postcostal cell, e.g., *I. gimani* (Fig. 5A) or have alternating pale and dark sections in the postcostal cell, e.g., *I. artus* (Fig. 2A), *I. loriensis* (Fig. 4A) and *I. kaanti* (Fig. 3A).

Etymology

The Latin term '*oppositus*' means 'set against' or 'opposite'. Named after the arrangement of the aedeagal spines in left lateral view which are set against each other with their tips pointing in opposite directions.

Material examined

Holotype

AUSTRALIA – **NSW** • ♂; Dorrigo Nat. Pk.; [30.362º S, 152.731º E]; 11 Nov. 1961; C.W. Frazier leg.; ASCU ASCTHE017104.

Description

Colour. Central parts of frons and clypeus light brown, lateral parts whitish. Anteclypeus mid to dark brown. Vertex mid to dark brown. Pronotum whitish apart from darker anterior parts. Mesonotum mid brown. Forewings hyaline colourless except for a mid to dark brown longitudinal band along the anterior margin of the wing (formed by dark postcostal cell and dark pterostigma and only interrupted by a pale stripe at base of pterostigma), a light to mid brown transverse band at level of pterostigma; veins light to dark brown; tubercles concolorous with veins. Legs light brown. Body dark brown.

Measurements. Body length: ♂ 6.2 mm.

Head. Vertex about 1.1× as long as wide; apical transverse carina incised (u-shaped); subapical transverse carina slightly u-shaped; median carina of vertex covering about ⅓ of entire length of basal compartment. Frons about 2.3× longer than wide at frontoclypeal suture, about 2.0× longer in widest part; maximum width of frons more than twice apical width, steadily broadening; frons near apical transverse carina very narrow (about 3× as wide as median ocellus of frons); lateral carinae of frons in facial view convex, rectilinear apically; foliaceous, slightly extended laterally.

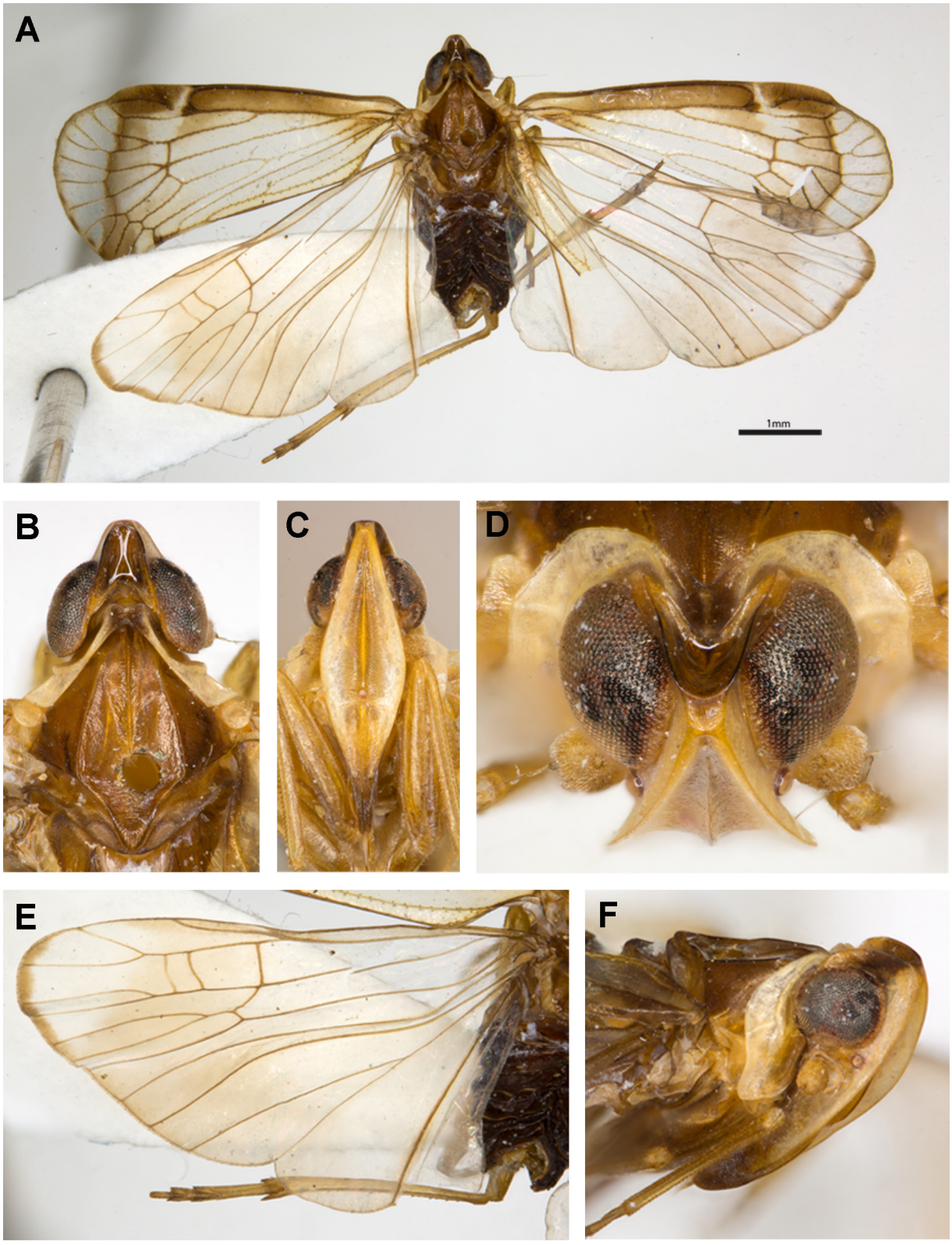

Fig. 7. *Innobindus oppositus* sp. nov., holotype, ♂ (ASCU ASCTHE017104). **A**. Habitus. **B–D, F**. Head and thorax. **E**. Hindwing.

Thorax. Hind margin of pronotum more or less rectangular. Forewing about 3.1 × longer than wide; costal margin with about 4–5 very indistinct tubercles; fork of ScP+RA and RP at same level as fork CuA1 and CuA2; crossvein r–m_1 slightly basad of, or at same level as fork MP1+2 and MP3+4; transverse veinlet m–cu_1 where it inserts at CuA distinctly basad of transverse veinlet r–m_1; transverse veinlet m–cu_1 where it inserts at MP3+4 at same level as transverse veinlet r–m_1; icu, where it inserts at CuA, distinctly distad of apex of clavus; RA unforked; MP3+4 bifid; crossvein m–cu_2 (delimiting subapical cell C4) distinctly distad of crossvein icua (delimiting subapical cell C5); nodus of y-vein slightly distad of centre of

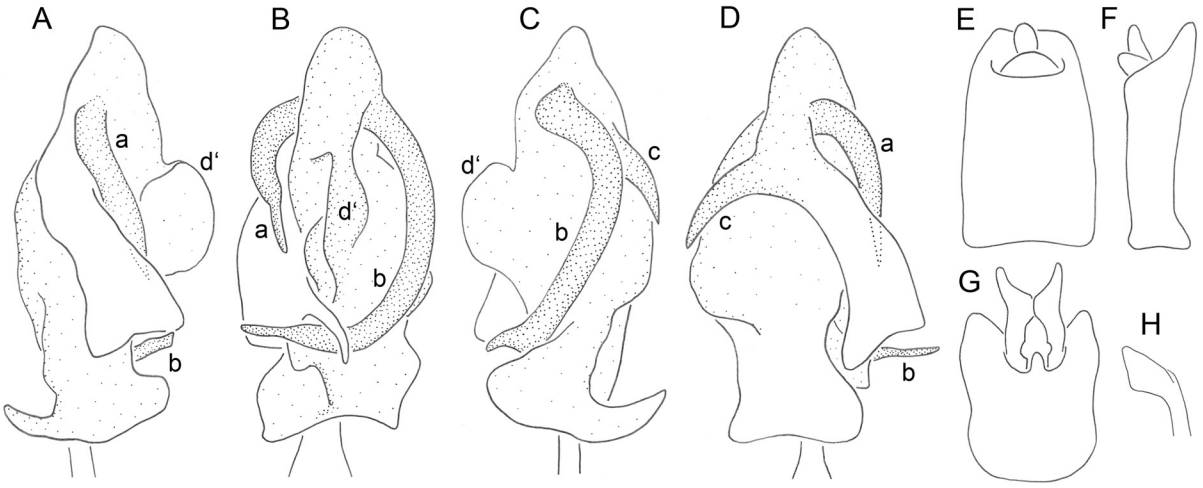

Fig. 8. *Innobindus artus* sp. nov., paratype, ♂ (BMNH). **A**. Aedeagus, left lateral view. **B**. Aedeagus, ventral view. **C**. Aedeagus, right lateral view. **D**. Aedeagus, dorsal view. **E–F**. Anal tube. **G–H**. Genital styles.

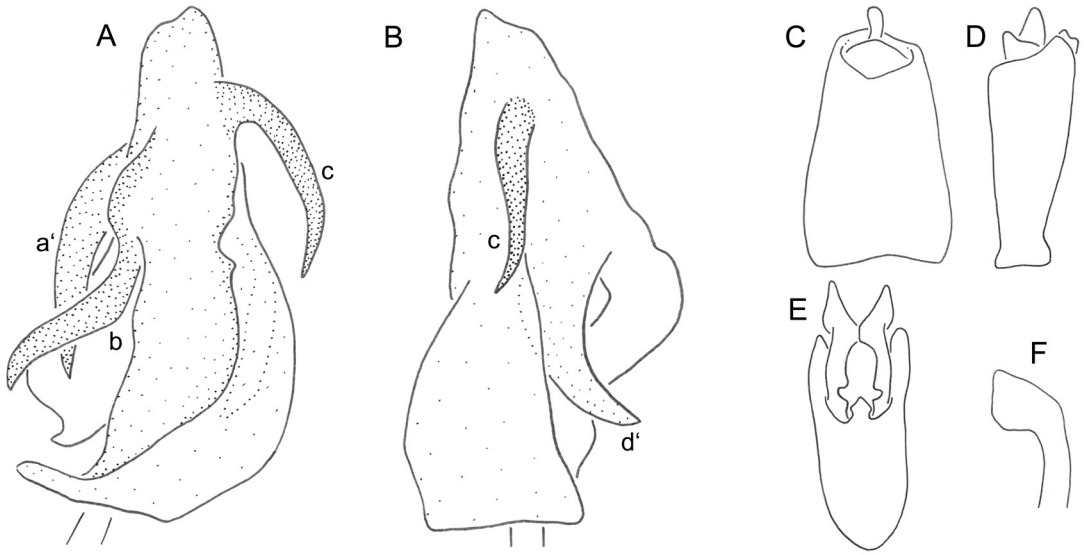

Fig. 9. *Innobindus kaanti* sp. nov., holotype, ♂ (ASCU ASCTHE016807). **A**. Aedeagus, left lateral view. **B**. Aedeagus, ventral view. **C–D**. Anal tube. **E–F**. Genital styles.

clavus. Hind leg: tibia with 7 apical spines and 6–7 very small to small lateral spines; 1st tarsomere with 7 apical teeth and no platellae; 2nd tarsomere with 8 apical teeth, no platellae, but up to 3 very fine setae.

Male genitalia. Anal tube as in Fig. 13C–D. Pygofer and genital styles as in Fig. 13E–F: ventromedian process of pygofer narrow, subtriangular. Shaft of genital styles without indentation. Aedeagus (Fig. 13A–B): phallotheca left laterally with a long spine (a), bent about 90 degrees in distal half; ventrally with a long, curved spine (b); dorso-(right)laterally with a very long, very thin spine (c), covering almost entire length of phallotheca. Flagellum without spines or spine-like ridges.

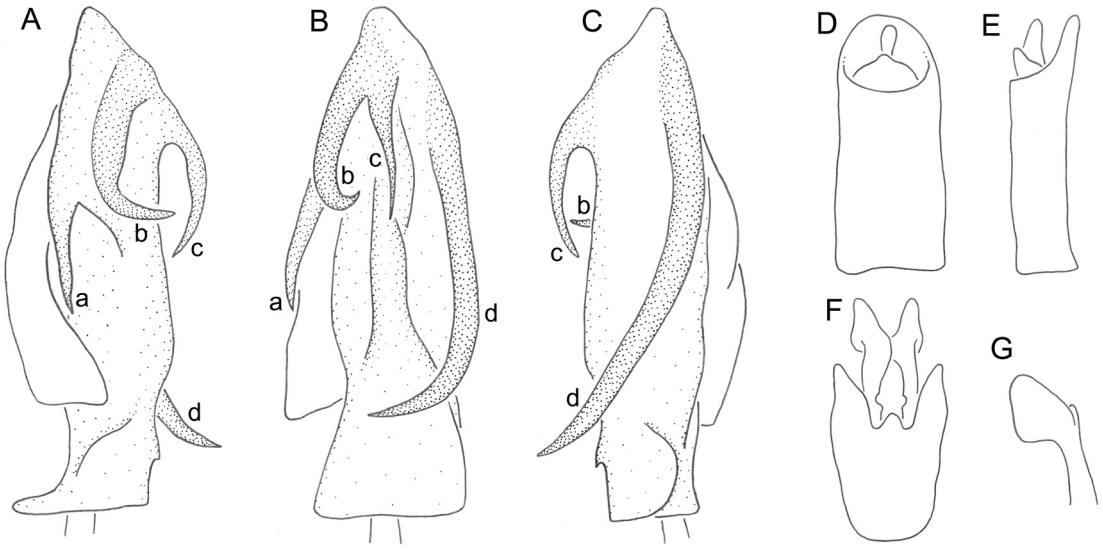

Fig. 10. *Innobindus loriensis* sp. nov., holotype, ♂ (ASCU ASCTHE017059). **A**. Aedeagus, left lateral view. **B**. Aedeagus, ventral view. **C**. Aedeagus, right lateral view. **D–E**. Anal tube. **F–G**. Genital styles.

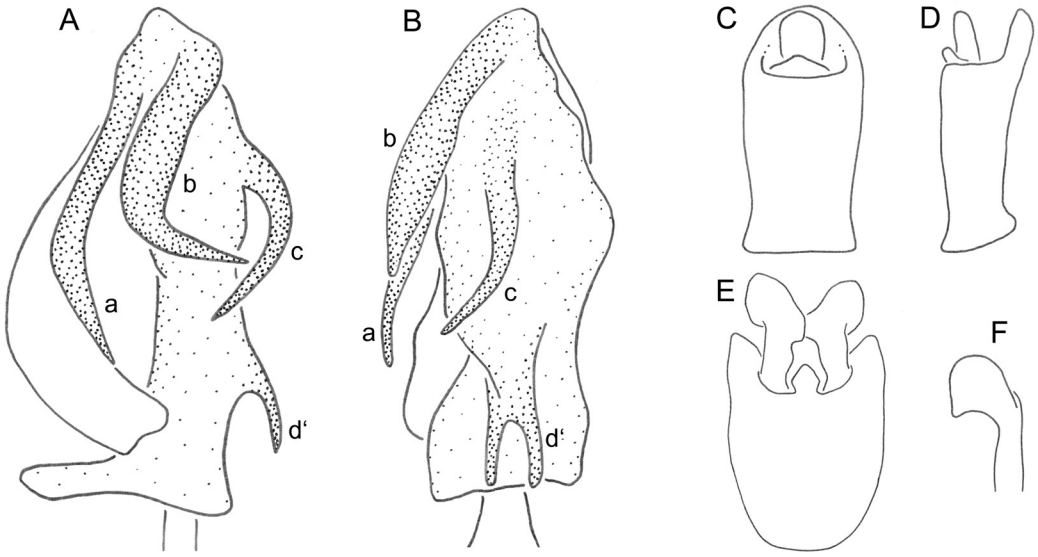

Fig. 11. *Innobindus gimani* sp. nov., holotype, ♂ (ASCU ASCT00181701). **A**. Aedeagus, left lateral view. **B**. Aedeagus, ventral view. **C–D**. Anal tube. **E–F**. Genital styles.

Distribution

Central NSW (Fig. 14A).

Discussion

Innobindus geminatus sp. nov. and *I. alternans* appear to be closely related, as they share many features such as the shape of anal tube and genital styles and the presence of a bifurcate ventral process on the phallotheca (Fig. 12A–G; Löcker *et al.* 2007: fig. 10a–e). However, features that are only present on one side in *I. alternans* are seen on both sides in *I. geminatus* such as the medium-sized spine and minute

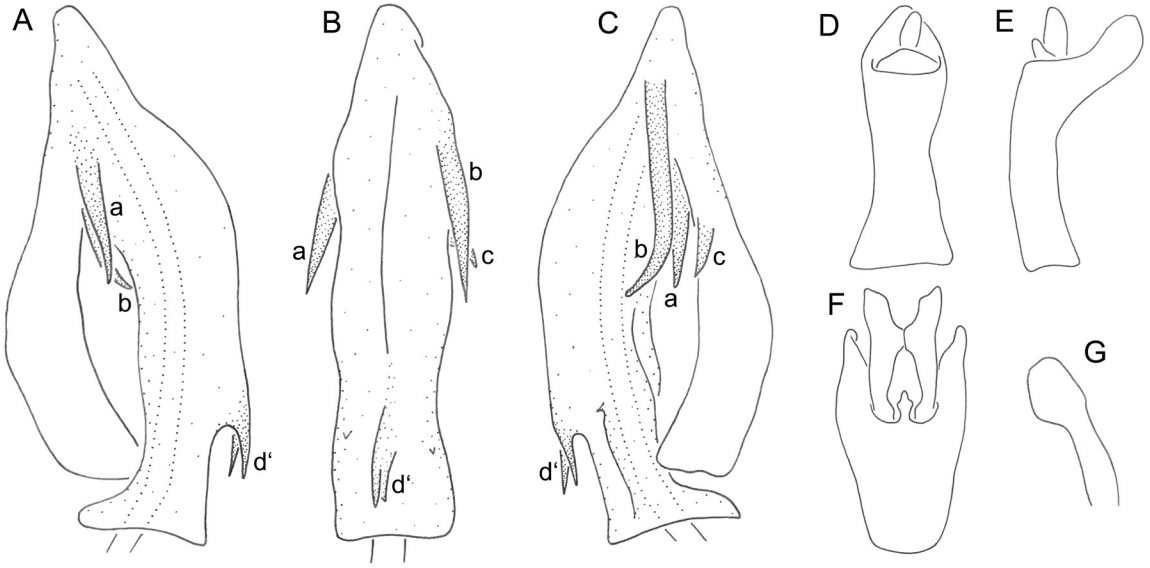

Fig. 12. *Innobindus geminatus* sp. nov., holotype, ♂ (AMS K.594470). **A**. Aedeagus, left lateral view. **B**. Aedeagus, ventral view. **C**. Aedeagus, right lateral view. **D–E**. Anal tube. **F–G**. Genital styles.

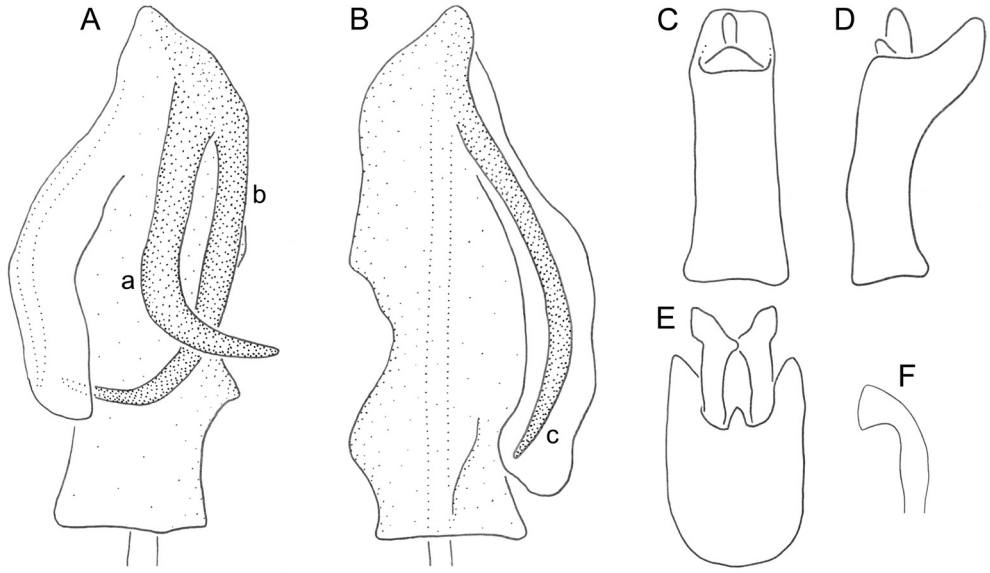

Fig. 13. *Innobindus oppositus* sp. nov., holotype, ♂ (ASCU ASCTHE017104). **A**. Aedeagus, left lateral view. **B**. Aedeagus, right lateral view. **C–D**. Anal tube. **E–F**. Genital styles.

spine on right lateral side of phallotheca in *I. alternans* (Löcker *et al.* 2007. fig. 10a) versus medium-sized spines and minute spines on both sides in *I. geminatus* (Fig 12 A–C). There are further differences between the two species such as a small spine on the flagellum, and the humped shape of the phallotheca in lateral view in *I. geminatus* which are not present in *I. alternans*. Interestingly Löcker *et al.* 2007 lists a specimen of *I. alternans* that is excluded from the type series, which has the medium-sized spine inserted on the left hand side of the phallotheca (all other *I. alternans* specimens have it on the right side). This specimen, as well as the other specimens of *I. alternans*, were collected in the Lamington National Park, only about 200 km south of the Conondale Range where *I. geminatus* occurs. Altogether three species of *Innobindus* are known from Lamington National Park: *I. alternans*, *I. marginatus* and *I. artus* sp. nov. Further collecting in the border region of New South Wales and Queensland and a phylogenetic study are needed to clarify the situation and find out whether hybridisation is happening between these species, as has been found in New Zealand cixiids of the genus *Cixius* Latreille, 1804 (Larivière 1999).

Examination of additional material since Löcker *et al.* 2007 revealed that the 'length of median carina of frons' character used in the identification key of Löcker *et al.* 2007 to distinguish between the

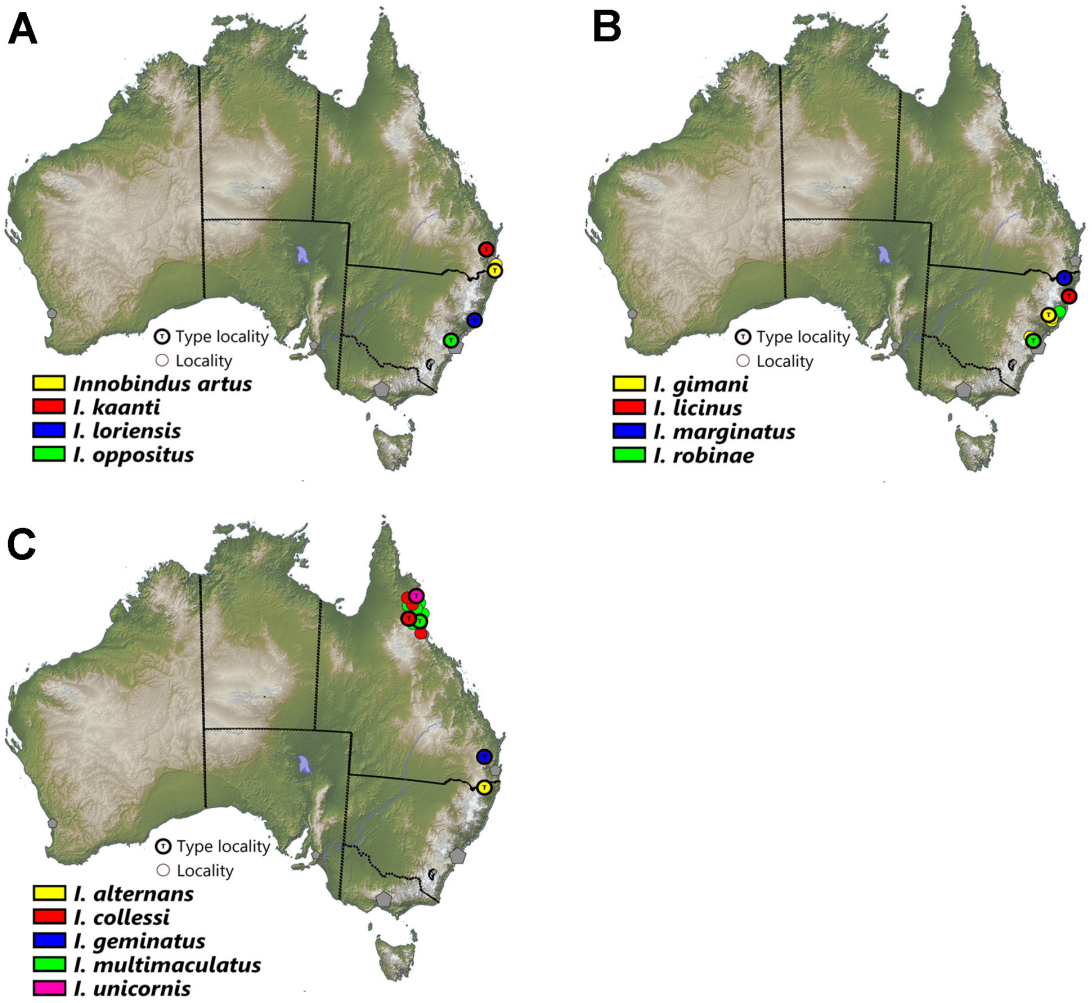

Fig. 14. Known distribution of species of *Innobindus* Jacobi, 1928. **A**. *artus* group and *I. oppositus* sp. nov. **B**. *licinus* group. **C**. *multimaculatus* group.

multimaculatus and *licinus* groups does not work for all specimens. One specimen of *I. multimaculatus*, one specimen of *I. geminatus* sp. nov. and four specimens only identifiable to the *multimaculatus* group, have a median carina on the frons that covers exactly ¾ or slightly more of the entire length of the frons. This character has been discarded from the identification key in this current paper. The best character to separate the two groups is the elevation of the lateral carinae of the frons, strongly elevated (distinctly higher elevated than median carina of frons) in the *multimaculatus* group and slightly to moderately elevated (slightly higher elevated than median carina of frons) in the *licinus* group.

Barely anything is known regarding habitat or host plants of *Innobindus*. One specimen of *Innobindus robinae*, five of *I. geminatus* sp. nov. and seven specimens of *I. multimaculatus* have been collected in rainforests, one specimen of *I. gimani* sp. nov. in an Antarctic Beech forest and one specimen of *I. collessi* was retrieved during a pyrethrum knockdown of trees and logs. Specific host plants are still unknown, possibly due to the small number of specimens of *Innobindus* in collections, as well as the collecting methods by which these were obtained, such as at light, or from pitfall, flight intercept and malaise traps. The only species with an associated plant record is *I. kaanti* sp. nov., of which all four specimens have been collected from *Argyrodendron actinophyllum*, a large rainforest tree in the family Malvaceae, that is native to eastern Australia commonly called Black Jack or Black Booyong.

Innobindus is endemic to Queensland and New South Wales. Its association with rainforests may explain why its distribution (Fig. 13) is restricted to coastal areas, although not necessarily why it is absent from the Northern Territory, Victoria, Tasmania and Western Australia, as each of these states has rainforest areas. Climate and isolation amongst other factors may have inhibited population of these areas. Further collecting in these areas may increase the known distribution and reveal more undescribed species.

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