European Journal of Taxonomy 891: 128–150
https://doi.org/10.5852/ejt.2023.891.2277
ISSN 2118-9773
www.europeanjournaloftaxonomy.eu
2023 · Constant J. & Semeraro L.

Research article

urn:lsid:zoobank.org:pub:3DC84AA2-B448-449F-B766-8872F615666E

The Australian issid planthopper genus *Orinda* Kirkaldy, 1907: New subgenera, new species, host plant and identification key (Hemiptera: Fulgoromorpha: Issidae)

Jérôme CONSTANT[1,*] & Linda SEMERARO[2]

[1] Royal Belgian Institute of Natural Sciences, O.D. Phylogeny and Taxonomy, Entomology, Vautier Street 29, B-1000 Brussels, Belgium.
[2] Agriculture Victoria Research, Agribio, Centre for Agribioscience, 5 Ring Road, Bundoora, 3083, Victoria, Australia.

[*] Corresponding author: jerome.constant@naturalsciences.be
[2] Email: linda.semeraro@agriculture.vic.gov.au

[1] urn:lsid:zoobank.org:author:6E6072A1-9415-4C8D-8E60-2504444DB290
[2] urn:lsid:zoobank.org:author:DCAAD2E7-80F7-4EA9-98D9-167FE8B97C58

Abstract. A new subgenus of *Orinda* Kirkaldy, 1907, *Montorinda* subgen. nov., is described to accommodate two new species from southeastern Queensland, *O.* (*Montorinda*) *eungellana* sp. nov. from Eungella National Park and *O.* (*Montorinda*) *montana* sp. nov. from Mount Walsh National Park. The new species are compared to the other species of the genus and a new subgenus *Scapulorinda* subgen. nov. is described to accommodate *Orinda* (*Scapulorinda*) *scapularis* (Jacobi, 1928), leaving a single species in the subgenus *Orinda*: *O.* (*Orinda*) *lucindae* (Kirkaldy, 1906). Illustrations of the male holotype, a female paratype and male genitalia are provided for both new species as well as habitus and wing of *O.* (*Scapulorinda*) *scapularis* (Jacobi, 1928), the most closely related species, for comparison. The type series of the *O.* (*Montorinda*) *montana* sp. nov. was collected on *Grevillea whiteana* Mc Gill. (Proteaceae). The genus *Orinda* is only recorded from Queensland and now contains four species.

Keywords. Fulgoroidea, Auchenorrhyncha, Australia, Issinae.

Constant J. & Semeraro L. 2023. The Australian issid planthopper genus *Orinda* Kirkaldy, 1907: New subgenera, new species, host plant and identification key (Hemiptera: Fulgoromorpha: Issidae). *European Journal of Taxonomy* 891: 128–150. https://doi.org/10.5852/ejt.2023.891.2277

Introduction

The family Issidae Spinola, 1839 contains about 216 genera and 1089 species according to the FLOW database (Bourgoin 2022), representing nearly 8% of the species of Fulgoromorpha. The Australian Issidae currently include 12 species in 5 genera, representing only 1.1% of the world issid species (Gnezdilov & Fletcher 2010). Almost all of the Australian fauna was described in only three papers, each about one century old: two by Kirkaldy (1906, 1907) and one by Jacobi (1928). The Australian members of the family were more recently reviewed by Gnezdilov & Fletcher who added one new

species, *Chlamydopteryx mammoides* Gnezdilov & Fletcher, 2010, based on a series of female specimens (Gnezdilov & Fletcher 2010). Despite their importance for species identification, no male genitalia of these species was ever illustrated or described so far and no host plant record is available for an Australian Issidae species. The Australian issid fauna remains practically undescribed, with all known species from the eastern part of the country. Gnezdilov (2013, 2020) suggested an Oriental origin of the Australian Issidae; however, none of the recently published phylogenies (Wang *et al.* 2016; Gnezdilov *et al.* 2020, 2022) contained an Australian sample.

The genus *Orinda* Kirkaldy, 1907 was established by Kirkaldy (1907) to include *Sarnus lucindae* Kirkaldy, 1906. A second species, *Tetrica scapularis* Jacobi, 1928 was tranferred to *Orinda* by Gnezdilov & Fletcher (2010) who also discussed the variability of the hind wings within the genus. Both species are recorded from Northern Queensland and their biology remains unknown although Gnezdilov & Fletcher (2010) hypothesized that the rudimentary hind wings of *O. lucindae* may be an adaptation to a different habitat with low and thinly growing vegetation as opposed to rainforest for *O. scapularis*. A third species was described in the genus, *O. bimaculifrons* Jacobi, 1928 but it was later transferred to the genus *Chlamydopteryx* Kirkaldy, 1907 by Gnezdilov & Fletcher (2010).

Recent expeditions in southeastern Queensland in December 2019 and March 2020 have revealed two new species of *Orinda* and allowed the identification of a host plant.

The present paper aims to describe the new species as *O. eungellana* sp. nov. and *O. montana* sp. nov. as well as two new subgenera, *Montorinda* subgen. nov. and *Scapulorinda* subgen. nov. to accommodate the different species groups recognized within the genus. We also provide data on their habitat and host plant and a distribution map for all species of the genus.

Material and methods

The male genitalia were extracted after boiling the apex of the abdomen several minutes in a 10% solution of potassium hydroxide (KOH) at about 100°C. The pygofer was thoroughly rinsed in 70% ethanol, then separated from the abdomen remains and the aedeagus dissected with a needle blade for examination. The whole was then placed in glycerine for preservation in a polyethylene tube attached to the pin of the specimen.

The external morphological terminology follows O'Brien & Wilson (1985) and for the male genitalia, Bourgoin & Huang (1990). The classification used follows the most recent one published by Gnezdilov *et al.* (2022). The metatibiotarsal formula gives the number of spines on the (side of metatibia) apex of the metatibia/apex of the first metatarsus/apex of the second metatarsus. The terminology of the wing venation follows Bourgoin *et al.* (2015) with additions from Wang *et al.* (2019) for the hind wing venation.

The photographs of the collection specimens were taken with a Leica EZ4W stereo microscope with integrated camera, stacked with CombineZ software and optimized with Adobe Photoshop CS3. The distribution map was produced with SimpleMappr (Shorthouse 2010).

The measurements were taken as in Constant (2004).

Abbreviations for measurements

BB = maximum breadth of the body
BF = maximum breadth of the frons
BTg = maximum breadth of the tegmen
BV = maximum breadth of the vertex

LF = length of the frons in median line
LT = total length (apex of head to apex of tegmina)
LTg = maximum length of the tegmen
LV = length of the vertex in median line

Abbreviations for the terminalia

An = anal tube
G = gonostylus
Py = pygofer

Institutional abbreviations

BPBM = Bernice P. Bishop Museum, Honolulu, Hawaii
QM = Queensland Museum, Brisbane, Queensland, Australia
RBINS = Royal Belgian Institute of Natural Sciences, Brussels, Belgium

Results

Taxonomy

Class Insecta Linnaeus, 1758
Order Hemiptera Linnaeus, 1758
Suborder Auchenorrhyncha Duméril, 1806
Infra-order Fulgoromorpha Evans, 1946
Superfamily Fulgoroidea Latreille, 1807
Family Issidae Spinola, 1839
Subfamily Issinae Spinola, 1839
Tribe Sarimini Wang, Zhang & Bourgoin, 2016

Genus ***Orinda*** Kirkaldy, 1907

Orinda Kirkaldy, 1907: 103 (keyed), 104 (described, compared to *Hysteropterum*). Type species: *Sarnus lucindae* Kirkaldy, 1906, by monotypy.

Orinda – Metcalf 1958: 288 [catalogued]. — Gnezdilov & Fletcher 2010: 41 [diagnosis], 44 [keyed].

Diagnosis

Costal margin of tegmina with peculiar concavity in proximal portion. Hind wings rudimentary or well developed and trilobed; veins: ScP+R and CuA bifurcate, MP, CuP, Pcu and A1 fused on a long distance basally, Pcu unforked and A2 simple; one transverse vein between second branch of ScP+R and MP and between MP and first branch of CuA; second branch of CuA and CuP are fused distally. Metatibiae with 2 lateral spines.

Note

Following the tribe definitions proposed by Wang *et al.* (2016), the genus *Orinda* is here placed in the Sarimini Wang, Zhang & Bourgoin, 2016. This tribe is characterized by a three-lobed hind wing with Pcu-A1 lobe more or less as wide as ScP-R-MP-Cu lobe and the following venation characters: Pcu single or forked, Pcu and A1 anastomosing for a short or long distance and A2 non branched.

Species included (type locality)

Orinda (*Montorinda*) *eungellana* sp. nov. (Queensland: Eungella National Park)
Orinda (*Montorinda*) *montana* sp. nov. (Queensland: Mount Walsh National Park)
Orinda (*Orinda*) *lucindae* (Kirkaldy, 1906) (Queensland: Lucinda Point)
Orinda (*Scapulorinda*) *scapularis* (Jacobi, 1928) (Queensland: Bellenden Ker, Malanda)

Subgenus ***Montorinda*** subgen. nov.
urn:lsid:zoobank.org:act:2E18F76C-545F-4C70-AECA-C01FA5DD7C14

Type species

Orinda (*Montorinda*) *eungellana* sp. nov., by present designation.

Diagnosis

Body parallel-sided in dorsal view; posterior wings well developed, trilobed with veins CuA and CuP fused apically.

The subgenus differs from *Orinda* (*Orinda*) by its well-developed hind wings (sugbgenus *Orinda* with rudimentary hind wings); from the subgenus *Scapulorinda* subgen. nov. by its parallel-sided body (body narrowing towards the posterior in *Scapulorinda*) and by the hind wings with veins CuA and CuP fused only apically (veins fused along distal ¼ and thickened in *Scapulorinda*).

Orinda* (*Montorinda*) *eungellana sp. nov.
urn:lsid:zoobank.org:act:415CFF22-4FB8-4497-97B4-FBEBC2A5301F
Figs 1–3, 4A–B, 5–6

Diagnosis

The species can be separated from the other species of *Orinda* by the combination of the following characters:

1. Posterior wings well developed, trilobate (Figs 1D, 2D).
2. Body parallel-sided in dorsal view (Figs 1A, 2A).
3. Posterior wings with CuA and CuP merging only apically (Figs 1D, 2D).
4. Anterior tibia elongate and slender, with parallel margins, about 4.6× as long as wide (Figs 1A–B, F, 2A–B, F).
5. Dorsal process of gonostyli with anterior margin more or less straight in lateral view (Fig. 3A).
6. Gonostyli in posterior view without lateral hump under the dorsal process (Fig. 3C).
7. Aedeagus in anterodorsal view abruptly angularly expanded laterally at about midlength (Fig. 3J).

Etymology

The species epithet refers to the type locality of the species, Eungella National Park.

Type material

Holotype

AUSTRALIA • ♂, dissected, genitalia in glycerine, right posterior wing mounted; Queensland, Eungella N.P.; 21°10′08.1″ S, 148°30′18.5″ E; 16–17 Mar. 2020; J. Constant and L. Semeraro leg.; Leopold III Funds Expedition; QM.

Fig. 1. *Orinda* (*Montorinda*) *eungellana* sp. nov., ♂, holotype (QM). **A**. Habitus, dorsal view. **B**. Habitus, ventral view. **C**. Habitus, lateral view. **D**. Posterior wing. **E**. Habitus, anterolateral view. **F**. Habitus, perpendicular view of frons. **G**. Left posterior leg, apical half of tibia and tarsus, ventral view.

Paratypes

AUSTRALIA • 1 ♂, 2 ♀♀; same collection data as for holotype; QM • 1 ♂, 2 ♀♀; same collection data as for holotype; RBINS.

Description

Measurements and ratios. LT: ♂ (n = 3): 3.9 mm (3.8–3.9); ♀ (n = 4): 4.3 mm (4.2–4.3). LTg/BB = 1.50; LV/BV = 0.4; LF/BF = 1.0; LW/BW: ♂: 1.38, ♀: 1.36.

Head (Figs 1A–C, E–F, 2A–C, E–F). Vertex yellow-brown, longitudinally rather deeply excavate, slightly shorter in midline than along lateral margins; all margins carinate, lateral ones sinuate, anterior one more or less straight, posterior one deeply excavate. Frons variegated yellow-brown and brown with a row of yellow-brown spots along lateral margins, rugose, weakly convex in lateral view, with dorsal margin deeply excavate and lateral margins sinuate in perpendicular view; wider in ventral half; median carina well marked, not reaching fronto-clypeal suture ventrally and stopping at peridiscal carina dorsally; peridiscal carina complete. Genae bicolour in two well delimited areas, pale yellow in anterodorsal portion, dark brown in posteroventral portion. Antennae brown with base of pedicel narrowly black; scape short, pedicel bulbous. Eyes strongly protruding, projecting dorsolaterally in anterior view and projecting posteriorly behind the level of vertex in dorsal view. Clypeus brown with paler markings on sides, triangular, longer than width at base. Labium pale yellow with black tip, elongate and narrow, with last segment longer than wide, slightly tapering towards apex and shorter than penultimate.

Thorax (Figs 1A, C, E–F, 2A, C, E–F). Pronotum pale yellow-brown with irregular yellowish tubercles and yellowish median carina; anterior margin carinate and angularly projecting anteriorly in midline, posterior margin weakly rounded; disc shallowly concave with one impressed point on each side of median carina; median carina extending from anterior to posterior margin. Paranotal lobes dark brown with pale yellow tubercles along upper portion of lateral margin; lateral margin rounded, lateroventral angle slightly projecting ventrally, angularly rounded. Mesonotum yellow-brown, slightly longer then pronotum in midline with obsolete median carina not reaching apex of scutellum; transverse elevation at base of scutellum followed by a depression in middle of scutellum. Tegulae pale brown.

Tegmina (Figs 1A, C, E, 2A, C, E). Dark brown with minute yellowish-brown spots; a broad transverse band from basal ¼ to midlength and distal portion, paler, yellowish-brown with small darker spots; elongate and convex; sides more or less parallel in dorsal view with distal ⅓ roundly tapering; costal margin rather strongly excavate at basal ¼, with narrow hypocostal plate from base to end of excavation; humped at apex of clavus in lateral view. Basal cell elongate and rather narrow. Longitudinal veins raised, transverse cross-veins numerous and weakly raised. Vein ScP+R forked near base; MP forked at about ⅓ of tegmen length; CuA forked slightly distally to first fork of MP; Pcu and A1 fused at about ⅔ of clavus length, Pcu+A1 reaching apex of clavus.

Posterior wings (Figs 1D, 2D). Strongly infuscate with dark brown veins; trilobed with deep CuP notch, less deep A1 notch and margin concave at A2; Sc-R-Mp-CuA lobe wider than CuP-Pcu-A1 lobe, latter about as wide as A2 lobe. Veins: ScP+R and CuA bifurcate, MP, CuP and A2 simple; Pcu and A1 fused for a long distance basally, Pcu unforked; one transverse vein between second branch of ScP+R and MP and between MP and first branch of CuA; second branch of CuA and CuP fused distally.

Legs (Figs 1A–C, E–F, 2A–C, E–F). Pro- and mesocoxae pale yellow with base dark brown; pro- and mesotrochanters pale yellow with small brown marking; profemora black with large pale yellow markings, wider than corresponding tibiae; protibiae dark brown with few pale yellow markings, elongate and slender, about 4.6× as long as wide in ventral view; protarsi brown; mesofemora mostly dark brown dorsally, with some pale yellow markings, mostly pale yellow ventrally with some dark brown markings,

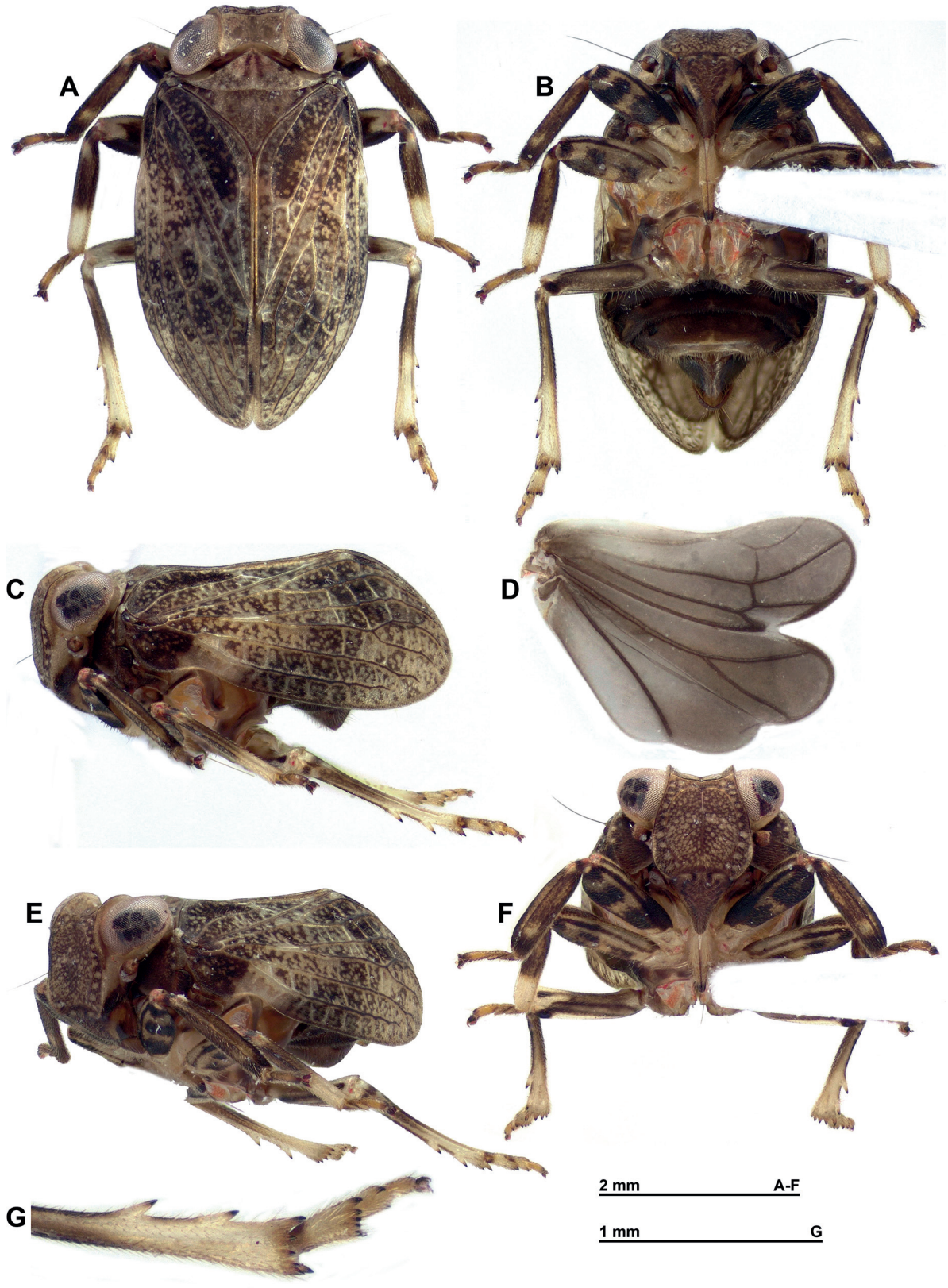

Fig. 2. *Orinda* (*Montorinda*) *eungellana* sp. nov., ♀, paratype (QM). **A**. Habitus, dorsal view. **B**. Habitus, ventral view. **C**. Habitus, lateral view. **D**. posterior wing. **E**. Habitus, anterolateral view. **F**. Habitus, perpendicular view of frons. **G**. Left posterior leg, apical half of tibia and tarsus, ventral view.

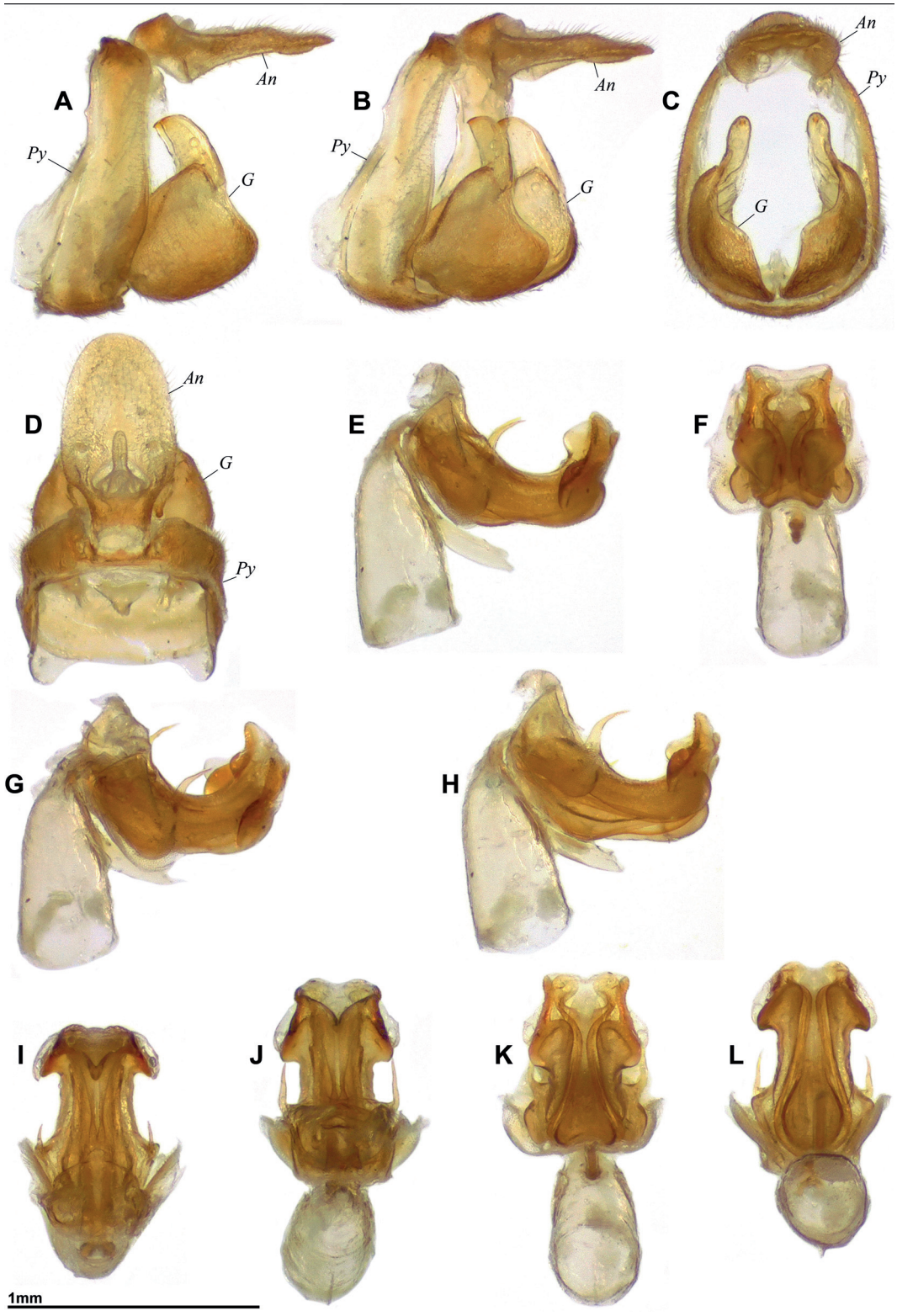

Fig. 3. *Orinda* (*Montorinda*) *eungellana* sp. nov., ♂, holotype (QM), terminalia. **A–D**. Pygofer, anal tube and gonostyli. **A**. Left lateral view. **B**. Left posterolateral view. **C**. Posterior view. **D**. Dorsal view. **E–L**. Aedeagus. **E**. Left lateral view. **F**. Posterior view. **G**. Left laterodorsal view. **H**. Left lateroventral view. **I**. Dorsal view. **J**. Anterodorsal view. **K**. Posteroventral view. **L**. Ventral view. Abbreviations: see Material and methods.

wider than corresponding tibiae; mesotibiae dark brown with basal marking and distal ⅓ pale yellow; mesotarsi pale yellow; metacoxae and trochanters pale brown; metafemora brown, distally with blackish and pale yellow markings; metatibiae basal half brown and distal half except apex, pale yellow, with 2 lateral and 6 apical spines; all spines of metatibiae and metatarsi apically black; first metatarsomere with 7 apical spines, second metatarsomere with 2 apical spines. Metatibiotarsal formula: (2) 6/7/2.

Abdomen (Figs 1B, 2B). Dark brown.

Male terminalia (Fig. 3). Pygofer (Fig. 3A–D) narrow in lateral view with anterior and posterior margins nearly parallel; posterior margin slightly sinuate, making pygofer slightly wider at about ventral ⅓; in caudal view, about 1.35× as high as wide and with lateral margins broadly rounded; posterior margin deeply U-shaped notched in dorsal view. Gonostyli (Fig. 3A–C) rather short and convex; in lateral view, subquadrate with dorsal margin oblique, ventral margin rounded basally then nearly straight and oblique, posteroventral angle angularly rounded, posterior margin slightly excavate, a moderate oblique elongate

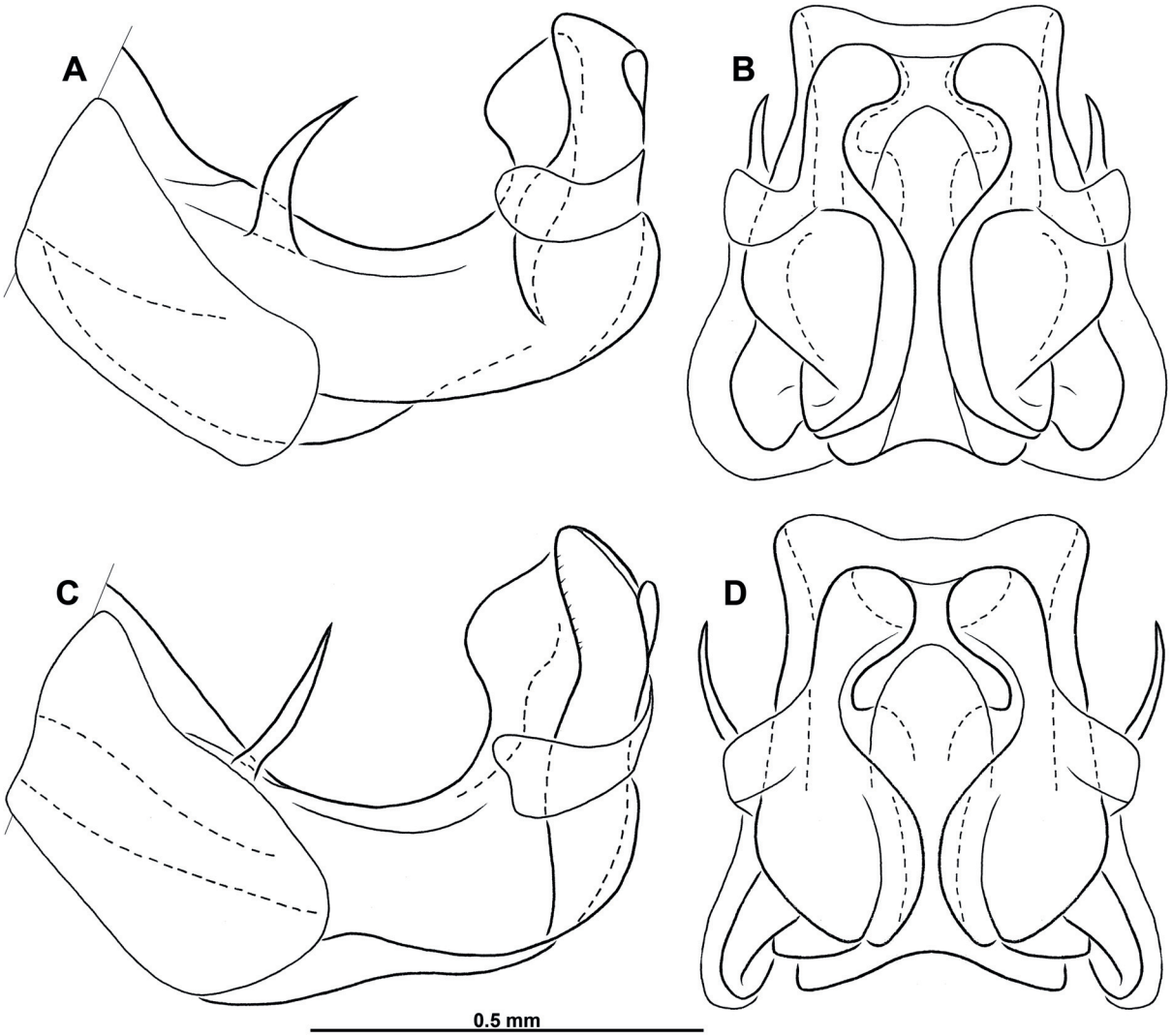

Fig. 4. *Orinda* (*Montorinda*) spp., adeagus of holotypes. **A–B**. *O.* (*Montorinda*) *eungellana* sp. nov. **A**. Left lateral view. **B**. Posterior view. **C–D**. *O.* (*Montorinda*) *montana* sp. nov. **C**. Left lateral view. **D**. Posterior view.

swelling from base of dorsal process to basoventral angle; in caudal view, posterior margin strongly sinuate and lateral margin broadly rounded, upper part of lateral swelling oblique; dorsal process laterally flattened, with apical small tooth, in lateral view with anterior margin nearly straight and posterior margin weakly rounded to more strongly rounded dorsal angle. Aedeagus (Figs 3E–L, 4A–B) rather strongly curved dorsad in lateral view with pair of spinose basidorsal processes directed posterodorsad, curved in lateral view and straight in dorsal view; aedeagus in anterodorsal view abruptly angularly expanded laterally at about midlength. Connective elongate, strongly curved ventrad on basal half then straight, with strongly developed, subtubular tectiductus widening from base to apex; apical opening circular. Dorsal lobe of periandrium rather wide in dorsal view, with subapical median carina well developed and rounded in lateral view, forming an angular projection directed cephalad on apical margin in dorsal view. Ventral lobe of periandrium rather poorly sclerotized, ending in 2 apically rounded projections and with roundly angular lateral process directed dorsocephalad near angle of aedeagus (best visible in laterodorsal view). Anal tube (Fig. 3A–D) elongate and dorsoventrally flattened, surpassing level of gonostyli; in dorsal view, 1.67 × as long (in midline) as wide, suboval with apical margin rounded and lateral margins rather abruptly emarginate on basal 1/5; anal opening at basal 1/5, anal column surpassing basal ⅓; in lateral view, ventral margin projecting ventrally at basal ¼ into roundly angular process, then weakly concave on remaining distal portion, dorsal margin abruptly excavate at base of anal opening.

Biology

The specimens were collected by sweeping the dense bushes around the information center near the bridge over Broken River (Fig. 5).

Distribution

Australia, SE Queensland, Eungella National Park (Fig. 6).

Fig. 5. Habitat of *Orinda* (*Montorinda*) *eungellana* sp. nov., Eungella National Park, 17 Mar. 2020.

Orinda* (*Montorinda*) *montana sp. nov.
urn:lsid:zoobank.org:act:B882CD18-8D1D-45B7-A625-AC331F55AB4F
Figs 4C–D, 6–10

Diagnosis

The species can be separated from the other species of *Orinda* by the combination of the following characters:

1. Posterior wings well developed, trilobate (Figs 7F, 8D).
2. Body parallel-sided in dorsal view (Figs 7A, 8A).
3. Posterior wings with CuA and CuP merging apically (Figs 7F, 8D).
4. Anterior tibiae rather short and laterally dilated, with lateral margin broadly rounded about 3.8× as long as wide (Figs 7A–B, D, 8A–B, F).
5. Dorsal process of gonostyli with anterior margin curved anteriorly in lateral view (Fig. 9A).
6. Gonostyli in posterior view with strong lateral hump under the dorsal process (Fig. 9C).
7. Aedeagus in anterodorsal view smoothly obliquely expanded laterally at about midlength (Fig. 9J).

Etymology

The species epithet refers to the habitat of the species at the type locality, the summit of Mount Walsh National Park.

Type material

Holotype

AUSTRALIA • ♂, dissected, genitalia in glycerine, right posterior wing mounted; Queensland, Mount Walsh N.P.; 25°34′00″ S, 152°02′58″ E; 14 Dec. 2019; summit, sweeping *Grevillea whiteana* Mc Gill.; J. Constant leg.; QM.

Paratypes

AUSTRALIA • 2 ♀♀; same collection data as for holotype; QM • 1 ♂, 1 ♀; same collection data as for holotype; RBINS.

Description

Measurements and ratios: LT: ♂ (n = 2): 3.8 mm; ♀ (n = 3): 4.0 mm (3.9–4.1). LTg/BB = 1.45; LV/BV = 0.41; LF/BF = 0.9; LW/BW: ♂: 1.58, ♀: 1.53.

Head (Figs 7A–E, 8A–C, E–F). Vertex yellow-brown to brown, longitudinally rather deeply excavate, slightly shorter in midline than along lateral margins; all margins carinate, lateral ones sinuate, anterior one more or less straight, posterior one deeply excavate. Frons variegated yellow-brown and brown to dark brown with a row of yellow-brown spots, more or less contrasted, along lateral margins, rugose, weakly convex in lateral view, with dorsal margin deeply excavate and lateral margins sinuate in perpendicular view; wider in ventral half; median carina well marked, not reaching fronto-clypeal suture ventrally and stopping at peridiscal carina dorsally; peridiscal carina complete. Genae bicolour in two well delimited areas, pale yellow in anterodorsal portion, dark brown to black in posteroventral portion. Antennae brown to dark brown with base of pedicel narrowly black; scape short, pedicel bulbous. Eyes strongly protruding, projecting dorsolaterally in anterior view and projecting posteriorly behind the level of vertex in dorsal view. Clypeus brown to dark brown with paler markings on sides, triangular, longer than width at base. Labium brown with last segment darker, turning to black on distal half, elongate and narrow, with last segment longer than wide, slightly tapering towards apex and shorter than penultimate.

Thorax (Figs 7A, C–E, 8A, C, E–F). Pronotum pale yellow-brown to brown with more or less contrasted, irregular yellowish tubercles and yellowish median carina; anterior margin carinate and angularly projecting anteriorly in midline, posterior margin weakly rounded; disc shallowly concave with one impressed point on each side of median carina; median carina extending from anterior to posterior margin. Paranotal lobes brown to dark brown with pale yellow tubercles along upper portion of lateral margin; lateral margin rounded, lateroventral angle slightly projecting ventrally, angularly rounded. Mesonotum yellow-brown to brown, slightly longer then pronotum in midline with obsolete median carina not reaching apex of scutellum; transverse elevation at base of scutellum followed by a depression in middle of scutellum. Tegulae pale brown.

Tegmina (Figs 7A–C, E, 8A–C, E). Dark brown with minute yellowish-brown spots; a broad transverse band from basal ¼ to midlength and distal portion, paler, more or less contrasted yellowish-brown with small darker spots; elongate and convex; sides more or less parallel in dorsal view with distal ⅓ roundly tapering; costal margin rather strongly excavate at basal ¼, with narrow hypocostal plate from base to end of excavation; humped at apex of clavus in lateral view. Basal cell elongate and rather narrow. Longitudinal veins raised, transverse cross-veins numerous and weakly raised. Vein ScP+R forked near base; MP forked at about ⅓ of tegmen length; CuA forked slightly distally to first fork of MP; Pcu and A1 fused at about ⅔ of clavus length, Pcu+A1 reaching apex of clavus.

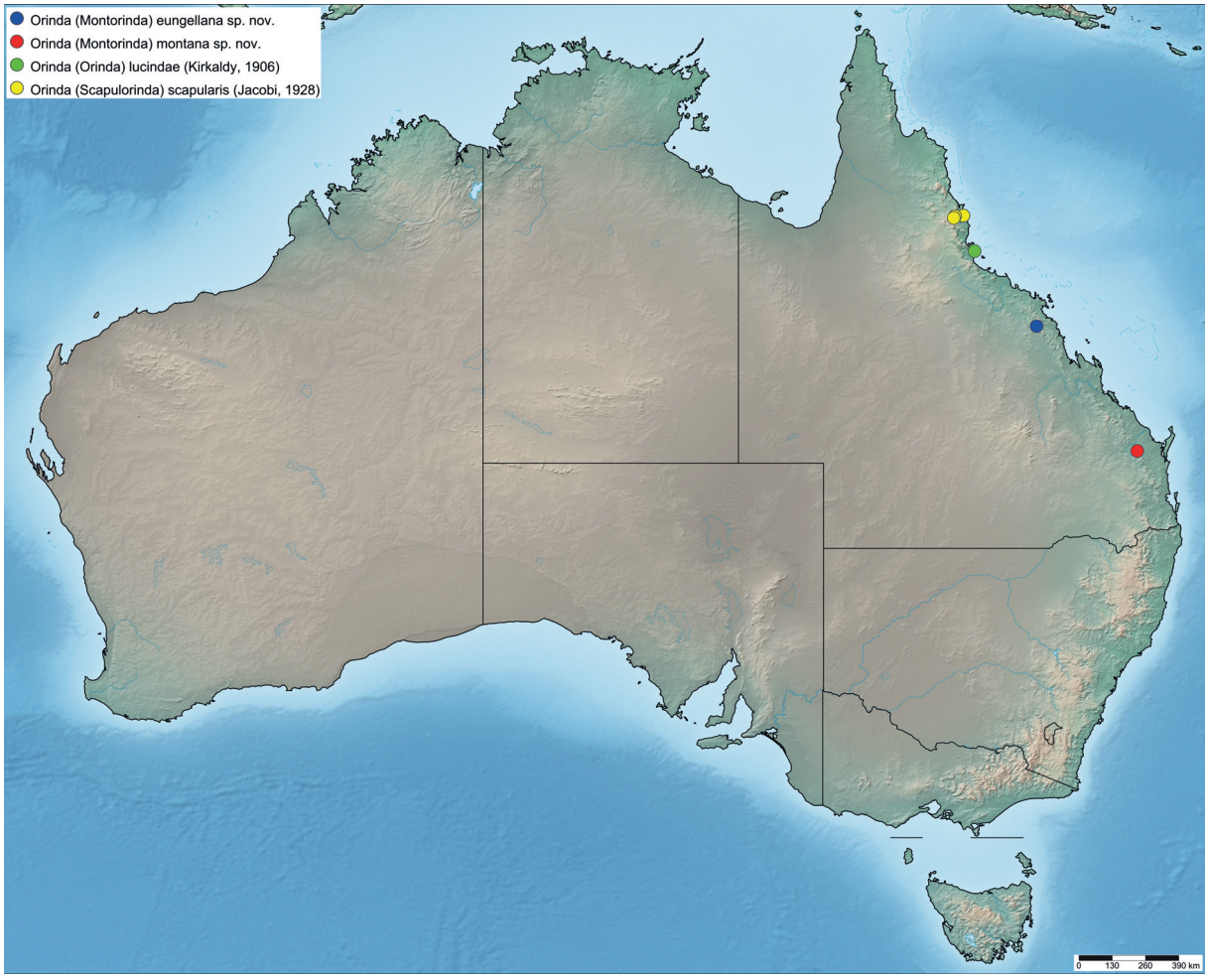

Fig. 6. *Orinda* spp., distribution map.

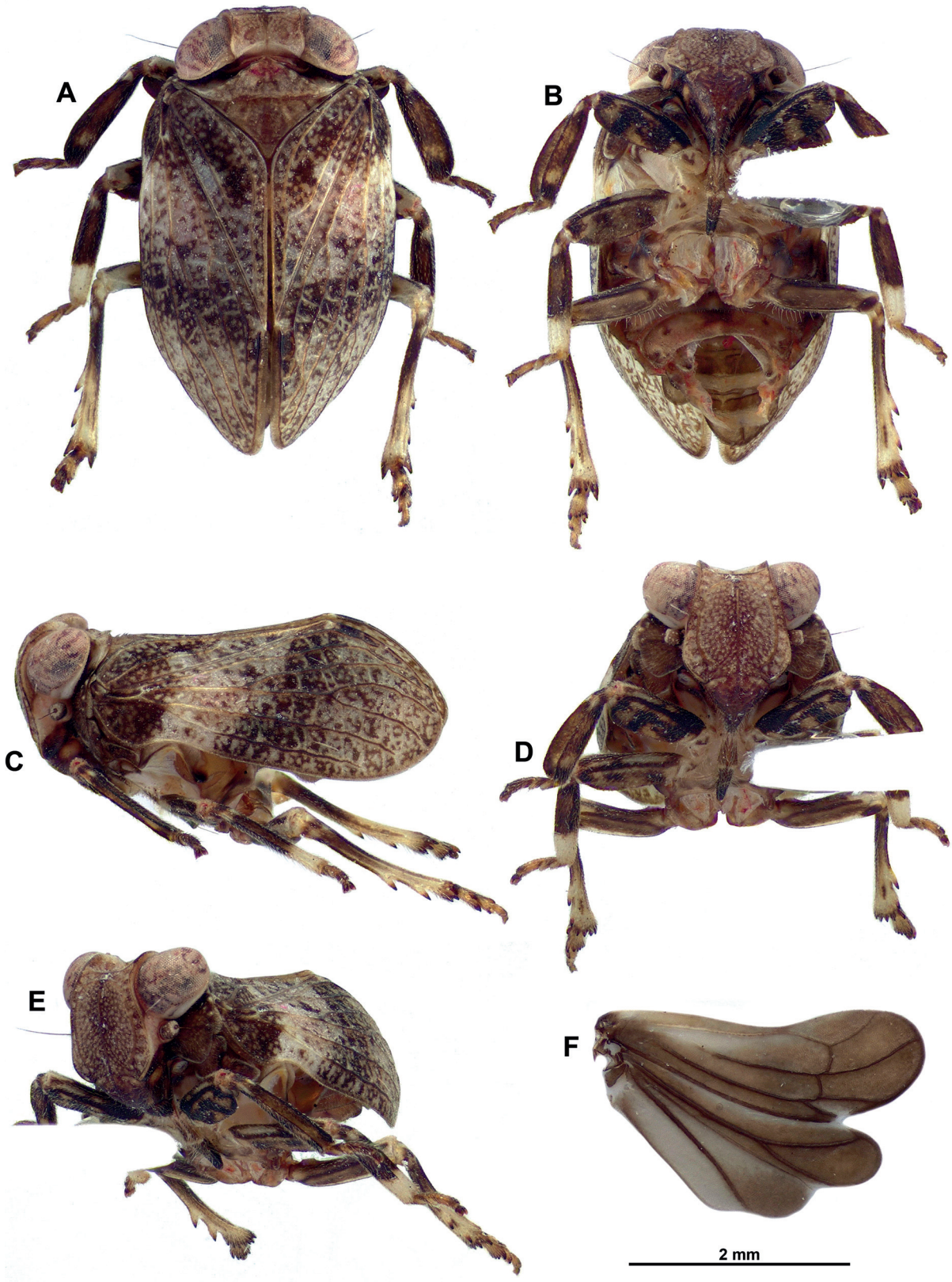

Fig. 7. *Orinda* (*Montorinda*) *montana* sp. nov., ♂, holotype (QM). **A**. Habitus, dorsal view. **B**. Habitus, ventral view. **C**. Habitus, lateral view. **D**. Habitus, perpendicular view of frons. **E**. Habitus, anterolateral view. **F**. Posterior wing.

Fig. 8. *Orinda* (*Montorinda*) *montana* sp. nov., ♀, paratype (QM). **A**. Habitus, dorsal view. **B**. Habitus, ventral view. **C**. Habitus, lateral view. **D**. Posterior wing. **E**. Habitus, anterolateral view. **F**. Habitus, perpendicular view of frons. **G**. Left posterior leg, apical half of tibia and tarsus, ventral view.

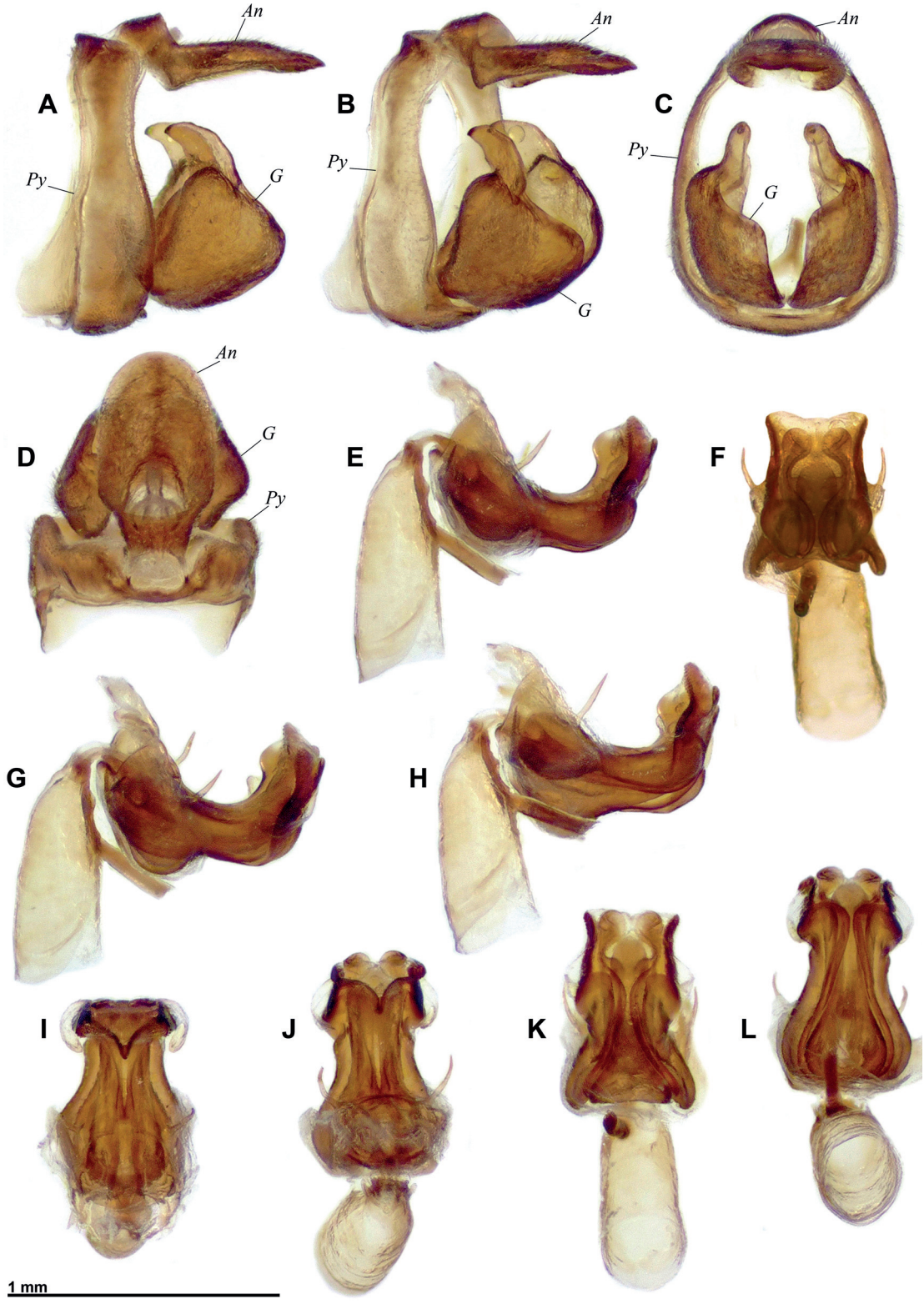

Fig. 9. *Orinda* (*Montorinda*) *montana* sp. nov., ♂, holotype (QM), terminalia. **A–D**. Pygofer, anal tube and gonostyli. **A**. Left lateral view. **B**. Left posterolateral view. **C**. Posterior view. **D**. Dorsal view. **E–L**. Aedeagus. **E**. Left lateral view. **F**. Posterior view. **G**. Left laterodorsal view. **H**. Left lateroventral view. **I**. Dorsal view. **J**. Anterodorsal view. **K**. Aedeagus posteroventral view. **L**. Ventral view. Abbreviations: see Material and methods.

Posterior wings (Figs 7F, 8D). Strongly infuscate with dark brown veins; trilobed with deep CuP notch, less deep A1 notch and margin concave at A2; Sc-R-Mp-CuA lobe wider than CuP-Pcu-A1 lobe, latter about as wide as A2 lobe. Veins: ScP+R and CuA bifurcate, MP, CuP and A2 simple; Pcu and A1 fused on a long distance basally, Pcu unforked; one transverse vein between second branch of ScP+R and MP and between MP and first branch of CuA; second branch of CuA and CuP fused distally.

Legs (Figs 7A–E, 8A–C, E–G). Pro- and mesocoxae pale yellow with base dark brown; pro- and mesotrochanters pale yellow with small brown marking; profemora black with more or less developed pale yellow markings, slightly wider than corresponding tibiae; protibiae dark brown with few pale yellow markings, rather short and laterally dilated, with lateral margin broadly rounded, about 3.8× as long as wide in ventral view; protarsi brown to black-brown; mesofemora mostly brown to dark brown dorsally, with some pale yellow markings, paler ventrally with some darker and paler brown markings, wider than corresponding tibiae; mesotibiae dark brown to black with basal marking and distal ⅓ pale yellow; mesotarsi pale yellow; metacoxae and trochanters brown; metafemora brown to dark brown, distally with blackish and pale yellow markings; metatibiae brown with distal half except apex, pale yellow, with 2 lateral and 6 apical spines; all spines of metatibiae and metatarsi apically black; first metatarsomere with 7 apical spines, second metatarsomere with 2 apical spines. Metatibiotarsal formula: (2) 6/7/2.

Abdomen (Figs 7B, 8B). Dark brown.

Male terminalia (Figs 4C–D, 9). Pygofer (Fig. 9A–D) narrow in lateral view with anterior and posterior margins nearly parallel; posterior margin slightly sinuate, making pygofer slightly wider

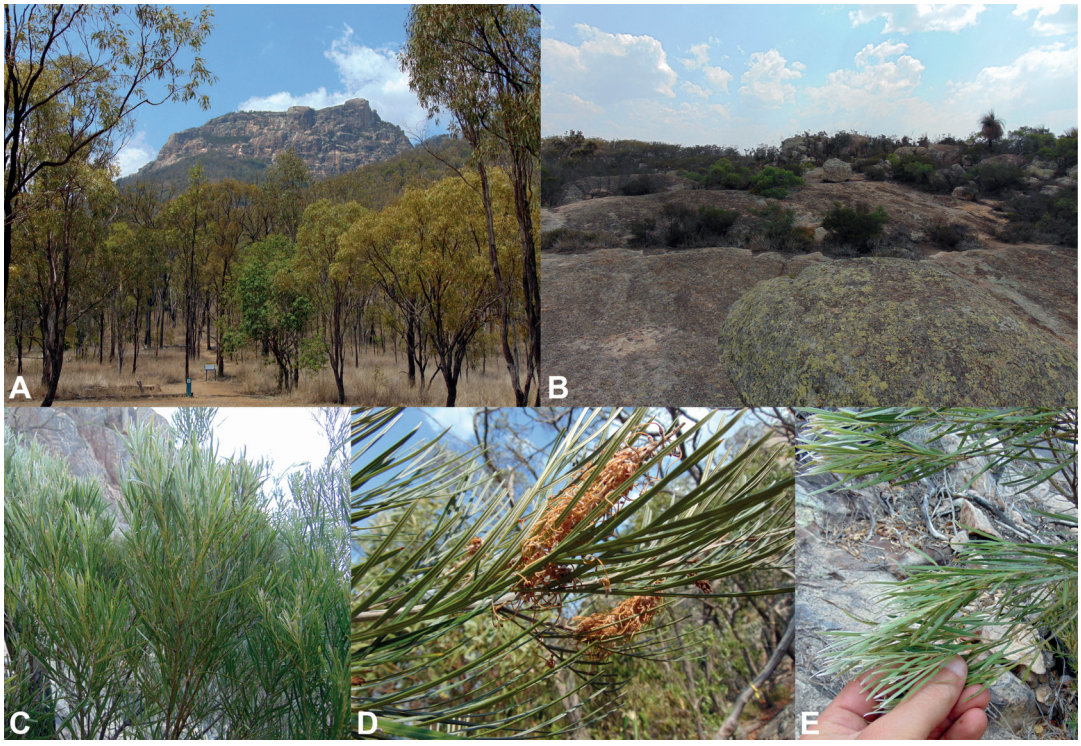

Fig. 10. Habitat and host plant of *Orinda* (*Montorinda*) *montana* sp. nov., Mount Walsh National Park, 14 Dec. 2019. **A**. Mount Walsh as seen from the car park. **B**. Landscape on the top of Mount Walsh with shrubs growing between the rocks. **C**. Host plant, *Grevillea whiteana* Mc Gill. (Proteaceae). **D–E**. Host plant, *G. whiteana*, detail.

at about ventral ⅓; in caudal view, about 1.32× as high as wide and with lateral margins broadly rounded; posterior margin deeply U-shaped notched in dorsal view. Gonostyli (Fig. 9A–C) rather short and convex; in lateral view, subquadrate with dorsal margin oblique, ventral margin rounded basally then weakly rounded and oblique, posteroventral angle angularly rounded, posterior margin slightly convex, a rather strong oblique elongate swelling from base of dorsal process to basoventral angle; in caudal view, posterior margin strongly sinuate and lateral margin broadly rounded, upper part of lateral swelling strongly projecting laterally to almost right angle; dorsal process laterally flattened, with apical small tooth, in lateral view with anterior margin curved anteriorly and posterior margin rather strongly rounded. Aedeagus (Figs 4C–D, 9E–L) rather strongly curved dorsad in lateral view with pair of spinose basidorsal processes directed posterodorsad, straight in lateral view and curved in dorsal view; aedeagus in anterodorsal view smoothly obliquely expanded laterally at about midlength. Connective elongate, strongly curved ventrad on basal half then straight, with strongly developed, subtubular tectiductus widening from base to apex; apical opening circular. Dorsal lobe of periandrium rather wide in dorsal view, with subapical median carina well developed and rounded in lateral view, forming an angular projection directed cephalad on apical margin in dorsal view. Ventral lobe of periandrium rather poorly sclerotized, ending in 2 rounded projections and with angular lateral process directed dorsocephalad near angle of aedeagus (best visible in laterodorsal view). Anal tube (Fig. 9A–D) elongate and dorsoventrally flattened, surpassing level of gonostyli; in dorsal view, 1.70× as long (in midline) as wide, suboval with apical margin rounded and lateral margins rather abruptly emarginate on basal 1/5; anal opening at basal 1/5, anal column surpassing basal ⅓; in lateral view, ventral margin projecting ventrally at basal ¼ into roundly angular process, then weakly concave on remaining distal portion, dorsal margin abruptly excavate at base of anal opening.

Biology

The specimens were collected on the top of Mount Walsh by sweeping 2–2.5 m high *Grevillea whiteana* Mc Gill. (Proteaceae) bushes, at about 700 m in altitude (Fig. 10A–B). These "Munduberra grevillea" appear to be a host plant of *O.* (*Montorinda*) *montana* sp. nov. (Fig. 10B–C).

Distribution

Australia, SE Queensland, Mount Walsh National Park (Fig. 6).

Subgenus ***Orinda*** Kirkaldy, 1907

Type species

Orinda lucindae (Kirkaldy, 1906), by present designation.

Diagnosis

Characters of the genus, with hind wings rudimentary.

The subgenus differs from *Montorinda* subgen. nov. and *Scapulorinda* subgen. nov. by its rudimentary hind wings (well-developed and trilobed in the two other subgenera).

Orinda* (*Orinda*) *lucindae (Kirkaldy, 1906)
Fig. 6

Sarnus lucindae Kirkaldy, 1906: 440 (description).

Orinda lucindae Kirkaldy 1907: 104 (transferred to *Orinda*). — Gnezdilov & Fletcher 2010: 41 (note on type material), figs 11, 14 (habitus and tegmen of syntype).

Diagnosis

Only species in the subgenus *Orinda* subgen. nov., which can be separated from all other species of *Orinda* by the characters of the subgenus.

Material examined

Syntype

AUSTRALIA • ♂, examined from photographs in Gnezdilov & Fletcher 2010: figs 11, 14; BPBM.

Subgenus ***Scapulorinda*** subgen. nov.

urn:lsid:zoobank.org:act:59E79FEE-332B-44D7-B0C2-8DED1BE507FB

Type species

Orinda scapularis (Jacobi, 1928), by present designation.

Diagnosis

Body narrowing towards the posterior in dorsal view (Fig. 11A); posterior wings well developed, trilobed with veins CuA and CuP fused apically along distal ¼ and thickened (Fig. 11D).

The subgenus differs from *Orinda* (*Orinda*) by its well-developed hind wings (subgenus *Orinda* with rudimentary hind wings); from the subgenus *Montorinda* subgen. nov. by its body narrowing towards the posterior (parallel-sided in *Montorinda*) and by the hind wings with veins CuA and CuP fused along distal ¼ and thickened (veins fused only apically in *Montorinda*).

Orinda* (*Scapulorinda*) *scapularis (Jacobi, 1928)

Figs 6, 11–12

Tetrica scapularis Jacobi, 1928: 12 (described), fig. 5 (tegmen).

Orinda scapularis – Gnezdilov & Fletcher 2010 (transferred to *Orinda*): figs 10 (syntype, habitus), 21 (posterior wing).

Diagnosis

Only species in the subgenus *Scapulorinda* subgen. nov., which can be separated from all other species of *Orinda* by the characters of the subgenus.

Material examined

Syntype

AUSTRALIA • sex unknown; examined from photographs in Gnezdilov & Fletcher (2010: figs 10, 21); Queensland, Bellenden Ker; no date; leg. Mjöberg; NHRS.

Additional material

AUSTRALIA • 1 ♀; Queensland, Lake Eacham; 17°17′10″ S, 145°37′45″ E; 6 May 2022; alt. 790 m; J. Constant and L. Semeraro leg.; Leopold III Funds Expedition; QM.

Biology

The specimen from Lake Eacham was collected by sweeping dense bushes around the car park near the lake (Fig. 12); other specimens were previously collected at a light trap in Malanda (Gnezdilov & Fletcher 2010).

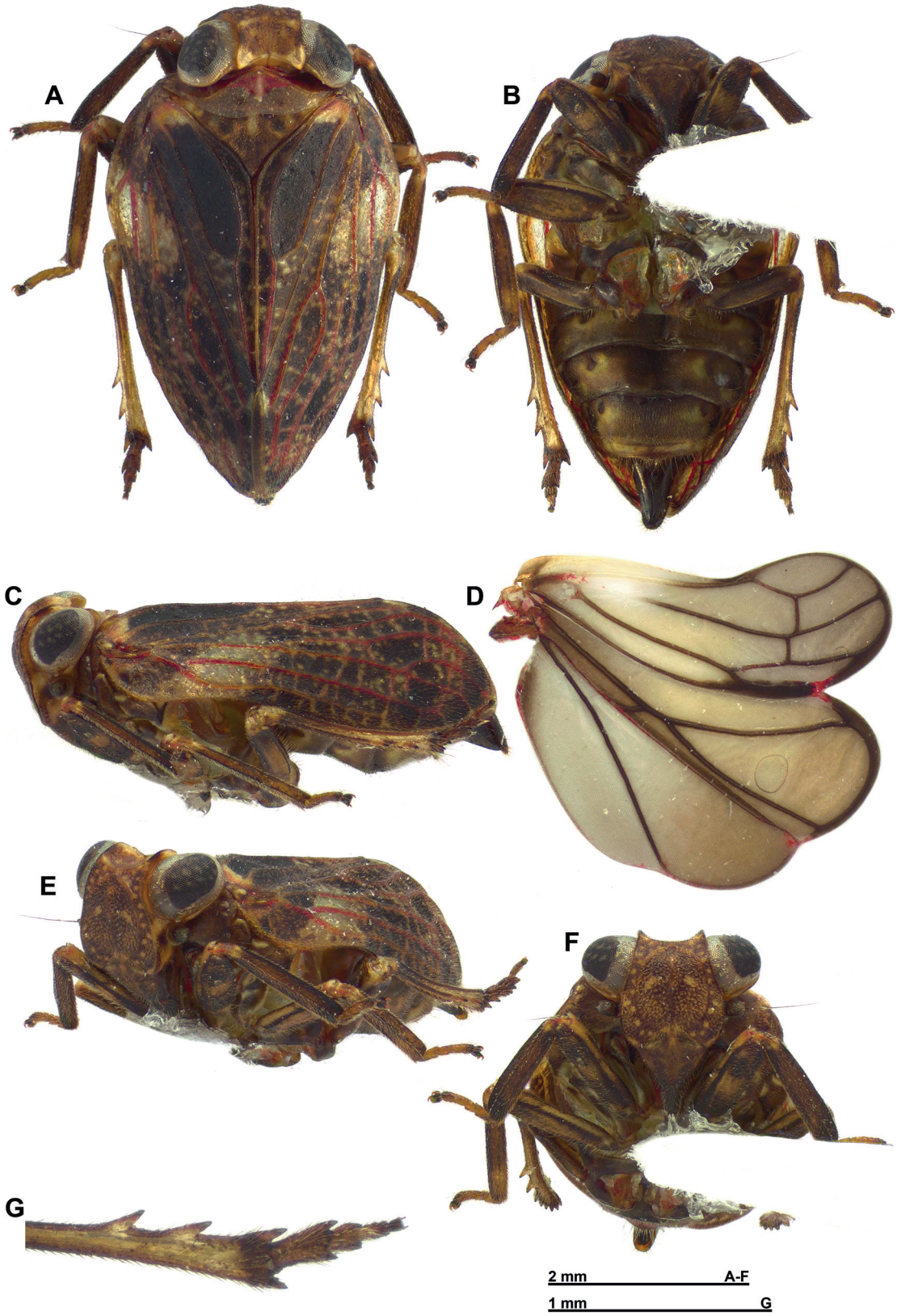

Fig. 11. *Orinda* (*Scapulorinda*) *scapularis* (Jacobi, 1928), ♀ (QM). **A**. Habitus, dorsal view. **B**. Habitus, ventral view. **C**. Habitus, lateral view. **D**. Posterior wing. **E**. Habitus, anterolateral view. **F**. Habitus, perpendicular view of frons. **G**. Left posterior leg, apical half of tibia and tarsus, ventral view.

Distribution

Australia, N Queensland: Bellenden Ker, Malanda and Lake Eacham (Fig. 6).

Identification key to the subgenera and species of Orinda Kirkaldy, 1907

1. Posterior wings rudimentary (subgenus ***Orinda*** Kirkaldy, 1907) .... ***O.* (*Orinda*) *lucindae*** (Kirkaldy, 1906)
– Posterior wings well developed, trilobed (Figs 1D, 11D) 2
2. Body parallel-sided in dorsal view (Fig. 1A); posterior wings with CuA and CuP merging apically (Fig. 1D) (***Montorinda*** subgen. nov.) 3
– Body wider at anterior third in dorsal view, tapering towards apex (Fig. 11A); posterior wings with CuA and CuP fused along distal ¼ (Fig. 11D) (***Scapulorinda*** subgen. nov .... ***O.* (*Scapulorinda*) *scapularis*** (Jacobi, 1928)
3. Anterior tibiae elongate and slender, with parallel margins, about 4.6 × as long as wide (Figs 1A–B, F, 2A–B, F); dorsal process of gonostyli with anterior margin more or less straight in lateral view (Fig. 3A); gonostyli in posterior view without lateral hump under the dorsal process (Fig. 3C); aedeagus in anterodorsal view abruptly angularly expanded laterally at about midlength (Fig. 3J) .. .. ***O.* (*Montorinda*) *eungellana*** sp. nov.
– Anterior tibiae rather short and laterally dilated, with lateral margin broadly rounded, about 3.8 × as long as wide (Figs 7A–B, D, 8A–B, F); dorsal process of gonostyli with anterior margin curved anteriorly in lateral view (Fig. 9A); gonostyli in posterior view with strong lateral hump under the dorsal process (Fig. 9C); aedeagus in anterodorsal view smoothly obliquely expanded laterally at about midlength (Fig. 9J) ..... ***O.* (*Montorinda*) *montana*** sp. nov.

Discussion

Together with the two new species described above, the Australian fauna of Issidae counts 14 species. Gnezdilov & Fletcher (2010) stated that many undescribed species exist in collections and this is

Fig. 12. Habitat of *Orinda* (*Scapulorinda*) *scapularis* (Jacobi, 1928), Lake Eacham car park, 6 May 2022.

confirmed by our observations (Constant & Semeraro, unpublished data). However, before any further intensive study can be conducted, the 12 named species need to be accurately redescribed, including the diagnostic features of the male genitalia, based on the corresponding type material. In this framework, the study of the male genitalia of *O*. (*Orinda*) *lucindae* and *O*. (*Scapulorinda*) *scapularis*, will also allow an assessment of the hypothesis proposed by Gnezdilov & Fletcher (2010) that the shape of the posterior wings is not a relevant character to justify a placement in separate genera; however, this treatment was mostly based on an analogy with a Western Palaearctic genus *Mycterodus* Spinola, 1839, which belongs to another subfamily Hysteropterinae Melichar, 1906 (Bourgoin 2022). Intrageneric and intraspecific variation in the development of the wings is known to occur in some families of planthoppers, for example in the Delphacidae Leach, 1815 (Della Giustina 2019) but as for the Sarimini, it was never recorded in the literature or observed in the numerous specimens from Southeast Asia and New Guinea that we examined. The higher classification of the Australian taxa would also greatly benefit from more species and genera being incorporated in broader molecular studies of the family. The closest relatives to *Orinda* are probably to be found in Australia or in New Guinea but this seems currently impossible to assess as, according to Gnezdilov (2013) about Australia: "The whole continent, with the exception of its eastern part has not been studied", and about New Guinea "one can conclude that the fauna of New Guinea is known by only 0.7%".

A host plant, *Grevillea whiteana* Mc Gill. (Proteaceae) is recorded for *O*. (*Montorinda*) *montana* sp. nov., while specimens of *O*. (*Montorinda*) *eungellana* sp. nov. were collected from various species of shrubs in the Eungella National Park. Further study is required to determine the distribution range, host plants and other aspects of Australia's native Issidae in order to assess their conservation status and avoid to relegate them to the 'data deficient' category (e.g., Cardoso *et al*. 2011; Moir & Brennan 2020; Constant *et al.* 2022). Such progress is still impeded by the limited taxonomic capacity available on Australian planthoppers, which needs to be addressed (Taxonomy Decadal Plan Working Group 2018).

Acknowledgements

We wish to thank Dr Melinda Moir (Department of Primary Industries and Regional Development, South Perth, Australia) and Dr Francesco "Bacon" Martoni (Agriculture Victoria, Melbourne, Australia) for their help, company and enthusiasm during the collecting trip in December 2019; Dr Christine Lambkin, Dr Susan Wright and Mrs Karin Koch for all their help with the collecting permits and visits to the QM collections; Miss Mado Berthet (RBINS) for improving the plates of habitus and genitalia; Dr Thierry Backeljau and Dr Jackie Van Goethem (RBINS – Leopold III Funds), Dr Mark Blacket (Agriculture Victoria), and Dr Justin Bartlett and Dr Mark Schutze (Queensland Department of Agriculture and Fisheries, Brisbane, Australia) for their support of the expeditions in December 2019 and March 2020; Dr John Wainer (Agriculture Victoria) for the plant identification; the two reviewers of the original manuscript for their valuable suggestions. This paper is partly a result of the Leopold III Funds project "Fulgoridae and Eurybrachidae of Australia: (I) Taxa of coastal SE Queensland".

References

Bourgoin T. 2022. FLOW (Fulgoromorpha Lists on The Web): a world knowledge base dedicated to Fulgoromorpha. V.8, updated [27 Nov. 2022]. Available from http://hemiptera-databases.org/flow/ [accessed 27 Nov. 2022].

Bourgoin T. & Huang J. 1990. Morphologie comparée des genitalia mâles des Trypetimorphini et remarques phylogénétiques (Hemiptera: Fulgoromorpha: Tropiduchidae). *Annales de la Société entomologique de France, Nouvelle Série* 26 (4): 555–564.

Bourgoin T., Wang R.R., Asche M., Hoch H., Soulier-Perkins A., Stroinski A., Yap S. & Szwedo J. 2015. From micropterism to hyperpterism: recognition strategy and standardized homology-driven terminology

of the fore wing venation patterns in planthoppers (Hemiptera: Fulgoromorpha). *Zoomorphology* 134 (1): 63–77. https://doi.org/10.1007/s00435-014-0243-6

Cardoso P., Erwin T.L., Borges P.A.V. & New T.R. 2011. The seven impediments in invertebrate conservation and how to overcome them. *Biological Conservation* 144 (11): 2647–2655. https://doi.org/10.1016/j.biocon.2011.07.024

Constant J. 2004. Révision des Eurybrachidae (I). Le genre *Amychodes* Karsch, 1895 (Homoptera: Fulgoromorpha: Eurybrachidae). *Bulletin de l'Institut royal des Sciences naturelles de Belgique* 74: 11–27.

Della Giustina W. 2019. Les Delphacidae de France et des pays limitrophes (Hemiptera, Fulgoromorpha). *Faune de France* 100: 1–831.

Gnezdilov V.M. 2013. Modern classification and the distribution of the family Issidae Spinola (Homoptera, Auchenorrhyncha: Fulgoroidea). *Entomologicheskoe Obozrenie* 92 (4): 724–738. [In Russian.] [English translation in *Entomological Review* (2014) 94 (5): 687–697).]

Gnezdilov V.M. 2020. New tribe, new genera, and new species of the family Issidae (Hemiptera: Fulgoroidea) from southeastern Asia and New Guinea, with notes on morphology and evolution of the family. *Proceedings of the Zoological Institute RAS* 324 (3): 306–345.

Gnezdilov V.M. & Fletcher M.J. 2010. A review of the Australian genera of the planthopper family Issidae (Hemiptera: Fulgoromorpha) with description of an unusual new species of *Chlamydopteryx* Kirkaldy. *Zootaxa* 2366: 35–45.

Gnezdilov V.M., Konstantinov F.V. & Bodrov S.Y. 2020. New insights into the molecular phylogeny and taxonomy of the family Issidae (Hemiptera: Auchenorrhyncha: Fulgoroidea). *Proceedings of the Zoological Institute RAS* 324: 146–161. https://doi.org/10.31610/trudyzin/2020.324.1.146

Gnezdilov V.M., Konstantinov F.V. & Namyatova A.A. 2022. From modern to classic: Classification of the planthopper family Issidae (Hemiptera, Auchenorrhyncha, Fulgoroidea) derived from a total-evidence phylogeny. *Systematic Entomology* 47 (4): 551–568. https://doi.org/10.1111/syen.12546

Jacobi A. 1928. Results of Dr E. Mjöberg's Swedish Scientific Expeditions to Australia 1910–1913. Rhynchota Homoptera. 1. Fulgoridae und Cercopidae. *Arkiv för Zoologi* 19A (28): 1–50.

Kirkaldy G.W. 1906. Leaf hoppers and their natural enemies. *Bulletin of the Experiment Station of the Hawaiian Sugar Planters' Association, Division of Entomology* 1 (9): 271–479. Available from https://biodiversitylibrary.org/page/15499805 [accessed 14 Nov. 2022].

Kirkaldy G.W. 1907. Leaf hoppers supplement (Hemiptera). *Bulletin of the Experiment Station of the Hawaiian Sugar Planters' Association, Division of Entomology* 3: 1–186. Available from https://biodiversitylibrary.org/page/15500139 [accessed 14 Nov. 2022].

Metcalf Z.P. 1958. Fascicle IV, Fulgoroidea. Part 15. Issidae. *In*: Metcalf Z. P. (ed.) *General Catalogue of the Homoptera. Fascicule IV*. North Carolina State College, Raleigh.

Moir M.L. & Brennan K.E.C. 2020. Incorporating coextinction in threat assessments and policy will rapidly improve the accuracy of threatened species lists. *Biological Conservation* 249: 108715. https://doi.org/10.1016/j.biocon.2020.108715

O'Brien L.B. & Wilson S.W. 1985. Planthoppers systematics and external morphology. *In*: Nault L.R. & Rodriguez J.G. (eds) *The Leafhoppers and Planthoppers*: 61–102. John Wiley & Sons, New York.

Shorthouse D.P. 2010. SimpleMappr, an online tool to produce publication-quality point maps. Retrieved from http://www.simplemappr.net [accessed 12 Nov. 2022].

Taxonomy Decadal Plan Working Group 2018. *Discovering Biodiversity: A Decadal Plan for Taxonomy and Biosystematics in Australia and New Zealand 2018–2027*. Australian Academy of Science and Royal Society Te Apārangi, Canberra / Wellington. Available from https://royalsociety.org.nz/assets/Uploads/Discovering-Biodiversity-decadal-plan.pdf [accessed 27 Aug. 2023].

Wang M.-L., Zhang Y.-L. & Bourgoin T. 2016. Planthopper family Issidae (Insecta: Hemiptera: Fulgoromorpha): linking molecular phylogeny with classification. *Molecular Phylogenetics and Evolution* 105: 224–234. https://doi.org/10.1016/j.ympev.2016.08.012

Wang M.-L., Zhang Y.-L. & Bourgoin T. 2019. On the tribe Sarimini with two new genera from south of China (Hemiptera, Fulgoromorpha, Issidae). *Zootaxa* 4706 (2): 375–383. https://doi.org/10.11646/zootaxa.4706.2.10

Manuscript received: 29 November 2022
Manuscript accepted: 8 May 2023
Published on: 22 September 2023
Topic editor: Tony Robillard
Section editor: Christopher H. Dietrich
Desk editor: Eva-Maria Levermann