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Australian Cleotychini planthoppers: review of the genus *Cleotyche* Emeljanov, 1997 with three new species (Hemiptera: Fulgoromorpha: Dictyopharidae)

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Abstract. The genus *Cleotyche* in the monotypic Australian planthopper tribe Cleotychini (Fulgoroidea: Dictyopharidae) is reviewed. The subgenus *Griseotyche* subgen. nov. is described to accommodate one species *Cleotyche blanda* Emeljanov, 2011 while the second species, *C. mariae* Emeljanov, 1997, is retained in the subgenus *Cleotyche* (*Cleotyche*) Emeljanov, 1997. Three new species of *Cleotyche* (*Cleotyche*) from Queensland, *C.* (*Cleotyche*) *christinae* sp. nov. from Cania Gorge National Park, *C.* (*Cleotyche*) *francescoi* sp. nov. from Eurimbula National Park and *C.* (*Cleotyche*) *montana* sp. nov. from Blackdown Tableland National Park are described and compared to the type species of the subgenus, *C.* (*Cleotyche*) *mariae* Emeljanov, 1997. Illustration of the type specimens, male and female whenever available, and a distribution map are provided for the five species of the genus. The male genitalia and habitat of the three new species are illustrated. The tribe Cleotychini now contains one genus, *Cleotyche* with two subgenera and five species. Biological, ecological and biogeographical information is provided where available for each species. The diversity of Australian Dictyopharidae and mimicry of jumping spiders (Araneae: Salticidae) in Cleotychini are discussed briefly.

Keywords. Auchenorrhyncha, Fulgoroidea, Caliscelidae, Salticidae, spider-mimic, Australia.

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Introduction

The family Dictyopharidae Spinola, 1839 contains 160 genera and 740 species according to the FLOW database (Bourgoin 2022), representing about 5.3% of the species of Fulgoromorpha Evans, 1946. The Australian fauna of Dictyopharidae is poorly documented and currently includes only about 2% of the global dictyopharid fauna with 15 described species in eight genera. These low numbers are likely a result of too little taxonomic work and possibly also of an impoverished fauna.

The genus *Cleotyche* Emeljanov, 1997 was established by Emeljanov (1997) to include *C. mariae* Emeljanov, 1997 from New South Wales. A separate tribe, Cleotychini Emeljanov, 1997, within the subfamily Dictyopharinae Spinola, 1839, was erected to accommodate *Cleotyche*, which superficially resembles members of the Caliscelidae Amyot & Serville, 1843 (Emeljanov 1997). Later, a second species, *C. blanda* Emeljanov, 2011 was described from Western Australia (Emeljanov 2011), unfortunately without any illustration. Emeljanov (1997, 2011) treated the tribe Cleotychini as a sister group of the Neotropical tribes Nersiini Emeljanov, 1983 and Taosini Emeljanov, 1983 based on the trigons on the vertex in both groups. More recently, Song *et al*. (2018) in their morphological phylogeny of the family Dictyopharidae, placed Taosini as sister to Lappidini Emeljanov, 1983, both sister to Nersiini (all three tribes exclusively Neotropical) and excluded Cleotychini from the Dictyopharidae, leaving it as an incertae sedis tribe within Fulgoroidea Latreille, 1807. However, the phylogeny proposed by Song *et al*. (2018) did not include any Cleotychini species and no specimen belonging to the tribe was examined; the eight characters given to justify the exclusion of the tribe from Dictyopharidae were all extracted from Emeljanov's (1997, 2011) descriptions.

Behavioural observations of Cleotychini including possible mimicry of jumping spiders were reported by Moir & Fletcher (2012). In this case, the planthoppers wave their forelegs with contrasting white tarsi similar to the way Salticidae Blackwill, 1841 (particularly males) move their forelegs and pedipalps.

Recent expeditions in Queensland during December 2019 and March 2020 have revealed three new species of *Cleotyche*, all collected by sweeping grass in open forests of *Eucalyptus* L'Her. The description and photographs of the type specimen of *C. blanda* allowed us to assess the consistency of the generic characters of *Cleotyche*, and to conclude that *C. blanda* displays significant differences with the other species in the genus, supporting the erection of a new subgenus.

Here, we describe the new subgenus *Griseotyche* subgen. nov. to accommodate *C. blanda*. In addition, we describe three new species of *Cleotyche*: *C.* (*Cleotyche*) *christinae* sp. nov., *C.* (*Cleotyche*) *francescoi* sp. nov. and *C.* (*Cleotyche*) *montana* sp. nov., as well as include notes on their ecology and biology and compare each of them to the other species. Finally, we provide an identification key and biogeographic information for all taxa within the tribe Cleotychini.

Material and methods

Male genitalia dissections followed a standard process. Specifically, the pygofer was separated from the abdomen of the fresh specimen and the aedeagus was extracted after soaking the organs for approximately 12 hours in a 10% solution of potassium hydroxide (KOH) at room temperature. The aedeagus was subsequently dissected with a needle blade for examination. The organs were then placed in glycerine for preservation, in a polyethylene genitalia tube attached to the pin of the specimen.

The external morphological terminology follows O'Brien & Wilson (1985) with additions from Emeljanov (1997), and for the male genitalia, Bourgoin & Huang (1990). Morphometric characters were recorded including the metatibiotarsal formula which gives the number of spines on the (side of metatibia) apex of metatibia / apex of first metatarsus / apex of second metatarsus. For example, the

metatibiotarsal formula: (1) 6 (2-4)/2/2 represents 1 spine on the side of metatibia, 6 teeth on the apex of metatibia (in two groups: 2 internal and 4 external, separated by a diastema), 2 spines on the apex of first metatarsus, and 2 spines on the apex of second metatarsus.

Further measurements were taken as in Constant (2004) with additions for the anterior legs.

Abbreviations for measurements

BF = maximum breadth of the frons
BPf = maximum breadth of the profemur
BPt = maximum breadth of the protibia
BTg = maximum breadth of the tegmen
BV = maximum breadth of the vertex
LF = length of the frons in median line
LPf = total length of the profemur
LPt = total length of the protibia
LTg = maximum length of the tegmen
LT = total length (apex of head to apex of abdomen)
LV = length of the vertex in median line

Photographs of the type specimen habitus and male genitalia were taken with a Leica EZ4W stereo microscope with integrated camera, stacked with CombineZ software and optimized with Adobe Photoshop ver. CS3. The distribution map was produced with SimpleMappr (Shorthouse 2010). Other photographs were provided by the respective institutions where the specimens are housed and credited accordingly in figure captions.

Institutional abbreviations

ANIC = Australia National Insect Collection, Canberra, Australia
DPIRD = Department of Primary Industries and Regional Development, Perth, Western Australia, Australia
HNHM = Hungarian Natural History Museum, Budapest, Hungary
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 Dictyopharidae Spinola, 1839
Subfamily Dictyopharinae Spinola, 1839

Tribe **Cleotychini** Emeljanov, 1997

Diagnosis

Habitus reminiscent of Caliscelidae (Hemiptera: Fulgoromorpha), with pyriform body shape and the anterior part of body slightly compressed. Head with well delimited trigons (triangular area delimited by carinae at anterior angles of vertex). Frons approximately rectangular, parallel-sided, much longer

than wide. Vertex subquadrate, longer than wide. Apical segment of the labium half as long as subapical segment. Pronotum elongate (slightly shorter than vertex along mid-line), dorsally tricarinate, with a single lateral keel on each side and posterior margin nearly straight. Mesonotum smooth, carinae nearly obsolete. Tegmina strongly reduced, without carina; clavus not defined. Tegulae absent. Dorsum of abdomen without carinae. Procoxae with outer carina extended into triangular apical lobe. Profemora and protibiae flattened and dilated, often foliate. Metatibiae with two lateral spines, one near tibiofemoral joint and one in distal half of tibia. Apex of metatibiae with 6 teeth separated in two groups: 2 teeth on internal side and 4 on external side. First and second segments of metatarsus with platellae instead of spines, except large lateral common teeth without setae. Arolium with one pair of chetoid sensilla. Claws with 3 setae. Sternite VIII of males fused with pygofer. Pygofer with broad base, narrowed backwards in ventral view. Gonostyli without dorsal teeth (such as in *Orthopagus* Uhler, 1897 species for example) but with dorsal lobe bearing a dorsolateral hook. Connective fused with lower wall of pygofer, largely connected with base of gonostyli. Lateral lobe of gonoplacs (third valvae of ovipositor) without appendix; medial lobe of gonapophyses VIII (first valvae of ovipositor) with two nervures; lateral lobes with bidentate apex.

Remark

The tribe Cleotychini is here conservatively retained within the family Dictyopharidae until more detailed phylogenetic studies confirm or refute the familial placement (see also discussion below).

Genus ***Cleotyche*** Emeljanov, 1997

Cleotyche Emeljanov, 1997: 78 [described, compared to *Caliscelis* De Laporte, 1833, *Parorgerioides* de Bergevin, 1928 and *Anorgeriopus* Kusnezov, 1930].

Type species

Cleotyche mariae Emeljanov, 1997, by monotypy and original designation.

Diagnosis

Only genus in the tribe.

Description

Body. Pyriform; anterior part of body slightly compressed laterally.

Head. Trigons (triangular area delimited by carinae at anterior angles of vertex) well delimited. Frons subrectangular, narrow, parallel-sided, much longer than wide, with three longitudinal carinae and often two additional incomplete carinae on dorsal portion. Vertex subquadrate, longer than wide, with median carina. Clypeus elongate and narrow, subtriangular. Apical segment of the labium half as long as subapical segment.

Thorax. Pronotum smooth, elongate (slightly shorter than vertex along mid-line), tricarinate, with a single lateral keel on each side and posterior margin nearly straight. Mesonotum about ⅔ as long as pronotum, smooth with carinae nearly obsolete.

Tegmina. Strongly reduced, without carina, truncate apically and slightly widening from base to apex; clavus not defined. Tegulae absent.

Legs. Procoxae with triangular, lobe-shaped carina. Profemora and protibiae flattened and dilated, often foliate; with internal margin more or less evenly curved. Mesofemora and mesotibiae elongate and slender. Metatibiae with two lateral spines, one near tibiofemoral joint and one in distal half of tibia.

Apex of metatibiae with 6 teeth separated in two groups: 2 teeth on internal side and 4 on external side. First and second segments of metatarsus with platellae instead of spines, except large lateral common teeth without setae. Arolium with one pair of chetoid sensilla. Claws with 3 setae.

Abdomen. Dorsoventrally flattened. Dorsum of abdomen without carinae.

Male terminalia. Pygofer narrow in lateral view, suboval and about much wider than high in posterior view; anterior and posterior margins rounded in lateral view; posterior margin deeply notched in dorsal and ventral view. Gonostyli rather compact, longer than high in lateral view, very elongate in ventral view; dorsal margin smoothly sinuate in lateral view; posteroventral margin rounded in lateral view; strong basidorsal lateral hook. Aedeagus elongate and narrow in dorsal view, with 2 pairs of membranous processes, each bearing a sclerotized spine; phallobase with 2 elongate sclerotized dorsal processes; connective elongate and narrow. Anal tube more or less oval in dorsal view with rounded apical margin; ventral margin sinuate; 2 strong apicolateral teeth directed ventrad.

Species included (type locality in parentheses)

Cleotyche (*Griseotyche*) *blanda* Emeljanov, 2011 (Stirling Range National Park, Western Australia)
Cleotyche (*Cleotyche*) *christinae* sp. nov. (Cania Gorge National Park, Queensland)
Cleotyche (*Cleotyche*) *francescoi* sp. nov. (Eurimbula National Park, Queensland)
Cleotyche (*Cleotyche*) *mariae* Emeljanov, 1997 (Pearl Beach, New South Wales)
Cleotyche (*Cleotyche*) *montana* sp. nov. (Blackdown Tableland National Park, Queensland)

Identification key to the subgenera and species of Cleotychini Emeljanov, 1997

1. Ground colour pale grey (Fig. 16A); transverse white stripe on frons continuing laterally along body, becoming less distinct on abdomen (Fig. 16B–C); no white band along apical margin of tegmina (Fig. 16A) (subgenus *Griseotyche*) ..... ***C.* (*Griseotyche*) *blanda*** Emeljanov, 2011
– Ground colour dark brown (Fig. 1); no transverse white stripe on frons nor lateral white stripe along side of body (Fig. 2C); white band along apical margin of tegmina (Fig. 1) (subgenus *Cleotyche*) 2

2. Profemora and protibiae narrower, more than 3 × as long as broad (Fig. 1A, D; Table 1) 3
– Profemora and protibiae broader, less than 3 × as long as broad (Fig. 1B–C; Table 1) 4

3. Profemora more slender, 3.78 × as long as broad; tibiae slightly broader than femora; vertex 1.56 × as long as broad (Fig. 1A) ..... ***C.* (*Cleotyche*) *christinae*** sp. nov.
– Profemora broader, 3.16 × as long as broad; tibiae slightly narrower than femora; vertex 2.10 × as long as broad (Fig. 1D) ..... ***C.* (*Cleotyche*) *montana*** sp. nov.

4. Profemora and protibiae broader, 2.55 and 2.73 × as long as broad, respectively; vertex less elongate, 1.71 × as long as than broad (Fig. 1B) ..... ***C.* (*Cleotyche*) *francescoi*** sp. nov.
– Profemora and protibiae narrower, 2.91 and 2.93 × as long as broad, respectively; vertex less elongate, 2.04 × as long as broad (Fig. 1C) ..... ***C.* (*Cleotyche*) *mariae*** Emeljanov, 1997

***Cleotyche* (*Cleotyche*)** Emeljanov, 1997

Type species

Cleotyche mariae Emeljanov, 1997, by present designation.

Diagnosis

Ground colour brown to dark brown (pale grey in *Cleotyche* (*Griseotyche*)). No transverse white stripe on face nor lateral white stripe on body (transverse whitish stripe on frons continues along side of

Table 1. Comparative morphometric ratios of species of *Cleotyche* (*Cleotyche*) Emeljanov, 1997.

	Frons LF/BF	Vertex LV/BV	Tegmen LTg/BTg	Profemur LPf/BPf	Protibia LPt/BPt	Protibia vs Profemur BPt/BPf
C. (*Cleotyche*) *christinae* sp. nov.	3.12	1.56	1.39	3.78	3.34	1.15
C. (*Cleotyche*) *francescoi* sp. nov.	3.65	1.71	1.12	2.55	2.73	0.96
C. (*Cleotyche*) *mariae* Emeljanov, 1997	3.94	2.04	1.17	2.91	2.93	1.07
C. (*Cleotyche*) *montana* sp. nov.	3.39	2.10	1.32	3.16	3.52	0.92

body, becoming less distinct and greyish on abdomen in *Cleotyche* (*Griseotyche*)). White band along apical margin of tegmina (absent in *Cleotyche* (*Griseotyche*)). No visible dark spots on segments of the abdomen dorsally where the sensory pits occur (small dark spots on all visible segments of the abdomen dorsally where the sensory pits occur in *Cleotyche* (*Griseotyche*)).

Cleotyche* (*Cleotyche*) *christinae sp. nov.
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Figs 2–6, Table 1

Diagnosis

The species can be separated from the other species of *Cleotyche* (*Cleotyche*) by the combination of the following characters:

1. Profemora slender, 3.78 × as long as broad, and slightly narrower than tibiae (Figs 2A, 3A).
2. Vertex rather short, 1.56 × as long as broad (Figs 2F, 3F).
3. Vertex and anterior portion of pronotum dark brown (Figs 2F, 3F).

Differential diagnosis

This species differs from the three other species by the relatively slender profemora (profemora 3.78 × as long as broad vs max. 3.16 × in other species).

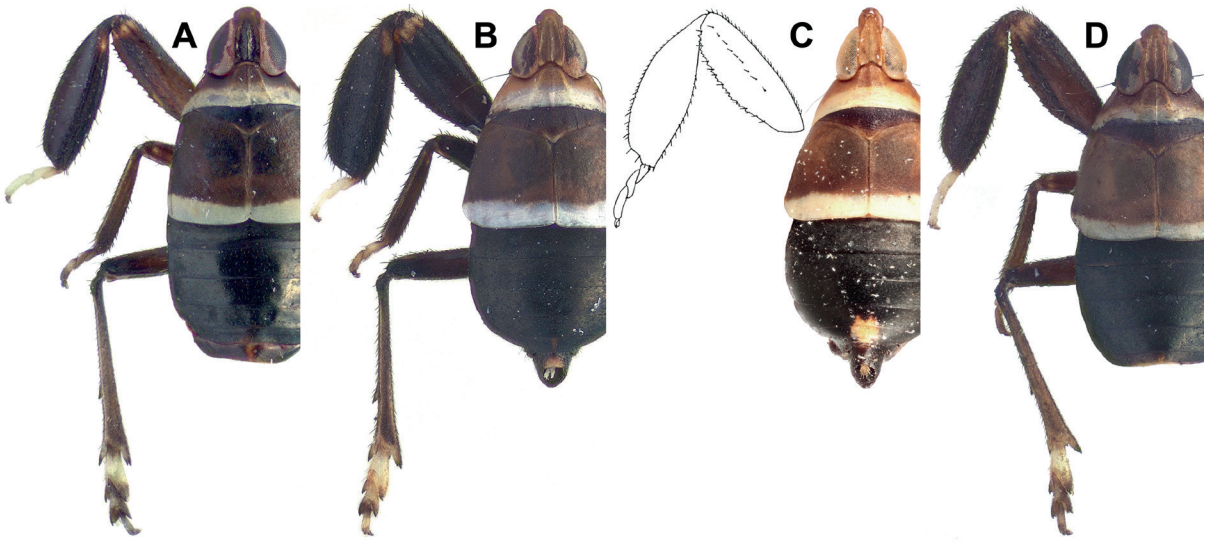

Fig. 1. *Cleotyche* (*Cleotyche*) Emeljanov, 1997 spp. of eastern Australia, ♂♂, dorsal view. **A**. *C.* (*Cleotyche*) *christinae* sp. nov. **B**. *C.* (*Cleotyche*) *francescoi* sp. nov. **C**. *C.* (*Cleotyche*) *mariae* Emeljanov, 1997. **D**. *C.* (*Cleotyche*) *montana* sp. nov.

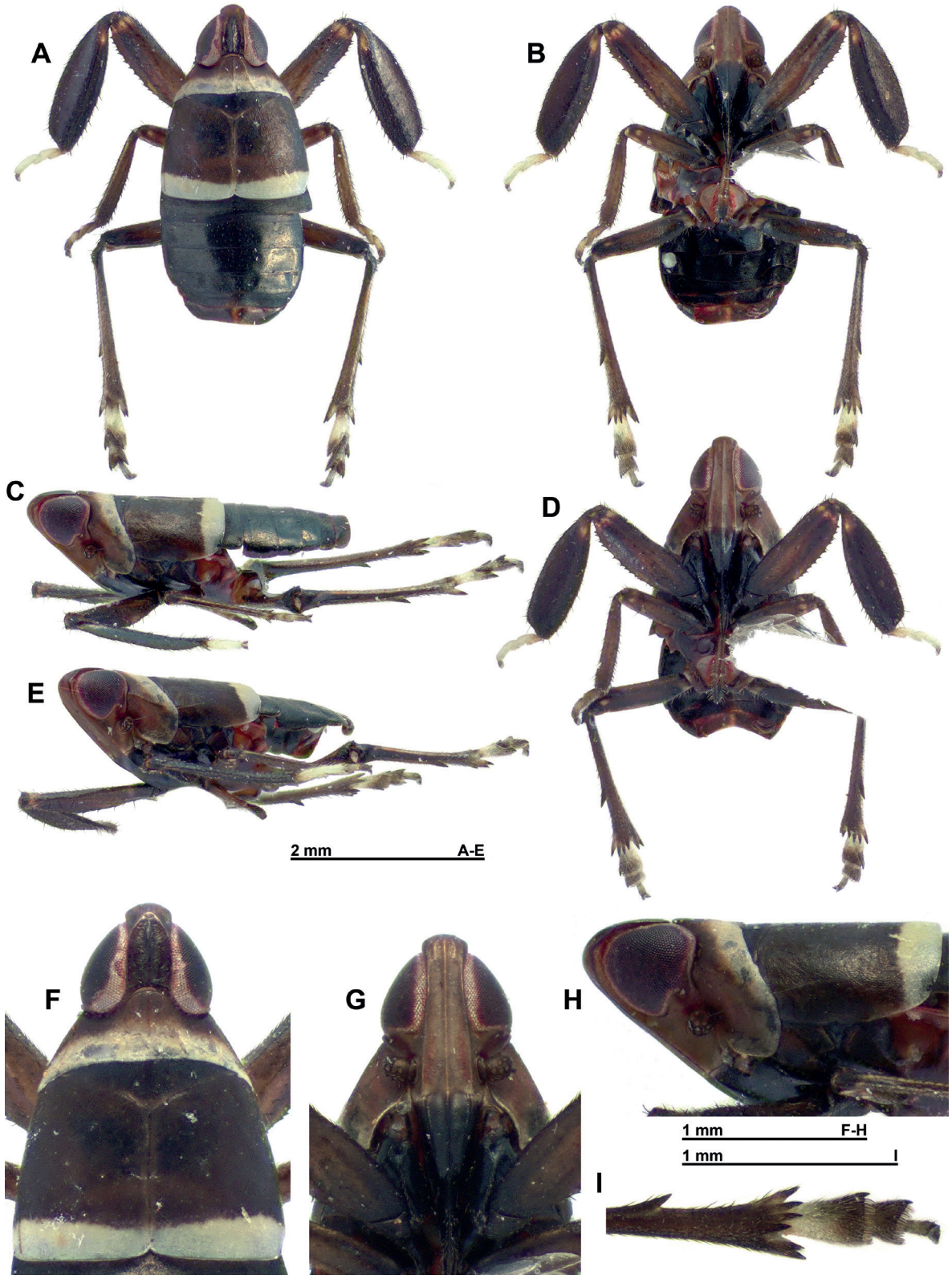

Fig. 2. *Cleotyche* (*Cleotyche*) *christinae* sp. nov., ♂, holotype (QM). **A**. Habitus dorsal view. **B**. Habitus, ventral view. **C**. Habitus, lateral view. **D**. Habitus, perpendicular view of frons. **E**. Habitus, anterolateral view. **F**. Head and thorax, dorsal view. **G**. Frons, perpendicular view. **H**. Head and thorax, lateral view. **I**. Distal portion of posterior leg, ventral view.

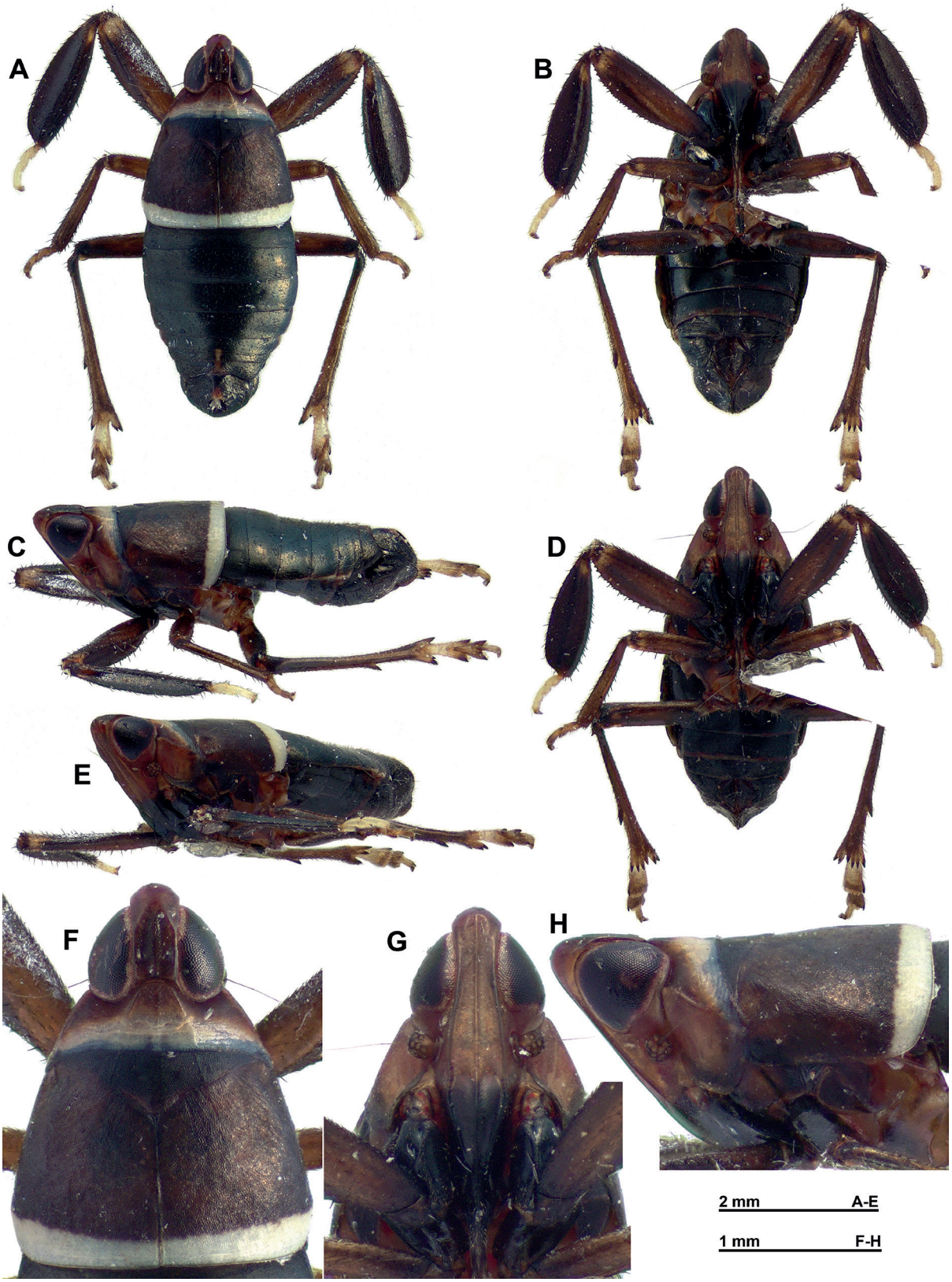

Fig. 3. *Cleotyche* (*Cleotyche*) *christinae* sp. nov., ♀, paratype (QM). **A**. Habitus dorsal view. **B**. Habitus, ventral view. **C**. Habitus, lateral view. **D**. Habitus, perpendicular view of frons. **E**. Habitus, anterolateral view. **F**. Head and thorax, dorsal view. **G**. Frons, perpendicular view. **H**. Head and thorax, lateral view.

The most similar species is *C.* (*Cleotyche*) *montana* sp. nov. which additionally differs from *C.* (*Cleotyche*) *christinae* sp. nov. by character 2 (vertex 2.10 × as long as broad vs 1.56 × in *C.* (*Cleotyche*) *christinae* sp. nov.).

Etymology

The species epithet refers to Dr Christine Lambkin (QM) in acknowledgement for all her proactive support of the authors' research projects in Queensland.

Type material

Holotype

AUSTRALIA • ♂; [Queensland]; Cania Gorge N.P.; 24°43′14″ S, 150°59′21″ E; 13 Dec. 2019; sweeping [grasses]; J. Constant, F. Martoni, M. Moir and L. Semeraro leg.; "Australia Qld, Cania Gorge N.P., 24°43′14″S 150°59′21″E, 13.xii.2019, sweeping, leg. J. Constant, F. Martoni, M. Moir & L. Semeraro"; QM.

Paratype

AUSTRALIA • 1 ♀; same collection data as for holotype; QM.

Description

Measurements and ratios. LT: ♂ (n = 1): 3.50 mm; ♀ (n = 1): 4.85. LTg/BTg = 1.39; LV/BV = 1.56; LF/BF = 3.12; LPf/BPf = 3.78; LPt/BPt = 3.34.

Head (Figs 2F–H, 3F–H). Yellow-brown with vertex dark brown and clypeus black; labium yellow brown with distal part of terminal segment black. Vertex elongate, 1.56 × as long as broad, roundly pointed anteriorly, with complete median carina and with lateral margins slightly carinate and parallel; posterior margin roundly incurved. Frons elongate, straight in lateral view, with sides subparallel, 3.12 × as long as broad, anteriorly rounded in perpendicular view, with three carinae, one median and one along each lateral margin, all extending to apex of clypeus; two weak, short carinae between median and sublateral carinae extending from dorsal margin along 1/5 of the way along the frons. Clypeus elongate and narrow, triangular. Eyes rather large, moderately protruding laterally. Antennae with scape short and cylindrical; pedicel short, inflated, barrel-shaped and with large sensory plates on ventral portion. Ocelli absent. Labium elongate and narrow, reaching posterior trochanters and with apical segment elongate, about half as long as penultimate one.

Thorax (Figs 2E–H, 3E–H). Pronotum brown with posterior half whitish extending in a whitish band along posterior margin of paranotal lobes; mesonotum dark brown, darker than anterior portion of pronotum; thoracic sternites dark brown. Pronotum smooth with anterior margin strongly bisinuate, roundly projecting anteriorly behind vertex and roundly emarginate behind eyes, and posterior margin weakly incurved; median longitudinal carina and two lateral carinae on disc merging anteriorly along anterior margin; lateral carina behind eye; paranotal lobe broad, angularly rounded posteroventrally. Mesonotum very short, about ⅔ as long as pronotum, smooth with three very weakly marked obsolete carinae prolongating pronotal ones. Tegulae absent.

Tegmina (Figs 2A, C, F, H, 3A, C, F, H). Brown with rather broad white band along posterior margin, covering about 1/5 of tegmina length; slightly elongate in dorsal view, 1.39 × as long as broad, slightly broadening from base to apex, truncate apically, convex, smooth; no trace of venation.

Legs (Figs 2A–D, I, 3A–D). Brown with pro- and mesocoxae and trochanters black; profemora paler than protibiae; apical pale yellowish interrupted ring on pro- and mesofemora; protibiae with basal pale yellow marking dorsally and ventrally; protarsi white; apex of metafemora and base of metatibiae darker;

metatarsi brown with basal ⅔ of first metatarsomere and most of third one, whitish. Profemora and protibiae moderately foliaceous, rather slender, 3.78 and 3.34 × as long as broad, respectively; protibiae 1.15 × as broad as profemora; profemora with anterior margin straight and posterior margin broadly

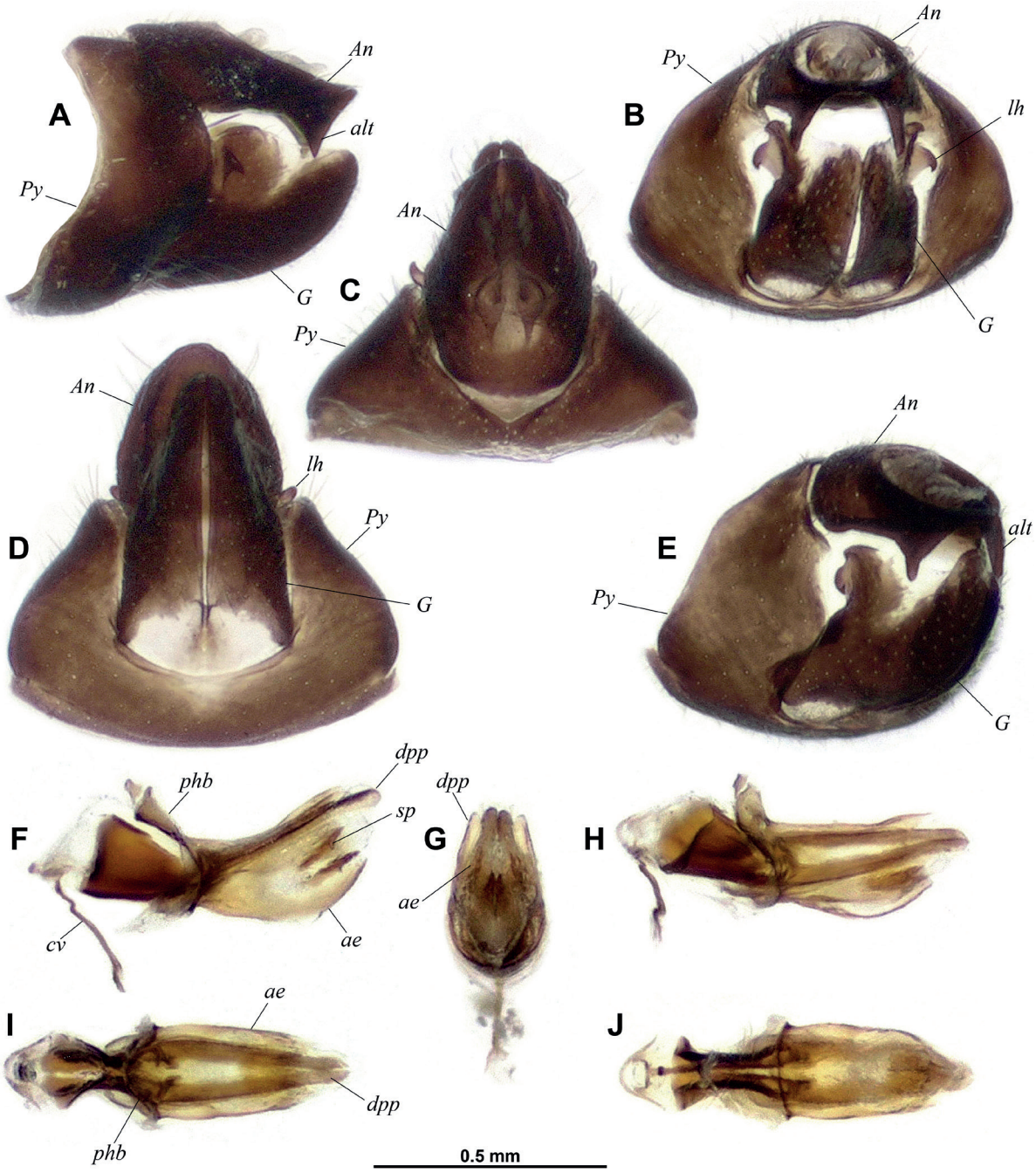

Fig. 4. *Cleotyche* (*Cleotyche*) *christinae* sp. nov., ♂, holotype (QM). **A–E**. Pygofer, anal tube and gonostyli. **A**. Left lateral view. **B**. Caudal view. **C**. Dorsal view. **D**. Ventral view. **E**. Laterocaudal view. **F–J**. Aedeagus. **F**. Left lateral view. **G**. Caudal view. **H**. Dorsolateral view. **I**. Dorsal view. **J**. Ventral view. Abbreviations: *ae* = aedeagus; *alt* = apicolateral tooth of anal tube; *An* = anal tube; *cv* = connective; *dpp* = dorsal process of phallobase; *G* = gonostylus; *lh* = lateral hook of gonostylus; *phb* = phallobase; *Py* = pygofer; *sp* = spine of aedeagus.

rounded, with 12–14 small teeth; protibiae with margins broadly rounded and external margin roundly truncate apically; median and posterior legs elongate and slender; metatibiae broadening towards apex, with one ventrolateral spine at distal 3/5 and 6 apical spines; first and second metatarsomeres with strong spine at each side and apical row of 12 platellae ventrally. Metatibiotarsal formula: (2) 6 (2-4)/2/2.

Abdomen (Figs 2A–D, 3A–D). Black with median yellowish marking on dorsal surface of last segment in male (Fig. 2A), on two last segments in female (Fig. 3A); small yellowish marking on anal tube at base of anal column. Abdomen dorsoventrally flattened and smooth.

Male terminalia (Fig. 4). Pygofer (*Py*) (Fig. 4A–E) narrow in lateral view, 2.5 × as high as long at mid-height, suboval and about 1.4 × as wide as high in posterior view; anterior and posterior margins rounded in lateral view; posterior margin deeply notched in dorsal and ventral view, with V-shaped notch dorsally and U-shaped notch ventrally. Gonostyli (*G*) (Fig. 4A–E) rather compact, 1.63 × as long as high in lateral view, 3.4 × as long as wide at base in ventral view, slightly surpassing anal tube; dorsal margin smoothly sinuate in lateral view; posteroventral margin strongly rounded in lateral view; strong basidorsal lateral hook (*lh*) curved lateroventrad, with dorsal margin rounded in caudal view. Aedeagus (*ae*) (Fig. 4F–J) elongate and narrow in dorsal view, with 2 pairs of membranous processes, each bearing an anteapical lateral sclerotized spine (*sp*); phallobase (*phb*) with 2 elongate, narrow, straight, sclerotized dorsal processes (*dpp*); connective (*cv*) elongate and narrow. Anal tube (*An*) (Fig. 4A–E) in dorsal view obovate, 1.45 × as long as wide, widest at basal 2/5, with apical margin rounded and with anal opening at basal 36% of length; ventral margin sinuate with posterior half regularly roundly concave before 2

Fig. 5. Habitat of *Cleotyche* (*Cleotyche*) *christinae* sp. nov. in Cania Gorge National Park, 13 Dec. 2019.

strong apicolateral teeth (*alt*); teeth with posterior margin slightly concave in lateral view, rather narrow and slightly diverging in caudal view; length of teeth along posterior margin in lateral view equals ⅓ of length of anal tube.

Biology

The specimens were collected by sweeping grass in an open area in the valley of Three Moon Creek (Fig. 5).

Distribution

Australia, SE Queensland, Cania Gorge National Park (Fig. 6).

Cleotyche* (*Cleotyche*) *francescoi sp. nov.

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Figs 6–10, Table 1

Diagnosis

The species can be separated from the other *Cleotyche* (*Cleotyche*) species by the combination of the following characters:
1. Profemora very broad, only 2.55 × as long as broad, and slightly broader than protibiae (Figs 7A, 8A).
2. Vertex rather short, 1.71 × as long as broad (Figs 7F, 8F).
3. Vertex and anterior portion of pronotum pale brown (Figs 7F, 8F).

Differential diagnosis

This species differs from the three other species by its broad profemora (profemora 2.55 × as long as broad vs min. 2.91 × in the three other species).

The most similar species is *C.* (*Cleotyche*) *mariae* Emeljanov, 1997 which additionally differs by character 2 (vertex more elongate, 2.04 × as long as broad vs 1.71 × in *C.* (*Cleotyche*) *francescoi* sp. nov.).

Etymology

The species epithet refers to Dr Francesco "*Bacon*" Martoni (VAIC) in acknowledgement for all his help and enthusiasm during the field work in Queensland in December 2019.

Type material

Holotype

AUSTRALIA • ♂; [Queensland]; Eurimbula N.P., Ganoonga Noonga Lookout; 24°12′05″ S, 151°48′11″ E; 9 Dec. 2019; sweeping [grasses]; J. Constant, F. Martoni, M. Moir and L. Semeraro leg.; "Australia Qld, Eurimbula N.P., Ganoonga Noonga Lookout, 24°12′05″S 151°48′11″E, 9.xii.2019, sweeping, leg. J. Constant, F. Martoni, M. Moir & L. Semeraro"; QM.

Paratypes

AUSTRALIA • 4 ♂♂, 1 ♀; same collection data as for holotype; QM • 3 ♂♂, 1 ♀; same collection data as for holotype; DPIRD • 4 ♂♂; same collection data as for holotype; RBINS.

Description

Measurements and ratios. LT: ♂ (n = 2): 4.04 mm (3.94–4.14); ♀ (n = 1): 4.69. LTg/BTg = 1.12; LV/BV = 1.71; LF/BF = 3.65; LPf/BPf = 2.55; LPt/BPt = 2.73.

Head (Figs 7F–H, 8F–H). Yellow-brown with clypeus glossy black; labium brown with terminal segment black. Vertex elongate, 1.71 × as long as broad, projected anteriorly, rounded to a blunt point apically, with median carina not reaching anterior margin and with lateral margins carinate and incurved; posterior margin roundly concave. Frons elongate, with sides subparallel, weakly narrowing along eyes, 3.65 × as long as broad, straight in lateral view, anteriorly rounded, projected to a blunt point in perpendicular view, with three complete carinae, one median and one along each lateral margin, all extending to apex of clypeus; two weak, short carinae between median and sublateral carinae extending from dorsal margin along 1/5 of the way along the frons. Clypeus elongate and narrow, triangular. Eyes rather large, moderately protruding laterally. Antennae with scape short and cylindrical; pedicel short, inflated, barrel-shaped and with large sensory plates on ventral portion. Ocelli absent. Labium elongate and narrow, reaching posterior trochanters and with apical segment elongate, about half as long as penultimate one.

Thorax (Figs 7E–H, 8E–H). Pronotum yellow-brown with posterior half whitish extending in a whitish band along posterior margin of paranotal lobes; mesonotum dark brown, darker than anterior portion of pronotum, with apex of scutellum slightly paler; thoracic sternites glossy black. Pronotum smooth with anterior margin strongly bisinuate, roundly projecting anteriorly behind vertex and roundly emarginate behind eyes, and posterior margin weakly incurved; median longitudinal carina and two lateral carinae on disc merging anteriorly along anterior margin; lateral carina behind eye; paranotal lobe angularly

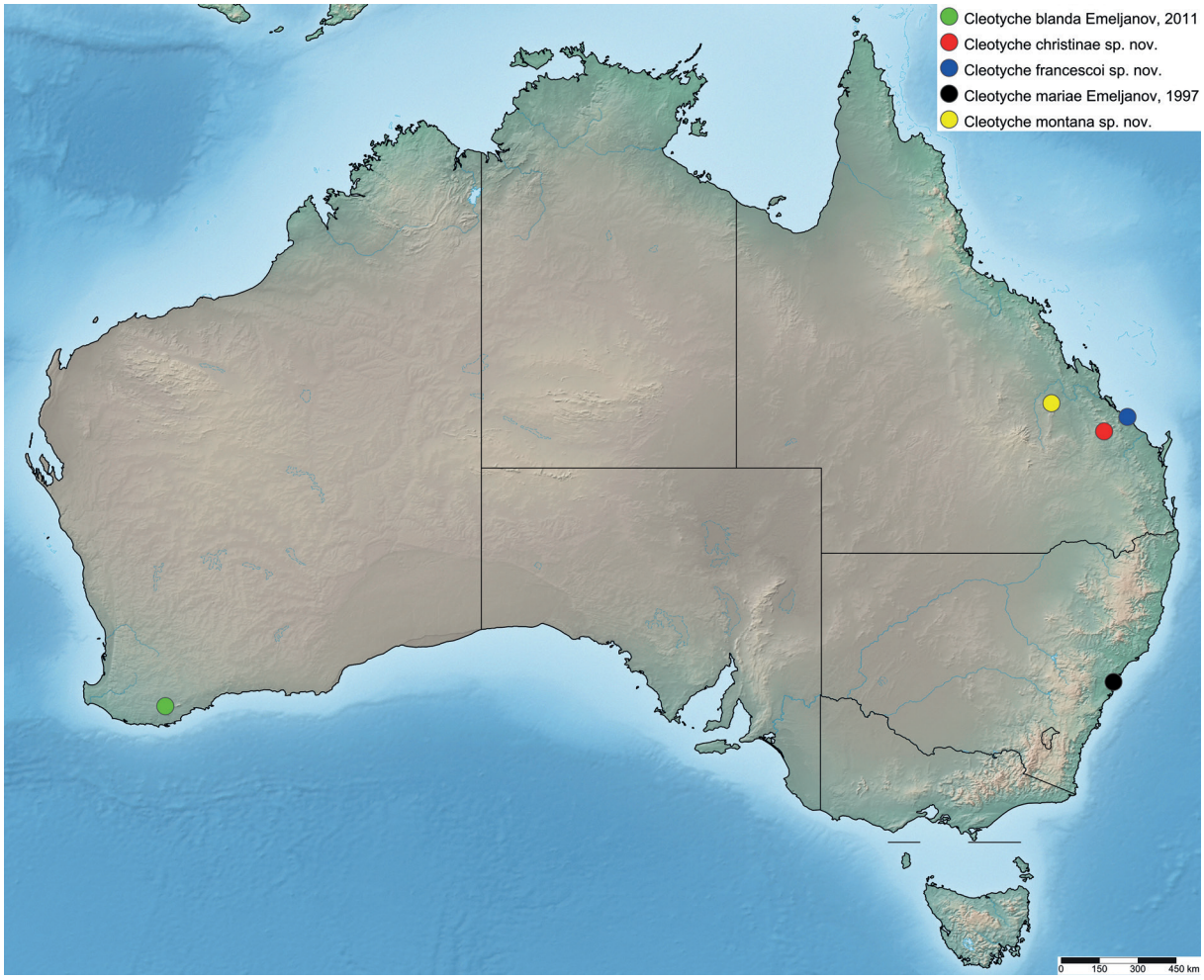

Fig. 6. The distribution of described species of Cleotychini in Australia.

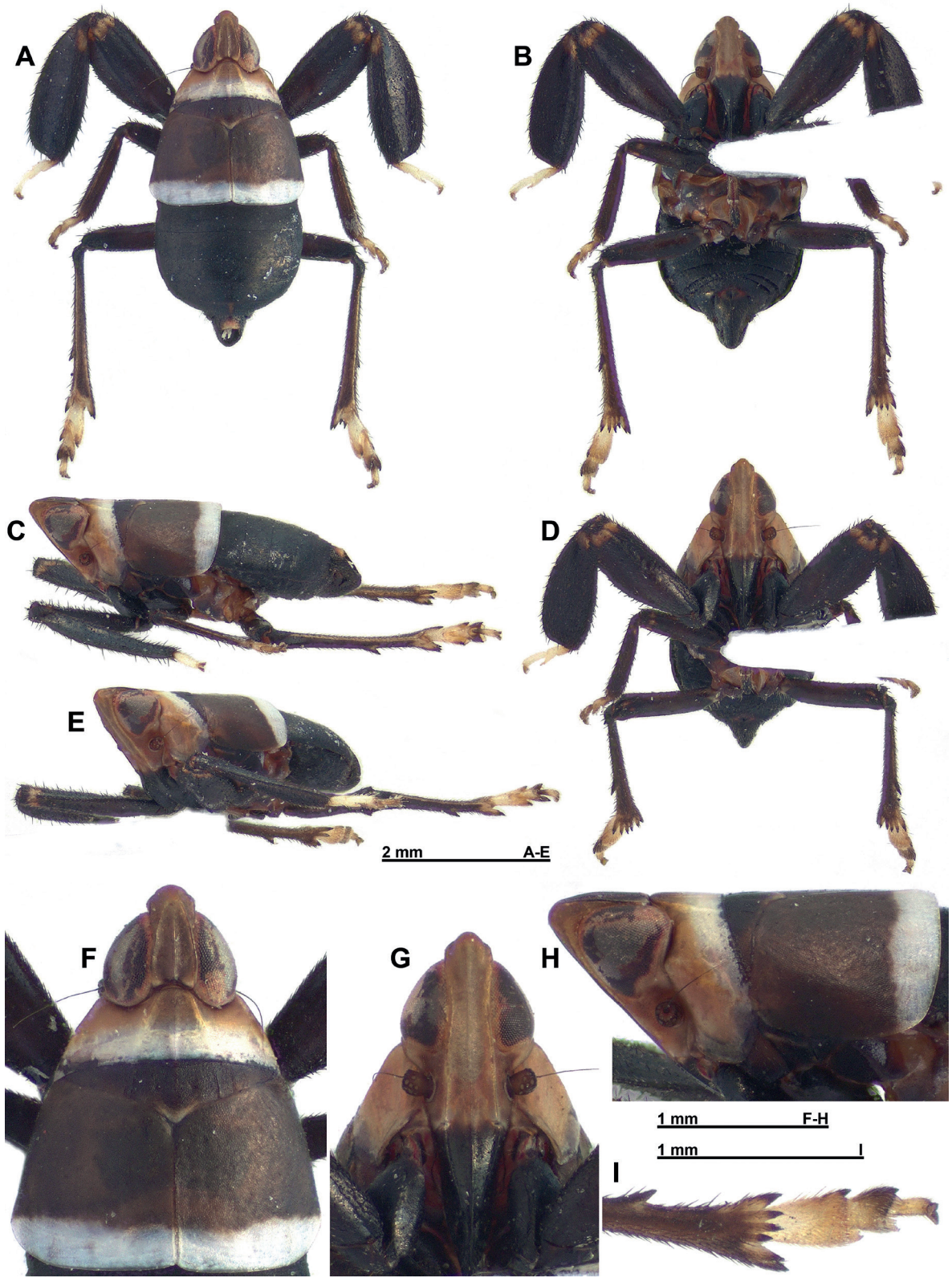

Fig. 7. *Cleotyche* (*Cleotyche*) *francescoi* sp. nov., ♂, holotype (QM). **A**. Habitus dorsal view. **B**. Habitus, ventral view. **C**. Habitus, lateral view. **D**. Habitus, perpendicular view of frons. **E**. Habitus, anterolateral view. **F**. Head and thorax, dorsal view. **G**. Frons, perpendicular view. **H**. Head and thorax, lateral view. **I**. Distal portion of posterior leg, ventral view.

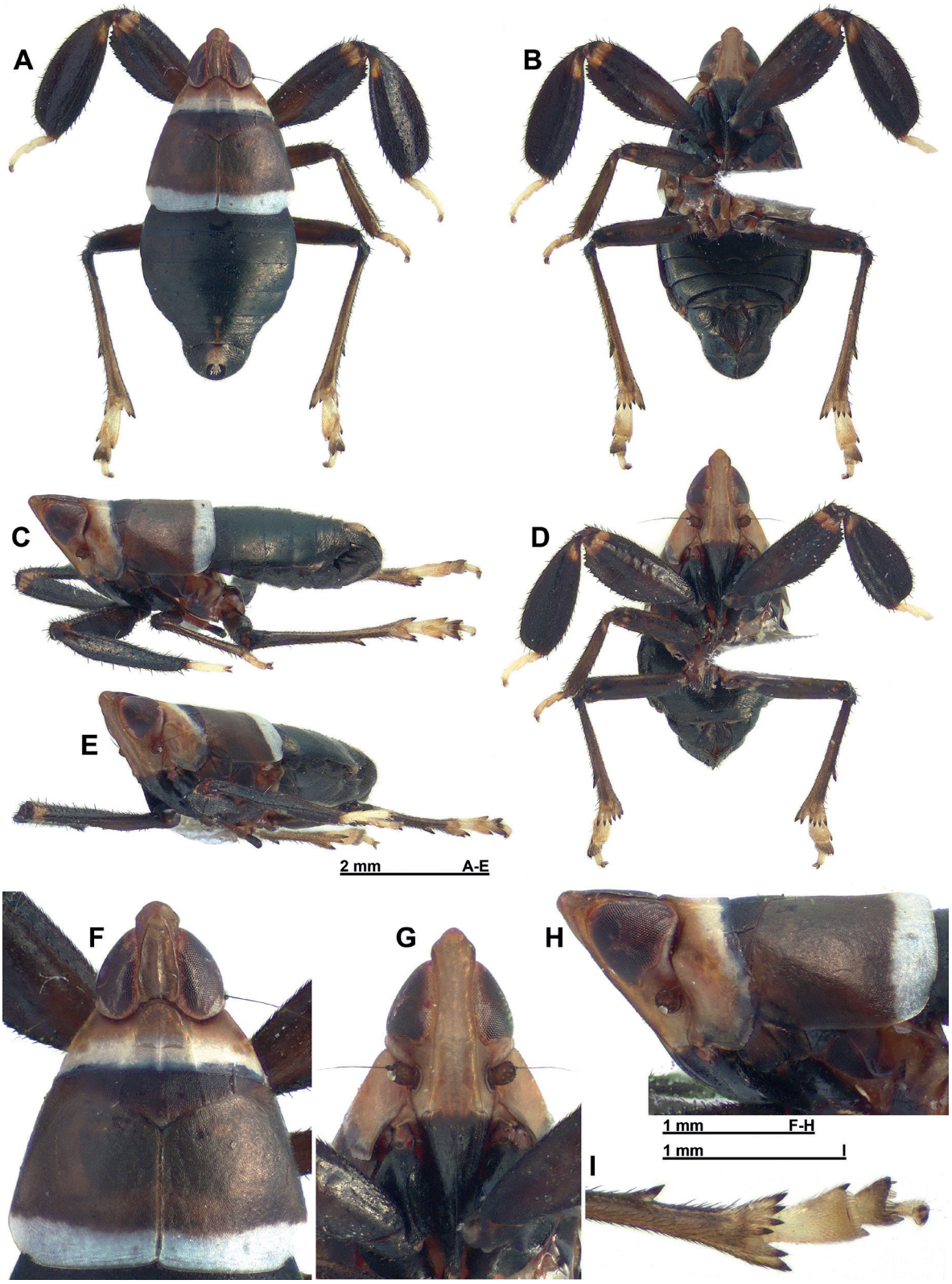

Fig. 8. *Cleotyche* (*Cleotyche*) *francescoi* sp. nov., ♀, paratype (QM). **A**. Habitus dorsal view. **B**. Habitus, ventral view. **C**. Habitus, lateral view. **D**. Habitus, perpendicular view of frons. **E**. Habitus, anterolateral view. **F**. Head and thorax, dorsal view. **G**. Frons, perpendicular view. **H**. Head and thorax, lateral view. **I**. Distal portion of posterior leg, ventral view.

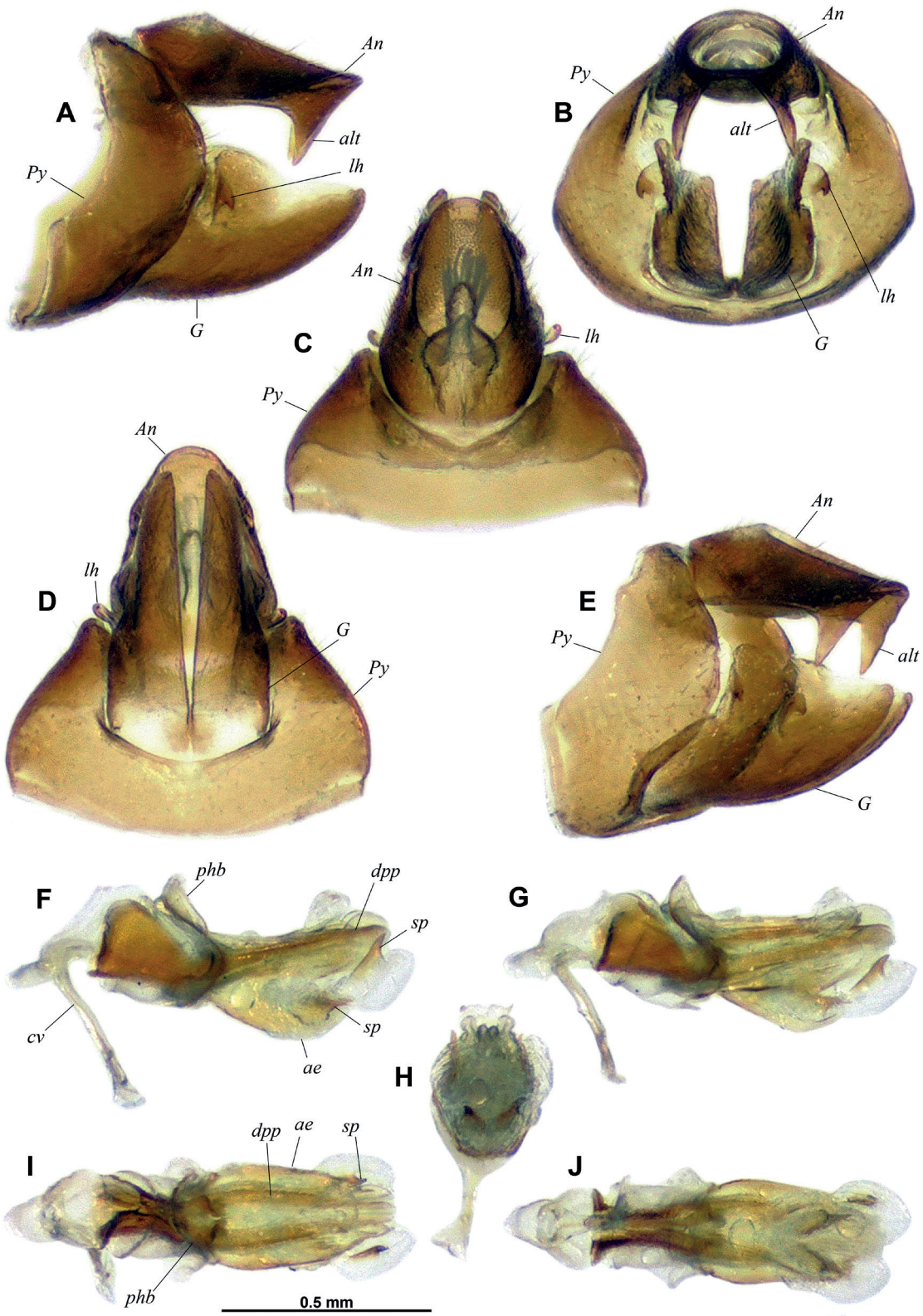

Fig. 9. *Cleotyche* (*Cleotyche*) *francescoi* sp. nov., ♂, holotype (QM). **A–E**. Pygofer, anal tube and gonostyli. **A**. Left lateral view. **B**. Caudal view. **C**. Dorsal view. **D**. Ventral view. **E**. Laterocaudal view. **F–J**. Aedeagus. **F**. Left lateral view. **G**. Dorsolateral view. **H**. Caudal view. **I**. Dorsal view. **J**. Ventral view. Abbreviations: see Fig. 4.

rounded posteroventrally. Mesonotum very short, about ⅔ as long as pronotum, smooth with three weakly marked obsolete carinae prolongating pronotal ones. Tegulae absent.

Tegmina (Figs 7A, C, F, H, 8A, C, F, H). Brown as mesonotum with rather broad white band along posterior margin, covering about ¼ of tegmina length; slightly elongate in dorsal view, 1.12 × as long as broad, slightly broadening from base to apex, truncate apically, slightly rounded, particularly along lateral apical margin, convex, smooth; no venation apparent.

Legs (Figs 7A–D, I, 8A–D, I). Dark brown to black with pro- and mesocoxae and trochanters black; profemora slightly paler basally; apical pale yellowish interrupted ring on pro- and mesofemora; protibiae with basal pale yellow marking dorsally and ventrally; protarsi white; apex of metafemora and base of metatibiae darker; metatibiae turning yellowish from base to apex; metatarsomeres whitish except brown posterior portion of second one. Profemora and protibiae foliaceous, broad, 2.55 and 2.73 × as long as broad, respectively; protibiae 0.96 × as broad as profemora; profemora with anterior margin weakly curved and posterior margin broadly rounded, with 14–16 small teeth; protibiae with margins broadly rounded and external margin roundly truncate apically; median and posterior legs elongate and slender; metatibiae broadening towards apex, with one ventrolateral spine at distal ⅗ and 6 apical spines; first and second metatarsomeres with strong spine at each side and apical row of 12 platellae ventrally. Metatibiotarsal formula: (2) 6 (2-4)/2/2.

Fig. 10. Habitat of *Cleotyche* (*Cleotyche*) *francescoi* sp. nov. in Eurimbula National Park, 9 Dec. 2019.

Abdomen (Figs 7A–D, 8A–D). Glossy black with median yellowish marking on last segment in male, on two last segments in female; small yellowish marking on anal tube at base of anal column. Abdomen dorsoventrally flattened and smooth.

Male terminalia (Fig. 9). Pygofer (*Py*) (Fig. 9A–E) narrow in lateral view, 2.9 × as high as long at mid-height, suboval and about 1.25 × as wide as high in posterior view; anterior and posterior margins rounded in lateral view; posterior margin deeply notched in dorsal and ventral view, with roundly V-shaped notch dorsally and U-shaped notch ventrally. Gonostyli (*G*) (Fig. 9A–E) moderately elongate, 1.75 × as long as high in lateral view, 3.4 × as long as wide at base in ventral view, slightly surpassing anal tube; dorsal margin sinuate in lateral view; posteroventral margin regularly rounded in lateral view; strong basidorsal lateral hook (*lh*) curved lateroventrad, with dorsal margin strongly rounded in caudal view. Aedeagus (*ae*) (Fig. 9F–J) elongate and narrow in dorsal view, with 2 pairs of membranous processes, each bearing an anteapical lateral sclerotized spine (*sp*); phallobase (*phb*) with 2 elongate, narrow, straight, sclerotized dorsal processes (*dpp*); connective (*cv*) elongate and narrow. Anal tube (*An*) (Fig. 9A–E) in dorsal view obovate, 1.4 × as long as wide, widest at basal 2/5, with apical margin rounded and with anal opening at basal ⅓ of length; ventral margin straight, abruptly rounded at straight angle before strong apicolateral teeth (*alt*); teeth with posterior margin weakly concave in lateral view, narrow and slightly diverging in caudal view; length of teeth along posterior margin in lateral view equals 0.47 × length of anal tube.

Biology

The specimens were collected by sweeping grass in and around the trail to Ganoonga Noonga Lookout, in relatively open *Eucalyptus* woodland (Fig. 10).

Distribution

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

Cleotyche* (*Cleotyche*) *mariae Emeljanov, 1997

Figs 6, 11–12, Table 1

Diagnosis

The species can be separated from the other *Cleotyche* (*Cleotyche*) species by the combination of the following characters:
1. Profemora rather broad, only 2.91 × as long as broad, and slightly narrower than protibiae (Fig. 1C).
2. Vertex rather elongate, 2.04 × as long as broad (Figs 11B, 12B).
3. Vertex and anterior portion of pronotum pale brown (Figs 11B, 12B).

Differential diagnosis

This species differs from *C.* (*Cleotyche*) *christinae* sp. nov. and *C.* (*Cleotyche*) *montana* sp. nov., by the proportions of the profemora (profemora 2.91 × as long as broad vs min. 3.16 × in the two other species).

The most similar species is *C.* (*Cleotyche*) *francescoi* sp. nov. which additionally differs by having broader profemora (2.55 × as long as broad vs 2.91 × in *C.* (*Cleotyche*) *mariae*) and less elongate vertex (1.71 × as long as broad vs 2.04 × in *C.* (*Cleotyche*) *mariae*).

Material examined

Holotype (examined from photographs – Fig. 11)
AUSTRALIA • ♂; [New South Wales, Pearl Beach]; [33°32′59″ S, 151°17′57″ E]; [13 Mar. 1997]; Emeljanov leg.; "Australia, NSW, Pearl Beach, 13.III.1997, Emeljanov"; "Holotypus *Cleotyche mariae* Emeljanov 1997"; "ANIC Database No. 20 011325"; ANIC.

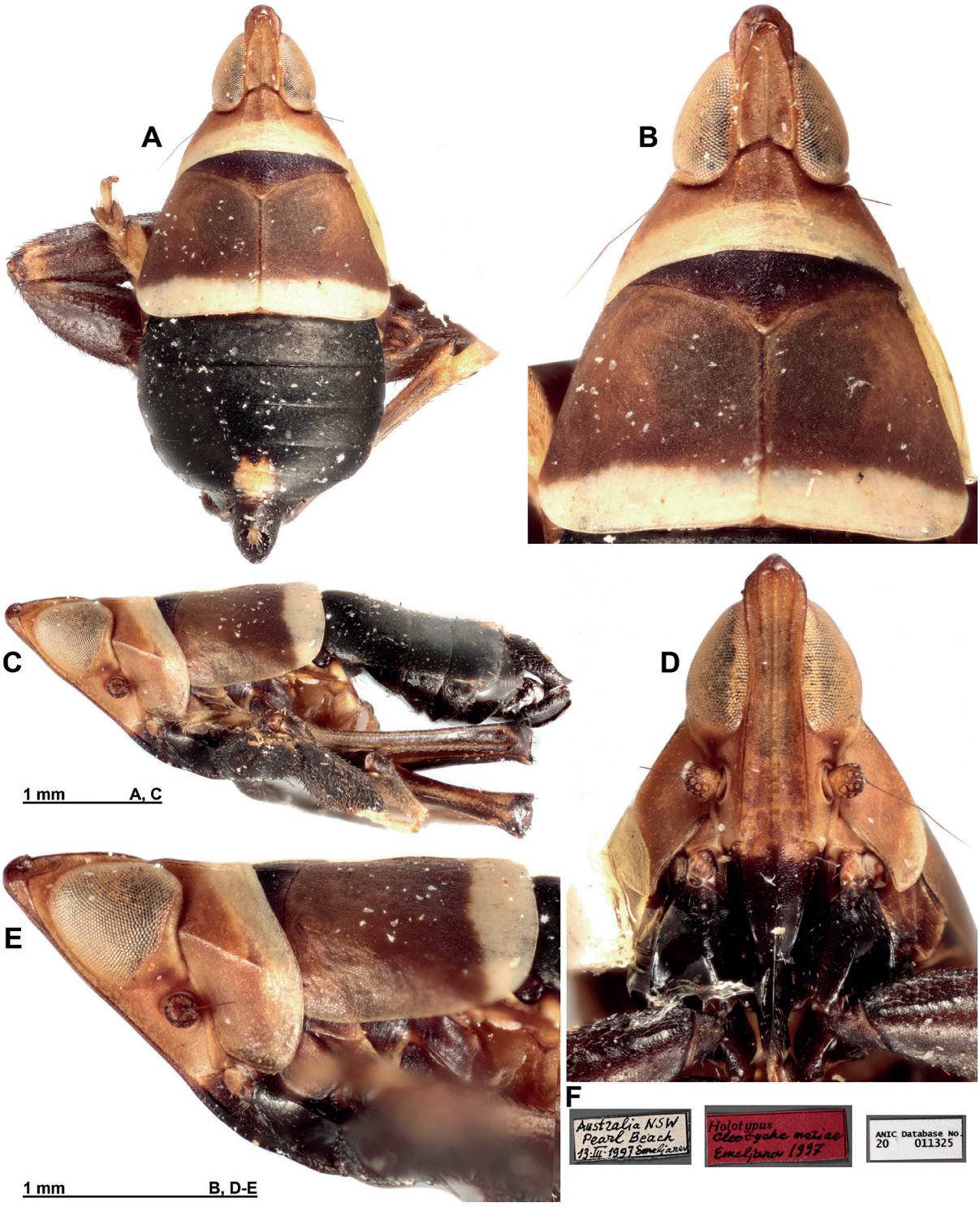

Fig. 11. *Cleotyche* (*Cleotyche*) *mariae* Emeljanov, 1997, ♂, holotype (ANIC). **A**. Habitus dorsal view. **B**. Head and thorax, dorsal view. **C**. Habitus, lateral view. **D**. Frons, perpendicular view. **E**. Head and thorax, lateral view. **F**. Labels. Photographs: © T. Pleines – CSIRO.

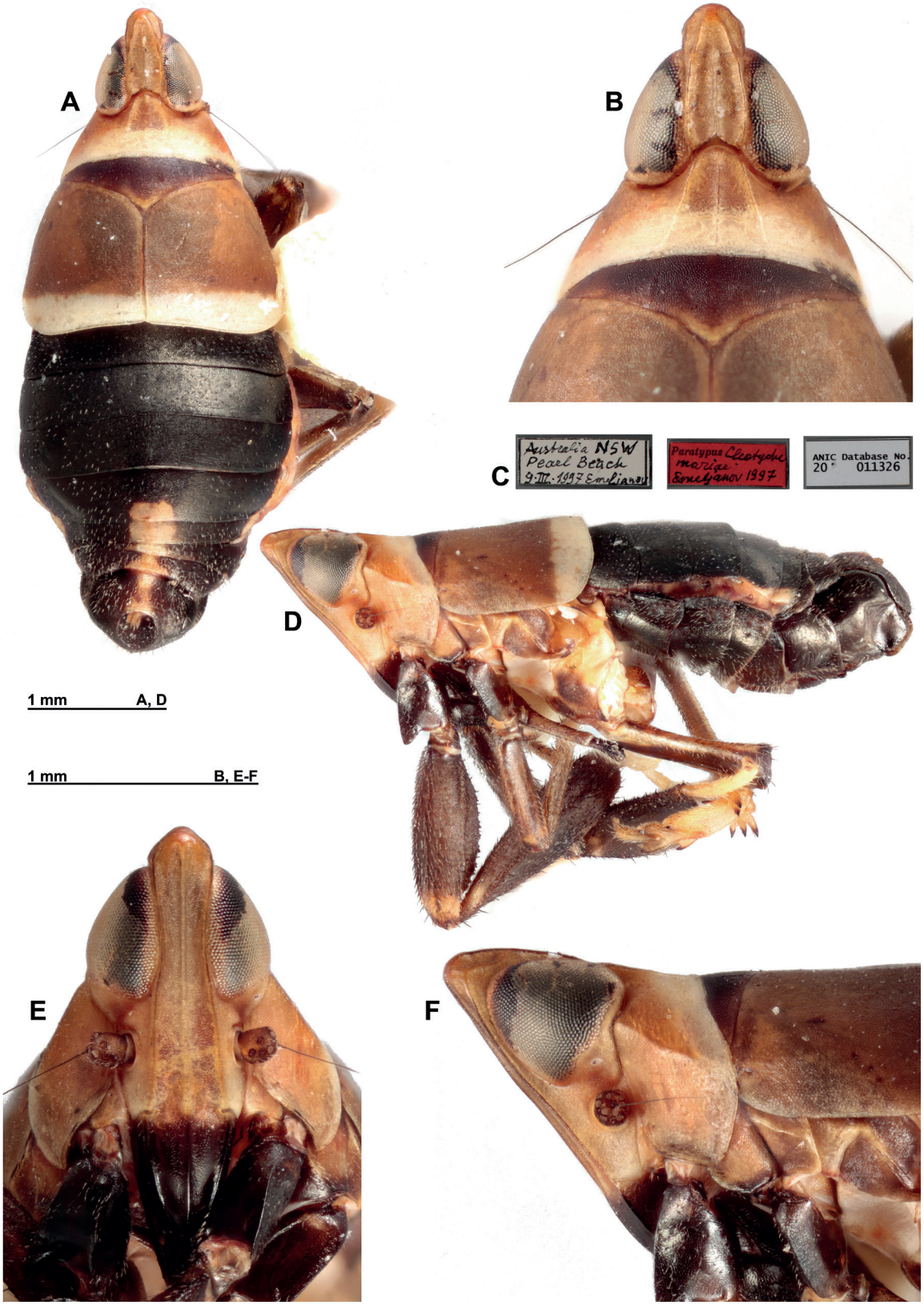

Fig. 12. *Cleotyche* (*Cleotyche*) *mariae* Emeljanov, 1997, ♀, paratype (ANIC). **A**. Habitus dorsal view. **B**. Head and thorax, dorsal view. **C**. Labels. **D**. Habitus, lateral view. **E**. Frons, perpendicular view. **F**. Head and thorax, lateral view. Photographs: © T. Pleines – CSIRO.

Paratype (examined from photographs – Fig. 12)
AUSTRALIA • ♀; [New South Wales, Pearl Beach]; [33°32′59″ S, 151°17′57″ E]; [9 Mar. 1997]; Emeljanov leg.; "Australia, NSW, Pearl Beach, 9.III.1997, Emeljanov"; "Paratypus *Cleotyche mariae* Emeljanov 1997"; "ANIC Database No. 20 011326"; ANIC.

Supplementary description

Measurements and ratios. LTg/BTg = 1.17; LV/BV = 2.04; LF/BF = 3.94; LPf/BPf = 2.91; LPt/BPt = 2.93.

Distribution

Australia, New South Wales, Pearl Beach (Fig. 6).

Cleotyche* (*Cleotyche*) *montana sp. nov.

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Figs 6, 13–15, Table 1

Diagnosis

The species can be separated from the other *Cleotyche* (*Cleotyche*) species by the combination of the following characters:

1. Profemora rather slender, 3.16 × as long as broad, and slightly broader than protibiae (Fig. 13A).
2. Vertex elongate, 2.10 × as long as broad (Fig. 13F).
3. Vertex and anterior portion of pronotum medium brown (Figs 13F).

Differential diagnosis

This species differs from *C.* (*Cleotyche*) *francescoi* sp. nov. and *C.* (*Cleotyche*) *mariae* Emeljanov, 1997 by its relatively more slender profemora (profemora 3.16 × as long as broad vs max. 2.91 × in the two other species).

The most similar species is *C.* (*Cleotyche*) *christinae* sp. nov. which differs by its narrower profemora (3.78 × as long as broad vs 3.16 × in *C.* (*Cleotyche*) *montana* sp. nov.), and the proportions of the vertex (vertex 2.10 × as long as broad vs 1.56 × in *C.* (*Cleotyche*) *christinae* sp. nov.).

Etymology

The species epithet is a Latin adjective meaning 'associated with mountain' and refers to the mountainous habitat on top of Blackdown Tableland where the species was discovered.

Type material

Holotype
AUSTRALIA • ♂; [Queensland, Blackdown Tableland N.P.]; [11–12 Mar. 2020]; 23°42′48″ S, 149°07′06″ E; J. Constant and L. Semeraro leg.; "Australia Qld, Blackdown Tableland N.P., 11–12 Mar 2020, 23°42′48″S 149°07′06″E, leg. J. Constant & L. Semeraro, Leopold III Funds Expedition"; QM.

Description

Measurements and ratios. LT: ♂ (n = 1): 3.9 mm. LTg/BTg = 1.32; LV/BV = 2.10; LF/BF = 3.39; LPf/BPf = 3.16; LPt/BPt = 3.52.

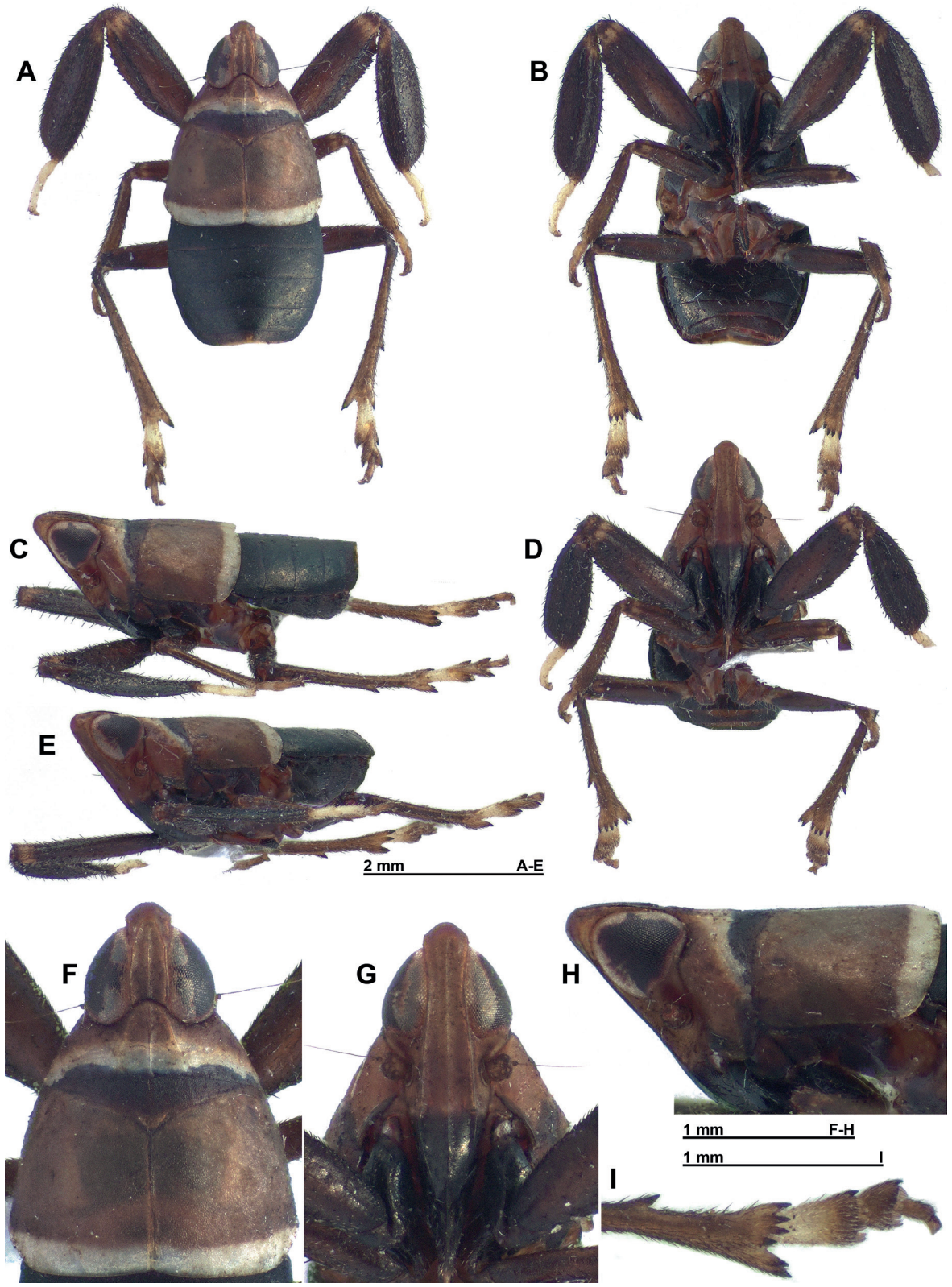

Fig. 13. *Cleotyche* (*Cleotyche*) *montana* sp. nov., ♂, holotype (QM). **A**. Habitus dorsal view. **B**. Habitus, ventral view. **C**. Habitus, lateral view. **D**. Habitus, perpendicular view of frons. **E**. Habitus, anterolateral view. **F**. Head and thorax, dorsal view. **G**. Frons, perpendicular view. **H**. Head and thorax, lateral view. **I**. Distal portion of posterior leg, ventral view.

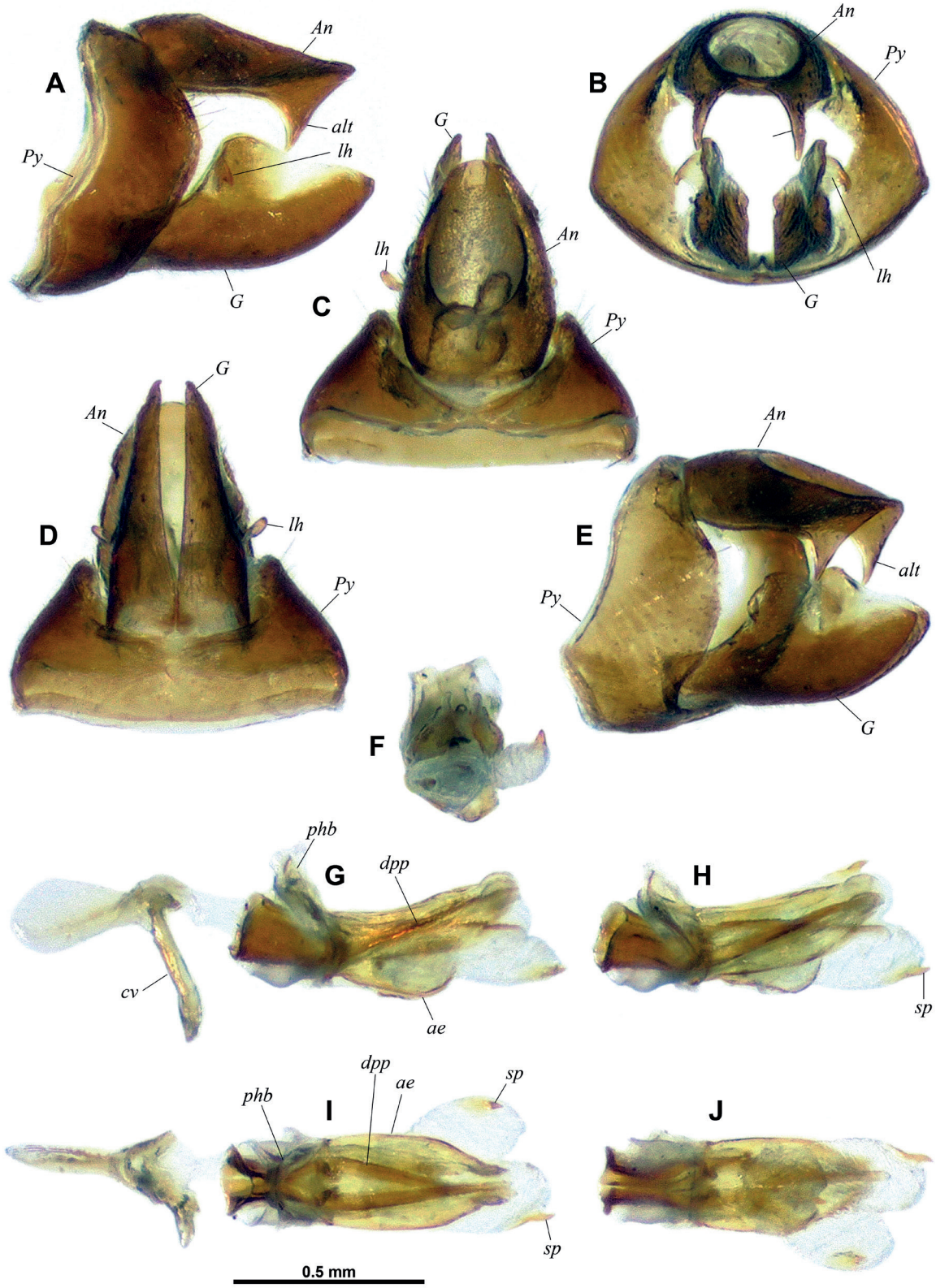

Fig. 14. *Cleotyche* (*Cleotyche*) *montana* sp. nov., ♂, holotype (QM). **A–E**. Pygofer, anal tube and gonostyli. **A**. Left lateral view. **B**. Caudal view. **C**. Dorsal view. **D**. Ventral view. **E**. Laterocaudal view. **F–J**. Aedeagus. **F**. Caudal view. **G**. Left lateral view. **H**. Dorsolateral view. **I**. Dorsal view. **J**. Ventral view. Abbreviations: see Fig. 4.

Head (Fig. 13F–H). Rufous-brown with clypeus black; labium brown with terminal segment black. Vertex elongate, 2.10 × as long as broad, projected anteriorly, rounded to a blunt point apically, with median carina not reaching anterior margin and with lateral margins carinate, subparallel along eye and incurved anteriorly; posterior margin roundly incurved. Frons elongate, very weakly concave in lateral view, with sides subparallel, weakly narrowing along eyes, 3.29 × as long as broad, anteriorly pointly rounded in perpendicular view, with three complete carinae, one median and one along each lateral margin, all extending to apex of clypeus; two weak, short carinae between median and sublateral carinae extending from dorsal margin along 1/5 of the way along the frons. Clypeus elongate and narrow, triangular. Eyes rather large, moderately protruding laterally. Antennae with scape short and cylindrical; pedicel short, inflated, barrel-shaped and with large sensory plates on ventral portion. Ocelli absent. Labium elongate and narrow, reaching posterior trochanters and with apical segment elongate, about half as long as penultimate one.

Thorax (Fig. 13E–H). Pronotum rufous-brown with posterior half whitish, paranotal lobes slightly darker towards posterior and ventral margins; mesonotum dark brown, darker than anterior portion of pronotum, with apex of scutellum slightly paler; thoracic sternites dark brown. Pronotum smooth with anterior margin strongly bisinuate, roundly projecting anteriorly behind vertex and roundly emarginate behind eyes, and posterior margin weakly incurved; median longitudinal carina and two lateral carinae on disc merging anteriorly along anterior margin; lateral carina behind eye; paranotal lobe angularly

Fig. 15. Habitat of *Cleotyche* (*Cleotyche*) *montana* sp. nov. in Blackdown Tableland National Park, 12 Mar. 2020.

rounded posteroventrally. Mesonotum very short, about ⅔ as long as pronotum, smooth with three hardly visible obsolete carinae prolongating pronotal ones. Tegulae absent.

Tegmina (Fig. 13A, C, F, H). Rufous-brown as mesonotum with rather broad white band along posterior margin, covering slightly less than 1/5 of tegmina length; slightly elongate in dorsal view, 1.32 × as long as broad, slightly broadening from base to apex, broadly truncate apically, slightly rounded along lateral apical margin, convex, smooth; no trace of venation.

Legs (Fig. 13A–D, I). Brown with profemora along lateral margins, protibiae and metafemora dark brown; pro- and mesocoxae and trochanters black-brown; apical pale yellowish interrupted ring on pro- and mesofemora; protibiae with basal pale yellow marking dorsally and ventrally; protarsi white; base of metatibiae darker; metatibiae turning yellowish from base to apex; metatarsomeres brown with first one whitish on basal ⅔. Profemora and protibiae moderately foliaceous, rather slender, 3.16 and 3.52 × as long as broad, respectively; protibiae 0.92 × as broad as profemora; profemora with anterior margin weakly curved and posterior margin broadly rounded, with about 15 small teeth, teeth progressively smaller towards base of femur; protibiae with margins broadly rounded, external margin rather straight along median ⅔, and roundly truncate apically; median and posterior legs elongate and slender; metatibiae broadening towards apex, with one ventrolateral spine at distal 3/5 and 6 apical spines; first and second metatarsomeres with strong spine at each side and apical row of 12 platellae ventrally. Metatibiotarsal formula: (2) 6 (2-4)/2/2.

Abdomen (Fig. 13A–D). Black with median yellowish marking on last segment in male (female unknown); small yellowish marking on anal tube at base of anal column. Abdomen dorsoventrally flattened and smooth.

Male terminalia (Fig. 14). Pygofer (*Py*) (Fig. 14A–E) narrow in lateral view, 2.7 × as high as long at mid-height, suboval and about 1.25 × as wide as high in posterior view; anterior and posterior margins rounded in lateral view; posterior margin deeply notched in dorsal and ventral view, with rounded notch dorsally and U-shaped notch ventrally. Gonostyli (*G*) (Fig. 14A–E) rather elongate, 1.9 × as long as high in lateral view, 3.4 × as long as wide at base in ventral view, slightly surpassing anal tube; dorsal margin sinuate in lateral view; posteroventral margin straight in basal ⅓ then rounded in lateral view; strong basidorsal lateral hook (*lh*) curved lateroventrad, with dorsal margin oblique in caudal view. Aedeagus (*ae*) (Fig. 14F–J) elongate and narrow in dorsal view, with 2 pairs of membranous processes, each bearing an anteapical lateral sclerotized spine (*sp*); phallobase (*phb*) with 2 elongate, narrow, straight, sclerotized dorsal processes (*dpp*); connective (*cv*) elongate and rather strong. Anal tube (*An*) (Fig. 14A–E) in dorsal view obovate, 1.45 × as long as broad in dorsal view, widest at basal ⅓, with apical margin rounded and with anal opening at basal ⅓ of length; ventral margin straight, strongly rounded before strong apicolateral teeth (*alt*); teeth with posterior margin weakly concave in lateral view, narrow and subparallel in caudal view; length of teeth along posterior margin in lateral view 0.47 × as long as anal tube.

Biology

The specimen was collected by sweeping grass in an open *Eucalyptus* forest up the plateau, not far from Yaddamen Dhina – Horseshoe Lookout (Fig. 15).

Distribution

Australia, SE Queensland, Blackdown Tableland National Park (Fig. 6).

Subgenus ***Griseotyche*** subgen. nov.
urn:lsid:zoobank.org:act: 24EC3313-F915-45FD-894B-B6091307CBDE

Type species and locality

Cleotyche blanda Emeljanov, 2011 (by present designation); Stirling Range National Park, Western Australia.

Species included

Cleotyche (*Griseotyche*) *blanda* Emeljanov, 2011.

Diagnosis

Ground colour pale grey (brown in *Cleotyche* (*Cleotyche*)). Transverse whitish stripe on frons continued on side of body, becoming less distinct and greyish on abdomen (no transverse white stripe on face nor lateral white stripe on body in *Cleotyche* (*Cleotyche*)). No white band along apical margin of tegmina (present in *Cleotyche* (*Cleotyche*)). Small dark spots on all visible segments of the abdomen dorsally where the sensory pits occur (no dark spots on dorsum of abdomen in *Cleotyche* (*Cleotyche*) due to the very dark ground colouration of species).

Etymology

The new subgenus name is formed from '*griseus*' (adj., Latin) meaning 'grey', and '*-tyche*', the ending of '*Cleotyche*'. It refers to the mostly grey colouration of the member of the new subgenus.

Cleotyche* (*Griseotyche*) *blanda Emeljanov, 2011
Figs 6, 16

Cleotyche blanda Emeljanov, 2011: 317 [described, compared with *C. mariae*].

Material examined

Holotype (examined from photographs – Fig. 16)
AUSTRALIA • ♀; [Western Australia]; White Gum Flat, Stirling Range N.P.; [34°23′47″ S, 117°51′00″ E]; [25 Jan. 1979–6 Mar. 1979]; pit trap; "W.A., White Gum Flat, Stirling Range N.P., N° 1514, 25.I.1979–6.III.1979, pit trap"; HMNH.

Diagnosis

Only species of the subgenus. It can be separated from all species of *Cleotyche* by the characters given to recognize the subgenus *Griseotyche*.

Biology

Unknown, however, White Gum Flat in the Stirling Range National Park is a picnic area in open forest, dominated by *Eucalyptus wandoo* Blakely (Myrtaceae).

Distribution

Australia, southwest Western Australia, Stirling Range National Park (Fig. 6).

Discussion

With the current work, the Australian Dictyopharidae fauna now consists of 18 species in eight genera. Moir & Fletcher (2012) stated that a number of species of Cleotychini remain undescribed and they

Fig. 16. *Cleotyche* (*Griseotyche*) *blanda* Emeljanov, 2011, ♀, holotype (HMNH). **A**. Habitus dorsal view. **B**. Habitus, perpendicular view of frons. **C**. Habitus, lateral view. Photographs: © P. Kobor.

illustrated one such species from Western Australia. More generally, the Australian Dictyopharidae are highly diverse and probably less than 10% of the species are currently named (Constant, Semeraro & Moir, unpublished data).

The placement of the Cleotychini as a sister group of the Neotropical tribes Nersiini and Taosini by Emeljanov (1997, 2011) was refuted by Song *et al*. (2018) who placed Taosini as sister to Lappidini, both sister to Nersiini, all three tribes being Neotropical. Based on eight morphological characters extracted from Emeljanov (1997, 2011), Cleotychini was excluded from the Dictyopharidae in Song *et al*. (2018), although no specimen of Cleotychini was either included in their morphological phylogenetic study or directly examined. The placement of the tribe as an incertae sedis tribe within Fulgoroidea (Song *et al*. 2018) remains unsatisfactory and was not followed here; the tribe was provisionally retained in the Dictyopharidae until a comprehensive study including morphological and molecular data determines the correct placement.

The species of Cleotychini described to date appear to be considerably geographically restricted, and with no two species overlapping in distribution (Fig. 6). As flightless insects, dispersal is limited and populations could easily be isolated by landscape barriers (e.g., by mountains, rivers, dense rainforests), and have speciated (e.g., Ikeda *et al*. 2012). Undercollecting could be confounding assessments though, as *Cleotyche* are very small insects, with highly modified reduced wings giving the impression that they are nymphs, which could result in zoologists and ecologists dismissing them as bycatch. Further surveys are required to definitively determine the biogeography, host plants, and response to disturbance by Cleotychini, thereby allowing conservation assessment without automatically being relegated to the 'data deficient' category (e.g., Cardoso *et al*. 2011; Moir & Brennan 2020). However, the major limitation to such assessment remains the limited taxonomic capacity in Australia, which needs to be addressed (Taxonomy Decadal Plan Working Group 2018).

The dark, foliate profemora and protibiae followed by contrasting white tarsi are present in all species of Cleotychini and appear to be used to mimic the pedipalps and forelegs of jumping spiders (Araneae: Salticidae) (Moir & Fletcher 2012). Current interest in jumping spiders from Australia, especially in the peacock spiders of the genus *Maratus* Karsch, 1878 (e.g., see https://www.facebook.com/projectmaratus/ or https://www.inaturalist.org/projects/peacock-spiders-of-australia), might lead some arachnologists and citizen-scientists, to document the behaviour of the Cleotychini as 'side-observations', and could result in a better understanding of this phenomenon. However, tailored experiments are necessary to assess the efficiency and scope of this putative protection method, for example through tests with predators like ants (Hymenoptera: Formicidae) or the Salticidae present in the same habitat as the planthopper.

Acknowledgements

We wish to thank Dr Francesco "*Bacon*" Martoni (Victoria Agriculture, Melbourne, Australia) for his 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, Melbourne, Australia), 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 Jacek Szwedo and Dr Dmitry Dmitriev for literature; Dr Olivia Evangelista and Mrs Thekla Pleines (CSIRO – ANIC) for the photographs of the type specimens of *Cleotyche mariae*; Dr Péter Kobor (Hungary) for his effort providing the authors with photographs of the holotype of *C. blanda*; the two reviewers of the original manuscript for their valuable suggestions.This paper is

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