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Research article

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The first documented record of *Chvalaea* Papp & Földvári, 2002 (Diptera, Hybotidae, Ocydromiinae) from the Australasian Region: a new species and its possible relationship to other members of the genus

Luana Machado BARROS^{1,*}, Matheus Mickael Mota SOARES²,
Rafael Augusto Pinheiro de FREITAS-SILVA³ & Rosaly ALE-ROCHA⁴

^{1,2,3}Graduate Program in Entomology (PPG-Ent), Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus, Amazonas, Brazil.

⁴Coordenação de Biodiversidade (COBIO, INPA), Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus, Amazonas, Brazil.

*Corresponding author: barrosluana222@gmail.com

²Email: matheusmmsoares@gmail.com

³Email: rpfreitas.silva@gmail.com

⁴Email: alerocha@inpa.gov.br

¹urn:lsid:zoobank.org:author:BA0BB127-8BED-490B-8B7E-F271FF9E7809

²urn:lsid:zoobank.org:author:AFBD324E-622B-4C74-98FE-41EA66FA35FC

³urn:lsid:zoobank.org:author:CADE0CEE-4413-4919-BBA7-9B1AE962249A

⁴urn:lsid:zoobank.org:author:4E0A90DF-3F17-4F3E-842A-F03F72DAADF0

Abstract. *Chvalaea australis* sp. nov. is described and illustrated, representing the first species of *Chvalaea* Papp & Földvári, 2002 from the Australasian Region. A discussion of the geographic distribution and the possible relationship among the species of the genus is provided.

Keywords. Empidoidea, taxonomy, dance flies, iNaturalist, citizen science.

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Introduction

Chvalaea Papp & Földvári, 2002 is a small hybotid genus of predatory flies included in Ocydromiinae subfamily. The genus is recognized by the heavily sclerotized and punctated abdomen, cua cell approximately half length of bm cell and male and female terminalia concealed or retracted within the abdominal segment eight (Ale-Rocha 2006).

The genus was previously mentioned as “undescribed genus B” by Sinclair & Cumming (2000). It was formally described as *Chvalaea* by Papp & Földvári (2002), including the type species *Leptopeza rugosiventris* Strobl, 1910 from Austria and *C. sopianae* Papp & Földvári, 2002 from Hungary. Ale-Rocha (2006) described five species from the Neotropical region: *C. amazonica* Ale-Rocha, 2006; *C. boliviana* Ale-Rocha, 2006; *C. catarinensis* Ale-Rocha, 2006; *C. masneri* Ale-Rocha, 2006 and *C. pulchra* Ale-Rocha, 2006. Kahanpää (2013) broadened the distribution of the genus to Northern Europe, by the record of *C. sopianae* from eastern Finland. Shamshev *et al.* (2017) proposed *Chvalaea sopianae* Papp & Földvári, 2002 as a synonym of *Chvalaea rugosiventris* (Strobl, 1910), and increased the occurrence of *C. rugosiventris* to Eastern Siberia and the Russian Far East. Barros *et al.* (2019) described three additional species from the Neotropical Region: *C. annularis* Barros & Ale-Rocha, 2019, *C. ecuadoriensis* Barros & Ale-Rocha, 2019 and *C. sinclairi* Barros & Ale-Rocha, 2019, besides an illustrated key, distributional map and updated diagnoses of all the Neotropical species. The latest species described in the genus was *C. yolkamini* Jaume-Schinkel, Soares & Barros, 2020 from Mexico, that represents the New World northernmost record of the genus. The hunting behavior of adults, description and illustration of the eggs, as well as a possible courtship display of *C. yolkamini* had also been provided (Jaume-Schinkel *et al.* 2020, 2022). Nevertheless, the data about the biology of the immature stages of the genus are completely absent.

Currently, *Chvalaea* comprises 10 valid species distributed in Palearctic (Austria, Croatia, Hungary, Finland and Russia), Oriental (China) and Neotropical (Brazil, Bolivia, Costa Rica, Ecuador, Guatemala, Mexico, Peru, and Venezuela) regions (Sinclair & Cumming 2000; Kahanpää 2013; Shamshev *et al.* 2017; Barros *et al.* 2019; Jaume-Schinkel *et al.* 2020).

In this paper, we describe a new species of *Chvalaea*, the first documented record of the genus from Australasian Region, previously cited in Barros *et al.* (2019) as an “undescribed species for the Australasian Region”. In addition, we discuss the geographic distribution, morphology and the possible relationship to other species of the genus.

Material and methods

Terms used for adult structures and abbreviations follow Cumming & Wood (2017). We describe the male terminalia based on their unrotated position, considering the cerci positioned dorsally. In descriptions and figures, male terminalia and their parts are presented oriented with their basal (anterior) part at the bottom and the apical (posterior) part at the top of the figure. Female terminalia are shown in the figure with the anterior part oriented to the left and the posterior part to the right.

Terminalia were removed from the abdomen, treated with hot 85% lactic acid and after analysis kept in a microvial partially filled with glycerine. Wing was photographed after being removed from the body, mounted between cover slides with Canada balsam and glued by one side to a small piece of cardboard. Microvials and cover slides were pinned together with their respective specimens.

Specimens were photographed with a Leica MC170 HD camera, attached on a Leica M165C stereo microscope. Photographs were stacked and combined using Leica Application Suite ver. V4.11. The distribution map was created with Simplemappr (Shorthouse 2010) using specimen labels and records of iNaturalist until November 2021.

Institutional abbreviations

AMS = Australian Museum, Sydney, Australia
CNC = Canadian National Collection of Insects, Ottawa, Canada
INPA = Coleção de Invertebrados do Instituto Nacional de Pesquisas da Amazônia, Manaus, Brazil
MNH = Museum of Natural History, Oxford, England

ZMUT = Zoological Museum of University of Turku, Finland

Results

Taxonomy

Class Insecta Linnaeus, 1758
Superfamily Empidoidea Latreille, 1804
Family Hybotidae Meigen, 1820
Subfamily Ocydromiinae Schiner, 1862
Genus *Chvalaea* Papp & Földvári, 2002

Chvalaea australis sp. nov.

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Figs 1–4

Diagnosis

Frons short (approximately $\frac{1}{5}$ length of face), wide (as wide as ocellar triangle), with a shallow concavity at mid-length; occiput black with gray pruinosity, except central upper postcranium region with yellow pruinosity. Coxae yellow with white pruinosity, except basal half of fore coxa brown and bare; hind tibia black, except base brown; fore and mid tarsi brown, hind tarsus black; hind tarsomeres 3–5 with short, blunt and black spine-like ventral setae. Wing with cell cua slightly longer than half length of cell bm , veins M_1 and M_4 not reaching the wing margin, cell r_1 slightly broadened at apex.

Etymology

From Latin '*auster*' meaning 'south', referring to Australia.

Material examined

Holotype

AUSTRALIA • ♂; "NSW" [New South Wales]; "Barrington Tops SF"; [ca 32°4'2.982" S, 151°39'47.495" E]; [alt] "1000 m"; "Feb.11.1984" [11 Febr. 1984]; "L. Masner, S.S." [leg.] [white label]; "HOLOTYPE, *Chvalaea australis* Barros, Soares, Freitas-Silva & Ale-Rocha" [red label]; condition: good, terminalia dissected; AMS.

Paratypes

AUSTRALIA • 5 ♂♂, 8 ♀♀; same collection data as for holotype; AMS • 1 ♂, 1 ♀; same collection data as for preceding; MNH • 2 ♂♂, 4 ♀♀; same collection data as for preceding; INPA • 2 ♂♂, 3 ♀♀; same collection data as for preceding; CNC.

Additional material

AUSTRALIA • 2 ♂♂, 6 ♀♀; same collection data as for holotype; ZMUT • 2 ♂♂, 6 ♀♀; same collection data as for holotype; MNH • 1 ♂, 1 ♀; same state as for holotype; "Monga State Forest" [Monga National Park]; [ca 35°37'21.0" S, 149°54'22.2" E]; 19–24 Jan. 1984; L. Masner leg.; AMS • 4 ♂♂; same state as for holotype; "Toloom Scrub" [Toloom National Park]; [ca 28°27'23.9" S, 152°26'43.0" E]; alt. 1000 m; 14 Feb. 1984; L. Masner leg.; AMS • 2 ♂♂, 1 ♀; same collection data as for holotype; CNC • 2 ♂♂, 1 ♀; same collection data as for holotype; INPA • 1 ♂, 2 ♀♀; same state as for holotype; New England National Park; [ca 30°30'21.6" S, 152°24'36.3" E]; alt. 1300–1500 m; 13 Feb. 1984; L. Masner leg.; INPA • 1 ♂, 3 ♀♀; "Wiangaree N.P." [Border Ranges National Park], Brindle Creek; [ca 28°23'01.0" S, 153°05'45.9" E]; 14 Feb.1984; INPA • 3 ♂♂; same state as for holotype; Dorrigo National Park; [ca 30°22'15.0" S, 152°44'40.4" E]; alt. 1000 m; 13 Feb.1984; Peck leg.; CNC • 3 ♂♂; Queensland, Mount Glorious National Park; [ca 27°19'49" S, 152°45'35" E]; alt. 630 m; 28 Feb. 1984;

L. Masner leg.; CNC • 1 ♀; same state as for preceding; [Landsborough], Landsborough Shire; [ca 26°49'19.4" S, 152°58'02.5" E]; alt. 200 m; 8 Mar. 1984; L. Masner leg.; CNC • 1 ♀; Victoria, 10 km North of Warburton Archeron Gap; [ca 37°40'37.8" S, 145°44'27.7" E]; alt. 750 m; 7 May.1978; S. and

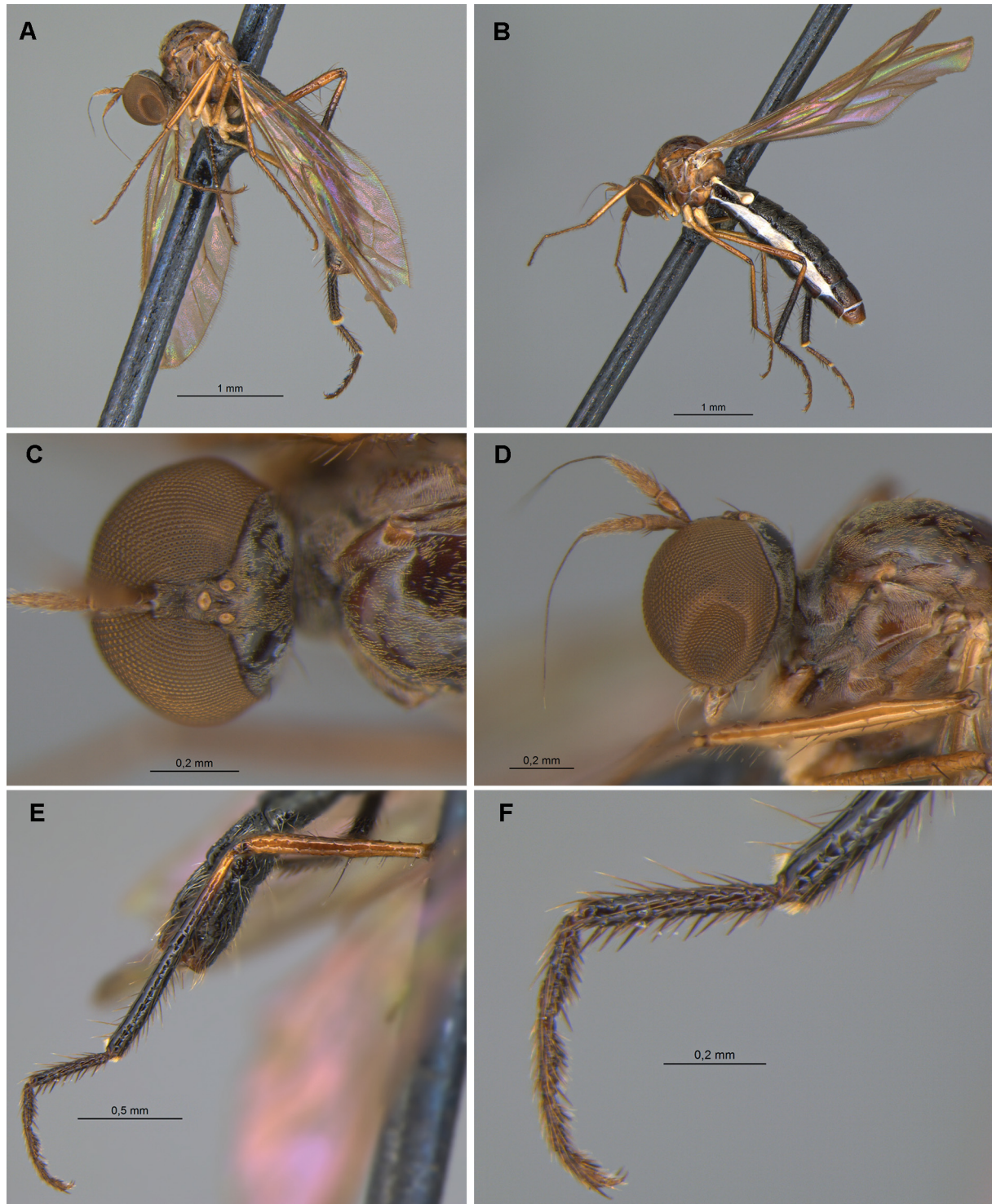


Fig. 1. *Chvalaea australis* sp. nov. **A, C–F.** ♂, holotype (AMS). **A.** Habitus, lateral view. **B.** ♀, paratype (AMS), habitus, lateral view. **C.** Frons, dorsal view. **D.** Head, lateral view. **E.** Hind leg, lateral view. **F.** Hind tarsus, lateral view.

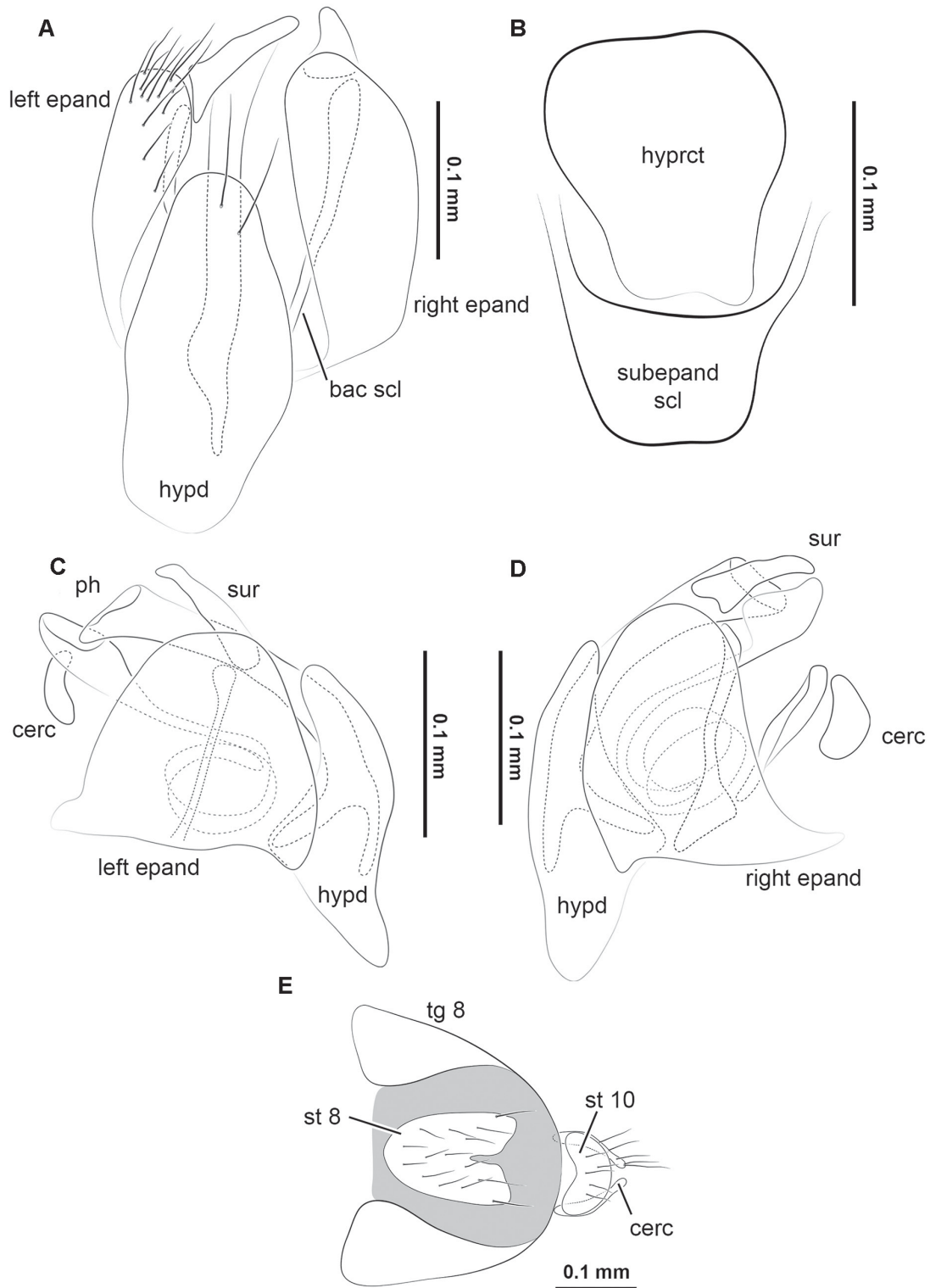


Fig. 2. *Chvalaea australis* sp. nov. **A–D.** Male terminalia, holotype (AMS). **A.** Ventral view. **B.** Dorsal view. **C.** Left lateral view. **D.** Right lateral view. **E.** Female terminalia, paratype (AMS), ventral view. Abbreviations: bac scl = bacilliform sclerite; cerc = cercus; epand = epandrium; hypd = hypandrium; hyprct = hypoproct; ph = phallus; st = sternite; subepand scl = subepandrial sclerite; sur = surstylus; tg = tergite.

J. Peck leg.; CNC • 1 ♂; Tasmania, 10 km South of Hellyer River; [ca 41°20'42.4" S, 145°37'54.7" E]; 10 Jan. 1984; L. Masner leg.; CNC.

Description

Male (Fig. 1A)

MEASUREMENTS. Holotype body length 3.5 mm. Wing length 3.8 mm.

HEAD. Frons short, brown, covered with dense yellow pruinosity, approximately $\frac{1}{5}$ length of face, as wide as ocellar triangle, with a shallow concavity at mid-length (Fig. 1C); 1 pair of proclinate ocellar setae, 1 pair of postocellar setae long and strong, about $2 \times$ as long as ocellar setae [observed in paratypes]. Antenna ground color brown (Fig. 1D), except anterior spot on pedicel yellowish; postpedicel long, triangular, about $1.3 \times$ as long as scape and pedicel combined, covered with yellow microtrichia, 1 short dorsal seta on basal third, about $\frac{1}{4}$ length of postpedicel; arista-like stylus apical, bare, about $3 \times$ as long as postpedicel. Proboscis brown (Fig. 1D), very short; palpus brown, with fine and short yellow setae, and 1 long apical seta, about $3 \times$ as long as palpus. Occiput black (Fig. 1C), covered with gray pruinosity, except central portion of upper postcranium with yellow pruinosity.

THORAX. Shining, covered with yellow pruinosity. Antepronotum dark brown (Fig. 1D). Scutum dark brown, except posterior margin of postpronotal lobe yellow and postalar callus pale yellow. Scutellum shining brown, with yellow pruinosity on lateral margin. Mesopleuron extensively brown, except laterotergite light brown, covered with yellow pruinosity. Mediotergite shining brown, with sparse yellow pruinosity. Acrostichals biserial; dorsocentrals uniserial, short, fine and sparse, 2 prescutellar setae longer; 1 long and strong notopleural seta; 1 short and fine anterior postalar seta, and 1 posterior postalar seta [lost in holotype, but apparently strong]. Scutellum with 1 pair of long and strong apical setae [observed in paratypes] and 1 pair of short and thin lateral setae [observed in paratypes].

WING (Fig. 3). Light brown; cell *cua* slightly longer than half length of cell *bm*; veins M_1 , M_4 and $CuA+CuP$ not reaching wing margin; cell *dm* slightly shorter than *br* and *bm* cells; pterostigma slightly darker than rest of wing membrane; cell r_1 somewhat broadened at apex; halter dark brown, except stem yellow.

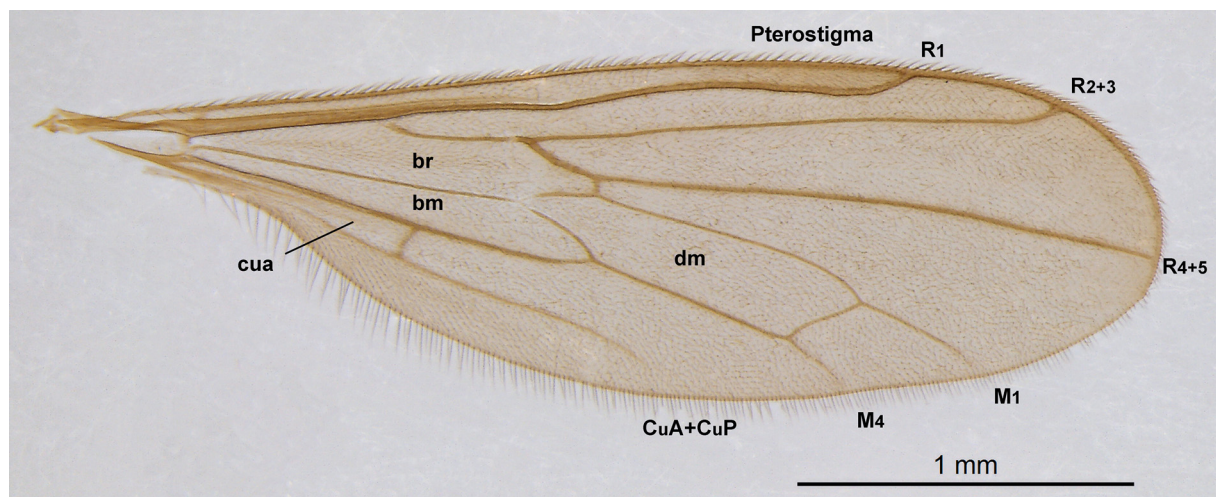


Fig. 3. *Chvalaea australis* sp. nov. Wing of male paratype (AMS). Abbreviations: *bm* = basal medial cell; *br* = basal radial cell; *cua* = anterior cubital cell; $CuA+CuP$ = anterior branch of cubital vein + posterior branch of cubital vein; *dm* = discal medial cell; M_1 = first branch of media; M_4 = fourth branch of media; R_1 = anterior branch of radius; R_{2+3} = second branch of radius; R_{4+5} = third branch of radius.

LEGS. All coxae yellow, covered with white pruinosity, except basal half of fore coxa brown and bare; femora pale brown, except middle dorsal surface of hind femur and apexes of all femora darker; fore and mid tibiae brown, hind tibia black except base brown (Fig. 1E); fore and mid tarsi brown, hind tarsus black. *Chaetotaxy*: mid femur with 2 long anterior setae on apical half and 1 apical seta stronger; hind femur with 3 long setae near apex (1 dorsal and 1 anteroventral fine, 1 anterior strong), and 1 long ventral seta at mid-length; fore tibia with 1 long and strong ventral seta at mid-length; mid tibia with 1 strong dorsal seta near base, 3 long and strong anterodorsal setae (1 seta on basal 1/3, 1 at mid-length, 1 near apex) and 1 long and strong ventral seta at mid-length of mid tibia; hind femur with 2 long and fine anteroventral setae (1 on basal half and 1 at mid-length), and 1 long and fine posteroventral on basal half. Fore basitarsus with 1 long and strong ventral seta near base; mid basitarsomere with 1 posteroventral long and strong seta near base; hind tarsomeres (Fig. 1F) 1–2 with 1 anteroventral and 1 posteroventral rows of long strong black spine-like setae, hind tarsomere 3 with 3 anteroventral and 2 posteroventral short and blunt spine-like setae, hind tarsomere 4 with 1 short and blunt spine-like ventral seta, 1 anteroventral and 1 posteroventral spine-like setae at apex, hind tarsomere 5 with 1 short and blunt spine-like ventral setae.

ABDOMEN. Black, slender, slightly curved downwards, covered with short and thin pale setae. Segment 8 about as long as wide, with 1 row of long and fine setae near the apex.

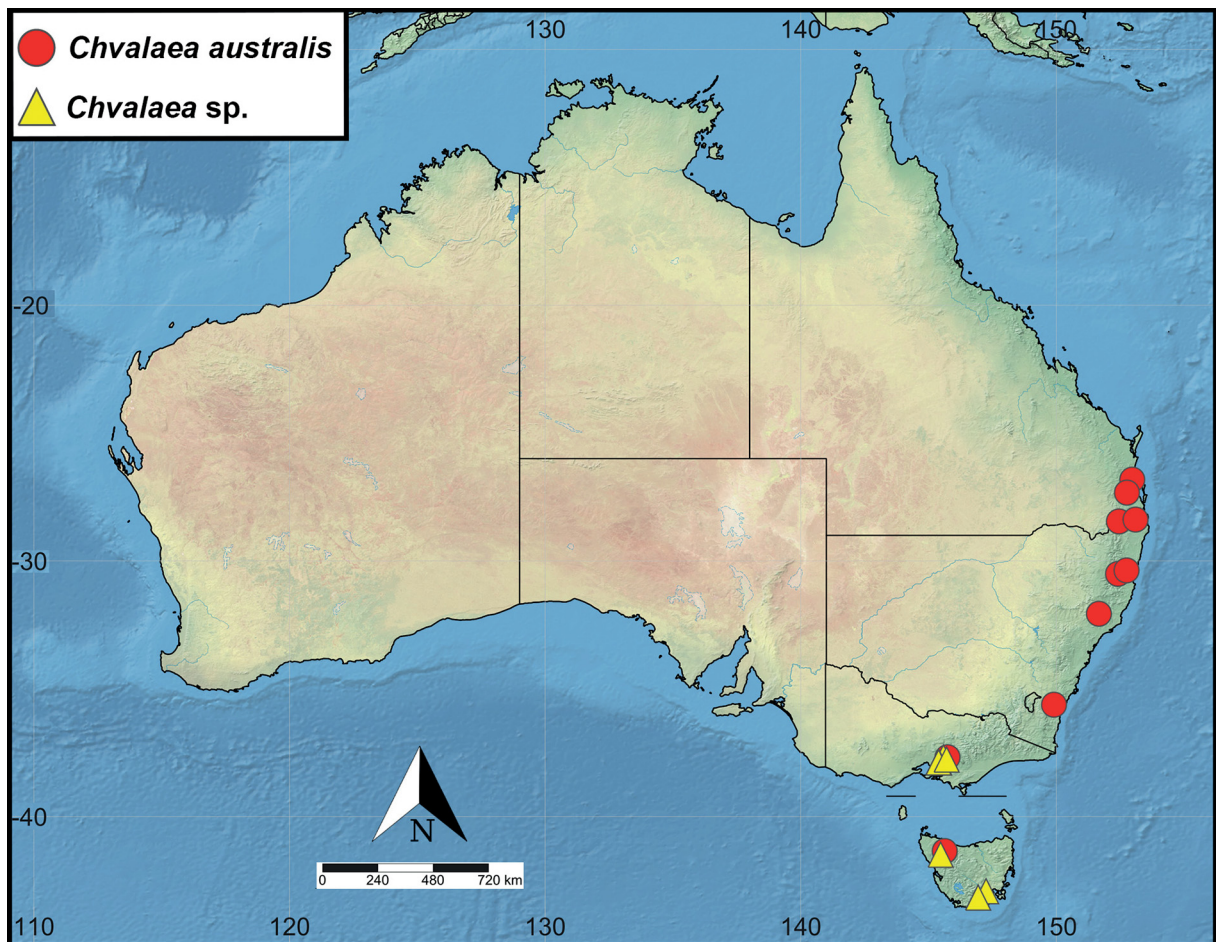


Fig. 4. Geographical records of the Australian species of *Chvalaea* Papp & Földvári, 2002.

TERMINALIA. Cerci (Fig. 2C) (lateral view): left cercus short, slender at apex; right cercus slightly longer than left cercus, broader at base. Left epandrial lamella (Fig. 2C) as long as wide; right epandrial lamella (Fig. 2D) $1.4 \times$ as long as wide, rounded apex. Surstyli long, of subequal length, narrowing at apex; phallus elongate, phallic shaft gradually arched, cylindrical, without protuberances. Hypandrium (Fig. 2A) narrow, elongate and oval, $2 \times$ as long as wide, apical margin convex with 4 setae arranged in trapezoidal pattern; subepandrial sclerite with basal margin sinuate and apical margin truncate (Fig. 2B); hypoproct (Fig. 2B) about as long as wide, apex slightly sinuate at mid-width, lateral margins round, basal margin concave in middle.



Fig. 5. Living specimens of *Chvalaea* Papp & Földvári, 2002 from the Australasian Region. A–B. Specimens resting on tips of branches (Geeveston, Tasmania), provided by Tony Daley. C. Specimen resting on a flower of *Bedfordia salicina* D.C. (Wellington Park, Tasmania), provided by Keith Martin-Smith.

Female (Fig. 1B)

Similar to male, except by abdominal segment 8 less sclerotized. Female terminalia (Fig. 2E). Sternite 8 large, about as long as wide, suboval, a narrow concave on distal margin; sternite 10 short, kidney-shaped; cercus short, slender.

Variation

In some specimens the scutum has a denser pruinosity. The number of short and blunt spine-like setae may vary in hind tarsomere 3 (4–7), hind tarsomere 4 (2–5) and hind tarsomere 5 (1–2).

Remarks

Chvalaea australis sp. nov. is similar to *C. ecuadoriensis*, by frons broad, as wide as ocellar triangle. The new species may be distinguished from the latter by the color of the hind tibia, which is brown in *C. ecuadoriensis*, but black with a brown base in *C. australis*, and by the cell r_1 which is wide at the apex in *C. australis* but narrow in *C. ecuadoriensis*.

Distribution (Fig. 4)

Chvalaea australis sp. nov. is known to occur only in the temperate broadleaf forests (Olson *et al.* 2001) of Queensland, New South Wales, Victoria and Tasmania.

Discussion

Species of *Chvalaea* form a well-supported monophyletic group based on the anal lobe poorly developed (even narrower than in *Oropezella* Collin, 1926) and cell cua short, approximately half the length of the second basal cell (bm), in addition to the abdomen heavily sclerotized and male terminalia concealed within the abdominal segment 8, and it seems to imply in paraphyly of *Oropezella* (Ale-Rocha & Freitas-Silva 2014).

Within the genus, a group of Neotropical species (*C. annularis* Barros & Ale-Rocha, 2019, *C. boliviana* Ale-Rocha, 2006, *C. catarinensis* Ale-Rocha, 2006 and *C. pulchra* Ale-Rocha, 2006) may form a monophyletic clade, defined by the presence of short, blunt, black spine-like ventral setae on the fore and mid tarsomeres 3–4, as well as the veins M_1 and M_4 not reaching the wing margin or evanescent (Barros *et al.* 2019). In *Chvalaea australis* sp. nov. (Figs 1A–B, 3) and *C. rugosiventris* (Shamshev *et al.* 2017: fig. 5–6) M_1 and M_4 do not reach the wing margin, but both lack the blunt spine-like setae on the tarsomeres. *Chvalaea australis* (Fig. 2A) also shares with the Neotropical species (Ale-Rocha 2006: figs 8, 14, 21, 27; Barros *et al.* 2019: figs 23, 27; Jaume-Schinkel *et al.* 2020: fig. 14) the narrow and elongated hypandrium, while in *C. rugosiventris* the hypandrium is rather short (Shamshev *et al.* 2017: fig. 10). However, *C. australis* (Fig. 3) shares with *C. rugosiventris* the slightly enlarged and widened costal cell at the apex (Shamshev *et al.* 2017: figs 5–6), different from the Neotropical species, whose costal cell is apically narrower (Barros *et al.* 2009: figs 45–52; Jaume-Schinkel *et al.* 2020: fig. 13).

In the Neotropics, six out of nine species are known exclusively from altitudes higher than 1000 m (3000–1100 m), while other three occur in lower altitudes (60–550 m), but in all cases each species is known to inhabit a narrow altitudinal range (Barros *et al.* 2009; Jaume-Schinkel *et al.* 2020). The specimens sampled in this paper indicate that *Chvalaea australis* sp. nov. occurs in a wide altitudinal range, from Landsborough Shire (alt. 200 m) to the New England National Park (alt. 1300–1500 m), all of them in temperate wet forests (Olson *et al.* 2001). Despite all these altitudinal ranges, the species may inhabit similar microenvironments, given that little morphological variation was observed among the specimens.

In addition to the previous records of the Palaearctic, Oriental and Neotropical Regions, *Chvalaea* is known to occur also in the Australasian Region, fulfilling 11 species worldwide. Currently, the genus is more diverse in the Neotropics, with nine known species, but more species may await description in Australasia. A quick search on the iNaturalist website (iNaturalist 2022) for *Chvalaea* from Australia returns 11 records from Victoria and Tasmania, some of them reproduced here (Fig. 5A–C). Those photographs show interesting variations in comparison with those of *C. australis* sp. nov.; all exemplars have mostly black legs, and in some of them only the coxae are yellow, while in *C. australis* the legs are more extensively yellow, with only the hind tibia and tarsus black. Unfortunately, it is not possible to affirm or deny if any of those specimens is conspecific with *C. australis* or new species, given that the safe identification of species of *Chvalaea* requires the dissection and comparison of male terminalia. In addition, male and female terminalia in *Chvalaea* are hidden by the eighth abdominal segment, making even the sexual determination unavailable in photographs. Thus, despite the positive impact that photographs of insects in social media may play in taxonomy, particularly in approximating specialists and enthusiasts in the discovery of possible new taxa (Jaume-Schinkel *et al.* 2020), the close examination of the insects is still mandatory for *Chvalaea*, evidencing the need for a more comprehensive study of the genus in Australia.

Photographs from websites such as iNaturalist, referenced with the respective local of observation, may also lead to priority areas to carry out collections and help to improve the knowledge of the diversity of *Chvalaea*, which is still poorly represented in entomological collections.

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