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Small jewels: two new species of the rare genus *Masona* van Achterberg (Hymenoptera, Ichneumonoidea, Braconidae), with a catalogue of world species and comments on the peculiar morphology of the genus

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Abstract. A comprehensive review of the enigmatic genus *Masona* van Achterberg is provided. Two new species are described from the USA: *Masona neon* Dal Pos & Martens sp. nov. from Puerto Rico, and *Masona wow* Dal Pos & Martens sp. nov. from California. A key to the world species of *Masona* is presented, together with a discussion of the morphology of the genus and an annotated catalogue of the species. [*Masona*] *timpaynei* Quicke, 2019, is excluded from Braconidae and placed as incertae sedis in the Ichneumonidae, subfamily Neorhacodinae.

Keywords. Braconidae, Masoninae, taxonomy, North America, distribution.

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Introduction

Masoninae van Achterberg, 1995 is considered one of the smallest subfamilies among the Braconidae Nees, 1811, currently composed of two genera and eight species (van Achterberg 1995, 2001; Engel & Bennett 2008; Quicke *et al.* 2019a, 2019b). The subfamily Masoninae was erected by van Achterberg (1995) to accommodate two morphologically peculiar genera: *Mannokeraia* van Achterberg, 1995 and *Masona* van Achterberg, 1995, which were initially grouped into two tribes, Mannokeraiini and Masonini, respectively. At the time, *Mannokeraia* was represented by only one species, *Mannokeraia*

apterus van Achterberg, 1995, while the genus *Masona* contained four species: *Masona bulbofemoralis* van Achterberg, 1995, *M. infuscata* van Achterberg, 1995, *M. prognatha* van Achterberg, 1995, and *M. similis* van Achterberg, 1995. In 2001, the first fossil species of Masoninae, *Masona pyrinceps* van Achterberg, 2001, was described from Dominican amber (van Achterberg 2001). Seven years later, Engel & Bennet (2008) added a new fossil genus, *Anoblepsis* Engel & Bennett, 2008, and described *Anoblepsis konokeraia* Engel & Bennet, 2008, based on a single specimen from the same formation as *M. pyrinceps*. Subsequently, Sharanowski *et al.* (2011) restructured the subfamily, based on molecular data, and moved *Mannokeraia* into the braconid subfamily Euphorinae Förster, 1863, therefore indirectly dissolving the two tribes of Masoninae. Recently, two new species of *Masona* have been described, *Masona popeye* Quicke & Chaul, 2019 from Brazil (Quicke *et al.* 2019a), and *Masona timpaynei* Quicke, 2019 from Australia (Quicke *et al.* 2019b).

The position of the subfamily Masoninae within the superfamily Ichneumonoidea Latreille, 1802 has recently been a topic of debate. Originally, the subfamily was placed within the Braconidae, but Quicke *et al.* (2019a), based on the, at that time, unpublished phylogenetic data of Quicke *et al.* (2019b), moved Masoninae from the Braconidae into the sister family Ichneumonidae. However, the most recent classification of the Braconidae by Jasso-Martínez *et al.* (2022) recovered *Masona* as sister to the aphidioid complex, thus transferring Masoninae back to the Braconidae. For the purposes of this paper, we are following the classification presented by Jasso-Martinez *et al.* (2022) and retain Masoninae as a subfamily within the Braconidae.

In this contribution, we provide a review of the genus *Masona* with the description of two new species: *Masona neon* Dal Pos & Martens sp. nov., that represents the first described extant species of the genus reported from the Caribbean, and *Masona wow* Dal Pos & Martens sp. nov., that represents the first record of the genus from western North America. Moreover, *Masona bulbofemoralis* van Achterberg, 1995, is reported for the first time for Florida based on the second specimen of the species collected since the original description. The taxonomic position of *Masona timpaynei* is reassessed, and the species is moved into the family Ichneumonidae and placed incertae sedis in the subfamily Neorhacodinae Hedicke, 1922, which is now recorded for Australia for the first time. A comprehensive treatment of the extant species of *Masona*, with comments on the overall morphological features of the genus is provided, together with a key to the species of the world.

Material and methods

Photographs

Images were taken with a Canon Eos 7D, lens Canon MP-E 65 mm f/2.8 1–5× Macro and MPlan Apo 10× Mitutoyo objective mounted onto the EF Telephoto 70–200mm Canon zoom lens. Images were then enhanced using Photoshop ver. 24.4.0.

Treatment of taxa

Morphological terminology follows Sharkey & Wahl (1992) and is aligned with the Hymenoptera Anatomy Ontology (Yoder *et al.* 2010).

For each species, type information, material examined, and relevant comments are provided. Type localities are reported as they appeared in the original publication with the addition of the country of origin. Unavailable names are identified in square brackets (as in Dal Pos *et al.* 2023). The genus of the original combination in species treated as incertae sedis are reported in square brackets. Metasomal tergites are reported abbreviated as T1 (first metasomal tergite), T2 (second metasomal tergite), etc.

Mapping

Maps were produced using QGIS 3.2 using the Esri Imagery (https://www.esri.com) plugins integrated into the Python console for QGIS for the main background layer, and overlaid globe projection using the Thematic Mapping using the Thematic Mapping Engine integration.

List of depositories

ANIC = Australian National Insect Collection, Canberra, Australia
ASUHIC = Arizona State University Hasbrouck Insect Collection, Tempe, AZ, USA
CELC = Coleção Entomológica do Laboratório de Sistemática e Biologia de Coleoptera, Universidade Federal de Viçosa, Viçosa, MG, Brazil
CNC = Canadian National Collection of Insects, Arachnids and Nematodes, Ottawa, Ontario, Canada
DDPC = Davide Dal Pos private collection, Orlando, FL, USA
EMUS = Entomology Museum, Utah State University, Logan, UT, USA
RMNH = Naturalis Biodiversity Center (formerly Rijksmuseum van Natuurlijke Historie), Leiden, The Netherlands
SBMNH = Santa Barbara Museum of Natural History, Santa Barbara, CA, USA

Data of examined material

Label information for the type specimens is reported verbatim, using the following conventions: / = different lines; // = different labels; italic = handwriting. For non-type specimens, names of collecting localities have been standardized.

Results

Key to the world species of Masona *van Achterberg, 1995*

The following key has been modified and expanded from that provided in van Achterberg (1995). Only the males of *M. prognatha* and *M. similis* are known. Despite the fact that *timpaynei* is treated as incertae sedis in the subfamily Neorhacodinae in the present paper, we report it here as [*Masona*] *timpaynei*, and we include it into the following key to facilitate identification.

1. Female winged; head orthognathous; tibia not expanded ..... [***M.***] ***timpaynei*** Quicke, 2019 incertae sedis in Neorhacodinae (Ichneumonidae)
– Female wingless; head prognathous (Figs 1, 6, 10, 12A); tibia bulbous (Figs 1, 2B, 7A, 8B) 2

2. Scutellum present (Figs 1B, 5A, 7A) 3
– Scutellum absent (Figs 10A, 11A) 5

3. Propodeum strongly bulbous, with carinate apophyse (Fig. 2A); pronotum with a strongly projecting flange (Fig. 6A); antenna with 14 flagellomeres; body pale yellowish (Fig. 7A); Brazil .... ***M. popeye*** Quicke & Chaul, 2019
– Propodeum not strongly bulbous, without carinate apophyse (Fig. 2B); pronotum without a strongly projecting flange (Fig. 6B); antenna with 11 or 16 flagellomeres; body brown or yellowish (Figs 1, 2B, 5, 6B); USA (Southeast & Puerto Rico) 4

4. Antenna with 11 flagellomeres; apical flagellomere 5 × as long as wide (Fig. 5A); head in dorsal view not strongly narrowing posteriorly, almost parallel-sided (Fig. 5A); occipital carina simple, not foveolate (Fig. 5A); body pale yellowish (Figs 5, 6B); body length 1.2 mm; Puerto Rico ....***M. neon*** Dal Pos & Martens sp.nov.

– Antenna with 16 flagellomeres; apical flagellomere 2.2 × as long as wide (Fig. 1A); head in dorsal view strongly narrowing posteriorly (Fig. 1B); occipital carina foveolate (Fig. 1B); body dark brown (Figs 1, 2B); body length 1.8 mm; USA (Southeast) .....***M. bulbofemoralis*** van Achterberg, 1995

5. Length of third flagellomere 1.3–1.5 × its width; antenna as long as combined length of head and mesosoma (Figs 10A, 11A); head in dorsal view more robust, slightly narrowed posteriorly (Figs 10A, 11A); occipital carina short in lateral view, not reaching ventral margin of gena (Fig. 10B); precoxal sulcus present, superficially impressed (Fig. 11B); male pterostigma present, weakly defined (male of *M. wow* sp. nov. unknown); USA 6
– Length of third flagellomere about 2.5 × its width; antenna somewhat longer than combined length of head and mesosoma; head in dorsal view less robust, narrowed posteriorly (van Achterberg 1995: figs 735, 741); occipital carina longer in lateral view, almost reaching external ventral margin of gena (van Achterberg 1995: fig. 733); precoxal sulcus absent; male pterostigma absent (male of *M. infuscata* unknown); Australia 7

6. Head smooth, without processes (Fig. 10); pronotum not projecting into a flange, round (Fig. 10); USA (Southeast) ..... ***M. prognatha*** van Achterberg, 1995
– Head with two processes on the frons, about half the distance between eyes and occipital carina (Figs 11B, 12A); pronotum with a strongly projecting flange (Fig. 11B); USA (Southwest) .... ***M. wow*** Dal Pos & Martens sp. nov.

7. Antenna with 12–14 flagellomeres; metasoma completely pale yellowish; fore basitarsus in dorsal view more robust (van Achterberg 1995: fig. 734); head in dorsal view slightly less narrowed posteriorly (van Achterberg 1995: fig. 735); length of body of female 0.9–1.2 mm ....***M. similis*** van Achterberg, 1995
– Antenna with 16 flagellomeres; metasoma (except first tergite) more or less dark brown; fore basitarsus in dorsal view less robust (van Achterberg 1995: fig. 742); head of female in dorsal view slightly more narrowed posteriorly (van Achterberg 1995: fig. 741); length of body of female about 1.7 mm ....***M. infuscata*** van Achterberg, 1995

Taxonomy

Class Insecta Linnaeus, 1758
Order Hymenoptera Linnaeus, 1758
Superfamily Ichneumonoidea Latreille, 1802
Family Braconidae Nees, 1811
Subfamily Masoninae van Achterberg, 1995

Genus ***Masona*** van Achterberg, 1995

Masona van Achterberg, 1995: 97. Type species *Masona prognatha* van Achterberg, 1995, by original designation.

Masonia [sic] – van Achterberg 1995: 154–155. Incorrect subsequent spelling of *Masona* van Achterberg, 1995.

Diagnosis

The genus *Masona* has a highly unusual morphology relative to the rest of Ichneumonoidea. Quicke *et al.* (2019b) slightly modified the diagnosis of the genus (and therefore of the subfamily) based on the description of [*Masona*] *timpaynei* Quicke, 2019. However, the latter is hereby treated as incertae sedis in the subfamily Neorhacodinae (see below), and, therefore, we report the original characters used to diagnose the genus: (1) head prognathous in most of females, orthognathous in males; (2) ocelli absent

in the female, present in the male; (3) occipital carina absent ventrally; (4) labial palps one-segmented; (5) female wingless, males macropterous; (6) all femora strongly swollen in females; (7) ovipositor short, upcurved, with a long shallow dorsal notch.

Remarks

In the captions for the species *Masona prognatha*, van Achterberg (1995: 154–155, figs 12–32) wrote the genus name as *Masonia*, which also appears on the original holotype label of the species (van Achterberg (1995: fig. 9A). This is clearly a misspelling that unfortunately has never been reported before. *Masonia* should be considered an incorrect subsequent original spelling of the genus *Masona*, rendering the name unavailable (ICZN 1999: Article 33.3).

Masona bulbofemoralis van Achterberg, 1995
Figs 1, 2B, 3

Masona bulbofemoralis van Achterberg, 1995: 98–99 (description, key, distribution, images).

Masona bulbofemoralis – Yu *et al.* 2016 (catalogue). — Quicke *et al.* 2019a : 592 (comments); 2019b: appendix S1 (list).

Differential diagnosis

Masona bulbofemoralis can be easily distinguished from all the other species of the genus by the following morphological features: (1) scutellum present (absent in *M. infuscata*, *M. prognatha*, *M. similis* and *M. wow* sp. nov.); (2) larger size, about 1.8 mm; (3) brown color (*M. neon* sp. nov. and *M. popeye* are completely yellow); (4) non-bulbous propodeum (strongly bulbous in *M. popeye*); (5) occipital carina foveolate (simple in all the other species of the genus).

Original type series

Holotype (by original designation)
UNITED STATES OF AMERICA • ♀; Georgia, Decatur County; 22 Jun. 1953; P.B. Kannowski leg.; EMUS.

Material examined

UNITED STATES OF AMERICA • 1 ♀; Florida, Orange Co., Hal Scott Regional Preserve, Cypress swamp; 28.502818° N, 81.134632° W; 5–26 Jul. 2022; D. Dal Pos and A. Pandolfi leg.; D. Dal Pos det., 2022; Malaise trap; DDPC.

Male

Unknown.

Distribution

UNITED STATES OF AMERICA: Georgia (van Achterberg 1995); Florida (**new record**) (Fig. 3).

Remarks

The specimen reported above is a new record for Florida, expanding the distribution of the species further south, and it is the first specimen recorded since the holotype was collected nearly 70 years ago.

The specimen was collected via Malaise trap at the ecotone between a cypress dome forested wetland and a palm flat wood. During the wet season (June–September), the area is frequently inundated with

water. The Malaise trap was left in situ for an entire year (August 2021–August 2022) but only a single specimen of *M. bulbofemoralis* was collected. The collecting period (5–26 June) matches the month of the holotype collection (22 June 1953).

According to Quicke *et al.* (2019a), *Masona popeye* Quicke & Chaul, 2019, is the largest species of *Masona* currently described, having a body length of 2.0 mm. However, the specimen of *Masona bulbofemoralis* here recorded measures 2.0 mm too.

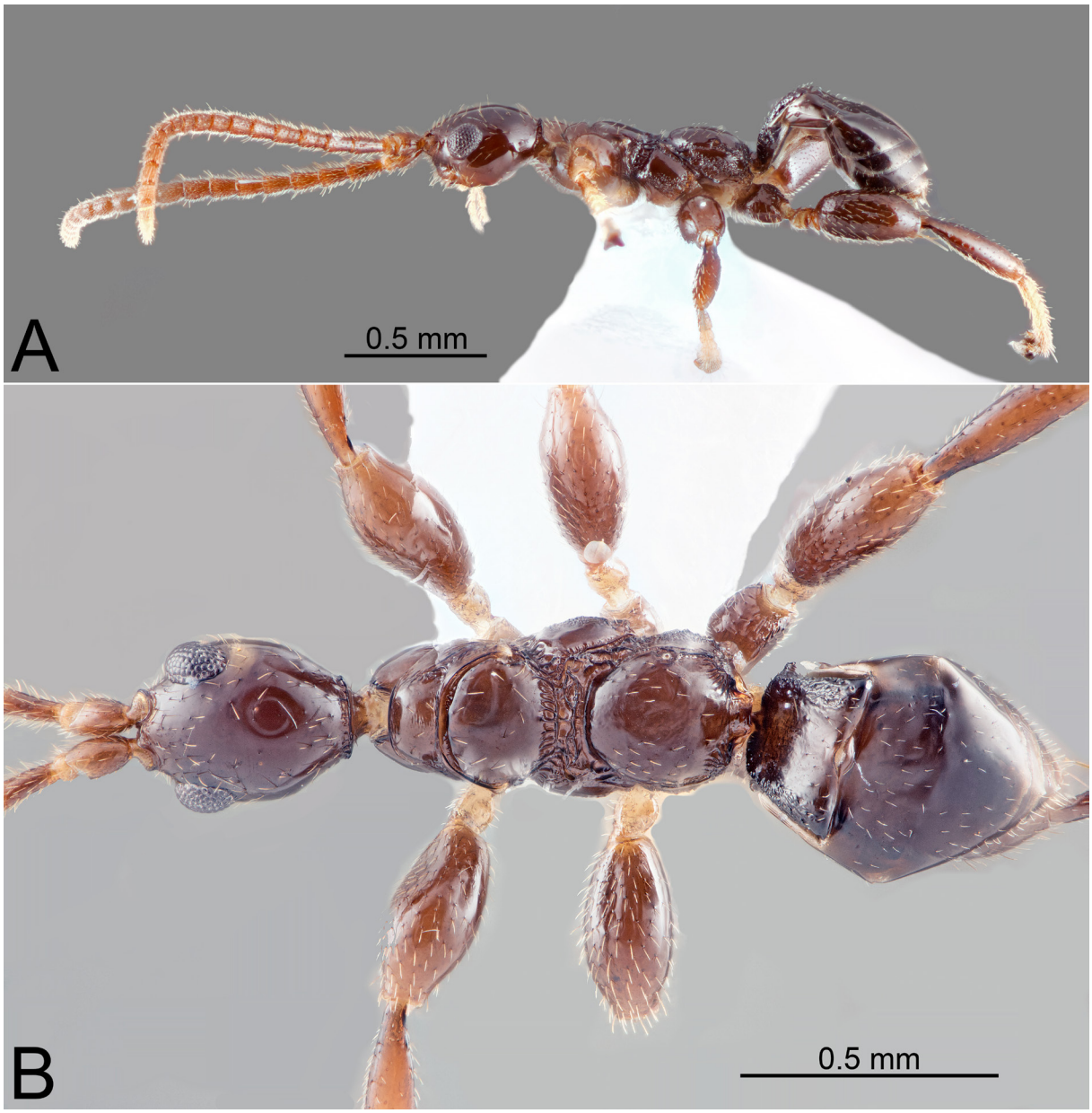

Fig. 1. *Masona bulbofemoralis* van Achterberg, 1995, ♀ (DDPC). **A**. Habitus, lateral view. **B**. Habitus, dorsal view.

Fig. 2. Propodeum, lateral view. **A**. *Masona popeye* Quicke & Chaul, 2019, holotype, ♀ (CELC). **B**. *Masona bulbofemoralis* van Achterberg, 1995, ♀ (DDPC).

Masona infuscata van Achterberg, 1995
Fig. 4

Masona infuscata van Achterberg, 1995: 99 (description, key, distribution, images).

Masona infuscata – Yu *et al.* 2016 (catalogue). — Quicke *et al.* 2019a : 592 (comments); 2019b: appendix S1 (list).

Differential diagnosis

Masona infuscata can be easily distinguished from all the other species of the genus by the following morphological features: (1) scutellum absent (present in *M. bulbofemoralis*, *M. popeye*, and *M. neon* sp. nov.); (2) first flagellomere about 2.5 × as long as medially wide (1.5 or less in *M. prognatha* and *M. neon* sp. nov.); (3) antenna longer than head and mesosoma together (shorter in *M. prognatha* and *M. wow* sp. nov.); (4) T2–T7 brown (yellow in *M. similis*); (5) body length approximately 1.7 mm (0.9–1.2 mm in *M. similis*); (6) occipital carina well-developed, almost reaching ventral margin of the gena (short in *M. prognatha* and *M. wow* sp. nov.).

Original type series

Holotype (by original designation)
AUSTRALIA • ♀; Queensland, Near Heathlands National Park; 21 Oct.–12 Nov. 1993; P. Zborowski and M. Horak leg.; ANIC.

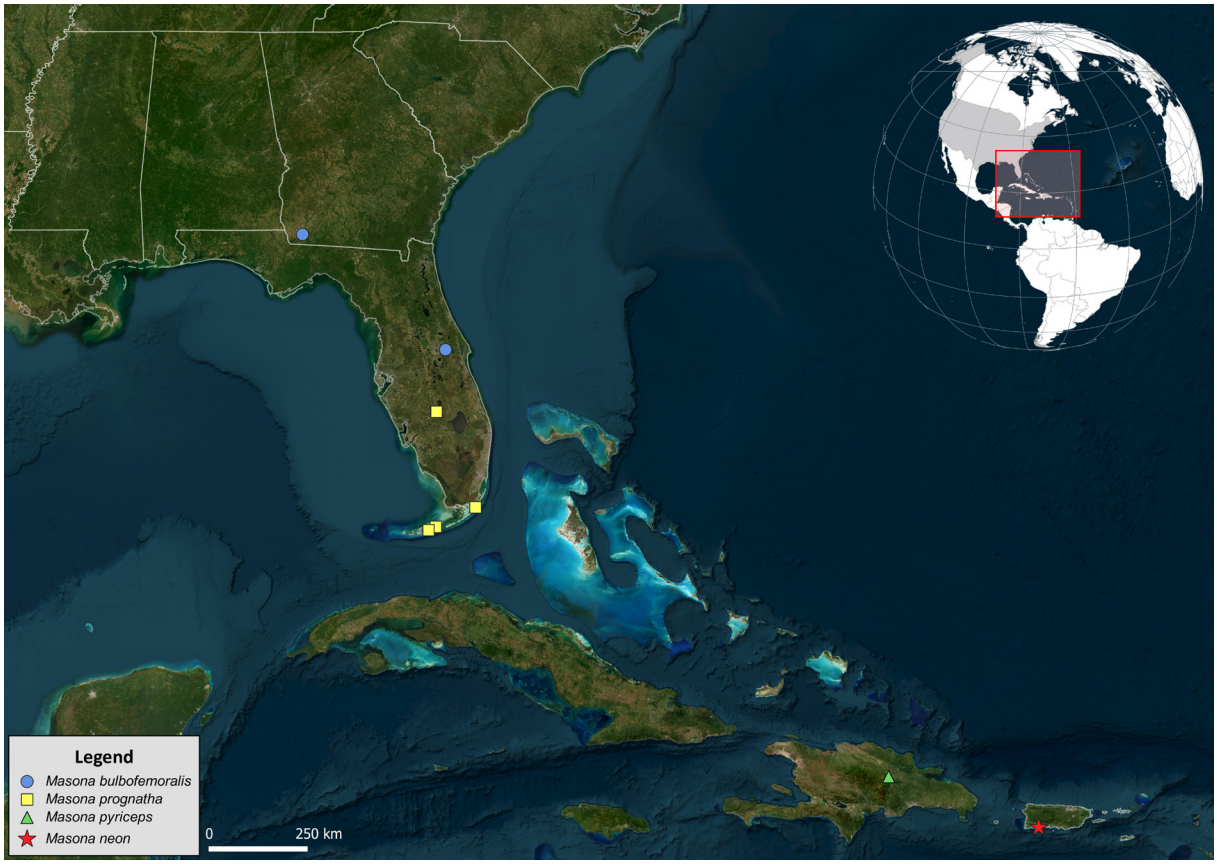

Fig. 3. Distribution of *Masona* van Achterberg, 1995, in the southeastern USA.

Male

Unknown.

Distribution

AUSTRALIA: Queensland (van Achterberg 1995) (Fig. 4).

Remarks

Known only from the holotype.

Masona neon Dal Pos & Martens sp. nov.
urn:lsid:zoobank.org:act:461CAE8C-50C0-468D-A387-A2659E54148D
Figs 3, 5, 6B

Differential diagnosis

Masona neon sp. nov. can be easily distinguished from all the other species of the genus by the following morphological features: (1) scutellum present (absent in *M. infuscata*, *M. prognatha*, *M. similis* and *M. wow* sp. nov.); (2) yellow color (brown in *M. bulbofemoralis*); (3) propodeum not inflated (bulbous in *M. popeye*); (4) a long apical flagellomere, 5× as long as wide (less than 2× as long as wide in *M. bulbofemoralis*); (5) pronotum without a projecting flange (flange present in *M. popeye*).

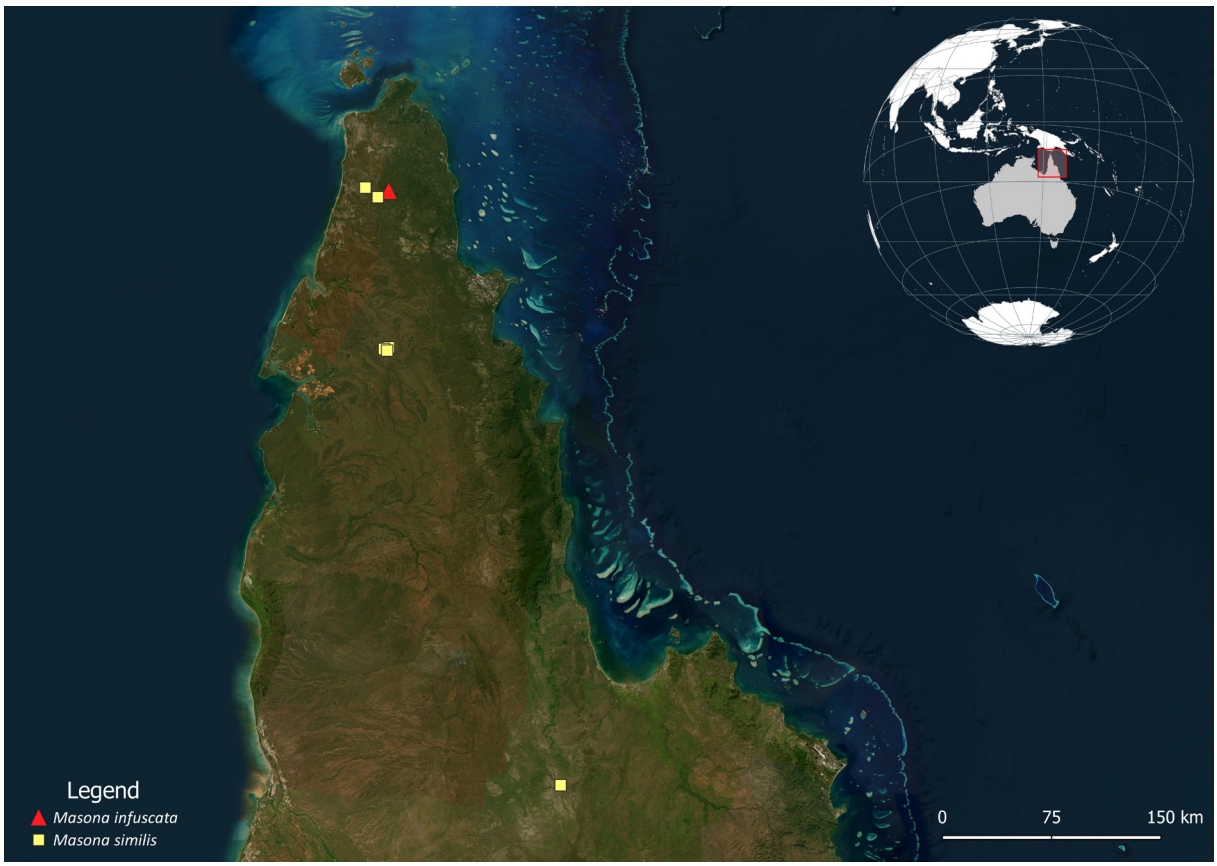

Fig. 4. Distribution of *Masona* van Achterberg, 1995, in Queensland, Australia.

Etymology

The species is dedicated to the National Ecological Observatory Network (NEON) project (https://www.neonscience.org/), which monitors ecosystems across the USA. This new species was collected as bycatch of a larger pitfall trap project used to monitor Carabidae (Coleoptera). Hopefully, it will serve as an incentive to strengthen collaboration between different disciplines (e.g., ecology and taxonomy), and to increase awareness of the importance of biodiversity monitoring, especially in this period of dire biodiversity crisis. Taxonomy is still active, functional, and crucial for the study of biodiversity. The specific epithet '*neon*' is a noun in apposition.

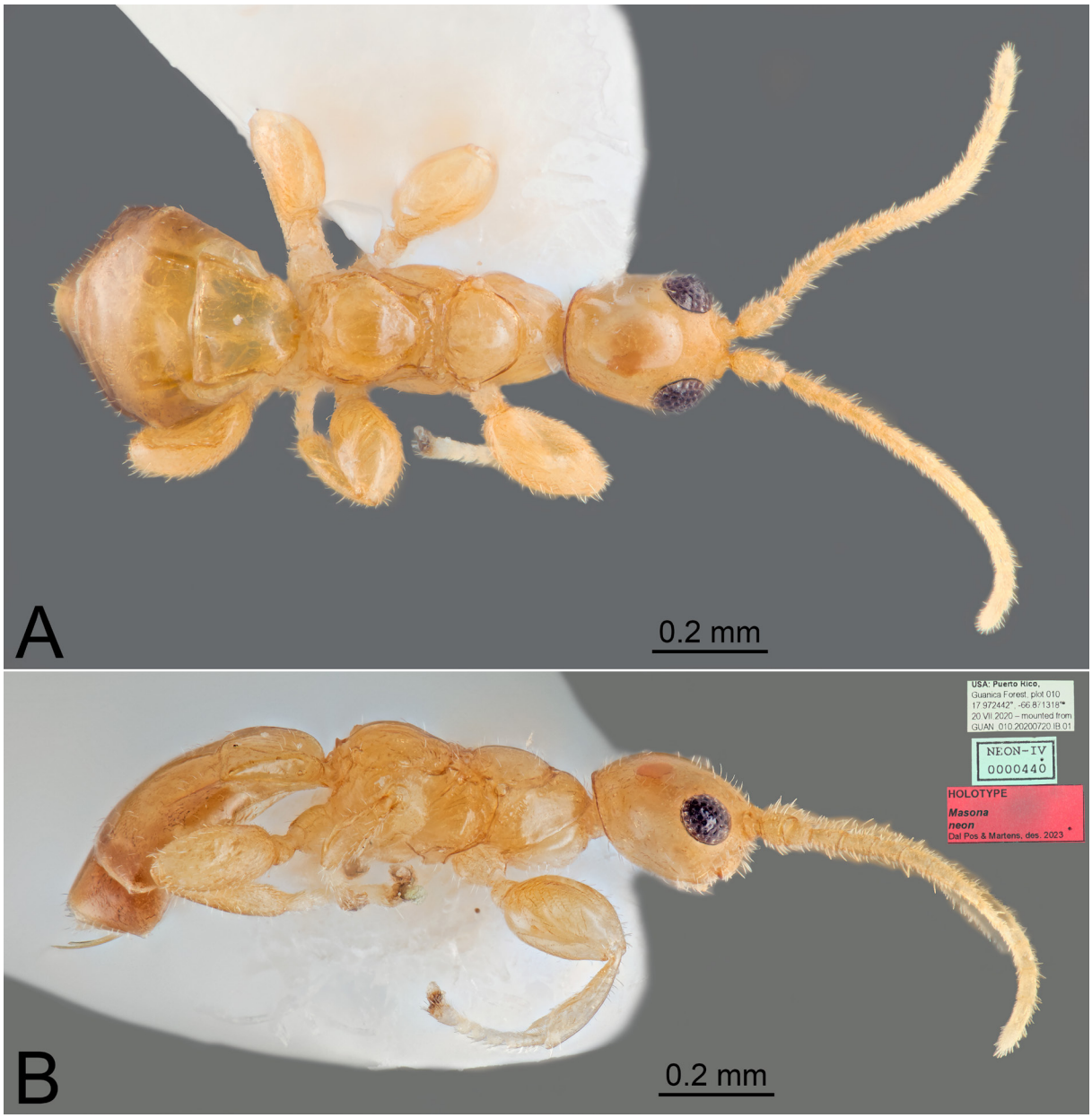

Fig. 5. *Masona neon* Dal Pos & Martens sp. nov., holotype, ♀ (ASUHIC). **A**. Habitus, dorsal view. **B**. Habitus, lateral view.

Type material

Holotype

UNITED STATES OF AMERICA • ♀; "[White label] USA: Puerto Rico / Guanica Forest, plot 010 / 17.972442°, -66.87.13118 / 20.VII.2020 – mounted from / GUAN 010.20200720.IB.01 // [Light green label] NEON–-IV / 00000440 // [Red label] HOLOTYPE / *Masona* / *neon* / Dal Pos & Martens, des. 2023"; ASUHIC. The specimen is in good condition, missing only the entire left fore leg.

Description

Female

Measurement. Body length: 1.3 mm.

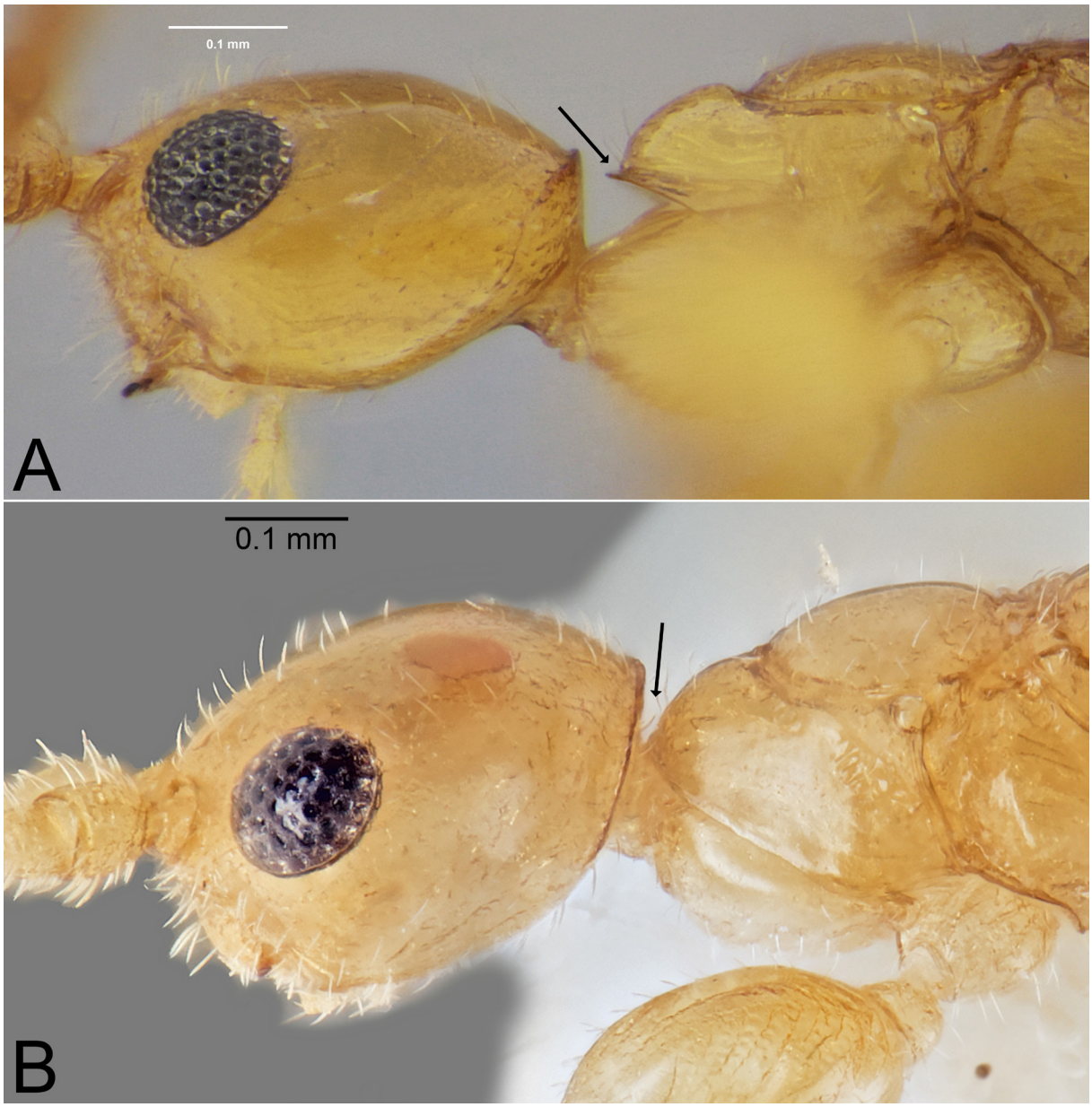

Fig. 6. Head and pronotum, lateral view. **A**. *Masona popeye* Quicke & Chaul, 2019, holotype, ♀ (CELC). **B**. *Masona neon* Dal Pos & Martens sp. nov., holotype, ♀ (ASUHIC). Arrows indicates the projecting flange of the pronotum.

Head. Prognathous, 1.2 × as long as wide, overall smooth and shiny; mandibles strongly twisted and blade-like; clypeus distinct, clearly separated form face, with small tentorial pits; face extremely reduced; occipital carina strong dorsally, gradually dissipating laterally; antenna with 11 flagellomeres, all of which longer than wide, with apical flagellomere 5 × as long as medially wide; scape and pedicel about as long as wide; area between antennal sockets not elevated.

Mesosoma. Overall smooth and shiny; 2.2 × as long as maximally wide. Pronotum shorter than mesoscutum and without a well-developed, lamelliform carina anteriorly; antescutal depression present. Propleuron convex ventrally, its posterior margin projecting into a point between fore coxae. Mesoscutum 0.8 × as long as wide, notauli absent. Scutellum distinct, approximately 6.0 × as wide as long medially. Mesopleuron smooth and shiny, with sternaulus distinct and reaching mid coxa; postpectal carina complete. Scutellum present. Metanotum indistinct. Propodeum smooth and shiny, widest at midlength, wider than mesoscutum, slightly convex (almost flat) in lateral view, and produced into two blunt apophyses posteriorly; propodeal spiracle round. Metapleuron smooth and shiny, with juxtacoxal carina distinct.

Legs. Femora extremely expanded, bulbous. Tibiae gradually expanded.

Wings. Absent.

Metasoma. Overall smooth and shiny. T1 medio-anteriorly concave, with developed dorso-lateral carinae, without laterope, narrow anteriorly, 0.9 × as long as posteriorly wide; T1 spiracle situated in anterior 0.3 of segment. T2 laterally sclerotized, with a distinct articulation with T3. T1–T4 clearly discernible, T5–T8 retracted and indiscernible. Ovipositor barely protruding beyond apex of metasoma, strongly upcurved.

Coloration. Entire body yellowish-white.

Male

Unknown.

Host

Unknown.

Distribution

UNITED STATES OF AMERICA: Puerto Rico (Fig. 3).

Remarks

The specimen was collected by means of a pitfall trap. The genus *Masona* has been previously recorded from the Caribbean (Dominican Republic) based on the fossil species *Masona pyriceps* van Achterberg, 2001. However, *M. neon* sp. nov. marks the first record of an extant species for the area, and it is the first record of the genus from the island of Puerto Rico.

Masona popeye Quicke & Chaul, 2019
Figs 2A, 6A, 7–9

Masona popeye Quicke & Chaul in Quicke *et al.*, 2019a: 588–592 (description, key, distribution, images).

Differential diagnosis

Masona popeye can be easily distinguished from all the other species of the genus by the following morphological features: (1) scutellum present (absent in *M. infuscata*, *M. prognatha*, *M. similis* and *M. wow* sp.nov.); (2) strong anterior flange of pronotum (absent in *M. bulbofemoralis* and *M. neon*

sp. nov.); (3) bulbous propodeum (not bulbous in *M. bulbofemoralis* and *M. neon* sp. nov.); (4) dorsolateral carina on T1 present (absent in *M. bulbofemoralis*).

Original type series

Holotype (by original designation)
BRAZIL • ♀; Minas Gerais, Mata do Paraíso; 9 Nov. 2016; J. Chaul leg.; CELC.

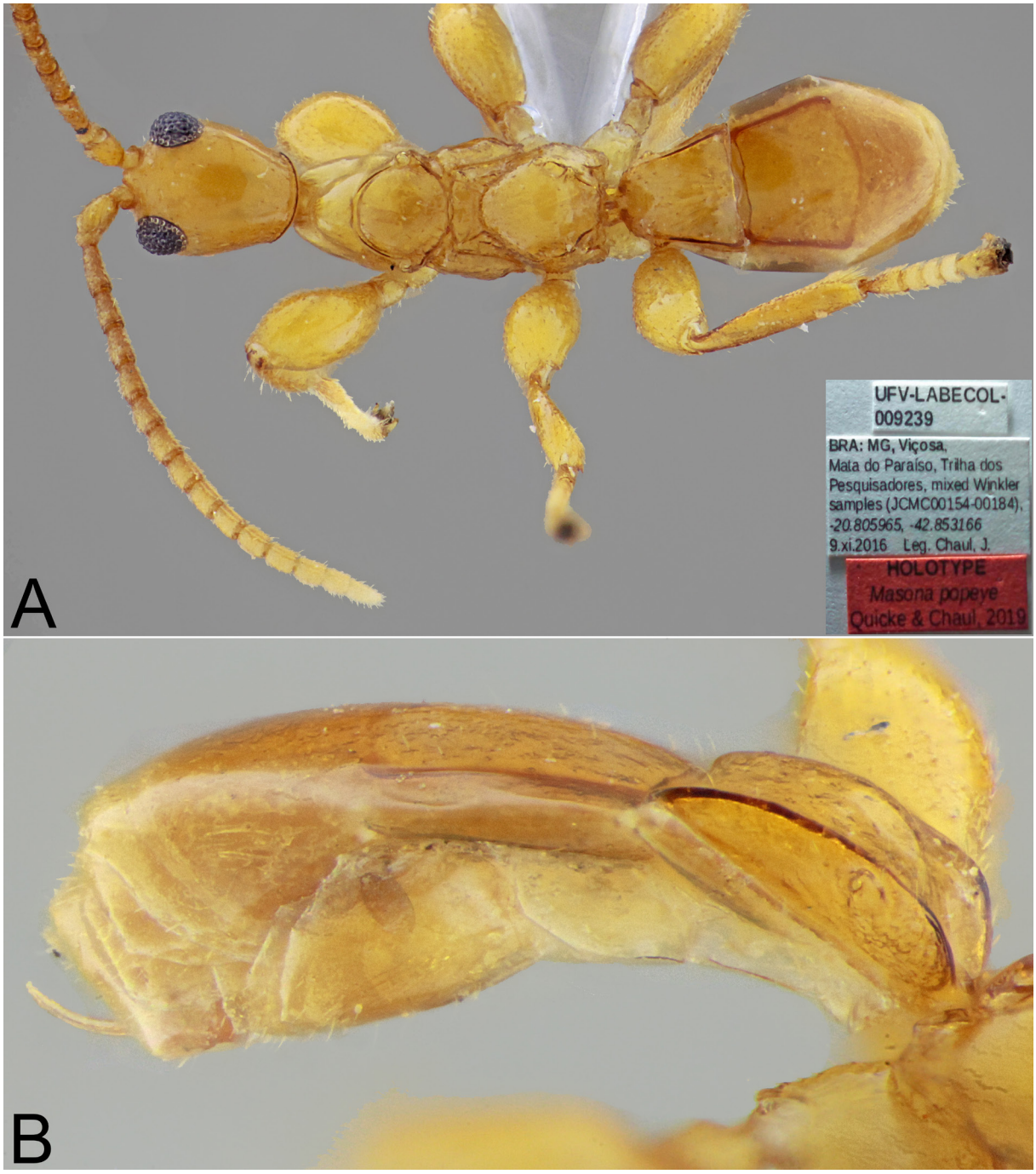

Fig. 7. *Masona popeye* Quicke & Chaul, 2019, holotype, ♀ (CELC). **A**. Habitus, dorsal view. **B**. Metasoma, lateral view.

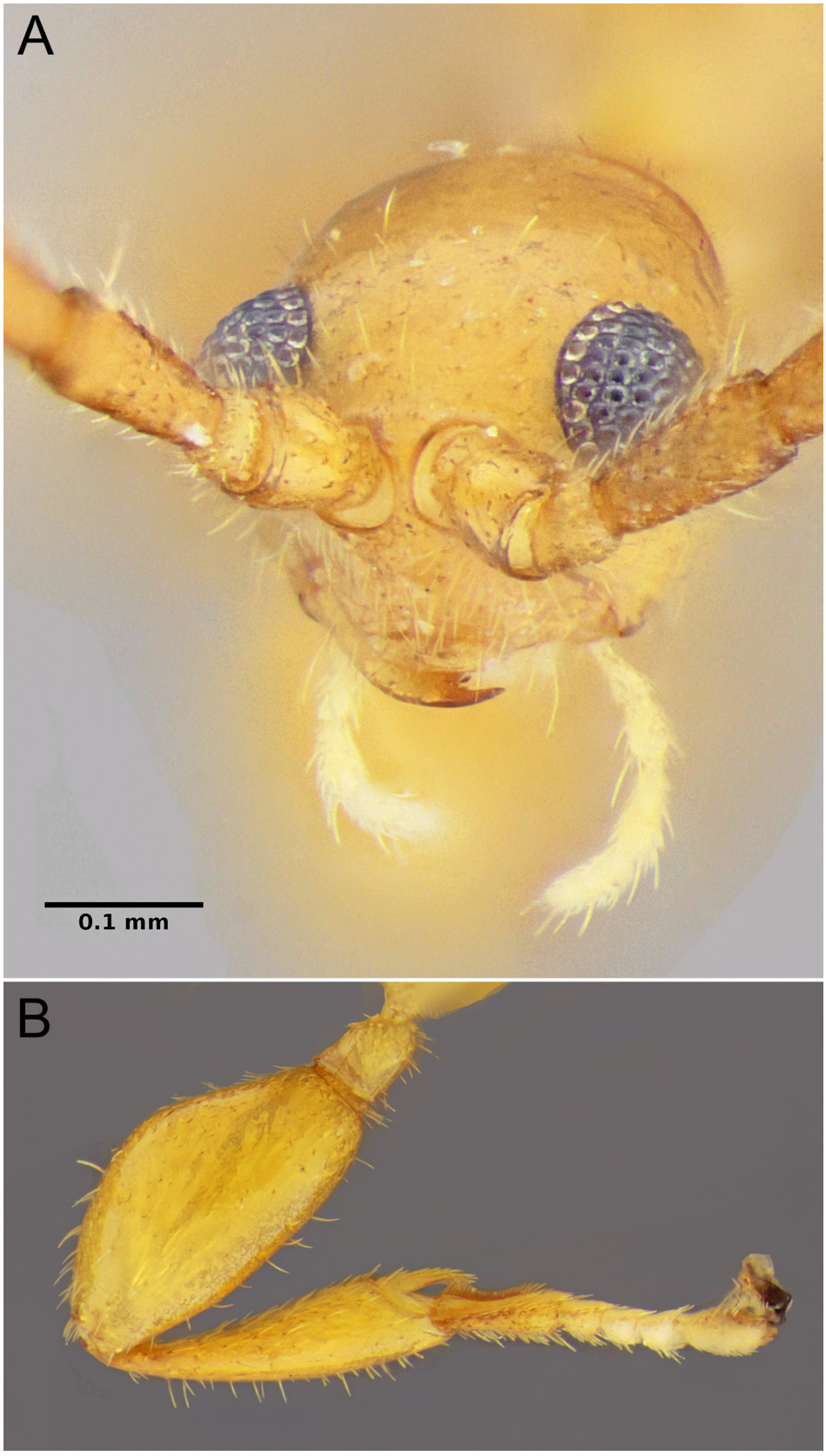

Fig. 8. *Masona popeye* Quicke & Chaul, 2019, holotype, ♀ (CELC). **A**. Head, frontal view. **B**. Fore leg, internal view.

Male

Unknown.

Distribution

BRAZIL: Mina Gerais (Quicke *et al.* 2019a) (Fig. 9).

Remarks

Known only from the holotype.

Masona prognatha van Achterberg, 1995
Figs 3, 10

Masona prognatha van Achterberg, 1995: 100–101 (description, key, distribution, images).

Masona prognatha – Yu *et al.* 2016 (catalogue). — Quicke *et al.* 2019a: 588 (notes); 2019b: appendix S1 (list).

Differential diagnosis

Masona progantha can be easily distinguished from all the other species of the genus by the following morphological features: (1) scutellum absent (present in *M. bulbofemoralis*, *M. neon* sp. nov., and *M. popeye*); (2) processess on head absent (present in *M. wow* sp. nov.); (3) antenna as long as metasoma

Fig. 9. Distribution of *Masona popeye* Quicke & Chaul, 2019, in South America.

Fig. 10. *Masona prognatha* van Achterberg, 1995, holotype, ♀ (CNC). **A**. Habitus, dorsal view. **B**. Habitus, lateral view. Downloaded from the public CNC database (available also at https://www.cnc.agr.gc.ca/taxonomy/Taxonomy.php?id=3044).

and head combined (longer in *M. similis* and *M. infuscata*); (4) precoxal sulcus present (absent in *M. similis* and *M. infuscata*); (5) occipital carina short, not reaching the ventral margin of the gena (well-developed in *M. similis* and *M. infuscata*).

Original type series

Holotype (by original designation)
UNITED STATES OF AMERICA • ♀; Florida, Monroe Co., Big Pine Key; 3 May–3 Aug. [19]85; S. and J. Peck leg.; CNC.

Paratypes
UNITED STATES OF AMERICA • 6 ♂♂; CNC, RMNH • 2 ♀♀; CNC.

Material examined

Holotype
UNITED STATES OF AMERICA • ♀; "[White label] FLA:MonroeCo. / BigPineKey,Watson / Hammock,S&JPeck / 3.V-3.VIII.85,malaise / FIT\.hardwoodhammock // [Red label] ♀ *Masonia gen. nov.* / *prognatha sp. nov.* / C. van Achterberg, 19*92* / HOLOTYPE // [Red label] HOLOTYPE / *Masona* / *prognatha* / CNC No.*22593*"; CNC (images examined).

Male

Described in van Achterberg (1995).

Distribution

UNITED STATES OF AMERICA: Florida (van Achterberg 1995) (Fig. 3).

Remarks

In the original description, there is an inconsistency in the number of males and females. van Achterberg (1995: 100) listed "6♂♂ & 2♀♀" among the paratypes of the species. However, when the author listed the full locality data for each specimen, the number of males amounts to seven and that of females to one.

Known only from the original type series, this species has an interesting distribution: all specimens were collected in the Florida Keys (in Monroe Co., Florida, USA), except for a single specimen collected in mainland Florida at the Archbold Biological Station (Highlands Co., Florida, USA). It is very possible that *Masona prognatha* is associated with the hammock hardwood forests present in South Florida, and this apparently disjunct distribution is mainly due to a lack of sampling in the greater Miami area, between the Florida Keys and the Archbold Biological Station, where hardwood forests are still present as remnants (Fernández-Triana, pers. comm.).

Masona similis van Achterberg, 1995
Fig. 4

Masona similis van Achterberg, 1995: 101–102 (description, key, distribution, images).

Masona similis – Yu *et al.* 2016 (catalogue). — Quicke *et al.* 2019b: appendix S1 (list).

Differential diagnosis

Masona similis can be easily distinguished from all the other species of the genus by the following morphological features: (1) scutellum absent (present in *M. bulbofemoralis*, *M. neon* sp. nov., *M. popeye*); (2) first flagellomere about 2.5 × as long as medially wide (1.5 or less in *M. prognatha* and *M. neon*

sp. nov.); (3) antenna longer than head and mesosoma together (shorter in *M. prognatha* and *M. wow* sp. nov.); (4) metasoma completely yellow (dark brown in *M. infuscata*); (5) body length approximately 0.9–1.2 mm (1.7 mm in *M. infuscata*); (6) occipital carina well-developed, almost reaching ventral margin of the gena (short in *M. prognatha* and *M. wow* sp. nov.).

Original type series

Holotype (by original designation)
AUSTRALIA • ♀; Queensland, Wenlock, Batavia Downs; 22 Jun.–23 Aug. 1992; P. Zborowski and J. Cardale leg.; ANIC.

Paratypes
AUSTRALIA • 4 ♂♂ (ANIC, RMNH); 9 ♀♀ (ANIC, RMNH).

Male

Described in van Achterberg (1995).

Distribution

AUSTRALIA: Queensland (van Achterberg 1995) (Fig. 4).

Remarks

Known only from the original type series.

Masona wow Dal Pos & Martens sp. nov.
urn:lsid:zoobank.org:act:0897F552-3922-49E3-9AEE-ED5DFE687419
Figs 11–13

Differential diagnosis

Masona wow sp. nov. can be easily distinguished from all the other species of the genus by the presence of two processes on the dorsal side of the head (absent in all the other species). Other morphological features are: (1) scutellum absent (present in *M. bulbofemoralis*, *M. neon* sp. nov., and *M. popeye*); (2) antenna as long as metasoma and head combined (longer in *M. similis* and *M. infuscata*); (3) precoxal sulcus present (absent in *M. similis* and *M. infuscata*); (4) occipital carina short, not reaching the ventral margin of the gena (well-developed in *M. similis* and *M. infuscata*).

Etymology

The specific epithet is a noun in apposition based on the common English expression 'wow', that means astonishment and / or admiration. The name refers to the first author (DDP)'s reaction when he first noticed the two unmistakable protuberances on the holotype's head as well as the surprise in discovering a new unmistakable species of this rare genus in the USA.

Type material

Holotype
UNITED STATE OF AMERICA • ♀; "[White label] CA: Los Angeles Co. / 32° 58' 33.47'' N / San Clemente Island / Northwest terrace flar / MDS boxthorn // [White label] 118° 34' 15.74'' W / 6/28/10 / U.S. Navy// [White label] Hymenoptera / Bethylidae / Bethylid wasp // [Blue label] SBMNH / ENT0117604 // [White label] *Masona* / det. M. Gimmel 2020 // [Orange label] PHOTO // [Red label] HOLOTYPE / *Masona* / *wow* / Dal Pos & Martens, des. 2023"; SBMNH. The specimen is in very good condition.

Description

Female

Measurement. Body length: 1.5 mm.

Head. Prognathous, 1.3 × as long as wide (measured dorsally, across the eyes), overall smooth and shiny; mandibles strongly twisted and blade-like; clypeus distinct, clearly separated form face, with small

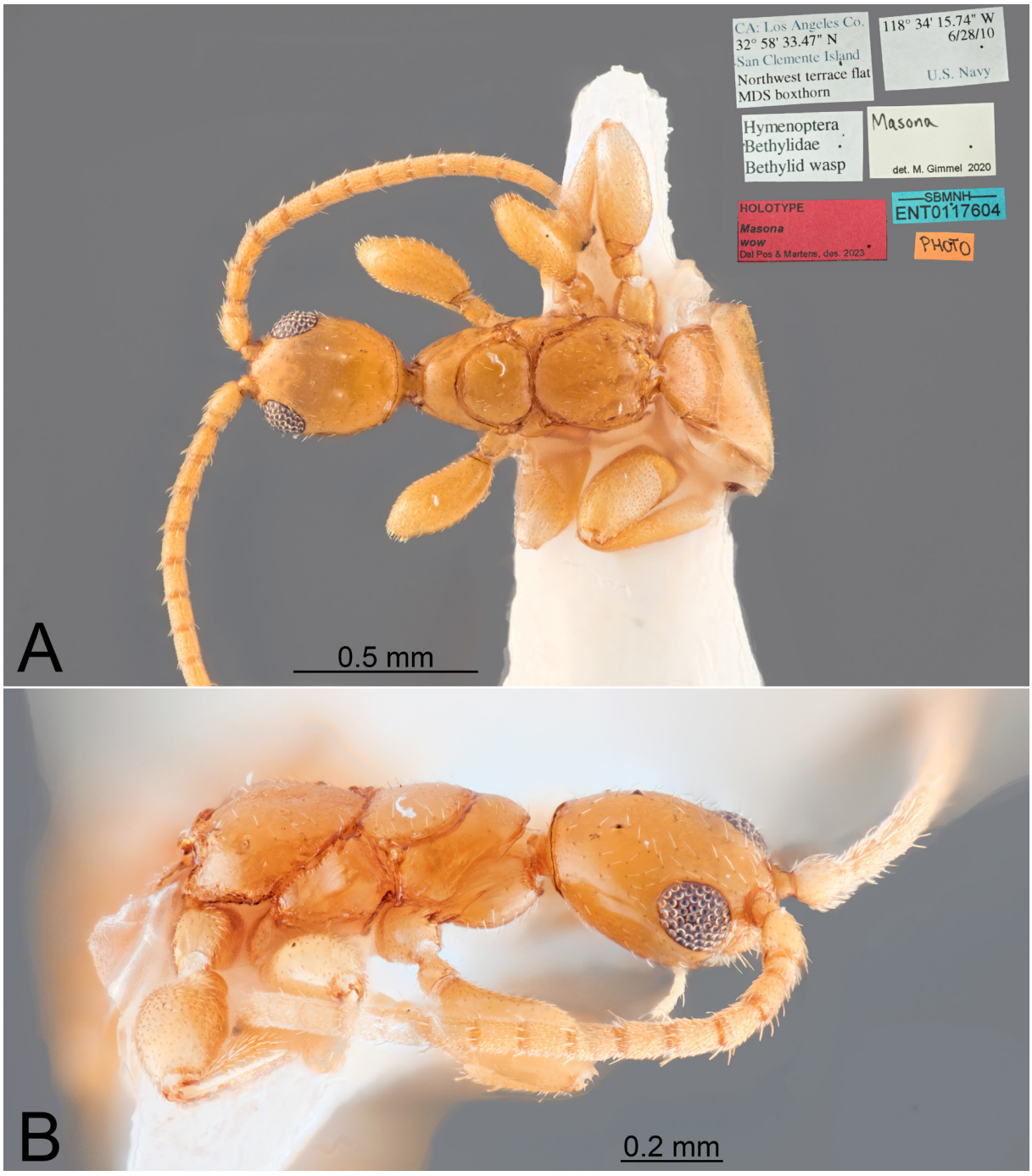

Fig. 11. *Masona wow* Dal Pos & Martens sp. nov., holotype, ♀ (SBMNH). **A**. Habitus, dorsal view. **B**. Habitus, lateral view.

Fig. 12. *Masona wow* Dal Pos & Martens sp. nov., holotype, ♀ (SBMNH). **A**. Head, dorso-lateral view. **B**. Head and propleuron, ventral view.

tentorial pits; face extremely reduced; occipital carina strong dorsally, gradually dissipating laterally; antenna with 14 flagellomeres, all of which longer than wide, with apical flagellomere 2.2 × as long as medially wide; scape and pedicel about as long as wide; area between antennal sockets not elevated; dorsal side of head with two processes beyond middle.

Mesosoma. Overall smooth and shiny; 2.3 × as long as maximally wide. Pronotum shorter than mesoscutum and with a well-developed, lamelliform carina anteriorly; antescutal depression present. Propleuron convex ventrally, its posterior margin projecting into a point between fore coxae. Mesoscutum 0.9 × as long as wide, notauli absent. Scutellum distinct, approximately as long as medially wide. Mesopleuron smooth and shiny, with sternaulus distinct and reaching mid coxae. Scutellum absent. Metanotum indistinct. Propodeum smooth and shiny, widest at midlength, wider than mesoscutum, flat in lateral view, and produced into two blunt apophyses posteriorly; propodeal spiracle round. Metapleuron smooth and shiny, with juxtaocoxal indistinct.

Legs. Femora extremely expanded, bulbous. Tibiae gradually expanded.

Wings. Absent.

Metasoma. Overall smooth and shiny. T1 not medio-anteriorly concave, with developed dorso-lateral carinae, without laterope, narrow anteriorly, 0.9 × as long as posteriorly wide; T1 spiracle situated in anterior 0.3 of segment. T2 laterally more sclerotized, with a distinct articulation with T3. T1–T4 clearly discernible, T5–T8 retracted and indiscernible. Ovipositor barely protruding beyond apex of metasoma, strongly upcurved.

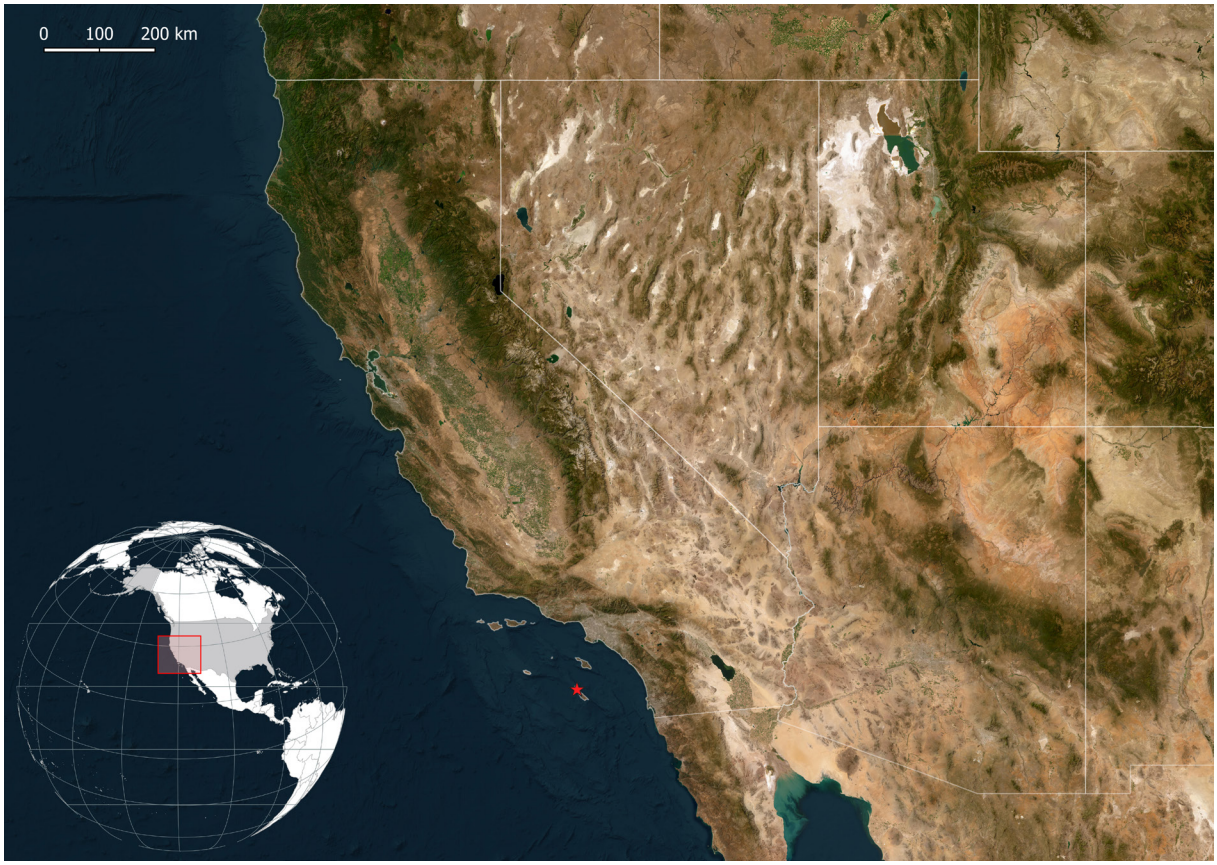

Fig. 13. Distribution of *Masona wow* Dal Pos & Martens sp. nov., in the southwestern USA.

Coloration. Entire body yellow.

Male

Unknown.

Host

Unknown.

Distribution

UNITED STATES OF AMERICA: California (Fig. 13).

Remarks

Masona wow sp. nov. marks the first record for the species of the genus from the western USA, and it is the first species recorded with two processes on the head, the function of which is unknown.

Family Ichneumonidae Latreille, 1802
Subfamily Neorhacodinae Hedicke, 1922

[*Masona*] *timpaynei* Quicke, 2019 [incertae sedis]
Fig. 14

Masona timpaynei Quicke in Quicke *et al.*, 2019b: appendix S1 (description, distribution, images).

Original type series

Holotype (by original designation)
AUSTRALIA • ♀; Western Australia, Millstream National Park; 17 Jun. 2014; N. Brougham leg.; ANIC.

Male

Described in the same work (Quicke *et al.* 2019b).

Distribution

AUSTRALIA: Western Australia (Quicke *et al.* 2019b) (Fig. 14).

Remarks

In the original description, *timpaynei* was placed within *Masona* and distinguished from all the other species of the genus by the following morphological features: (1) wings present in females (absent in all the other species); (2) orthognathous head in females (prognathous in all the other species of the genus). This made *timpaynei* a morphologically unusual species for the genus. Based on the two diagnostic characters that set *M. timpaynei* apart from all the other species, Quicke *et al.* (2019b: appendix S1) redefined the diagnosis of the genus. A careful examination of the characters and the images in the original description led us to believe that *timpaynei* is not a species of *Masona*, nor does it belong to the family Braconidae. In addition to the two diagnostic characters listed to diagnose the species (see above), the presence of a pronounced dorsal notch on the terebra, and the conspicuous ovipositor sheaths, make it unlikely that *timpaynei* could be placed within the genus *Masona.* Moreover, the wing venation and the general habitus (e.g., large pedicel) renders *timpaynei* more similar to a member of the subfamily Neorhacodinae (Ichneumonidae). This also explains why in their phylogenetic analyses, Quicke *et al.* (2019b) retrieved *Masona* nested well within the Ichneumonidae, very differently from the results of Jasso-Martínez *et al.* (2022) who placed *Masona* well within Braconidae.

Even though the correct generic placement is still doubtful and cannot be securely proven without a direct study of the original type series, we can safely place *timpaynei* incertae sedis within the subfamily Neorhacodinae, as [*Masona*] *timpaynei.* The description of this species is of great interest still, as the first record of the subfamily Neorhacodinae from Australia.

Current status

Incertae sedis in Neorhacodinae (this work).

Discussion

The scutellum of *Masona*

Masona presents a very peculiar external anatomy, and one of the big divides between the species of the genus is the presence or absence of a scutellum. In their paper, Quicke *et al.* (2019a) considered the presence of a scutellum as a less derived state relative to its absence, and concluded that since only two species, *Masona pyriceps* and *M. popeye*, have a scutellum, then the origin of the subfamily is likely from the New World. However, in the light of the description of *Masona wow* Dal Pos & Martens sp. nov., this conclusion is no longer valid as the new species has a New World distribution but does not have a scutellum. Moreover, since the entire superfamily Ichneumonoidea suffers from a lack of modern comprehensive comparative anatomical studies, it is difficult to understand if the structure identified as a scutellum in *Masona* is actually a scutellum or a different structure. In fact, within Apocrita Gerstaecker, 1867 there are two "scutella": the *mesoscutellum* (called simply scutellum in Ichneumonoidea) and

Fig. 14. Distribution of [*Masona*] *timpaynei* Quicke, 2019 (Ichneumonidae, Neorhacodinae), in Western Australia.

the *metascutellum* (called postscutellum in Ichneumonoidea, and sometimes identified as the entire metanotum) (e.g., Mikó *et al.* 2007; Vilhelmsen *et al.* 2010). The meso- and metascutellum are areas of the mesonotum and metanotum, respectively. They both accommodate circulatory organs connected to the posterior wing veins via the hollow scutellar arms, functioning as pulsating organs and facilitating the circulation of hemolymph through the wings (Vilhelmsen 2000; Mikó *et al.* 2007; Vilhelmsen *et al.* 2010; Pass 2018). Therefore, as species of *Masona* are mostly wingless, it is logical to expect a reduction or complete disappearance of the scutella (as is the case for *M. prognatha*, *M. infuscata*, *M. similis* and *M. wow* sp. nov.). The question remains as to why in some species the mesoscutellum is still present. We identified two possibilities: (1) the mesoscutellum has lost its function as a pulsating organ, accompanied by a loss of the mesoscutello-metanotal muscle; or (2) the mesoscutellum has been incorrectly identified as such and is a different structure that occupies the same area of the mesoscutellum between the mesoscutum and the metapectal-propodeal complex. Further comparative analysis of the skeleto-musculature of *Masona* will be necessary to investigate the presence or absence of the mesoscutello-metanotal muscle as well as to align the terminology with the rest of the group.

Distribution and ecology

The overall distribution of *Masona* is scattered, with species known only from three biogeographical regions: Australasia, Nearctic, and Neotropical. However, both van Achterberg (1995) and Quicke *et al.* (2019a) reported the presence of two undescribed species from the Afrotropical and Indomalayan regions, respectively, and, in the CNC collection, there are specimens from Kenya and Madagascar (Fernández-Triana, pers. comm.). Although these species remain undescribed, when taken into consideration they create a more cosmopolitan distribution for the genus, which is then missing only from the Palaearctic region. As already underlined by Quicke *et al.* (2019a), more sampling of leaf-litter fauna should produce specimens and will ultimately be useful for filling the gaps in the distribution of this genus.

The host association and ecology of the species of *Masona* is entirely unknown. The known species have been collected mostly by Malaise or pitfall trap, and no direct observation or rearing from host has ever been reported. *Masona prognatha* appears to be associated with tropical hardwood hammocks, typical habitats of south Florida (Key islands included), while *Masona bulbofemoralis* is associated for the first time with a Cypress dome, a common habitat in Florida and in the Atlantic and Gulf coastal plains, which is commonly flooded for 6–9 months a year (Casey & Ewel 1998). The new specimen of *M. bulbofemoralis* was collected at the ecotone of these habitats, during the summer period which is peak flooding season in Florida. The Australian species appears more associated with heathlands, and dense-canopied, mixed shrubland habitat that is typical of Australia.

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