



# Another needle in the haystack: a new species of the rare genus *Masona* van Achterberg, 1995 (Hymenoptera: Braconidae) and updates to the global key

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## Abstract

The small subfamily Masoninae van Achterberg, 1995 (Hymenoptera, Braconidae) comprises nine species across two genera: *Anoblepsis* Engel & Bennett, 2008, and *Masona* van Achterberg, 1995. The genus *Masona* is notable for its rarity in collections and distinctive morphology, with females being apterous, having a prognathous head, and strongly swollen femora. In this study, we describe *Masona uau* Santos & Dal Pos sp. n. from Brazil, representing the second species and specimen recorded in the country and the first for the state of Tocantins. Additionally, we provide the most comprehensive morphological documentation of one species of the genus to date, incorporating low-vacuum SEM images, automontage photographs, and detailed drawings, enhancing the understanding of its diagnostic features and facilitating future identifications.

**Keywords** Parasitoid wasps · Neotropical · Taxonomy · Morphology · New species

## Introduction

The small subfamily Masoninae van Achterberg, 1995 (Hymenoptera, Braconidae) consists of nine species distributed across two genera: *Anoblepsis* Engel & Bennett, 2008, and *Masona* van Achterberg, 1995 (van Achterberg 1995, 2001; Engel and Bennett 2008; Quicke et al. 2019a; Dal Pos et al. 2024). *Anoblepsis* is monotypic, containing only one fossil species, while the remaining eight species belong to *Masona* (van Achterberg 2001; Engel and Bennett 2008; Dal Pos et al. 2024).

Of the eight *Masona* species, one, *Masona pyriceps* van Achterberg, 2001, was described from Dominican amber, while the others are all extant with varying geographic

distributions: two species are Australian (*Masona infuscata* van Achterberg, 1995 and *Masona similis* van Achterberg, 1995), two are Neotropical (*Masona popeye* Quicke & Chaul, 2019 and *Masona neon* Dal Pos & Martens, 2024), and three are Nearctic (*Masona bulbofemoralis* van Achterberg, 1995, *Masona prognatha* van Achterberg, 1995 and *Masona wow* Dal Pos & Martens, 2024).

As a note, in 2019, *Masona timpaynei* Quicke, 2019 was described from Australia (Quicke et al. 2019b), but the species was recently removed from Braconidae and placed *incertae sedis* in the Ichneumonidae, subfamily Neorhacodinae (Dal Pos et al. 2024).

The genus *Masona* is overall known for its highly unusual morphology and it can be easily identified by six main features: (1) head prognathous in most 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 (Dal Pos et al. 2024).

In this contribution, we provide a comprehensive morphological description of a new species of *Masona*: *Masona uau* Santos & Dal Pos sp. n., from Brazil, which represents the second species and specimen for the country as well as the first for the state of Tocantins.

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## Material and methods

A single specimen was collected in a pitfall trap in the municipality of Xambioá, located in northern Brazil, within the predominantly Amazonian biome (Fig. 1). The specimen is deposited in the Coleção de Entomologia da Universidade Federal do Tocantins (CEUFT), Porto Nacional, Tocantins, Brazil.

Morphological terminology primarily follows Sharkey and Wharton (1997), while surface sculpture terminology is based on Harris (1979), and sensilla terminology follows Yang et al. (2022). Photographs were captured using a LEICA M165C stereomicroscope equipped with an automated Leica MC170HD camera, employing the z-stacking method. Image assembly was performed with Leica Application Suite 3

software. Additional investigations of the specimen's tegument sculpture were conducted using a scanning electron microscope (SU 3800, Hitachi High-Tech Europe, Krefeld, Germany) in low vacuum conditions at the Museu de Zoologia da Universidade de São Paulo (MZUSP). Technical drawings, image corrections, and plates assembly were carried out using Adobe Illustrator and Adobe Photoshop 2025.

Sensillar lengths were measured using ImageJ 1.53 k (<https://imagej.nih.gov/ij>, accessed on 24 January 2025, National Institutes of Health, Bethesda, MA, USA).

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.



**Fig. 1** Distribution of Brazilian species of *Masona* van Achterberg, 1995. The red star represents *Masona uau* Santos & Dal Pos, sp. n., and the orange circle represents *Masona popeye* Quicke & Chaul, 2019

**Braconidae Nees, 1811****Masoninae van Achterberg, 1995****Masonina van Achterberg, 1995*****Masonina uau Santos & Dal Pos, sp. n.***

<https://zoobank.org/urn:lsid:zoobank.org:act:E609BC21-3D2B-4025-82F8-C9A6F7FBDEB8>

**Diagnosis**

Head narrowed posteriorly; antenna with 13 flagellomeres; scutellum absent; metasomal T1 narrow anteriorly,  $0.6 \times$  as long as posteriorly wide.

**Description**

**Female.** Body length 1.7 mm, antenna 1.0 mm. *Head.* Prognathous (Fig. 2e, f),  $1.3 \times$  as long as wide, overall smooth and shiny, in dorsal view narrowed posteriorly. Antenna with 13 flagellomeres (Fig. 2a, b, Table 1), all longer than wide; first flagellomere  $1.7 \times$  longer than medially wide,  $1.4 \times$  longer than second flagellomere; apical flagellomere  $2.4 \times$  as long as medially wide; sensilla placodea (Spl) present on lateral surfaces of flagellomeres 4–13 (Table 1 for measurements); flagellomeres 7 and 8 with a single sensilla coeloconica (Sco) located basolaterally (detail on image 1b). Face extremely reduced; face height (measured from antennal foramen to tentorial pit)  $0.4 \times$  distance between tentorial pits. Clypeus confluent with face bounded by large tentorial pits; ventral margin strongly concave, without median tooth; distance between tentorial pits  $1.9 \times$  maximum height of clypeus. Labrum exposed, ventral margin weakly convex and bearing a row of setae. Mandibles strongly twisted and blade-like. Maxillary palp with five segments (Figs. 2e, 3a), extending nearly three-quarters of distance from anterior to posterior part of head; lengths ( $\mu\text{m}$ ) of maxillary palpi segments 1–5: 18, 38, 37, 40, 45. Labial palp (Fig. 3b) with one small segment measuring 20  $\mu\text{m}$ . Area between toruli not delimited by a raised carina. Occipital carina entirely strong, weakly scrobiculate and almost reaching ventral part of head (Fig. 3c, d).

*Mesosoma.* Overall nitid with sparse punctuation;  $2.2 \times$  as long as maximally wide. Propleuron rectangular in ventrolateral view (Fig. 3e, f). Pronotum in dorsal view medially slightly shorter than mesoscutum and without a well-developed, lamelliform carina anteriorly (Fig. 3d). Antescutal depression not visible, obscured by other body parts. Mesoscutum  $0.8 \times$  as long as wide, notauli absent (Fig. 4d). Scutellum absent. Metanotum indistinct represented only by a groove between mesoscutum and propodeum (Fig. 4c, d). Mesopleuron smooth and shiny, with precoxal sulcus distinct

and reaching mid coxa (Fig. 3g); postpectal carina complete forming a strong keel-like projection medially (Fig. 3e). Propodeum smooth and shiny, widest at midlength, wider than mesoscutum, convex in lateral view and produced into two blunt apophyses posteriorly; propodeal spiracle small and round (Fig. 4a–d). Metapleuron smooth and shiny, with juxtacoxal area strongly rugulose (Fig. 4b); submetapleural carina forming a strong keel-like projection, weakly striate, medially (Fig. 3h). Legs. Femora extremely expanded, bulbous. Tibiae gradually expanded. Tarsomeres 1 and 5 cylindrical, gradually expanding towards apex, which is bilobed; tarsomeres 2–4 heart-shaped. Arolium large, in dorsal view diamond shaped bearing a single large seta (Fig. 5g). Tarsal claws small, not pectinate (Fig. 5g). Wings absent.

*Metasoma.* Overall smooth and shiny. T1 (Fig. 5a, b, d, e) medio-anteriorly concave with a strong dorso-lateral carina, without laterope; T1 narrow anteriorly,  $0.6 \times$  as long as posteriorly wide and with spiracle situated in anterior part of segment. T2 laterally sclerotized, without a distinct articulation with T3 (Fig. 5e, f). T1–T8 clearly discernible (Fig. 5c, f), with a row of setae on posterior margin of each segment. Cercus with long setae (Fig. 5i). Ovipositor barely protruding beyond apex of metasoma, weakly upcurved.

*Color.* Entire body yellowish-brown.

**Male**

Not known.

**Biology**

Not known.

**Material examined**

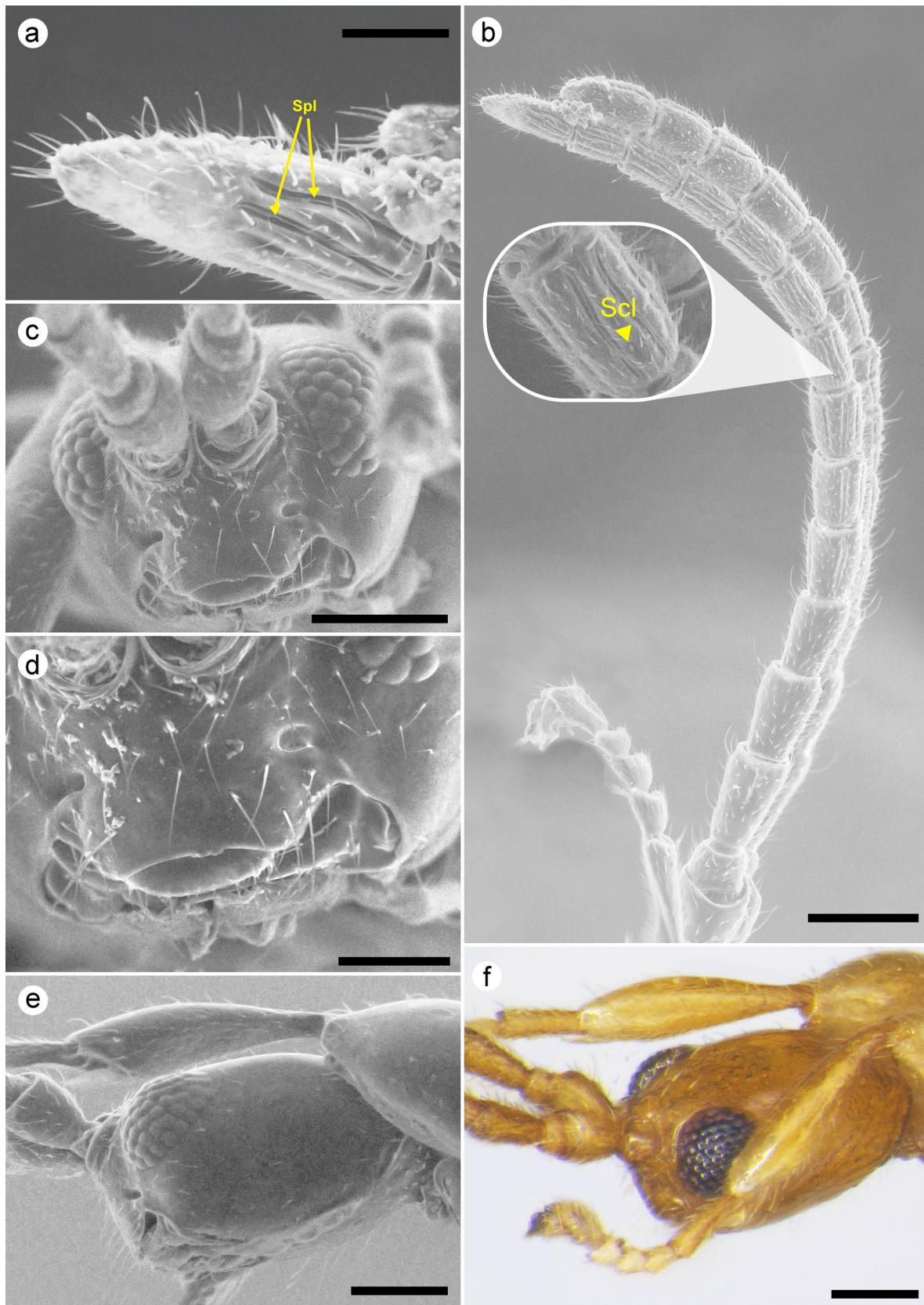
Holotype. BRAZIL • ♀; Tocantins, Xambioá;  $-6.408140$ ,  $-48.524044$ ; 10–11.XI.2024; Pitfall trap; Andrade, I. C. P. col; CEUFT005863 (CEUFT).

**Etymology**

The specific epithet, a noun in apposition, *uau*, is a Portuguese expression of surprise, exclaimed by the first author upon discovering this species. This reaction reflects his excitement, as he had been searching for this genus since 2019, when it was first reported in the Americas. Similarly, the second author had a comparable reaction upon encountering the species *Masonina wow* Dal Pos & Martens, 2024, which inspired the first author to adopt a similar naming approach.

**Remarks**

In the key to the world species (Dal Pos et al. 2024), *Masonina uau* sp. n. surprisingly keys out on couplet seven with the



◀Fig. 2 *Masona uau* Santos & Dal Pos, sp. n. **a** Apical flagellomere, with yellow arrows indicating sensilla placodea (Spl). **b** Antenna in lateral view, with a detailed view of the 7th flagellomere showing yellow arrows indicating sensilla coeloconica (Scl). **c** Head in frontal view. **d** Clypeus in frontal view. **e** Head in ventrolateral view. **f** Head in dorsolateral view. Scale bars: 30 µm (a, d), 100 µm (b, c, e, f)

Australian species (*M. infuscata* van Achterberg, 1995 and *M. similis* van Achterberg, 1995). In fact, they share the following characters: the scutellum absent, head in dorsal view narrowed posteriorly (Fig. 6); occipital carina longer in lateral view, almost reaching external ventral margin of gena. However, it is possible to differentiate *M. uau* sp. n. from the Australian species mostly by metasomal T1 narrow anteriorly, 0.6× as long as posteriorly wide. The head of *M. uau* sp. n. is slightly less narrowed posteriorly than *M. similis* (very similar to *M. infuscata*). From the Neotropical region, *M. uau* sp. n. closely resembles *Masona popeye* Quicke & Chaul, 2019 on the shape of the metasomal T1 and the propodeum produced into two blunt apophyses posteriorly. However, they differ by the absence of scutellum and the head in dorsal view narrowed posteriorly in *M. uau* sp. n. (Fig. 6).

The specimen was collected in a region of the Amazon rainforest that has experienced severe fragmentation due to deforestation in the last three decades (Feitosa et al. 2023). The impact of deforestation on the population and diversity of *Masona* wasps remains unknown, as the parasitoid fauna of leaf litter and soil is still poorly explored (Silva and Feitosa 2017). Given that many parasitoids play crucial roles

in regulating insect populations and maintaining ecological balance, further studies are needed to assess how habitat degradation may influence their abundance, host availability, and overall biodiversity in these increasingly fragmented landscapes.

### Addendum to the key to *Masona* (after Dal Pos et al. 2024)

7. First metasomal tergite in dorsal view narrow anteriorly, resulting in a more or less trapezoidal shape (Fig. 4) ..... *Masona uau* Santos & Dal Pos, sp. n.
- First metasomal tergite in dorsal view robust and evenly wide, giving it a squared appearance ..... 8
8. 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

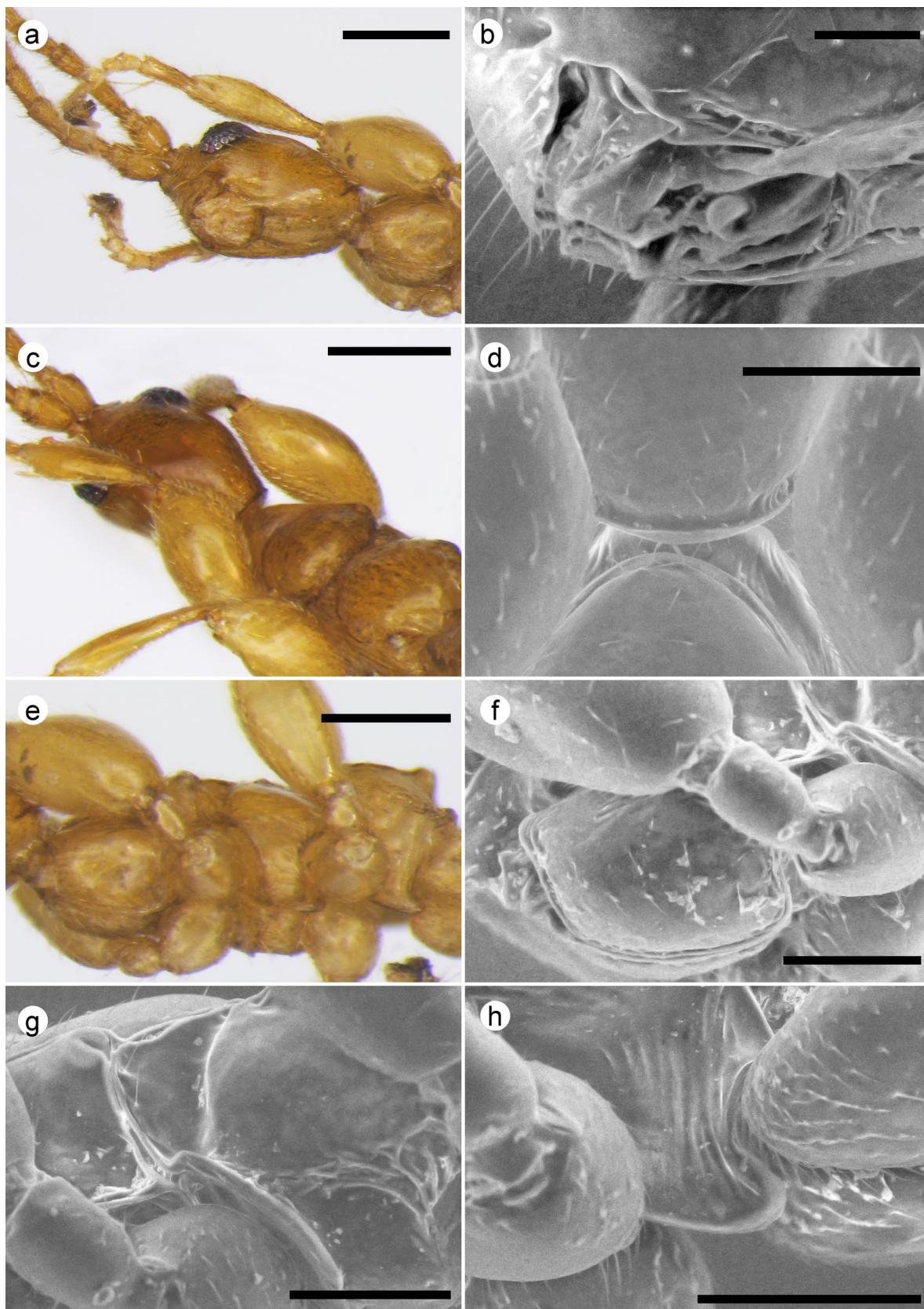
### Discussion

The new species, *Masona uau* Santos & Dal Pos, sp. n., belongs to an informal group within the genus *Masona* that lacks a scutellum. Alongside *Masona wow* Dal Pos & Martens, 2024, it is one of the few scutellum-lacking species with a New World distribution and the first recorded in the Neotropical region. This finding adds new data to the discussion by Dal Pos et al. (2024) on the evolution of the scutellum in *Masona*, showing that scutellum loss (a derived condition) has also occurred in New World species.

The distribution of the genus *Masona* across the Neotropical, Afrotropical, Australian, and Indo-Malayan regions (Dal Pos et al. 2024), but not the Palearctic, may suggest a Gondwanan origin, aligning with the possible biogeographical history of its sister group, Aphidiinae (Belshaw et al. 2000; Jasso-Martínez et al. 2022). However, the presence of possible plesiomorphic characteristics in North American *Masona* species is an intriguing point, suggesting post-Gondwanan dispersal events, necessitating further phylogenetic and biogeographic investigations for a complete understanding.

**Table 1** Measurements of antennal flagellomeres and sensilla placodea (Spl) in *Masona uau* Santos & Dal Pos, sp. n.

Flagellomere	Length (µm)	Number of Spl	Length of Spl (µm)
1st	85	absent	absent
2nd	82	absent	absent
3rd	72	absent	absent
4th	50	3	54±1
5th	61	4	54±9
6th	61	5	56±7
7th	60	4	53±6
8th	61	4	53±4
9th	61	4	54±5
10th	59	4	54±2
11th	55	4	52±3
12th	46	4	56±4
13th	91	5	50±4

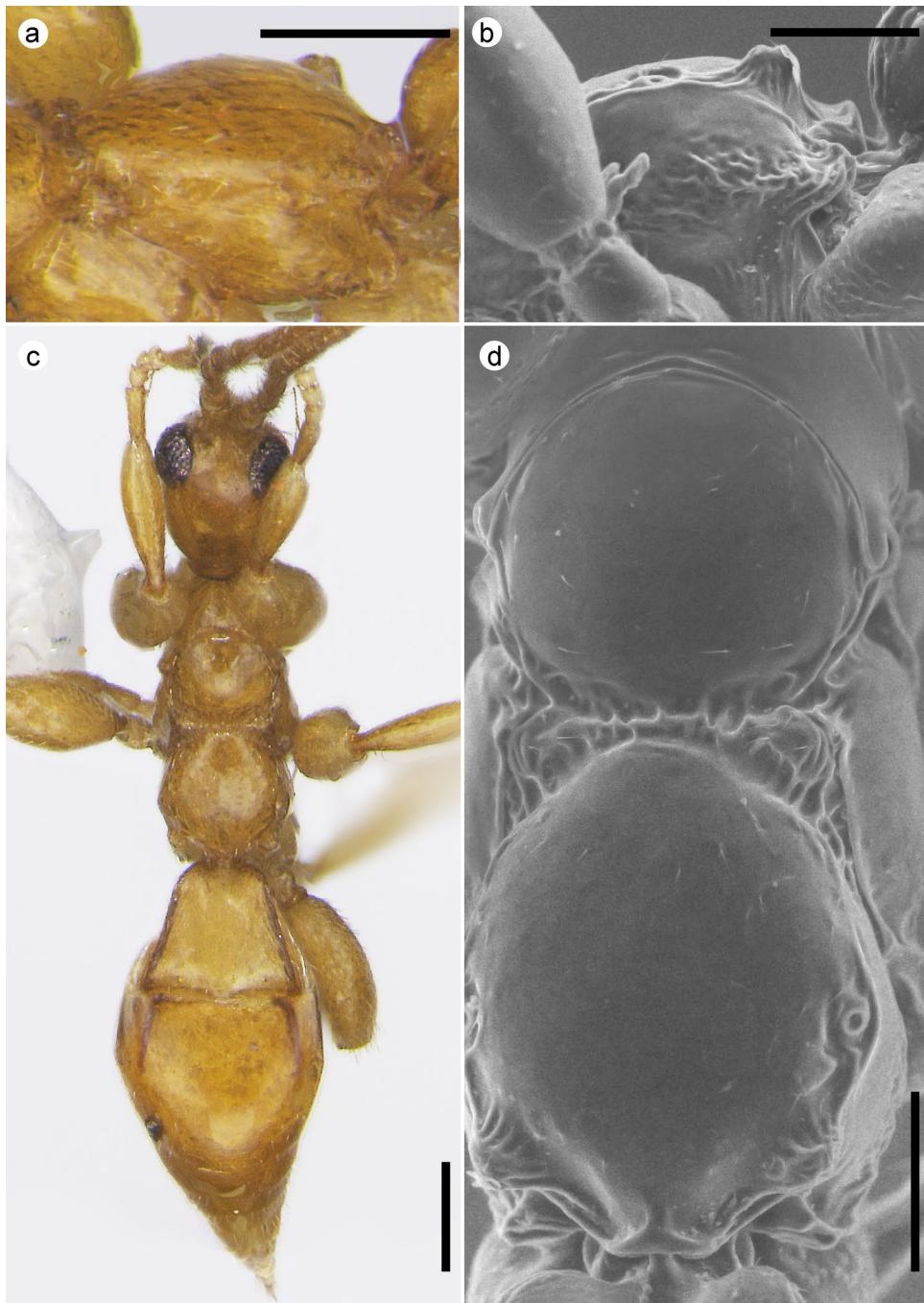


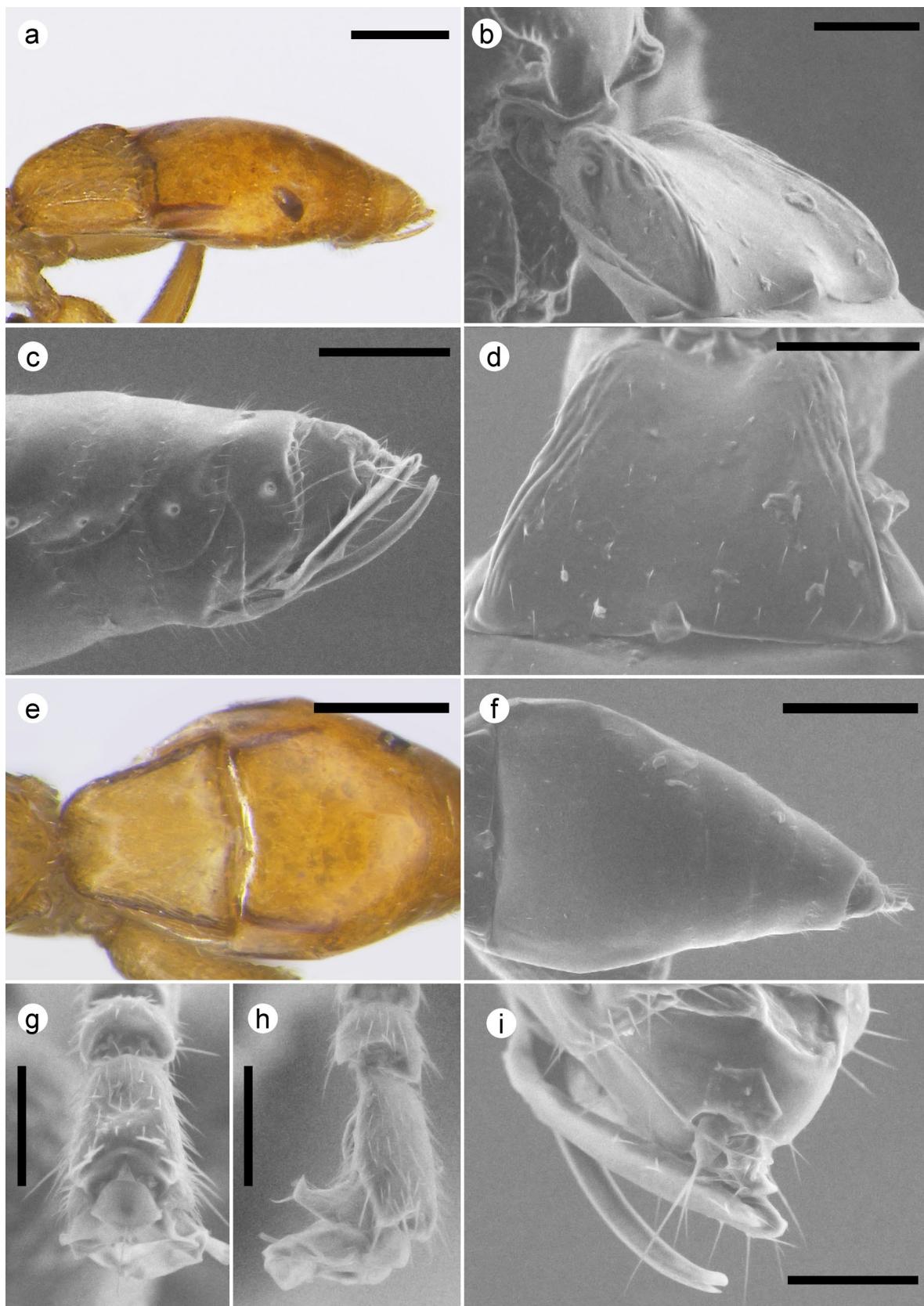
**Fig. 3** *Masona uau* Santos & Dal Pos, sp. n. **a** Head and propleuron in ventrolateral view. **b** Mouthparts in ventrolateral view. **c** Head and part of mesosoma in dorsolateral view. **d** Occipital carina in dorsal view. **e** Mesosoma in ventrolateral view. **f** Propleuron in lateral view. **g** Mesopleuron in ventrolateral view. **h** Mesopleuron in ventral view. Scale bars: 200 µm (a, c), 50 µm (b), 100 µm (d, e–h)

From a morphological standpoint, *Masona* is an extremely intriguing genus. Dal Pos et al. (2024) emphasized the need for a more in-depth study of its skeleтомusculature to clarify the true identity and function of the scutellum, particularly

in relation to the genus's wingless condition in females. In this context, the uniquely expanded legs may compensate for flightlessness by enhancing specific modes of terrestrial locomotion such as jumping or substrate crawling. Notably, recent studies have shown that leg expansion in arthropods can serve multiple functions depending on the internal organization of flexor and extensor muscles, influencing behaviors such as jumping, walking, and grasping (Földvári et al. 2019). Additionally, Gibson (1986) also described the jumping mechanism in brachypterous Eupelmidae in

**Fig. 4** *Masona uau* Santos & Dal Pos, sp. n. **a, b** Propodeum and metapleuron in lateral view. **c** Head, mesosoma and metasoma in dorsal view. **d** Mesosoma in dorsal view. Scale bars: 200 µm (a–c), 100 µm (d)

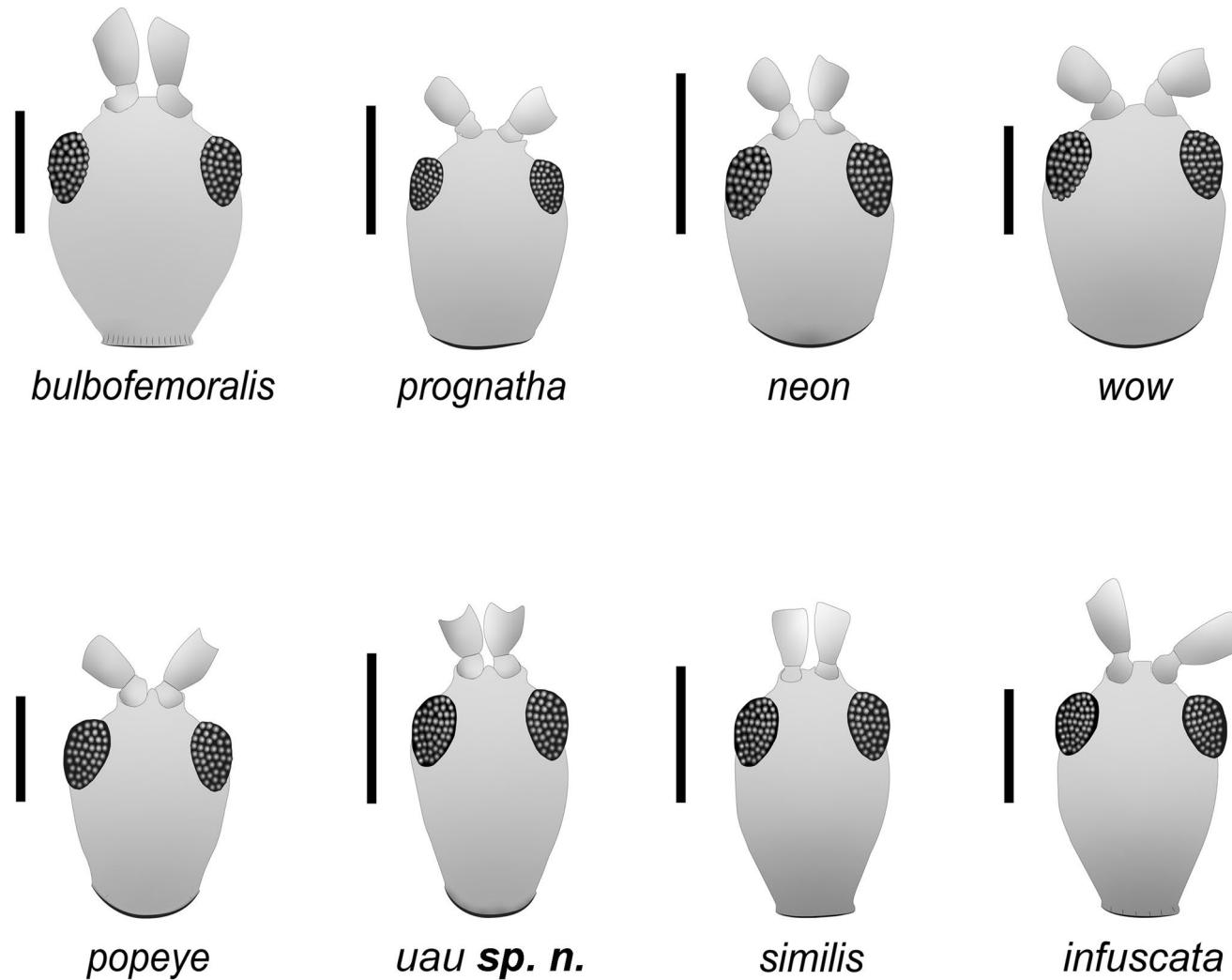




**◀Fig. 5** *Masona uau* Santos & Dal Pos, sp. n. **a** Metasoma in lateral view. **b** First metasomal tergite in dorsolateral view. **c** Final metasomal segments in lateral view. **d** First metasomal tergite in dorsolateral view (alternative view). **e, f** Metasoma in dorsal view. **g** Fore 5th tarsomere in dorsal view. **h** Fore 5th tarsomere in lateral view. **i** Ovipositor in lateral view. Scale bars 200 µm (a, e, f), 100 µm (b–d), 50 µm (g–i)

which the mesoscutum and the entire mesosoma play an important role. Could *Masona* employ a similar mechanism, integrating both leg expansion and mesosoma reduction? Moreover, given that the specimen was collected in a pitfall

trap, *M. uau* sp. n. appears to be associated with leaf litter or soil. In this context, the enlarged femora may facilitate more efficient locomotion within confined spaces, such as soil tunnels or other substrate galleries created by insects like ants and spiders. This function would be analogous to what is observed in Sclerogibbidae wasps, whose enlarged femora allow them to move swiftly inside the silk galleries of webspinners (Olmi 2003). Or might the expansion of the legs be related to an as-yet-unknown host-capture strategy? Future comparative anatomical studies of fresh material, alongside investigations into host hearing, will be crucial to unravel these questions.



**Fig. 6** Illustration depicting the heads in dorsal view of all extant species of *Masona* van Achterberg, 1995. Scale bars: 200 µm

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**Author's contribution** Conceptualization, ADS and DDP; Data collection, ADS; Data interpretation, ADS and DDP; Manuscript writing—original draft preparation, ADS and DDP; Writing—review and editing, ADS and DDP. All authors have read and agreed to the published version of the manuscript.

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**Data availability** All data generated or analyzed during this study are included in this published article.

## Declarations

**Ethical approval** N/A.

**Informed consent** N/A.

**Conflict of interest** The authors declare no competing interests.

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