Zootaxa 5404 (1): 189–205
https://www.mapress.com/zt/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

https://doi.org/10.11646/zootaxa.5404.1.12
http://zoobank.org/urn:lsid:zoobank.org:pub:69AC7876-31D1-4D36-922A-2C3464C725C0

Three New Species of *Microsphecodes* s.str. (Hymenoptera: Halictidae) with an updated key to species of the subgenus

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Abstract

We diagnose, describe and illustrate three new species of *Microsphecodes* Eickwort and Stage, all from the nominate subgenus: *M. peckorum* Graham and Packer **n. sp.** from Venezuela, *M. fernandoi* Graham and Packer **n. sp.** from French Guiana, and *M. septentrionalis* Graham and Packer **n. sp.** from Guatemala. The latter extends the known range of the subgenus further north by approximately 500 km. We provide an updated, illustrated, key to the species of *Microsphecodes* s.str.

Key words: Cleptoparasitism, rarity, taxonomy, Sphecodina, biodiversity, wing morphology, size

Introduction

The halictine subtribe Sphecodina contains exclusively cleptoparasitic or socially parasitic bees. There are five genera usually recognized within the subtribe: *Eupetersia* Blüthgen, *Microsphecodes* Eickwort and Stage, *Nesosphecodes* Engel, *Ptilocleptis* Michener and *Sphecodes* Latreille (Michener 2007) with a sixth—*Melissocleptis* Gonçalves recently described by Gonçalves (2021) who also suggested raising *Austrosphecodes* to generic level rather than it being a subgenus of *Sphecodes*. *Eupetersia* is restricted to the Eastern hemisphere (Africa and Asia only) whereas, other than for the cosmopolitan *Sphecodes*, the others (including Gonçalves' new genus and *Austrosphecodes*) are restricted to the Western hemisphere, mostly in the tropics.

Microsphecodes was described by Eickwort and Stage (1972) as a subgenus of *Sphecodes* for *S.* (*Microsphecodes*) *kathleenae* Eickwort, a species of socially parasitic halictine found in the nests of *Lasioglossum* (*Dialictus*) *umbripenne* (Ellis) (Eickwort and Eickwort 1972). They recognized two additional species in their new subgenus, both of which had previously been described as belonging to *Sphecodes* s.str. Subsequently Michener (1978) raised *Microsphecodes* to generic status and Engel (2013) divided it into two subgenera, with *M.* (*Baeosphecodes*) Engel being restricted to the Caribbean islands and *Microsphecodes s. str*. from the Central and South American mainland from Costa Rica to southeastern Brazil. At that time, the genus was known from ten, mostly rare, species. The purpose of this paper is to describe an additional three species of *Microsphecodes* s.str. that are known from French Guiana, Guatemala and Venezuela. Only one is known from more than a single female. All species are clearly members of the genus *Microsphecodes* and the subgenus *Microsphecodes* s.str. based upon the combination of relatively fine punctation on the head and mesosoma, short submarginal cells, lack of a vertical pronotal lateral ridge, clypeus at least 3X wider than long, gently curved anterior mesoscutal profile lacking a vertical anterior surface, relatively extensive pale markings on the body, mandible at most as long as the compound eye, strongly foveolate dorsal area of the metapostnotum which is bordered by a carina and the somewhat dense pubescence on the side of the mesosoma. It is the last two of these features that separates the subgenus from *M.* (*Baeosphecodes*) which lacks a distinct carinate margin to the metapostnotum and has relatively glabrous sides to the mesosoma. The diagnoses that follow in the species accounts do not repeat these generic and subgeneric characteristics.

Accepted by J. Gibbs: 20 Nov. 2023; published: 25 Jan. 2024

Materials and Methods

Terminology follows that used in recent papers from our laboratory such as Mir Sharifi *et al*. (2019) and Packer and Graham (2020) which in turn are largely based upon Michener (2007). We also follow Michener (1978) for terminology for cleptoparasitic Halictinae. We employ the term "stigmal perpendicular" (Michener 2002) to assess the relative position of the apex of the stigma and the submarginal cells and veins that subtend them. It is the line that is at a right angle to the leading edge of the forewing from the apex of the stigma (Fig. 1). Following our recent work (*loc. cit*.) we use the terms frontal, vertexal and genal areas rather than frons, vertex and gena. Surface sculpture terminology follows Harris (1978) with the exception that the term "stria" and its derivatives refer to raised, rather than impressed, linear features.

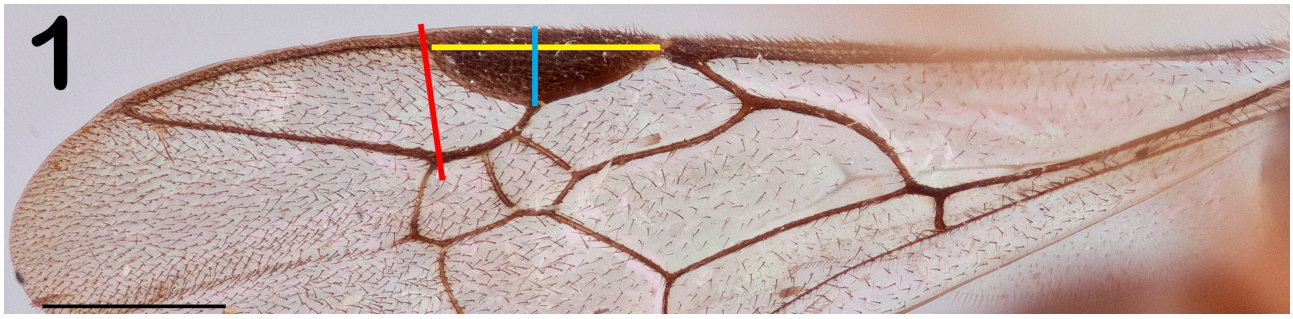


FIGURE 1. Part of forewing holotype of *M. fernandoi* Graham and Packer **sp. n.** to show the stigmal perpendicular (red line) and how to measure the length (yellow line) and breadth (blue line) of the stigma. Scale bar 0.5mm.

The precise location of the landmarks used below are indicated in Figure 2. Head length is measured from the clypeal apex to the upper margin of the vertexal area in frontal view. The following acronyms are used: UOD = upper inter-ocular distance (minimum distance between compound eyes above the concavity in the inner margin), LOD = lower inter-ocular distance (minimum distance between compound eyes below the concavity in the inner margin), ASD = antennal socket diameter (minimum distance from medial to lateral margins of antennal socket), IAD = interantennal distance (distance between inner margins of antennal sockets), AOD antennocular distance (distance between lateral margin of antennal socket and inner margin of compound eye measured horizontally), IOD = interocellar distance (minimum distance between lateral ocelli), OOD = ocellocular distance (minimum distance between lateral ocellus and the inner margin of the ipsilateral compound eye), MOD = transverse diameter of the median ocellus. Supraclypeal area length is measured from the epistomal sulcus at the base of the clypeus to the middle of the imaginary line that indicates the minimum IAD as described above. Body length was estimated by summing the numbers obtained from measuring the separate lengths of the head, mesosoma and metasoma. All measurements were made using an eyepiece graticule of unknown manufacture with the microscope noted below.

Puncture spacing is given in terms of the distance between the punctures ("i" for interspace) and the puncture diameters. Thus, i~1d means the punctures are separated by a distance that approximates their diameters, i<0.5d means they are separated by less than half their diameters.

Specimens were observed with a Wild Heerbrugg Apochromat 1x dissection microscope using 6-50x magnification, and an unbranded ring LED light except for the observation of surface sculpture for which Philips 14W LED daylight bulbs were preferred. Images were taken with a Canon EOS 5D Mark II camera, using a Tamron SP AF Tele-Converter with 1.4x magnification, and a Canon MP-E 65mm macro lens. Images were taken at regular intervals using a P-51 Camlift, version 2.9.7.1, and then amalgamated using Helicon Focus version 5.3. Final images were given scale bars and amalgamated into plates using Adobe Photoshop CS 6 extended.

Museum acronyms associated with material mentioned herein are as follows: AMNH: American Museum of Natural History, New York, New York, USA; CNC: The Canadian National Collection of Insects, Arachnids and Nematodes, Agriculture and Agri-Food Canada, Ottawa, Canada, MCZ: Museum of Comparative Zoology, Harvard University, Cambridge Massachusetts, USA and UNAM: Universidad Nacional Autónoma de México, Mexico City, Mexico.

Locality data are copied verbatim from the labels although abbreviations are expanded where necessary with the additional text in square brackets and country names are given in capitals at the beginning of the locality

data whether this was the case on the label or not. Latitude and longitude are added to the locality data, similarly placed in square brackets, and were estimated using Google Earth Pro. The map was prepared with SimpleMappr (Shorthouse, 2010).

Although the material available to us is limited (as is often the case with this genus), each of the new species we describe is differentiated from previously described ones and each other based upon more than one morphological characteristic and we do not take colour differences of a single tagma alone as being sufficient to differentiate a new taxon.

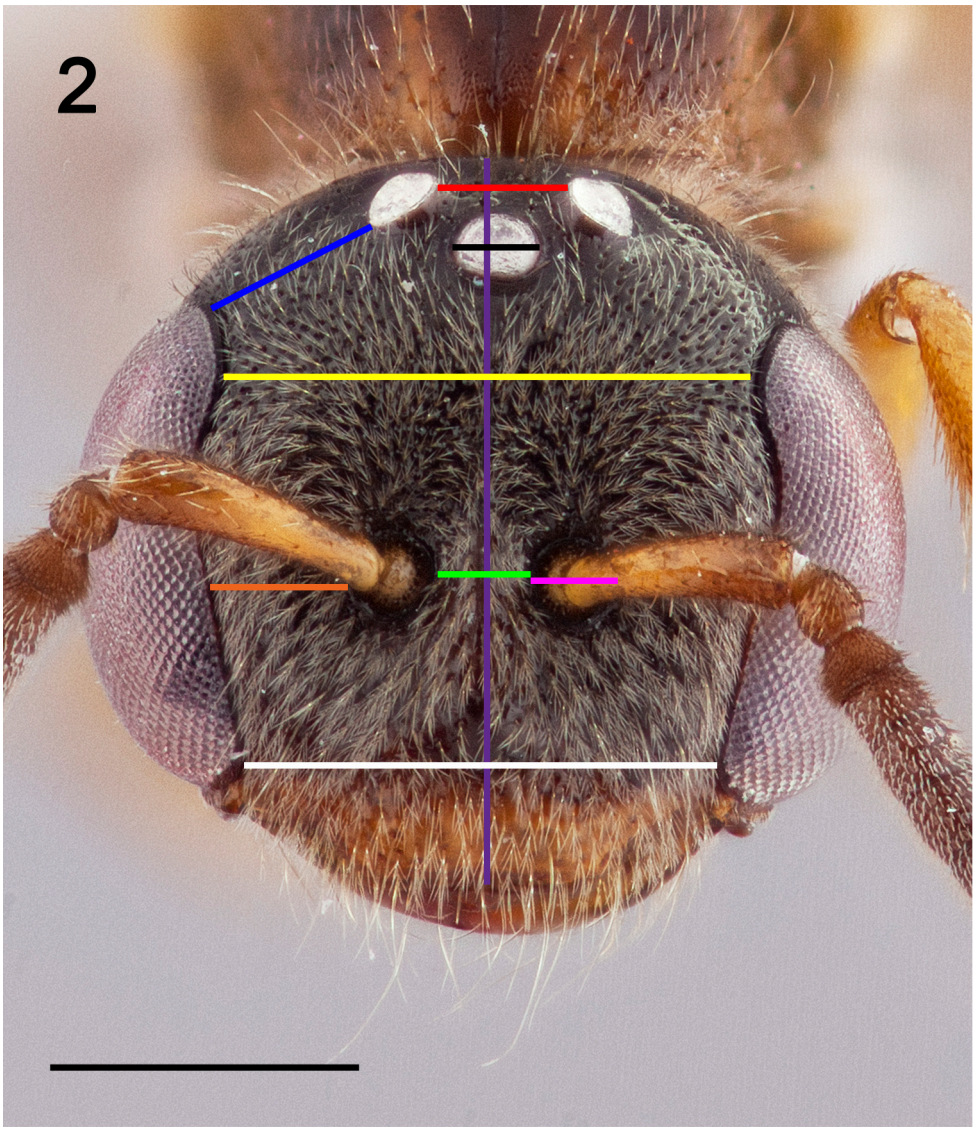


FIGURE 2. Head of holotype of *M. peckorum* Graham and Packer, **sp. n.** facial view, to show landmarks used or measurement of various features. Purple line—head length, yellow line—UOD, white line—LOD, green line—IAD, pink line—ASD, orange line—AOD, black line—MOD, red line—IOD, blue line—OOD. See **Materials and Methods**, second paragraph, for definitions of acronyms.

Species Descriptions

Microsphecodes peckorum Graham & Packer

Figs. 2–10, 13, 25, 33–35, 37 & 39

Diagnosis: The combination of mesosoma varied in colour with extensive pale markings but the mesoscutum largely dark brown (Figs. 3–6), clypeus <4X as wide as long (Figs. 2 & 10), mesoscutum entirely lacking microsculpture

except across anterior margin (Figs. 5 & 8) and T1 entirely and T2 partly orange brown to entirely yellow brown (Figs. 6 & 9) separates this species from all others except *M. kathleenae*. The two differ in a range of minor characteristics, but most readily in the relatively smaller ratio of IAD to AOD (Fig. 2 also compare figures 36 and 37) and the degree of setation, which differs most notably on the metasoma (compare figures 39 and 40).

Description: ***Holotype female***:

Dimensions: Approximate body length 4.44 mm; forewing length 3.76 mm; head broader than long, width 1.34 mm, length 1.18 mm; intertegular distance 0.86 mm.

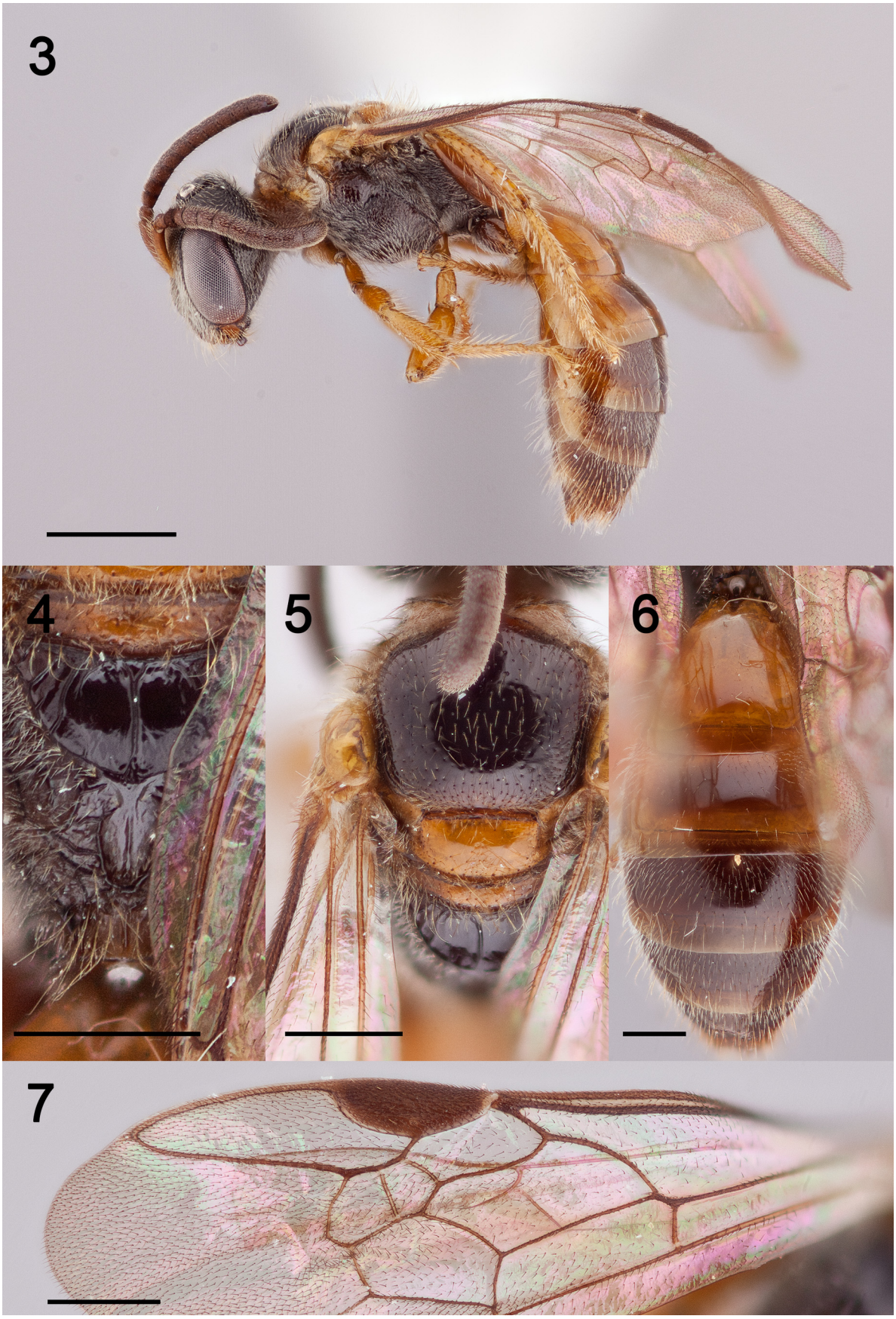
Colouration: Black-brown except as follows: Mandibles yellow, apical 1/3 red-brown; labrum light brown apically; torulus and extreme base of scape yellow; pedicel orange, flagellum brown; pronotal lobe and tegula yellow; scutellum and metanotum orange-yellow; wing veins dark brown; wing membrane translucent. Legs orange-yellow except metacoxa dark brown, and metafemur brown except yellow at base and apex. T1 orange-yellow; T2 disc brown, the rest orange-yellow; T3–T4 brown with irregular apicolateral orange-yellow patch; T1–T4 apical impressed areas translucent yellow-brown; T5 brown, apical impressed area opaque brown; pygidial plate dark red-brown; S1 brown basally, orange-yellow apically, margins dark brown; S2–S4 yellow, apical impressed areas translucent yellow-brown; S5–S6 brown.

Pubescence: pale yellowish, relatively sparse fine simple sub-erect to erect except when stated otherwise; hairs of face dense, somewhat plumose, on clypeus mostly longer than on rest of face; sparser and longer on vertexal area than on face, but shorter than longest hairs of clypeus; anterior surface of flagellum hairs dense and short with underlying placodea. Pronotal collar with sparse yellow hair dorsally, lateral surface with short hairs, pronotal lobe hairs plumose; side of mesosoma with dense somewhat plumose short white subappressed hairs with sparse long white hairs intermixed; metatibia hairs simple, longest apicoventrally, shorter than or equal to the apical width of tibia; dorsal surface of metatibia with fine pale bristles bearing few short branches on dorsal side of rachis. T1–T2 glabrous except for scattered hairs especially laterally and basally; T3–T5 hairs denser, of medium length on disc, longer laterally, short and white basally. S1 hairs long, sparse along midline, absent elsewhere; S2–S6 with scattered long hairs, S3–S5 with a transverse row of simple, posteriorly oriented hairs apically.

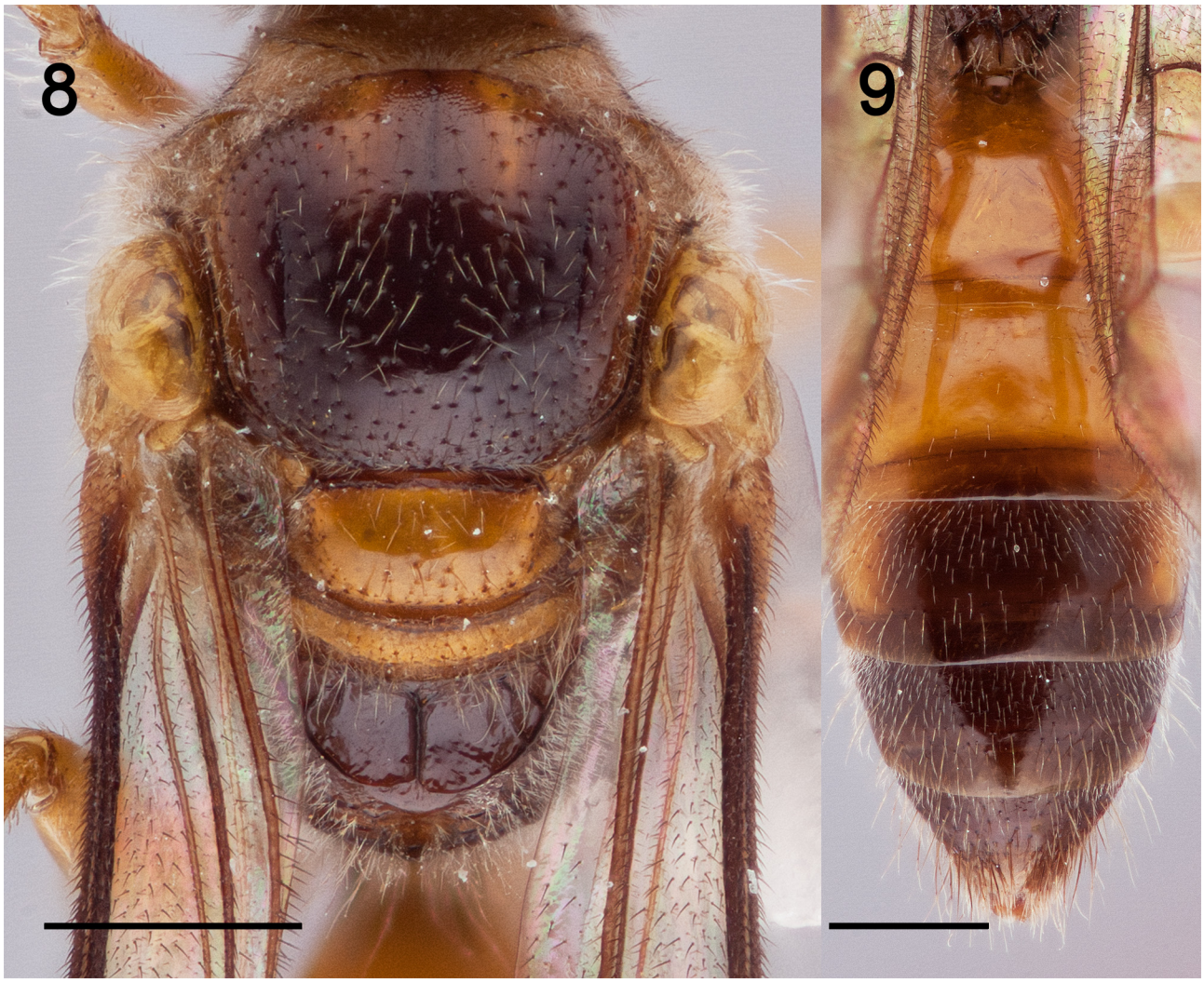
Surface Sculpture: Integument shiny lacking microsculpture unless stated otherwise. Face densely punctate i<0.5d except sparser towards apex of supraclypeal area and towards ocelli mostly i~1d; impunctate around ocelli; vertexal area behind ocelli minutely roughened; genal area punctures small i~1d; hypostomal area very weakly imbricate, obscurely and sparsely punctate. Mesoscutum imbricate along anterior margin between notauli, punctures distinct, irregularly spaced mostly i=0.25–3d around margins, sparser on disc; mesoscutellum disc sparsely punctate, punctures smaller and denser i≤d around margins; metanotum punctures obscure, irregularly spaced. Metapostnotum dorsal surface margined by strong carina; areolate, median pair of areolae on either side of a complete median carina take up most of the dorsal surface with smaller elongate areolae laterally. Preepisternum weakly rugose, more distinct anteriorly and below hypoepimeral area; both areas finely punctate i~1d except sparser dorsally on hypoepimeral area; mesepisternum punctures small and somewhat ovoid, i<d; metepisternum with coarse longitudinal striae; areolae on posterior surface of propodeum variable in size, irregular in shape. Tegula impunctate, weakly imbricate anteriorly. T1–T2 punctures very sparse and weak, T3–T5 punctures small, hair-bearing. Sterna weakly imbricate, punctures scattered and mostly hair-bearing.

*Structure***:** Mandible shorter than compound eye (0.7:0.76 mm). Clypeus more than 3.5X broader than long (0.86 mm:0.24 mm). Supraclypeal area convex, somewhat protuberant in profile. Frontal line carinate from below lower tangent of antennal socket to 1 MOD below median ocellus (MOD = 0.14 mm). Inner margin of compound eye convergent below: UOD:LOD 0.88 mm:0.82 mm; ASD 0.1 mm, IAD 0.18 mm; supraclypeal area almost as wide as long, width 0.28 mm, length 0.3 mm; IOD:OOD 0.2 mm:0.3 mm; vertex strongly convex in frontal view, upper tangent of compound eyes 0.5 MOD below lower tangent of median ocellus; genal area narrower than compound eye in profile (0.28 mm:0.38 mm). F1 and F2 of similar length. Mesoscutum shorter than ITW (0.78 mm: 0.86 mm). Stigma large, 0.66 mm long, 0.24 mm broad, L:W <3:1; marginal cell 1.14 mm long, 0.35mm wide, free portion less than 3X as long as that subtending submarginal cells (0.92 mm:0.32 mm); 1m-cu meets second submarginal cell slightly beyond middle, stigmal perpendicular just beyond 2r-m; hind wing with five hamuli. Pygidial plate apically rounded, surface concave.

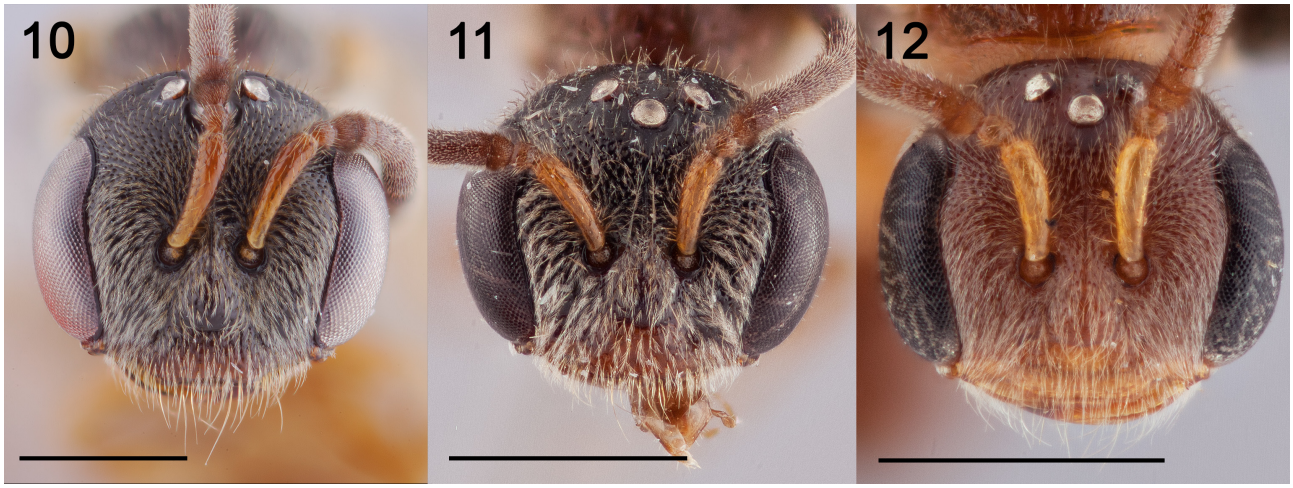
Variation: The two known specimens vary in details of colouration as indicated by comparing figures 5 & 6 with 8 & 9.



FIGURES 3–7. Holotype of *M. peckorum* Graham and Packer, **sp. n.** Fig. 3—lateral habitus; Fig. 4 –posterior half of mesosoma to show metapostnotal sculpture; Fig. 5.—dorsal view of mesosoma; Fig. 6—dorsal view of metasoma; Fig. 7—forewing.



FIGURES 8–9. Paratype of *M. peckorum* Graham and Packer, **sp. n.** to show differences in coloration to the holotype. Fig. 8—Mesosoma dorsum; Fig. 9—Metasomal dorsum.



FIGURES 10–12. Head, frontal view of the three new species of *Microsphecodes* being described herein. Fig. 10—Holotype of *M. peckorum* Graham and Packer, **sp. n.**; Fig. 11—Holotype of *M. fernandoi* Graham and Packer, **sp. n.** Fig. 12—Holotype of *M. septentrionalis* Graham and Packer, **sp. n**.

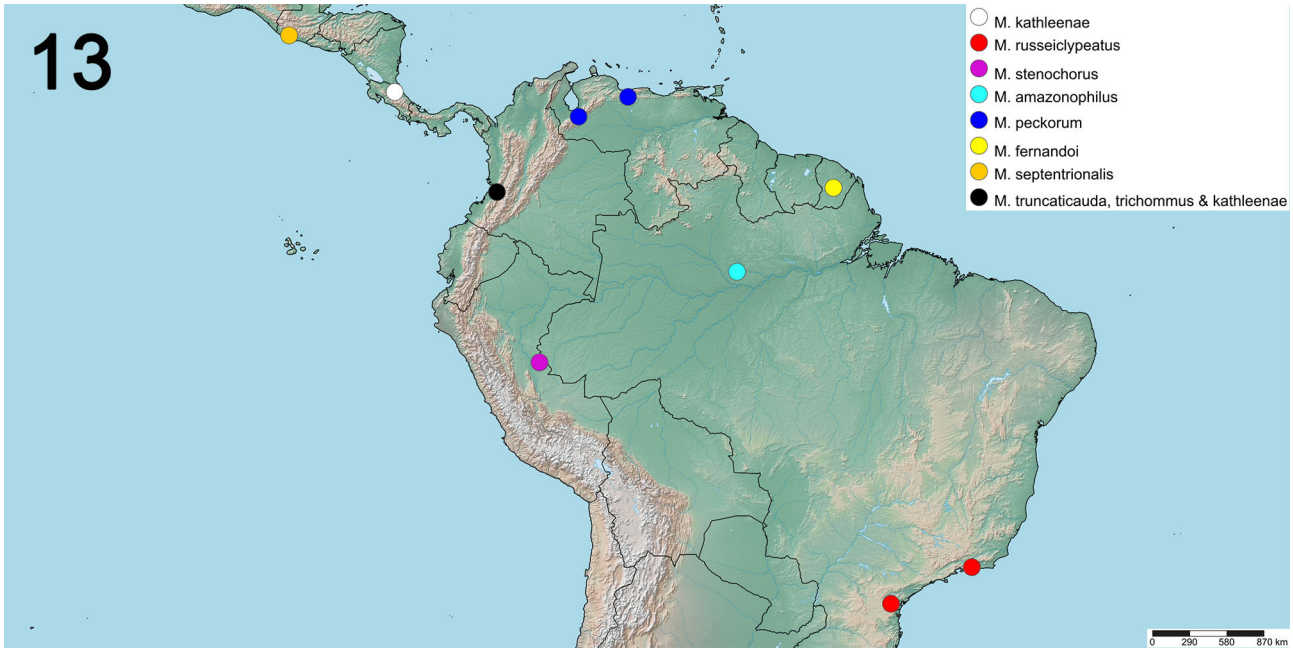


FIGURE 13. Map showing locations of captures of *Microsphecodes* (*Microsphecodes*) species. Note that the black symbol indicates an area where three species have been found.

Material Studied. *Holotype* female: VENEZUELA, Merida, Tabay LaMucuy, 1900 m, 18.VI–2.VIII. 1989, [8.62 -71.057] S.&J. Peck, M[alaise] T[rap] streamside meadow. *Paratype* female: VENEZUELA, Aragua, Parque Nac[ional]. H[enri]. Pittier, Rancho Grande, env[irons] [10 -67.6], 1100 m, 9.IV.1994, L. Masner, s[creen].s[weep]. Both specimens will be returned to the CNC pending completion of ongoing studies.

Etymology: We are happy to name this new species after the collectors of the holotype, well-known Canadian entomologists Stewart Peck and Jarmilla Kukalova-Peck.

Comments: This species is known from two localities separated by less than 450km (Fig. 13). The paratype was caught with a sweep net with an additional 1/4inch mesh to screen out large pieces of debris (Masner, personal communication).

Microsphecodes fernandoi Graham & Packer

Figs. 11, 13–18, 29, 32 & 36.

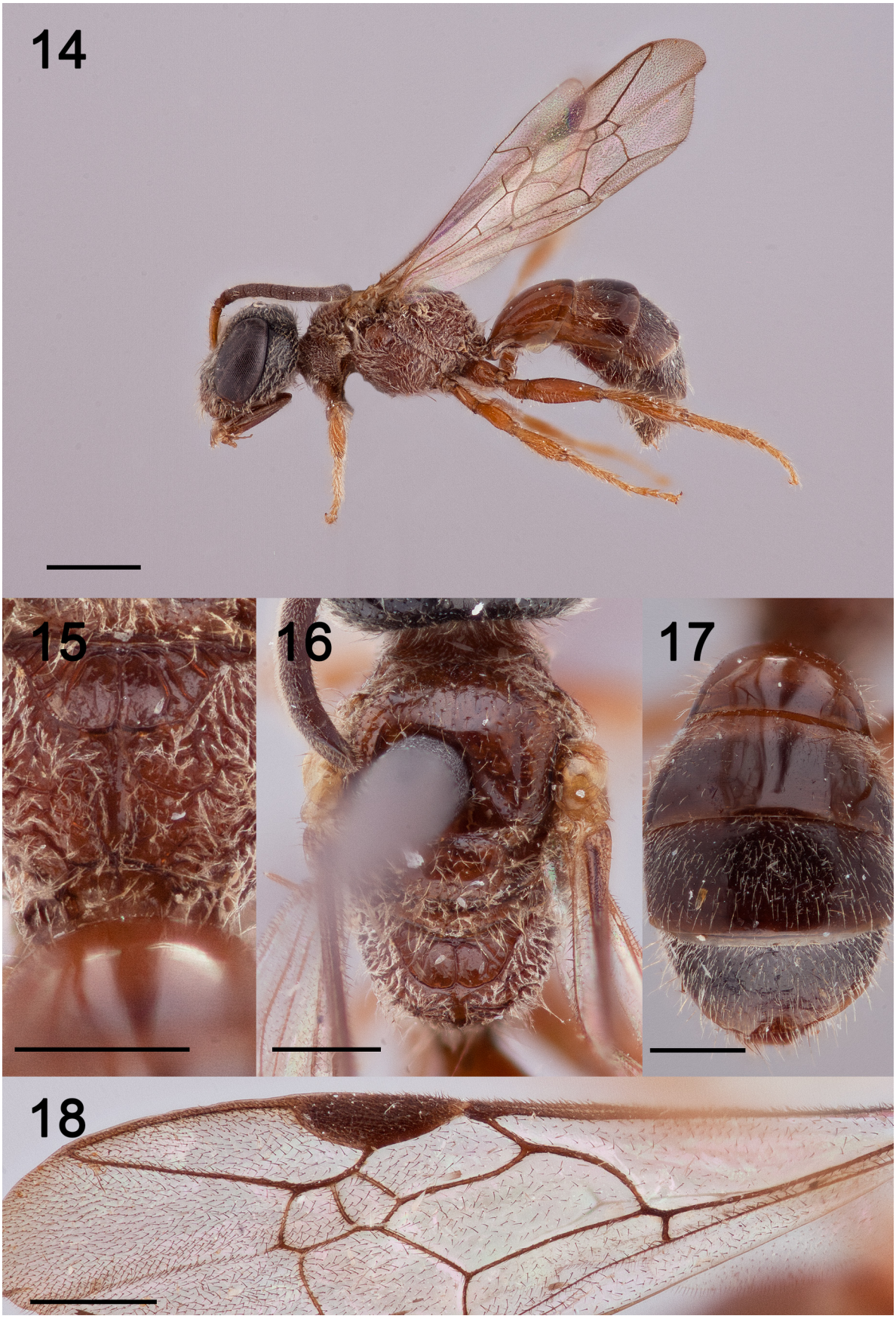
Diagnosis: The colour pattern of this species is unique: the head is black except the clypeus is dark yellowish brown (Fig. 11), the mesosoma is brown, T1 and the base of T2 are somewhat paler than the remaining terga (except for the somewhat paler translucent apical impressed areas) which are dark brown (Figures 14 & 17). This is the only species with the entire mesosoma somewhat paler than the discs of T2–T6 (Figs. 14–17).

Description: *Holotype female*:

Dimensions: Total body length 4.6 mm; forewing length 3.76 mm. Head broader than long, width 1.42 mm, length 1.22 mm. Intertegular distance not measurable due to distortion caused by pin.

Colouration: Light brown except as follows: Mandible brown, apical 1/4 red-brown; labrum and clypeus orange-brown; supraclypeal area dark brown; torulus, scape and pedicel orange-brown; flagellum brown; rest of head black; tegula yellow, wing veins dark brown, wing membrane translucent. All legs orange-brown. T1 orange-brown, with a dark brown apical impressed area; T2 orange-brown basally, dark brown elsewhere; T3 dark brown, apical appressed area paler; T4–T5 and pygidial plate dark brown; S1 orange-brown; S2 orange-brown basally, dark brown apically; remaining sterna dark brown; apical impressed areas translucent yellow.

Pubescence: pale yellowish, relatively sparse fine simple sub-erect to erect except when stated otherwise; clypeus hairs short, branched, with longer simple hairs intermixed; lower paraocular area hairs denser with many



FIGURES 14–18. Holotype of *M. fernandoi* Graham and Packer, **sp. n.** Fig. 14—lateral habitus; Fig. 15—posterior half of mesosoma to show metapostnotal sculpture; Fig. 16.—dorsal view of mesosoma; Fig. 17—dorsal view of metasoma; Fig. 18—forewing.

branches, hairs marginally longer than on rest of face; sparser on vertexal area than face, shorter than longest hairs of clypeus; anterior surface of flagellum hairs sparse and long, underlying placodea dark, obscure against dark background. Pronotal collar with short, dense white hair laterally, dorsally less dense; side of mesosoma with dense somewhat plumose short white subappressed hairs with sparse erect long white hairs intermixed; hypoepimeral area almost entirely glabrous; mesoscutum hairs short sparse (surface of mesoscutum obstructed by pin posteromedially); scutellum hairs long white sparse; metanotum with dense white long hairs; posterior surface of propodeum with short, dense white hairs with some longer hairs intermixed; metatibia hairs simple suberect longest apically, shorter than or equal to apical width of tibia; dorsal surface of metatibia with pale bristles bearing few short branches on dorsal side of rachis. T1 glabrous except laterally hairs of medium length, sparsely branched; T2 as for T1, but with short appressed hairs basally; T3–T5 hairs moderately dense and short on disc, with sparse long hairs intermixed laterally and apically, subappressed medium length and white anterolaterally. S1 hairs long sparse along midline, absent elsewhere; S2–S5 hairs scattered long suberect, D-shaped glabrous area apicomedially; S6 hairs short subappressed.

*Surface Sculpture***:** Integument shiny lacking microsculpture unless stated otherwise. Face densely punctate i≤d, with the exception being more sparse towards apex of supraclypeal area; vertexal area punctures sparser i=1–4d; impunctate around ocelli; genal area punctures small sparse i=1–3d; hypostomal area weakly imbricate except on disc, sparsely punctate. Mesoscutum very weakly imbricate, punctures distinct, varying in size, irregularly spaced i=0.5–2.5d, densest laterally, sparsest on disc (obscured by pin posteriorly); mesoscutellum faintly imbricate, punctures scattered on disc, denser around margins i~1d; metanotum punctures dense i~1d. Metapostnotum dorsal surface margined by strong carina, indented posteromedially; areolate, median pair of areolae on either side of apically complete median carina take up most of the dorsal surface, margined by smaller elongate areolae. Preepisternum and hypoepimeral areas weakly rugose; mesepisternum punctate posteriorly punctures small, i<d; [metepisternum obscured by pubescence]; propodeum coarsely areolate, areolae on posterior surface large. Tegula impunctate weakly imbricate. T1–T2 very weakly imbricate laterally, impunctate; T3 punctures small dense i=0.5–3d; T4–T5 weakly imbricate, punctures small. S1 weakly imbricate, impunctate; S2–S5 imbricate, punctures shallow; S6 imbricate, more densely punctate than other sterna.

*Structure***:** Mandible shorter than compound eye (0.6 mm:0.82 mm). Clypeus 3.5X broader than long (0.84 mm:0.24 mm). Supraclypeal area convex, somewhat protuberant in profile. Frontal line carinate from just below lower tangent of antennal socket to ~1MOD below median ocellus (MOD = 0.12 mm). Inner margin of compound eyes somewhat convergent below: UOD:LOD 0.92 mm:0.82 mm; ASD 0.1 mm, IAD 0.2 mm; supraclypeal area as long as wide (apical width 0.28 mm, length 0.28 mm); IOD:OOD 0.24 mm:0.28 mm; vertex strongly convex in frontal view, upper tangent of compound eyes 0.25 MOD below lower tangent of median ocellus; genal area narrower than compound eye in profile (0.32 mm:0.42 mm); F1 shorter than F2 (0.08mm: 0.12 mm). [Mesoscutum length to width ratio not measurable—surface distorted by pin.] Stigma large, 0.62 mm long, 0.18mm wide (~3.5:1); margin in marginal cell convex, marginal cell 1.04 mm long, 0.28mm wide, free portion slightly less than 3X that subtended by submarginal cells (0.82 mm: 0.3 mm); 1m-cu meets second submarginal cell near middle; stigmal perpendicular goes through 2r-m near anterior margin; hind wing with five distal hamuli. Pygidial plate apically rounded, surface slightly concave.

Material Studied. *Holotype* female: FRENCH GUIANA, Les Eaux Claires, 3.5 mi. N[orth of] Saul, N3°38-40'W53°13' [~3.65 -53.21], 14-21 July 1995, mal[aise]. trap, A. Berkov, AMNH.

Etymology: The species is known from a unique specimen and is named to honour the memory of Fernando Silveira who was also a unique individual, one of the warmest and funniest people the junior author has ever met; his passing is a great loss.

Microsphecodes septentrionalis Graham & Packer

Figs. 12, 13, 19–23, 30 & 32.

Diagnosis: The marginal carina around the dorsal surface of the metapostnotum is absent posteromedially, a unique feature to this species within the subgenus. The combination of the head, mesosoma, and T1 of the metasoma (Figs. 19–22) being orange-brown is also unique: other species have either at least some of these parts marked with black or dark brown or the pale colouration is more extensive on the metasoma.

Description: *Holotype female:*

Dimensions: Total body length 4.14 mm; forewing length 3.48 mm. Head broader than long, width 1.3 mm, length 1.05 mm. Intertegular distance approximately 0.76 mm (somewhat distorted by pin).

Colouration: Pale brown-orange except as follows: Mandibles darker brown-orange, apical 1/6 red; labrum and clypeus yellow-orange; torulus and extreme base of scape orange; pedicel and flagellum brown; pronotum yellow; tegula dark yellow; wing veins yellow, wing membrane translucent. All legs entirely yellow. T1 & T2 yellow, with some light brown patches apicolaterally, and a thin dark brown line along the apical margin, with some darker markings throughout the disc [these darker markings result from internal structures visible through the translucent terga]; T2–T3 light brown; T4–T5 dark brown; pygidial plate dark red-brown; S1–S2 yellow; S3 yellow on disc margins dark brown, S4 yellow basally, brown apically; S5 dark brown.

*Pubescence***:** Pale yellow (almost white) relatively sparse fine simple sub-erect to erect except when stated otherwise; clypeus and lower paraocular area hairs dense with short branches, mostly longer than on rest of face with some medium length hairs intermixed; less dense on vertexal area face, generally shorter than longest hairs of clypeus, some long hairs intermixed; anterior surface of flagellum hairs dense and short with underlying placodea obscure but present. Pronotal collar covered in short, dense white hair; side of mesosoma with dense somewhat plumose short white subappressed hairs, sparse erect long white hairs intermixed; hypoepimeral with short sparse erect hairs. Metatibia hairs pale, mostly simple suberect longest apicoventrally shorter than apical width of tibia. T1 hairs on lateral surface only, medium to long, sparse and erect; T2 with short sparse suberect hairs basally and laterally on disc some long hairs intermixed laterally, anteriorly glabrous; T3–T4 hairs sparse and short on disc, medium to long laterally; T5 hairs longer and more dense than on other terga with some longer hairs intermixed. S1 hairs sparse medium length; S2–S5 with scattered long suberect hairs not restricted to apical halves.

*Surface Sculpture***:** Integument shiny lacking microsculpture unless stated otherwise. Entire head except hypostomal area, densely punctate i<0.5–1d; small impunctate shining area anterior to median ocellus, roughly 1 MOD. Hypostomal area shining, obscurely punctate among sparse but coarse microsculpture. Pronotum impunctate and imbricate. Mesoscutum densely irregularly punctate, i=0.5–3xd, denser laterally and posteriorly where punctures smaller; mesoscutellum impunctate on disc except midline densely punctate, anterior and posterior margins densely punctate, i=0.5–1d, punctures small; metanotum densely punctate, i=0.5d. Metapostnotum dorsal surface margined by carina that is effaced medially; areolate, median pair of areolae on either side of median carina take up most of the dorsal surface, unequal in size, margined by smaller elongate areolae; hypoepimeral area weakly punctate, i=d; propodeum coarsely areolate, areolae on posterior surface large. Tegula impunctate weakly imbricate anteriorly. T1 punctures sparse and shallow i=3–7d; T2–T5 punctures scattered minute hair-bearing. S1–S6 punctures small hair-bearing only, microsculpture weak to absent.

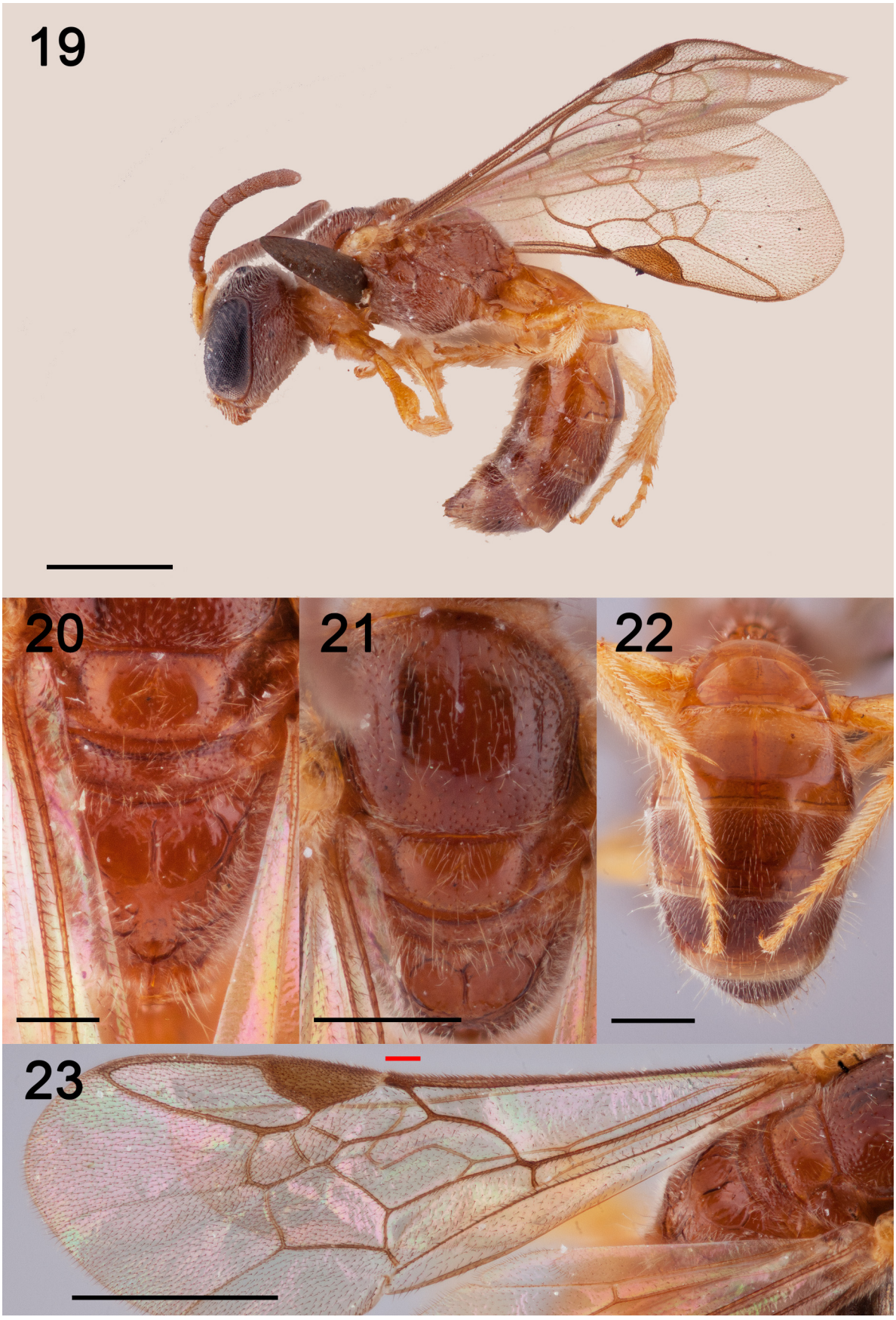
*Structure***:** Mandible slightly shorter than compound eye (0.6 mm:0.74 mm). Clypeus 3.6 times broader than long (0.82 mm:0.23 mm). Supraclypeal area convex, somewhat protuberant in profile. Frontal line carinate from lower tangent of antennal socket to <1 MOD below median ocellus (MOD = 0.12 mm). Inner margin of compound eyes somewhat convergent below (UOD:LOD 0.84 mm:0.76 mm); ASD 0.26 mm, IAD 0.2 mm; supraclypeal area apical width 0.16mm, length 0.26 mm; IOD:OOD 0.18 mm:0.28 mm; vertex strongly convex in frontal view, upper tangent of compound eyes 0.5 MOD below lower tangent of median ocellus; genal area narrower than compound eye in profile (0.3 mm:0.36 mm). F1 equal in length to F2 (0.1mm:0.1mm). Mesoscutum shorter than ITW, 0.68mm: 0.76mm. Stigma large, 0.52 mm long 0.22 mm wide, stigmal perpendicular goes through anterior extremity of vein 2r-m; margin in marginal cell weakly convex, marginal cell 0.94 mm long, 0.27mm wide, free portion more than 3X the length of that subtended by submarginal cells (0.26 mm:0.8 mm); 1m-cu meets second submarginal cell beyond middle; hind wing with five distal hamuli. Pygidial plate apically rounded.

Material Studied. *Holotype* female: GUATEMALA, Moca, Guatalon, [14.5 -91.33] 1,000m. Mar. Apr.[19]31 |, J. Bequaert (MCZ).

Etymology: The species name indicates the northern locality for this species.

Comments: This species extends the geographic range of the genus approximately 500km further north. However, there is a specimen of the genus from Morelos, Mexico at UNAM which we have not seen. See below for a discussion on stigma size in the Sphecodina.

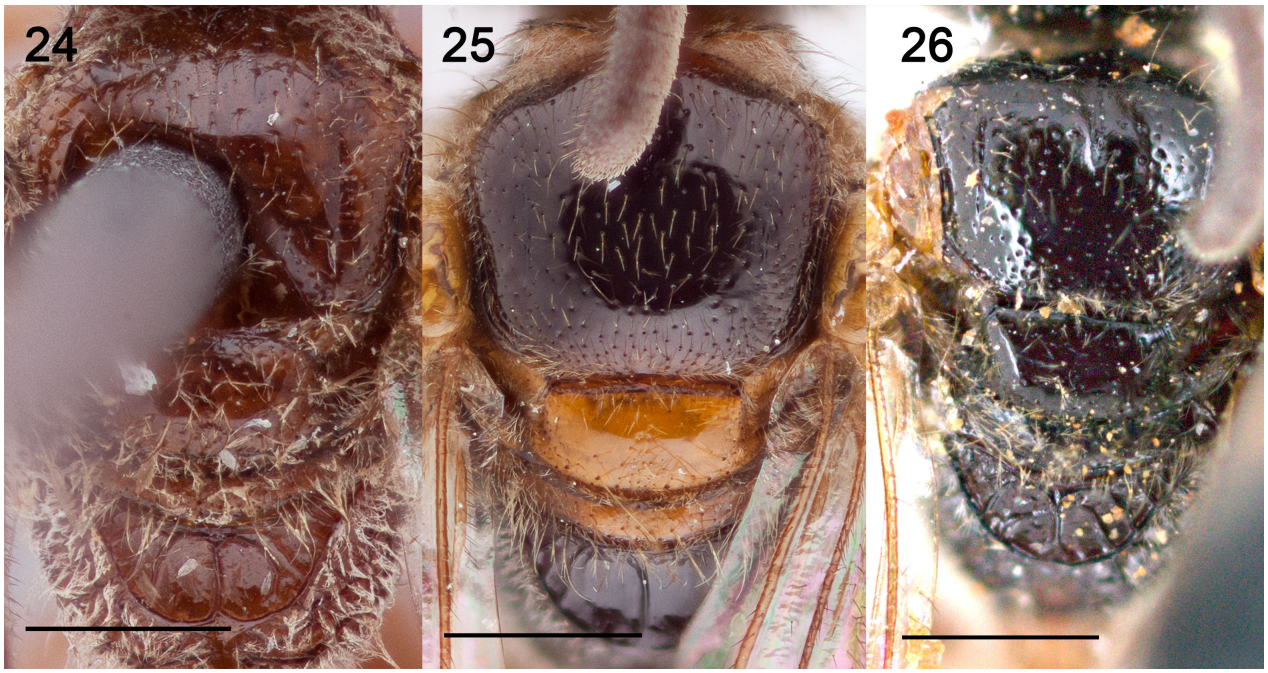
The incomplete metapostnotal carina is of interest as this is complete in other species of the nominate subgenus, but absent in *M*. (*Baeosphecodes*).



FIGURES 19–23. Holotype of *M. septentrionalis* Graham and Packer, **sp. n.** Fig. 19.—lateral habitus; Fig. 20 –posterior half of mesosoma to show metapostnotal sculpture; Fig. 21.—dorsal view of mesosoma; Fig. 22—dorsal view of metasoma; Fig. 23—forewing.

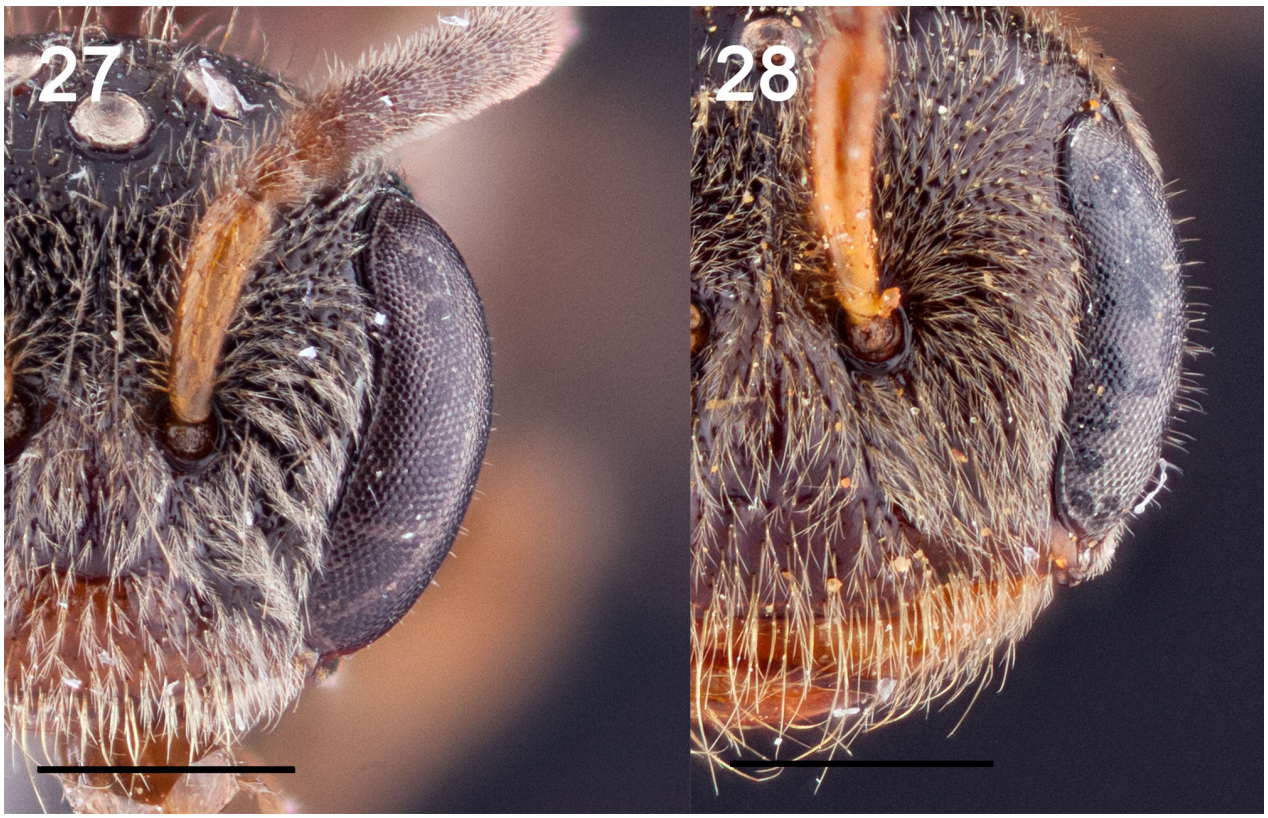
Identification key (modified from Engel (2013) to include the species described above)

1. Mesosoma entirely dark brown to black (Fig. 26) except sometimes pronotal lobe paler (Panama and Colombia) 2
   Mesosoma with large areas of pale colouration (Figs. 24–25) 3

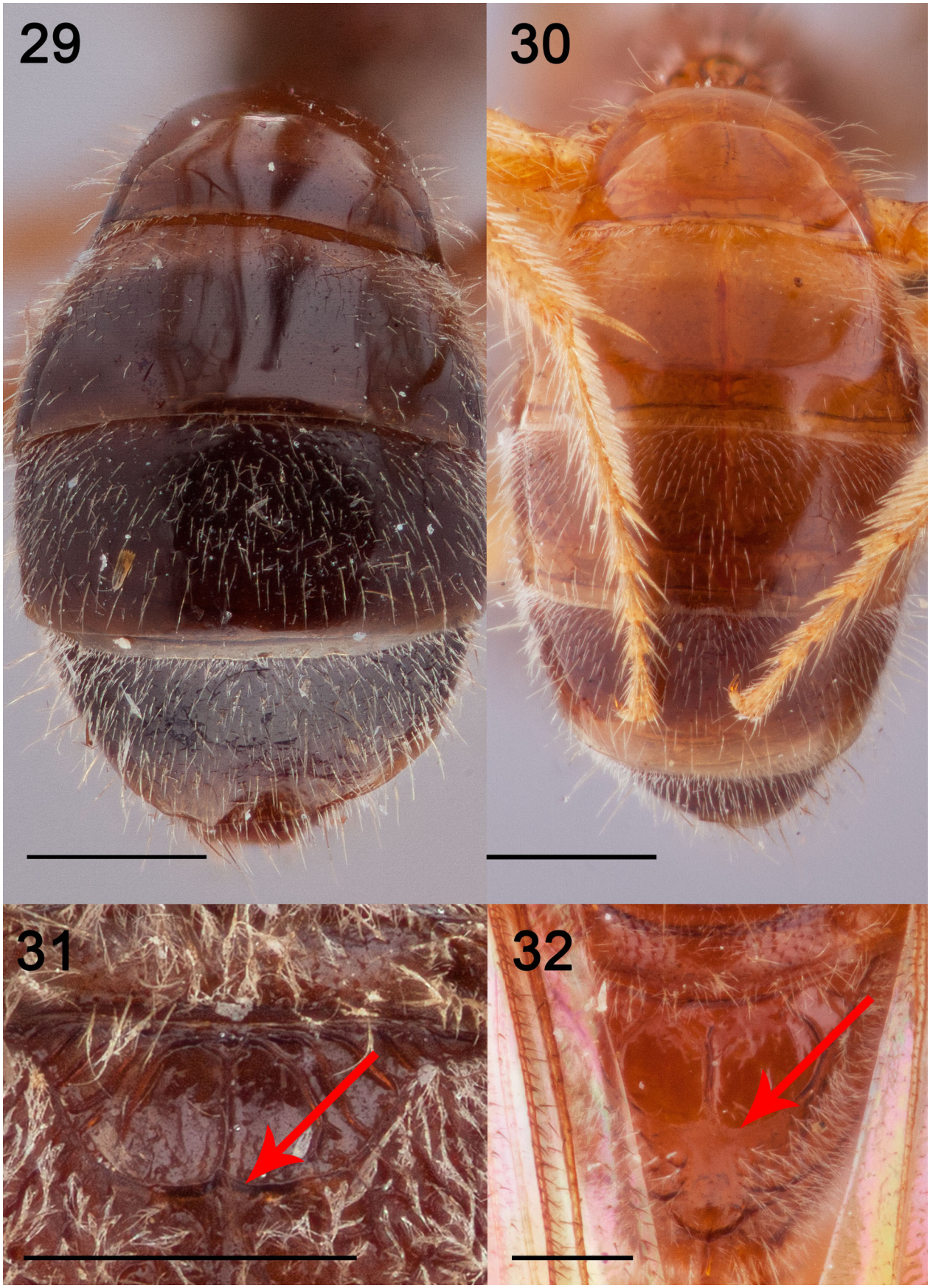


FIGURES 24–26. Mesosomal dorsum of each of: Fig. 24.—*M. fernandoi* Graham and Packer, **sp. n.**; Fig. 25.—*M. peckorum* Graham and Packer, **sp. n.** and—Fig. 26. *M. trichommus* Michener

2(1) Setae of compound eyes minute to absent (as in Fig. 27) . . . . . *M. truncaticaudus* Michener
   Setae of compound eye distinct, at least 2 ommatidial diameters in length (Fig. 28) . . . . . *M. trichommus* Michener



FIGURES 27–28. Partial head, frontal view to show relative lengths of hairs on compound eyes of: Fig. 27.—*M. truncaticaudus* Michener and Fig. 28. *M. trichommus* Michener.



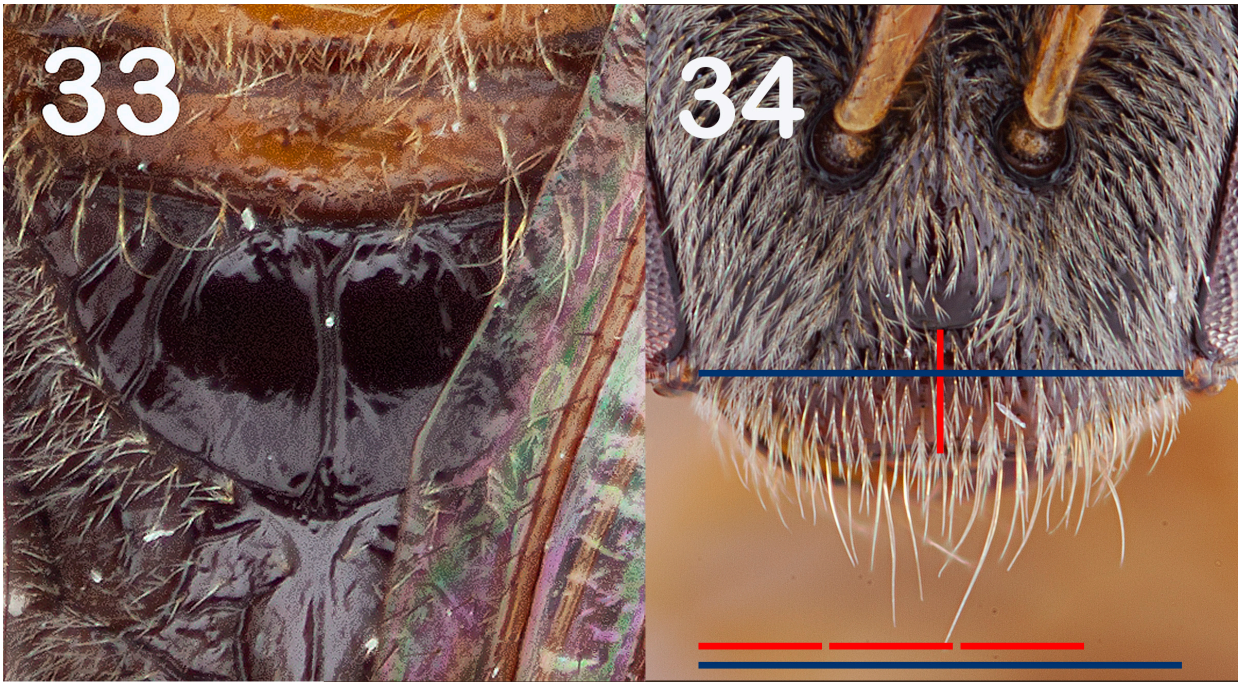
FIGURES 29–32. Metasomal dorsum (Figs. 29&30) and metapostnotum (Figs. 31&32) of: Figs. 29&39—*M. fernandoi* Graham and Packer, **n. sp.** and Figs. 30&32—*M. septentrionalis* Graham and Packer, **n. sp.**

3(1) Mesosoma entirely dark yellow-brown to orange or red-brown except sometimes sutures between sclerites and/or extreme margins of, and carinae on, metapostnotum darker (Fig. 24, see also Figs. 14–15, 19–21) 4
Mesosoma more extensively dark brown or black (Fig. 25) 6

4(3) Almost entire body orange except head black (other than clypeus and appendages) and more apical terga marked with brown (Figs. 1–4 in Mahlmann and Engel, 2023) . . . . . *M. amazonophilus* Mahlmann & Engel
Body with more extensive dark colouration (Figs. 25, 35–36) 5

5(4) Metasoma from T2 (except base) to apex dark brown, clearly darker than both T1 and mesosomal dorsum (Figs. 24 & 29); metapostnotum with marginal carina complete (Fig. 31) (French Guiana) . . . . . *M. fernandoi* Graham & Packer **n. sp.**
Metasoma entirely orange-brown albeit somewhat darker on more apical terga but not clearly darker than mesosomal dorsum (Figs. 21–22 & 30) metapostnotum with marginal carina incomplete posteriorly (Fig. 32) (Guatemala) . . . . . *M. septentrionalis* Graham & Packer **n. sp.**

6(3) Dorsal area of metapostnotum with areolae on either side of midline distinctly enlarged relative to those of neighbouring alveolae (Fig. 33); clypeus at least 3.5X as wide as medial length (Fig. 34) 7
Dorsal area of metapostnotum with areolae on either side of midline relatively narrower, more similar in size to neighbouring alveolae (Fig. 3 in Engel, 2013); clypeus slightly less than 3X wider than medial length (Fig. 2 in Engel, 2013) (Peru) . . . . . *M. stenochorus* Engel

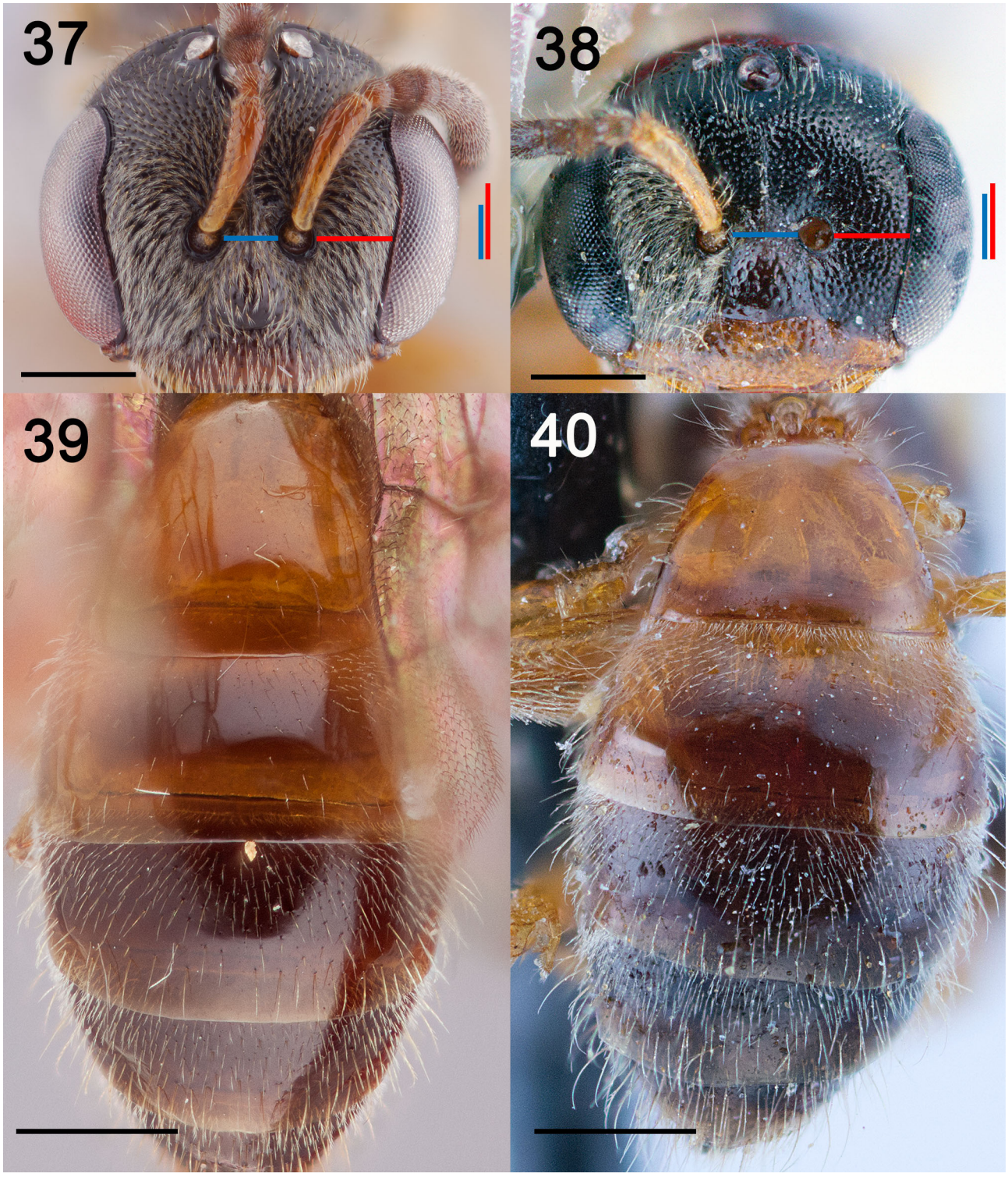


FIGURES 33–34. *Microsphecodes peckorum* Graham and Packer **n. sp.**: Fig. 33—Metapostnotum to show enlarged medial areolae; Fig. 34. Lower face to show relative width (blue line) and length (red line) of clypeus, with width at least 3.5X medial length.

FIGURES 35–36. *Microsphecodes* mesosomal dorsum: Fig. 35. *M. peckorum* Graham and Packer **n. sp.**; Fig. 36. *M. fernandoi* Graham and Packer, **n. sp.**

7(6) Mesoscutellum yellow-orange to orange-red, clearly contrasted to mostly much darker mesoscutum, metapostnotum and propodeum (Fig. 35); clypeus 3.5–4X as wide as medial length (Fig. 34) (Costa Rica to Venezuela) 8
Mesoscutellum brown, not contrasting with mesoscutum, metapostnotum and propodeum (as in Fig. 36); clypeus 4.5X as wide as medial length (as in Sakagami and Moure, 1962, Fig. 1) (Brazil) . . . . . *M. russeiclypeatus* (Sakagami & Moure)

8(7) AOD more than 1.5X IAD (Fig. 37); metasoma with sparser, shorter (<1.5MOD) pubescence (Fig. 39) (Venezuela) . . . . . *M. peckorum* **n. sp.** Graham and Packer
AOD and IAD subequal (Fig. 38); metasoma with denser, longer (~2MOD) pubescence (Fig. 40) (Costa Rica and Colombia . . . . . *M. kathleenae* (Eickwort)



FIGURES 37–40. Head facial view of *M. peckorum* Graham and Packer **n. sp.**; (Fig. 37) and *M. kathleenae* (Eickwort) (Fig. 38) to show relative dimensions of IAD (blue lines) and AOD (red lines). Metasomal dorsum to show less dense and shorter pubescence of *M. peckorum* Graham and Packer **n. sp.**; (Fig. 39) compared to that of *M. kathleenae* (Eickwort) (Fig. 40).

Discussion

The subtribe Sphecodina currently contains five to seven genera: the cosmopolitan *Sphecodes* (285 described species), the African and Asian genus *Eupetersia* (34 spp.), the Caribbean *Nesosphecodes* (three spp.), the Meso- and South American *Ptilocleptis* (three spp.) (numbers from Ascher and Pickering, (2020)) and *Microsphecodes* (now with fourteen species). A sixth genus described by Gonçalves (2021) needs re-evaluation (Arduser, personal communication) but its numbers here are included among those for *Sphecodes*. Michener's (1978) subgenus *Austrosphecodes* was recently raised to generic level (Gonçalves 2021), a view supported by molecular data (Habermannová *et al*. 2013), although the latter authors also found that *Microsphecodes* arose from within *Austrosphecodes* rendering the latter paraphyletic. However, the molecular study did not include any exemplars of *Nesosphecodes* or *Ptilocleptis* which would be necessary before further higher-level classificatory changes can be broadly accepted. Any stable classification of Sphecodina will require study of a large number of species, especially of *Sphecodes* of which species should be included from throughout the world.

One of the key features of *Microsphecodes* is the considerably enlarged stigma which is at least 3.8 MOD in length (from 4.3 to 5.2 MOD in the species described herein). But the stigma is even larger in some related genera: in *Nesosphecodes cubicola* Engel it is 5 MOD in length and <2 X as long as wide, in the three specimens of *Ptilocleptis* available to us the stigma is at least 4.5 MOD long. Small bees often have an enlarged stigma (Danforth 1989) so it is a little surprising to see these larger relatives of *Microsphecodes* having a relatively larger stigma.

As is often the case with cleptoparasitic bees (Sheffield, *et al*. 2013; Packer 2016; Packer and Graham 2020) the species we have described here are rare, known from only one or two females each. It is clear that additional collecting will result in the discovery of more undescribed species as well as some males, which are known for only a few of the 17 species of the genus. While we are in possession of some undescribed males, we do not describe them here as we cannot be sure they are not conspecific with females of known species. While DNA barcoding would be useful to associate the sexes (e.g. Freitas *et al*., 2018), the material available to us is too old for successful application of standard procedures (barcoding was attempted on one of the specimens of *M. peckorum* to no avail).

As was pointed out by Michener (1979) active search of the nest sites of small *Lasioglossum* species in South and Central America would be a good way to find *Microsphecodes*. Although as two of the four specimens we describe above were collected in malaise traps, that method, as well as pan trapping in areas where there are large numbers of potential hosts, should also be productive.

Acknowledgements

The senior author's work on this manuscript was made possible by a generous donation by Robert and Cecily Bradshaw for which we are most grateful. The junior author's contribution was aided by a Discovery Grant from the Natural Science and Engineering Research Council of Canada. We thank the curators and collection managers who loaned us the specimens described above: Jerry Rozen, Corey Smith, Eli Wyman, Sophie Cardinal, Andrew Bennett and John Huber. Images were taken with equipment purchased as a result of funding from the Canadian Foundation for Innovation and Ontario Research Fund through Canadensys. We thank Julio Genaro for loaning us specimens of *M. dominicanus* Stage and *Nesosphecodes cubicola* Engel and Michael Arduser for the loan of specimens of *Microsphecodes* and discussion on the classification of Sphecodina. We are grateful to Ricardo Ayala for attempts to locate the *Microsphecodes* specimen held at UNAM. We also thank Michael Arduser, an anonymous reviewer and Jason Gibbs for comments that helped improve the manuscript.

References

Ascher, J.S. & Pickering, J. (2020) Discover life bee species guide and world checklist (Hymenoptera: Apoidea: Anthophila). Available from: http://www.discoverlife.org/mp/20q?guide =Apoidea_species&flags=HAS (accessed April 2023)

Danforth, B.N. (1989) The evolution of hymenopteran wings: the importance of size. *Journal of Zoology,* 218, 247–276. https://doi.org/10.1111/j.1469-7998.1989.tb02536.x

Eickwort, G.C. & Stage, G.I. (1972) A new subgenus of neotropical Sphecodes [sic] cleptoparasitic upon Dialictus [sic]

(Hymenoptera: Halictidae, Halictinae). *Journal of the Kansas Entomological Society,* 45, 500–515.
Engel, M.S. (2013) A new species of *Microsphecodes* from Peru, with notes on the classification of the genus (Hymenoptera: Halictidae). *Journal of Melittology,* 24, 1–9.
https://doi.org/10.17161/jom.v0i1.4433
Freitas, F.V. Santos Júnior, J.E. Santos, F.R. & Silveira, F.A. (2018) Species delimitation and sex associations in the bee genus *Thygater*, with the aid of molecular data, and the description of a new species. *Apidologie*, 49, 484–496.
https://doi.org/10.1007/s13592-018-0576-0
Gonçalves, R.B. (2021) A revised genus-level classification for the Neotropical groups of the cleptoparasitic bee tribe Sphecodini Schenck (Hymenoptera, Apidae, Halictinae). *Revista Brasileira de Entomologia*, 65 (1), e20200094.
https://doi.org/10.1590/1806-9665-rbent-2020-0094
Habermannová, A., Bogusch, P. & Straka, J. (2013) Flexible host choice and common host switches in the evolution of generalist and specialist cuckoo bees (Anthophila: *Sphecodes*). *PLosONE*, 8 (5), e64537.
https://doi.org/10.1371/journal.pone.0064537
Harris, R.A. (1979) A glossary of surface sculpturing. *Occasional Papers in Entomology, Department of Food and Agriculture, Division of Plant Industry*, 28, 1–36.
Mahlmann, T. & Engel, M.S. (2023) First occurrence of the cleptoparasitic bee genus *Microsphecodes* from Amazonian Brazil (Hymenoptera: Halictidae*). Entomologists's Monthly Magazine*, 159, 105–109.
https://doi.org/10.31184/M00138908.1592.4194
Michener, C.D. (1978) The parasitic groups of Halictidae (Hymenoptera, Apoidea). *University of Kansas Science Bulletin*, 51, 291–339.
https://doi.org/10.5962/bhl.part.24961
Michener, C.D. (1979) New and little-known Halictine bees from Colombia (Hymenoptera: Halictidae). *Journal of the Kansas Entomological Society*, 52, 180–208.
Michener, C.D. (2002) The bee genus *Chilicola* in the tropical Andes, with observations on nesting biology and a phylogenetic analysis of the subgenera (Hymenoptera: Colletidae, Xeromelissinae). *Scientific Papers Natural History Museum University of Kansas*, 26, 1–47.
https://doi.org/10.5962/bhl.title.8449
Michener, C.D. (2007) *The Bees of the World, 2nd Edition.* John Hopkins University Press, Baltimore, Maryland. xiv + [i] + 953 pp., 20 pls.
Mir Sharifi, N., Graham, L. & Packer, L. (2019) Fifteen new species of *Liphanthus* Reed (Hymenoptera: Andrenidae) with two submarginal cells. *Zootaxa*, 4645 (1), 1–80.
https://doi.org/10.11646/zootaxa.4645.1.1
Packer, L. (2016) Two new species of Epeolini (Hymenoptera: Apoidea: Apidae) from Chile with the first record of *Triepeolus* from the country and a key to Chilean *Doeringiella* species. *Journal of Melittology,* 64, 1–11.
https://doi.org/10.17161/jom.v0i64.5775
Packer, L. & Graham, L. (2020) Four new species of Isepeolini (Hymenoptera; Apidae) from northern Chile. *BMC Zoology*, 5 (3).
https://doi.org/10.1186/s40850-020-00052-8
Sakagami, S.F. & Moure, J.S. (1962) *Sphecodes russeiclypeatus,* n. sp., obtido de um ninho de *Dialictus (Chloralictus) seabrai* (Moure, 1956). *Boletim da Universidad do Paraná Zoologia,* 18, 1–6.
Sheffield, C.S., Pindar, A., Packer, L. & Kevan, P.G. (2013) The potential of cleptoparasitic bees as indicator taxa for assessing bee communities. *Apidologie*, 44, 501–510.
https://doi.org/10.1007/s13592-013-0200-2
Shorthouse, D.P. (2010) SimpleMappr, an online tool to produce publication-quality point maps. Available from: https://www.simplemappr.net/ (accessed 22 Sep 2019)