EntomoBrasilis
e-ISSN 1983-0572

Taxonomy and Systematics

Taxonomic notes with update of records of *Trigona* (*Dichrotrigona*) Engel, 2021 (Hymenoptera: Apidae: Meliponini)

Cristiano Feitosa Ribeiro[1], David Silva Nogueira[2] & Marcio Luiz de Oliveira[3]

1. Fundação Universidade Federal de Rondônia, Presidente Médici, RO, Brazil. 2. Instituto Federal de Educação, Ciência e Tecnologia do Amazonas, São Gabriel da Cachoeira, AM, Brazil. 3. Instituto Nacional de Pesquisas da Amazônia, Programa de Pós-Graduação em Entomologia. Manaus, AM, Brazil

EntomoBrasilis 17: e1052 (2024)

Abstract. In this paper, we provide taxonomic notes for species of the *Trigona* (*Dichrotrigona*) Engel, 2021, with additional photographs. An identification key and a distribution map of the species of this subgenus is also provided here. We also update records of *Trigona* (*Dichrotrigona*) *sesquipedalis* Almeida, 1984 (Hymenoptera: Apidae: Meliponini) with the first records for the state of Roraima, Brazil.

Keywords: Amazon; Distribution; Morphology; Stingless bee; Taxonomy.

Edited by:
William Costa Rodrigues

Article History:
Received: 01.viii.2023
First Answer: 19.x.2023
Accepted: 21.xii.2023
Published: 23.i.2024

✉**Corresponding author:**
Cristiano Feitosa Ribeiro
cristiano.emarc@gmail.com

EntomoBrasilis Update Check

10.12741/ebrasilis.v17.e1052

The genus *Trigona* Jurine, 1807 (Hymenoptera: Apidae: Meliponini) is restricted to the Neotropics, and currently composed of 35 valid species (Ribeiro *et al*. 2023), with 25 from Brazil (Nogueira 2023; Oliveira *et al*. 2023; Ribeiro *et al*. 2023).

Eight subgenera are recognized in *Trigona*: *Trigona* (*Trigona s. str.*), *Trigona* (*Aphaneuropsis*) Engel, 2021, *Trigona* (*Koilotrigona*) Engel, 2021, *Trigona* (*Aphaneura*) Gray, 1832, *Trigona* (*Nostotrigona*) Engel, 2021, *Trigona* (*Ktinotrofia*) Engel, 2021, *Trigona* (*Necrotrigona*) Engel, 2021 and *Trigona* (*Dichrotrigona*) Engel, 2021 (Engel *et al*. 2021, 2023; Oliveira *et al*. 2023; Ribeiro *et al*. 2023).

The subgenus *T*. (*Dichrotrigona*) is composed by three valid species (Engel *et al*. 2021, 2023): *Trigona* (*Dichrotrigona*) *dimidiata* Smith, 1854, *Trigona* (*Dichrotrigona*) *venezuelana* Schwarz, 1948 and *Trigona* (*Dichrotrigona*) *sesquipedalis* Almeida, 1984. Of these, only *T*. (*D*.) *dimidiata* has a wide distribution, occurring in several countries in South America, unlike the other species that are recorded in only one or two countries. There is no information about the biology of the species available in the literature.

This paper provides taxonomic notes for species of the subgenus *Dichrotrigona* Engel, 2021. We also report the first occurrence of *T*. (*D*.) *sesquipedalis* for the state of Roraima, Brazil and provide an identification key and a distribution map of the species of this subgenus (Figure 1).

MATERIAL AND METHODS

Bees from the following institutions were examined: the Instituto Nacional de Pesquisas da Amazônia, (INPA, Manaus, Amazonas, Brazil), the Coleção Prof. J.M.F. Camargo, Universidade de São Paulo, Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto (RPSP, Ribeirão Preto, São Paulo, Brazil) (digitized image, paratype, *T*. (*D*.) *sesquipedalis*) and National Museum of Natural History, Smithsonian Institution, Washington DC, USA (USNM, Washington DC, USA) (digitized image, holotype, *T*. (*D*.) *venezuelana*).

Photographs were prepared using a Leica M205A stereomicroscope, coupled with a Leica DMC4500 camera and stacked using the software Leica Application Suite v4.10.0 Interactive Measurements, Montage. The order of the material examined followed the state (in bold and in alphabetical order), the raw data of each label, the number of individuals, and the collection to which it belongs (in parentheses). Abbreviated information has been completed in square brackets. Geographic distribution was obtained based on label data from all specimens examined, as well as some data obtained from the literature (Camargo *et al*. 2013; Oliveira *et al*. 2023). The geographical distribution map was plotted using the online mapping software SimpleMappr (Shorthouse 2010).

RESULTS AND DISCUSSION

Genus *Trigona* Jurine, 1807

Subgenus *Dichrotrigona* Engel, 2021

Diagnosis (Adapted from Engel 2021): Integument predominantly black; mandible with

five teeth; labrum simple; metatibia enlarged and flattened, with the outer surface close to the concave apical third; metatibia with developed corbicula; forewing membrane dichroic, proximally infuscate, apically whitish; and metasoma elongated.

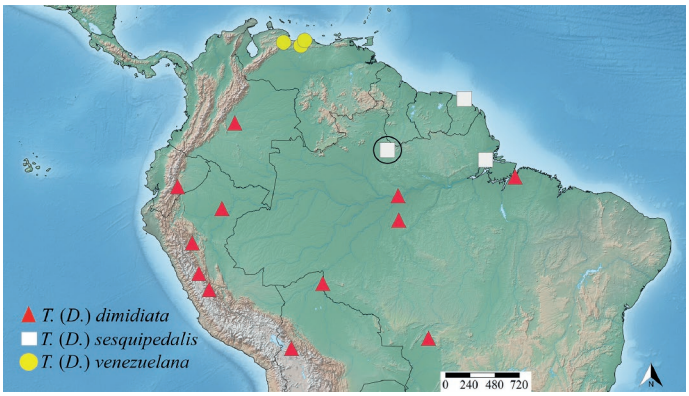

Figure 1. Geographical distribution of *Trigona* (*Dichrotrigona*). Black circle represents new record. Scale bar: Kilometers.

Comments: The character "metasoma elongated" is added here in the diagnosis of the subgenus for the first time. As reported by Engel (2021), this subgenus is similar to *T.* (*Aphaneuropsis*) in pattern of wing coloration. Still according to this author, *T.* (*Dichrotrigona*) easily differs from *T.* (*Aphaneuropsis*) in the five mandibular teeth, among other characters. However, we believe that the metasoma elongated can be very useful for identifying this subgenus, especially to differ from *T.* (*Trigona s. str.*) (metasoma subtriangular, except *T.* (*Trigona s. str.*) *dallatorreana*).

Trigona (*Dichrotrigona*) *dimidiata* Smith, 1854

(Figure 2A-D)

Trigona dimidiata Smith, 1854: 411 [original description]; Camargo *et al.* 2013 [catalog, geographic distribution].

Trigona atroalba Ducke, 1908: 35 [original description]; Ducke 1916: 74 [synonymy].

Diagnosis: This species is similar to *T.* (*D.*) *sesquipedalis* in the lower half of the glabrous and polished supraclypeal area. But differs by the following combination of traits: wings membranes and veins infuscate in the basal half, sub-marginal cell whitish; T3 with relatively short setae (0.09 mm) in the middle region, setae with about 0.5x the scape diameter; total body length approximately 8.5 mm.

Geographic distribution: Bolivia (La Paz); **Brazil** (Amazonas, Mato Grosso, Pará, Rondônia); **Colombia** (Meta); **Ecuador** (Morona Santiago); **Peru** (Huánuco, Junín, Loreto, San Martín).

Examined material: (03 workers): **BRAZIL, Amazonas:** Itacoatiara, Faz[enda]. Agropecuária Aruanã, 58°45'W e 3°S (-3.000000, -58.750000), 13.xi.2006 / Rede entomológica, Flores Rasteiras, C. F. Santos, Leg. / *Trigona dimidiata* Smith, 1854 Det. Camargo, 2007, 1 (INPA); Maués, Rio Abacaxis, 05°15'09"S - 58°41'52"W (-5.252500, -58.683333) / 27-29.v.2008. J.A. Rafael e equipe, coleta manual / *Trigona dimidiata* Smith, 1854, 1 (INPA); **Rondônia:** Guajará Mirim, 10°48'S, 65°22'W (-10.800000, -65.366667) / 12-14/X/2001, Oliveira, Morato & Cunha leg., 1 (INPA).

Comments: This species was described by Smith (1854), as being from "Brazil (Para)". According to Schwarz (1948) the whereabouts of type material possibly it is the Smith collection at Oxford University.

Trigona (*Dichrotrigona*) *sesquipedalis* Almeida, 1984

(Figure 2E-H)

Trigona (*Trigona*) *sesquipedalis* Almeida, 1984: 138, 139, 140, 141, 142 [original description]; Camargo *et al*. 2013 [catalog, geographic destribution].

Diagnosis: This species is similar to *T.* (*D.*) *dimidiata* in the lower half of the glabrous and polished supraclypeal area. But differs by the following combination of traits: wings membrane and veins infuscate in approximately 2/3 basal, sub-marginal cell slightly darkened; T3 with setae relatively long (0.22 mm) and dense in the the middle region, setae with about 1x the scape diameter; total body length approximately 9.6 mm.

Geographic distribution: Brazil (Amapá, Roraima); **French Guiana** (Sinnamary).

Examined type material: One worker (paratype) was examined through of digital image. BRASIL, Amapá: Serra do Navio, x-1957, K. Lenko leg. / *Trigona dimidiata* Smith, *Det*. Moure, 1973 / *T.* (*Trigona*) *sesquipedalis* Det. Camargo, 1982 / Paratype *Trigona sesquipedalis* Almeida, 1984 / Coleção Campos SEABRA, (RPSP).

Additional material examined: (13 workers): **BRAZIL, Roraima:** Caroebe, 00°52'49"N 59°41'53"W (0.88027777777778, -59.698055555556), alt. 115m 06.XII.2006. / Silva, S.J.R.; Grigio Jr., O. & Otaviano, A. A., Em flor de *Senna* sp. / 13 op. - nos. 3527, 3545, 3538, 3533, 3544, 3530, 3535, 3529, 3536, 3531, 3534, 3537 e 3528 MIRR (INPA).

Comments: This species was described by Almeida (1984) based on ten workers specimens, the holotype and nine paratypes, all from Serra do Navio, Amapá, Brazil. The records were expanded to Sinnamary, French Guiana in the subsequent publication by Roubik (1990). The record of this species in the municipality of Caroebe in the state of Roraima in Brazil, favors to the understanding of the distribution of species of subgenus, in addition to confirming the first record of *Trigona* (*D.*) *sesquipedalis* in the state.

Trigona (*Dichrotrigona*) *venezuelana* Schwarz, 1948

(Figure 3A-D)

Trigona (*Trigona*) *dimidiata venezuelana* Schwarz, 1948: 291 [original description]; Camargo *et al*. 2013 [catalog, geographic destribution].

Trigona (*Trigona*) *venezuelana*: Almeida, 1984: 141, 142 [comparative notes].

Diagnosis: This species is similar to *T.* (*D.*) *dimidiata* in the wing membrane and infuscate veins in the basal half, sub-marginal cell whitish. But differs from other species of the subgenus mainly in the half of the supraclypeal area below the antennal cavities more or less hairy, like the half extending above the antennal cavities. total body length approximately 6 to 7,5 mm.

Geographic distribution: Venezuela (Aragua, Distrito Federal, Yaracuy).

Examined type-material: One worker (holotype) was examined through of digital image. Lagunita de Aroa Venez / Altitude 2000 ft / MACarriker collector / HOLOTYPE / *Trigona* (*Trigona*) *dimidiata*. var. *venezuelana* H.F. Schwarz / Type No 61571 USNM / USNM ENT 00534531.

Comments: This species was described by Schwarz (1948) based on workers specimens, all from Venezuela. Although Schwarz (1948) indicated that the paratypes are in the British Museum (Natural History) and the American Museum of Natural History, he does not mention the numbers of paratypes in each collection. *T.* (*D.*) *venezuelana* is similar

Figure 2. Worker of *Trigona* (*Dichrotrigona*) *dimidiata* Smith, 1854. **A**-Lateral habitus. **B**-Head, frontal view. **C**-Dorsal habitus. **D**-Metatibia and metabasitarsus. Worker of *Trigona* (*D.*) *sesquipedalis* Almeida, 1984. **E**-Lateral habitus. **F**-Head, frontal view. **G**-Dorsal habitus. **H**-Metatibia and metabasitarsus. Scale bars: 1 mm.

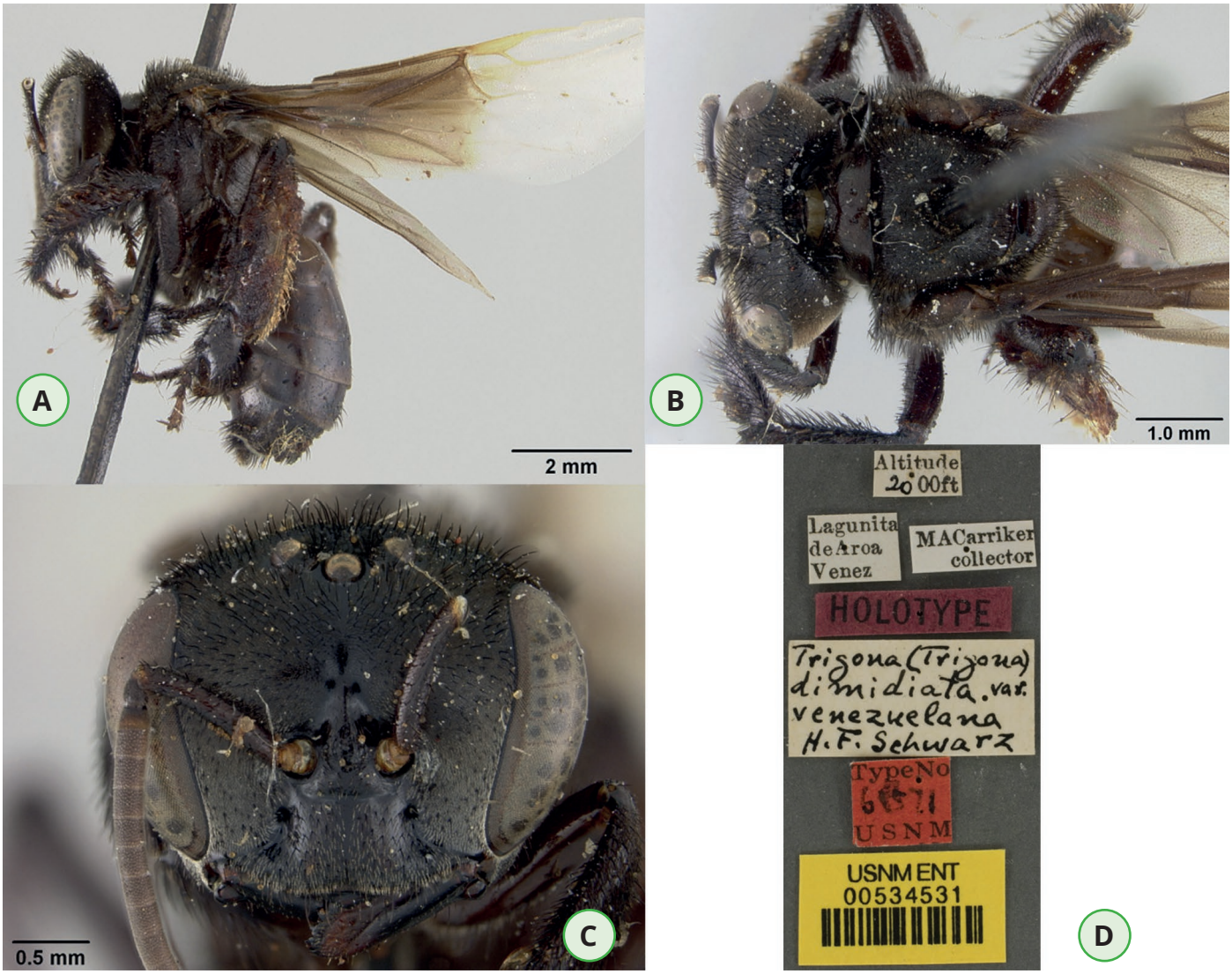

Figure 3. Holotype of *Trigona* (*Dichrotrigona*) *venezuelana* Schwarz, 1948. **A**-Lateral habitus. **B**-Dorsal habitus. **C**-Head, frontal view. **D**-labels. (Source: USNM-Smithsonian Institution (USNMENT00534531). Available in: <http://n2t.net/ark:/65665/3b8990f1d-dc3f-4ec4-84a8-3c4d8704d8ea>).

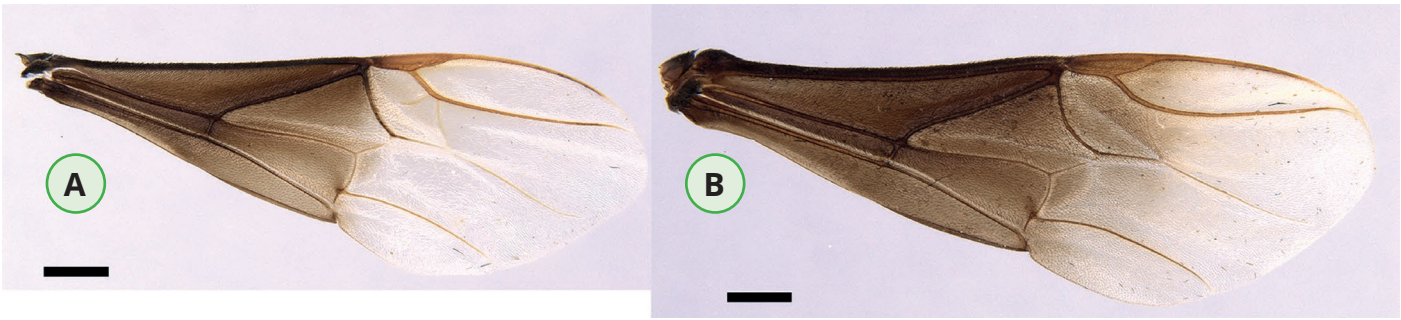

Figure 4. Forewing view. A - *Trigona* (*Dichrotrigona*) *dimidiata* Smith, 1854; B - *Trigona* (*Dichrotrigona*) *sesquipedalis* Almeida, 1984. Scale bar: 1 mm.

to *T.* (*D.*) *dimidiata* mainly in relation to the size of the body and wing membrane (wing membranes and veins infuscate in the basal half, sub-marginal cell whitish), however, differs from *T.* (*D.*) *dimidiata* and *T.* (*D.*) *sesquipedalis* by half of the supraclypeus below the antennal cavities more or less hairy, like the half extending above the antennal cavities

Key of the *Trigona* (*Dichrotrigona*) Engel, 2021 (workers). (Adapted from Schwarz, 1948)

1. The half of the supraclypeus below the antennal cavities more or less hairy, like the half extending above the antennal cavities; mandibles mainly black, with a reddish-brown band, immediately behind the black apical teeth; wings short, forewing including tegula about 8.5 mm long; total body length approximately 6 to 7,5 mm . ...*T.* (*D.*) *venezuelana* Schwarz, 1948.

- The lower half of the supraclypeus glabrous and polished; mandibles generally predominantly reddish-brown, except for the black apical teeth; wings long, the forewing including the tegula, measuring about 10.5 to 10.75 mm; total body length approximately 7,5 a 10 mm 2

2(1). Wing membranes and veins infuscate in the basal half, sub-marginal cell whitish (Figure 4A); T3 with relatively short setae (0.09 mm) in the middle region, with about 0.5x the scape diameter; total body length approximately 8.5 mm ....*T.* (*D.*) *dimidiata* Smith, 1854.

- Wing membranes and veins infuscate in approximately 2/3 basal, sub-marginal cell slightly darkened (Figure 4B); T3 with setae relatively long (0.22 mm) and dense in the median region, with about 1x the diameter of the scape; total body length approximately 9.6 mm .... *T.* (*D.*) *sesquipedalis* Almeida, 1984.

TAXONOMIC AUTHORITIES

Trigona atroalba Ducke, 1908 [original description] in Ducke (1908); *Trigona* (*Aphaneura*) Gray, 1832 in Gray (1832). *Trigona* Jurine, 1807 in Jurine (1807).

ACKNOWLEDGMENTS

Material and imaging equipment were provided by the Invertebrate Collection of the Instituto Nacional de Pesquisas da Amazônia (INPA). Photographs of the paratype of *T.* (*D.*) *sesquipedalis* Almeida, 1984 were provided by the Coleção Prof. J.M.F. Camargo, Universidade de São Paulo, Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto (RPSP, Ribeirão Preto, São Paulo, Brazil). Photographs of the holotype of *Trigona* (*Dichrotrigona*) *venezuelana* Schwarz, 1948 <https://collections.nmnh.si.edu/search/ento/?ark=ark:/65665/3b8990f1ddc3f4ec484a83c4d8704d8ea> were provided by the Collection of the National Museum of Natural History, Smithsonian Institution, Washington DC, USA (USNM, Washington DC, USA). The photographer/creator Matthew Kweskin, the person who took the photo of the holotype of *T.* (*D.*) *venezuelana* Schwarz, 1948.

AUTHORS CONTRIBUTION

All authors contributed to the study conception and design. CFR: The analysis of metadata, first draft and final writing of the article, DSN: Revision and final writing of the article, MLO: Revision and Supervision. All authors read and approved the final manuscript.

FUNDING INFORMATION

Programa de Pós-Graduação em Entomologia, Instituto Nacional de Pesquisas da Amazônia (PPG-ENT). This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior-Brazil (CAPES)-Finance Code 001, and FAPEAM-Programa POSGRAD. Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq-for the productivity grant recognized in the processe: MLO-305150/2020-0).

CONFLICT OF INTEREST STATEMENT

The authors declare no competing interests.

REFERENCES

Almeida, MC (1984). Duas espécies novas de *Trigona* (s. str.) (Apidae, Meliponinae) da região Neotropical. *Dusenia*, 14(3):129-144.

Camargo, JMF; Pedro, SRM & Melo, GAR (2013). Meliponini Lepeletier, 1836. *In*: Moure, JS; Urban, D & Melo, GAR (Orgs.). *Catalogue of Bees (Hymenoptera, Apoidea) in the Neotropical Region. Online Version*. URL: <http://www.moure.cria.org.br/catalogue>. Access: 06.vi.2023.

Ducke, A (1908). Contributions à la connaissance des Hyménoptères des deux Amériques. *Revue d'Entomologie (Caen)*, 27(3): 28-87.

Ducke, A (1916). Enumeração dos Hymenopteros colligidos pela Comissão e Revisão das espécies de abelhas do Brasil. Commssão de Linhas Telegraphicas Estrategicas de Mato Grosso ao Amazonas (Publicação 35, annexo 5). URL: <https://www.obrasraras.fiocruz.br/media.details.php?mediaID=264>.

Engel, MS; Rasmussen, C; Ayala, R & Oliveira, FF (2023). Stingless bee classification and biology (Hymenoptera, Apidae): a review, with an updated key to genera and subgenera. *Zookeys*, 1172: 239-312. https://doi.org/10.3897/zookeys.1172.104944

Engel, MS; Hollister, WH; Steven, RD; Wang, B & Thomas, JC (2021). Stingless bees in Miocene amber of southeastern China (Hymenoptera: Apidae). *Journal of Melittology*, 105: 1-83. https://doi.org/10.17161/jom.i105.15734

Gray, G (1832). New genera and species, pp. 575-575. In: Griffith, E & Pidgeon, E (Eds.). *Class Insecta, arranged by Baron Cuvier, with supplementary additions to each order, and notices of new genera and species by George Gray* [*in*: Griffith, E., The animal kingdom arranged in conformity with its organization by the Baron Cuvier, member of the Institute of France, etc., with supplementary additions to each order, vol. 15] Vol. 2. Whittaker, Treacher, and Co.

Jurine, L (1807). *Nouvelle méthode de classer les hyménoptères et des diptères*. J. J. Pachoud. https://doi.org/10.5962/bhl.title.10282

Nogueira, DS (2023). Overview of Stingless Bess in Brazil (Hymenoptera: Apidae: Meliponini). *EntomoBrasilis*, 16: e1041. https://doi:10.12741/ebrasilis.v16.1041

Oliveira, ML; Nogueira, DS & Zanella, FCV (2023). Apidae. *In*: Catálogo Taxonômico da Fauna do Brasil. PNUD. URL: <http://fauna.jbrj.gov.br/fauna/faunadobrasil/11288>. Access: 6.vii.2023.

Pedro, SRM (2014). The Stingless Bee Fauna in Brazil (Hymenoptera: Apidae). *Sociobiology*, 61(4): 348-354. https://doi.org/10.13102/sociobiology.v61i4.348-354

Ribeiro, CF; Nogueira, DS; Oliveira, FF & Oliveira, ML (2023). Review of *Trigona* (*Nostotrigona*) Engel, 2021 from Brazil with description of three new species (Hymenoptera: Apidae: Meliponini). *Zootaxa*, 5306(3): 349-366. https://doi.org/10.11646/zootaxa.5306.3.3

Roubik, DW (1990). Niche preemption in tropical bee communities: a comparison of Neotropical and Malesian faunas, pp. 245-257. In: Sakagami, SF; Ohgushi, R & Roubik, DW (Eds.), *Natural history of social wasps and bees in Equatorial Sumatra*. Hokkaido University Press.

Schwarz, HF (1948). *Stingless bees (Meliponidae) of the Western Hemisphere*. American Museum of Natural History.

Smith, F (1854). *Catalogue of Hymenopterous Insects in the Collection of the British Museum*, part 2. Apidae. British Museum (Natural History). https://doi.org/10.5962/bhl.title.20858

Shorthouse, DP, (2010). *SimpleMappr, an online tool to produce publication-quality point maps*. URL: <https://www.simplemappr.net>.