



First record of the orchid bee *Euglossa imperialis* Cockerell, 1922 (Hymenoptera, Apidae, Euglossina) in Mato Grosso do Sul state, midwestern Brazil

Jessica Amaral Henrique, Ana Isabel Sobreiro, Valter Vieira Alves Júnior

Universidade Federal da Grande Dourados. Faculdade de Ciências Biológicas e Ambientais. Programa de Pós-Graduação em Entomologia e Conservação da Biodiversidade, Laboratório de Apicultura, Rodovia Dourados, Itahum, Km 12, Cidade Universitária, CEP 79804-070, Dourados, MS, Brazil.

Corresponding author: Jessica A. Henrique, jessica.ufgd@gmail.com

Abstract

The occurrence of *Euglossa imperialis* Cockerell, 1922 is recorded for the first time in Mato Grosso do Sul, Brazil. This paper extends the distribution of the species by about 800 km west of the São Paulo state, its nearest record.

Key words

Bait trap; Cerrado domain; Neotropical region; range extension.

Academic editor: Filippo Di Giovanni | Received 9 August 2018 | Accepted 8 October 2018 | Published 16 November 2018

Citation: Henrique JA, Sobreiro AI, Alves Júnior VV (2018) First record of the orchid bee *Euglossa imperialis* Cockerell, 1922 (Hymenoptera, Apidae, Euglossina) in Mato Grosso do Sul state, midwestern Brazil. Check List 14 (6): 1059–1064. <https://doi.org/10.15560/14.6.1059>

Introduction

The bees of the Euglossina subtribe (Silveira et al. 2002), also known as orchid bees, are distributed in 5 genera, *Eufriesea* Cockerell, 1908, *Eulaema* Lepeletier, 1841, *Euglossa* Latreille, 1802, *Exaerete* Hoffmannsegg, 1817 and *Aglae* Lepeletier & Serville, 1825, the latter being monotypic (Oliveira 2006, Nemésio 2009). Moreover, they occur widely in the Neotropical region (Dressler 1982, Cameron 2004, Nemésio 2005). *Euglossa* is the most diverse within the Euglossina subtribe, with more than 120 known species and is currently subdivided into 6 subgenera (Moure et al. 2012). The species present certain characteristics such as: size ranging from 8–18 mm, brightly metallic tegument, which usually varies between green and intense blue, with some species showing areas of red, coppery or violet (Bonilla-Gómez and Nates-Parra 1992, Silveira et al. 2002, Oliveira 2006).

Euglossa imperialis Cockerell, 1922, is a species of the subgenus *Glossura* Cockerell, 1917, distributed from Central America to São Paulo state and occurring in the Brazilian biomes of the Amazon Basin, Atlantic Forest and Cerrado (Rebêlo and Moure 1995, Rebêlo and Garófalo 1997, Rocha-Filho and Garófalo 2013, Storck-Tonon et al. 2013, Mateus et al. 2015, Suni 2016). The males of *E. imperialis* are usually attracted by cineole, eugenol and methyl salicylate (Rebêlo and Moure 1995, Nemésio 2009). Eight species of *Euglossa* have been recorded in Mato Grosso do Sul: *E. townsendi* Cockerell, 1904, *E. cordata* (Linnaeus, 1758), *E. fimbriata* Moure, 1968, *E. melanotricha* Moure, 1967, *E. pleosticta* Dressler, 1982, *E. stellfeldi* Moure, 1947, *E. viridis* (Perty, 1833), *E. annectans* Dressler, 1982 (Lima and Silvestre 2017). This study presents the first record of *E. imperialis* to the state of Mato Grosso do Sul, in midwestern Brazil.

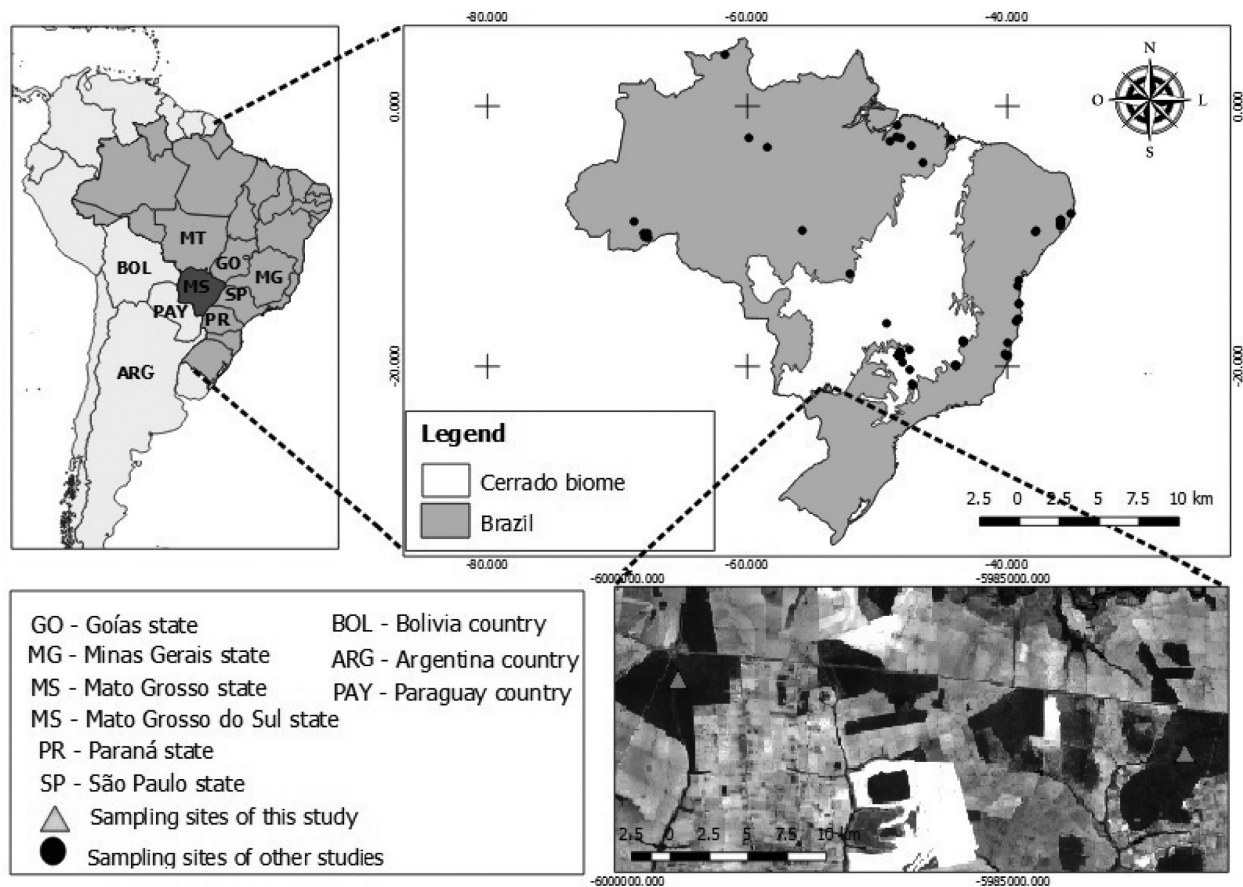


Figure 1. Distribution of *Euglossa imperialis* in Brazil and the new record.

Methods

Sampling was conducted in 2 Cerrado fragments in the municipality of Nova Alvorada do Sul (4.019 km²), located in the southwestern mesoregion of Mato Grosso do Sul. The municipality is at an elevation of approximately 400 m, with average temperatures between 20–24 °C, annual precipitation ranging between 1600–1900 mm and is under the influence of the tropical climate Am with dry winters (Alvares et al. 2013). The sampling localities of the *Euglossa imperialis* specimens represent the new record described here (Fig. 1).

We conducted the sampling between the months of July and August 2017 and January 2018. All specimens were captured with the use of bait traps, modified from Campos et al. (1989). The bait traps were exposed for 61 days, totalizing approximately 1464 hours. In each fragment, we used 5 attractive fragrances: cineole, vanillin, methyl salicylate, eugenol and methyl cinnamate. The specimens captured in the bait traps were preserved in a solution of 1 L of alcohol (70%) with detergent liquid and sodium chloride until it was removed, a procedure which was done every 15 days. For the identification of the species, we used the taxonomic keys of Rebêlo and Moure (1995) and Nemésio (2009). MMA and ICMBio authorized the samplings for the study (N: 60018-1). The voucher specimens are deposited in the Museu da Biodiversidade-MuBio, Federal University of Grande Dourados. The images were obtained using a Nikon cam-

era mounted on a Discovery.V8 stereomicroscope and the final images were constructed using the software Helicon Focus. The map was produced with the presented record and known literature records (Table 1, Fig. 1).

Results

Euglossa imperialis Cockerell, 1922

Figures 2–5

New record. Brazil: Mato Grosso do Sul: Nova Alvorada do Sul: Fragment-1 (21.61867° S, 053.70859° W), males, 22 July 2017, coll. J.A. Henrique, bait trap cineole, (voucher number MuBio 10481, 1 specimen; not vouchered 1 specimen). Fragment-1, male, 5 August 2017, bait trap methyl cinnamate (voucher number MuBio 10482, 1 specimen). Fragment-1, males, 18 January 2018, bait traps methyl salicylate, cineole and methyl cinnamate (not vouchered 23 specimens). Fragment-2 (21.62201° S, 053.71014° W), male, 18 January 2018, coll. J.A. Henrique, bait trap methyl salicylate (voucher number MuBio 10483, 1 specimen; not vouchered 1 specimen). Fragment-2, bait trap cineol (voucher number MuBio 10484, 1 specimen, 5 specimens not vouchered).

Identification. According to the diagnosis of Rebêlo and Moure (1995) and Nemésio (2009), males of *Euglossa imperialis* can be distinguished from other species of *Euglossa* by the following characteristics: large size of approximately 16 mm, ivory markings on scape

Table 1. Surveys of Euglossina bees with *Euglossa imperialis* records from Brazil.

Locality	Capture Method	Scent baits	Reference
Uberlândia, MG	Entomological net	1,8 cineole	Alvarenga et al. (2007)
Uberlândia, MG	Bait trap	1,8 cineole; methyl salicylate	Justino and Augusto (2010)
Pedregulho, SP	Entomological net	1,8 cineole	Mateus et al. (2015)
Canindé do São Francisco, SE; Piranhas, AL	Entomological net		Moura and Schlindwein (2009)
Rio Branco, AC	Bait trap; entomological net		Nemésio and Morato (2006)
Uberlândia, MG	Entomological net		Nemésio (2016)
Belo Horizonte, MG	Entomological net		Nemésio et al. (2015)
Valença, BA	Bait trap	Eucaliptol; methyl salicylate	Neves and Viana (1997)
Amazônia central, AM	Bait trap		Oliveira and Campos (1995, 1996)
Amazônia central, AM	Bait trap		Oliveira (1999)
Cabo de Santo Agostinho, Jaboatão dos Guararapes, Moreno, PE	Entomological net	β-ionone; 1,8 cineole; eugenol; methyl salicylate	Oliveira et al. (2015)
Ribeirãoascalheira, MT	Bait trap; entomological net	1,8 cineole	Oliveira-Júnior et al. (2015)
Southern Bahia State, BA	Bait trap		Ramalho et al. (2013)
Buriticupu, São Luiz, MA	Bait trap	1,8 cineole, methyl salicylate, vanillin	Silva and Rebêlo (1999)
Cajuru, SP	Entomological net	1,8 cineole	Rebêlo and Garófalo (1997)
Triângulo Mineiro, MG	Bait trap; entomological net		Silveira et al. (2015)
Rio Branco, Senador Guimard, Porto Acre, Bujari, AC	Bait trap; entomological net	Benzyl acetate, 1,8 cineole, skatole, methyl salicylate, vanillin	Storck-Tonon et al. (2009)
Rio Branco and surrounding areas, AC	Bait trap; entomological net		Storck-Tonon et al. (2013)
São Gonçalo do Rio Preto, MG	Entomological net		Antonini et al. (2016)
Tailândia, PA	Bait trap		Brito et al. (2017)
Sooterama, Linhares, ES	Entomological net		Nemésio (2013a)
Paragominas, PA	Bait trap		Solar et al. (2016)
São Gonçalo do Rio Preto, MG	Bait trap	1,8 cineole, methyl <i>trans</i> -cinnamate	Nemésio and Faria Jr (2004)
Belo Horizonte, MG	Entomological net		Nemésio and Silveira (2010)
Belo Horizonte, MG	Entomological net	Cineole, methyl cinnamate	Nemésio and Silveira (2007)
Porto Seguro, Santa Cruz Cabralia BA	Entomological net		Nemésio (2013c)
Amajari, RR	Bait traps		da Silva et al. (2013)
Goiânia, GO	Bait traps	Methyl salicylate	Grandolfo et al. (2013)
Monte Carmelo, MG	Bait traps	Methyl salicylate	Pereira and Souza (2015)
Novo Mundo, MT	Bait traps		Figueiredo et al. (2015)
Boca do Acre, AM	Entomological net	Cineole, methyl salicylate	Storck-Tonon et al. (2011)
Una, BA	Entomological net		Nemésio (2013b)
Murici e São José da Laje, AL; Jaqueira, PE	Entomological net Bait traps	p-cresol acetate, dimethoxybenzene, p-tolyl acetate, 1,8 cineole, skatole, eugenol, methyl salicylate	Nemésio and Santos Junior (2014)

occupying one to two-thirds of the anterior surface, well developed and complete inferior ivory paraocular markings with entirely ivory malar area, extended tongue larger than body length, biconvex scutellum with strong mean depression, mandible bidentate, outer mesotibial surface with posterior and anterior tufts fused in a single one, very large and presenting triangular appearance with a subtle notched in the first third of the anterior border, triangular hind tibia, presence of slits that converge at the midline of the sternum II.

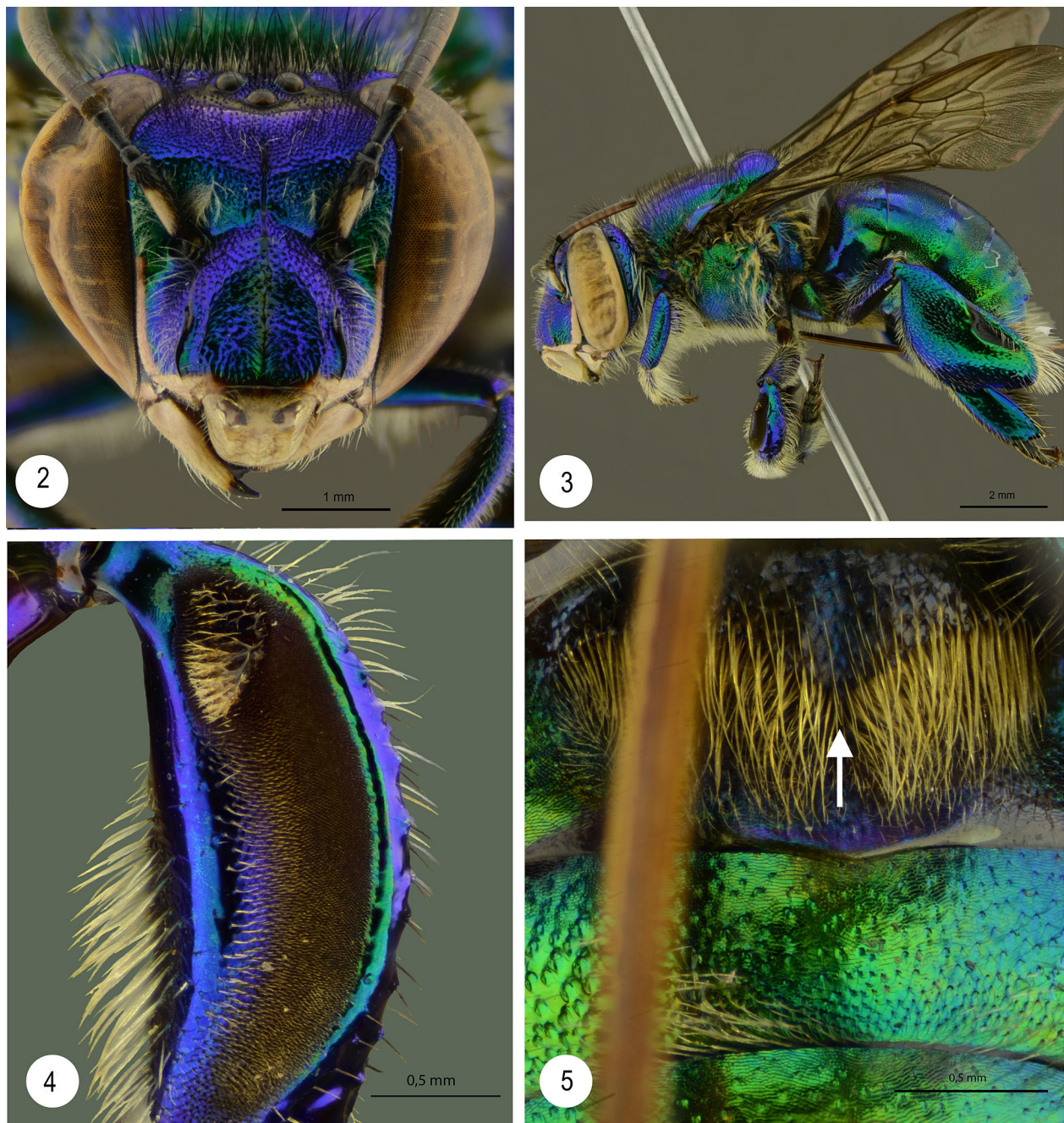
Discussion

Euglossa imperialis is considered a typical Amazonian species, being also present in the remnants of Atlantic Forest (Rebêlo and Moure 1995, Silveira et al. 2015). Several studies in most environments indicate that the

species could be associated with wetter habitats (Mateus et al. 2015, Silveira et al. 2015, Brito et al. 2017). However, this species presents a large occurrence in the Neotropical region (Nemésio and Silveira 2007), being also recorded in more open areas of forests in the Cerrado (Nemésio and Faria 2004, Justino and Augusto 2010, Nemésio 2016).

We recorded males of *E. imperialis* in 2 sampled fragments of Cerrado, which may indicate the amplitude of occurrence of the species in different phytophysiognomies. In addition, the gallery forests which are also present in the region of sampling, can act as bio-corridors, enabling the species to move around the most diverse habitats as reported by Moura and Schlindwein (2009).

Our record contributes to the knowledge and distribution of the orchid bee fauna throughout the Neotropical region, since the species have a key-role in the pollina-



Figures 2–5. *Euglossa imperialis*. **2.** Front view of the head. **3.** Lateral habitus. **4.** Outer mesotibial surface (see the anterior and posterior tufts). **5.** Ventral view (see the slits indicated by the white arrow).

tion process of several botanical families (Dressler 1982, Ramirez et al. 2002). It also shows that the lack of sampling in still under-explored places contributes to the late record of a widely distributed species. We extended the distribution of the species by about 800 km to the west from its nearest record in the São Paulo state (Mateus et al. 2015, Table 1).

Acknowledgements

We thank Bhrenno Trad (Hecolab of Federal University of Grande Dourados) for his help with the photos; the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) for the financial support to the first author; the

Intituto Chico Mendes de Conservação da Biodiversidade (ICMBio-System) for permission to collect bees. The authors also thank the anonymous reviewers.

Authors' Contributions

JAH collected and identified the specimen. AIS made de distribution map. JAH, AIS, VVAJ wrote the text, reviewed and approved the manuscript.

References

- Alvarenga PEF, Freitas RF, Augusto SC (2007). Diversidade de Euglossini (Hymenoptera: Apidae) em áreas de Cerrado do Triângulo Mineiro, MG. *Bioscience Journal* 23 (1): 37–37.

- Alvares CA, Stape JL, Sentelhas PC, de Moraes JLG, Sparovek G (2013). Köppen's climate classification map for Brazil. *Meteorologische Zeitschrift* 22 (6): 711–728. <http://doi.org/10.1127/0941-2948/2013/0507>
- Antonini Y, Silveira RA, Oliveira ML, Martins C, Oliveira R (2016). Orchid bee fauna responds to habitat complexity on a savanna area (Cerrado) in Brazil. *Sociobiology* 63 (2): 819–825. <http://doi.org/10.13102/sociobiology.v63i2.1038>
- Bonilla-Gómez MA, Nates-Parra G (1992). Abejas Euglosinas de Colombia (Hymenoptera: Apidae) I. Claves Ilustradas. *Caldasia* 17 (1): 149–172.
- Brito TF, Phifer CC, Knowton JL, Fiser CM, Becker NM, Barros FC, Contrera FAL, Maués MM, Juen L, Montag LFA, Webster CR, Flaspohler DJ, Santos MPD, Silva DP (2017). Forest reserves and riparian corridors help maintain orchid bee (Hymenoptera: Euglossini) communities in oil palm plantations in Brazil. *Apidologie* 48 (5): 575–587. <http://doi.org/10.1007/s13592-017-0500-z>
- Cameron SA (2004). Phylogeny and Biology of Neotropical Orchid Bees (Euglossini). *Annual Review of Entomology* 49: 377–404. <https://doi.org/10.1146/annurev.ento.49.072103.115855>
- Campos LAO, da Silveira FA, de Oliveira MA, Abrantes CVM, Morato EF, Melo GAR (1989). Utilização de armadilhas para a captura de machos de Euglossini (Hymenoptera, Apoidea). *Revista Brasileira de Zoologia* 6 (4): 621–626.
- Cockerell TDA (1922). Bees in the collection of the United States Nacional Museum. *Proceedings of the United States Nacional Museum* 60 (18): 1–20.
- Da Silva SJR, Neto JLG, Parente FS (2013). Abundância e Diversidade de Abelhas Euglossina (Hymenoptera: Apidae) da Serra do Tepequém, município de Amajari, Roraima, Brasil. *Revista Agro@mbiente on-line* 7 (2): 225–230.
- Dressler RL (1982). Biology of the orchid bees (Euglossini). *Annual Review of Ecology and Systematics* 13: 373–394.
- Figueiredo JDS, Souza MHS, Anjos-Silva EJ (2015). Abelhas-das-orquídeas (Hymenoptera: Apidae: Euglossini). In: Rodrigues DJ, Noronha JC, Vindica VF, Barbosa FR (Eds) *Biodiversidade do Parque Estadual do Cristalino*. Átoma Editorial, Sinop, 97–109.
- Grandolfo VA, Bozza Junior RC, Silva Neto CG, Mesquita Neto, Gonçalves BB (2013). Riqueza e Abundância de Abelhas Euglossini (Hymenoptera, Apidae) em Parques urbanos de Goiânia, Goiás. *Entomobrasilis* 6 (2): 126–31. <http://doi.org/10.12741/embrasilis.v6i2.296>
- Justino DG, Augusto SC (2010). Avaliação da eficiência de coleta utilizando armadilhas aromáticas e riqueza de Euglossini (Hymenoptera, Apidae) em áreas de Cerrado do Triângulo Mineiro. *Revista Brasileira de Zoociências* 12 (3): 227–239.
- Lima FVO, Silvestre R (2017). Abelhas (Hymenoptera, Apidae *sensu lato*) do Estado de Mato Grosso do Sul, Brasil. *Iheringia, Série Zoologia* 107 (supl): e2017123. <http://doi.org/10.1590/1678-4766e2017123>
- Mateus S, Andrade-Silva ACR, Garófalo CA (2015). Diversity and Temporal Variation in the Orchid Bee Community (Hymenoptera: Apidae) of the Remnant of a Neotropical Seasonal Semi-deciduous Forests. *Sociobiology* 62 (4): 571–577. <http://doi.org/10.13102/sociobiology.v62i4.391>
- Moura DC, Schlindwein C (2009). Mata Ciliar do Rio São Francisco como Biocorredor para Euglossini (Hymenoptera: Apidae) de Florestas Tropicais Úmidas. *Neotropical Entomology* 38 (2): 281–284.
- Moure JS, Melo GAR, Faria Jr LRR (2012). Euglossini Latreille, 1802. In Moure JS, Urban D, Melo GAR (Orgs). *Catalogue of Bees* (Hymenoptera: Apoidea) in the Neotropical Region—online version <http://www.moure.cria.org.br/catalogue>. Accessed on: 2017-12-29.
- Nemésio A (2005). Fluorescent colors in orchid bees (Hymenoptera: Apidae). *Neotropical Entomology* 34 (6): 933–936.
- Nemésio A (2009). Orchid bees (Hymenoptera: Apidae) of the Brazilian Atlantic Forest. *Zootaxa* 2041: 1–242.
- Nemésio A (2013a). Are orchid bees at risk? First comparative survey suggests declining populations of forest-dependent species. *Brazilian Journal of Biology* 73 (2): 367–374. <http://doi.org/10.1590/S1519-69842013000200017>
- Nemésio A (2013b). The orchid bee fauna (Hymenoptera: Apidae) of ‘Reserva Biológica de Una’, a hotspot in the Atlantic Forest of southern Bahia, eastern Brazil. *Brazilian Journal of Biology* 73 (2): 347–352. <http://doi.org/10.1590/S1519-69842013000200014>
- Nemésio A (2013c). The orchid bee faunas (Hymenoptera: Apidae) of two Atlantic Forest remnants in southern Bahia, eastern Brazil. *Brazilian Journal of Biology* 73 (2): 375–381. <http://doi.org/10.1590/S1519-69842013000200018>
- Nemésio A (2016). Orchid Bees (Hymenoptera, Apidae) from the Brazilian savanna-like ‘Cerrado’: how to adequately survey under low population densities? *North-Western Journal of Zoology* 12 (2): 230–238.
- Nemésio A, Faria Jr LRR (2004). First assessment of the orchid-bee fauna (Hymenoptera: Apidae) at Parque Estadual do Rio Preto, a cerrado area in southeastern Brazil. *Lundiana* 5 (2): 113–117.
- Nemésio A, Morato EF (2006). The orchid-bee fauna (Hymenoptera: Apidae) of Acre state (northwestern Brazil) and a re-evaluation of euglossine bait-trapping. *Lundiana* 7 (1): 59–64.
- Nemésio A, Santos Junior JE (2014). Is the “Centro de Endemismo Pernambuco” a biodiversity hotspot for orchid bees? *Brazilian Journal of Biology* 74 (3): S78–S92. <http://doi.org/10.1590/1519-6984.26412>
- Nemésio A, Santos LM, Vasconcelos HL (2015). Long-term ecology of orchid bees in an urban forest remnant. *Apidologie* 46: 359–368. <http://doi.org/10.1007/s13592-014-0328-8>
- Nemésio A, Silveira FA (2007). Diversity and Distribution of Orchid Bees (Hymenoptera: Apidae) with a revised checklist of species. *Neotropical Entomology* 36 (6): 874–888. <http://doi.org/10.1590/S1519-566X2007000600008>
- Nemésio A, Silveira FA (2010). Forest fragments with larger core areas better sustain diverse orchid bee faunas (Hymenoptera: Apidae: Euglossina). *Neotropical Entomology* 39 (4): 555–561. <http://doi.org/10.1590/S1519-566X2010000400014>
- Neves EL, Viana BF (1997). Inventário da fauna de Euglossinae (Hymenoptera, Apidae) do baixo sul da Bahia, Brasil. *Revista Brasileira de Zoologia* 14 (4): 831–837.
- Oliveira-Júnior JMB, Almeida SM, Rodrigues L, Silvério Júnior AJ, Anjos-Silva EJ (2015). Orchid bees (Apidae: Euglossini) in a forest fragment in the ecotone Cerrado-Amazonian Forest, Brazil. *Acta Biológica Colombiana* 20 (3): 67–78. <http://doi.org/10.15446/abc.v20n3.41122>
- Oliveira ML (1999). Sazonalidade e horário de atividade de abelhas Euglossinae (Hymenoptera, Apidae), em florestas de terra firme na Amazônia Central. *Revista Brasileira de Zoologia* 16 (1): 83–90.
- Oliveira ML (2006). Nova hipótese de relacionamento filogenético entre os gêneros de Euglossini e entre as espécies de *Eulaema* Lepeletier, 1841 (Hymenoptera: Apidae: Euglossini). *Acta Amazonica* 36 (2): 273–285.
- Oliveira ML, Campos LAO (1995). Abundância, riqueza e diversidade de abelhas Euglossinae (Hymenoptera, Apidae) em florestas contínuas de terra firme na Amazônia Central. *Revista Brasileira de Zoologia* 12 (3): 547–556.
- Oliveira ML, Campos LAO (1996). Preferência por estratos florestais e por substâncias odoríferas em abelhas Euglossinae (Hymenoptera, Apidae). *Revista Brasileira de Zoologia* 13 (4): 1075–1085.
- Oliveira R, Pinto CE, Schlindwein C (2015). Two common species-rich euglossine bee fauna of an Atlantic Rainforest remnant in Pernambuco, Brazil. *Brazilian Journal of Biology* 75 (4): S1–S8. <http://doi.org/10.1590/1519-6984.18513>
- Pereira SAN, Souza CS (2015). Levantamento da fauna de abelhas no município de Monte Carmelo-MG. *Revista GeTec* 4 (7): 11–24.
- Ramalho M, Rosa JF, Dantas E Silva M, Silva M, Monteiro D (2013). Spatial distribution of orchid bees in a rainforest/rubber agro-forest mosaic: habitat use or connectivity. *Apidologie* 44 (4): 385–403. <http://doi.org/10.1007/s13592-012-0189-y>
- Ramirez S, Dressler RL, Ospina M (2002) Abejas euglosinas (Hymenoptera: Apidae) de la región Neotropical: listado de especies con

- notas sobre su biología. *Biota Colombiana* 3 (1): 7–118.
- Rebêlo JMM, Garófalo CA (1997). Comunidade de machos de Euglossini (Hymenoptera: Apidae) em matas semidecíduais do nordeste do estado de São Paulo. *Anais da Sociedade Entomológica do Brasil* 23: 243–255.
- Rebêlo JMM, Moure JS (1995). As Espécies de *Euglossa* Latreille do Nordeste de São Paulo (Apidae, Euglossinae). *Revista Brasileira de Zoologia* 12 (3): 445–456.
- Rocha-Filho LC, Garófalo CA (2013). Community ecology of euglossine bees in the coastal Atlantic Forest of São Paulo State, Brazil. *Journal of Insect Science* 13 (23): 1–19. <https://doi.org/10.1673/031.013.2301>
- Silva FS, Rebêlo JMM (1999). Euglossine bees (Hymenoptera: Apidae) of Buriticupu, Amazonia of Maranhão, Brazil. *Acta Amazonica* 29 (4): 587–599.
- Silveira FA, Melo GAR, Almeida EAB (2002) *Abelhas Brasileiras: Sistemática e Identificação*. Edição do Autor, Belo Horizonte, 253 pp.
- Silveira GC, Freitas RF, Tosta THA, Rabelo LS, Gaglianone MC, Augusto SC (2015). The orchid bee fauna in the Brazilian savanna: do forest formations contribute to higher species diversity? *Apidologie* 46: 197–208. <http://doi.org/10.1007/s13592-014-0314-1>
- Solar RRC, Chaul JCM, Maués M, Schoereder JH (2016). A quantitative baseline of ants and orchid bees in human-modified Amazonian landscapes in Paragominas, Pará, Brazil. *Sociobiology* 63 (3): 925–940. <http://doi.org/10.13102/sociobiology.v63i3.1052>
- Storck-Tonon D, Morato EF, Melo AWF, Oliveira ML (2013). Orchid bees of forest fragments in southwestern Amazonia. *Biota Neotropica* 13 (1): 133–141. <http://doi.org/10.1590/S1676-06032013000100015>
- Storck-Tonon D, Morato EF, Oliveira ML (2009). Fauna de Euglossina (Hymenoptera: Apidae) da Amazônia sul-ocidental, Acre, Brasil. *Acta Amazonica* 39 (3): 693–706. <http://doi.org/10.1590/S0044-59672009000300026>
- Storck-Tonon D, Silva MV, Morato EF (2011). Checklist of orchid bees (Hymenoptera: Apidae) of “Lago do Silêncio” area, Boca do Acre, Amazonas, Brazil. *Check List* 7 (5): 648–651. <http://doi.org/10.15560/7.5.648>
- Suni SS (2016). Dispersal of the orchid bee *Euglossa imperialis* over degraded habitat and intact forest. *Conservation Genetics* 18 (3): 621–630. <https://doi.org/10.1007/s10592-016-0902-x>