

## Scientific Note

# Occurrence of *Aglae caerulea* Lepeletier & Serville, 1825 (Apidae, Hymenoptera) in the Cerrado biome: new records from Minas Gerais state, Brazil

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**Abstract.** *Aglae caerulea* Lepeletier & Serville, 1825 (Apidae, Hymenoptera) is a rare cleptoparasitic species primarily associated with the Amazon rainforest and gallery forest in the Cerrado Biome. Here, we report two new records of *A. caerulea* from surveys conducted in seasonal semideciduous forest remnants of Cerrado, extending its home range to Minas Gerais state, Brazil. During these surveys, five *A. caerulea* males were attracted to methyl cinnamate. These findings highlight the importance of forested habitat in the Cerrado for supporting rare euglossine species and contribute to a better understanding of the distributional range and habitat use of *A. caerulea*.

**Keywords:** Brazilian savanna, cleptoparasite, euglossine, aromatic baits, methyl cinnamate.

Euglossine bees are distributed throughout tropical America and include both pollen-collecting genera (*Euglossa* Latreille, 1802; *Eulaema* Lepeletier, 1841 and *Eufriesea* Cockerell, 1908) and cleptoparasitic genera (*Aglae* Lepeletier & Serville, 1825 and *Exaerete* Hoffmannsegg, 1817), whose females lay their eggs in the nests of free-living euglossine females (Dressler 1982). *Aglae caerulea* Lepeletier & Serville, 1825 (Apidae, Hymenoptera) is a rare cleptoparasitic species of *Eulaema* nests and is characterized by its metallic blue coloration and large and slender bodies (20–28 mm) (Myers 1935; Friese 1941; Dressler 1982). Although *A. caerulea* is primarily associated with the Amazon rainforest (Moure 1967; Ramírez et al. 2002), recent records have expanded its known distribution to forested environments in the Cerrado biome (Anjos-Silva et al. 2006; Silva et al. 2013; Martins et al. 2016; Souza et al. 2020).

The only known host record for *A. caerulea* is the orchid bee *Eulaema nigrata* Lepeletier (Myers, 1935) (*E. nigrata*), whose nests are also parasitized by females of another cleptoparasitic orchid bee species, *Exaerete smaragdina* (Guérin, 1844) (*Ex. smaragdina*) (Garófalo & Rozen 2001). Several studies have recorded *Ex. smaragdina* in the Cerrado (Silva 2012; Pires et al. 2013; Nascimento et al. 2015; Silveira et al. 2015; Martins et al. 2016; Tosta et al. 2017). Notably, *El. nigrata* is a widespread species, ranging from Costa Rica to Argentina, occurring in several vegetational types from forest to open areas (Roubik & Hanson 2004). It is also common in altered, disturbed areas such as urban environments (López-Uribe et al. 2008). This species was considered commonly found in Cerrado habitats (Nemésio 2016), while its cleptoparasite *A. caerulea* present limited records in this biome (Anjos-Silva et al. 2006; Silva et al. 2013; Martins et al. 2016; Souza et al. 2020).

Studies on the euglossine bee community have been conducted in the forested remnants within the Biome Cerrado, in the Triângulo Mineiro and Alto Paranaíba (Minas Gerais, Brazil) mesoregion and covering an area of approximately 442 km<sup>2</sup> (Alvarenga et al. 2007; Silveira et al. 2015; Tosta et al. 2017; Prado-Junior et al. 2020; Ignácio-Souza & Augusto, unpublished data). As a result of these studies, we report here new records of *A. caerulea* contributing to a better

understanding of its distributional range and habitat use.

The records were made during euglossine bee surveys performed in two forested remnants of Cerrado: Boa Vista and Mata da Água Fria Farms, located at Triângulo Mineiro/Alto Paranaíba Mesoregion, Minas Gerais State, Brazil (Fig. 1). The Mata da Água Fria Farm (18°29'50" S, 48°23'03" W) is a private property located in the municipality of Araguari (Minas Gerais, Brazil). This remnant has approximately 200 hectares of continuous forest, primarily composed of seasonal semideciduous forest and gallery forest physiognomies, surrounded by pasture and crop areas (Lopes et al. 2012).

The Boa Vista Farm (FBV) is a private property located in the municipality of Patrocínio (Minas Gerais, Brazil) (18°47'20.94"S, 47°5'4.61"W). This remnant has approximately 177.158 hectares and consists of gallery forests interspersed with seasonal semideciduous forest in low-lying areas with water, as well as savanna formations in higher elevations. These habitat characteristics were identified through field observations and geoprocessing analysis.

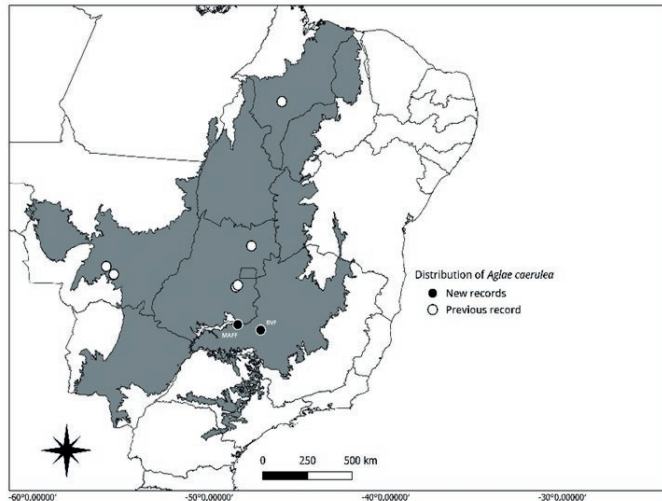
The sampled remnants are located in a region characterized by a tropical savanna climate with two distinct seasons: a dry/cold season and a rainy/hot season. The climate is classified as Aw according to the Köppen classification (Kottek et al. 2006).

Samplings were conducted during the rainy season, between 9:00 AM and 4:00 PM. To attract orchid bee males, seven scent baits were used: eucalyptol, eugenol, vanillin, methyl salicylate, benzyl acetate, β-ionone, and methyl cinnamate. Each bait was suspended 1.5 m above the ground, spaced approximately 12 m apart from each other, and replenished every two hours (Tosta et al. 2017).

All specimens were pinned, labeled, and identified based on entomological keys by a specialist (Rocha-Filho, L.C.). These individuals were deposited in the collection of the 'Laboratório de Ecologia e Comportamento de Abelhas (LECA)' at the Institute of Biology of the Federal University of Uberlândia, under collection numbers MAFPE130, MAFPE134 FBV009, FBV010 and FBV011.

Five males of *A. caerulea* were recorded. Two males were collected on February 27, 2014, at Mata da Água Fria Farm, in a seasonal semideciduous forest, and three males were collected on March 19,

2023, at Boa Vista Farm (Fig. 2), in a gallery forest, using traps baited with methyl cinnamate in both sampling days.



**Figure 1.** Sampling site locations: Boa Vista Farm, municipality of Patrocínio, and Mata da Água Fria Farm, municipality of Araguari, Minas Gerais state, Brazil. The figure also highlights data from other studies reporting occurrences of *Aglae caerulea* in the Cerrado biome (Anjos-Silva et al. 2006; Silva et al. 2013; Martins et al. 2016; Souza et al. 2020).

To date, we have conducted approximately 870 hours of sampling of euglossine fauna in 27 remnants of the Cerrado (Alvarenga et al. 2007; Silveira et al. 2015; Tosta et al. 2017; Prado-Junior et al. 2020; Ignácio-Souza & Augusto, unpublished data). Despite this extensive

effort, *A. caerulea* was sampled in only two seasonal semideciduous forest remnants.

Consistent with previous studies, methyl cinnamate proved to be the most effective bait for attracting *A. caerulea* males (Dodson et al. 1969; Morato 2001; Anjos-Silva et al. 2006). Although it is commonly used in euglossine surveys, its effectiveness varies. *Aglae caerulea* males appears to have a strong preference for this type of aromatic bait, similar to males of other euglossine species that exhibit specificity in their attraction to particular baits (Morato 2001; Anjos-Silva et al. 2006; Eltz et al. 2005; Martins et al. 2016).

The Cerrado biome is characterized by a set of different vegetal physiognomies, including forested formations, such as gallery forest and semideciduous forest, embedded within the savanna environments, which resulted from climatic fluctuations that occurred at the end of the Quaternary period (Oliveira & Ratter 1995). The forested environments served as mesic bio-corridors for many species from the Amazon and the Atlantic forests, particularly those dependent on higher humidity levels (Oliveira & Ratter 1995). Our studies on euglossine bees demonstrated the importance of seasonal semideciduous and gallery forests in maintaining the diversity of the euglossine fauna in the Cerrado, including species primarily associated with the Amazon rainforest and rarely sampled in inventories, such as *A. caerulea* and *Euglossa decorata* Smith, 1874 (Nemésio et al. 2007). The most recent records of *A. caerulea* outside the Amazon Basin were made in gallery forest remnants (see Souza et al. 2020). Additionally, our results reinforce the association of *A. caerulea* with the seasonal semideciduous forests of Cerrado. Therefore, there is an urgent need to conserve forested habitats in the Cerrado to ensure the survival and establishment of euglossine species populations.



**Figure 2.** *Aglae caerulea* male recorded in the gallery forest of the Cerrado, in the municipality of Patrocínio, Minas Gerais, Brazil. A - Front View, B - Dorsal view, C - Lateral view; Bars: 10 mm. Photos: Ignácio-Souza, J.H.

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## Author's Contributions

SCA: Conceptualisation, Writing – original draft, Writing – review & editing; JHI-S: Conceptualisation, Investigation, Writing – original draft, Writing – review & editing; THAT: Conceptualisation, Investigation, Writing – review & editing; LCR-F: Writing – original draft, Writing – review & editing.

## Conflict of Interest Statement

The authors declare that no competing interests exist.

## References

- Alvarenga, P. E. F.; Freitas, R. F.; Augusto, S. C. (2007) Diversidade de Euglossini (Hymenoptera: Apidae) em áreas de cerrado do Triângulo Mineiro, MG. *Bioscience Journal*, 23: 30-37.
- Anjos-Silva, E. J.; Camillo, E.; Garófalo, C. A. (2006) Occurrence of *Aglae caerulea* Lepeletier & Serville (Hymenoptera: Apidae: Euglossini) in the Parque Nacional da Chapada dos Guimarães, Mato Grosso State, Brazil. *Neotropical Entomology*, 35(6): 868-870. doi: [10.1590/S1519-566X2006000600024](https://doi.org/10.1590/S1519-566X2006000600024)
- Dodson, C. H.; Dressler, R. L.; Hills, H.; Adams, R. M.; Williams, N. H. (1969) Biologically active compounds in orchid fragrances. *Science*, 164(3885): 1243-1249. doi: [10.1126/science.164.3885.1243](https://doi.org/10.1126/science.164.3885.1243)
- Dressler, R. L. (1982) Biology of the orchid bees (Euglossini). *Annual Review of Ecology and Systematics*, 13: 373-394. doi: [10.1146/annurev.es.13.110182.002105](https://doi.org/10.1146/annurev.es.13.110182.002105)
- Eltz, T.; Sager, A.; Lunau, K. (2005) Juggling with volatiles: exposure of perfumes by displaying male orchid bees. *Journal of Comparative Physiology A*, 191: 575-581. doi: [10.1007/s00359-005-0603-2](https://doi.org/10.1007/s00359-005-0603-2)
- Friese, H. (1941) Apidae aus Süd-Ost-Afrika gesammelt von Missionar Henri A. Junod Dr. phil. hc (1863-1934) (Hym. Apid.). *Transactions of the Royal Entomological Society of London*, 90: 67-74.
- Garófalo, C. A.; Rozen, J. G. (2001) Parasitic behavior of

- Exaerete smaragdina* with descriptions of its mature oocyte and larval instars (Hymenoptera: Apidae: Euglossini). *American Museum Novitates*, 3349: 1-26. doi: [10.1206/0003-0082\(2001\)349<0001:PBOESW>2.0.CO;2](https://doi.org/10.1206/0003-0082(2001)349<0001:PBOESW>2.0.CO;2)
- Kottek, M.; Grieser, J.; Beck, C.; Rudolf, B.; Rubel, F. (2006) World map of the Köppen-Geiger climate classification updated. *Meteorologische Zeitschrift*, 15(3): 259-263. doi: [10.1127/0941-2948/2006/0130](https://doi.org/10.1127/0941-2948/2006/0130)
- López-Urbe, M. M.; Oi, C. A.; Del Lama, M. A. (2008) Nectar-foraging behavior of Euglossine bees (Hymenoptera: Apidae) in urban areas. *Apidologie*, 39(4): 410-418. doi: [10.1051/apido:2008023](https://doi.org/10.1051/apido:2008023)
- Lopes, S. F.; Schiavini, I.; Oliveira, A. P.; Vale, V. S. (2012) An ecological comparison of floristic composition in Seasonal Semideciduous Forest in southeast Brazil: Implications for conservation. *International Journal of Forestry Research*, 1-14. doi: [10.1155/2012/537269](https://doi.org/10.1155/2012/537269)
- Martins, D. C.; Albuquerque, P. M. C.; Silva, F. S.; Rebêlo, J. M. M. (2016) First record of *Aglae caerulea* (Hymenoptera, Apidae, Euglossini) in Brazilian Cerrado east of the Amazon Region, Maranhão State, Brazil. *Brazilian Journal of Biology*, 76: 554-556. doi: [10.1590/1519-6984.06415](https://doi.org/10.1590/1519-6984.06415)
- Myers, J. G. (1935) Ethological observations on the citrus bee *Trigona silvestriana* Vachal and other neotropical bees. (Hym., Apoidea). *Transactions of the Royal Entomological Society of London*, 83(1): 131-142. doi: [10.1111/j.1365-2311.1935.tb00419.x](https://doi.org/10.1111/j.1365-2311.1935.tb00419.x)
- Morato, E. F. (2001) Ocorrência de *Aglae caerulea* Lepeletier & Serville (Hymenoptera, Apidae, Apini, Euglossina) no estado do Acre, Brasil. *Revista Brasileira de Zoologia*, 18(3): 1031-1034. doi: [10.1590/S0101-81752001000300034](https://doi.org/10.1590/S0101-81752001000300034)
- Moure, J. S. (1967) A check-list of the known Euglossine bees (Hymenoptera, Apidae). In: *Atas do Simpósio sobre a Biota Amazônica*, pp. 395-415. Rio de Janeiro: Conselho Nacional de Pesquisas.
- Nascimento, S.; Canale, G. R.; Silva, D. J. (2015) Abelhas Euglossina (Hymenoptera: Apidae) associadas à monocultura de eucalipto no cerrado mato-grossense. *Revista Árvore*, 39(2): 263-273. doi: [10.1590/0100-67622015000200006](https://doi.org/10.1590/0100-67622015000200006)
- Nemésio, A.; Augusto, S. C.; Almeida, E. A. (2007) *Euglossa decorata* Smith (Hymenoptera: Apidae) no Brasil Central - implicações biogeográficas. *Lundiana: Revista Internacional de Biodiversidade*, 8(1): 57-61. doi: [10.35699/2675-5327.2007.23178](https://doi.org/10.35699/2675-5327.2007.23178)
- 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: 230-238
- Oliveira, P. E.; Ratter, J. A. (1995) A study of the origin of central Brazilian forests by the analysis of plant species distribution patterns. *Edinburgh Journal of Botany*, 52(2): 141-202. doi: [10.1017/S0960428600000949](https://doi.org/10.1017/S0960428600000949)
- Pires, E. P.; Morgado, L. N.; Souza, B.; Carvalho, C. F.; Nemésio, A. (2013) Community of orchid bees (Hymenoptera: Apidae) in transitional vegetation between Cerrado and Atlantic Forest in southeastern Brazil. *Brazilian Journal of Biology*, 73(3): 507-513. doi: [10.1590/S1519-69842013000300007](https://doi.org/10.1590/S1519-69842013000300007)
- Prado-Júnior, J. A.; Maravalhas, J. B.; Tosta, T. H. A.; Rosa, T. F.; Augusto, S. C.; Vasconcelos, H. L. (2020) Spatio-temporal changes in the structure of the ant, bee, and tree communities in the Brazilian Cerrado. *Oecologia Australis*, 24(2): 448-460. doi: [10.4257/oeco.2020.2402.15](https://doi.org/10.4257/oeco.2020.2402.15)
- Ramírez, S. R.; Dressler, R. L.; Ospina, M. (2002) Abejas Euglossinas (Hymenoptera: Apidae) de la región Neotropical: Listado de especies con notas sobre su biología. *Biota Colombiana*, 3: 7-118.
- Roubik, D. W.; Hanson, P. E. (2004) *Orchid bees of tropical America: Biology and field guide*. Santo Domingo de Heredia: INBio.
- Silva, D. P.; Aguiar, A. J.; Melo, G. A.; Anjos-Silva, E. J.; De Marco, P. (2013) Espécies amazônicas na savana do Cerrado: novos registros e distribuição potencial para *Aglae caerulea* (Apidae: Euglossini). *Apidologie*, 44: 673-683. doi: [10.1007/s13592-013-0216-7](https://doi.org/10.1007/s13592-013-0216-7)
- Silva, F. S. (2012) Orchid bee (Hymenoptera: Apidae) community from a gallery forest in the Brazilian Cerrado. *Revista de Biología Tropical*, 60(2): 625-633. doi: [10.15517/rbt.v60i2.3949](https://doi.org/10.15517/rbt.v60i2.3949)
- Silveira, G. C.; Freitas, R. F.; Tosta, T. H. A.; Rabelo, L. S.; Gaglianone, M. C.; Augusto, S. C. (2015) The orchid bee fauna in the Brazilian savanna: do forest formations contribute to higher species diversity? *Apidologie*, 46: 197-208. doi: [10.1007/s13592-014-0314-1](https://doi.org/10.1007/s13592-014-0314-1)
- Souza, M. H. S.; Figueiredo, J. D. S.; Cunha, J. C.; Pains, S. O.; Brito, M. T.; Lobaig, F. A.; Garófalo, C. A.; Anjos-Silva E. J. (2020) Range expansion of the cleptoparasitic orchid bee *Aglae caerulea* in the Pantanal of Mato Grosso, Brazil. *Sociobiology*, 67(4): 599-603. doi: [10.13102/sociobiology.v67i4.4581](https://doi.org/10.13102/sociobiology.v67i4.4581)
- Tosta, T. H. A.; Silveira, G. D. C.; Schiavini, I.; Sofia, S. H.; Augusto, S. C. (2017) Using short-term surveys and mark-recapture to estimate diversity and population size of orchid bees in forest formations of the Brazilian savanna. *Journal of Natural History*, 51(7-8): 391-403. doi: [10.1080/00222933.2016.1274441](https://doi.org/10.1080/00222933.2016.1274441)