



## SHORT NOTE

### First Case of Gynandromorphism in the Orchid Bee *Euglossa viridissima* Friese, 1899 (Hymenoptera: Apidae: Euglossini) in El Salvador

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#### Abstract

The first case of gynandromorphism in the orchid bee *Euglossa viridissima* Friese is described and illustrated. A specimen collected in Popotlán, El Salvador, using an aromatic (eugenol) bait trap, exhibits a marked bilateral gynandromorphic pattern and a mild mixed pattern. The left side of the body exhibits male phenotypic characteristics, while the right side exhibits female characteristics. Asymmetries in the head (ivory markings and mandible), mesosoma (middle and hind legs), and metasoma are detailed. These gynandromorphic findings were compared with a regular male of the species, specifically the head and metasoma. This finding corresponds to the ninth case of this anomaly reported for the genus *Euglossa*, the eleventh for the tribe Euglossini, the first for the species *E. viridissima*, and the first record of a gynandromorphic bee for El Salvador.

#### Introduction

Gynandromorphism is a developmental anomaly in which a single individual exhibits simultaneous expression of male and female phenotypic characteristics (Michez et al., 2009). This phenomenon, although rare, has been reported in diverse groups of insects, especially in Hymenoptera. Gynandromorphs have traditionally been classified into three patterns: bilateral (sagittal division into male and female sides), mosaic or mixed (a patchwork of tissues from both sexes), and transverse (anteroposterior division) (Wcislo et al., 2004; Hinojosa-Díaz et al., 2012).

Within bees (Anthophila), cases of gynandromorphism have been documented in most families (except Stenotritidae) and biogeographic regions. In the Neotropical orchid bee tribe Euglossini, the marked sexual dimorphism facilitates the detection of these morphological features. Males possess specialized structures, such as modified hind tibiae for storing

fragrances and brushes on the forelegs, which are absent in females. In contrast, females have a corbicula for transporting pollen and nest-building materials (Dressler, 1982; Roubik & Hanson, 2004).

In the last decade, eight cases of gynandromorphism have been documented in Euglossini: *Euglossa iopoecila* Dressler (Giangarelli & Sofia, 2011), *Euglossa tridentata* Moure (Hinojosa-Díaz et al., 2012), *Eulaema athleticana* Nemésio (Silveira et al., 2012), *Euglossa pleosticta* Dressler (Camargo & Gonçalves, 2013), *Euglossa gorgonensis* Cheesman (González, 2014), *Euglossa melanotricha* Moure (Suzuki et al., 2015), *Eulaema meriana* (Olivier) (Pazmiño & Oliveira, 2021), and more recently, *Euglossa chalybeata* (Santos-Silva & Oliveira, 2024). Most of these cases exhibit a mosaic or mixed pattern. This article describes the first case of a gynandromorph in *Euglossa viridissima* Friese, 1899, representing the ninth documented occurrence in the tribe Euglossini and the first in the bee fauna of El Salvador.



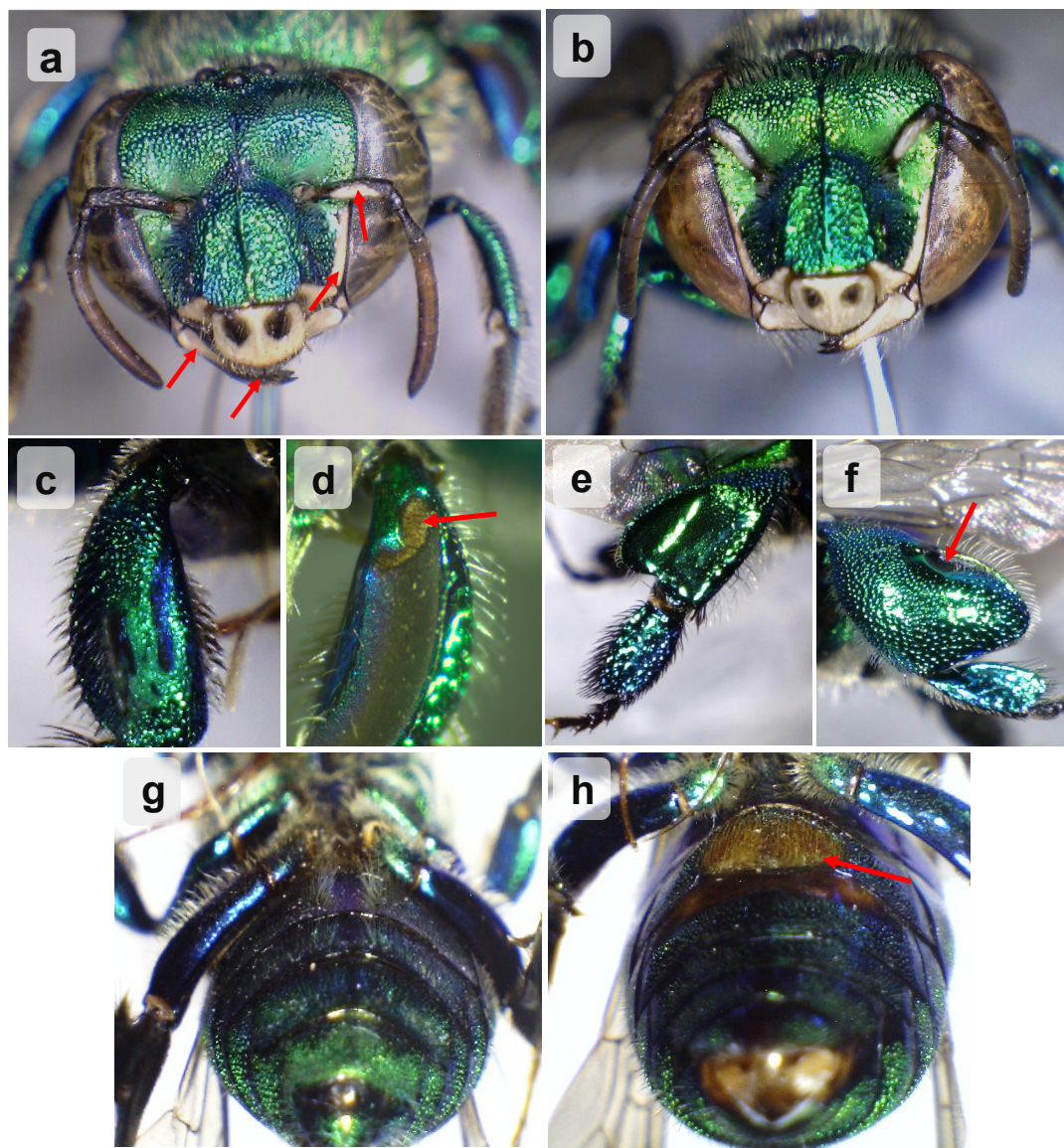
## Material and Methods

The specimen was collected in Popotlán, Apopa District, San Salvador, El Salvador (13.799025, -89.165687, 470 masl) in June 2024. It was attracted to a “TB” type bottle trap (Vélez & Barrios, 2005) baited with eugenol and preserved in 70% alcohol. The taxonomic identification of the specimen was conducted by the authors utilizing the dichotomous keys and morphological descriptions provided in “Orchid Bees of Tropical America: Biology and Field Guide” (Roubik & Hanson, 2004). Only divergent characteristics were considered in the description of the specimen. The exemplar was examined and photographed using a Motic stereomicroscope (Model SMZ-161-TLED R2LED). Morphological terminology follows Michener (2007) and Roubik & Hanson (2004). Measurements were taken with an ocular micrometer and are expressed in millimeters (mm). Digital photographs were processed with AMCAP software (version 8.12) and the image editor

of Microsoft Office 2021. The specimen is deposited in the reference collection of the Laboratory of Biodiversity and Ecology of Bees of El Salvador (BEIES), School of Biology, Faculty of Natural Sciences and Mathematics, University of El Salvador.

## Results

The specimen shows a predominantly bilateral division of secondary sexual characteristics, with the left side displaying male features and the right side displaying female features. General measurements (mm): Total body length: 10.0; head width: 4.0; intertegular distance: 3.0. Head: Asymmetrical. The left (male) side features an ivory paraocular band extending from the clypeus to the upper margin of the eye, and a spot of the same color on the antennal scape. The right (female) side completely lacks these markings (Fig 1a). The mandible is of a mixed gynandromorphic type (Fig 1a). For comparison, Fig 1b shows the head of a regular male.



**Fig 1.** *Euglossa viridissima* Friese with gynandromorphic characteristics. a) Gynandromorph head: right side ♀, left side ♂; mixed gynandromorphic mandible. b) Regular ♂ head. c) Gynandromorph right middle tibia ♀. d) Gynandromorph left middle tibia ♂. e) Gynandromorph right hind tibia ♀. f) Gynandromorph left hind tibia ♂. g) Gynandromorph metasoma sternite II ♀. h) Regular ♂ metasoma sternite II.

**Mesosoma:** The asymmetry is most evident in the legs.

**Middle tibia:** The right tibia is female-like, but lacking specialized structures (Fig 1c). In contrast, the left tibia exhibits male characteristics, showing a noticeable felt-like area and two tufts of setae on the external surface (Fig 1d).

**Hind tibia:** The left tibia exhibits male characteristics, being swollen (lobulated) with the characteristic tibial setose groove for fragrance storage (Fig 1f). In contrast, the right tibia displays female features, appearing slender and bearing a well-developed corbicula (Fig 1e).

**Metasoma:** In ventral view, the second sternite lacks the pair of setal tufts characteristic of *E. viridissima* males, indicating female-type morphology (Fig 1g). Figure 1h shows the metasoma of a regular male.

## Discussion

To contextualize our findings within previously known cases, we updated the comparative table of gynandromorphs in Euglossini proposed by Pazmiño and Oliveira (2021), incorporating the most recent records. The specimen of *E. viridissima* described here is the ninth case of gynandromorphism in the genus *Euglossa* and the eleventh for Euglossini. Unlike most previous cases, which are classified as mixed or mosaic due to an irregular distribution of sexual characters across body parts (see Table 1), this individual exhibits an

almost perfect, mostly bilateral gynandromorphic pattern. The sagittal dividing line is consistent across the head and mesosoma, especially in structures with greater sexual dimorphism, such as facial markings and legs modifications. This finding adds to the recent report of a mosaic-type gynandromorph in *E. chalybeata* (Santos-Silva & Oliveira, 2024), reinforcing that most anomalies in Euglossini follow this mixed pattern and further highlighting the uniqueness of the bilateral specimen described here.

The pattern observed in *E. viridissima* (left male/right female) is the inverse of that reported for the gynandromorph of *Euglossa pleosticta* (left female/right male) by Camargo & Gonçalves (2013). Notably, both specimens were attracted to aromatic baits (eugenol and cineole, respectively), suggesting that these anomalous individuals may retain the fragrance-seeking behavior typical of males, at least when a significant portion of the sensory system and leg structures corresponds to the male phenotype.

In accordance with the findings reported by Giangarelli & Sofia (2011) for *E. iopoecila*, the gynandromorph in the present study was also attracted to eugenol. However, unlike the partial division described by those authors, this specimen exhibited marked bilaterality.

The mandible of this specimen exhibits mixed gynandromorphic features, displaying dark coloration and two teeth, typical of the females, while the remaining mandibular

**Table 1.** Comparison of phenotypic characters in gynandromorphs of the tribe Euglossini reported to date (♀ = female, ♂ = male). (adapted from Pazmiño & Oliveira, 2021, and updated with new records).

Species	Type	Anomalous phenotypic characters	Reference
<i>Euglossa (Alloglossura) gorgonensis</i>	Mixed	Head and mesosoma ♂; mixed legs.	González, 2014
<i>Euglossa (Euglossa) melanotricha</i>	Mixed	Head, mesosoma, and metasoma ♀; right legs ♀, left legs ♂.	Suzuki et al., 2015
<i>Euglossa (Euglossa) pleosticta</i>	Mixed	Head: right side ♂, left side ♀. Mixed legs. Mesosoma and metasoma ♀.	Camargo & Gonçalves, 2013
<i>Euglossa (Euglossa) tridentata</i>	Mixed	Head and mesosoma: right side ♀, left side ♂, but labrum inverted. Mixed legs. Mesosoma: right side ♀, left side ♂.	Hinojosa-Díaz et al., 2012
<i>Euglossa (Glossura) chalybeata</i>	Mixed	Head ♂. Mesosoma with scutellar tuft ♀; metatibiae with characteristics of both sexes. Metasoma: pre-genital sternites and genital capsule with deformations.	Santos-Silva & Oliveira, 2024
<i>Euglossa (Euglossa) viridissima</i>	Bilateral with mixed elements	Head: left side ♂ (facial markings), right side ♀; mandible of mixed type. Mesosoma and legs: left side ♂, right side ♀. Metasoma: ventrally ♀.	This study
<i>Euglossa (Glossura) chalybeata</i>	Mixed	Head ♂. Mesosoma with scutellar tuft ♀; metatibiae with characteristics of both sexes. Metasoma: pre-genital sternites and genital capsule with deformations.	Santos-Silva & Oliveira, 2024
<i>Euglossa (Glossura) iopoecila</i>	Mixed	Head: right side ♀, left side ♂. Mesosoma: left side ♂, right side ♀. Metasoma: ♀, except left side of 2nd sternite ♂.	Giangarelli & Sofia, 2011
<i>Eulaema (Eulaema) atleticana</i>	Mixed (Transverse)	Head and mesosoma ♂; metasoma ♀; legs with mixed characters.	Silveira et al., 2012
<i>Eulaema (Eulaema) meriana</i>	Mixed	Head and mesosoma: left side ♂, right side ♀. Genitalia ♂. Yugal comb (♂) on both wings.	Pazmiño & Oliveira, 2021

structures show the ivory coloration typical of males. At the metasomal level, the second sternite exhibits exclusively female characteristics.

The detection of this individual highlights the importance of biodiversity inventories, even in peri-urban areas like Poptlán. This first record of a gynandromorphic bee for El Salvador highlights the significant knowledge gaps that remain about the country's insect fauna. Documentation of these natural anomalies is not merely a curiosity; it provides valuable insights into the genetic and developmental mechanisms controlling sex determination and morphological differentiation in insects.

### Authors' Contributions

F.J.C.L.: Data curation, investigation, validation, visualization, writing-original draft.

E.N.J.A.: Data curation, investigation, validation, visualization, writing-original draft.

R.E.A.R.: Methodology, validation.

J.G.M.E.: Data curation, methodology, resources, validation, visualization, writing-original draft, writing-review & editing.

J.N.M.F.: Conceptualization, data curation, methodology, investigation, project administration, resources, validation, visualization, writing-original draft, writing-review & editing.

M.A.M.M.: Conceptualization, data curation, project administration, supervision, writing-original draft, writing-review & editing.

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### References

- Camargo, M. C. & Gonçalves, R. B. (2013). Register of a gynandromorphy of *Euglossa pleosticta* Dressler (Hymenoptera, Apidae). *Revista Brasileira de Entomologia*, 57: 424-426. <https://doi.org/10.1590/s0085-56262013005000033>
- Dressler, R. L. (1982). Biology of the orchid bees (Euglossini). *Annual Review of Ecology and Systematics*, 13: 373-394. <https://doi.org/10.1146/annurev.es.13.110182.002105>
- Giangarelli, D. C. & Sofia, S. H. (2011). First record of a gynandromorph orchid bee, *Euglossa iopoecila* (Hymenoptera: Apidae: Euglossini). *Annals of the Entomological Society of America*, 104: 229-232. <https://doi.org/10.1603/an10104>
- González, M. (2014). Record of a gynandromorph of *Euglossa gorgonensis* Cheesman, 1929 (Hymenoptera: Apidae), from Parque Nacional Natural Gorgona, Colombia. *Dugesiana*, 21: 77-80. <https://doi.org/10.32870/dugesiana.v21i1.4138>
- Hinojosa-Díaz, I. A., González, V. H., Ayala, R., et al. (2012). New orchid and leaf-cutter bee gynandromorphs, with an updated review (Hymenoptera, Apoidea). *Zoosystematics and Evolution*, 88: 205-214. <https://doi.org/10.1002/zoos.201200017>
- Michener, C. D. (2007). *The Bees of the World* [2nd Edition]. Johns Hopkins University Press.
- Michez, D., Rasmont, P., Terzo, M. & Vereecken, N. J. (2009). A synthesis of gynandromorphy among wild bees (Hymenoptera: Apoidea), with an annotated description of several new cases. *Annales de la Société Entomologique de France*, 45: 365-375. <https://doi.org/10.1080/00379271.2009.10697621>
- Pazmiño, A. & Oliveira, M. (2021). First case of gynandromorphism in the orchid-bee *Eulaema meriana* (Olivier) (Hymenoptera: Apidae). *Sociobiology*, 68: e5778. <https://doi.org/10.13102/sociobiology.v68i3.5778>
- Roubik, D. W. & Hanson, P. E. (2004). *Abejas de orquídeas de la América tropical, biología y guía de campo*. Instituto Nacional de Biodiversidad (INBIO). <https://doi.org/10.15517/rbt.v42i1-2.33120>
- Santos-Silva, J. A. & Oliveira, M. L. (2024). A scientific note on a description and behavior of a gynandromorph of the orchid bee *Euglossa (Glossura) chalybeata* (Hymenoptera, Apidae). *Apidologie*, 55: 75. <https://doi.org/10.1007/s13592-024-01116-1>
- Silveira, M. S., Peixoto, M. H. P., Martins, C. F. & Zanella, F. C. V. (2012). Ginandromorfia em *Eulaema atleticana* Nemésio (Apidae, Euglossini). *EntomoBrasilis*, 5: 238-241. <https://doi.org/10.12741/ebrasilis.v5i3.172>
- Suzuki, K. M., Giangarelli, D. C., Ferreira, D. G., et al. (2015). A scientific note on an anomalous diploid individual of *Euglossa melanotricha* (Apidae, Euglossini) with both female and male phenotypes. *Apidologie*, 46: 495-498. <https://doi.org/10.1007/s13592-014-0339-5>
- Vélez, D. & Barrios, P. H. (2005). Observaciones sobre la estratificación vertical de abejas euglosinas (Apidae: Euglossini) en un bosque ripario de la Orinoquía Colombiana. *Caldasia*, 27: 267-270. <https://doi.org/10.18257/raccefyn.1636>
- Wcislo, W. T., Gonzalez, V. H. & Arneson, L. (2004). A review of deviant phenotypes in bees in relation to brood parasitism, and a gynandromorph of *Megalopta genalis* (Hymenoptera: Halictidae). *Journal of Natural History*, 38: 1443-1457. <https://doi.org/10.1080/0022293031000155322>

