



First records of four orchid bee species (Hymenoptera, Apidae: Euglossini) in Ecuador

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ABSTRACT. Orchid bees (Hymenoptera, Apidae, Euglossini) play a vital role as key pollinators in the Neotropical forests. Their preference for forested areas makes these bees more susceptible to environmental changes, particularly in areas under severe human impact, such as the Chocó-Darién biodiversity hotspot. This study presents new data on orchid bees within the Canandé Biological Reserve, a lowland rainforest in the Chocó region of northwestern Ecuador. At this site, four species of orchid bees were recorded for the first time in Ecuador: *Euglossa bursigera* Moure, 1970, *Euglossa crassipunctata* Moure, 1968, *Euglossa villosiventris* Moure, 1968 and *Eufriesea macroglossa* (Moure, 1965). We also provide species-specific information on diagnosis, distribution maps, and high-resolution images. With these records, the total number of orchid bee species recorded in Ecuador now stands at 119.

Keywords: Apinae, Chocó, *Euglossa*, *Eufriesea*, rainforest

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INTRODUCTION

Orchid bees belong to Euglossini (Apidae, Apinae), a tribe distributed from Northern Mexico to South America with a single species known in the southern United States (Grissold et al., 2015). This tribe plays a crucial role in pollination and ecological balance within tropical and subtropical forests in the Neotropics (Roubik & Hanson, 2004). Orchid bees, with their striking metallic colours, elongated tongues, and unique odor-collecting behaviour, have long fascinated scientists and nature enthusiasts (Hinojosa-Díaz et al., 2012). Despite this, knowledge of the diversity and distribution of this tribe in the New World keeps increasing. To date, 249 euglossine extant species have been described, *Euglossa* Latreille, 1802 is the genus with the highest richness, with 134 described species (Engel, 2021), followed by *Eufriesea* Cockerell, 1908, *Eulaema* Lepelletier, 1841, *Exaerete* Hoffmannsegg, 1817 and *Aglae* Lepelletier & Serville, 1825 and a few extinct species (Moure & Melo, 2023). The orchid bee fauna has been summarized in

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species checklists and other studies in 10 countries from Central and South America (Ramírez et al., 2002; Moure & Melo, 2023).

Ecuador, in particular, exhibits extraordinary species richness, with 115 known species, of which 68 belong to *Euglossa*, 23 to *Eufriesea*, 18 to *Eulaema*, five to *Exaerete*, and one to *Aglae* (Ramírez et al., 2002; Padron et al., 2018; Moure & Melo, 2023). Padron et al. (2018) published the first checklist of orchid bees in Ecuador, mentioning that most species have been found in tropical Amazon rainforests. However, much of the Ecuadorian territory remains unexplored. This is particularly true for the tropical lowland rainforest of the Chocó-Darién biodiversity hotspot in northwestern Ecuador, a region that remains largely unexplored. Chocó-Darién rainforests are characterized by a remarkable species richness and endemism in various plant and animal taxa (Yáñez-Muñoz et al., 2010). At the same time, this zone is particularly threatened due to massive timber extraction, especially in the Ecuadorian portion (Vásquez, 2005). Within this hotspot, most of the orchid bee surveys have been concentrated in Panamá, leaving an important information gap in Colombia and Ecuador.

To address these gaps, a first study of Euglossini diversity was conducted in the Canandé Biological Reserve, one of the last large, well-preserved remnants of the lowland Chocó a rainforest in northwestern Ecuador. Among the species found, we recorded four Euglossini species for the first time in Ecuador: *Euglossa bursigera* Moure, 1970, *Euglossa crassipunctata* Moure, 1968, *Euglossa villosiventris* Moure, 1968, and *Eufriesea macroglossa* Moure, 1965. In this study, we offer complete diagnoses, distribution maps and high-resolution images for these species to help with their identification. Finally, this research contributes to the state of knowledge and perspectives on the diversity and distribution of orchid bees in Ecuador and the Chocó-Darién biodiversity hotspot.

MATERIAL AND METHODS

Study area. The Canandé Biological Reserve (RBC) is located in the tropical region of Chocó-Darién hotspot in northwestern Ecuador, in the Esmeraldas province, between 230–600 m elevation. It is one of the largest private reserves in the country, with an area of 8488 hectares that belongs to the Fundación de Conservación Jocotoco. The vegetation is characterized by the Chocó Lowland Evergreen Forest (Ministerio de Ambiente de Ecuador, 2013) (Fig. 1). Sampling was conducted at two sites located within large, continuous patches of pristine rainforest within the RBC: **1.** Gualpí de los Cayapas 0°34'02.1"N, 79°03'47.6"W, 400 m of elevation (October 11th–26th, 2022). **2.** El Silencio, 0°30'56.3"N, 79°01'18.3"W, 335 m of elevation (May 29th–June 6th, 2023).

Field survey. For each sampling site, a single transect was established with six collection points spaced 100 meters apart. At each collection point, four trees were randomly selected, and two traps were placed on each tree - one in the canopy and one in the understory. Each trap consisted of a 1500-mL plastic bottle featuring three inlets in the upper third, each fitted with a plastic bottleneck. The bottlenecks had a layer of sand glued inside to facilitate bee access. Inside each trap, a piece of cotton saturated with an aromatic compound was tied to one end of a thin stick held by the bottle's lid. This trap design was chosen based on its common use in recent Euglossini bee studies (Ramalho et al., 2009; Ribeiro et al., 2022). Four different aromatic compounds were used in the traps: methyl salicylate, clove oil, Eucalyptus oil, and vanillin (Oliveira & Campos, 1995; Santos-Junior et al., 2014). The traps were active for six continuous days, with samples collected daily, resulting in a total sampling time of 144 hours per trap. To set the canopy traps, a slingshot was used to throw a string over a tree branch and lift the trap to the canopy, which was between 10–15 meters high. The collected specimens were preserved in 96% ethanol and organized by capture method, habitat, and sampling unit, with proper labelling.

Laboratory work and identification. Specimens collected were pinned, viewed under a stereomicroscope (Olympus® SZ61), and identified to genus and morphospecies using the identification keys of Roubik & Hanson (2004) and Bonilla-Gómez & Nates-Parra (1992). Species-level identifications were made using specialized taxonomic keys for each genus: *Eulaema* (Oliveira, 2006), *Exaerete* (Kimsey, 1979; Oliveira & Nemesio, 2003; Oliveira, 2011), *Eufriesea* (Kimsey, 1982) and *Euglossa* (Engel, 2021; Dressler, 1982a, 1982b, 1982c; Bonilla-Gómez & Nates-Parra, 1992; Hinojosa-Díaz et al., 2012; Nemesio & Engel, 2012).



Figure 1. Habitat of the study area at Canandé Biological Reserve (RBC), northwestern Ecuador. [Image by Jorge Brito]

Bee specimens collected were compared with the Instituto Nacional de Biodiversidad Entomological Collection (MECN), an Ecuadorian orchid bee reference collection identified by specialists RL Dressler and ML Oliveira. Specimens were compared to high-resolution images of Euglossini reference specimens, including type material, available on the websites of the Smithsonian Tropical Research Institute (<https://stricollections.org/>) and the Smithsonian National Museum of Natural History (<https://collections.nmnh.si.edu/search/>). Finally, we confirmed each identified species with the original taxonomic descriptions. Photographic records were made with a Canon® EOS 7D camera adapted with a 100 mm lens and Raynox® DCR-250 2.5× Super Macro Lens. Photo-stacking was done with Helicon Focus® v. 7.5.6 (Helicon Soft Ltd.). Specimens were deposited in the Instituto Nacional de Biodiversidad Entomological Collection (MECN).

RESULTS

Taxonomic hierarchy

Class Insecta Linnaeus, 1758

Order Hymenoptera Linnaeus, 1758

Superfamily Apoidea Latreille, 1802

Family Apidae Latreille, 1802

Genus *Euglossa* Latreille, 1802

Subgenus *Glossurella* Dressler, 1982

Euglossa (Glossurella) bursigera Moure, 1970 (Figs 2, 7A)

Material examined. 5♂♂ (MECN-HYM-8056, MECN-HYM-8082, MECN-HYM-8119 to 8121), ECUADOR: Esmeraldas Province, Eloy Alfaro, Telembí, Gualpí de los Cayapas; 0°34'02.1"N, 79°03'47.6"W; 400 m alt., 13.X.2022, A. Pazmiño | D. Díaz leg., bottle trap Vainillina | Clove | Eucalyptus oil; 8♂♂ (MECN-HYM-8805 to 8812), Quinindé, Malimpia, El Silencio; 0°30'56.3"N, 79°01'18.3"W; 335 m alt.; 23.V.2023; D. Díaz | M.S. Basantes | E. Marçayata leg., bottle trap Eucalyptus oil | Vanillin | Clove.

Identification. Within the subgenus *Glossurella*, *Eug. bursigera* can be differentiated by the following combination of characters: Shape of metatibia triangular (posterior angle acute); scape cylindrical; length of labio-maxillary complex reaching or barely surpassing tip of metasoma; malar length about ½ width of mid-flagellomeres; separation of the tip of metatibial organ slit from the ventral margin of metatibia slightly over maximum width of organ slit; tiny mid-mandibular tooth, adjacent to the outer tooth; punctuation of tergum-II decreasing in size over broad band (Dressler, 1982c; Hinojosa-Díaz et al., 2012).

Distribution. Colombia, Costa Rica, Ecuador (**new record**), Honduras, Nicaragua, and Panamá (Hinojosa-Díaz et al., 2012; Nova León, 2021). Lowland rainforest up to 800 m elevation.

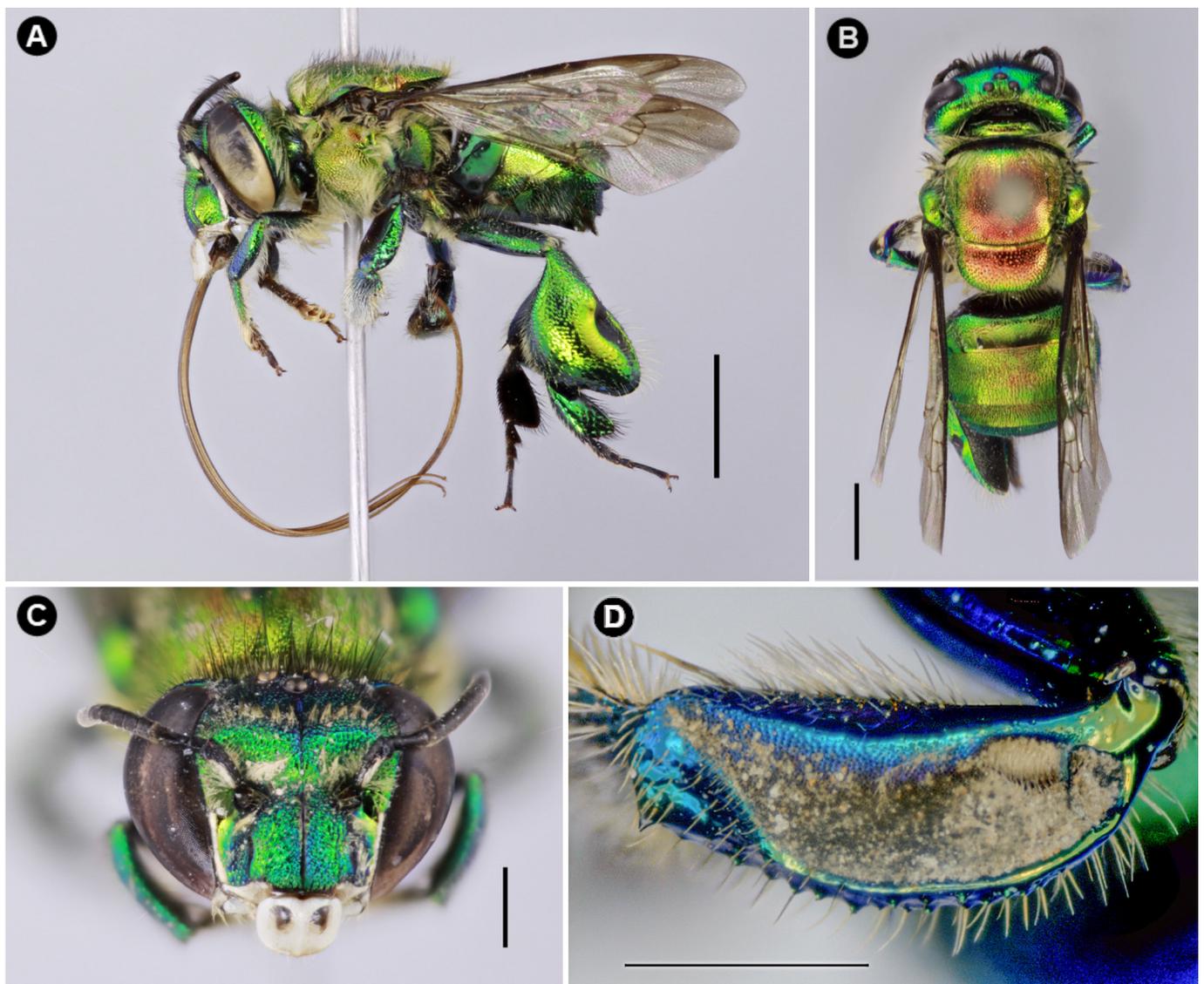


Figure 2. *Euglossa (Glossurella) bursigera* Moure, 1970. **A.** Habitus, lateral view, scale bar = 3 mm; **B.** Habitus, dorsal view, scale bar = 2 mm; **C.** Head, frontal view, scale bar = 1 mm; **D.** Velvet area and tufts of mid-tibia. [Images by Marissa Barreno and Alex Pazmiño-Palomino]

Subgenus *Trachyglossa* Engel, 2021

Euglossa (Trachyglossa) crassipunctata Moure, 1968 (Figs 3, 4, 7B)

Material examined. 2♂♂ (MECN-HYM-8079, MECN-HYM-8080), ECUADOR: Esmeraldas Province, Eloy Alfaro, Telembí, Gualpí de los Cayapas; 0°34'02.1"N, 79°03'47.6"W; 400 m alt., 13.X.2022, A. Pazmiño | D. Díaz leg., bottle trap Eucalyptus oil.

Identification. Within the subgenus *Trachyglossa*, *Eug. crassipunctata* should be differentiated by the following combination of characters: Mesoscutum, mesoscutellum, and majority of the body brilliant metallic green or green-blue; clypeus blue or green-blue, episternum and scutum not coarsely punctured; tibial hairline fringe covering almost the entire length of the hind tibial slit; sternum VIII apically coming to a sharp, narrow point, with posterolateral projections of anterior section prominently angled; gonostylus with broader base (Fig. 4); posterior mesotibial tuft well developed and triangular, much larger and encompassing nearly entire bordering area of depressed integument (Roubik & Hanson, 2004; Bonilla-Gómez & Nates-Parra, 1992; Nemesio & Engel, 2012; ML Oliveira obs. pers.).

Distribution. Brazil, Colombia, Costa Rica, Ecuador (**new record**), French Guiana, Honduras, Nicaragua, and Panamá (Ramírez et al., 2002; GBIF, 2024).

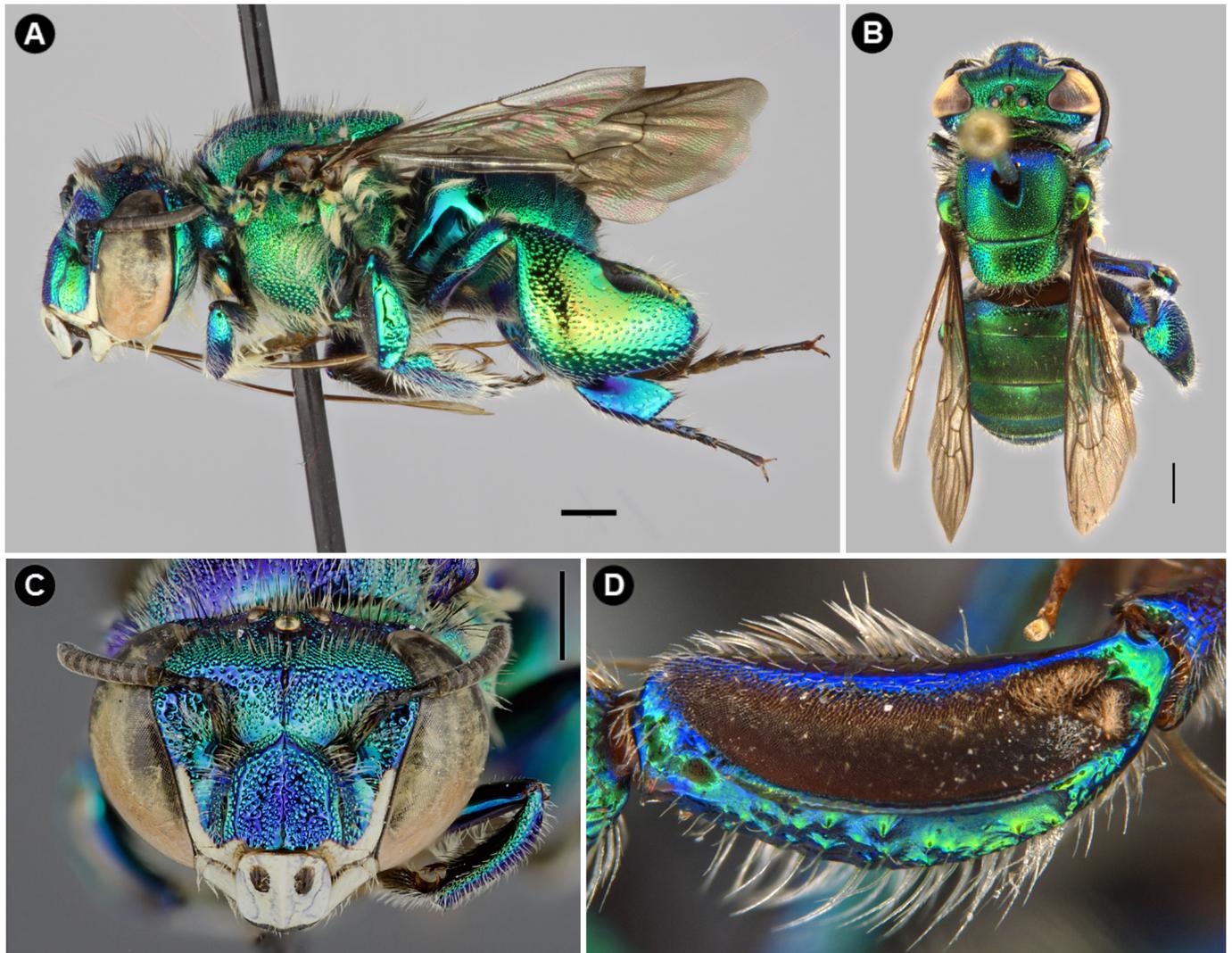


Figure 3. *Euglossa (Trachyglossa) crassipunctata* Moure, 1968. **A.** Habitus, lateral view, scale bar = 1 mm; **B.** Habitus, dorsal view, scale bar = 1 mm; **C.** Head, frontal view, scale bar = 1 mm; **D.** Velvet area and tufts of mid-tibia. [Images by Marissa Barreno and Marcio Oliveira]

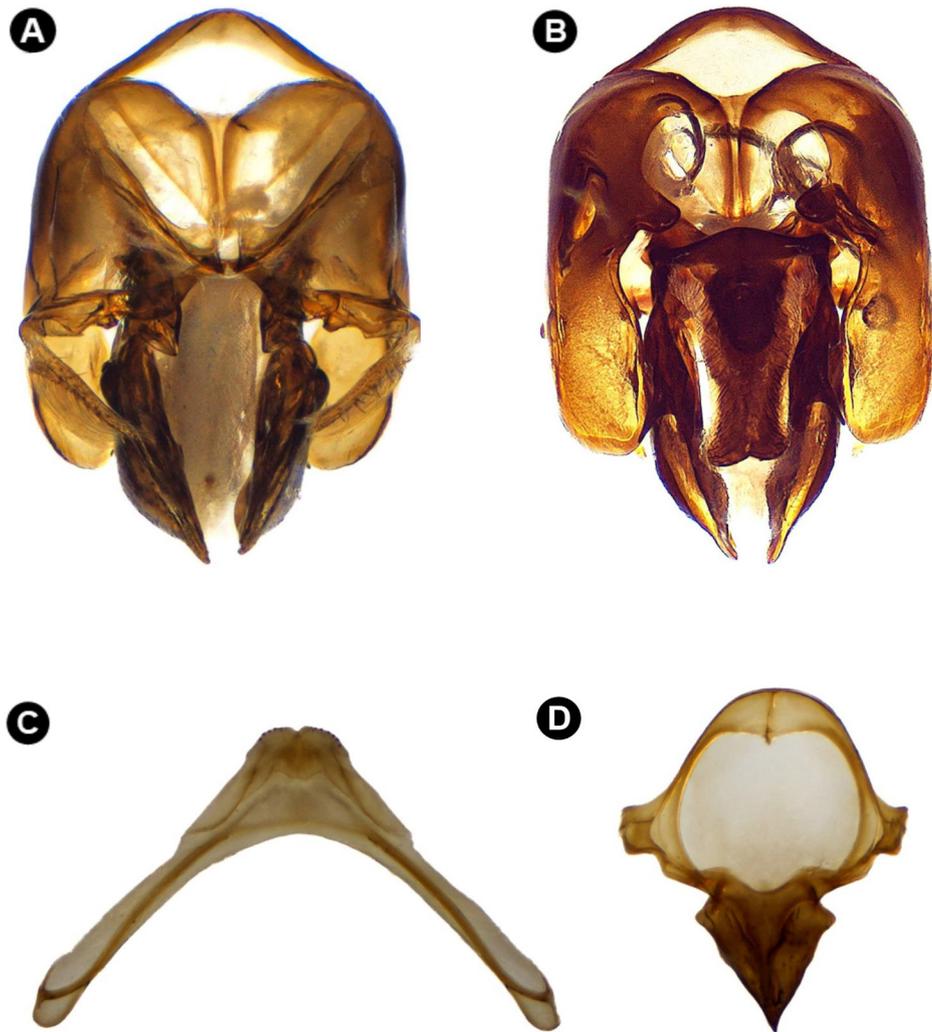


Figure 4. Male terminalia of *Euglossa crassipunctata* Moure, 1968 (MECN-HYM-8079). **A.** Genital capsule, ventral view; **B.** Genital capsule, dorsal view; **C.** Seventh metasomal sternum; **D.** Eighth metasomal sternum. Dissection prepared by Alexandra Hernández and Marissa Barreno. [Images by Alex Pazmiño-Palomino and Josue Franco]

Subgenus *Euglossa* (*Euglossa*) Latreille, 1802

Euglossa (*Euglossa*) *villosiventris* Moure, 1968 (Figs 5, 7C)

Material examined. 32♂♂ (MECN-HYM-7642 to 7673), ECUADOR: Esmeraldas Province, Eloy Alfaro, Telembí, Gualpí de los Cayapas; 0°34'02.1"N, 79°03'47.6"W; 400 m alt., 13.X.2022, A. Pazmiño | D. Díaz leg., bottle trap Vainillina | Methyl salicylate; 3♂♂ (MECN-HYM-8813 to 8815), Quinindé, Malimpia, El Silencio; 0°30'56.3"N, 79°01'18.3"W; 335 m alt.; 25.V.2023; D. Díaz | M.S. Basantes | E. Marçayata leg., bottle trap Vainillina.

Identification. Within the subgenus *Euglossa s.str.*, *Eug. villosiventris* can be differentiated by the combination of the following characters: mandible bidentate; posterior mid-tibial tuft present (though may be very small), an anterior tuft of median tibia slightly divided, lobules indistinguishable; sternum II with a single large tuft of confluent hairs occupying almost the entire structure; clypeus green; body colour blue-violet; terminal tergites green or bronze (Dressler, 1982b; Roubik & Hanson, 2004; Bonilla-Gomez & Nates-Parra, 1992).

Distribution. Colombia, Costa Rica, Ecuador (**new record**), Nicaragua, Panamá, and Venezuela (Ramírez et al., 2002; Ospina-Torres et al. 2015).

Genus *Eufriesea* Cockerell, 1908

***Eufriesea macroglossa* (Moure, 1965) (Figs 6, 7D)**

Material examined. 4♂♂ (MECN-HYM-8046 to 8049), ECUADOR: Esmeraldas Province, Eloy Alfaro, Telembí, Gualpí de los Cayapas; 0°34'02.1"N, 79°03'47.6"W; 400 m alt., 13.X.2022, A. Pazmiño | D. Díaz leg., bottle trap Methyl salicylate | Vanillin | Clove; 1♂ (MECN-HYM-8816), Quinindé, Malimpia, El Silencio; 0°30'56.3"N, 79°01'18.3"W; 335 m alt., 25.V.2023; D. Díaz | M.S. Basantes | E. Marçayata leg.; bottle trap Vainillin.

Identification. Within the *macroglossa* group, the species *Euf. macroglossa* can be distinguished by the steel blue male face and purple female face, male midtibial brush continuous with an anterior felty patch, and gonostylar dorsal lobe as long as the ventral one. Among the most similar species, the colour of the terga distinguishes them: *Euf. venusta* generally has brilliantly orange to coppery terga, *Euf. lucida* has more greenish terga, *Euf. macroglossa* has reddish/yellowish terga, and *Euf. nigrescens* has dark purplish terga (Kimsey, 1982).

Distribution. Colombia, Costa Rica, Ecuador (new record), and Panamá (Ramírez et al., 2002).

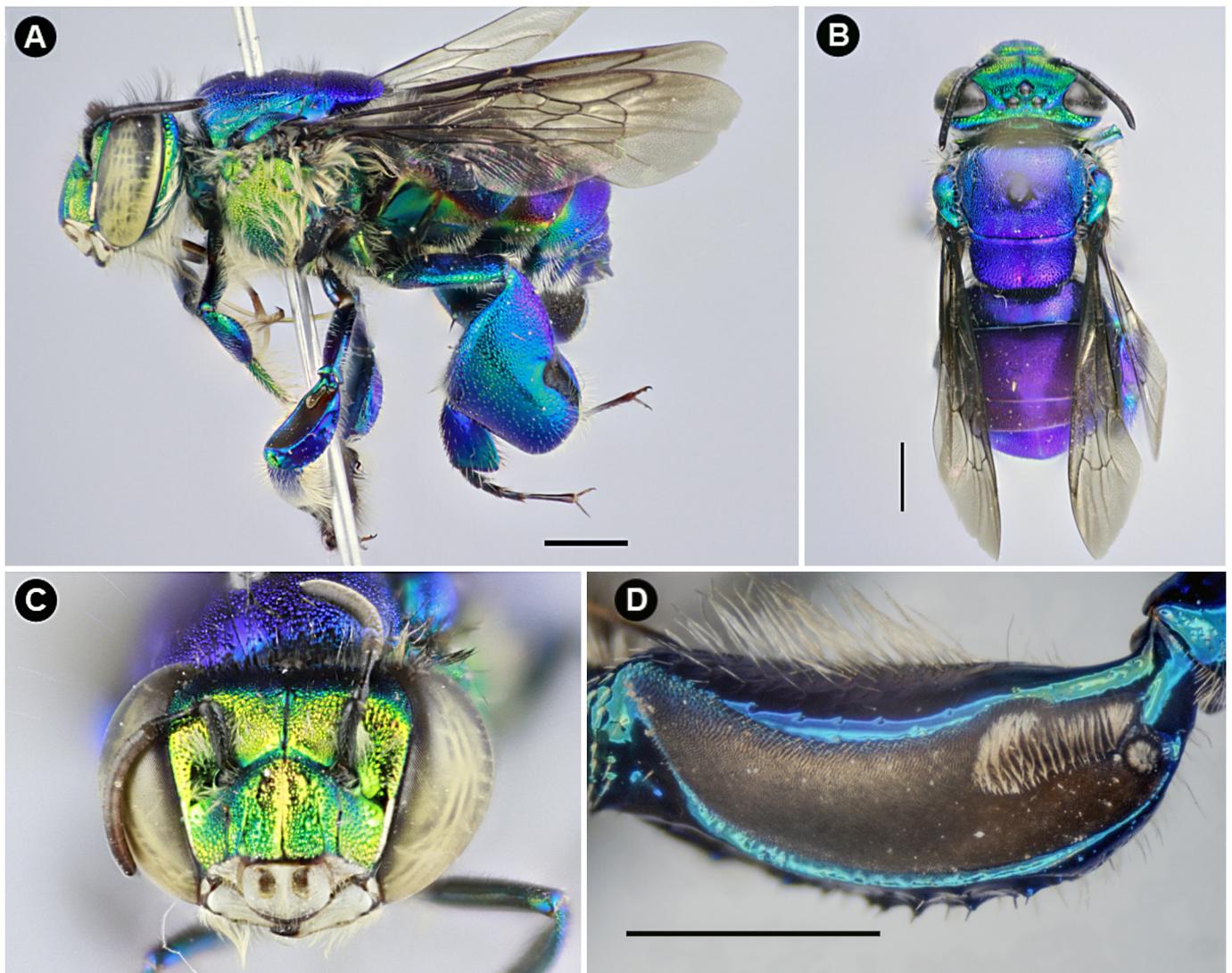


Figure 5. *Euglossa (Euglossa) villosiventris* Moure, 1968. **A.** Habitus, lateral view, scale bar = 2 mm; **B.** Habitus, dorsal view, scale bar = 2 mm; **C.** Head, frontal view, scale bar = 1.7 mm; **D.** Velvet area and tufts of mid-tibia. [Images by Marissa Barreno and Alex Pazmiño-Palomino]

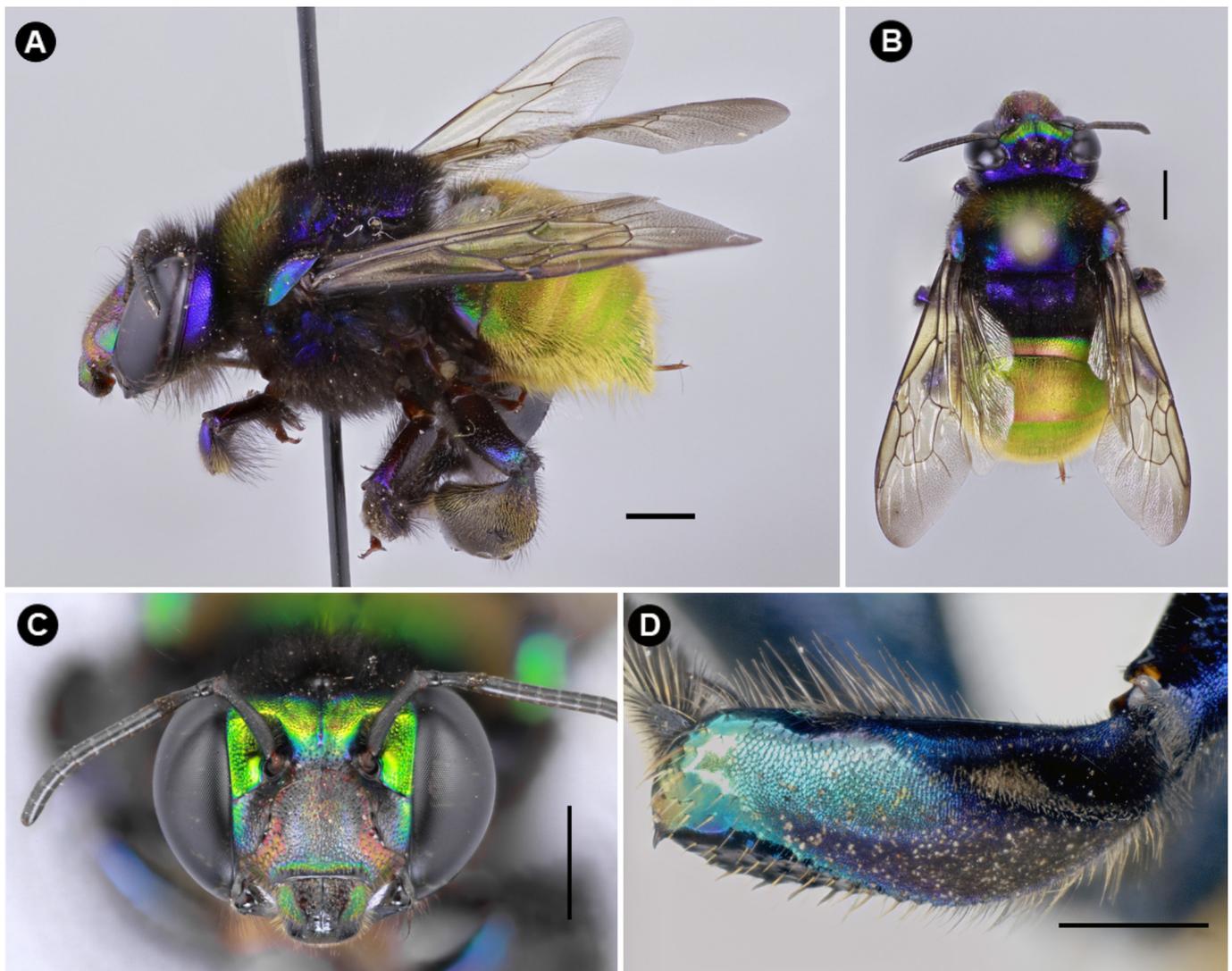


Figure 6. *Eufriesea macroglossa* (Moure, 1965). **A.** Habitus, lateral view, scale bar = 2 mm; **B.** Habitus, dorsal view, scale bar = 2 mm; **C.** Head, frontal view, scale bar = 2 mm; **D.** Velvet area and tufts of mid-tibia. [Images by Marissa Barreno and Alex Pazmiño-Palomino]

DISCUSSION

Our study presents the first confirmed records of four orchid bee species in Ecuador. These findings significantly expand the known range of these species: For *Eug. bursigera*, the nearest known record is over 700 kilometers away, located in the Antioquia department of Colombia (Nova León, 2021). For *Eug. villosiventris*, the closest confirmed record lies more than 130 kilometers away from our sampling site in the Nariño department of Colombia (Ospina-Torres et al., 2015). The nearest known record of *E. crassipunctata* is more than 280 Kilometers to the northeast of our sampling localities in Putumayo department, Colombia (GBIF, 2024). Finally, the Ecuadorian records of *Eufriesea macroglossa* are over 1000 kilometers away from the nearest record in Telamanca, Limón province of Costa Rica, marking it the southernmost known occurrence of this species (GBIF, 2024).

The Chocó's rainforest remains an under-explored biodiversity hotspot for many zoological groups, including bees (Yáñez-Muñoz et al. 2010). It is believed that further studies of the bee fauna of Chocó will lead to more important discoveries about these fascinating taxa. Ecuador's location at the southernmost extent of the Chocó region where rainforest ecosystems meet the tropical Andes, creates a unique site for the existence of endemic species (Sarkar et al., 2009). These ecosystems in Ecuador are under significant threat from rapid timber extraction, mining and land use change (Roy et al., 2018; Sarkar et al., 2009).

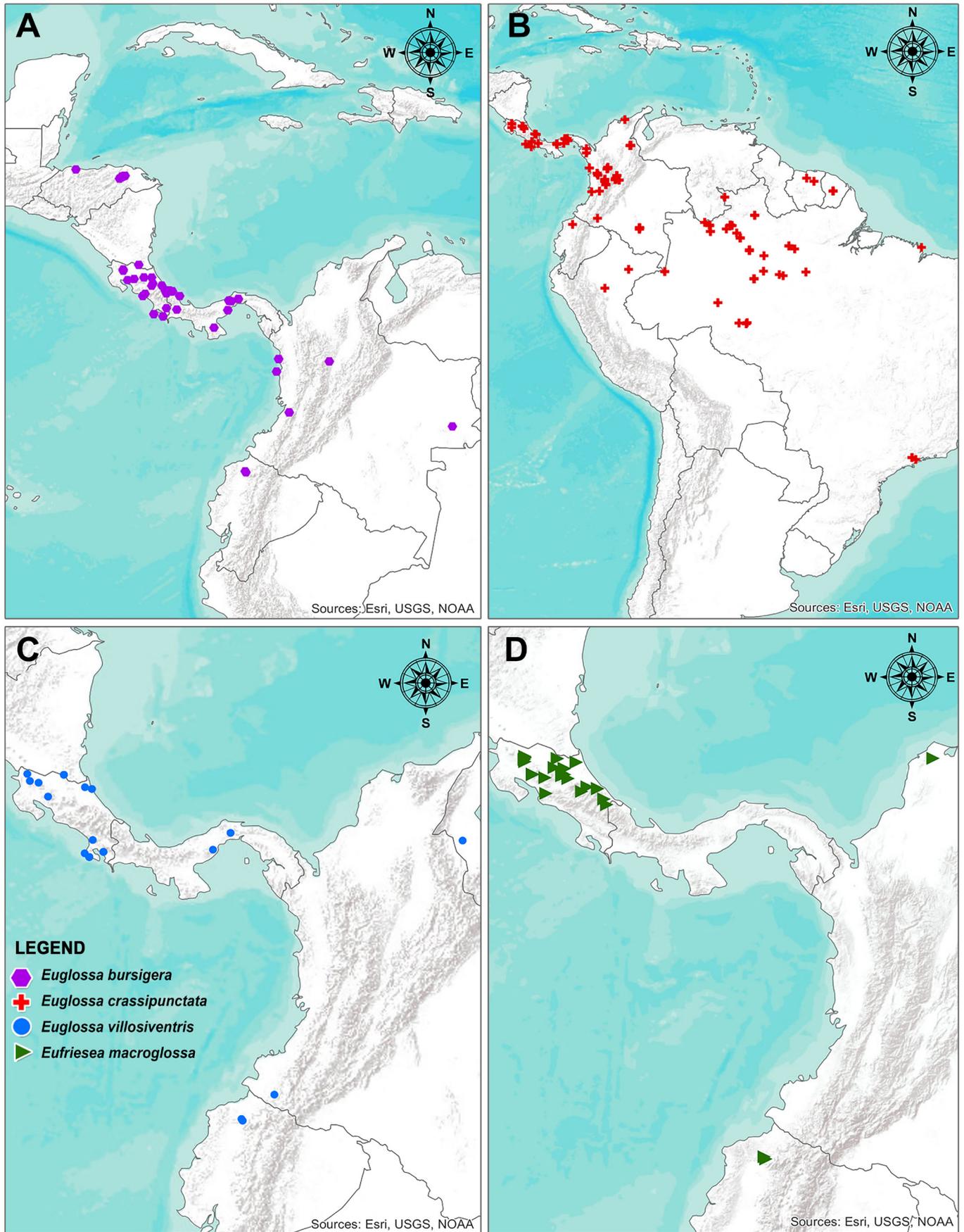


Figure 7. Distribution maps of the species recorded for the first time in Ecuador. **A.** *Euglossa bursigera* (violet hexagons); **B.** *Euglossa crassipunctata* (red crosses); **C.** *Euglossa villosiventris* (blue circles); **D.** *Eufriesea macroglossa* (green triangles).

This makes it urgent to explore biodiversity in the Ecuadorian portion of the Chocó-Darién hotspot, home to many endemic species, including potentially threatened insects (Barria, 2022).

In conclusion, these findings bring the total number of known orchid bee species in Ecuador to 119, an increase from the preliminary list of 115 species provided by Padrón et al. (2018). However, it is important to conduct further bee inventories to understand the current distribution of orchid bees with a particular emphasis on Ecuador. Bee diversity in Ecuador remains largely underexplored. Currently, a national checklist is available only for the Euglossini tribe (Padrón et al., 2018). The absence of comprehensive checklists for other bee groups presents a significant challenge for entomologists and zoologists studying these important pollinators, especially in the tropics.

AUTHOR'S CONTRIBUTION

The authors confirm their contribution to the paper as follows: A.D. Hernández Hernández: Conceptualization, Investigation, Writing – original draft; M.L. de Oliveira: Investigation, Validation, Writing – review & editing; D.R. Díaz-Guevara: Investigation, Visualization, Resources, Writing – review & editing; C. Alarcón-Ortiz: Investigation, Data Curation, Writing – review & editing; A. Pazmiño-Palomino: Conceptualization, Methodology, Validation, Supervision, Project administration, Writing – original draft, Writing – review & editing. The authors read and approved the final version of the manuscript.

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AVAILABILITY OF DATA AND MATERIAL

The specimens listed in this study are deposited in the Instituto Nacional de Biodiversidad Entomological Collection (MECN) and are available from the curator, upon request.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study only included arthropod material, and all required ethical guidelines for the treatment and use of animals were strictly adhered to in accordance with international, national, and institutional regulations. No human participants were involved in any studies conducted by the authors for this article.

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this paper.

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اولین گزارش‌های چهار گونه زنبور ارکیده (Hymenoptera, Apidae: Euglossini) در اکوادور

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چکیده: زنبورهای ارکیده (Hymenoptera, Apidae, Euglossini) نقش حیاتی به عنوان گرده‌افشان‌های کلیدی در جنگل‌های منطقه آمریکای جنوبی دارند. تمایل این زنبورها به مناطق جنگلی آنها را به تغییرات محیطی به ویژه در مناطق متأثر از فعالیت‌های شدید انسانی، مانند نقطه‌داغ تنوع زیستی چوکو-دارینن، حساس‌تر می‌کند. این مطالعه داده‌های جدیدی در مورد زنبورهای ارکیده در ذخیره‌گاه زیستی کاناندی، یک جنگل بارانی در منطقه چوکو در شمال غربی اکوادور ارائه می‌دهد. در این مکان، چهار گونه زنبور ارکیده شامل: *Euglossa bursigera* Moure, 1970، *Euglossa crassipunctata* Moure, 1968، *Euglossa villosiventris* Moure, 1968 و *Eufriesea macroglossa* (Moure, 1965) برای اولین بار در اکوادور ثبت شدند. ما همچنین اطلاعات خاص هر گونه شامل خصوصیات افتراقی، نقشه‌های پراکنش و تصاویر با وضوح بالا ارائه دادیم. با ثبت‌ها این موارد، تعداد کل گونه‌های زنبور ارکیده ثبت شده در اکوادور اکنون به ۱۱۹ رسیده است.

واژگان کلیدی: Apinae، چوکو، *Euglossa*، *Eufriesea*، جنگل بارانی