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Presence of *Euglossa* (*Euglossa*) *amazonica* outside of the Amazon Basin – biogeographic insights

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Abstract. Distributional patterns of euglossine bees are often shadowed by the most noticeable features of the group, their morphology and behavior. With the constant discovery of records of euglossine species in novel localities, and the ongoing systematic work in the group, especially in *Euglossa* Latreille, a better picture of the evolution and biogeography of these bees is being developed. Provided here is an account of new records of *Euglossa* (*Euglossa*) *amazonica* Dressler outside of the Amazon Basin region are presented along with a brief discussion of distributional patterns of the genus in northwestern South America.

INTRODUCTION

Euglossine bees are well characterized by their morphological features, particularly the bright metallic coloration of the integument, the elongate labiomaxillary complex, and the secondary sexual characters of the males, the last involved in their characteristic chemical-gathering behavior, especially from flowers of Orchidaceae and from whom the group takes its common name (orchid bees). Besides this set of morphological and behavioral features, the group is also of relevance in terms of its phylogenetic position and distributional patterns. Based on data sets using morphology of both extant and fossil taxa, the tribe appears as sister to all other corbiculate groups (Engel, 2001a, 2001b; Cardinal & Packer, 2007), while they are the only tribe restricted to the New World tropics. *Euglossa* Latreille, the largest genus in the tribe, occurs naturally from northern Mexico to northern Argentina and subtropical southeastern Brazil (Rebêlo 2001; Roubik & Hanson, 2004; Michener, 2007). The genus also includes the only living euglossine species in the Caribbean (Engel, 1999; Rebêlo, 2001), and an adventive population of another species established in southern Florida (Skov & Wiley, 2005; Hinojosa-Díaz *et al.*, 2009). Only three or four nominal species in the genus have widespread ranges throughout the Neotropical region (Roubik & Han-

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son, 2004), all others exhibiting restricted ranges that can be interpreted in different ways (e.g., Roubik & Hanson, 2004; Ramírez *et al.*, 2010). Overall there is a principal divide between taxa occurring on either side of the northern section of the Andes, i.e., those found in the Amazon Basin and associated areas to the south and southeast as well as the Guiana Shield versus those found in Central America and related areas in Mexico and the Pacific side of the Andes in northwestern South America. This general pattern can be found between sister-group assemblages at different levels within the genus, but awaits clarification as the infrageneric classification is revised based on recent phylogenetic studies (Hinojosa-Díaz, 2010; Ramírez *et al.*, 2010). *Euglossa* (*Euglossa*) *amazonica* Dressler is a typical example of a species thought to be restricted to the Amazon Basin (Dressler, 1982). New records of the species are here presented that expand its distribution towards the western side of the northern Andean extreme with a brief discussion on broader biogeographic implications.

MATERIAL AND METHODS

Specimens of *E. (E.) amazonica* reviewed during this work are deposited in the Division of Entomology (Snow Entomological Collection), University of Kansas Natural History Museum, Lawrence, Kansas, USA (SEMC). The holotype of the species was available through the online resources of the United States National Museum of Natural History (Smithsonian Institution), Washington, D.C., USA (USNM). Taxonomic identity was confirmed using external morphology and male genitalic structures of the male specimens involved. Male genitalic dissections followed standard methodology (e.g., Hinojosa-Díaz, 2008). Photomicrographs were prepared using a Cannon EOS 7D digital camera with an Infinity K-2 long-distance microscope lens. Multilayer images were produced by using the software CombineZP.

RESULTS

Two male specimens of *E. (E.) amazonica*, were found to fall outside of the previously cited range for the species, i.e., the Amazon Basin (Dressler, 1982; Ramírez *et al.*, 2002; Moure *et al.*, 2012). All other specimens examined (in SEMC) were from localities falling well within the previously known range of the species. The label data for the two specimens outside of the former range are as follows:

1 ♂, label data (Figs. 1–4):

“PANAMA: Darién, Cana Biological Station, Serrania de Pirre, 800 m, 7°45'18"N,
77°41'6"W, 6 Jun 1996, J. Ashe, R. Brooks, PAN1AB96 054 ex: eucalyptus oil.”

“*Euglossa townsendi* Cockerell 1904, det. R. W. Brooks 1998”

“*Euglossa (Euglossa) amazonica* Dressler, det. I. Hinojosa-Díaz 2012”

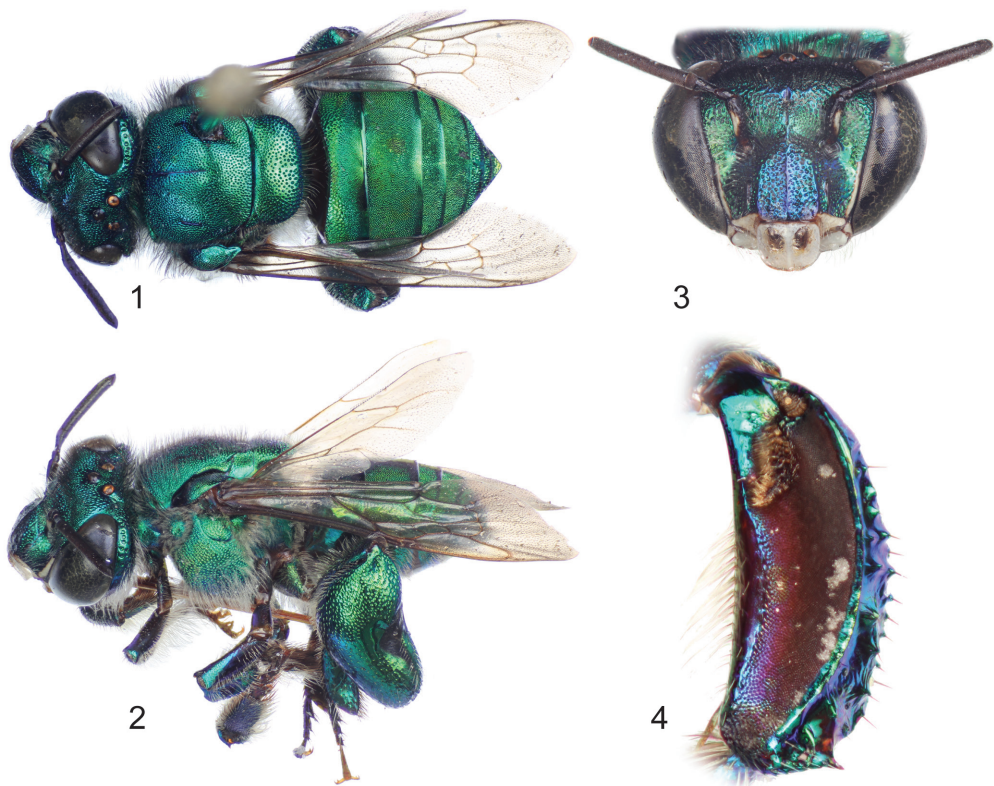
1 ♂, label data:

“COLOMBIA, Ant., Rio Porce, 2.IV.1968, R.L. Dressler [910]”

“*Euglossa (Euglossa) amazonica* Dressler, det. I. Hinojosa-Díaz 2012”

DISCUSSION

The attractive biology and morphology of orchid bees tends to obscure some fascinating features of the clade, including their phylogenetic position with respect to other



Figures 1–4. Male specimen of *Euglossa (Euglossa) amazonica* Dressler from Serrania de Pirre, Cana Biological Station, Darién, Panama. 1. Dorsal habitus. 2. Lateral habitus. 3. Facial aspect. 4. Outer surface of mesotibia.

corbiculate bees and the distributional patterns of constituent groups and species. For example, the fact that they are the only corbiculate tribe restricted to the New World tropics is seemingly at odds with their basal position in this clade as revealed by multiple data sets (e.g., Engel, 2001a, 2001b; Cardinal & Packer, 2007). The paucity of the fossil record for the group does not help (Engel, 1999; Hinojosa-Díaz & Engel, 2007), and as such caution must be taken when venturing biogeographic scenarios for the early evolution of the corbiculate clade (see Engel *et al.*, 2009). The distributional arrangement of extant euglossine taxa at the generic and infrageneric levels are of interest on their own. Excluding those few nominal species with a widespread Neotropical distribution [three or four according to Roubik & Hanson (2004)], within *Euglossa* there are species and species assemblages with known distributions restricted to specific areas in the neotropics. Interpretations on the limits and arrangement of such areas depends on the approach used and the availability of locality records, as well as the geographical resolution to which these are applied [see Roubik & Hanson (2004) and Ramírez *et al.* (2010)]. Regardless of the approach, one major distributional feature of *Euglossa* species is the faunistic divide between species restricted to the Amazon Basin in a broader sense (including the Guiana Shield and areas in southeastern Brazil), and species occurring only in Central America and associated areas to the north in Mexico and to the south in the Pacific Andean side of northwestern South America. Within the genus a few documented examples of closely related groups having disjunct distribu-

tions in the aforementioned areas are as follows: in the subgenus *Euglossella* all species in the *decorata* species group (Hinojosa-Díaz & Engel, 2011) are restricted to the Amazon Basin in its broadest sense; the small group of species including *E. (Glossurella) bursigera* Moure has two species in the extended Central America region (including northwestern Colombia) and three in the Amazon Basin (Hinojosa-Díaz *et al.*, 2012); the recently erected subgenus *Alloglossura* (Hinojosa-Díaz & Engel, 2012), includes only one species restricted to the western region of the Amazon Basin and the remainder found from the western side of the northern Andes to Costa Rica. Camargo & Pedro (2003) discussed a similar vicariant pattern found between monophyletic species assemblages in *Partamona* Schwarz (Meliponini), for which they suggested the uplift of the Andes of present day Ecuador as a possible geologic event triggering such a disjunction. Evidently the northern section of the Andes serves as the separation between the two major areas here discussed for species and species assemblages in *Euglossa*. In this regard, Ramírez *et al.* (2010) proposed that splits involving Central American and South American (*i.e.*, widespread Amazon) or widespread lineages occurred early in the evolution of the genus. This could have well been the case; however, the phylogenetic hypotheses available, either molecular (Ramírez *et al.*, 2010) or morphological (Hinojosa-Díaz, 2010), show that these biogeographic splits are found between species and groups at different levels in the topology of the trees, not merely basal clades. In this context, understanding the distributional patterns of species of *Euglossa* becomes relevant, particularly new geographic information that expands the known distribution of species into distinct biogeographic units.

Euglossa (E.) amazonica was originally believed to be restricted to the Amazon Basin, even cited in the original description of the species as “perhaps the commonest small green *Euglossa* in the Amazon Basin”, and this was the basis for Dressler’s (1982) toponymic epithet. The type locality for the species is Belém, Pará, in northern Brazil, very close to the mouth of the Amazon River system; there are confirmed specimens of the species from other localities along the Amazon region of Brazil, in addition to localities in French Guiana, Guyana, Venezuela, and Bolivia (in SEMC). The two specimens here reported were collected in localities lying in lowland areas on the western side of the Andes, in a distinctly different biogeographic region. The Colombian specimen was collected close to the northern extreme of the Cordillera Central, one of the three Andean branches in Colombia, while the Panamanian specimen from Darién Province is from a locality close to the Colombian border. Both specimens have the distinctive morphological features of the species as it occurs in the Amazon area. *Euglossa (E.) amazonica* belongs to a group of species highly diverse in Central America (Dressler, 1982), but is easily distinguished from the common species of the group found in Costa Rica. Further surveys in the Pacific side of the Andes in northern Colombia and in southern Panama will hopefully provide a clearer understanding of the species’ distribution. Until such a time, the above records are clear evidence of its occurrence in this region. The distributional pattern for *E. (E.) amazonica* could mirror, albeit reversed, a general pattern for species of *Euglossa* occurring primarily in the Mexico-Central America-northwestern South America region, but having some penetration in the northwestern part of the Amazonian region, much like that of *E. (E.) tridentata* Moure (pers. obs.). *Euglossa (E.) amazonica* inverts this pattern as it is a primarily Amazonian species penetrating into the Pacific side of the northern Andean region.

The distribution of a species is a concept depending on, among other things, the availability of geographic records, and accordingly the report of novel localities for

any species is of significance, particularly when such records alter our previously conceived notions. Records at great distances from previous boundaries, in localities otherwise in different biogeographic realms, or when introduced by human activity into novel regions (intentionally or otherwise), all permit a more refined understanding of the ecological parameters necessary for a species' persistence and clues as to its history. Several important examples of this for species of *Euglossa* have been reported in recent years (e.g., Skov & Wiley, 2005; Anjos-Silva, 2008; Nemésio, 2007), and as field surveys, particularly in under-sampled areas, and taxonomic revisions continue, a clarified biogeographic history of *Euglossa* is emerging.

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