

SHORT COMMUNICATION

Euglossa decorata Smith (Hymenoptera: Apidae) in central Brazil – biogeographic implications

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Abstract

Euglossa decorata Smith is currently regarded as endemic to the Amazon Basin. In the present study, a report is discussed of the presence of *E. decorata* in Uberlândia municipality, state of Minas Gerais, which is in the “Cerrado” or Brazilian savanna, and which extends the bee’s known geographic range over 2,000 km southwards. *E. decorata* either failed to respond to ancient vicariant events that caused speciation in other animal clades or expanded its range after geographical barriers ceased to exist between Amazonian and central Brazilian biogeographical components. This species may be endangered in the Uberlândia region, due to extensive habitat destruction.

Keywords: Apini, Biogeography, Euglossina, orchid bees.

Most of the 200 known species of Euglossina are small metallic blue or green bees of the genus *Euglossa*. A small group of apparently closely-related *Euglossa* species (*Euglossa decorata* Smith, *E. perpulchra* Moure & Schindwein, and *E. singularis* Mocsáry) is composed by bees which only show slight metallic coloration on the face, metasoma and mesosoma, which are densely covered with yellowish hairs, giving the bees a general appearance of *Apis* and *Melipona* (and, for this reason, two junior synonyms of *E. singularis* were named *E. apiformis* Schrottky and *E. meliponides* Ducke).

Both *E. decorata* and *E. singularis* are regarded as endemic to the Amazon Basin. The other species in this “group”, *E. perpulchra*, was recently described (Moure & Schindwein, 2002) and is only known from the state of Pernambuco, northeastern Brazil, in the Atlantic Rain Forest domain. D.W. Roubik and colleagues (in litt.) suggest that *E. decorata* (and its putative close allies) probably belongs to a very old lineage within Euglossina and therefore deserves further inquiry (D. W. Roubik, pers. comm. to AN).

Although *E. perpulchra* has been collected in good numbers during recent surveys, *E. decorata* and *E. singularis* are rarely seen in orchid bee inventories. In Brazil, *E. decorata* has only been reported from the states of Amazonas (Smith, 1874; Oliveira & Campos, 1996; Silveira et al., 2002), Acre (Nemésio & Morato, 2006 a, b), Amapá, Maranhão, Pará (Silveira et al., 2002), and Rondônia (M. L. Oliveira and E. F. Morato, pers. comm.), all in the Amazonian forests of Brazil, and, recently, in the state of Mato Grosso (Anjos-Silva, 2006). Silveira et al. (2002: 78) also included the state of Minas Gerais in the distribution range of the species, but no indication of the source of this record was given and two of the authors (F.A. Silveira, pers. comm. to AN and EABA) could not confirm the source of this information. The holotype of *Euglossa ruficauda* Cockerell, currently recognized as a junior synonym of *E. decorata*, was collected in Guyana (see Kimsey & Dressler, 1986; Roubik & Hanson, 2004), thus extending the known geographic distribution of *E. decorata* to this country. Finally, Ramírez et al. (2002) included Colombia and Ecuador to the distributional range of *E. decorata*. These records, however, must be checked, since D.W. Roubik (pers. comm.) has only attracted male *E. singularis* in Ecuador and Bonilla-Gómez & Nates-Parra (1992) have not recorded *E. decorata* for Colombia.

In a list of the bees of the Estação Ecológica do Panga, a small area (404 ha) situated in the southern portion of

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Uberlândia municipality (19°09'20" - 19°11'10" S; 48°23'20" - 48°24'35" W - ca. 800 m above sea level - see Schiavini & Araújo, 1989), Central Brazil, Carvalho & Bego (1996) recorded for the first time the occurrence of *E. decorata* outside the Amazon Forest. They listed a single female of this species (Carvalho & Bego, 1996: 149), but no further comment was made on this record by them. The identity of this specimen was checked by us and confirmed, but it revealed to be a male. It was collected at a flower of *Vochysia tucanorum* Mart. (Vochysiaceae) (see Carvalho & Bego 1996) and is currently deposited in the Entomological Collection of Universidade Federal de Minas Gerais (UFMG), Belo Horizonte, Brazil. In the present study, this outstanding record of *E. decorata* in Central Brazil is discussed.

Biogeographic implications

The occurrence of *E. decorata* in a cerrado area approximately 2,000 km away from the nearest previously known locality of occurrence of this species in the Amazon (i.e., Rio Branco region, state of Acre, Brazil, Nemésio & Morato, 2006 a,b) and some 1,200 km away from its recently reported occurrence in the state of Mato Grosso (Anjos-Silva, 2006) has two main implications: (i) its geographic distribution is quite wider than once thought; (ii) this may not be a forest-dependent species.

The first implication may be understood by the scarcity of information on forest-bee distribution for most of South America. Most orchid-bee inventories focus on a few locations in the Amazon (Morato et al., 1992; Oliveira & Campos, 1996; Rebêlo & Cabral, 1997; Silva & Rebêlo, 1999; Brito & Rêgo, 2001) and in the Atlantic Forest domains (Rebêlo & Garófalo, 1991, 1997; Neves & Viana, 1997, 1999; Bonilla-Gómez, 1999; Bezerra & Martins, 2001; Tonhasca Jr. et al., 2002; Peruquetti et al., 1999; Nemésio, 2003; Nemésio, 2004; Nemésio & Silveira, 2006 a; Sofia et al., 2004; Sofia & Suzuki, 2004). The vast area covered by the cerrado is virtually unknown, with the exception of three studies, one in the state of Maranhão, northeastern Brazil (Silva & Rebêlo, 2002), and two in the state of Minas Gerais (Nemésio & Faria Jr., 2004; Faria Jr., 2005). Thus, range extensions of several species may increase when these areas are fully sampled, as shown recently for two species of *Eulaema*: *E. seabrai* Moure (Nemésio & Silveira, 2004) and *E. helvola* Moure (Nemésio & Silveira, 2006 b).

On the other hand, finding a species believed to be closely associated to dense forest environments in Central Brazil is noteworthy. Dressler (1979), when discussing the Müllerian mimetic complex involving some *Eulaema* and *Eufriesea* species in the Amazon Basin, made considerations on what he called the *El. seabrai* complex, widely distributed from Central America to southeastern Brazil. He suggested, then, that "*E. seabrai* may have reached southern coastal Brazil not through Bahia and Espírito Santo, but through Mato Grosso and Goiás." Although this specific matter is open to debate (see Nemésio & Silveira, 2004 and Nemésio & Silveira, 2006b), the hypothesis by Dressler that Amazonian orchid bees may have used a Central Brazilian route for their range expansion should not be ignored. Supporting this point of view, Bigarella et al. (1975) suggested that a "Southeastern-Northwestern Bridge" may have existed in late Quaternary linking both forest biomes. Their conclusions were drawn from observation of patterns of floristic and

faunistic similarities between Eastern Amazon and Southeastern Atlantic Forest. Bigarella and colleagues did not suggest where and how this bridge would have linked the Amazon and Atlantic forests, but it may have been as old as mid-Cretaceous (Amorim & Pires, 1996). Oliveira-Filho & Ratter (2000) pointed out that it may have been either a continuous forested corridor or forest fragments through the Cerrado domain in Central Brazil. Evidence gathered by Oliveira-Filho & Ratter (2000) for several plant taxa, and by Willis (1992) and Silva (1996) for several bird species, shows some patterns of "trans-forest" distribution, occurring in both Amazon and Atlantic forests. Other species, however, appear to have been "trapped" in between these two biomes. These latter species, when from Amazonian origin, reach Central Brazil, sometimes quite close to Uberlândia city. A remarkable example is *Vochysia haenkeana* Mart. (Vochysiaceae) (Oliveira-Filho & Ratter, 2000:82), a species belonging to the same genus as the species in which flowers the *E. decorata* male was caught. The role of the gallery forests for dispersal and maintenance of forest taxa is, thus, obvious. Pires (1984) even suggested that gallery forests in the Cerrado region are modern forest refuges. In support of this hypothesis, *E. decorata* was recently collected in "Chapada dos Guimarães", state of Mato Grosso (Anjos-Silva, 2006).

Stingless bees (Apidae, Meliponina) are the best studied group of bees for their biogeographical history in the Neotropics, with a few genera recently investigated by J. M. F. Camargo and colleagues (e.g. *Geotrigona* - Camargo & Moure, 1996; *Paratrigona* and *Aparatrigona* - Camargo & Moure, 1993; *Partamona* - Camargo & Pedro, 2003; Pedro & Camargo, 2003). Euglossina and Meliponina are probably roughly the same age, given that they belong to a rather derived corbiculate clade within the family Apidae, which also includes bumble bees (*Bombina*) and honey bees (*Apina*). The barriers that affected the past distribution of Meliponina can be, therefore, expected to have contributed, to some extent, to shape the biogeographical history of Euglossina.

Summaries of the biogeographical results found for Meliponina are provided by Camargo (1996) and Camargo & Pedro (2003). A similar scenario was found by Amorim & Pires (1996) for a diverse array of taxa. Morrone (2006) reviewed the division of the Neotropical Region into areas of endemism and found a subdivision of this region congruent with results by Amorim & Pires (1996), Camargo (1996), and Camargo & Pedro (2003). For Euglossina, however, analytical investigation of historical biogeography is hindered by the lack of phylogenetic hypotheses for most groups. Nonetheless, it is possible to notice distributions of euglossine species or species-groups in areas that are concordant with the biogeographical components described by Camargo and colleagues for various neotropical groups of Meliponina (see Nemésio, 2004). These are the species whose histories were potentially more effectively affected by the vicariant events in the Neotropical Region. Epicontinental seas may have divided widely distributed ancestral populations into smaller ones which, in the long term could lead to sister taxa with biogeographical affinities for distinct modern areas of endemism. Subpopulations in the Cerrado domain in central Brazil (part of the SEAm area of Camargo and Pedro 2003) would, by this mechanism, become isolated from Amazonian subpopulations.



Figure 1 – Metatibia of a male *Euglossa decorata* with uniform pale brown coloration. Specimen collected in Manaus, Amazonas, Brazil, (with no date or collector).



Figure 2 – Metatibia of a male *Euglossa decorata* with mixed pale brown and black coloration. Specimen collected in the Parque Zoobotânico, Rio Branco, Acre, Brazil, in 26/07/96, by E. F. Morato.



Figure 3 – Metatibia of a male *Euglossa decorata* with uniform black coloration. Specimen collected in the Parque Zoobotânico, Rio Branco, Acre, Brazil, in 26/04/96, by E. F. Morato.

In contrast with species geographically restricted, there are cases such as *E. decorata*, which range spans across three major biogeographical components of South America - SEAm, NAM, and SWAm. For Meliponina, species with equally wide distributions exist: the three most widely distributed species of *Partamona*: *P. ailyae* Camargo, *P. combinata* Pedro & Camargo, and *P. vicina* Camargo have distributions as extensive as that of *E. decorata*, occurring in portions of Amazon, in the Cerrado, and in the case of *P. ailyae*, in the Caatinga as well (see Pedro and Camargo, 2003 for detailed distributional data of *Partamona*).

Species with a wide geographical range could have either (i) failed to respond to vicariance events or (ii) expanded their range after dispersal barriers ceased to exist. The phylogenetic study of the clade in which *Euglossa decorata* is inserted will provide the basis for a hypothesis of historical biogeography that could help elucidating the current distribution of this species. In case this species group constitutes an early branch of *Euglossa*, as mentioned above, the hypothesis of an ancestrally wide distribution not followed by speciation events due to vicariance is supported as a viable scenario.

Finally, D.W. Roubik (pers. comm.) suggested a third hypothesis – that this specimen belongs to a new species or, alternatively, that *E. decorata* may represent a complex of cryptic species. We also considered these ideas but rejected them at this moment for three reasons: (i) as long-term orchid bee studies in Central Brazil are virtually non-existent, and given the data available for well studied taxa such as Meliponina (see above) and birds (see Willis, 1992 and Silva, 1996), it is possible that a similar distribution pattern may be found for some orchid bee species, *E. decorata* being one of them; (ii) only a single specimen was caught to date. This specimen is, in its morphology, consistently similar to specimens examined from the states of Acre and Amazonas; (iii) more important, three individuals collected in a single area in the state of Acre and currently deposited at UFMG show a great color variation (Figs. 2-3), suggesting a possible polymorphism. The two extreme variants are so distinct (pale brown integument, as in Fig. 1, and black integument in metatibia, Fig. 3) that it would be a temptation to consider them separate species, if an intermediate form (Fig. 2) were not present. Thus, for the moment, we chose not to consider a new species based on a single individual of an apparently highly variable species (or species-complex).

Conservation status

It may be premature to discuss the actual conservation status of this species in the state of Minas Gerais at the present stage. However, two factors may be argued to suggest its possible rarity: (i) it is apparently confined to the westernmost part of the territory of Minas Gerais, and forested areas in this region are under heavy pressure for agricultural purposes and for the construction of hidroelectric dams. For this reason, the two species of *Partamona* which have geographic distributions similar to *E. decorata*, *P. ailyae* and *P. combinata*, were recently included in the red list of the threatened species of the fauna of the state of Minas Gerais (F.A. Silveira, pers. comm.). (ii) Recent samplings using aromatic compounds were not successful in trapping this bee at Panga Reserve, although these samplings were fortuitous and sporadic. Nevertheless, males of some species of orchid bees are not readily attracted by the

ordinary aromatic compounds generally used in orchid bee inventories (see Moure, 1999 and Nemésio & Silveira, 2004). Due to the low frequencies of *E. decorata* in those surveys where it was caught, the hypothesis that this species is not strongly attracted to any of the mostly used orchid-bee attractants should not be discarded. Both *E. decorata* and *E. singularis* readily come to pure vanillin in ethanol, and even to vanilla extract in French Guyana (D.W. Roubik, pers. comm.). Anjos-Silva (2006) collected a single male *E. decorata* in a two-year study in the state of Mato Grosso, attracted to vanillin. E.F. Morato (unpub. data) also collected *E. decorata* in methyl salicylate in the state of Acre. Until more data are gathered and more systematic orchid-bee samplings are carried out at the Panga Reserve or other areas in the region, no definitive inferences regarding the conservation status of this bee in the state of Minas Gerais can be made.

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