Update on the distribution of *Diphylla ecaudata* Spix, 1823 (Mammalia, Chiroptera): New records from the Brazilian northeast

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**ABSTRACT:** The subfamily Desmodontinae encompasses the only mammals known to feed exclusively on the blood of other vertebrates. This study provides records of the desmodontine bat *Diphylla ecaudata* from a major gap in its known distribution in northeastern Brazil. Specimens were captured at five localities, all associated with caves. Two of these sites are located in the state of Sergipe, two in Bahia, and one in Ceará. The record of *D. ecaudata* from Ceará is the first for this state.

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*Phyllostomidae* is one of the most diverse bat families in both morphological and ecological terms, covering the full diversity of chiropteran feeding niches, including species that are insectivorous, nectarivorous, frugivorous, carnivorous, omnivorous, and sanguivorous (Kunz 1982). The subfamily Desmodontinae is composed of the only three mammal species known to feed exclusively on the blood of other vertebrates — the Common Vampire Bat, *Desmodus rotundus* (É. Geoffroy, 1810), the White-winged Vampire Bat, *Diaemus youngii* (Jentink, 1893), and the Hairy-legged Vampire Bat, *Diphylla ecaudata* Spix, 1823 (Kwon and Gardner 2008).

*Diphylla ecaudata* occurs between México and southern Brazil, with records from Colombia, Venezuela, Ecuador, Peru, and Bolivia (Greenhall et al. 1984; Kwon and Gardner 2008). In Brazil, the species is found in all biomes (Paglia et al. 2012). There is an apparent lacuna between the central Amazon basin and southwestern South America, however, which suggests a potentially disjunct distribution for the species in this continent (Kwon and Gardner 2008). Prior to the present study, there was also an extensive gap in the known distribution of the species in the Brazilian Northeast. The present study provides records of *D. ecaudata* from five new localities (Figure 1), two in the Brazilian state of Sergipe, two in Bahia, and one in Ceará. In all five cases, the occurrence of *D. ecaudata* was associated with the presence of caves or mines.

The specimens were collected under the license 27524-1 (SISBIO) either in mist-nets, in open habitats, or by using hand nets, when captured in caves. All specimens were handled in accordance with the recommendations of Sikes et al. (2011). The voucher specimens were deposited in the mammal collection of the Universidade Federal da Paraíba (UFPB), in João Pessoa (Paraíba, Brazil) and in Laboratory of Conservation Biology (LBC) of the Universidade Federal de Sergipe, in São Cristóvão (Sergipe, Brazil), after being fixed in 10% formaldehyde and preserved in 70% ethanol, with the subsequent extraction of the skull. A total of 13 specimens were collected between 2010 and 2012, five in two caves (Casa de Pedra and Miaba) in Sergipe (LBC 31, LBC 32, LBC 73, LBC 78, LBC 79), three in Paripiranga, Bahia (UFPB 6548, UFPB 6564, UFPB 6566), two in Boqueirão da Onça, Bahia (UFPB 6663, UFPB 6665), and three in Santa Quitéria, Ceará (UFPB 9255, UFPB 9256, UFPB 9257).

Casa de Pedra cave (10°50′ S, 37°27′ W) is located in the municipality of Itabiania (Sergipe) and has a horizontal extension of around 200 m. The surrounding landscape is dominated by pastures and orchards, which are relatively dense along watercourses. In this cave, two individuals of *D. ecaudata* were spotted close (about 20 cm distance) of a group of approximately 200 individuals of *D. rotundus*. Miaba cave is located in the municipality of Sáo Domingos (10°43′ S, 37°37′ W), close to the Vaza-Barris River, in an ecotone of the Atlantic Forest and Caatinga domains, known locally as the Agreste. A resident group of approximately 50 individuals of *D. ecaudata* was found at this site.

The Fim-do-Morro-do-Parafuso cave (10°41′ S, 37°37′ W) in Paripiranga, Bahia, is surrounded by grazing land and plantations of manioc and maize, with some fragments of shrubby caatinga mainly along the local rivers. Despite the large number of caves found in the area, 15 of which were inspected, *D. ecaudata* groups were found only in Fim-do-Morro-do-Parafuso. The second site in Ba-
hia, Boqueirão da Onça (09°52’ S, 41°06’ W), in the municipality of Sento Sé, is characterized by a complex of hills and valleys covered by an arboreal caatinga (deciduous trees of 10–12 m height) that forms a closed canopy in the wet season (December–April). In the valleys, where the individuals were captured, the rivers retain moisture, even during the dry season, which allows the formation of dense, evergreen vegetation.

In Ceará, *D. ecaudata* specimens were captured near an abandoned mine in Santa Quitéria (04°33’ S, 39°46’ W), a region dominated by open, shrubby caatinga on shallow, stony soils (IPECE 2009). The region encompasses a number of intermittent watercourses, which are associated with denser patches of semideciduous woodland.

*Diphylla ecaudata* is the smallest vampire bat, with a head and body length of 75–93 mm, forearm of 50–56 mm, and weight of 24–43 g (Greenhall et al. 1984). This species feeds preferentially on the blood of birds, with bites being observed on the margin of the cloaca, and on the tarsus and feet (Gardner 1977). It is distinguished from the other desmodontines by the presence of two lower molars and a much wider postorbital constriction. Externally, the uropatagium, legs, and feet of *D. ecaudata* are conspicuously hirsute, the thumb is short (< 13 mm), with no basal pad, the eyes are large, and the ears short and rounded (Allen 1896; Greenhall et al. 1983).

*Diphylla ecaudata* is found primarily in natural refuges, in particular caves, where roosting sites may be selected according to environmental conditions (e.g., humidity, temperature) and availability of crevices (Greenhall et al. 1984; Altringham 1996). Almost half (39) of the 86 records of the species in the wild have been obtained from surveys of caves (Table 1). At both sites in Sergipe, *Diphylla* was found cohabiting with *D. rotundus*. This latter species is generally more common than *D. ecaudata* not only in the local caves (PAR, personal observation), but also in those from southern (Trajano 1985) and central Brazil (Bredt et al. 1999). The greater selectivity of roosts observed in *D. ecaudata* may, at least partly, account for this difference; *D. rotundus* can often be found in man-made structures (Gomes and Uieda 2004).

This study expands considerably the known distribution of *D. ecaudata* in the caatinga scrub of northeastern Brazil—previously restricted almost entirely to the state of Pernambuco and neighboring areas—and represents the first record of this species for the state of Ceará, where a total of 35 chiropteran species are now known to occur (Gurgel-Filho and Langguth, in press). These findings further support the conclusion of Kwon and Gardner (2008) that the highly disjunct distribution of the species (Figure 1) may simply be due to a lack of adequate inventories.

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TABLE 1. Localities at which Diphylla ecaudata has been recorded. The code numbers refer to the points shown in Figure 1. Localities marked with an asterisk (*) are caves.

| COUNTRY/POINT | LAT-Y | LONG-X | STATE | LOCALITY | SOURCE |
|---------------|-------|--------|-------|----------|--------|
| Mexico        |       |        |       |          |        |
| 1             | 22.63333 | -99.0333 | Tamaulipas | Sierra Madre Oriental * | Elizalde-Arellano et al. (2007) |
| Venezuela      |       |        |       |          |        |
| 2             | 10.45 | 63.96667 | Sucre | 21 km E of Cumaná | Handley (1976) |
| 3             | 10.35 | 67.66667 | Aragua | Portachuelo | Ojasti and Linares (1971) |
| 4             | 8.716667 | -71.45 | Mérida | Cueva de la Azulita | Ojasti and Linares (1971) |
| Colombia       |       |        |       |          |        |
| 5             | 11.283333 | -74 | Magdalena | Cacaguaito | Allen (1900) |
| 6             | 4.25 | 73.56667 | Meta | Restrepo | Aellen (1970) |
| 7             | 2.166667 | -71.5 | Vaupés | Cerro de las Pinturas | Wenzel et al. (1966) |
| Equador        |       |        |       |          |        |
| 8             | -1.466667 | 78.133333 | Pastaza | Mera | Albuja (1983) |
| Peru           |       |        |       |          |        |
| 9             | -5.6 | 78.283333 | Amazonas | 10 Km by trail SE of La Peca | Graham and Barkley (1984) |
| 10            | -6.166667 | 77.26667 | San Martín | Puca Tambo | Thomas (1926) |
| 11            | -8.283333 | -74.65 | Ucayali | Parque Nacional | Sanborn (1949) |
| 12            | -7.933333 | 74.933333 | Mérida | Cueva de la Azulita | Ojasti and Linares (1971) |
| 13            | -10.833333 | -74.85 | Pasco | Nevati | Tuttle (1970) |
| 14            | -11.783333 | -72.7 | Cusco | San Martín-3 | Solari et al. (2001) |
| Brazil         |       |        |       |          |        |
| 15            | -7.45 | 73.683333 | Acre | Parque Nacional da Serra do Divisor | Nogueira et al. (1999) |
| 16            | -8.766667 | -63.9 | Rondônia | Porto Velho (USNM 562686) | Mok et al. (1982) |
| 17            | 2.05 | -50.8 | Goyiá | Santa Quitéria* | This Study |
| 18            | -3.45 | 52.883333 | Pará | Parque Nacional | This Study |
| 19            | -7.983333 | 35.96667 | Pernambuco | Parque Ecológico Municipal Professor João Vasconcelos, Caruaru | Sousa et al. (2004) |
| 20            | -12.35 | -37.85 | Bahia | Construção | This Study |
| 21            | -14.35 | -46.25 | Goiás | Parque Nacional | This Study |
| 22            | -15.05 | -46.25 | Goiás | Parque Nacional | This Study |
| 23            | -15.45 | -46.25 | Goiás | Parque Nacional | This Study |
| 24            | -15.75 | -46.25 | Goiás | Parque Nacional | This Study |
| 25            | -16.35 | -46.25 | Goiás | Parque Nacional | This Study |
| 26            | -17.05 | -46.25 | Goiás | Parque Nacional | This Study |
| 27            | -17.35 | -46.25 | Goiás | Parque Nacional | This Study |
| 28            | -17.65 | -46.25 | Goiás | Parque Nacional | This Study |
| 29            | -17.95 | -46.25 | Goiás | Parque Nacional | This Study |
| 30            | -18.25 | -46.25 | Goiás | Parque Nacional | This Study |
| 31            | -18.55 | -46.25 | Goiás | Parque Nacional | This Study |
| 32            | -18.85 | -46.25 | Goiás | Parque Nacional | This Study |
| 33            | -19.15 | -46.25 | Goiás | Parque Nacional | This Study |
| 34            | -19.45 | -46.25 | Goiás | Parque Nacional | This Study |
| 35            | -19.75 | -46.25 | Goiás | Parque Nacional | This Study |
| 36            | -20.05 | -46.25 | Goiás | Parque Nacional | This Study |
| 37            | -20.35 | -46.25 | Goiás | Parque Nacional | This Study |
| 38            | -20.65 | -46.25 | Goiás | Parque Nacional | This Study |
| 39            | -20.95 | -46.25 | Goiás | Parque Nacional | This Study |
| 40            | -21.25 | -46.25 | Goiás | Parque Nacional | This Study |
| 41            | -21.55 | -46.25 | Goiás | Parque Nacional | This Study |
| 42            | -21.85 | -46.25 | Goiás | Parque Nacional | This Study |
| 43            | -22.15 | -46.25 | Goiás | Parque Nacional | This Study |
| 44            | -22.45 | -46.25 | Goiás | Parque Nacional | This Study |
| 45            | -22.75 | -46.25 | Goiás | Parque Nacional | This Study |
| 46            | -23.05 | -46.25 | Goiás | Parque Nacional | This Study |
| 47            | -23.35 | -46.25 | Goiás | Parque Nacional | This Study |
| 48            | -23.65 | -46.25 | Goiás | Parque Nacional | This Study |
| 49            | -23.95 | -46.25 | Goiás | Parque Nacional | This Study |
| 50            | -24.25 | -46.25 | Goiás | Parque Nacional | This Study |
| 51            | -24.55 | -46.25 | Goiás | Parque Nacional | This Study |
| 52            | -24.85 | -46.25 | Goiás | Parque Nacional | This Study |
| 53            | -25.15 | -46.25 | Goiás | Parque Nacional | This Study |
| 54            | -25.45 | -46.25 | Goiás | Parque Nacional | This Study |
| 55            | -25.75 | -46.25 | Goiás | Parque Nacional | This Study |
| COUNTRY/ POINT | LAT-Y | LONG-X | STATE | LOCALITY | SOURCE |
|---------------|-------|--------|-------|----------|--------|
| 51            | -14.9 | -49.2  | São Paulo  | Vila Rica | Barbosa et al. (1999) |
| 52            | -14.9 | -49.2  | São Paulo  | Vila Rica | Barbosa et al. (1999) |
| 53            | -14.9 | -49.2  | São Paulo  | Vila Rica | Barbosa et al. (1999) |
| 54            | -14.9 | -49.2  | São Paulo  | Vila Rica | Barbosa et al. (1999) |
| 55            | -14.9 | -49.2  | São Paulo  | Vila Rica | Barbosa et al. (1999) |
| 56            | -14.9 | -49.2  | São Paulo  | Vila Rica | Barbosa et al. (1999) |
| 57            | -14.9 | -49.2  | São Paulo  | Vila Rica | Barbosa et al. (1999) |
| 58            | -14.9 | -49.2  | São Paulo  | Vila Rica | Barbosa et al. (1999) |
| 59            | -14.9 | -49.2  | São Paulo  | Vila Rica | Barbosa et al. (1999) |
| 60            | -14.9 | -49.2  | São Paulo  | Vila Rica | Barbosa et al. (1999) |
| 61            | -14.9 | -49.2  | São Paulo  | Vila Rica | Barbosa et al. (1999) |
| 62            | -14.9 | -49.2  | São Paulo  | Vila Rica | Barbosa et al. (1999) |
| 63            | -14.9 | -49.2  | São Paulo  | Vila Rica | Barbosa et al. (1999) |
| 64            | -14.9 | -49.2  | São Paulo  | Vila Rica | Barbosa et al. (1999) |
| 65            | -14.9 | -49.2  | São Paulo  | Vila Rica | Barbosa et al. (1999) |
| 66            | -14.9 | -49.2  | São Paulo  | Vila Rica | Barbosa et al. (1999) |

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