

Short Note

William Douglas Carvalho, Mayara Almeida Martins, Daniela Dias and Carlos Eduardo Lustosa Esbérard*

Extension of geographic range, notes on taxonomy and roosting of *Histiotus montanus* (Chiroptera: Vespertilionidae) in southeastern Brazil

Abstract: Here we report the first records of the vespertilionid bat *Histiotus montanus* in southeastern Brazil. A male was found sheltering under a rock and collected by hand in the Serra do Papagaio State Park, Aiuruoca municipality, state of Minas Gerais. The taxonomic aspects of this species are discussed, and measurements of the sample are provided.

Keywords: elevation limit; geographic distribution; measures; roosting behavior.

*Corresponding author: Carlos Eduardo Lustosa Esbérard,

Laboratório de Diversidade de Morcegos, Instituto de Biologia, Universidade Federal Rural do Rio de Janeiro, UFRRJ, BR 465, Km 7, CP 74507, CEP 23890-000, Seropédica, RJ, Brazil, e-mail: cesberard@superig.com.br

William Douglas Carvalho: Laboratório de Diversidade de Morcegos, Instituto de Biologia, Universidade Federal Rural do Rio de Janeiro, UFRRJ, BR 465, Km 7, CP 74507, CEP 23890-000, Seropédica, RJ, Brazil

Mayara Almeida Martins: Laboratório de Mastozoologia, Instituto de Biologia, Universidade Federal Rural do Rio de Janeiro, UFRRJ, BR 465, Km 7, CEP 23890-000, Seropédica, RJ, Brazil

Daniela Dias: Laboratório de Biologia e Parasitologia de Mamíferos Silvestres Reservatórios, IOC, Fundação Oswaldo Cruz, Avenida Brasil, 4365, Manguinhos, CEP 21040-360, Rio de Janeiro, RJ, Brazil

The genus *Histiotus* Gervais, 1856, endemic to South America, encompasses four to seven species depending on the taxonomic review adopted (Simmons 2005, Handley and Gardner 2007). They are bats with large ears that feed exclusively on insects captured during flight (Wilson 1973). Until now, four species have been reported for Brazil: *H. alienus* Thomas, 1916, *H. montanus* (Philippi and Lanbeck, 1861), *H. laeophotis* Thomas, 1816 and *H. velatus* (I. Geoffroy, 1824). *Histiotus velatus* occurs

in 12 states of southern, southeastern, northeastern and center-western Brazil, whereas the other species have a more restricted distribution in the country. *Histiotus alienus* is known in Brazil only for its type locality, Joinville, in Santa Catarina State (Thomas 1916, Peracchi et al. 2011). *Histiotus laeophotis* has been recorded also in Santa Catarina (Miranda et al. 2007) and Goiás States (Pol et al. 1998, Peracchi et al. 2011). *Histiotus montanus* had been recorded so far only in southern Brazil (Cherem et al. 2004, Fabián et al. 2006, Miranda et al. 2006). During a visit to Serra do Papagaio State Park (22°01'01"–22°18'34"S and 44°52'38"–44°37'39"W), located in Aiuruoca, state of Minas Gerais (Figure 1).

On May 15, 2011, a group of excursionists collected by hand an adult male of *Histiotus montanus* with abdominal testes. The specimen was donated to the Laboratório de Diversidade de Morcegos (LDM) of the Universidade Federal Rural do Rio de Janeiro, where it was killed, fixed in 10% formaldehyde and preserved in alcohol 70° GL with the skull removed. The specimen was deposited in LDM's reference collection under the number LDM 5222.

Serra do Papagaio State Park has an area of approximately 23,000 ha and is located within the Serra da Mantiqueira Preservation Area, an important Atlantic Forest remnant (Pérez et al. 2004, Vasconcelos 2008, Santos et al. 2009, Toledo et al. 2009). The park's vegetation is characterized as a transition between semi-deciduous seasonal forest, dense rainforest, savanna (cerrado), and Araucaria forest (Brasil 1983). The climate, according to Köppen's classification, is of the type Cwb, also known as a temperate climate with dry winters. The temperature of the warmest month is usually below 22°C, the average annual temperature varies between 18°C and 19°C and the average annual rainfall reaches 1400 mm. The rainiest period is from December to February, and the lowest rainfall occurs from June to August (Pérez et al. 2004,

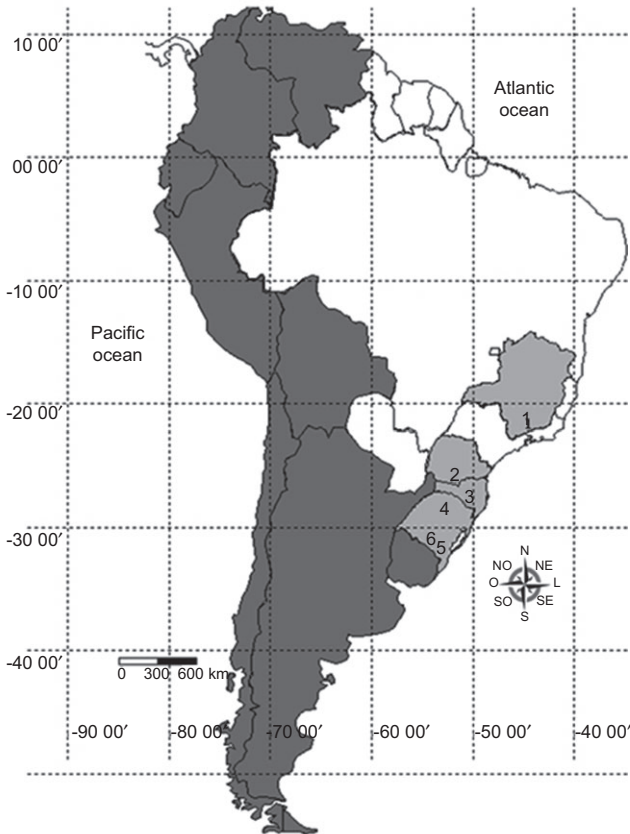


Figure 1 South American map with the marginal occurrence of *Histiotus montanus*.

Dark gray indicates South American countries with confirmed occurrences of this species. Light gray indicates the Brazilian states with confirmed occurrences. The numbers represent the occurrences of the species in Brazil: (1) Aiuruoca, state of Minas Gerais, this study; (2) Palmas, state of Paraná (Miranda et al. 2006); (3) Lages, state of Santa Catarina (Cherem et al. 2004); (4) Ilópolis; (5) Pinheiro Machado; and (6) Bagé, state of Rio Grande do Sul (Fabián et al. 2006).

Santos et al. 2009, Tolledo et al. 2009). The region of Serra do Papagaio is characterized by a complex geology, consisting of folding and faulting rocks of the Atlantic Mobile Belt. The region is inserted in the eastern sector of the Itatiaia Plateau unit, which is characterized by deep faulting, differential dissection, elongated relief and bare hillsides in the middle portion (Brasil 1983). Serra do Papagaio State Park is located in an area of extreme biological importance, where a few studies have been conducted and which is located within the corridor of Serra da Mantiqueira Preservation Area (MMA 2000). It is also considered as one of the priority areas for the conservation of mammals in Minas Gerais, together with Itatiaia National Park (Drummond et al. 2005, Biodiversitas 2011). In the region, there is a rocky outcrop above 2000 m above

sea level (m.a.s.l.), with many crevices caused by the fracture of rocks that become loose due to erosion, spreading and accumulating on the substrate.

Identification was based on descriptive and diagnostic characters available in the literature (e.g., Acosta Y Lara 1950, 1955, Barquez et al. 1999, Handley and Gardner 2007). External and cranial measurements were taken with a caliper (precision of 0.02 mm), following Taddei et al. (1998).

The specimen examined was found roosting under a rock loosened by erosion in a rocky outcrop at 2192 m.a.s.l. at the coordinates 22°03'35.8"S and 44°40'35.6"W (Figures 2–4). The specimen has the morphological characters described for *Histiotus montanus*: elliptical ears united by a discrete skin elevation grooved in the center; median portion of the pavilion curved up to a slightly rounded vertex; outer edge of the ear descending and starting with a small concavity that becomes convex up to the base; tragus developed and reaching almost half of the height of the pavilion; zone above the snout, between the muzzle and the eyes, darker than between the eyes and close to the ears; several conspicuous parallel ridges on the median part of the pavilion, upward from the bisectrix up to the outer edge; a large fold along the inner edge of the pavilion; sparse golden fur between the edge of the pavilion; and the aforementioned ridges and on the outer part of the pavilion.

The dorsal fur is chestnut-colored and very dark, with coppery-brown tips and with light contrast between the base and tips. The ventral fur is lighter than the dorsal fur;



Figure 2 *Histiotus montanus*, male captured at 2192 m.a.s.l. in Southeastern Brazil.



Figure 3 Rocks loosened by erosion in a rocky outcrop at 2192 m.a.s.l. in Serra do Papagaio State Park, Minas Gerais state, Southeastern Brazil.



Figure 4 Roost of the individual of *Histiotus montanus* in a rocky outcrop at Southeastern Brazil, showing accentuated inclination (~70%) where the bat was found. The arrow indicates the individual of *H. montanus*.

the base of the hairs is black, and the tips are yellowish gray, which gives a grayish color to the abdomen. The wing membranes and ears are also very dark, almost black. Acosta Y Lara (1950, 1955) observed individual variation in fur and membrane color in specimens from Uruguay; he observed lighter and darker specimens, as well as lighter ears, wings and muzzles in some specimens, but darker in others.

The specimen also exhibits a robust skull, the interorbital region is wide and inflated, with an almost quadrangular shape in dorsal view; developed tympanic bullae (measuring 4.02 mm); a marked groove on the frontal bone and along the suture of the nasal bones; the angular process of the mandible is curved upwards and extends behind the mandibular condyles; inner incisors with

double cusps, with the outer cusp smaller; outer incisors rudimentary, not reaching the height of the smallest cusp of the central incisors and separated from the canine teeth by a gap equal to its own diameter; lower incisors trifold, placed in overlapping rows, rising in level from the center to the sides of the mandible; upper premolar robust, in contact with the canine tooth and the first molar; and the lower first premolar not more than half of the height of the second premolar. The measurements obtained for this specimen are within the variation known for *Histiotus montanus* (Table 1).

Histiotus montanus differs from *H. velatus* in many aspects. In the latter, the ear is markedly triangular, with a wide base, and the inner edge folds, forming a wide rounded lobe (approximately one-third of the total width of the pavilion), which is projected forward, close to the muzzle; the membranous connection on the forehead is conspicuous, measuring approximately 3 mm or more in height and the cranium and rostrum are narrower than in its congeners (Barquez et al. 1999, Acosta Y Lara 1955, Handley and Gardner 2007).

Histiotus montanus is frequently mistaken for *H. macrotus* (Poeppig, 1835), as both species are very similar (Barquez et al. 1999). The color is similar, and both species have no or a low, barely noticeable, interauricular band. In *H. macrotus*, the membranes and ears are dark, almost black (Barquez et al. 1999), similar to those observed in the studied specimen. However, the ears are smaller and more round in *H. montanus* (26–28 mm) than in *H. macrotus* (27–38 mm and in general larger than 30 mm), though there is overlap in their measurements. In addition, *H. macrotus* has a wider snout, a more robust skull and more developed

Table 1 Selected measurements of *Histiotus montanus* specimens from Serra do Papagaio State Park, Minas Gerais, Southeastern Brazil¹, Paraná state, Southern Brazil², Uruguay³ and Argentina⁴.

Variável	Present study ¹	Miranda et al. (2006) ²	Acosta Y Lara (1950) ³	Barquez et al. (1999) ⁴
Forearm length	46.40	43.70	44.00–48.00	42.50–49.00
Ear length	28.00	29.40	23.00–25.00	20.00–29.50
Greatest length of the skull	18.44	18.30	17.00–18.60	17.50±0.35
Condylar-incisive length	17.66	–	–	–
Basal length	15.72	14.80	14.50–15.80	–
Upper toothrow length	6.58	6.60	6.10–6.80	5.90–6.80
Breadth across upper canines	5.30	5.00	4.50–5.00	4.60–5.30
Breadth across molars	7.16	7.10	–	6.60–7.60
Interorbital breadth	6.36	–	–	–
Postorbital breadth	4.60	4.60	4.00–4.60	4.40±0.16
Breadth of braincase	8.68	8.60	8.00–8.50	8.20±0.20
Zygomatic breadth	11.56	11.30	11.30–12.20	11.20±0.41
Mastoid breadth	9.30	9.20	–	9.10±0.15
Mandible length	12.46	12.00	12.00–13.50	11.50–12.80
Lower toothrow length	7.04	7.10	6.70–7.10	6.8±0.18

¹n=1 male; ²n=1 male; ³n=4 males and 8 females; ⁴n=26 without information on sex.

tympenic bullae than *H. montanus* (Barquez et al. 1999, Handley and Gardner 2007). Barquez (2006) emphasized that the information available in the literature about several records of *H. montanus* and *H. macrotus* are, in general, not reliable as they do not provide detailed descriptions to aid in identification, making controversial the definition of the geographic range of these species; he points out the need for more detailed studies, based on a higher number of specimens. *Histiotus macrotus* is not currently reported as occurring in Brazil, as the only record known, from the state of Goiás (Pol et al. 1998), was actually a *H. laephotis* (see Peracchi et al. 2011).

Histiotus laephotis, treated as a subspecies of *H. montanus* by Handley and Gardner (2007), can be easily differentiated from *H. montanus* by several characters. In *H. laephotis*, the membranes and ears are pale, and the band of skin over the forehead and the ears is clearly visible, although not very evident in taxidermized specimens, the width between molars is below 7 mm and the snout is narrower (Pol et al. 1998, Barquez et al. 1999, Barquez 2006, Peracchi et al. 2011). Despite taxonomic issues (cf., Barquez et al. 1999, Handley and Gardner 2007), *H. laephotis* has been considered a valid species by most authors (e.g., Simmons 2005, Barquez 2006, Miranda et al. 2006, Bianconi and Pedro 2007, Handley and Gardner 2007, Peracchi et al. 2011).

Qualitative characters, such as dark color, narrow and oval-shaped ears, a low and barely noticeable membranous connection between the ears and some quantitative characters are also compatible with *Histiotus alienus*, according to the short diagnosis provided by

Thomas (1916) in the species description. *Histiotus alienus*, considered as a valid species by several authors (e.g., Koopman 1993, Simmons 2005, Bianconi and Pedro 2007, Peracchi et al. 2011), is distributed in Uruguay and central-eastern Argentina (Handley and Gardner 2007), and it is known in Brazil only from its type locality, Joinville, Santa Catarina (Peracchi et al. 2011). Its taxonomic status, however, must be resolved through a revision of the genus, as it is considered as a subspecies of *H. montanus* by Handley and Gardner (2007) and was not included in the annotated list of mammals of Argentina (Barquez 2006).

This specimen of *Histiotus montanus* (Figure 5) represents the first confirmed record of the species in southeastern Brazil and an extension of geographic distribution



Figure 5 Detailed photography of the roost, showing the individual of *Histiotus montanus* immediately before the capture. The arrow indicates the individual of *H. montanus*.

of at least 900 km to the north in relation to its far northern record for Brazil, available from São João Farm, Palmas, southern Paraná State, at 26°S. So far, only *H. velatus* had been recorded in southeastern Brazil (Bergallo et al. 2003, Esbérard and Bergallo 2005, Peracchi and Nogueira 2010). *Histiotus montanus* seems to be restricted to temperate regions (Emmons and Feer 1997); it can be found in different habitats and at high altitudes in most of its geographic range, being found at altitudes ranging from 4117 m.a.s.l. in Ecuador (Baker 1974) to 218 m.a.s.l. in southern Brazil (Fabián et al. 2006), occurring from low to medium altitudes, as in southern Brazil (from 218 to 800 m.a.s.l., Fabián et al. 2006) and also at high altitudes in the Venezuelan Andes (2100 m.a.s.l., Linares 1987). In Santa Catarina, this species was collected at over 800 m.a.s.l. (Cherem et al. 2004) and in Paraná from 1200 to 1300 m.a.s.l. (Miranda et al. 2006). Its capture at a high altitude in southeastern Brazil (at almost 2200 m.a.s.l. in Minas Gerais, 23°S) corroborates the preference of the species for colder and harsh climates in regions closer to the Equator.

Roosts are important for most mammals and in particular for bats because they provide protection against predators and stable microclimates for thermoregulation (e.g., Lewis 1995). Bats stay in day roosts for over 12 h every day, and it is in roosts that many other activities, apart from feeding, are carried out (e.g., Muñoz-Romo 2006). To facilitate the access to roosts, many species use structures above the ground, which allows them to take off more easily. Due to all these characteristics, roofs and hollow trees are adequate roosts for most species (Esbérard et al. 1999). Except for radiotracking studies, in which the bat can be easily located in its day roost (e.g., Bernard and Fenton 2003), most observations inside roosts are obtained by chance. There is a huge variety of natural or human structures that are used by bats, but information for urban areas are more common (e.g., Bredt et al. 1996).

The limited space available on the perch where the specimen was reported seems to be just large enough for one or more of some specimens. *Histiotus montanus* has been classified as gregarious, forming groups of up to 20 animals (Nowak 1994); the use of roof linings and caves has also been reported (Acosta Y Lara 1955, Pearson and Pearson 1989, Barquez et al. 1999, Achaval et al. 2004). However, *H. montanus* has been observed in small rock crevices at 4117 m.a.s.l. in Ecuador (Baker 1974), a similar situation as observed in the present study.

Although it was a fallen rock, the bat had easy access to this roost, as it was located on a steep substrate, allowing the animal to take off easily. As the studied specimen was living in a rocky substrate, it probably benefited from insolation and heat conservation. It is known that the temperature on the lower surface of rocks under the sun depends more on thickness than on the area exposed to the sun (Dean and Turner 1991, Ignacio et al. 1993).

The existence of good inventories on highlands in southeastern Brazil may increase the discover of species of cold climates, as noted in this and other examples (e.g., Miranda et al. 2006, Gregorin and Loureiro 2011, Gregorin et al. 2011). High elevation areas are priorities for sampling in Brazil due to the minimal effort already expended on inventories of bats (e.g., Bergallo et al. 2003).

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