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Biogeography and taxonomic status of *Myotis keaysi pilosatibialis* LaVal 1973 (Chiroptera: Vespertilionidae)

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Abstract

We document the first confirmed Colombian records of *Myotis keaysi pilosatibialis* LaVal, 1973 from various localities on the Colombian Caribbean and the Eastern Cordillera of the Colombian Andes. These records confirm geographic overlap between *M. k. pilosatibialis* and the nominate subspecies *M. k. keaysi* J. A. Allen, 1914, in northeastern Colombia, questioning the subspecific status of *M. k. pilosatibialis*. Models of potential distribution, produced for the two taxa by the application of the Maxent algorithm, show a potential geographic overlap in the northeastern portion of the Andes of Colombia and Venezuela. In order to clarify the taxonomic status of putative *M. keaysi* variants, we analyzed the variation of Colombian representatives of *M. keaysi* through a Principal Components Analysis (PCA), and a Discriminant Function Analysis (DFA) performed on 18 cranio-dental measurements, as well as the analysis of discrete characters. The morphological independence between *M. k. keaysi* and *M. k. pilosatibialis* was supported statistically in our PCA and DFA, as well as by the presence of unique discrete characters, lending support to the recognition of *M. k. pilosatibialis* as full species. Herein, we include new discrete characters setting apart *M. pilosatibialis* from the morphologically similar species *M. keaysi*.

Key words: Bats, first Colombian record, hairy legged ear mouse bats, overlapping distributions

Introduction

The insectivorous bat *Myotis keaysi* J.A. Allen, 1914 is one species of *Myotis* adapted to highland ecosystems (LaVal 1973). There are two currently recognized subspecies within *M. keaysi* (Simmons 2005, Hernández-Meza *et al.* 2005, and Wilson 2008): *M. k. keaysi* J. A. Allen, 1914 occurring across the Andes between 1100 and 2400 masl (LaVal 1973), from Argentina to Venezuela (Handley 1976, Hernández-Meza *et al.* 2005, Wilson 2008); and *M. k. pilosatibialis* LaVal, 1973, also present in highland ecosystems between 750 and 2000 masl from south Tamaulipas in Mexico across Central America, with discontinuous records in South America from Venezuela and Trinidad (LaVal 1973). Based on geographic ranges proposed in LaVal (1973), there is a potential overlap between these two subspecies in Colombia and Venezuela. Unfortunately, in his revision of the genus, LaVal (1973) had a limited hypodigm from Colombia, represented only by two specimens he identified as *M. k. keaysi* from the departments of Cundinamarca and Santander on the Eastern Cordillera. The low number of specimens from Colombia prevented LaVal (1973) from determining the actual geographic limits of the two subspecies across the complex mountainous system.

The putative geographic variants of *M. keaysi* are relatively easy to tell apart. *Myotis k. pilosatibialis* has hairs on the uropatagium and hindfoot, while hairs in *M. k. keaysi* are only present on the upper portion of the uropatagium; *M. k. pilosatibialis* has a paler coat color (buffy-brown) and shorter hair than the auburn-brown to dark-brown coat color and longer hair of *M. k. keaysi* (color nomenclature according to Ridgway [1912]). Internally, *M. k. pilosatibialis* has smaller skulls in comparison with *M. k. keaysi* (LaVal 1973). Differences between the two subspecies in LaVal (1973) and morphological discrete characters telling apart these two taxa are summarized in Table 1.

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APPENDIX I. Localities associated with *Myotis* specimens analyzed in this work.

- Myotis keaysi keaysi*: (18). COLOMBIA: Caldas, Manizales, Sitio entre la Quebrada la Guerra y el Mirador, Reserva Río Blanco (05°07'31,85"N, 75°26' 48,62"W) (ICN 15163 [F]); Manizales, Sitio Vereda Las Palomas, Reserva Río Blanco (05°06'26,78"N, 75°21' 42,48"W), (ICN 16982 [M]), (ICN 16984 [M]), (ICN 169685, 86 [F]), (ICN 16987 [M]). Cauca, Municipio Belalcázar, Parque Nacional Nevado del Huila (02°30'N, 76°35' W) (ICN 7644,45 [M]). Quindío, Municipio Finlandia, Vereda el Roble, Reserva Forestal (04°41'12,25"N, 75°38' 06,38"W) (ICN 12484 [M]); Municipio Salento, Reserva Natural, Caño Quindío, “La Marina” (04°40'00,60"N, 75°29'59,63"W) (ICN 12453,12455, 56 [M]), (ICN 12457 [F]); Municipio Salento, Reserva Natural, Caño Quindío, “Monte Loro” (04°40'00,60"N, 75°29'59,63"W) (ICN 12454 [F]). Santander, Municipio de Encino, Vereda Rionegro, Reserva Biológica Cachalú, (06°07, 53'22"N, 73°06' 01,81"W), (ICN 17628 [F]). Valle del Cauca, Cali, 5 Km al S, Pichincha en el Silencio (03°27'03,54"N, 76°31' 12,55"W) (ICN 6312 [M]), (ICN 6313 [F]); Felidia, Finca el Diamante, (03°47'07,49"N, 76°35,23' 11,12"W) (ICN 6315 [F]).
- Myotis keaysi pilosatibialis*: (21). COLOMBIA: Cesar, Serranía del Perija, Municipio de Manauré, Vereda El Cinco (10°22'17"N, 72°57'15,5"W), (ICN 18932,33 [M]). Huila, Municipio La Plata, Hacienda Meremberg (02°23'N, 75°54'W), (ICN 7642 [F]), (ICN 7643 [M]). Magdalena, Santa Marta, Serranía San Lorenzo, Hacienda La Victoria (10°48'N, 73°39'W), (ICN 5400,01[M]); Santa Marta, Serranía San Pedro de la Sierra, Finca Tierragata (11°15' N, 74°12'W), (ICN 5260 [M]). Santander, Municipio de Encino, Vereda Rionegro, Reserva Biológica Cachalú (06°07, 53'22"N, 73°06' 01,81"W), (ICN 17625 [F]), (ICN 17626,27 [M]), (ICN 20055, 56 [F]) (ICN 20057 [M]); Municipio de Charalá, Vereda Grima Alta, Finca La Campiña, Cueva del Tigre (5°59'52", N 73°28'33"W), (ICN 8154 [F]), (ICN 17507, 08, 09 [M]); Municipio de Ocamonte, Vereda Miraflores, Finca Macanal, Cueva de la Virgen (06°19'56,38"N, 73°06' 59,57"W), (ICN 17635, 36, 37, 38 [F]).

APPENDIX II. Colombian localities of *M. keaysi* mentioned by Muñoz-Arango (2001).

Amalfi; Campamento; El Jardín; La Solita; Llanos de Cuivá; and Santa Rosa de Osos in the department of Antioquia (records also reported in Muñoz Arango 1993); El Carmen de Viboral; El Porvenir; El Retiro; Los Ríos; Medellín; Santa Helena; and Titiribí also from the department of Antioquia, records also reported in Muñoz Arango (1990); Hato Grande, Cundinamarca, 13 km east of Gachalá, deposited at the collection of the University of Northern Iowa (UNI), 2735 masl (LaVal 1973), erroneously assigned by Muñoz Arango (2001, 223p) to the collection of the Instituto de Ciencias Naturales (ICN); La Planada, Ricaurte, department of Nariño (Alberico and Orejuela 1982), El Tambo and Ricaurte, also from the department of Nariño (Fawcett 1992), and a specimen from Lebrija, Santander, deposited at the United States National Museum of the Smithsonian Institution (USNM), identified with catalogue number USNM 43359, sex undetermined, preserved in fluid, collected by C. J. Marinkelle (collectors number 6022), on November 15, 1966, reported by LaVal (1973, 23p) and identified as *M. k. keaysi* by this author.