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TWO NEW SPECIES OF *MYOTIS* (CHIROPTERA: VESPERTILIONIDAE) FOR ARGENTINA

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ABSTRACT

Seven new species of Myotis have been recently described from South America, elevating to 20 the total number of species of the genus recognized for the region. Myotis izecksohni and Myotis lavalis were recently described from the States of Rio de Janeiro, Paraná and Pernambuco, Brazil. These are clearly different from all other known species of the genus in their external and cranial characters, which are exactly comparable with our specimens collected in Argentina. This allows to greatly expand the known geographic distributions for these two species. The addition to Argentina of Myotis lavalis with specimens collected in the Yungas ecoregion of Salta Province, and Myotis izecksohni with specimens collected in the Fields and Weedlands ecoregion of Misiones Province, increases the known ecoregions to date for the distribution of the two species.

KEY-WORDS: Distribution; Fields and Weedlands; Misiones; Salta; Yungas.

INTRODUCTION

Myotis Kaup, 1829 is one of the most complex and diverse genus among bats in the Neotropical Region. The previous difficulties to adequately identify the species of Argentina were mainly due to the small number of records collected throughout history in the country (Cabrera, 1930, 1958; Barquez, 1987; Barquez *et al.*, 1999), which prevented the develop-

ment of appropriate comparisons. However, the important development of further studies, has allowed the addition of sufficient information, both geographical and descriptive, and more elements facilitating to clarify the identity of species that were previously ambiguous. Barquez *et al.* (1999) included nine species of *Myotis* in Argentina, elevating this number to ten (Barquez, 2006) after recognizing *Myotis dinellii* as a full species as originally proposed by Thomas (1902).

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Recent investigations, basically developed by Moratelli *et al.* (2011, 2013) and Moratelli & Wilson (2011, 2014) are strongly impacting on the knowledge of the Neotropical species, so that the recognized number for the region is growing rapidly regarding the lists that emerged from reviews of the genus like those of Cabrera (1958), La Val (1973), or other more general articles as Simmons (2005) and Wilson (2008).

Wilson (2008) cited 12 species of *Myotis* for South America, seven of which are endemic, but including *M. dinellii* as a subspecies of *M. levis*, without paying attention to the previous opinion published by Barquez (2006).

The recent descriptions of five species (*M. diminutus*, *M. handleyi*, *M. izecksohni*, *M. lavalii*, and *M. midastactus*), plus the revalidation of *Myotis caucensis* (Moratelli *et al.*, 2011, 2013; Moratelli & Wilson, 2011, 2014) and the proposal for giving specific validity to *M. pilosatibialis* (Mantilla-Meluk & Muñoz Garay, 2014) elevate to 20 the number of currently recognized species of the genus in South America.

None of the traditional reviews (Miller & Allen, 1928; La Val, 1973) has included enough material from Argentina to allow, in those days, to convincingly clarify the identity of several of the species. Similarly, the traditional catalog of Cabrera (1958) includes a list of species that usually does not indicate the repositories of the specimens examined, but only refers to bibliographical sources and personal interpretation of the author. After an exhaustive review of specimens in systematic collections and its re-identification, along with many field sampling throughout the country (Barquez, 1987; Barquez *et al.*, 1999), a fundamental rearrangement of the species in Argentina was reached, allowing to more precisely defining the diagnostics characters and a refinement of their geographical distributions.

Until now 10 species of *Myotis* have been cited for Argentina (Barquez, 2006; Barquez & Díaz, 2009; Díaz *et al.*, 2011), most of them known only from a few records, leaving gaps along their general distributional areas. Therefore, it is not surprising to add new localities to the distribution of all species because many of them, as well as large territorial areas, have been effectively sub-sampled or have not been studied.

In this way, sampling in these regions enables the addition of more information, and also contributes to the knowledge of the populations, geographical, and ecological variations of the involved species. For the same reasons, the addition of new species to the Argentine territory is greater to the extent that the fieldwork, and the study of specimens in systematic collections, also increase.

In the context of extensive surveys conducted in northern Argentina, in the provinces of Salta and Misiones, we had the opportunity to collect two species that did not correspond, in their morphological and cranial characters, with any of the known species for the country, *Myotis izecksohni* and *Myotis lavalii* which, in addition to the inclusion in the fauna of Argentina, they represent an extensive expansion of their known distributions.

MATERIAL AND METHODS

The specimens were obtained in two localities, in the provinces of Salta and Misiones, Argentina (Fig. 1). They were prepared as skin, skull and skeletons following Díaz *et al.* (1998) and deposited at the CML (Colección Mamíferos Lillo), University of Tucumán, Argentina. The following measurements were taken using digital calipers to the nearest 0.1 mm (Tables 1, 2) as described by Barquez *et al.* (1999), and Moratelli *et al.* (2011) for comparative purposes: ear length, forearm length, body weight, greatest length of skull, condylo-incisive length, mastoid breadth, braincase breadth, interorbital breadth, postorbital breadth, zygomatic breadth, breadth across canines, breadth across molars, maxillary tooththrow length, mandibular length, and mandibular tooththrow length. The length of the dorsal hairs was taken from the base to the tip of the hairs measured between scapulas.

The study area in Salta Province is located in the Yungas Ecoregion, a forested region that is part of the Amazon Domain of the Neotropical Region (Cabrera, 1971, 1976; Cabrera & Willink, 1980). In Argentina, this ecoregion is located between 22° and 28.5° south latitude, and is not a continuous unit but exists in fragments. The whole region has been significantly modified by human activity. In its natural state, penetrations of other phytogeographical units take place, especially those of Chacoan origin. The ecosystem, as it exists in Argentina, is considered to be threatened (Prado, 1995) principally due to the lack of control of human actions.

In Misiones, the samples were taken as part of a study developed about diversity of bats of the Fields and Weedlands Ecoregion (Burkart *et al.*, 1999), which is a relatively small area located in part of southern Misiones and northern Corrientes, and characterized by the presence of grass savannas, alternating with patches of scrub and forests, constituting a complex ecotone between the Chacoan and Paranaense Phytogeographical Provinces.



FIGURE 1: New localities in Argentina for (1) *M. lavalii* (Finca Alto Verde, Salta Province), and (2) *M. izecksohni* (Parque Provincial de la Sierra “Ing. Agrónomo Martínez-Crovetto”, Misiones Province).

RESULTS

As a result we have obtained samples of two species of *Myotis*, recently described from Brazil, but new to Argentina, whose inclusion in the country extends significantly their known distributions; both are included in new environments where these species were not previously known.

Family Vespertilionidae

Myotis izecksohni Moratelli, Peracchi, Dias and de Oliveira, 2011

Specimens examined (2): Argentina, Misiones Province: Parque Provincial de la Sierra “Ing. Agrónomo Martínez-Crovetto”, Municipio de San José, Apóstol-

les Department, (27°44'39.49"S, 55°33'56.40"W), 210 m (Fig. 1), two females (CML 10200 and 10201) collected on 28 April 2010, by Fabricio M. Idoeta.

This species was recently described by Moratelli *et al.* (2011), based on specimens from Fazenda Maria Brandina, Reserva Biológica do Tinguá, Rio de Janeiro State, Brazil, 760 m altitude. The holotype and paratypes were previously cited as *M. levis* by Dias & Peracchi (2008); also some additional specimens were previously cited as *M. nigricans* from Rio de Janeiro (see Moratelli *et al.*, 2011) and from Paraná (Arnone & Passos, 2007). All the original records are from the Atlantic Rainforest of south and southeastern Brazil. In 2015, the distribution of this species was extended to three localities of the State of Minas Gerais, also in southeastern Brazil in a region classified as a transition between the Atlantic Forest and Cerrado, with veg-

TABLE 1: Measurements of the Holotype and a female Paratype of *M. izecksohni* from Moratelli *et al.* (2011), and two specimens from Misiones, Argentina. All measurements are expressed in mm, and weight is expressed in grams; *measurements taken from the dry skins.

	<i>Myotis izecksohni</i> Brazil		<i>Myotis izecksohni</i> Argentina	
	Holotype	Paratype	CML 10200	CML 10201
Ear length	12.5	12.7	12,17*	11,4*
Forearm length	38.3	36.3	37.8	36.52
Greatest length of skull	14.58	14.64	14.55	13.57
Condyllo-incisive length	13.70	13.71	13.85	12.93
Mastoid breadth	7.06	7.05	7.04	6.96
Braincase breadth	6.79	6.61	6.82	6.60
Interorbital breadth	4.40	4.52	4.52	4.45
Postorbital breadth	3.51	3.43	3.5	3.42
Zygomatic breadth	—	—	8.76	8.35
Breadth across canines	3.52	3.74	3.71	3.43
Breadth across molars	5.60	5.81	5.74	5.34
Maxillary tooththrow length	5.47	5.41	5.48	5.02
Mandibular length	10.13	10.21	10.56	9.82
Mandibular tooththrow length	5.80	5.80	5.75	5.33

etation characteristics of the two biomes (Dias *et al.*, 2015).

Description and comparisons

During our studies, carried out in April 2010, we captured in the province of Misiones, Argentina, two females of a species of *Myotis* that did not correspond to any of the known species of Argentina.

Shortly after our captures, when the description of *Myotis izecksohni* was published, we understood that our specimens (Fig. 2) corresponded exactly with the characteristics of the new species and their morphometry (see Table 1): forearm medium to large for South American species, long and silky fur (6.7 and 7.7 mm in specimens from Argentina), dorsal fur bicolor with dark bases and dark-brown to medium-brown tips, with bases and tips slightly contrasting; bicoloration is more evident in ventral fur, with hairs with very dark bases and light brown tips.

The wing membranes are dark brown; there is no fringe of hairs along the trailing edge of the uropatagium and the plagiopatagium is attached to the feet at the level of the toes.

The skulls of our specimens are as described in Moratelli *et al.* (2011) and comparatively large with respect to other *Myotis* species in Argentina, long and flat with a rounded supraorbital region; the sagittal crest is low, poorly marked and almost not evident; premolars aligned to the tooththrow, and P2 is not crowded to the lingual side and clearly visible in lateral view; external measurements of the Argentine specimens, compared with those provided by Moratelli *et al.* (2011), are shown in Table 1.

The geographical area where *Myotis izecksohni* was collected in the province of Misiones is also inhabited by other six *Myotis* species with which it can be confused (*M. albescentis*, *M. levis*, *M. nigricans*, *M. riparius*, *M. ruber*, and *M. simus*), but their differential characteristics (Díaz *et al.*, 2016) allow to separate them easily: *Myotis albescentis* is easily differentiable from this species by its frosted dorsal coloration, dark membranes rather than pale membranes, by the typical white abdominal and perianal area, the whitish band of the trailing edge of the uropatagium, and by its large and rounded feet. The species with which it can more easily be confused, by their similar size, is *M. levis*, but this has strikingly bicolored dorsal hairs, shorter dorsal hairs, and a fringe of hairs, although slightly visible, on the edge the tail membrane. It can be distinguished from *M. nigricans* by its markedly larger body size and by the bicolored dorsal hairs, which are almost unicolor in *M. nigricans*. From *M. riparius* can be distinguished by its larger size, dark coloration, long fur, and the absence of a sagittal crest in the skull. Although *Myotis ruber* is a species with long dorsal hairs, and similar in size to *Myotis izecksohni*, its strong red coloration separates them easily. It differs from *Myotis simus* because this has a very short and velvety fur, its coloration is bright orange-yellowish and the plagiopatagium is attached to the ankle and not to the toes.

Distribution and general comments

The collecting site is located within the “Fields and Weedlands” ecoregion (Martínez-Croveto, 1963; Burkart *et al.*, 1999) originally classified as a

TABLE 2: Measurements of the Holotype of *M. lavalis* (Moratelli *et al.*, 2011) and range of female specimens from the paratype series from Brazil, compared with the two specimens from Argentina. All measurements are expressed in mm, and weight is expressed in grams.

	<i>M. lavalis</i> Brazil		<i>M. lavalis</i> Argentina	
	Holotype	Range of females	CML 7622	CML 7623
Ear length	13.0	11-14	14	15
Forearm length	34.4	32-36	36	36
Body weight	4.5	4-8	5	5
Greatest length of skull	13.98	13.4-14.3	13.1	13.4
Condylar-incisive length	13.41	12.8-13.6	13.3	12.7
Mastoid breadth	7.04	6.7-7.1	7.2	6.9
Braincase breadth	6.38	6.2-6.6	6.2	6.4
Interorbital breadth	4.61	4.2-4.8	5	4.8
Postorbital breadth	3.32	3.2-3.5	3.5	3.6
Zygomatic breadth	8.46	8.5-8.7	—	—
Breadth across canines	3.49	3.2-3.7	3.7	3.5
Breadth across molars	5.46	5.1-5.7	5.6	5.8
Maxillary toothrow length	5.30	5.0-5.4	5.1	5.4
Mandibular length	10.03	9.4-10.1	—	—
Mandibular toothrow length	5.73	5.4-5.8	5.6	5.6

district of the Paranean Phytogeographic Province, an environment that was not cited for this species in previous publications (Moratelli *et al.*, 2011; Dias *et al.*, 2015). Our specimens were collected in a mist-net placed over a stream surrounded by dense vegetation of forests.

As Moratelli *et al.* (2011) indicated that they expected that this new species could be extended further south, including Uruguay; our samples confirm that prediction and expand the distribution of this species for about 650 km to the southwest of the currently known limits. This is also the first citation of this species out of Brazil.

***Myotis lavalis* Moratelli, Peracchi,
Dias, and de Oliveira, 2011**

Specimens examined (2): Argentina, Salta Province: Finca Alto Verde, aproximadamente 20 km SW Orán, Orán Department (23°13'S, 64°32'W), 670 m (Fig. 1), two females (CML 7622 and 7623) collected on September 14, 2006, by Daniela Miotti.

This species was recently described by Moratelli *et al.* (2011), through an holotype and 29 paratypes, found deposited in systematic collections, from three localities in northeastern Brazil. Most of these localities are situated in the northeastern Brazilian Caatinga ecosystem, with the exception of one, but all are from sub-humid and deciduous forest formations, with distinctive lower temperatures compared with other adjacent localities in lower altitudes (Moratelli *et al.*,

2011). Later Moratelli & Wilson (2013) added new distributional records for the Alto Chaco in Paraguay and for the Atlantic Forest of Brazil and Paraguay, extending the distribution of this species for about 2,000 km southwest and 400 km east.

In September 2006, we have captured at the Finca Alto Verde, a series of 15 specimens of *Myotis* of which two (CML 7622, 7623) were very different from the rest by their reddish brown coloration, and we have not been able to identify them as belonging to any of the known species of the genus. Our first impression, based on coloration, that this could be a geographical variation of *M. ruber*, was discarded in the laboratory because of the cranial morphology, distinctly smaller body size and general measurements of the specimens. These specimens were kept at the CML identified as *Myotis* sp. until *Myotis lavalis* was described by Moratelli *et al.* (2011); then, when we compared our specimens with the new species, we found that all the diagnostic characters matched perfectly with those of our sample.

Description and comparisons

This is a small to medium species of *Myotis* with a forearm of 31.5 to 37 mm, long and silky fur, length of dorsal hairs 6 to 7 mm. Dorsal coloration strongly bicolor, hairs with dark brown bases and light-brown tips, ventral fur strongly bicolor with dark brown bases and cinnamon-buff tips (Fig. 3). Other characters of this species are the absence of a fringe of hairs in the trailing edge of the uropatagium, plagiopatagium attached to the toes, sagittal

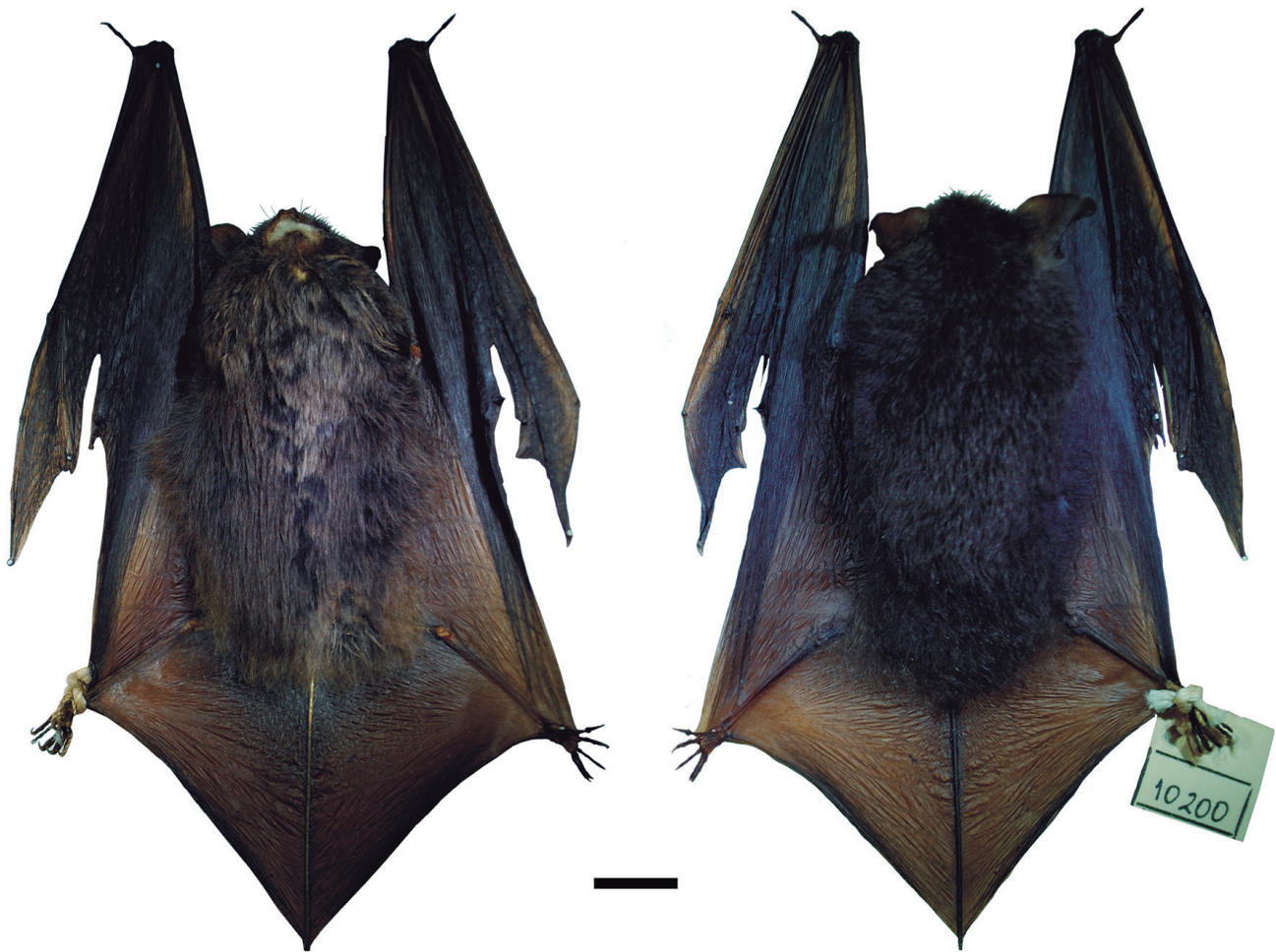


FIGURE 2: Dorsal (right) and ventral (left) view of *Myotis izecksohni* (CML 10200) from, Parque Provincial de la Sierra “Ing. Agrónomo Martínez-Crovetto”, Misiones, Argentina. Scale: 10 mm.

crest present, and second upper premolar not displaced to the lingual side, but generally aligned in the toothrow.

Coloration, morphometry, and skin and skulls characters (Table 2) of the specimens from Salta coincide exactly with the characters described for *M. lavalii* in Moratelli *et al.* (2011).

In the current area of distribution of *M. lavalii* in Argentina, other five species of the genus can be also found (Barquez, 2006; Barquez & Díaz, 2009). It cannot be confused with *M. albescens* because this has a strongly frosted dorsal pelage, a light colored venter, almost pure white on the abdomen and perianum and sides of the body, and pale wings membranes. From *M. dinelli* can be differentiated by the more reddish coloration, while *M. dinelli* is more yellowish and the edge of the uropatagium is whitish and have a fringe of hairs, although not very evident, and the face is very dark, almost black. Differentiation with *M. keaysi* is simple because this is clearly bigger, with the forearm more than 40 mm, general coloration dark and dorsal side of uropatagium covered by hairs that overpass the knees. *Myotis*

nigricans is similar in size but the fur is shorter, their general coloration is much darker, not reddish, and dorsal hairs are almost unicolor or slightly bicolor but never as well differentiated as in *M. lavalii*, and the sagittal crest is always absent. Finally, *M. riparius* is also similar in size (forearm 34.2–36.0 mm) but both can be differentiated because the dorsum of *M. riparius* have some hairs with yellowish tips giving this species a slight frosted appearance, and also has a small P2 that is displaced to the lingual side of the toothrow.

Distribution and general comments

The new records extend the distribution of this species, approximately 360 km to the southwest, to the province of Salta, in Argentina. Previous records are from localities of the Caatinga and Atlantic Forest of Brazil and the Alto Chaco of Paraguay. Our specimens add the Yungas which, like the Atlantic Forest, is a forest ecoregion, different from the xeric vegetation known so far for the distribution of this species.

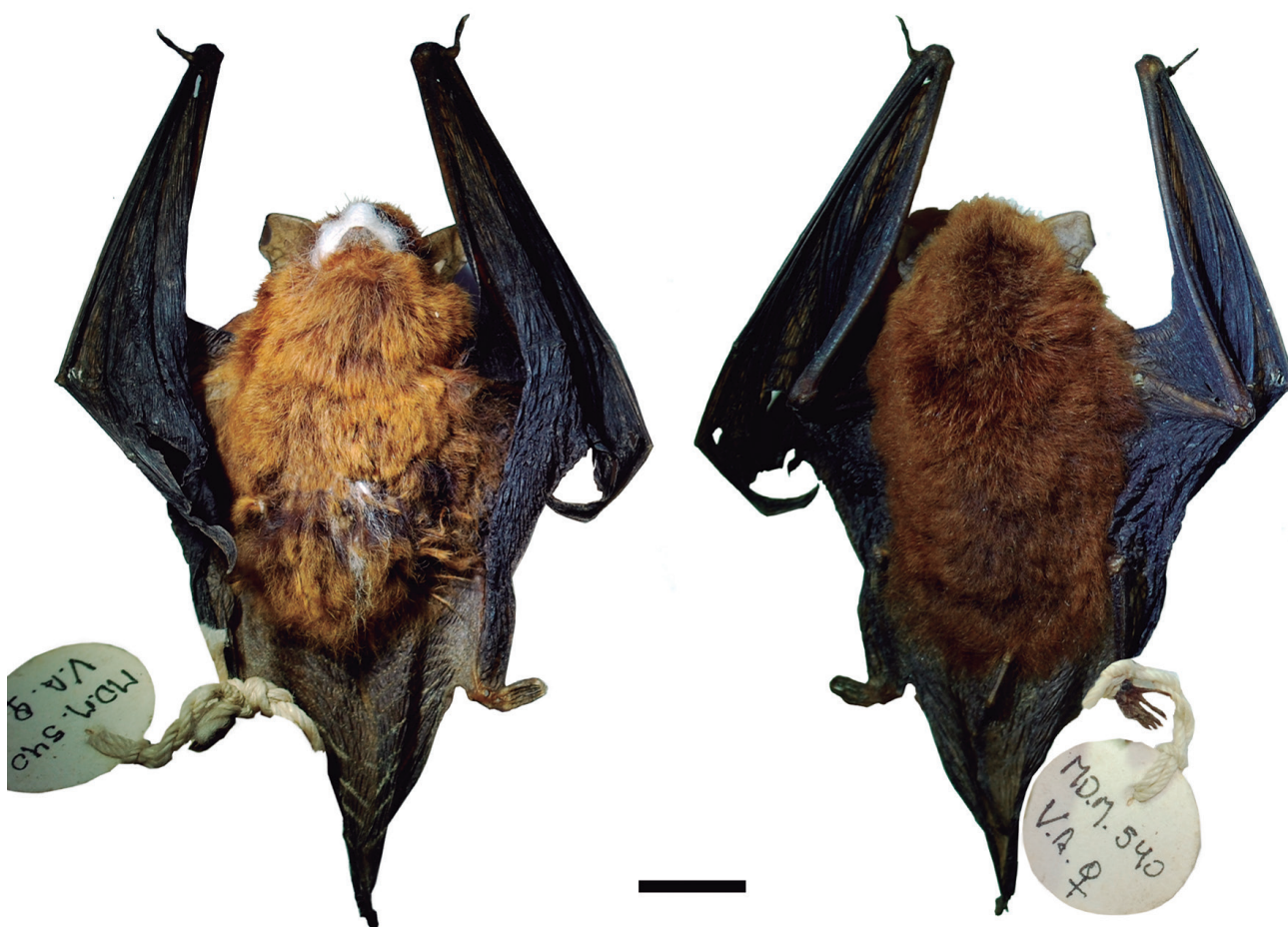


FIGURE 3: Dorsal (right) and ventral (left) view of *Myotis lavalii* (CML 7623) from Finca Alto Verde, Salta, Argentina. Scale: 10 mm.

The only two specimens collected were adult females, probably nulliparous according to the condition of their mammae, which were small, whitish, and covered by hairs.

It is remarkable how the descriptions of new species of *Myotis* have increased in recent years, as well as changes in the taxonomic status of several subspecies, that makes clear the importance and value of studying the museum collections to enlighten several aspects of systematics, distribution, and natural history of a fauna in need of urgent measures that favor their preservation. Also, the new investigations are favoring the scientific knowledge of the genus so allowing to improve our understanding of the evolutionary history of the group in South America.

RESUMEN

Siete nuevas especies de *Myotis* han sido recientemente descritas en Sud América elevando a 20 el número de especies del género conocidas para la región. *Myotis izecksohni* y *Myotis lavalii* han sido descritas recientemente mediante ejemplares procedentes de los Estados de Río de Janeiro, Paraná y Pernambuco, Brasil. Estas

especies son claramente diferentes de todas las otras conocidas del género, tanto en sus características externas como craneales, dichos caracteres coinciden exactamente con los de ejemplares encontrados en Argentina. Estos hallazgos permiten extender significativamente la extensión distribucional de las dos especies, e incluir a *Myotis lavalii* en la eco-región de las Yungas en la provincia de Salta, y a *Myotis izecksohni* en la eco-región de los Campos y Malezales de la provincia de Misiones. Dichas eco-regiones no eran conocidas para la distribución de las nuevas especies.

PALABRAS-CLAVE: Campos y Malezales; Distribución; Misiones; Salta; Yungas.

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