



First records of *Myotis nigricans* (Schinz, 1821) (Chiroptera, Vespertilionidae) and two new localities for three bat species in Santa Fe province, Argentina

María Eugenia Montani^{1,2,3}, Marcelo Daniel Gamboa², Franco Nicolás Fabre², Leandro Raúl Antoniazzi⁴, Victoria Arancio⁴, Jaime Fernando Carmona⁵, Andrés Alberto Pautasso^{2,6}, Valeria Carolina Colombo⁴

1 Museo Provincial de Ciencias Naturales “Dr. Ángel Gallardo”, San Lorenzo 1949, Rosario (2000), Santa Fe, Argentina. **2** PCMA (Programa de Conservación de los Murciélagos de Argentina), Miguel Lillo 251, San Miguel de Tucumán (4000), Tucumán, Argentina. **3** Programa de Investigaciones de Biodiversidad Argentina, Miguel Lillo 251, San Miguel de Tucumán (4000), Tucumán, Argentina. **4** Laboratorio de Ecología de Enfermedades, Instituto de Ciencias Veterinarias del Litoral, UNL – CONICET. R.P. Kreder 2805, Esperanza (3080), Santa Fe, Argentina. **5** Sección Fauna Urbana, Salubridad y Fumigaciones, Secretaría de Servicios Públicos, Municipalidad de Esperanza. Aaron Castellanos 1543, Esperanza (3080), Santa Fe, Argentina. **6** Museo Provincial de Ciencias Naturales “Florentino Ameghino”, Santa Fe. 1ª Junta 2859, Santa Fe (3000), Santa Fe, Argentina.

Corresponding author: María Eugenia Montani, euge.montani@gmail.com

Abstract

We present the first records of *Myotis nigricans* (Schinz, 1821) for Santa Fe province, Argentina. Four specimens were collected in the following localities: Esperanza (Las Colonias department), Laguna Paiva (La Capital department), and Rosario (Rosario department). These records extend the distribution area of *M. nigricans* 380 km to the south and increase the number of bat species in Santa Fe to 23. Additionally, Esperanza and Rafaela are added as new localities for *Eumops glaucinus* (Wagner, 1843), *Molossops temminckii* (Burmeister, 1854), and *Lasiurus blossevillii* (Lesson & Garnot, 1826).

Key words

Black myotis; distribution; range extension; Molossidae; *Eumops glaucinus*; *Molossops temminckii*; *Lasiurus blossevillii*.

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Introduction

The province of Santa Fe, in the central-eastern region of Argentina, occupies an extensive plain area (10–150 m a.s.l., 132,638 km²; Biasatti et al. 2016) where 4 phyto-geographic provinces—Chaqueña, Espinal, Pampeana,

and Paranaense—are represented (Cabrera 1994). Mainly in its northern zone, this province has suffered a high rate of deforestation, first by the wood industry and later by replacement of native forests by agriculture, mostly soy (Medan et al. 2011, Morello et al. 2012, Facciano and Diedrich 2013). Between 1915 and 1956, nearly 2.9

million ha of forest were lost (Zarrilli 2008), and more recently, in the period 2007–2016 the loss of native forests reached 30,863 ha (Dirección de Bosques de la Nación, Secretaría de Ambiente y Desarrollo Sustentable de la Nación, Unidad de Manejo del Sistema de Evaluación Forestal 2017).

With 22 bat species recorded, Santa Fe harbors at least one-third of the bat diversity found in Argentina (66 species; Díaz et al. 2016, Urquizo et al. 2017). These records are based on the work of zoologists such as Cabrera (1938), Yepes (1944), and Crespo (1974), and on more recent contributions by Vaccaro (1992), Barquez (2006; see also Barquez and Ojeda 1992, Barquez et al. 1993, 1999), Pautasso (2008; see also Pautasso and Arnau 2009, Pautasso et al. 2009), and Pavé et al. (2017). The Black Myotis (*Myotis nigricans*) has been cited from Santa Fe (Moggia 1997), but without proper support (no material vouchered); consequently, Barquez et al. (1999), Barquez (2006), and Barquez and Díaz (2009) did not recognize the record.

In this study, we provide the first vouchered record of *M. nigricans* for Santa Fe and add 2 new localities for 3 species still poorly known in this province: the molossids *Eumops glaucinus* and *Molossops temminckii*, and the vespertilionid *Lasiurus blossevillii*.

Methods

Specimens from Esperanza and San José del Rincón were obtained in the course of the project “Ecoepidemiología de patógenos de importancia para la salud pública y animal en fauna sinantrópica del centro de la provincia de Santa Fe”. They were captured in 12 m long mist nets opened from 20:00 to 2:00 during 3 consecutive nights. Our methods for handling and preparation were approved by the Ethics and Safety Committee of the Universidad Nacional del Litoral (Expte. FCV-0869428-17). License

for collecting specimens was provided by the Ministerio de Medio Ambiente de la Provincia de Santa Fe (Expte No. 02101-00181129-9, Resolution No. 093/2018). Specimens were stored in the Museo Provincial de Ciencias Naturales “Florentino Ameghino” (MFA) of Santa Fe. Specimens from Laguna Paiva, Rafaela, and Rosario were collected and donated to the same museum by the Dirección General de Bioquímica y Farmacia, Laboratorio Central, Santa Fe province.

Unless otherwise stated, specimens were prepared as skin, skull, and skeleton. Tissue samples were also collected for some individuals and are preserved in 96% ethanol. These samples were also stored in the Museo Ameghino. External and cranial measurements were obtained according to Díaz et al. (1998) and Barquez et al. (1999). The taxonomic identification was carried out according to Díaz et al. (2011, 2016) and descriptions were prepared following Barquez et al. (1999).

Results

Vespertilionidae

Myotis nigricans (Schinz, 1821)

New records. Four specimens examined:

Argentina, Santa Fe province, La Capital department, San José del Rincón, Villa California (31°36'07.6" S, 060°36'00.26" W), 2 adult males with scrotal testes (MFA-ZV-M 1406, 1407), collected by ME Montani and VC Colombo, 28 February 2018, in a private field on the shore of Laguna Setúbal, vegetation is mainly exotic, with predominance of *Eucalyptus* sp.

Argentina, Santa Fe province, La Capital department, Laguna Paiva (31°19'S, 060°23' W), 1 adult male (MFA-ZV-M 1331, preserved in 70% ethanol, later prepared as skin and skull), collected and donated by the Dirección General de Bioquímica y Farmacia, Laboratorio Central,

Table 1. Measurements[†] of *Myotis nigricans* from Santa Fe province, Argentina, and comparative data provided by La Val (1973; neotype), Barquez (1999; multiple localities in Argentina), and Moratelli et al. (2011; multiple localities in South America).

	MFA-ZV-M:1406	MFA-ZV-M:1407	La Val (1973)	Barquez et al. (1999)	Moratelli et al. (2011)
Total length	78.5	80.00	—	74.0–92.0	—
Tail length	31.5	32.00	—	30.0–40.0	—
Hindfoot length	8.00	8.00	—	5.7–8.0	—
Ear length	13.00	14.00	—	10.0–15.7	11.4 (8.0–15.0)
Forearm length	33.52	32.68	35.5	32.0–36.2	33.9 (30.5–38.9)
Weight	5.5	5.00	—	3.8–8.0	—
Greatest length of skull	13.7	13.9	13.9	12.9–14.3	12.62–14.14
Breadth of braincase	6.62	6.6	—	6.1–7.1	—
Postorbital breadth	3.41	3.48	3.6	3.2–3.7	—
Zygomatic breadth	8.62	8.36	—	8.2–8.8	—
Mastoid breadth	6.99	7.15	7.1	6.7–7.2	—
Length of maxillary toothrow	4.98	5.15	5.0	4.8–5.4	—
Width across canines	3.45	3.51	3.4	3.2–3.7	—
Width across molars	5.37	5.41	—	5.1–5.6	—
Length of mandible	9.58	10.04	—	9.4–10.1	—
Length of mandibular toothrow	5.35	5.58	6.4	5.0–5.6	—

[†]Weights in grams, other measurements in millimeters.

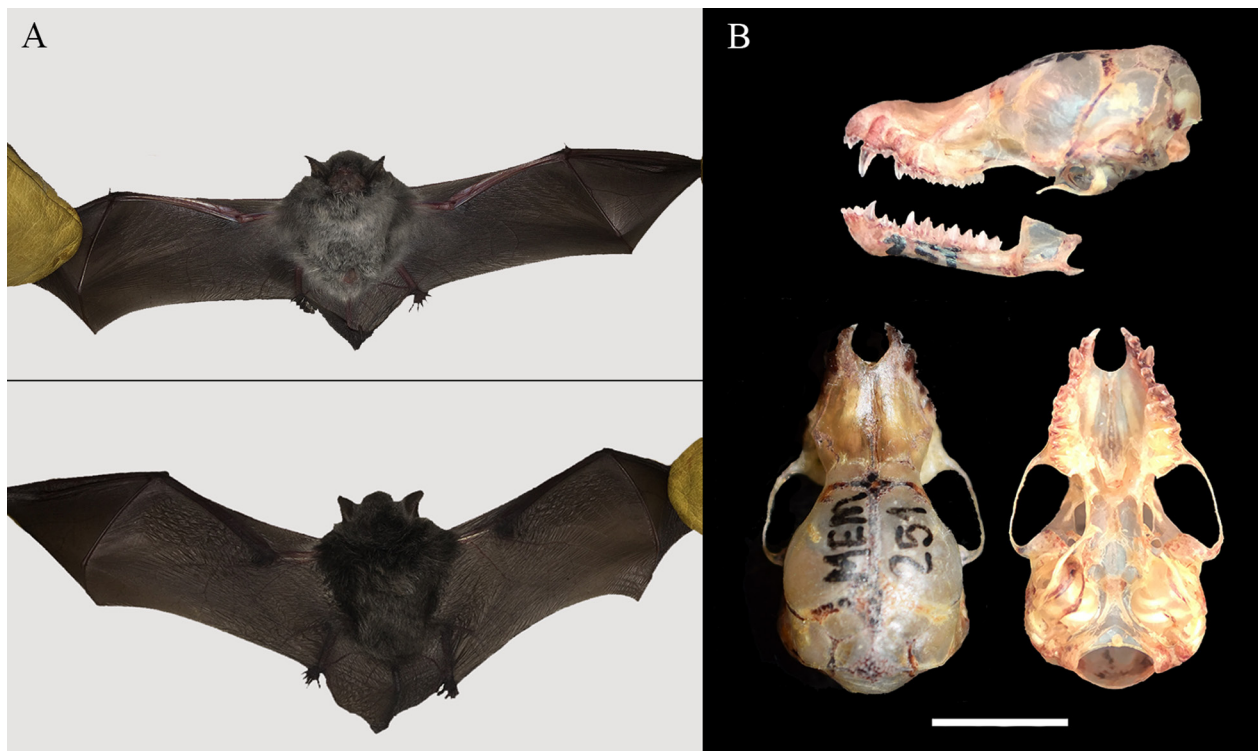


Figure 1. Adult male of *Myotis nigricans* (MFA-ZV-M: 1407) from Villa California, San José del Rincón, La Capital department, Santa Fe province, Argentina. **A.** Ventral and dorsal view. **B.** Lateral, dorsal, and ventral views of the skull and lateral view of the mandible. Scale bar = 5 mm.

2011, habitat data for collection site unknown.

Argentina, Santa Fe province, Rosario department, Rosario (32°57' S, 060°39' W), 1 adult male (MFA-ZV-M 1391, preserved in 70% ethanol), collected and donated by the Dirección General de Bioquímica y Farmacia, Laboratorio Central, 2011, in the center of the city.

Identification. The specimens studied present the following characters: forearm length between 32 and 36 mm; skull small and with a short face and no sagittal crest (Table 1; specimens donated not included due to skull damaged derived from rabies analysis); P2 aligned with other upper jaw teeth (Fig. 1); dorsal fur silky and bicolored, with a slight contrast between the dark base and the slightly paler tip; dark membranes; plagiopatagium attached at feet by a board band of membrane; and posterior border of the uropatagium lacking a fringe of hair. These features allow us to differentiate them from *Myotis levis* (Geoffroy, 1824), also present in the study area (Barquez et al. 1999, Pautasso 2008, Barquez and Díaz 2009, Moratelli et al. 2011, Díaz et al. 2016, Barquez et al. 2017).

Molossidae

Eumops glaucinus (Wagner, 1843)

New record. Argentina, Santa Fe province, Las Colonias department, Esperanza, Sociedad Rural “Las Colonias” (31°25'32.37" S, 060°59'28.32" W), 1 adult male with scrotal testes (MFA-ZV-M 1408), collected by ME Montani, VC Colombo, and LR Antoniazzi, January 2018, in a forested area bordered by cultivated fields, mainly

Eucaliptus sp. and *Tipuana tipu*.

Identification. The specimen agrees with descriptions of *E. glaucinus* provided by Barquez et al. (1999) and Barquez and Díaz (2009): length of forearm 63.2 mm; dorsal coloration blackish cinnamon, with the bases of hair lighter; tragus nearly square; ears united by a narrow band on the forehead; skull elongated and with a narrow rostrum and reduced sagittal crest; and M3 with the third commissure rudimentary. Dorsally, hairs are present over the arms, forearms, and along the sides of the body and plagiopatagium, whereas ventrally they extend only over the plagiopatagium and propatagium (Vaccaro 1992, Barquez et al. 1999). Because of its medium-sized body (for the genus), *E. glaucinus* can be confused with *Eumops auripendulus* (Shaw, 1800). These species, however, can be differentiated by coloration (dark or blackish brown in *E. auripendulus* vs paler in *E. glaucinus*), tragus shape (small and triangular in *E. auripendulus* vs small and square in *E. glaucinus*), and forearm length (61.0–69.0 mm in *E. auripendulus* vs 58.0–64.5 in *E. glaucinus*).

Molossidae

Molossops temminckii (Burmeister, 1854)

New records. Three individuals were released after examination and collection of tissue samples:

Argentina, Santa Fe province, Las Colonias department, Esperanza, Sociedad Rural “Las Colonias” (31°25'32.37" S, 060°59'28.32" W), 2 adult individuals, a male with scrotal testes (Fig. 2) and a female with closed vagina, captured and photographed by ME Montani, VC



Figure 2. Adult male of *Molossops temminckii* from Sociedad Rural "Las Colonias", Esperanza City, Las Colonias department, Santa Fe province, Argentina.

Colombo, MD Gamboa, and LR Antoniazzi, January 2018, in a forest area bordered by cultivated fields with predominate of *Eucalyptus* sp. and *Tipuana tipu*.

Argentina, Santa Fe province, Las Colonias department, Esperanza, Arroyo Cululú (31°21'41.91" S, 060°56'57.44" W), 1 adult male with scrotal testes captured and photographed by ME Montani, VC Colombo, and MD Gamboa, January 2018, in a grassland area with Aromitos (*Vachellia caven*) patches and located adjacent to a stream.

Identification. The examined individuals agree with the

description of *M. temminckii* by Barquez et al. (1999) and present the following characters: small body size (forearm 29.0–32.5 mm; it is the smallest molossid in Argentina); ears small, triangular, and well separated; snout elongated and flat; dorsal fur darker distally, presenting gray tones, and lighter at the base, with cream tones; and ventral fur cinnamon and extending over the membranes.

Vespertilionidae

Lasiurus blossevillii (Lesson & Garnot, 1826)].

New record. Argentina, Santa Fe province, Castellanos department, Rafaela (31°15'01.20" S, 061°29'12.10" W), 1 adult female with open vagina (MFA-ZV-M 1412, preserved in alcohol), collected and donated by the Dirección General de Bioquímica y Farmacia, Laboratorio Central, April 2018, in the center of the city.

Identification. Fur completely covering the dorsum of the uropatagium, but not extending beyond its posterior border. The lower part of the back has an orange fur, whereas the upper part is gray washed with reddish, with many hairs with the white tips, similar to *Lasiurus cinereus* (Palisot de Beauvois, 1796), which is also present in the area. The ventral region is yellowish (Barquez et al. 1999, Aguirre 2007). However, the specimen collected shows a strongly reddish tone, especially in the neck area. Also, the ears are small and rounded, and the tragus and muzzle are short. The forearm length (40.12

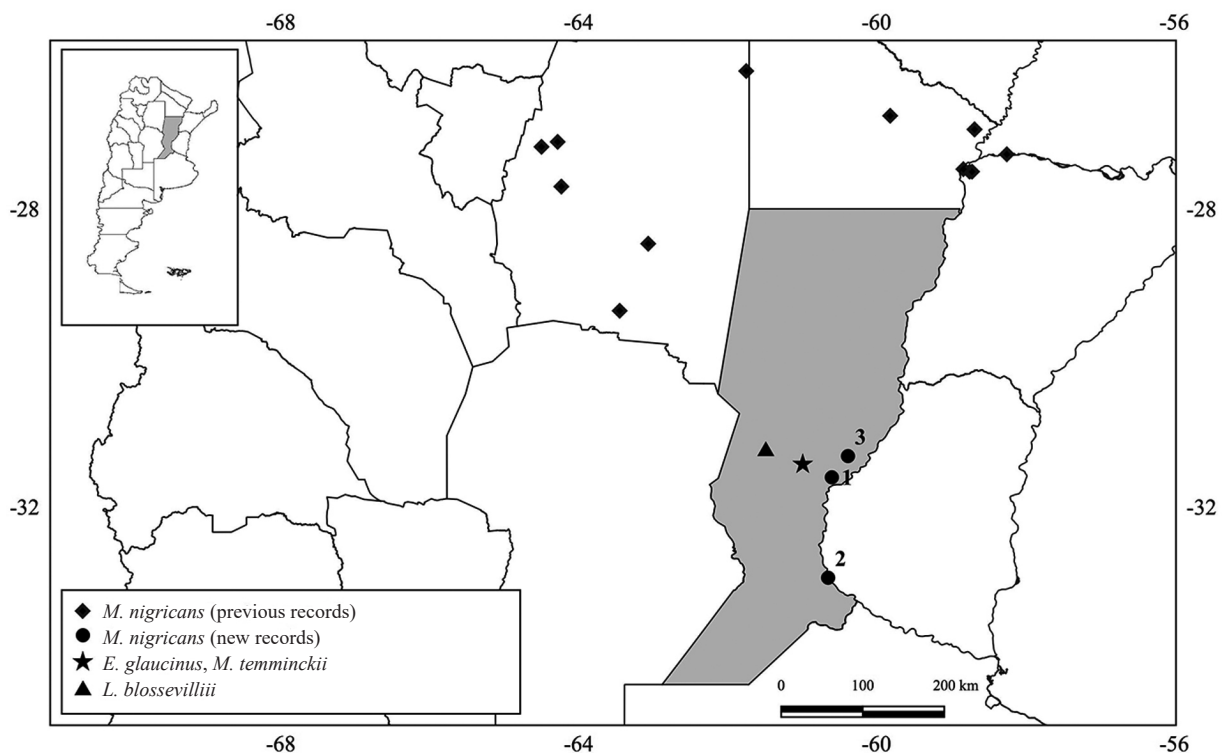


Figure 3. New records of *Myotis nigricans* from Santa Fe province, Argentina and previous records in nearby localities: diamonds = records compiled by Barquez et al. (1999); circles = new localities: (1) Villa California, San José del Rincón, La Capital department; (2) Rosario, Rosario department; (3) Laguna Paiva, La Capital department. Star = Esperanza, new locality for *Eumops glaucinus* and *Molossops temminckii*. Triangle = Rafaela City, new record for *Lasiurus blossevillii*.

mm) is within the range (37.7–41.3 mm) for *L. blossevillii* (Barquez et al. 1999).

Discussion

The 4 collected specimens of *M. nigricans* correspond to the descriptions proposed by La Val (1973), Wilson and Laval (1974), Barquez et al. (1999), Moratelli et al. (2011), Díaz et al. (2016), and Barquez et al. (2017). Measurements provided here are close to those from the neotype designated by La Val (1973) and are within the range provided by Barquez et al. (1999) for Argentine specimens and by Moratelli et al. (2011) (Table 1). *Myotis nigricans* is widely distributed in South America, where it seems to be absent only from Chile (Díaz et al. 2016). In Argentina, it can be found in the following provinces: Catamarca, Chaco, Corrientes, Formosa, Jujuy, Misiones, Salta, Santiago del Estero, and Tucumán (Barquez et al. 1999, Barquez and Díaz 2009). Thus, the new record from Rosario City, extends the known distribution of this species by approximately 380 km from the previous southernmost record in Sumampa (29°22' S, 063°27' W), Quebrachos department, Santiago del Estero province (Fig. 3) (Barquez et al. 1999). Ecologically, however, the new sites are similar to habitats of this species reported by Barquez et al. (1999).

Like *M. nigricans*, *L. blossevillii* is widely distributed in South America, lacking records only from Chile (Díaz et al. 2016). In Argentina, this species has been recorded only in the more northern and central provinces, including Buenos Aires, Catamarca, Chaco, Córdoba, Corrientes, Entre Ríos, Formosa, Jujuy, La Pampa, Misiones, Salta, Santa Fe, San Juan, Santiago del Estero, and Tucumán (Barquez and Díaz 2009). To the previous records in Santa Fe, La Capital department (Barquez et al. 1999, Romano et al. 1999, Barquez 2006, Pautasso 2008), we added Rafaela City, Castellanos department, which represents both a new locality and new department record.

In South America, *Eumops glaucinus* is known to occur in the north of Argentina, Bolivia, Brazil, Colombia, Ecuador, Guyana, Paraguay, Peru, and Venezuela (Gardner 2008, Díaz et al. 2016). In Argentina, it can be found in Chaco, Jujuy, La Rioja, Misiones, Salta, and Tucumán (Vaccaro 1992, Barquez et al. 1999, López Berzbeitia and Díaz 2013, Gamboa Alurralde et al. 2016). This species was recently reported by Pavé et al. (2017) from Santa Fe province, based on a specimen collected in the city of Santa Fe (La Capital department). Our specimen is, therefore, the second record for this province.

Molossops temminckii is found in South America (Gardner 2008), with records in Argentina, Bolivia, Brazil, Colombia, Ecuador, Guyana, Paraguay, Peru, Uruguay, and Venezuela (Díaz et al. 2016). In Argentina, it has been reported in Buenos Aires, Chaco, Chubut, Corrientes, Formosa, Misiones, Jujuy, Salta, Santa Fe, Santiago del Estero, and Tucumán. In Santa Fe, Pautasso (2008) cited the species, based on bibliography, from General Obligado and La Capital departments. We added

Esperanza, Las Colonias department, which is a new locality for Santa Fe.

Bats have been intensively studied in Argentina in recent decades, but the majority of these studies were conducted in the northwest region of the country, mainly in the provinces of Jujuy, Salta, Tucumán, Catamarca, and La Rioja (Mares et al. 1989, 1995, 1996, Barquez and Ojeda 1992, Barquez et al. 1993, 1999, 2009, 2017, Barquez and Díaz 2001, 2009, Barquez 2006, López Berzbeitia 2013, Díaz et al. 2016, Gamboa Alurralde et al. 2016, Urquizo et al. 2017). Knowledge on the diversity and distribution of the Santa Fe bat fauna has increased along the last century, but only due to reports based on occasional collections. This province still represents, therefore, an information gap in the distribution of many species, as highlighted by the new records assigned here. Additional systematic surveys will be important to fill this gap and help to provide a more accurate view of the bat diversity in Argentina

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Authors' Contributions

MEM collected, identified and prepared part of the specimens, took the pictures (specimen and skull), wrote and revised the manuscript; MDG collected, identified and prepared part of the specimens, wrote and revised the manuscript; FNF collected, identified and prepared part of the specimens; LRA facilitated the access to sampling sites, collected and identified specimens; VA collected specimens; JFC collected specimens; AAP collected, identified part of the material and prepared part of the specimens, wrote the manuscript and took skull photos; VCC facilitated the access to sampling sites, collected, identified specimens and revised the manuscript.

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