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FIRST RECORD OF *RHAGOMYS* (MAMMALIA: SIGMODONTINAE) IN BOLIVIA

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A recent monograph on the biological diversity of Bolivia concludes that the country is megadiverse (Ibisch and Merida, 2003); this statement is especially true for mammals. Despite being a landlocked country and representing only 6% of the geographic area of South America, Bolivia harbors the 4th most-diverse mammalian fauna of the continent (Ceballos and Simmonetti, 2002). However, the country remains poorly explored, as reports of new taxa for science or the country have recently been published (Pacheco et al., 2004; Rios-Uzeda et al., 2004; Solmsdorff et al., 2004; Emmons and Patton, 2005). These new records and species, coupled with further advances in the taxonomy and systematics on Neotropical mammals have rendered sections of Anderson's book Mammals of Bolivia (Anderson, 1997) obsolete in less than a decade after its publication. Accordingly, in this paper, we report a new genus and species of mammal for the fauna of Bolivia.

Measurements of the animal followed Luna and Patterson (2003) except for greatest length of skull (GLS), taken to be represented by the occipito-nasal length, and CML (Condylomolar length), which was not measured because it was not defined either by Luna and Patterson (2003) or any of the references cited therein (Myers et al., 1990; Voss, 1991 or Musser et al., 1998).

Rhagomys longilingua
Luna and Patterson, 2003

The Bolivian record of this distinctive taxon is based on a unique specimen obtained in Parque Nacional y Area Natural de Manejo Integrado Cotapata (PN-ANMI Cotapata, **Fig. 1**). The senior author caught the individual in a pitfall trap on March 28th, 2003 at Bajo Hornuni (16° 12.8' S, 67° 53.2 W, 1860 m elevation), prepared the animal as round skin and skull and deposited the specimen in the Colección Boliviana de Fauna, where it was assigned the catalog number CBF 7620. The specimen is a juvenile female, toothwear class TWC 1 of Voss (1991), as judged by the wooly pelage, the incomplete ossification of the basisphenoid-basioccipital suture, and the absence of wear in any of the molars.

The Bolivian specimen (CBF 7620) is identified as *Rhagomys longilingua* by the following diagnostic characters: the texture of the pelage is markedly spiny; all digits of manus and pes have broad, squared-shaped, blunt, and callous tips and deep transversal grooves. Finger tips bear a crescent-shaped depression and the hallux bears a nail instead of a claw. Cranially, CBF 7620 bears a large oval-shaped fontanelle in the parapterygoid fossae (**Fig. 2**). Its M3 has only a paracone and protocone, m2 and m3 are nearly the same size, with distinct

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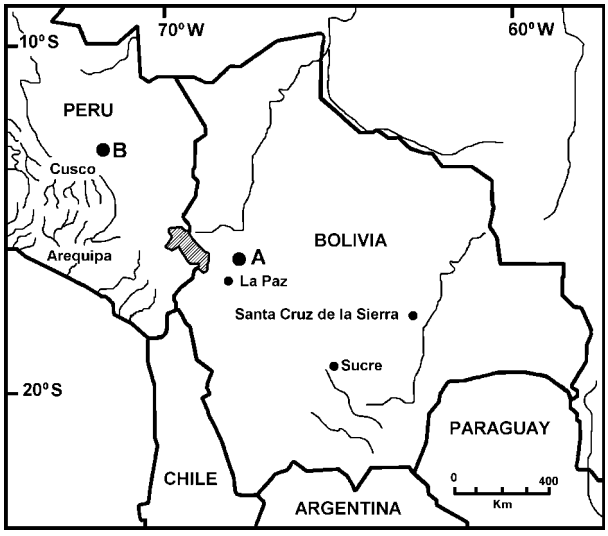

Fig. 1. Map of the localities mentioned in the text. A: Bajo Hornuni in the Parque Nacional y Area de Manejo Integral Cotapata; B: the type locality of *Rhagomys longilingua* in Peru.

metaconid, protoconid, posterolophid and hypoconid elements, and all mandibular teeth (m1-m3) have a posterocrista. The only diagnostic tooth character for *R. longilingua* missing in CBF 7620 is the anteromedian crista on M1, which in *R. longilingua* protrudes from the anterolabial conule. Other diagnostic features such as the length of the tongue were not recorded at the time of capture of CBF 7620 and are now missing.

The pelage coloration in CBF 7620 is strongly countershaded, resembling the description of *R. longilingua* (Luna and Patterson, 2003) except that the pelage in the Bolivian specimen is grayer on the dorsum and rump, with a woolly appearance presumably due to its youth. As in Peruvian *R. longilingua* the underparts of CBF 7620 are Light Ochraceous-Buff (Ridgway, 1912). However, CBF 7620 has a small patch (5 by 7 mm) of whitish hairs on the chest that is consistently missing in the Peruvian specimens.

The skull of CBF 7620 is strongly built; it bears a short rostrum, posteriorly divergent, beaded supraorbital margins, but only weak postorbital processes (**Fig. 2**). In profile, the skull appears slightly more convex than shown by Luna and Patterson (2003), but differences may be due to age. Other differences between CBF 7620 and the depicted paratype of *R. longilingua* include the size of the posterior opening of the alisphenoid canal, which in CBF 7620 is larger across than the strut of bone separating it from the foramen ovale accessorius, whereas it is about half as long in *R. longilingua*. The shape of the foramen ovale accessorius also differs, being clearly triangular in CBF 7620 as opposed to oval-shaped in *R. longilingua*. The posterolateral palatal pits depicted in Luna and Patterson (2003) are well defined and appear as single depressions on both sides of the mesopterygoid fossa, whereas on CBF 7620 the right side of the fossa presents three depressions and the left side only one. These and other minor morphological differences could be the result of geographic or interpopulational variation as seen in other groups of sigmodontine rodents (e.g., Musser et al., 1998). No postcranial or soft anatomic details were preserved for CBF 7620.

External, cranial and molar morphometric data for the Bolivian specimen demonstrate the smaller size of this individual (**Table 1**);

Fig. 2. Dorsal, ventral and lateral views of the cranium and mandible of *Rhagomys longilingua* from Bolivia (CBF 7620). Scale bar = 5mm

except for one measurement (IFB), all measurements of CBF 7620 are smaller than reported for *Rhagomys longilingua* (n=3 for external characters, n=2 for dental and cranial characters). The incisive foramen of the Bolivian specimen is wider than either of the two measured by Luna and Patterson (2003). Because CBF 7620 is a young individual some morphometric differences were to be expected, others may be due to measurers' variation, especially in areas of the skull apparently unaffected by postweaning growth in other sigmodontines (e.g., IBL, IFB, MTL and M1B; Voss 1988).

Ecological notes: The PN-ANMI Cotapata (**Fig. 1**) is located on the eastern slope of the Andes, some 70 km E of La Paz. The park houses abrupt changes in elevation (from 1100 to 5600 m) with concomitant changes in ecological characteristics and vegetation (Ribera-Arismendi, 1995; Paniagua et al., 2003). CBF 7620 was captured in a humid montane forest on the eastern slope of the Andes, characterized by an annual precipitation of less than 2000 mm and temperatures ranging between 17 and 20 °C. The soils at this locality are markedly acidic (pH below 4.5) with strong saturation of Al^{3+}, and a thick organic layer (Back et al., 2003).

The dominant vegetation is that of an open forest, between 15 and 30 m tall with a continuous and dense canopy and emergents that reach 40 m. Among the most important arboreal canopy species are *Hyeronima alchorneoides*, *Morus insignis*, *Liconia triandra*, *Ficus trigona*, *Ficus guianensis*,

Table 1

External and cranial measurements of *Rhagomys longilingua*, CBF 7620, and *Rhagomys rufescens*. Measurements are in millimeters; values are: mean, range, samples size, and standard deviation (in *Rhagomys longilingua*). Data for *Rhagomys longilingua* from Luna and Patterson (2003); data for *Rhagomys rufescens* was compiled from Luna and Patterson (2003), Percequillo et al. (2004), and Pinheiro et al. (2004). Measurements: HBL (head and body length); TL (tail length); HF (hind foot length); E (ear length); DFL (dorsal fur length); MVL (longest mystacial vibrissae length); SVL (longest superciliary vibrissae length); GVL (longest genal vibrissae length); GLS (greatest length of skull); CIL (condylo-incisive length); RL (rostral length); RB (rostral breadth); OFL (orbital fossa length); NL (nasal length); NB (nasal breadth); LIB (least interorbital breadth; DL (diastemal length); BPL (bony palate length); BPB (bony palate breadth across first upper molars); PPL (post palatal length); IFL (incisive foramina length); IFB (incisive foramina breadth); MTL (maxillary tooth row length); PBB (palatal bridge breadth); M1B (first upper molar breadth); ZB (zygomatic breadth); BB (braincase breadth); ZPB (zygomatic plate breadth); ID (incisor depth); BH (braincase height); MFB (mesopterygoid fossa breadth).

	Rhagomys longilingua	**CBF 7620**	***Rhagomys rufescens***
HBL	98 (90-103) 3 7.00	80	92 (75-107) 3
TL	97.7 (93-104) 3 5.686	75	99.67 (93-112) 3
HF	19 (17-20) 3 1.732	13	20.00 (19-21) 3
E	13.9 (13.6-14) 3 0.231	9	13.50 (12-15) 2
DFL	8 (8-8) 2 0	7	7
MVL	36 (35-37) 2 1.414	29	34
SVL	25.5 (25-26) 2 0.707	19	[ ]
GVL	20.75 (20-21.5) 2 1.06	14	17
GLS	28.33	25.34	[ ]
CIL	25.52 (25.02-26.01) 2 0.7	22.99	25.61 (22.69-28.52) 2
RL	7.7	6.92	9.36 (8.1-11.37) 3
RB	5.025 (4.99 - 5.06) 2 0.049	4.44	4.59 (4.12-5.41) 4
OFL	10.61 (10.5 - 10.72) 2 0.156	9.69	10.30 (9.72-10.95) 4
NL	8.55	7.8	8.24 (7.72-8.69) 3
NB	2.95	[ ]	3.09
LIB	5.64 (5.5 - 5.78) 2 0.198	5.30	5.06 (4.83-5.48) 4
DL	7.285 (7.24-7.33) 2 0.064	6.14	7.31 (6.02-8.2) 4
BPL	6.755 (6.65-6.86) 2 0.148	6.09	6.20 (5.72-6.67) 2

(Table 1, cont.)

	Rhagomys longilingua	**CBF 7620**	***Rhagomys rufescens***
BPB	5.095 (4.97-5.22) 2 0.177	4.82	5.29
PPL	8.79 (8.47-9.11) 2 0.453	8.46	[ ]
IFL	3.74 (3.5-3.98) 2 0.339	3.25	3.93 (3.43-4.62) 4
IFB	1.36 (1.28-1.44) 2 0.113	1.48	1.46 (1.34-1.58) 4
MTL	4.405 (4.29-4.52) 2 0.163	4.23	4.57 (4.39-4.73) 4
PBB	2.44 (2.36-2.52) 2 0.113	2.21	4.27 (2.71-5.13) 3
M1B	1.28 (1.26-1.3) 2 0.028	1.21	1.27 (1.23-1.29) 4
ZB	15.87 (15.86-15.88) 2 0.014	14.71	15.75 (13.73-16.76) 3
BB	13.63 (13.37-13.89) 2 0.368	12.01	[ ]
ZPB	3.13 (2.96-3.3) 2 0.24	2.75	3.58 (3.08-4.35) 4
ID	1.825 (1.74-1.91) 2 0.12	1.47	1.80
BH	9.155 (9-9.31) 2 0.219	8.52	[ ]
MFB	1.56 (1.4-1.72) 2 0.226	1.34	[ ]
Weight (gm)	[ ]	21	22 (12-32) 2

Hedyosmum angustifolium, *Virola* sp., *Inga* spp., and some Rubiaceae species of the genera *Ladenbergia* and *Bathysa*.

The pitfall trap where CBF 7620 was captured was surrounded by abundant fallen leaves, branches and fallen coarse tree trunks. The soil had a thick organic layer and humus-type mull 30 cm deep. The senior author also trapped *Akodon fumeus*, *Oxymycterus paramensis*, *Neacomys* n.sp., *Oryzomys yunganus*, *Oligoryzomys destructor*, *Oligoryzomys* indet., *Marmosops noctivagus*, and *Micoureus constantiae* at the site. Vargas et al. (2003) reported *Monodelphis adusta* from the same general area.

This record extends the distribution of *Rhagomys longilingua* by ca. 520 km to the southeast of its type locality in the Manu Biosphere Reserve along Rio Cosñipata (13° 06.032'S, 71° 34.125' W, 1900 m elevation). The species ranges from 450 m (in Peru) to 1900 m (in Peru and Bolivia).

As noted by Luna and Patterson (2003), *Rhagomys* is the first mammalian group to show a disjunct distribution between the Brazilian Atlantic Rainforest (*Rhagomys rufescens*) and the eastern slopes of the Andes (*Rhagomys longilingua*). Other groups show the same pattern of distribution; besides frogs of the *Hyla parvidens* group cited by Luna

and Patterson (2003), we found several groups of birds (e.g., the cotingas *Phibalura flavirostris* and *Phyllomyias fasciatus*, *Phyllomyias sp.* [Snow et al., 2004]), seven species of ferns (Smith et al., 1999), and two species of epiphytic cacti (Ibisch, 1996) that show the same pattern. Therefore, the vicariant nature of these distributions may indicate a once continuous distribution in *Rhagomys* which is now interrupted. Interestingly, it was suggested that such interruption may have occurred around the Plio-Pleistocene as the fluvial terraces of the Chaco, Beni and Pantanal subsided due to tectonic movements (Iriondo, 1993).

Recently, a phylogenetic analysis of sequences of the IRBP gene suggested that *Rhagomys* belongs to a clade containing *Thomasomys*, *Rhipidomys* and *Aepeomys* (D'Elia et al., 2006), which corresponds to the tribe Thomasomyini (sensu Smith and Patton, 1999). Because *Thomasomys* and *Aepeomys* are exclusively Andean in distribution and the more basal species in *Rhipidomys* are found in northwestern Amazonia (Costa, 2003), there is a possibility that *Rhagomys* may have originated in either the premontane forests region of the northern Andes, or the lowland forests of the western Amazonian basin. These areas have also been considered as the potential ancestral areas for the oryzomyines (Weksler, 2006). Therefore, the presence of *Rhagomys* in southeastern Brazil could have been the result of dispersal across the Amazon basin and Cerrado domains, maybe following the Paraná River basin "pathway" discussed by Costa (2003). Our record of *Rhagomys* in Bolivia support Luna and Patterson's suggestion that the genus may be continuously distributed across South America, and thus, collectors working in areas between the forested slopes of the Andes and the Atlantic Rainforest, especially in the interior Atlantic Rainforest of Misiones in Argentina, or south eastern Paraguay should be alert to the possible presence of *Rhagomys* in this area, either *R. rufescens* or a new sister species. Because 3 of the 4 specimens known of *Rhagomys longilingua* — including the new record for Bolivia — were obtained with pitfall traps we suggest the use of this kind of traps in their surveys. We concur with Luna and Patterson (2003) on the importance of *Rhagomys* in understanding the current diversity of the sigmodontine radiation.

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