



A new species of the genus *Oxymycterus* (Mammalia: Rodentia: Cricetidae) from the vanishing Yungas of Argentina

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Abstract

Morphological and molecular studies allowed us to recognize a new species of *Oxymycterus* from the southern end of the Yungas of Argentina. External morphologic traits allow the new species, *Oxymycterus wayku*, to be differentiated from *O. paramensis* and *O. akodontius*, the two currently recognized species for northwestern Argentina, as well as from the remaining species of the genus. Those traits include very dark general coloration, ears covered with nearly black hairs, a white spot on the chin, and claws on fore and hind feet long and robust. Cranial characteristics of the new species include wide and relatively shallow zygomatic notches, proportionally short incisive foramina and molar series, and a relatively robust braincase compared to *O. paramensis*. Phylogenetic analysis based on cytochrome b DNA sequences corroborates the distinctiveness of *Oxymycterus wayku* n. sp. Observed divergence values support this distinction. This new species is particularly important from a conservation viewpoint due to its rarity and the advanced level of alteration of its habitat.

Key words: hociudo, new species, Northwestern Argentina, Sigmodontinae, taxonomy

Introduction

The rodent genus *Oxymycterus* Waterhouse, subfamily Sigmodontinae, is a diverse and geographically widespread group, with records ranging from central Argentina (Buenos Aires province) and southern Uruguay to the Amazon basin (Hershkovitz 1994). This genus was one of the first sigmodontine genera studied (see Azara 1802; Waterhouse 1837). However, as it is the case with most Sigmodontinae (D'Elía & Pardiñas, 2007), *Oxymycterus* remains a relatively poorly understood genus with regard to species limits, phylogenetic relationships, natural history, and distribution. Some of the described forms are only known from the vicinity of their type localities (e.g., *O. hucucha* Hinojosa, Anderson & Patton; *O. misionalis* Sanborn); for others, holotype was not designated in the original descriptions (e.g., *O. rufus* [Fischer]). Fortunately, some researchers (e.g., D'Elía *et al.* 2008; Gonçalves & Oliveira 2004; Hershkovitz 1994; Hoffmann *et al.* 2002; Oliveira 1998) have recently contributed to clarify the taxonomy of parts of the *Oxymycterus* radiation, providing a baseline for the advancement in the knowledge of its diversity and clarification of species limits.

At least 23 nominal forms have been proposed for the entities consistently assigned to this group (Oliveira 1998), but the number of species recognized has fluctuated greatly (e.g., Cabrera 1961; Honacki *et al.* 1982;

Musser & Carleton 1993, 2005; Oliveira 1998; Reig 1987; Tate 1932). This is consequence not only of changes in the taxonomic status of some nominal forms (e.g., *O. akodontius* Thomas; *O. platensis* Thomas; *O. rufus*) described several decades ago, but also to the recent description of many species (*O. amazonicus* Hershkovitz, and *O. caparaoe* Hershkovitz [Hershkovitz 1994, 1998]; *O. hucucha* and *O. hiska* Hinojosa, Anderson & Patton [Hinojosa *et al.* 1987]; *O. josei* Hoffmann, Lessa & Smith [Hoffmann *et al.* 2002]). Currently, 16 species are recognized (Musser & Carleton 2005).

Only *O. paramensis jacentior* Thomas and *O. akodontius* have been reported in northwestern Argentina (Barquez 1976; Barquez *et al.* 1991; Díaz 1999; Mares *et al.* 1981, Mares *et al.* 1989; Mares *et al.* 1997; Ojeda & Mares 1989; Thomas 1921, 1925). These forms are treated by most authors as probably conspecific (Cabrera 1961; Hershkovitz 1994; Honacki *et al.* 1982; Reig 1987; Vitullo *et al.* 1986). Díaz (1999), however, considers them to be distinct species based on coloration pattern (see also Galliari *et al.* 1996).

Extensive field work in northwestern Argentina and review of existing collections led to the discovery of specimens of *Oxymycterus* that could not be assigned to any of the nominal forms of the genus. Here we describe this new form as a new species and compare it, on morphological and molecular grounds, with the rest of the *Oxymycterus* species. In addition, we report a phylogenetic analysis of *Oxymycterus* with the most extensive taxonomic coverage to date; representatives of three nominal forms are here phylogenetically analyzed for the first time.

Materials and methods

Specimens of the new species described here were either trapped with Sherman-like and snap traps baited with oats, or recovered from owl pellets. Animal care and use procedures followed guidelines approved by the American Society of Mammalogists (Animal Care and Use Committee 1998). Trapped individuals were measured, weighted, sexed, and prepared as skin, and complete skeleton, with tissue samples preserved in alcohol. Voucher specimens are housed at Colección de Mamíferos Lillo (CML), Universidad Nacional de Tucumán, Tucumán, Argentina, and Colección de Mamíferos del Centro Nacional Patagónico (CNP), Puerto Madryn, Chubut, Argentina (Appendix 1). Owl pellets samples are housed in the pellets personal collection of Pablo E. Ortiz (PEO-e).

Standard external measures for mammals were recorded: TBL: total body length; TL: tail length, HF: hind foot length (including the claw), EL: ear length, and W: weight. The following skull measurements were recorded following Myers *et al.* (1990): CIL: condyloincisive length, DL: diastema length, RW2: mid rostral width, MTRL: maxillary toothrow length, IFL: incisive foramen length, ZB: zygomatic breadth, BB: braincase breadth, IOC: interorbital constriction, NL: nasal length, RL: rostral length, OL: orbital length, OCW: occipital condyle width, ZP: zygomatic plate depth. Nomenclature used to describe the skull and its structures follows Voss (1988) and Wahlert (1985) and that of the molars corresponds to Reig (1977).

For morphological and morphometrical comparisons specimens were aged based on tooth wear following the general model established by Myers (1989) for the genus *Akodon*. Specimens corresponding to the new species were compared with the original descriptions of all nominal forms currently assigned to *Oxymycterus*, and with specimens determined as *O. akodontius*, *O. hiska*, *O. hucucha*, *O. inca* Thomas, and *O. paramensis* Thomas. These species were selected on the basis of the results of the phylogenetic analysis (see below) and geographic distribution. We conducted a T-test to compare the statistic significance of the morphometric differences between the new species and *O. paramensis*, a similar and geographically adjacent species. Statistical comparisons were not extended to other species due to the limited number of specimens available. Additionally, we performed two principal components analyses (PCA), one for young (ages 1 and 2) and another for adult (ages 3-5) individuals. The PCA for young specimens included a subset of nine dimensions (HFL, EL, CIL, MTRL, IFL, ZB, BB, IOC, NL) for 11 individuals (three of the new species, one *O. akodontius*, one *O. hiska*, one *O. hucucha*, and five *O. paramensis*). The PCA for adult specimens included 11 dimen-

sions (HFL, EL, CIL, MTRL, IFL, ZB, BB, IOC, NL, RL, ZP) for 26 individuals (three of the new species, one *O. hiska*, two *O. hucucha*, one *O. inca*, and 19 *O. paramensis*). The principal components were extracted from a variance-covariance matrix and computed by using the variables after transformations to Log_{10} using the program PC-ORD (McCune & Mefford 1997). The specimens used for these comparisons are listed in Appendix 1.

Genetic variation and phylogenetic analyses were based on the first 801 bases of the cytochrome *b* (*cyt b*) gene. Sequences were taken from GenBank and generated by us following protocols detailed in D'Elía *et al.* (2003). We sequenced the holotype (CML 7247) of the new species, as well as six other specimens determined as *O. delator* Thomas, *O. misionalis*, *O. nasutus* (Waterhouse) and *O. paramensis jacentior*; these sequences were deposited in GenBank (DQ518256-62). The dataset contained 24 specimens belonging to 10 of the currently recognized species of *Oxymycterus* (*sensu* Musser & Carleton 2005). Emphasis was put on those species with broad geographic distribution (e.g., *O. paramensis* and *O. rufus*). The phylogenetic sampling does not include the Brazilian species *O. angularis* Thomas, *O. caparaoe*, *O. hispidus* Pictet, and *O. roberti* Thomas, the central Bolivian *O. hucucha*, nor the northern Bolivian and south central Peruvian species *O. inca*. All specimens analyzed genetically, the source and length of their *cyt b* sequence, are listed in Table 1.

Sequence alignment was done with the program Clustal X (Thompson *et al.* 1997) by using the default values for all alignment parameters. Percentage of observed sequence divergence was estimated with PAUP* (Swofford 2000) ignoring those sites with missing data. Aligned sequences were subjected to maximum parsimony (MP; Farris 1982; Kluge & Farris 1969) and maximum likelihood analyses (ML; Felsenstein 1981). In the maximum parsimony analysis characters were equally weighted and treated as unordered. PAUP* (Swofford 2000) was used to perform 200 replicates of heuristic searches with random addition of sequences and tree bisection reconnection branch swapping. To root the phylogeny we have included as outgroups haplotypes of specimens of *Akodon azarae* (Fischer), *Bibimys labiosus* (Winge), *Blarinomys breviceps* (Winge), *Juscelinomys huancachae* Emmons, and *Scapteromys tumidus* (Waterhouse). *Juscelinomys* is the sister genus of *Oxymycterus* and with it constitutes the *Oxymycterus* division of the tribe Akodontini (*sensu* D'Elía 2003). The other outgroups represent the remaining four akodontine divisions (see D'Elía 2003). Two measures of clade support were calculated. Bremer support values (BS; Bremer 1994) were computed for each node in PAUP* using command files written in TreeRot version 2 (Sorenson 1999). A thousand parsimony jackknife (JK; Farris *et al.* 1996) replications with five addition sequence replicates each and the deletion of one third of the character data were performed. Branches with < 50% of support were allowed to collapse. Maximum likelihood analysis was conducted in PAUP* (Swofford 2000) with 10 replicates of heuristic searches with random addition of sequences, under the GTR+G+I (Rodriguez *et al.* 1990) evolutionary model with the following parameters: A = 0.3089, C = 0.3649, G = 0.1009, T = 0.2253; percentage of invariable sites = 0.546; $\gamma = 1.1966$. This model and its parameters were determined using Modeltest 3.8 (Posada & Crandall 1998) by evaluating the likelihood of 56 substitution models optimized on a neighbor joining tree (Saitou & Nei 1987) calculated from Jukes Cantor (1969) distances. A hundred parsimony jackknife (JK; Farris *et al.* 1996) replications with one addition sequence replicates each and the deletion of one third of the character data were performed as a measure of clade support. As in the case of the MP analysis, branches with < 50% of support were allowed to collapse.

Results

During fieldwork conducted in Tucumán in 2002, we captured five specimens of *Oxymycterus* that could not be assigned to *O. paramensis*, the most common species of this genus in Northwestern Argentina, nor to any other described form of *Oxymycterus*. Phylogenetic analysis based on one additional specimen captured in the same area in 2005 helped to corroborate the distinctiveness of these specimens.

TABLE 1. Sequences used in the phylogenetic analysis and genetic comparisons. Unless noted, all sequences are 801 base pairs in length. For all sequences GenBank accession number are provided. Catalog number and sampling locality are given for those sequences generated in this study. Specimens are or will be deposited in the following collections: Argentina: Colección de Mamíferos del Centro Nacional Patagónico (CNP), Puerto Madryn; Colección Mamíferos Lillo (CML), Tucumán. Paraguay: Museo Nacional de Historia Natural del Paraguay (MNHNP), San Lorenzo. Uruguay: field number of Guillermo D'Elía (GD, vouchers will be deposited at Museo Nacional de Historia Natural y Antropología, Montevideo). For sequences gathered from Genbank additional information can be found in the publications where these sequences were gathered: +, D'Elía (2003); *, Gonçalves & Oliveira (2004); #, Hoffmann *et al.* (2002); ^, Rinehart *et al.* (2005); ¶, Smith & Patton (1993).

Taxon	Locality	Catalog number	Accession number
<i>O. amazonicus</i>			AF454765#
<i>O. dasytrichus</i>			AF454769#
<i>O. dasytrichus</i>			AF454771#
<i>O. dasytrichus</i>			AF516659*
<i>O. delator</i>			AF454767#
<i>O. delator</i>	Paraguay: Itapúa, Estancia San Isidro	MNHNP 2914	DQ518256
<i>O. hiska</i>			U03542 ¹
<i>O. josei</i>			AF175289#
<i>O. judex</i>			AF454774#
<i>O. misionalis</i>	Argentina: Misiones, Reserva Privada de la UNLP “Valle del arroyo Cuña Pirú,” Balneario arroyo Cuña Pirú	CNP 851	DQ518257
<i>O. nasutus</i>			AF175286#
<i>O. nasutus</i>	Uruguay: Rocha, route 9 km 304.800	GD 577	DQ518258
<i>O. paramensis</i>			AY041197 [^] (727 bp)
<i>O. paramensis</i>			U03536 ¹
<i>O. paramensis</i>	Argentina: Jujuy, León, Río Lozano, 3 km upwaters route 9	CNP 852	DQ518260 (786 bp)
<i>O. paramensis</i>	Argentina: Jujuy: San Francisco	CNP 850	DQ518261 (789 bp)
<i>O. paramensis</i>	Argentina: Salta, Pampa Verde, ca. 8 km OSO Los Toldos and S Cerro Bravo, 2400 m	CML 7251	DQ518259 (796 bp)
<i>O. quaestor</i>			AF516661*
<i>O. quaestor</i>			AF454772# (777 bp)
<i>O. rufus</i>			AF516653*
<i>O. rufus</i>			AF516669*
<i>O. rufus</i>			AY275126+
<i>O. rufus</i>			AY275127+
<i>O. wayku</i> , n. sp.	Argentina: Tucumán, ca. 10 km S Hualinchay, on trail to Lara, 2316 m	CML 7247	DQ518262
<i>Akodon azarae</i>			DQ444328+
<i>Bibimys labiosus</i>			DQ444329+
<i>Blarinomys breviceps</i>			AY275112+
<i>Juscelinomys huanchacae</i>			AY275118+
<i>Scapteromys tumidus</i>			AY275133+

Morphological results: The specimens of the new species were morphometrically distinguishable from all species that inhabit the humid eastern slopes of the central Andes (Table 2). The univariate descriptive statistics show that most body (e.g., total body and tail length) and skull measurements (e.g., condyloincisive length, nasal length, rostral length) distinguish the new species from the smaller *O. hiska* and *O. hucucha*, as well as from the larger *O. inca*. The lengths of the incisive foramina and upper molar row were proportionally shorter than those of the other species with the exception of *O. hucucha*. In contrast, some skull width measurements (e.g., zygomatic breadth, skull breadth) are larger in the new species than in the other species, with the exception of *O. inca*. Morphologically, the most similar species to the new species is *O. paramensis*. However, the new species has, on average, a broader rostrum and larger occipital condyle width, narrower zygomatic plate, and shorter tail, maxillary toothrows, incisive foramina and nasals. Differences for average values of these measurements were statistically significant (Table 2). The only morphometric values known for *O. akodontius* (a nominal form synonymized with *O. paramensis* by most authors) are those of the holotype and other specimens deposited at the Natural History Museum (London), which, according to Thomas (1921), are juveniles. Although a comparison among individuals of different ages is not appropriate, some measurements that show continuous growth (e.g., length of the incisive foramen) or that are relatively conservative with age changes (e.g., length of the maxillary toothrow) are larger in these juvenile specimens than in the adults of the new species. The PCA corroborated the distinctiveness of the new species (Tables 3 and 4; Figures 1 and 2). In the young specimens the first three principal components are statistically significant according to the heuristic test of Jackson (1993) and summarize the 90.33% of the total variance. The first principal component (51.28% of the variance) allows to clearly distinguishing the undescribed species from *O. hiska*, *O. hucucha*, and *O. akodontius* by a longer hindfoot and condyle-incisive lengths and a wider zygomatic and braincase breadths. In the morphospace defined by the first two principal components (Fig. 1), the individuals of the new species appear close to but do not overlap with individuals of *O. paramensis*. The second principal component (21.54% of the variance) shows the comparatively short nasals and incisive foramina of the new species. The PCA for adult specimens is more eloquent in showing the distinctiveness of the undescribed species (Fig. 2). The first three principal components summarize the 89.68% of the total variance. Only the first one is statistically significant summarizing the 77.03% of the variance. This component clearly distinguishes the new species from *O. inca*, *O. hiska*, and *O. hucucha* by the condyle-incisive and rostral lengths, and the zygomatic plate and zygomatic breadths. The second principal component (7.45% of the variance) allows distinguishing the new species from all other species. The incisive foramina, the braincase breadth and the hindfoot length are, again, important in species discrimination.

Phylogenetic results: The MP analysis recovered three shortest trees (746 steps; CI = 0.523; RI = 0.657), the consensus of which is shown in Figure 3A. The undescribed species appears in a moderately supported clade (JK = 61; BS = 2) with a polytomy at its base formed by the following five clades: the undescribed species; (((*O. rufus*-*O. josei*) ((*O. judex*-*O. misionalis*) *O. quaestor*)); *O. nasutus*; *O. paramensis*; and *O. hiska*. In two of the shortest trees the undescribed species appears sister to *O. hiska*, while in the remaining tree it is sister to *O. paramensis*. Three additional steps are needed for the undescribed species to be sister to *O. nasutus* and also three extra steps are needed to group it with the clade (((*O. rufus*-*O. josei*) ((*O. judex*-*O. misionalis*) *O. quaestor*))). With regard to the undescribed species, the ML analysis provided similar results (tree score: -ln L = 4405.079; Fig. 3B) to those of the MP analysis. The polytomy described above is resolved, although with very low support. Here the undescribed species appears sister to a clade formed by the remaining species; note that this topology is one of the possible resolutions of the polytomy found in the MP analysis. The main difference between the MP and ML analyses relates to the monophyly of *Oxymycterus*. In the MP analysis the monophyly of the genus is strongly corroborated (JK = 92; BS = 3); however in the ML analysis *Oxymycterus* appears paraphyletic with respect to *Juscelinomys* or, depending on the placement of the root of the tree, to a clade formed by the remaining outgroups. As this study was not designed to test akodontine generic limits nor relationships among genera, we do not further discuss this issue.

TABLE 2. Comparative measurements of adult specimens of *Oxymycterus wayku*, new species, *O. inca*, *O. paramensis*, *O. hiska*, and *O. hucucha*. Measurements for *O. akodontius* are taken from young specimens. Measurements of the holotype of *O. inca* are taken from Thomas (1900), while the observed range is taken from Anderson (1997). Measurements of *O. hiska* and *O. hucucha* were reported by Hinojosa *et al.* (1987), and those of *O. akodontius* by Thomas (1921) and Díaz (1999). Asterisks indicate the variables whose differences were statistically significant ($p < 0.01$) for the comparison between *Oxymycterus wayku*, new species and *O. paramensis*.

	<i>Oxymycterus wayku</i> , new species			<i>Oxymycterus inca</i>			<i>Oxymycterus paramensis</i>		
	n	X ± SD	Range	holotype	n	Range	n	X ± SD	Range
HB	3	134 ± 10	124–144	135	14	120–184	18	135 ± 10	113–153
TL*	3	86 ± 10	77–97	105	14	92 – 140	18	98 ± 6	87–110
HFL	4	31 ± 2	28–32	33	14	25 – 35	18	31 ± 2	28–34
EL	4	19 ± 2	17–21	21	14	19 – 24	20	20 ± 1	18–23
W	4	61.8 ± 13.4	44.5–76.5	-	4	89 – 120	18	63.0 ± 14.8	41–87
CIL	4	30.04 ± 1.26	28.86–31.24	-	-	-	19	30.43 ± 1.31	28.82–33.10
DL	4	7.61 ± 0.35	7.28–8.06	9	-	-	20	7.87 ± 0.62	6.90–9.10
RW2	4	5.88 ± 0.35	5.46–6.18	-	-	-	20	5.76 ± 0.29	5.30–6.30
MTRL*	4	4.78 ± 0.13	4.64–4.90	5.7	7	5.1–6.1	20	5.17 ± 0.21	4.72–5.52
IFL*	4	5.81 ± 0.19	5.62–6.06	8	-	-	20	6.82 ± 0.40	5.90–7.36
ZB	4	15.52 ± 1.12	14.38–16.76	18	-	-	18	15.34 ± 0.69	14.20–16.54
BB	4	14.29 ± 0.39	13.94–14.80	14.28	3	14.3–14.8	19	14.21 ± 0.34	13.68–14.90
IOC	4	6.09 ± 0.10	5.98–6.20	6.7	7	6.3–6.8	20	6.10 ± 0.15	5.76–6.40
NL*	4	12.36 ± 0.71	11.40–13.10	14.3	-	-	20	13.28 ± 0.56	12.02–13.90
RL	4	14.15 ± 0.53	13.46–14.76	-	6	12.9- 14.8	20	14.47 ± 0.58	13.28–15.24
OL	4	9.90 ± 0.46	9.30–10.34	-	-	-	19	9.67 ± 0.57	8.70–10.76
OCW	4	8.11 ± 0.34	7.64–8.40	-	-	-	20	7.92 ± 0.18	7.62–8.20
ZP*	4	2.22 ± 0.22	2.04–2.48	-	-	-	20	2.59 ± 0.24	2.22–3.06

continued.

	<i>Oxymycterus hiska</i>	<i>Oxymycterus hucucha</i>		<i>Oxymycterus akodontius</i>		
	adult female	n	X ± SD	Range	n	X ± SD
HB	100	1	109	-	1	116
TL*	77	1	71	-	1	79
HFL	25	2	22	21–23	1	26
EL	16	2	14.5	14–15	1	18.5
W	30.0	1	36	-	-	-
CIL	25.10	2	24.75	24.09–25.41	1	27
DL	-	-	-	-	2	6.4 ± 0.3
RW2	-	-	-	-	2	4.5 ± 0.0
MTRL*	5.01	2	4.18	4.10–4.26	1	5
IFL*	6.06	2	5.58	5.29–5.88	1	6.2
ZB	13.63	2	12.60	12.19–13.01	1	13.5
BB	12.68	2	11.84	11.55–12.14	1	13.7
IOC	6.32	2	5.29	5.19–5.39	1	6
NL*	11.43	2	10.59	9.40–11.79	1	11.2
RL	11.43	2	10.69	10.36–11.03	2	12.5 ± 0.2
OL	-	-	-	-	-	-
OCW	-	-	-	-	-	-
ZP*	1.76	2	1.71	1.40–2.03	-	-

TABLE 3. Results of principal components analysis of craniodental measurements of young specimens of *Oxymycterus* (age classes 1 and 2; n = 11).

Variable	Eigenvector		
	PC 1	PC 2	PC 3
HFL	-0.4434	-0.1547	-0.0346
EL	-0.3790	-0.0164	0.3158
CIL	-0.4411	0.0425	0.0751
MTRL	-0.1227	0.0983	0.7138
IFL	0.0765	0.5837	0.3974
ZB	-0.4256	-0.0054	-0.1447
BB	-0.3956	-0.3166	0.0358
IOC	-0.2709	0.3878	-0.3822
NL	-0.1820	0.6107	-0.2403
Eigenvalue	4.615	1.939	1.575
% of Variance	51.283	21.547	17.500
Broken-stick Eigenvalue	2.829	1.829	1.329

TABLE 4. Results of principal components analysis of craniodental measurements of adult specimens of *Oxymycterus* (age classes 3-5; n = 26).

Variable	Eigenvector		
	PC1	PC 2	PC 3
HFL	-0.2999	0.3760	-0.1538
EL	-0.2897	0.1087	0.3916
CIL	-0.3271	0.0454	0.0802
MTRL	-0.2909	-0.2551	-0.3039
IFL	-0.2724	-0.5976	0.1714
ZB	-0.3127	0.1765	-0.1432
BB	-0.3009	0.4438	0.0001
IOC	-0.2679	-0.1005	-0.7271
NL	-0.3078	-0.3216	0.0543
RL	-0.3243	0.2212	0.2539
ZP	-0.3168	-0.1788	0.2798
Eigenvalue	8.473	0.820	0.572
% of Variance	77.030	7.453	5.201
Broken-stick Eigenvalue	3.020	2.020	1.520

Genetic comparisons: The observed genetic distances (Table 5) among the undescribed species and another *Oxymycterus* species range from 6.09 % (one specimen of *O. paramensis*) to 8.65 % (one specimen of *O. quaestor*). Comparisons between haplotypes recovered from conspecific individuals range from 0.26 % (*O. paramensis*) to 4.4 % (*O. paramensis*).

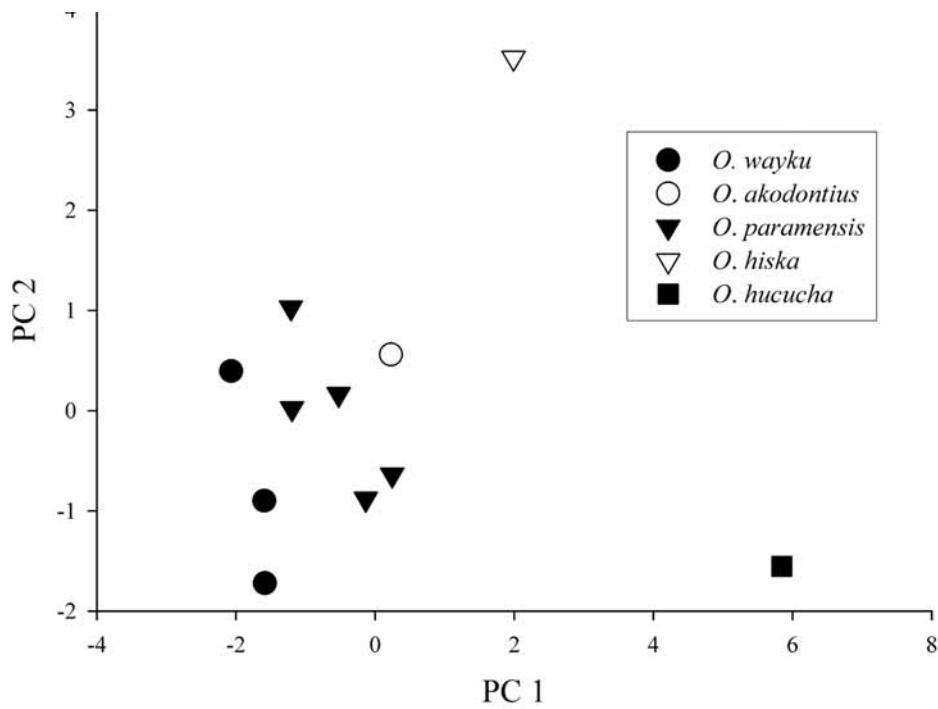


FIGURE 1. Specimen scores of young individuals of *Oxymycterus* (n = 11) for principal components 1 and 2 extracted from the variance-covariance matrix of 9 morphological distances (see text and table 3).

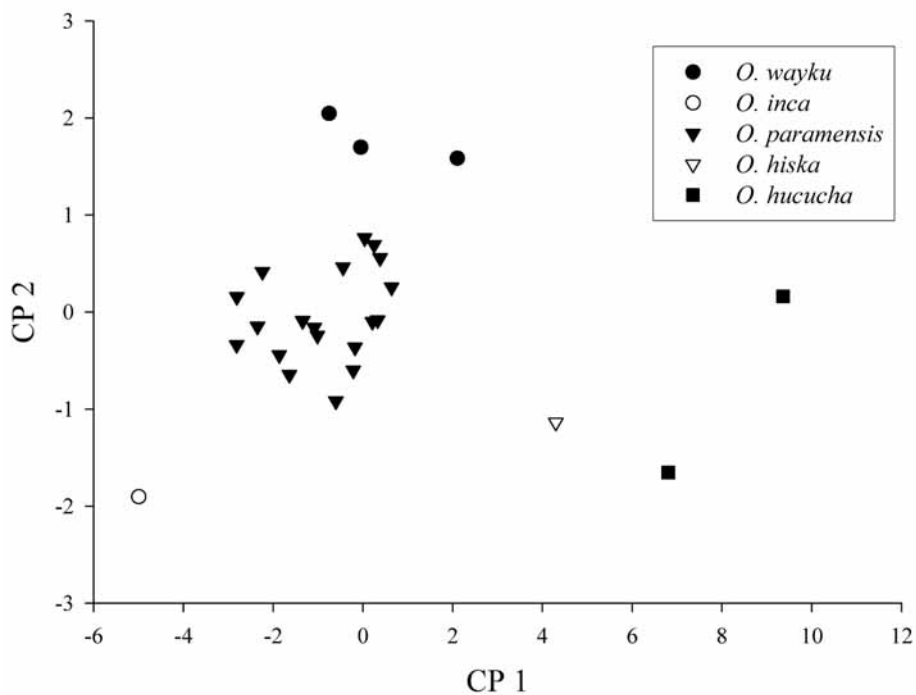


FIGURE 2. Specimen scores of adult individuals of *Oxymycterus* (n = 26) for principal components 1 and 2 extracted from the variance-covariance matrix of 11 morphological distances (see text and table 4).

Discussion

The morphological and genetic comparisons guided by the results of the phylogenetic analyses offer convincing evidence indicating that the specimens in question belong to an undescribed species of the genus *Oxy-*

mycterus. Diagnostic features of the new species include cranial characters (e.g., wide braincase, wide and shallow zygomatic notches, very short incisive foramina). Finally, although the degree of DNA sequence divergence is not a good indicator of specific status (Ferguson 2002; but see Bradley & Baker 2001, for an alternative viewpoint), it is interesting to note that the undescribed species is truly distinct from the other *Oxy-mycterus* species for which data are available (Table 5).

Based on these results we recognize a new species of *Oxymycterus* that we describe as follows:

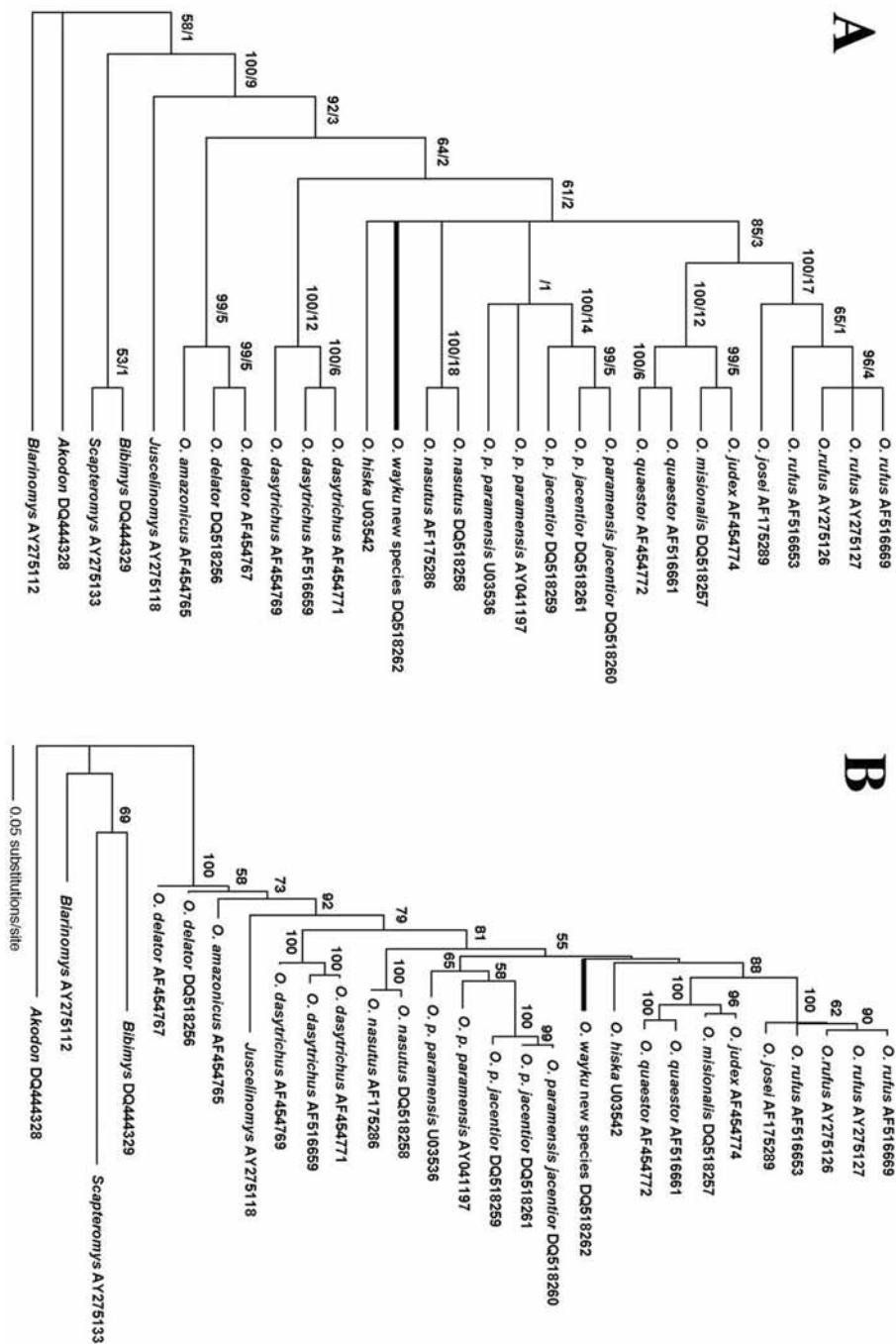


FIGURE 3. Results of the phylogenetic analyses based on the 801 first bases of the cyt *b* gene. A) Strict consensus tree of the three most parsimonious trees (length 746, CI = 0.523, RI = 0.657). Numbers indicate parsimony jackknife (left of the diagonal) and Bremer support (right to the diagonal) values of the nodes at their right. Only jackknife values above 50 % are shown. B) Most likely tree (-ln L = 4405.079). Numbers indicate jackknife values of the nodes at their right. Only jackknife values > 50 % are shown.

TABLE 5. Average observed genetic distances (p expressed as %) between *cyt b* pairs of haplotypes recovered from different species of *Oxymycterus* (see Appendix 1 for details of the specimens included).

	<i>amazonicus</i>	<i>dasytrichus</i>	<i>delator</i>	<i>hiska</i>	<i>josei</i>	<i>judex</i>	<i>misionalis</i>	<i>nasutus</i>	<i>paramensis</i>	<i>quaestor</i>	<i>rufus</i>
<i>dasytrichus</i>	6.20										
<i>delator</i>	2.50	6.04									
<i>hiska</i>	8.49	7.95	7.75								
<i>josei</i>	9.13	9.00	8.94	7.13							
<i>judex</i>	8.12	7.37	7.75	6.87	6.50						
<i>misionalis</i>	8.13	7.13	7.76	6.63	6.26	0.50					
<i>nasutus</i>	7.65	7.15	7.37	6.96	8.16	7.46	7.22				
<i>paramensis</i>	8.29	8.10	7.57	6.90	8.23	7.75	7.57	7.35			
<i>quaestor</i>	8.39	7.62	8.07	7.55	7.30	2.88	2.88	8.02	8.25		
<i>rufus</i>	9.55	9.25	9.19	7.06	1.78	6.78	6.53	8.16	8.50	7.26	
<i>wayku</i> n. sp.	8.12	7.32	7.49	6.73	7.50	8.12	7.88	6.80	7.18	8.58	7.62

***Oxymycterus wayku*, new species**

Holotype: CML 7247, Juvenile male (age 2), collected by J. P. Jayat on 19 June 2005 (original field number JPJ 1407), skin, skull, skeleton, and tissues in alcohol (Fig. 4).

Type locality: ARGENTINA, Province of Tucumán, Department of Trancas, 10 km by road south of Huallinchay on the trail to Lara (26° 19' 20.2" S, 65° 36' 45.5" W, 2316 m, Fig. 5).



FIGURE 4. *Oxymycterus wayku*, new species (holotype CML 7247): dorsal (upper left), ventral (upper right) and lateral (middle) views of skull and labial view (bottom) of mandible. Scale bar = 10 mm.

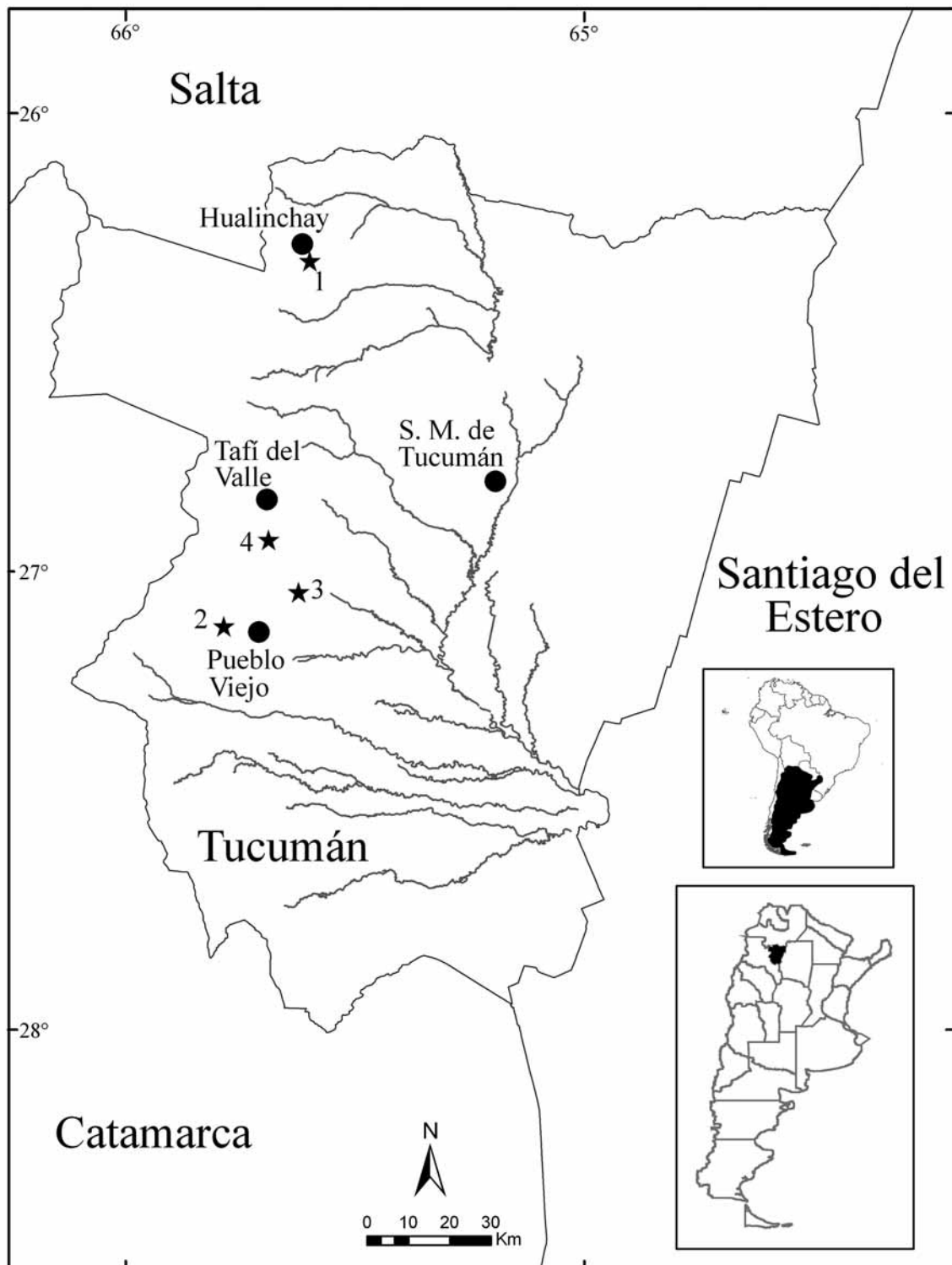


FIGURE 5. Recording localities of *Oxymycterus wayku*, new species (Province of Tucumán, Argentina). 1. Type locality; 2. Reserva Provincial La Florida, 3. Los Sosa, and 4. La Angostura.

Diagnosis: A member of the Subfamily Sigmodontinae (*sensu* Reig 1980) distinguishable from all other species of the genus *Oxymycterus* by the following combination of characters: size intermediate for the genus (mean values in mm for two individuals of age 3; length of head and body, 129; tail length, 81; condyloincisive length, 28.95; maxillary tooththrow length, 4.66); general coloration blackish brown with a slight ocre or reddish hue; internal ear surface covered by black hairs; white spot on the chin and/or throat; fore and hind

feet dorsally almost black; dark tail, almost black, slightly more clear on the ventral side; claws in fore feet (6.4 mm in average for adults, measured in finger III) and hind feet (5.1 mm in average for adults, measured in finger III) long and robust; wide braincase (14.9 mm in average for adults); short incisive foramina (5.81 mm in average for adults); wide and shallow zygomatic notches; lunar notch in mandible asymmetrical by a more excavated ventral portion and simplified molars.

Measurements of the holotype: External measurements (in mm): length of head and body, 128; tail length, 77; length of hind foot (with claw), 31; ear length, 18; weight (in g): 46. Cranial measurements (in mm): greatest length of skull, 32.60; condyloincisive length, 28.74; zygomatic breadth, 14.76; braincase breadth, 14.14; interorbital constriction, 6.06; maxillary toothrow length, 4.78; nasal length, 11.78; mid rostral width, 5.60; diastema length, 7.40; length of incisive foramen, 5.94; width across occipital condyles, 8.12; breadth of zygomatic plate, 2.18.

Paratypes: Five livetrapped specimens collected at the type locality (CML 7248, CML 7249, CML 7250, CNP 853, CNP 854) (See Table 6 for measurements of paratypes).

TABLE 6. *Oxymycterus wayku*, new species: measurements (in mm) of the paratypes.

	CML 7248 (age 1)	CNP 854 (age 1)	CML 7249 (age 3)	CNP 853 (age 4)	CML 7250 (age 4)
HB	117	116	124	-	144
TL	81	79	85	-	97
HFL	30	31	31	32	32
EL	17	17	17	20	18
W	39.0	47	44.5	76.5	66
CIL	27.40	27.62	28.86	31.24	31.02
DL	6.78	6.72	7.38	7.70	8.06
RW2	5.66	5.48	5.46	6.14	6.18
MTRL	4.92	4.64	4.68	4.88	4.90
IFL	5.38	5.16	5.70	5.86	5.62
ZB	14.92	-	14.78	16.76	16.14
BB	14.36	14.60	13.94	14.80	14.36
IOC	6.18	6.08	5.98	6.20	6.14
NL	11.10	11.10	11.40	12.42	12.50
RL	12.74	12.84	13.46	14.76	14.24
OL	9.14	8.96	9.30	10.34	10.16
OCW	8.14	8.00	8.06	8.40	8.32
ZP	1.94	2.04	2.04	2.30	2.48

Other referred specimens: One specimen from Reserva Provincial La Florida, Pueblo Viejo, 27° 13' S; 65° 37' W, at an altitude of approximately 1000 m, Department of Monteros (CML 6096); one specimen from Los Sosa, 27° 4' 13.5'' S, 65° 39' 43.5'' W, at an altitude of 860 m, Department of Monteros (MACN 20254); and three sets of cranial remains recovered from owl pellets from La Angostura, 26° 56' 25.5'' S, 65° 42' 10'' W, at an altitude of 1900 m, Department of Tafí del Valle (PEO-e 3, PEO-e 10, PEO-e 19). These remains were erroneously identified by Ortiz and Pardiñas (2001) as *Oxymycterus* cf. *O. paramensis*.

Distribution: The new species is distributed along the eastern humid slopes of the Sierra del Aconquija and Cumbres Calchaquíes mountain ranges, from 800 to 2400 m, in Tucumán province (Fig. 5). Notwithstanding, suitable habitat for the species exists along a narrow strip of 200 km length, from the northernmost

end of Cumbres Calchaquías range in southern Salta province, to the Sierra de Narvárez range at the boundary between Tucumán and Catamarca provinces.

Etymology: “wayku” is a word in Quechua language (spoken currently in the Central Andes) that means ravine. This word is commonly used in northwestern Argentina to refer to narrow creeks with steep slopes between mountains, similar to the ones where the new species was collected.

Morphological description: Pelage is blackish brown with a slight ochre or reddish hue; juvenile specimens are darker, almost black. Dorsal hairs are dark grey for most of their length (approximately 90% basal) and ochraceous at distal ends. Guard hairs are completely black and extend beyond the level of the fur hairs by approximately 3.5 mm on the rump. Flanks coloration is similar to the color of dorsal area. Ventral side is paler than the dorsum, with color ochre intermingled with the ash grey of the base of the hair. The chin has a conspicuous spot of completely white hair that, in some specimens, extends towards the throat. The ears are densely covered by black hairs on their inner surface. Immediately anterior to the ears, there is a tuft of black hairs with ochre tips that extends approximately to the middle of the pinnae. Fore and hind feet are dark grey, almost black. The long and robust claws are covered at their proximal ends by numerous white hairs that stand out against the uniform dark color of the limbs. The tail is almost black, densely covered by hairs and slightly paler in the ventral area without becoming clearly bicolored. The claws on fore and hind feet are strong and long, claws of forefeet are more strongly developed than the hindfeet (6.4 mm against 5.1 mm, in average for three adult specimens, measured at finger III).

The skull is long and robust, with a wide, rounded braincase and expanded zygomatic arches. The anterior end of skull is elongated, typical of this genus. Nasals are expanded in their distal portion, bended upwards, and with the premaxillae, project anteriorly beyond the incisors, forming a trumpet like expansion. The rostrum is wide and robust, with zygomatic notches broad and shallow, clearly visible in dorsal view. The frontal sinuses are inflated and the interorbital region has rounded margins. The zygomatic plate is narrow, delicate, with upper free border reduced and slanted backwards. The hamular process is short and bended upward in its posterior end. Postglenoid foramen is larger, approximately double or more, than the subsquamosal foramina in all ages examined. In ventral view, the cranium has incisive foramina that are remarkably short and oval shaped. Their posterior margins do not reach the level of the protoflexus of M1. Anterior margin of mesopterygoid fossa is straight or with a median spine and located posterior to the posterior face of M3. Posterior palatine foramina and posterolateral palatal pits are well developed. The latter are located at or slightly behind of the posterior margin of palate. Mesopterygoid fossa is wide and lyre shaped. Parapterygoid fossae are slightly excavated and subequal to mesopterygoid fossa at midline. Foramina ovale is well developed, and auditory bullae are relatively small with short eustachian tubes. Mandible is delicate, low and elongated with inconspicuous capsular projection. Anterior point of diastema is located at the same level as the alveolar plane. The mental foramen is visible from labial view. The coronoid process is thin, reflected well backward with apex slightly higher than condyloid process, determining a narrow sigmoidal notch. The angular process ends at or slightly anterior to condyloid process. Lunar notch is relatively well developed and asymmetrical due to a more excavated ventral portion. Masseteric crest is poorly developed, bended upwards anteriorly with upper and lower ridges meeting between m1 and m2. The anterior end reaches the level of posterior margin of protoconid of m1 or slightly behind and above the level of the mental foramen.

Upper incisors are yellowish white, orthodont or slightly opisthodont; lower incisors are slightly paler. Description of molars is based on juvenile specimens (age 1). In older individuals most of molar occlusal structures disappear due to wear (Fig. 6). Upper molars are crested, showing a tetralophodont pattern with lingual and labial cusps almost opposite. M1 with procingulum and anteromedian flexus well developed. On the labial side there are an anteroloph connected to parastyle and a robust mesoloph connected to mesostyle is present; posteroloph present but much reduced, resulting in a vestigial posteroflexus. On the lingual side, this molar is simplified without styles or accessory lophs. The M2 has a reduced procingulum; on labial margin there is a small mesoloph mesostyle and the remnant of a metalophule on the anterior border of the metacone;

posteroflexus penetrates more deeply than in M1. There is a small island of enamel between protocone and paracone. The morphology of the lingual side is similar to that of the M1. The M3 is cylindrical and half or less the size of M2; on labial side there are a short metaflexus and a posteroflexus more deeply penetrating than in M2. Lower molars are more complex than upper ones, with the lingual cusps anterior to the labials. The m1 presents a small procingulum with the anteromedian flexid slightly developed. Labially, there are a well developed posterostylid and a small ectolophid fused to the ectostylid. Lingually, the anterolophid is reduced; a well developed mesolophid joins the mesostylid and a well defined posterolophid determines a penetrating posteroflexid. A clearly visible enamel island is present between hypoconid and entoconid. The m2 has an extremely reduced procingulum. Labially, an ectolophid is barely visible. On the lingual margin a well developed mesolophid mesostylid and a posterolophid and posteroflexid are present. An island between hypoconid and entoconid is also present. The m3 is approximately half the size of m2. Labially, a well developed hypoflexid is present, while on the lingual side a short metaflexid and a penetrating entoflexid are observed.

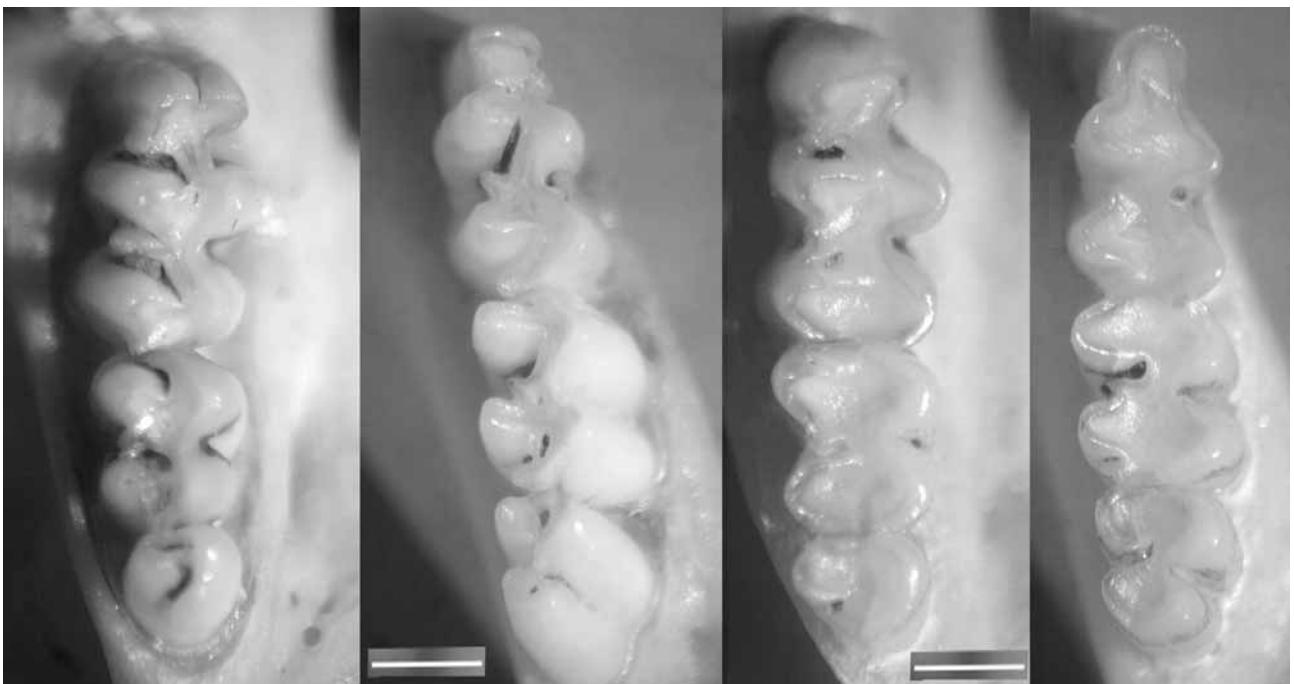


FIGURE 6. *Oxymycterus wayku*, new species: Left upper and right lower molar rows in young (left; paratype, CML 7248) and adult specimens (right; paratype, CML 7249). Scale bar= 1 mm.

Oxymycterus wayku n. sp. has 13 thoracic ribs; the vertebral column includes 13 thoracic, 7-8 lumbar, and 25-27 caudal vertebrae (n = 5).

Comparisons: *Oxymycterus paramensis* is the only species found in sympatry with *O. wayku* n. sp. This species presents a different general coloration than *O. wayku* n. sp., with lighter and reddish dorsal area (although some specimens lack the reddish color and appear more ochraceous brown). The ventral coloration is buffy brown although it can appear almost cinnamon in some specimens. Also, this species lacks a white spot in the chin and/or throat, has the inner surface of ears and dorsal region of fore and hind feet covered with agouti hairs, and has notably shorter and delicate claws. The braincase and zygomatic notches of *O. paramensis* are narrower, and the zygomatic arches are less expanded than in *O. wayku* n. sp. Incisive foramina in *O. paramensis* are longer and with straight edges and the lunar notch of mandible is symmetrically excavated (Fig 7). Molars of *O. paramensis* are more complex; M1 has an anteromedian style (*sensu* Hershkovitz 1962) on the anterior face of the procingulum, a visible protostyle and a well developed enteroloph enterostyle. Moreover, the M2 of *O. paramensis* presents an enteroloph enterostyle. Observed genetic distance between *O. paramensis* and *O. wayku* n. sp. range from 6.09 % to 8.07 %.

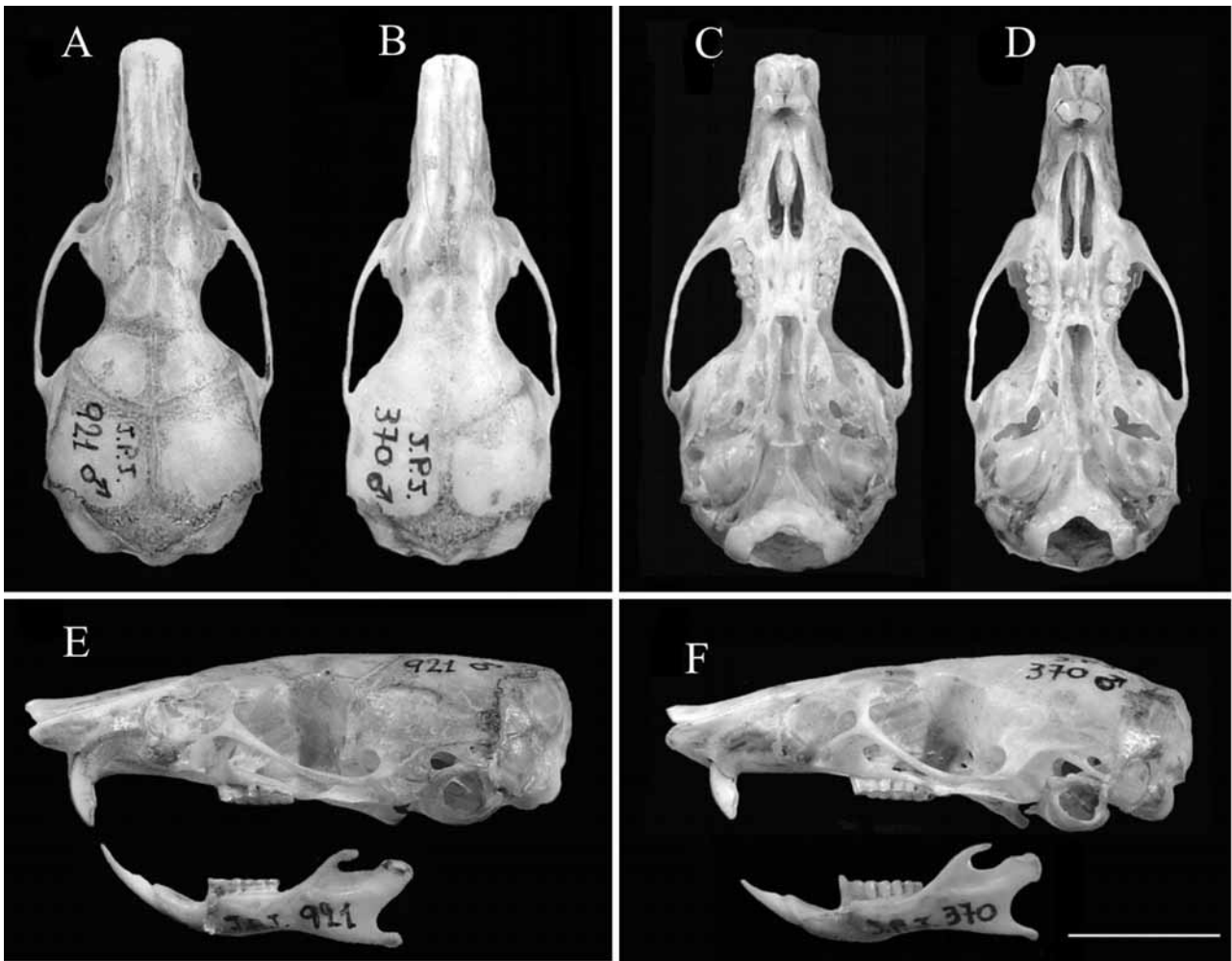


FIGURE 7. Dorsal, ventral, and lateral views of skulls and labial views of mandibles in *Oxymycterus wayku*, new species (paratype, CML 7250; a, c and e) and *O. paramensis* (JPJ 370; b, d and f). Scale bar = 10 mm.

Although it has been described as a darkly colored species, the skin of the holotype of *O. akodontius* is conspicuously lighter than skins of *O. wayku* n. sp., both in dorsal and ventral region (we examined photographs of the holotype of *O. akodontius*). *O. akodontius* lacks the white spot in the chin and/or throat, has paler feet and tail, and has shorter and more delicate claws in fore and hind feet. The skull shows less expanded zygomatic arches, narrower zygomatic notches, and longer incisive foramina than that of same age *O. wayku* n. sp. specimens. Furthermore, like *O. paramensis*, in *O. akodontius* the lunar notch of the mandible is symmetrically excavated.

Oxymycterus inca can be distinguished from *O. wayku* n. sp. by their notably larger size, including a more robust rostrum, deeper zygomatic notches, longer maxillary tooththrows and much longer incisive foramina (Table 2). Moreover, *O. inca* are paler reddish brown in color and lack the robust claws of *O. wayku* n. sp.

Oxymycterus hiska and *O. hucucha* are smaller than *O. wayku* n. sp. (Table 2). They have proportionally larger incisive foramina and maxillary tooththrows and a proportionally broader interorbital region than those of *O. wayku* n. sp. Moreover, both species present lesser developed zygomatic notches, lesser expanded zygomatic arches and more delicate zygomatic plates. The distal ends of the nasals of both species are more strongly reflected dorsally than in *O. wayku* n. sp. In addition, the rostrum and zygomatic notches of *O. hucucha* are conspicuously narrower than those of *O. wayku* n. sp. Observed genetic distance between *O. hiska* and *O. wayku* n. sp. is 6.73 %.



FIGURE 8. Two habitats where *Oxymycterus wayku*, new species was captured in Tucuman province, Argentina: A) Cloud forest near Hualinchay at about 2300 m. B) Rain forest in Reserva Provincial La Florida at about 600 m.

Oxymycterus delator can be distinguished from *O. wayku* n. sp. by several external and cranial characters. Notwithstanding a similar general dark coloration pattern, *O. delator* presents small light patches behind and above the eyes absent in *O. wayku* n. sp., and lacks the white spot in the chin and throat. It also lacks the long and robust claws in the feet, which are conspicuously developed in *O. wayku* n. sp. *O. delator* has a narrower and more elongated rostrum, longer incisive foramina and an unusually narrower braincase. Observed genetic

distance between *O. delator* and *O. wayku* n. sp. is on average 7.49 %. In addition, both species are distantly related (Fig. 3).

Natural history: Most *O. wayku* n. sp. specimens were trapped at the ecotonal zone between montane forests and highland grasslands, at the upper altitudinal limit of Yungas forests (“Bosque Montano” *sensu* Brown *et al.* 2001). This altitudinal belt develops on wet slopes between 1500 and 3000 m and represents the landscape with greatest heterogeneous structure within the Yungas (Brown *et al.* 2001). The habitat where the type series was collected is characterized by alder forest (*Alnus accuminata* H.B.K) and grass communities dominated by the genera *Festuca*, *Deyeuxia*, and *Stipa* (Fig 8A). Here the soils are deep with a well developed organic horizon, covered by abundant leaf detritus and fallen logs. Slopes are steep and interrupted by isolated rocky outcrops. Two additional specimens were captured at lower elevation in montane rainforest (“Selva Montana” *sensu* Brown *et al.* 2001). This belt develops between 700 and 1500 m and, in general, is dominated by evergreen tree species like *Phoebe porphyria*, *Tipuana tipu*, *Myrcianthes pungens* and *Blepharocalyx salicifolius*. The collecting site is characterized by humid forests on ravine slopes of mountain rivers (Fig. 8B).

Of the three specimens captured during fall, from late April to early May, only one female showed signs of reproductive activity. A male captured in July and other two captured in early spring were reproductively inactive. These data suggest that the species is reproductively active in the summer season. The specimens trapped during fall and winter showed molting over more than 50% of the body, while molt in one of the spring males was restricted to about 10% of its surface.

O. wayku n. sp. seems to be a rare species in its distribution range. Although extensive sampling has been conducted in Tucumán in recent years, up to now it is only known by a series of seven trapped specimens and cranial remains of a few individuals recovered from *Tyto alba* pellets. In the Hualinchay area, for example, of more than 400 specimens collected nearby the type locality (including nine sampling sites between 1700 and 3000 m) only five individuals of *O. wayku* n. sp. were obtained. Other sigmodontine species registered around the type locality and in the same kind of habitat include *Abrothrix illuteus* Thomas, *Akodon lutescens* J. A. Allen, *A. simulator* Thomas, *A. spegazzinii* Thomas, *Andinomys edax* Thomas, *Oligoryzomys* cf. *O. flavescens* Waterhouse, *Oligoryzomys* sp., and *Phyllotis anitae* Jayat *et al.* *Oxymycterus wayku* is also sympatric but not syntopic with *Necromys lactens* (Thomas) and *Phyllotis osilae* J. A. Allen, which inhabit grasslands at their ecotone with the alder forests. Other species captured in the area of Reserva Provincial La Florida were *A. illuteus* and *A. spegazzinii*. In owl pellets from La Angostura the following species besides *O. wayku* were recorded: *Abrothrix illuteus*, *Akodon spegazzinii*, *Andinomys edax*, *Calomys* cf. *C. laucha*-*C. musculus*, *C. fecundus* Thomas, *Necromys* cf. *N. lactens*, *Oligoryzomys* cf. *O. flavescens*, *Oligoryzomys* sp. and *Phyllotis osilae* (see Ortiz & Pardiñas 2001).

Phylogenetic relationships and additional taxonomic considerations: The phylogenetic analyses shown that *Oxymycterus wayku* n. sp. belongs to a large clade together with *O. nasutus*, *O. paramensis* s.l. (see below), *O. hiska* and the clade (((*O. rufus*-*O. josei*) (*O. judex*-*O. misionalis*) *O. quaestor*))) (Figure 3). Relationships among these lineages are not resolved, although in the ML analysis *O. wayku* appears as sister to the remaining species of the clade. Future studies with a broader taxonomic coverage and the analysis of more characters will contribute to further testing the phylogenetic relationships of the new species as well as biogeographical hypotheses of *Oxymycterus* evolution (e.g., Reig 1986).

In both phylogenetic analyses, haplotypes from specimens of *O. paramensis paramensis* are not sister to each other. This subspecies appears paraphyletic with respect to the clade formed by haplotypes of *O. p. jacentior*. The observed genetic divergence between pairs of *O. paramensis* s.l. haplotypes ranges from 4.4 % (*O. p. paramensis* from Peru vs. *O. p. paramensis* from Bolivia) to 6.4 % (*O. p. paramensis*: Peru vs. *O. p. jacentior*: Argentina). Although degree of DNA sequence divergence is not necessarily a good indicator of specific status (Ferguson 2002), these data together with the recovered genealogy indicate *O. paramensis* as today defined may constitute a complex of biological species. This concurs with the suggestion made by Musser and Carleton (1993) that the placement of the form *jacentior* with *O. paramensis* deserved reconsider-

ation. This relationship should be tested by comprehensive studies that must necessarily include the analysis of morphologic characters and topotypical specimens.

Another issue that needs to be further explored is the fact that in the ML analysis, the haplotypes gathered from both *O. delator* specimens do not form a monophyletic group. However, in the MP analysis the *O. delator* clade is strongly supported (JK = 99 %; BS = 5).

Finally, the last taxonomic issue to point out is the low observed divergence (0.5 %) found between haplotypes assigned to *O. judex* Thomas, and *O. misionalis*. This two species were placed by Oliveira (1998) in the same morphology based species group. Keeping in mind the observations placed above about the usage of genetic divergence to establish species limits, this low value is remarkable and raises the need of additional studies to assess species boundaries within the *O. judex* species group (sensu Oliveira 1998).

Final considerations: All known localities of *O. wayku* n. sp. are from the southern end of the Yungas, while the southernmost known localities of *O. paramensis* (Sierra de San Javier and Aguas Chiquitas, Tucumán province) are approximately 80 km to the NE from those of *O. wayku* n. sp. *Oxymycterus wayku* n. sp. is thus the southernmost *Oxymycterus* found along the Andean slopes.

The Yungas in northwestern Argentina is a spatially fragmented habitat and one of the most transformed environments in the last decades, with large areas converted to agriculture fields and cattle ranches (Brown *et al.* 2001). Moreover, several areas have been designated for forest exploitation, as well as for oil, gas and hydroelectrical production (Brown & Grau 1993). Unfortunately, the effects of these transformation processes on the populations of native mammals, including *O. wayku* n. sp., have not been yet evaluated, resulting in a lack of planning and development of conservation strategies for these species.

The area of Hualinchay is remarkable due to its outstanding diversity of sigmodontine rodents, with 11 species recorded. It constitutes the *terra typica* of an additional recently described rodent species of the genus *Phyllotis* (Jayat *et al.* 2007). This last fact emphasizes our poor knowledge is about the small mammal fauna of the Yungas and the need to intensify field work in this biome.

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Appendix 1

Specimens examined. Acronyms for institutions and personal catalogs are as follows. Argentina: Colección Mamíferos Lillo (CML), Tucumán; Colección de Mamíferos del Centro Nacional Patagónico (CNP), Puerto Madryn; Museo Argentino de Ciencias Naturales “Bernardino Rivadavia” (MACN), Buenos Aires. Bolivia: Colección Boliviana de Fauna (CBF), La Paz. USA: Museum of Vertebrate Zoology (MVZ), Berkeley. UK: Natural History Museum (BM). JPJ: field number of J. Pablo Jayat, to be deposited at CML; PEO-e: field number for owl pellets samples of Pablo E. Ortiz, to be deposited at Colección de Paleovertebrados Lillo (PVL), Tucumán. Localities are listed in alphabetic order. Simple asterisks (*) indicates specimens measured (Tables 2 and 6).

- Oxymycterus akodontius* (1). ARGENTINA: Jujuy Province: Higuierilla, 2000 m (skin and skull photograph of holotype BM 21.11.1.72).
- Oxymycterus hiska* (1). PERU: Puno Department: 14 km W Yanahuaya (MVZ 172659).
- Oxymycterus hucucha* (1). BOLIVIA: Cochabamba Department: 20 mi. E Totora, 9700 ft. (MVZ 119948).
- Oxymycterus paramensis* (34). ARGENTINA: Jujuy Province: Abra de Cañas, El Monolito (CML 1761); Calilegua, Mesada de Las Colmenas (MACN 20657); La Antena, Sierra del Centinela, al S de El Fuerte, 2350 m (JPJ 957*, 967*); La Herradura, 12 km al SW de El Fuerte, sobre Ruta Provincial Número 6, 1428 m (JPJ 575*); León, Río Lozano, 3 km upwaters Ruta 9 (CNP 852); Mesada de Las Colmenas, Calilegua (MACN 19520); Mesada de Las Colmenas, Parque Nacional Calilegua, 1150 m (MACN 19519); Termas de Reyes, mirador, sobre Ruta Provincial N^o 4 (JPJ 295); San Francisco (CNP 850). Salta: Abra de Ciénaga Negra, aprox. 3 km al SE, 3090 m (JPJ 730*, 733*); Aguaray, FCCNA, 700 m (MACN 30.279, 30.283, 30.282, 30.281, 30.280); aprox. 21 km (por ruta) al WNW de Vespucio, sobre el río Seco, 536 m (JPJ 1483); Campo Largo, km 74.5 de ruta provincial número 54, 684 m (JPJ 1529); Finca Falcón, aprox. 3 km al NW del pozo de agua número 5, cercanías del Río Seco, 704 m (JPJ 1384); Finca Jakulica, angosto Río Pescado, 650 m (MACN 20710, 20713); Finca Jakulica, Los Helechos, 1200 m (MACN 20711, 20712); Pampa Verde, aprox. 8 km al OSO de Los Toldos y al S del Cerro Bravo, 2400 m (CML 7251*); Parque Nacional Baritú, Arroyo Santa Rosa, 900 m (MACN 20714); Parque Nacional Baritú, Arroyo Santelmita, 900 m (MACN 20715); Parque Nacional Baritú, Finca Jakulica, angosto del Río Pescado, 650 m (CML 5507*); Parque Nacional Baritú, Finca Yakulica, bosque de helechos (CML 5505). Tucumán Province: 4 km al NE de Piscicultura, El Cadillal, Arroyo Aguas Chiquitas (CML 1047*); Cerro San Javier, 2300 m (MACN 26.146). BOLIVIA: Cochabamba Department: Choro, 3500 m (MACN 13024); Tinkusiri, 17 km E de Totora, 2950 m (CBF 2106, 2181). La Paz Department: Río Aceromarka, 2990 m (CBF 2595, 2596).
- Oxymycterus wayku*, new species (8). ARGENTINA: Tucumán Province: aprox. 10 km al S de Hualinchay, sobre el camino a Lara, 2316 m (CML 7247*; 7248*; 7249*; 7250*; CNP 853*; 854*); Reserva Provincial La Florida, Pueblo Viejo (CML 6096); Los Sosa (MACN 20254); cranial remains recovered from owl pellets from La Angostura (PEO-e 3, PEO-e 10, PEO-e 19).