Arquivos do Museu Nacional, Rio de Janeiro, v.63, n.1, p.113-130, jan./mar.2005
ISSN 0365-4508

TAXONOMY OF PIGMY RICE RATS GENUS *OLIGORYZOMYS* BANGS, 1900 (RODENTIA, SIGMODONTINAE) OF THE BRAZILIAN CERRADO, WITH THE DESCRIPTION OF TWO NEW SPECIES [1]

(With 4 figures)

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ABSTRACT: We present a taxonomic overview of the species of *Oligoryzomys* from the Brazilian Cerrado. We recognize seven species, including two described herein, making *Oligoryzomys* one of the most diverse mammalian genera of the Cerrado morphoclimatic domain. *Oligoryzomys chacoensis* occurs in the Cerrado and Chaco morphoclimatic domains. *Oligoryzomys flavescens* is distributed mainly in the Atlantic Forest of Brazil and the Pampas region of Argentina and Uruguay, but is also found in gallery forest in the Cerrado of Brazil near the border of the Atlantic Forest. *Oligoryzomys stramineus* and *O. fornesi* occur in the Cerrado and Caatinga morphoclimatic domains. *Oligoryzomys nigripes* is found in the Atlantic Forest and in the Southern portion of the Cerrado. The two new species are endemic to the Cerrado, and one of them is found only in "campo rupestre" vegetation. *Oligoryzomys eliurus* and *O. delticola* are placed tentatively as junior synonyms of *O. nigripes*. *Oligoryzomys fornesi* is recognized as a distinct species from *O. microtis*.

Key words: taxonomy, morphology, karyotype, *Oligoryzomys*, Cerrado.

RESUMO: Taxonomia dos camundongos-do-mato, gênero *Oligoryzomys* Bangs, 1900 (Rodentia, Sigmodontinae) do Cerrado brasileiro, com a descrição de duas novas espécies.

Apresentamos uma revisão taxonômica das espécies do gênero *Oligoryzomys* do Cerrado brasileiro. Reconhecemos sete espécies, incluindo duas aqui descritas, tornando *Oligoryzomys* um dos mais diversos gêneros de mamíferos do domínio morfoclimático do Cerrado. *Oligoryzomys chacoensis* ocorre nos domínios morfoclimáticos do Cerrado e do Chaco. *Oligoryzomys flavescens* se distribui principalmente na Mata Atlântica do Brasil e na região dos pampas da Argentina e Uruguai, mas é também encontrado em matas de galeria no Cerrado do Brasil próximo do limite com a Mata Atlântica. *Oligoryzomys stramineus* e *O. fornesi* ocorrem nos domínios morfoclimáticos do Cerrado e da Caatinga. *Oligoryzomys nigripes* é encontrado na Mata Atlântica e na porção sul do Cerrado. As duas novas espécies são endêmicas do Cerrado, e uma delas é encontrada apenas na vegetação de "campo rupestre". *Oligoryzomys eliurus* e *O. delticola* são tentativamente consideradas sinônimos juniores de *O. nigripes*. *Oligoryzomys fornesi* é reconhecida como uma espécie distinta de *O. microtis*.

Palavras-chave: taxonomia, morfologia, cariótipo, *Oligoryzomys*, Cerrado.

INTRODUCTION

Oligoryzomys Bangs, 1900 comprises a diverse group of small-sized Neotropical muroid rats distributed from northern Central America to the southernmost part of South America (MUSSER & CARLETON, 1993). The monophyly of *Oligoryzomys* is supported by morphologic data (CARLETON & MUSSER, 1989) and analyses of allozymes (DICKERMAN & YATES, 1995), mitochondrial genes (MYERS, LUNDRIGAN & TUCKER, 1995), and nuclear genes (WEKSLER, 2003). Delimitations of *Oligoryzomys* species, however, are still problematic due to lack of comprehensive revisions. Fifty-eight specific and subspecific names are associated with *Oligoryzomys* (MUSSER & CARLETON, 1993). The latest taxonomic summary of the genus (CARLETON & MUSSER, 1989) recognized 12 species divided in five groups: the *fulvescens* group, with *O. fulvescens* (Saussure, 1860), *O. arenalis* (Thomas, 1932), and *O. vegetus* (Bangs, 1902); the *microtis* group

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with *O. microtis* (Allen, 1916); the *andinus* group with *O. andinus* (Osgood, 1914) and *O. chacoensis* (Myers and Carleton, 1981); the *flavescens* group with *O. flavescens* (Waterhouse, 1837) and three undescribed species; and the *nigripes* group with *O. nigripes* (Olfers, 1818), *O. eliurus* (Wagner, 1845), *O. destructor* (Tschudi, 1844), *O. longicaudatus* (Bennet, 1832), and *O. delticola* (Thomas, 1917). GALLARDO & PALMA (1990) subsequently recognized *O. magellanicus* (Bennet, 1836) as a distinct species from *O. longicaudatus* based on phallic morphology and karyotypic and morphometric data. In their checklist of muroid species, MUSSER & CARLETON (1993) considered *O. griseolus* (Osgood, 1912) as a valid species apart from *O. fulvescens*, and included the extinct *O. victus* (Thomas, 1898) in the genus *Oligoryzomys*.

More recently, CARLETON & MUSSER (1995) recognized four subspecies in *O. fulvescens* based on phenetic and karyotypic distinctiveness while MYERS *et al.* (1995) considered *O. fornesi* (Allen, 1916) as a valid species distinct from *O. microtis* based on molecular data. Finally, SILVA & YONENAGA-YASSUDA (1997) reported two new karyotypes attributed to presumably undescribed species, while BONVICINO & WEKSLER (1998) described a new species, *O. stramineus*. Thus, the genus *Oligoryzomys*, at this time, comprises 17 recognized species, in addition to five other undescribed species and four subspecies of *O. fulvescens*.

Seven species of *Oligoryzomys* presumably occur in the Cerrado region of Central Brazil, eastern Bolivia, and Northern Paraguay: *O. chacoensis*, *O. eliurus*, *O. microtis*, *O. nigripes*, *O. stramineus*, *O. fornesi*, and *O. flavescens*. Thus, *Oligoryzomys* is one of most species-rich mammalian genus of the Cerrado, a morphoclimatic domain that is considered as a biodiversity hotspot (MYERS *et al.*, 2000). In 1996, we conducted a series of inventory expeditions to the Parque Nacional da Chapada dos Veadeiros and collected specimens clearly belonging to two different species of *Oligoryzomys*. Analyses of morphologic characters and karyotypic data indicated that they belong to two undescribed species. In the process of recognizing the distinctiveness of these taxa, we reviewed the material used in our previous report on *Oligoryzomys* (BONVICINO & WEKSLER, 1998) and incorporated new information from subsequent expeditions and from other sources (*e.g.*, SILVA & YONENAGA-YASSUDA, 1997). Here we present the description of the two new species, and provide a taxonomic summary of the remaining species of *Oligoryzomys* of the Cerrado morphoclimatic domain.

MATERIAL AND METHODS

Examination of external, cranial, and dental morphology was performed in 370 specimens of *Oligoryzomys*. Part of these specimens (284) is listed in BONVICINO and WEKSLER (1998). In addition, 86 specimens have been obtained recently from several Brazilian localities (Fig.1; Appendix 1). Skins and skulls are housed in the mammal collection of Museu Nacional, Rio de Janeiro (MN). The following acronyms refer to field numbers: C.R.Bonvicino (CRB), R.T.Santori (RTS), Laboratório de Vertebrados - Universidade Federal do Rio de Janeiro (LV), Laboratório de Biologia e Controle da Esquistossomose - Fundação Instituto Oswaldo Cruz, Rio de Janeiro (LBCE).

Oligoryzomys sp.nov.1 – Goiás State, 65km SSW Cavalcante, Fazenda Fiandeira 14°04'S 47°45'W (unsexed MN 50312, 50316-17, ♀ MN 50310, 50313, 50315, 50318, 50319, 50320, 50321; ♂ MN 50307, 50308, 50309, 50311, 50314, 50287, CRB 928, 937); Mimoso de Goiás, Fazenda Cadoz 15°03'22"S 48°09'41"W (♀ MN 67087).

Oligoryzomys sp.nov.2 – Goiás State, 5km N Alto Paraíso, Pouso Alto 14°07'57"S 47°30'36"W (unsexed MN 50328, ♀ CRB 1077, MN 50322, 50324, 50327, 50286; ♂ MN 50323, 50325, 50326).

O. nigripes – São Paulo State, Pedreira 22°43'S 46°55'W (unsexed CRB 1234, ♂ CRB 1209, 1247, 1407, 1427, 1435, 1436-37, ♀ CRB 1232, 1406, 1414, 1422, 1424-25, 1428); Fazenda Intervales (♀ INT 5, ♂ EM 1036); Rio Claro 22°45'S 47°33'W, Faz. São José (♂ RTS 5, CRB 1366, ♀ RTS 10); Araraquara 21°47'S 48°01'W (unsexed RTS 17, ♀ RTS 25). Rio de Janeiro State, Nova Friburgo 22°16'S 42°32'W (♂ CRB 1368, ♀ CRB 1369); Teresópolis 22°26'S 42°59'W, Vieira (♂ CRB 1271, 1441-44, ♀ CRB 1274, 1440, LBCE 495, 549, 551); Sumidouro 22°03'S 42°40'W (♂ LBCE 427, 439, 450, 455, 458, 474, 475, 478, 480-483, ♀ LBCE 445, 449).

O. flavescens – São Paulo State, Pedreira (♂ CRB 1405, 1408, 1419, 1430). Minas Gerais State, Itamonte 22°17'02"S 44°52'12"W (♀ CRB 1308).

O. fornesi – Bahia State, Fazenda Sertão do Formoso, Jaborandi 14°48'00"S 45°57'40"W (♂ MN 62637, 62638).

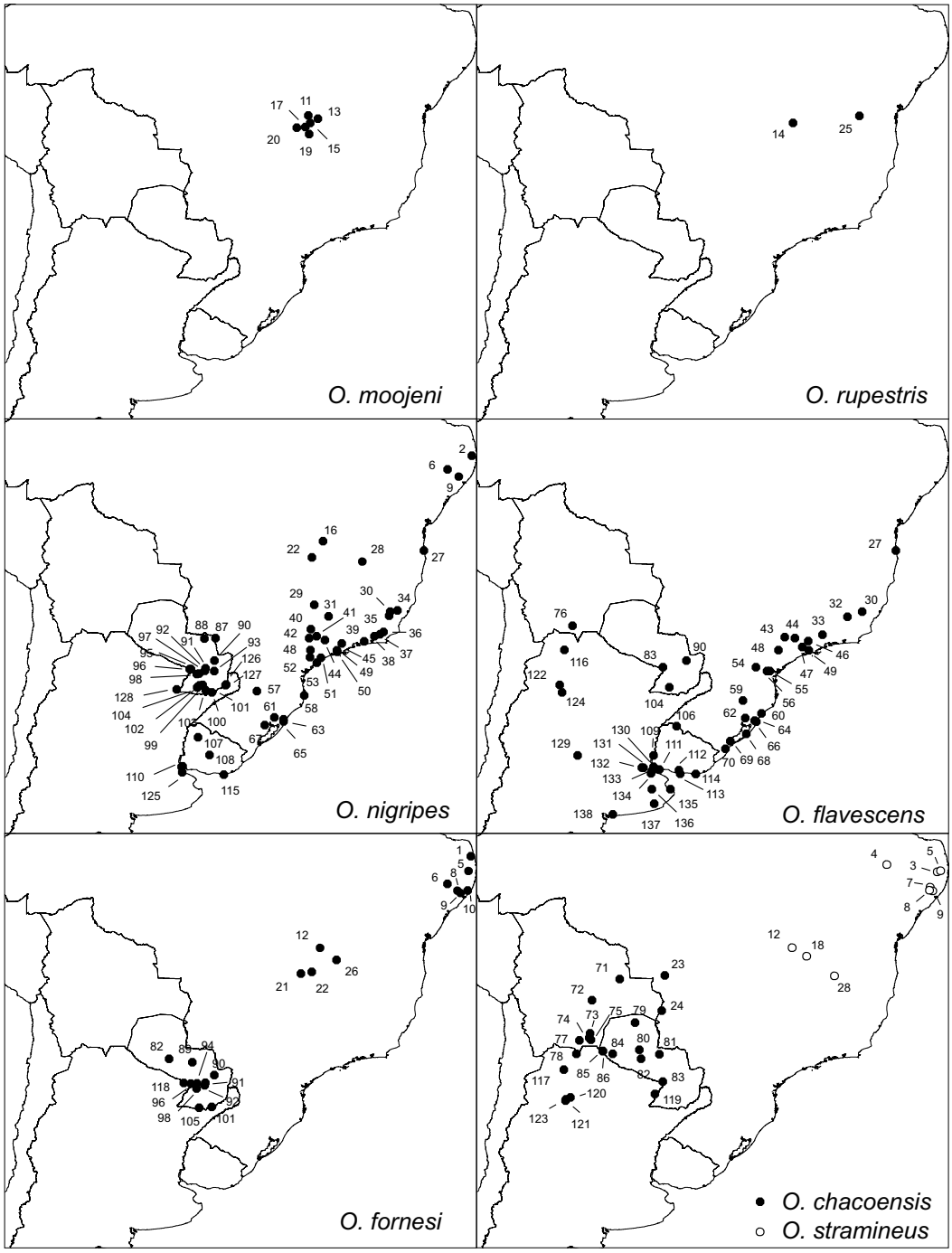

Fig.1- Geographic distribution of *Oligoryzomys* species that occur in the Brazilian Cerrado, Caatinga, and Atlantic Forest. Numbered symbols correspond to collection localities listed in the Appendix. *Oligoryzomys moojeni* sp.nov. and *O. rupestris* sp.nov. are endemic to the Cerrado, the latter being found only in "campo rupestre" vegetation. *Oligoryzomys nigripes* is found in the Atlantic Forest and in the Southern portion of the Cerrado, while *O. flavescens* is distributed mainly in the Atlantic Forest and Pampas, but is also found in gallery forest in the Cerrado of Brazil near the border of the Atlantic Forest. *Oligoryzomys chacoensis* occurs in the Cerrado and Chaco morphoclimatic domains, while *O. stramineus* and *O. fornesi* occur in the Cerrado and Caatinga morphoclimatic domains.

O. stramineus – Minas Gerais State, Juramento 16°50'S 43°35'W, Fazenda Canoas (♂ CRB 1380-81, ♀ LV-FC 156, CRB 1383).

We provide the mean, standard deviation, and range of 5 external and 18 skull measurements: head-and-body length (HB), tail length (T), length of feet with claws (F), maximum length of internal side of ear (E), weight (W), greatest skull length (GSL), condylo-incisive length (CIL), breadth of the occipital condyles (BOC), length of diastema (LD), palatal bridge (PB), length of incisive foramen (LIF), breadth of incisive foramen (BIF), length of maxillary molars (LM), breadth of first maxillary molar (BM1), external alveolar breadth (M1M), cranial height (CH), rostrum length (RL), rostrum breadth (BRO), least interorbital breadth (LIB), orbital length (ORL), zygomatic breadth (ZB), breadth of braincase (BB), and breadth of the zygomatic plate (BZP). External measurements (in millimeters) were recorded only from field-captured animals; we excluded pregnant females for weight values. Skulls were measured with digital calipers to the 0.01mm. Definitions of these measurements are the same as in BONVICINO & WEKSLER (1998). For morphometric characterization, we considered only adult specimens (all teeth erupted and with minimal wear) and grouped males and females.

Chromosome preparations were obtained from bone marrow cultures in RPMI 1640, 20% fetal calf serum, ethidium bromide (5µg/ml) and 10^{-6} M colchicine for two hours), following ANDRADE & BONVICINO (2003).

RESULTS

Oligoryzomys moojeni sp.nov.
(Figs.1, 2A, 3A, 4A)

Holotype – Adult ♂, MN 50309 (field number CRB 948). Skin, skull and partial skeleton, plus karyotype, collected in August 1996, by C.R.Bonvicino, M.Weksler, B.Lemos, and S.Lindbergh (Fig.2A).

Type-locality – Fazenda Fiandeira in "Morro do Chapéu" region, in the lowest part of the Chapada dos Veadeiros National Park, 65km SSW Cavalcante (14°04'S 47°45'W, altitude ranging from 550 to 740m), Goiás State, Brazil.

Paratypes – ♂ MN 50287, 50307, 50308, 50311, 50314, 50318, 50377, 50378, ♀ MN 50310, 50313, 50315, 50319, 50320, 50321, unsexed MN 50312, 50316, 50317.

Other specimens examined – MN 67087 from Faz. Cadoz, Mimoso de Goiás, Goiás State, Brazil.

External measurements – HB 89±4 (84-96, n=10), T 121±6 (112-132, n=9), F 23±2 (21-25, n=10), E 15±1.3 (13-17, n=10), W 16.9±5.3 (10-25, n=9).

Cranial measurements – See table 1.

Diagnosis – A medium-sized *Oligoryzomys* species characterized by: (1) brown-orange dorsal pelage, not contrasting with the creamy ventral pelage; (2) small incisive foramina; and (3) the highest diploid number (2n=70) among *Oligoryzomys* species.

Geographic distribution – Cerrado of Goiás and Minas Gerais States, in lower altitudes (less than 800m).

External characters – Adult dorsal pelage grizzled reddish-brown to yellowish-brown, composed of long and wholly guard hairs and slightly shorter overhairs with a sub-apical brown-yellowish or brown-reddish band. Lateral color lighter than in dorsum and without a defined limit with the creamy ventral pelage. Ventral hairs creamy at their upper half and gray at their basal half. Ventral regions of neck and limbs with entirely cream hairs. Inner side of pinnae with brown-reddish hairs. Dorsal surface of feet covered with lighter hairs, the tufts of longer hairs at base of pedal claws silvery. Tail slightly bicolored, dorsal surface dark gray and ventral surface light gray. Superciliary, genal, and mysticacial vibrissae not extending beyond ears. In juveniles, dorsum is reddish-brown to dark brownish-gray, ventral and lateral surfaces are gray, and the hairs of ventral surfaces of neck and limbs have a light gray base. There are eight mammae in inguinal, abdominal, postaxial, and pectoral pairs.

Cranial characters – Delicate skull, medium and narrow rostrum with similar width to interorbital constriction. Interorbital region hourglass-shaped. Braincase without supraorbital and postorbital ridges and with weakly developed lambdoidal ridge. Interparietal bone as broad as parietal. Large zygomatic plate relative to skull size, leading to deep zygomatic notch. Jugal bone absent, thus the zygomatic process of squamosal is in contact with the zygomatic process of maxillary. Incisive foramina with elongated teardrop shape, the posterior borders not extending beyond the anterior plane of the first molars, but sometimes almost reaching it. Palate with large posterolateral pits within fossa (absent in younger specimens). Palatal bridge broad and long; distance between the anterior border of mesopterygoid fossa and third molar similar to length of second molar. Mesopterygoid fossa usually perforated dorsally by large sphenopalatine vacuities, but partially ossified in some old animals. Width of parapterygoid plate slightly greater than width of mesopterygoid fossa. Stapedial foramen present (Fig.3), squamoso-alisphenoid groove and sphenofrontal

foramen absent (carotid circulatory pattern 2; VOSS, 1988). Medium or small subsquamosal fenestra and large postglenoid foramen. Alisphenoid strut absent. Large mastoid fenestra. Capsular projection of lower incisor alveolus present.

Dental characters – Upper and lower incisors opisthodont; molars pentalophodont. Superior molar rows parallel but with M3-M3 distance slightly broader than M1-M1 distance when taken from lingual side. Procingulum of first upper molar (M1) with anteromedian flexus; anterolabial and anterolingual conules of approximately equal size. Anteroloph reduced; posteroloph distinct but joined to metacone even in slightly worn molars. M3 reduced, with hypoflexus absent or very reduced, except in one animal where it is present.

Karyotype – Karyotypic analyses of 12 specimens of *Oligoryzomys moojeni* sp.nov. showed 2n=70, AN=74 (Fig.4A). The autosome complement comprised 3 pairs of small-sized biarmed chromosomes and 31 acrocentric pairs (one large pair and 30 varying in size from medium to small). The X chromosome is a large submetacentric, and the Y chromosome a small acrocentric. The 2n=70, AN=74 karyotype was described by ANDRADES-MIRANDA *et al.* (2001; see also LIMA *et al.*, 2003).

Table 1. Sample size, mean, standard-deviation, and range of cranial variables from *Oligoryzomys stramineus*, *O. nigripes*, *O. chacoensis*, *O. rupestris* sp.nov., *O. moojeni* sp.nov., *O. fornesi*, and *O. flavescens*.

	stramineus n=36	*chacoensis* n= 5	*nigripes* n=35	*rupestris* sp. nov. n=8	*moojeni* sp. nov. n=8	*fornesi* n=26	*flavescens* n=41
GSL	(33) 25.7±1.1 (23.3-28.3)	(3) 23.8±0.6 (23.2-24.3)	(31) 25.5±1.3 (23.1-28.4)	(7) 23.8±1.0 (22.7-25.2)	23.96±0.9 (25.0-22.1)	(25)22.8±0.8 (21.0-24.0)	(38) 22.5±1.1 (20.1-24.3)
CIL	(34) 23.2±1.1 (20.4-25.8)	(3) 21.2±0.7 (20.6-21.9)	(31) 22.9±1.3 (20.7-25.9)	(8) 20.9±1.1 (19.3-22.5)	21.58±0.9 (22.5-19.9)	(25)20.3±0.8 (18.7-21.6)	(41) 20.0±1.0 (17.4-22.0)
BOC	(33)5.7±0.2 (5.4-6.1)	(3) 5.7±0.3 (5.5-6.0)	(33) 5.7±0.2 (5.3-6.5)	(8) 5.6±0.2 (5.2-5.8)	5.29±0.3 (5.6-4.9)	(25) 5.4±0.2 (5.1-5.9)	(41) 5.4±0.2 (5.2-5.8)
LD	(36) 6.4±0.4 (5.3-7.5)	(5) 5.7±0.5 (5.2-6.3)	(35) 6.3±0.4 (5.4-7.6)	(8) 5.7±0.4 (4.3-4.9)	6.08±0.4 (6.4-5.3)	(26) 5.6±0.3 (5.0-6.2)	(39) 5.4±0.4 (4.5-6.0)
PB	(36) 4.7±0.3 (4.2-5.4)	(5) 4.1±0.2 (3.8-4.2)	(34) 4.5±0.3 (3.9-5.2)	(8) 4.5±0.2 (4.1-4.5)	4.28±0.3 (4.69-3.7)	(26) 4.0±0.2 (3.6-4.5)	(41) 3.8±0.2 (3.1-4.2)
LM	(36) 3.7±0.2 (3.3-4.2)	5 3.5±0.1 (3.3-3.7)	35 3.7±0.1 (3.5-4.0)	8 3.3±0.1 (3.2-3.5)	3.28±0.1 (3.4-3.1)	26 3.1±0.2 (2.8-3.6)	41 3.2±0.1 (3.0-3.5)
LIF	36 4.9±0.4 (4.2-5.7)	5 4.1±0.3 (3.9-4.5)	35 4.8±0.3 (4.1-5.9)	8 3.9±0.2 (3.5-4.1)	4.16±0.3 (4.7-3.7)	26 3.9±0.3 (3.4-4.9)	41 4.3±0.3 (3.4-4.9)
BIF	36 1.8±0.2 (1.5-2.4)	5 1.6±0.1 (1.4-1.8)	35 1.8±0.1 (1.5-2.1)	8 1.7±0.2 (1.5-2.0)	1.82±0.2 (2.1-1.5)	26 1.7±0.1 (1.4-1.9)	41 1.5±0.1 (1.3-1.8)
M1M	35 4.7±0.2 (4.3-5.3)	5 4.5±0.1 (4.5-4.6)	35 4.6±0.2 (4.3-5.1)	8 4.3±0.2 (3.5-4.1)	4.34±0.1 (4.5-4.2)	25 4.2±0.2 (3.9-4.6)	41 4.2±0.2 (3.8-4.5)
BM1	36 1.1±0.1 (1.0-1.3)	5 1.1±0.1 (1.1-1.2)	35 1.1±0.1 (1.0-1.2)	8 1.0±0.1 (1.0-1.1)	1.01±0.1 (1.13-0.89)	26 0.9±0.1 (0.8-1.1)	41 1.0±0.1 (0.9-1.1)
CH	36 7.8±0.3 (7.3-8.4)	5 7.5±0.2 (7.2-7.8)	35 7.8±0.3 (7.3-8.8)	8 7.2±0.2 (6.9-7.4)	7.36±0.35 (7.7-6.9)	25 7.0±0.3 (6.5-7.5)	41 7.1±0.3 (6.5-8.0)
RL	(35) 9.3±0.6 (7.8-10.7)	(4) 8.7±0.6 (8.3-9.5)	(35) 9.1±0.7 (7.7-10.6)	(7) 8.4±0.5 (7.9-9.3)	8.49±0.4 (9.1-7.6)	(26) 7.9±0.4 (7.3-8.7)	(38) 7.6±0.5 (6.4-8.6)
BRO	(35) 4.7±0.3 (4.2-5.6)	(5) 4.5±0.3 (4.2-4.8)	(35) 4.6±0.3 (4.0-5.4)	(8) 4.3±0.4 (3.7-4.6)	4.61±0.3 (4.9-4.2)	(26) 4.1±0.2 (3.7-4.7)	(40) 4.1±0.3 (3.5-4.5)
LIB	(36) 3.8±0.1 (3.5-4.0)	(5) 3.9±0.1 (3.8-4.0)	(35) 3.8±0.2 (3.5-4.1)	(8) 3.7±0.1 (3.4-3.9)	3.69±0.1 (3.8-3.6)	(25) 3.7±0.2 (3.3-4.2)	(41) 3.4±0.2 (3.2-3.9)
ORL	(36) 8.8±0.4 (7.6-9.6)	(5) 8.3±0.2 (8.0-8.5)	(35) 8.7±0.3 (8.1-9.5)	(8) 8.1±0.3 (7.8-8.6)	8.29±0.2 (8.6-8.0)	(26) 7.7±0.4 (6.8-8.6)	(41) 7.6±0.4 (6.6-8.2)
ZB	(36) 13.2±0.6 (11.9-14.8)	(4) 12.8±0.3 (12.3-13.1)	(35) 13.3±0.6 (12.3-14.9)	(7) 12.0±0.7 (10.8-12.8)	12.43±0.3 (12.7-11.9)	(26)12.0±0.6 (10.5-12.8)	(37) 12.0±0.7 (10.3-13.3)
BB	(35) 10.7±0.4 (10.1-11.6)	(3) 10.6±0.1 (10.4-10.6)	(32) 10.9±0.3 (10.2-11.5)	(7) 10.2±0.2 (9.9-10.4)	10.02±0.3 (10.7-9.8)	(24)10.0±0.4 (9.1-10.7)	(41) 10.1±0.3 (9.5-11.0)
BZP	(36) 2.8±0.2 (2.3-3.5)	(5) 2.4±0.3 (1.9-2.7)	(34) 2.6±0.2 (2.1-3.0)	(8) 2.2±0.2 (1.8-2.3)	2.34±0.2 (2.7-2.1)	(26) 2.3±0.1 (2.0-2.5)	(40) 2.2±0.2 (1.8-2.6)

See methods to variable abbreviations. (n) sample size.

Habitat – Specimens of *Oligoryzomys moojeni* sp.nov. were captured at lower altitudes (500-700m) in the Parque Nacional da Chapada dos Veadeiros. This species was captured primarily in open vegetation formations, like "cerrado *sensu stricto*" (6 individuals) and "campo úmido" in the border with "cerrado *sensu stricto*" (2 individuals), but also in forest formations like open gallery forest with bamboo trees (3 individuals) and in the border of disturbed "cerradão" (1 individual).

Reproduction – Two pregnant females were captured in August 1996 with three fetuses each. One of them was captured in the same trap with a young adult male.

Comparisons – *Oligoryzomys moojeni* sp.nov. differs from all other *Oligoryzomys* species by its unique karyotype. Other differences include: (1) a creamy ventral pelage without a defined limit between dorsal and ventral pelage color, contrary to a whitish venter and a sharply defined limit between dorsal and ventral coloration in adult specimens of *O. nigripes*, *O. chacoensis*, and *O. stramineus*; (2) absence of yellow hairs at ventral region between forelimbs, opposite to presence of patch of yellow hairs in *O. nigripes* and *O. stramineus*; (3) bicolored tail, contrary to unicolored tail in *O. nigripes* and *Oligoryzomys* sp.nov. 2 (see below); (4) entirely creamy ventral side of limbs, contrary to the dark coloration in *O. fornesi* and *O. flavescens*; (5) lighter and heterogeneous dorsal coloration (alternating dark and lighter hairs), opposite to darker and homogeneous dorsal coloration in *O. flavescens*; and (6) small incisive foramina (not reaching plane of first molar), opposite to longer foramina reaching first molar in *Oligoryzomys* sp.nov. 2, *O. flavescens, O. stramineus, O. nigripes*, and *O. chacoensis*.

Etymology – This species is named in honor to João Moojen, one of the foremost mammalogists of Brazil.

Remarks – LIMA *et al.* (2003) described a karyotypic variant of *Oligoryzomys* with the same diploid number of 70 as *O. moojeni* sp.nov., but with a different fundamental autosome number (AN=76). We did not examine those specimens, but the similar karyotype indicates that the variant might be closely related to *O. moojeni* sp.nov.

Fig.2- Dorsal, ventral and lateral views of skull of the holotypes of (A) *Oligoryzomys moojeni* sp.nov. (MN50309) and (B) *Oligoryzomys rupestris* sp.nov. (MN50286). The superior and molar row of *Oligoryzomys moojeni* sp.nov. is from MN50287.

Oligoryzomys rupestris, sp.nov.
(Figs.1, 2B, 3B, 4B)

Holotype – Adult ♀ MN 50286 (field number CRB 1141). This specimen was captured in November 1996 by C.R.Bonvicino, J.Freitas, L.Maroja, B.Lemos, and S.Lindbergh (Fig.2B). Skin, skull, partial skeleton, bone marrow cells and liver were preserved.

Type-locality – Pouso Alto (14°01'S 47°31'W), in the highest part of the Chapada dos Veadeiros National Park, at 1,500m altitude, 14km NNW of Alto Paraíso, Goiás State, Brazil.

Paratypes (same locality and collectors) – ♀ MN 50322, 50324, 50327, ♂ MN 50323, 50325, 50326, unsexed MN 503228.

External measurements – HB=82.9±10.0 (76-99, n=6), T=121.1±11.1 (114-138, n=6), F= 23.6±2.0 (20-25, n=6), E=14.5±2.0 (10-16, n=6), W=13.8±4.9 (10-20, n=6).

Cranial measurements – See table 1.

Diagnosis – A small-sized *Oligoryzomys* species, characterized by: (1) gray head contrasting with a lighter yellow-brownish dorsal body coloration; (2) small tufts of whitish hairs anterior to pinna base; (3) stapedial foramen reduced or absent, squamosal-alisphenoid groove and sphenofrontal foramen absent (carotid circulatory pattern 3; VOSS, 1988); and (4) the lowest known diploid number (2n=46, AN=52) among *Oligoryzomys* species.

Geographic distribution – Species known from only two localities, Alto Paraíso, Goiás State, and Pico das Almas, Bahia State, both with "campo rupestre" vegetation, at high altitudes.

External characters – Adult dorsal pelage grizzled yellowish-brown, with gray head and light gray cheeks, composed of long and dark guard hairs and slightly shorter over-hairs with distal part (1/3 of total length) brownish-yellow and light gray base (2/3 of total length). Lateral color yellowish, with less and lighter guard hairs than dorsum, and with a moderately defined limit with ventral pelage. Base of ventral hairs light gray, except for a small region of the neck with completely white hairs. Inner side of pinnae with light brown hairs. Subauricular patches, areas of whitish coloration immediately ventral to the pinnae base, present. Dorsal foot surface covered with white hairs, with tufts of longer hairs at base of pedal claws. Tail unicolored, dorsal and ventral surface gray. Young individuals with gray dorsal and lateral pelage. Eight mammae in inguinal, abdominal, postaxial, and pectoral pairs.

Cranial characters – Delicate skull, medium and narrow rostrum with similar breadth to interorbital constriction. Interorbital region hourglass-shaped. Braincase without supraorbital and postorbital ridge; lambdoidal ridge weakly developed. Interparietal bone as broad as parietal. Large zygomatic plate relative to skull size, with deep zygomatic notch. Jugal bone absent, thus the zygomatic process of squamosal is in contact with the zygomatic process of maxillary. Extension of posterior borders of incisive foramina variable, reaching or not the plane of first molar up to the anterocone. Posterolateral palatal pits varying in number and morphology, from single and large to multiple within a shallow fossa, or without fossa. Palatal bridge broad and long; distance between the anterior border of mesopterygoid fossa and the third molar similar to length of second molar. Mesopterygoid fossa dorsally perforated by large sphenopalatine vacuities. Width of parapterygoid plate slightly greater than width of mesopterygoid fossa. Stapedial foramen reduced or absent (Fig.3), squamosal-alisphenoid groove and sphenofrontal foramen absent (carotid circulatory pattern 3; VOSS, 1988). Medium or small subsquamosal fenestra and large postglenoid foramen. Alisphenoid strut absent. Large mastoid fenestra. Capsular projection of lower incisor alveolus present but not pronounced.

Dental characters – Upper and lower incisors opisthodont; molars pentalophodont. Superior molar rows parallel but with M3-M3 distance slightly broader than M1-M1 distance when taken from lingual side. Procingulum of first upper molar (M1) forming a continuous conule without anteromedian flexus. Anteroloph reduced, posteroloph distinct but joined to metacone even in slightly worn molars. M3 reduced, with hypoflexus usually present in younger specimens, but absent in very old exemplars.

Karyotype – Karyotypic analyses of 8 specimens of *Oligoryzomys rupestris* sp.nov. showed 2n=46, AN=52 (Fig.4B), one of the lowest known diploid number of the genus (Tab.2). The autosome complement comprised 4 pairs of biarmed chromosomes (2 large- and 2 small-sized) and 18 acrocentric pairs (one very large and 17 small). The X chromosome is a medium sized submetacentric and the Y chromosome a small acrocentric. The karyotype herein reported is similar to the one reported by SILVA & YONENAGA-YASSUDA (1997) in specimens identified as *Oligoryzomys* sp.1.

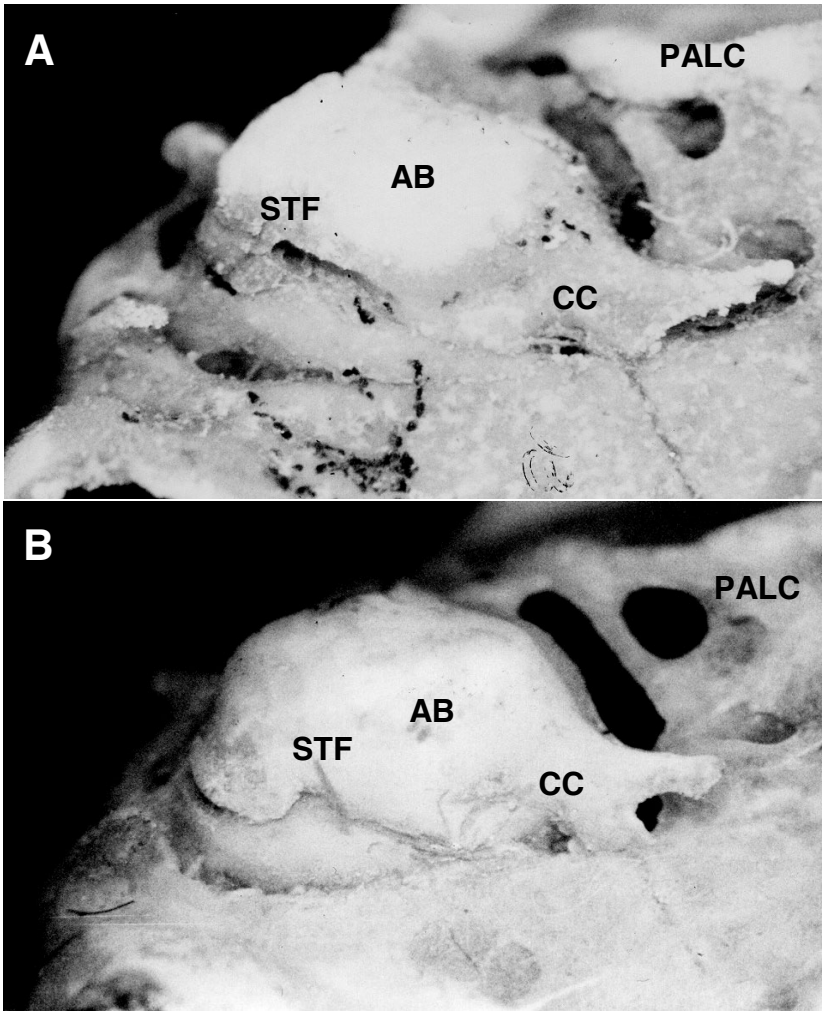

Fig.3- Ventral view of the ectotympanic region showing the different condition of carotid circulation in *Oligoryzomys moojeni* sp.nov. (A) and *Oligoryzomys rupestris* sp.nov. (B). Abbreviations: (AB) auditory bulla, (CC) carotid canal, (PALC) posterior opening of alisphenoid canal, (STF) stapedial foramen.

Habitat – *Oligoryzomys rupestris* sp.nov. is a habitat specialist. Although we sampled all vegetation types in the Pouso Alto region, this species was captured only at high altitude (1,500m) in "campo rupestre" or in the border of adjacent vegetation. Specimens karyotyped by SILVA & YONENAGA-YASSUDA (1997) were also captured in "campo rupestre". "Campo rupestre" is a type of vegetation typical of the Central Brazilian Cerrado, with outcrop rocks in scarce, 2-5m tall, cerrado vegetation (EITEN, 1994).

Comparisons – *Oligoryzomys rupestris* sp.nov. differs from all other *Oligoryzomys* species by its gray head contrasting with the remaining body coloration, absent or reduced stapedial foramen, and unique karyotype. Differences from other species includes: (1) a whitish ventral coloration with a moderate limit between lateral and ventral coloration, against a creamy coloration with a less clearly limit between lateral and ventral coloration in *Oligoryzomys moojeni* sp.nov., *O. flavescens*, and *O. fornesi*; (2) absence of yellow hairs in ventral region between forelimbs, contrary to it presence as a yellow patch in adult specimens of *O. nigripes* and *O. stramineus*; and (3) unicolored tail, against bicolored tail in *O. stramineus*, *Oligoryzomys moojeni* sp. nov., *O. flavescens*, and *O. fornesi*.

Etymology – *rupestris*, from "campo rupestre", a type of high altitude Cerrado vegetation with outcrop rocks, the typical habitat of this species.

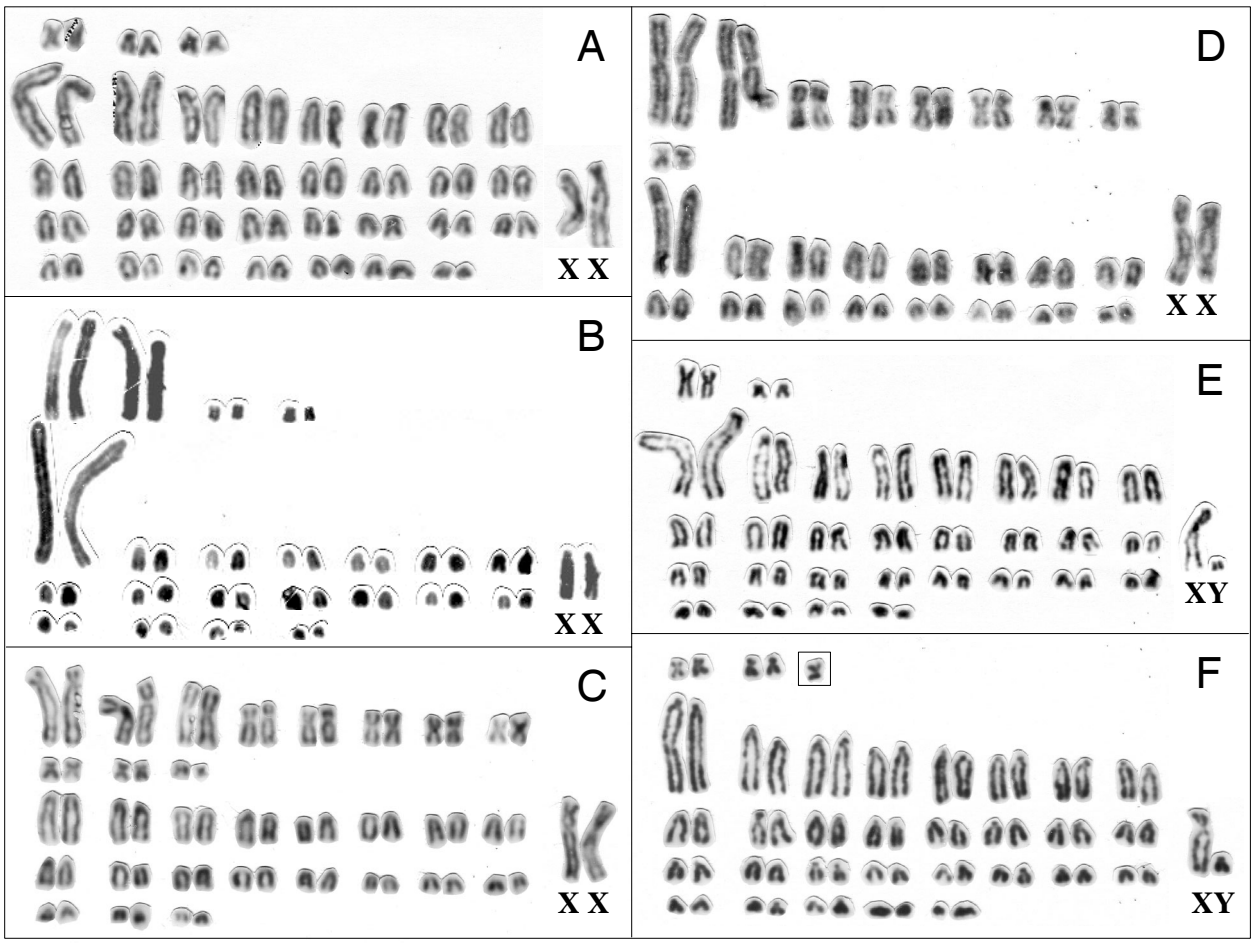

Fig.4- Conventional Giemsa coloration of (A) *Oligoryzomys moojeni* sp.nov., (B) *Oligoryzomys rupestris* sp.nov., (C) *O. nigripes*, (D) *O. stramineus*, (E) *O. fornesi*, and (F) *O. flavescens* karyotypes.

Remarks – The two specimens (MZUSP 29015, 29016), karyotypically identical to *O. rupestris* sp.nov. described by SILVA & YONENAGA-YASSUDA (1997), could not be found in the MZUSP (Museu de Zoologia da Universidade de São Paulo) collection. However, karyotypic and habitat similarities indicate that they are probably referable to *O. rupestris* sp.nov. The same authors described a second karyotype, 2n=44-45, AN=52-53, for another *Oligoryzomys* species (MZUSP 27423, 29013, and 29014) of the "campos rupestres" habitat of Serra do Cipó (19°18'S 43°35'W), State of Minas Gerais. Although this karyotype differs from the one described for *O. rupestris* sp.nov., the only available specimen (MZUSP 27423) is morphologically similar to *O. rupestris* sp.nov., also sharing the distinctive carotid circulatory pattern, indicating a close phylogenetic relationship.

Oligoryzomys nigripes (Olfers, 1818).
(Figs.1, 4C)

Type-locality – Paraguay - Department of Paraguarí, Ibicuy National Park, 85 km SSE Atyra (restricted by MYERS & CARLETON, 1981).

Diagnosis – A large sized *Oligoryzomys* species, characterized by (1) dark-brown to dark-yellowish dorsal pelage color, with defined limit with whitish ventral coloration, and often with an orange pectoral band, (2) long ears, and (3) a 2n=62, AN=78-82 karyotype.

Distribution – In Brazil, this species occurs in the Atlantic Forest, from the State of Pernambuco in the North to the Rio Grande do Sul State in the South, and in the Southern portion of the Cerrado in Federal District, Minas Gerais, and São Paulo states. It also occurs in Paraguay (east of Paraguay River), Uruguay (Departments of Salto, Durazno,

Colonia, and Maldonado), and Argentina (Provinces of Buenos Aires, Misiones, and Chaco).

External measurements – HB 92.0±9.9 (70-120, n=44), T 116±10.5 (96-144, n=43), F 24.8±1.8 (21-29, n=42), E 17±1.4 (14.5-20, n=44), W 25.4±4.7 (18-40, n=29).

Cranial measurements – See table 1.

Karyotype – Karyotypic analysis of 38 specimens showed 2n=62, AN=81-82 (Fig.4C); variation in autosome fundamental number due to pericentric inversions as previously described (YONENAGA *et al.*, 1976; MYERS & CARLETON, 1981).

Habitat – *O. nigripes* was captured at altitudes ranging from 100m (present study) to 2,000m (BONVICINO *et al.*, 1997) in the Atlantic Forest. It is the most habitat-generalist of all Brazilian *Oligoryzomys* species, occurring in primary and secondary vegetation, mainly in forest vegetation, like the montane and sub-montane forest of the Atlantic Forest and gallery forest of the Cerrado. It may be sympatric with *O. stramineus* (BONVICINO & WEKSLER, 1998) though not in the same trap line. It can be syntopic with *O. flavescens* and sympatric with *O. fornesi*, this latter species being an open vegetation inhabitant. We only collected *O. nigripes* on the ground level despite that MYERS & CARLETON (1981) collected specimens in trees and suggested some arboreal activity, also based on their relatively shorter feet than other *Oligoryzomys* species.

Reproduction – Pregnant females were collected in September and November with an average of 4.7 embryos (range 4-6) was recorded in a sample of 21 pregnant females. MYERS & CARLETON (1981) reported an average of 3.57 (range 2-5) in 32 pregnant females, and noted that reproduction occurs around June and August, with a hiatus in July.

Remarks – *Oligoryzomys nigripes* could not be separated from *O. delticola* and *O. eliurus* based on morphologic and karyotypic data (MYERS & CARLETON, 1981; BONVICINO & WEKSLER, 1998). Previous morphometric analyses did not detect differences between samples assigned to *O. delticola* and *O. nigripes* (BONVICINO & WEKSLER, 1998). Size alone does not provide a distinctive criterion for separating these species because *O. nigripes* exhibits a large variability, even within populations. We tentatively placed *O. delticola* and *O. eliurus* as junior synonyms of *O. nigripes*, but examination of the holotypes of these species is necessary to corroborate our taxonomic arrangement.

Oligoryzomys stramineus
Bonvicino and Weksler, 1998
(Figs.1, 4D)

Type-locality – Brazil - Goiás State: Teresina de Goiás, Fazenda Vão dos Bois.

Diagnosis – A large body-sized *Oligoryzomys* species characterized by (1) paler dorsal color, with defined limit between lateral and whitish ventral pelage, (2) long incisive foramen, (3) broad zygomatic plate, and (4) a 2n=52, AN=68-70 karyotype.

Distribution – Endemic to Brazil, from the Cerrado of Northern Goiás and Northern Minas Gerais states, and the Caatinga of Paraíba and Pernambuco states.

External measurements – HB=94.3±10.2 (70-111, n=33); T=118.6±=9.2 (95-134, n=32); F=25.5±1.4 (23-29, n=33); E=16.1±1.6 (12-20, n=32).

Cranial measurements: See table 1.

Karyotype – Karyotypic analyses of 5 specimens showed 2n=52, AN=68-69 (Fig.4D), similar to the one previously found in 30 specimens (BONVICINO & WEKSLER, 1998; Tab.2); differences in autosome fundamental number being due to an inversion in one small acrocentric pair.

Habitat – This species was collected mainly in gallery forest in the Cerrado morphoclimatic domain (BONVICINO & WEKSLER, 1998); data for Caatinga habitats are unavailable. *Oligoryzomys stramineus* is sympatric with *O. fornesi* (in the same line trap) and with *O. nigripes* (but never in the same line trap).

Reproduction – We collected young juveniles in August 1995, suggesting that reproduction occurred around June-July. One pregnant female captured in September 1997 produced 4 fetuses.

Oligoryzomys chacoensis
(Myers and Carleton, 1981).
(Fig.1)

Type-locality – Paraguay - Department of Boquerón, 419km by road NW Villa Hayes (alongside the Trans Chaco Highway).

Diagnosis (MYERS & CARLETON, 1981) – "A medium-sized species (of the subgenus) *Oligoryzomys,* unique by its whitish underside, with hair white to the base on the chin and throat, relatively long ears with hairs on inner surface with unusually short or absent dark basal bands, small but distinctive tuffs of orange hairs anterior to ears, and karyotype with 2n=58, AN=74".

Table 2. Data on *Oligoryzomys* karyotypes.

SPECIES GROUP	TAXON	2n	AN	LOCALITY	REFERENCE
andinus	*O. andinus*	60	70	Peru: Ancash	GARDNER & PATTON, 1976
andinus	*O. chacoensis*	58	74	Paraguay: Presidente Hayes	MYERS & CARLETON, 1981
andinus	*O. chacoensis* (*O. cf. longicaudatus*)	58	74	AR: Tucuman and Jujuy	ESPINOSA & REIG, 1991
flavescens	*O. flavescens*	64	68	BR: MG	BONVICINO & WEKSLER, 1998
flavescens	*O. flavescens*	64	66	BR: SP, Pedreira	this study
flavescens	*O. flavescens*	66	68	AR: Buenos Aires and Cordoba	ESPINOZA & REIG, 1991
flavescens	*O. flavescens*	66	70	Argentina and Uruguay	BRUM-ZORRILA *et al.* ,1988; VIDAL RIOJA *et al.*, 1988
flavescens	*O flavescens*	64-66	66-68	Bolivia: Tarija	ANISKIN & VOLOBOUEV, 1999
flavescens	*O. flavescens*	64-66	66-68	BR: RS, PR, and SC	ANDRADES-MIRANDA *et al.*, 2001
flavescens	*O. flavescens*	64-66	66-68	AR: Buenos Aires; Uruguay	BRUM-ZORRILA *et al.*, 1988
flavescens	*O. flavescens*	64-66	66-68	BR: PR, SC and RS	SBALQUEIRO *et al.*, 1991
flavescens	*O. flavescens* (*O.* cf. *flavescens*)	66-68	68-70	AR: Jujuy and Tucuman	ESPINOSA & REIG, 1991
flavescens	*O. flavescens* (*O. fornesi*)	64-66	66-68	Paraguay: Caaguazú, Canendiyu, Misiones, and Presidente Hayes	MYERS & CARLETON, 1981
flavescens	*O. fornesi*	62	64	BR: GO	BONVICINO & WEKSLER, 1998
flavescens	*O. fornesi*	62	64	Paraguay: Caaguazú and Canendiyu	MYERS & CARLETON, 1981
flavescens	*O. fornesi* (*O. aff. eliurus*)	62	64	BR: PE	FURTADO, 1981
flavescens	*O. fornesi* (*O. eliurus*)	62	64	BR: DF and GO	SVARTMAN, 1989; ANDRADES-MIRANDA *et al.*, 2001
flavescens	*O. microtis* (*O. longicaudatus* var. 2)	64	66	Peru: Loreto	GARDNER & PATON, 1976
flavescens	*O. microtis*	64	66	BR: AM	PATTON *et al.*, 2000
flavescens	*O. microtis*	64	66	Peru: Ucayali and Loreto	ANISKIN & VOLOBOUEV, 1999
flavescens	*O. moojeni* sp. nov. (*Oligoryzomys* sp.)	70	74	BR: GO, Minaçu, Niquelândia, Colinas do Sul, Uruaçú	ANDRADES-MIRANDA *et al.*, 2001
flavescens	*O. moojeni* sp. nov. (*Oligoryzomys* sp.)	70	74	BR: GO, Cavalcante and Mimoso do Goiás	LIMA *et al.*, 2003
flavescens	*Oligoryzomys* sp.	70	76	BR: TO, Lajeado and Porto Nacional	LIMA *et al.*, 2003
fulvescens	*O. fulvescens*	60	72	Venezuela: Miranda	KIBLISKY, 1969
fulvescens	*O. fulvescens costaricensis*	54	68	Costa Rica: San José	GARDNER & PATON, 1976; CARLETON & MUSSER, 1995
fulvescens	*O. fulvescens fulvescens*	60	74	Mexico: Veracruz	HAIDUK *et al.*, 1979; CARLETON & MUSSER, 1995
fulvescens	*O.* gr. *fulvescens* (*O. longicaudatus* var.3)	62	74,76	Venezuela: Bolivar	GARDNER & PATON, 1976
nigripes	*O. destructor* (*O. longicaudatus* var. 4)	60	76	Peru: Ayacucho	GARDNER & PATON, 1976
nigripes	*O. longicaudatus* (*O. l. philippii*)	56	66	Chile: Valdívia	GALLARDO & PATTERSON, 1985
nigripes	*O. magellanicus* (*O. l. magellanicus*)	54	66	Chile: Punta Arenas	GALLARDO & PATTERSON, 1985
nigripes	*O. nigripes*	62	82	Paraguay	MYERS & CARLETON, 1981

continued...

... conclusion

SPECIES GROUP	TAXON	2n	AN	LOCALITY	REFERENCE
nigripes	*O. nigripes*	62	82	BR: SP and RJ	YONENAGA *et al.*, 1976
nigripes	*O. nigripes* (*O. delticola*)	62	82	AR: Parana River Delta	ESPINOSA & REIG, 1991
nigripes	*O. nigripes*	62	78	BR: BA	ZANCHIN, 1988
nigripes	*O. nigripes*	61-62	78, 80-82	BR: GO, BA, ES, PR, SC, and RS	ANDRADES-MIRANDA *et al.*, 2001
nigripes	*O. nigripes*	62	81-82	BR: MG and RJ	BONVICINO & WEKSLER, 1998
nigripes	*O. nigripes*	62	80-82	BR: RJ, SP, ES, and RS	ZANCHIN, 1988; BONVICINO *et al.*, 2001
nigripes	*O. nigripes*	62	80-82	BR: SP and RJ	ALMEIDA & YONENAGA-YASSUDA, 1991
nigripes	*O. nigripes* (*O. delticola*)	62	80-81	Uruguay	BRUM-ZORRILA *et al.*, 1988
nigripes	*O. stramineus*	52	68	BR: MG, Juramento	this study
nigripes	*O. stramineus*	52	68	BR: GO	ANDRADES-MIRANDA *et al.*, 2001
nigripes	*O. stramineus* (*O. aff. eliurus*)	52	68	BR: PE	MAIA *et al.*, 1983; FURTADO, 1981
nigripes	*O. stramineus* (O. *aff. eliurus*)	52	68	BR: PE	FURTADO, 1981
nigripes	*O. stramineus*	52	68-70	BR: GO	BONVICINO & WEKSLER, 1998
nigripes	*Oligoryzomys* sp. (*O. delticola*)	60	76	Uruguay: Río Queguay	BRUM-ZORRILA *et al.*, 1988
nigripes	*Oligoryzomys* sp. (*O. longicaudatus* var.1)	68	74,76	Peru: Ayacucho	GARDNER & PATON, 1976
rupestris	*O. rupestris* sp. nov.	46	52	BR: GO, Alto Paraíso	this study
rupestris	*O. rupestris* sp. nov. (*Oligoryzomys* sp.1)	46	52	BR: BA, Pico da Almas	SILVA & YONENAGA-YASSUDA, 1997
rupestris	*Oligoryzomys* sp. (*Oligoryzomys* sp.2)	44-45	52-53	BR: MG, Serra do Cipó	SILVA & YONENAGA-YASSUDA, 1997
ungrouped	O. *cf. messorius*	56	58	BR: RR	ANDRADES-MIRANDA *et al.*, 2001
ungrouped	*Oligoryzomys* sp. (*O. microtis*)	66	74	BR: AP	ANDRADES-MIRANDA et al., 2001

Names used in the cited references are in brackets. Country and state acronyms read as follows: (AR) Argentina, (BR) Brazil; (AM) Amazonas, (AP) Amapá, (BA) Bahia, (ES) Espírito Santo, (GO) Goiás, (MG) Minas Gerais, (PE) Pernambuco, (PR) Paraná, (RJ) Rio de Janeiro, (RS) Rio Grande do Sul, (RR) Roraima, (SC) Santa Catarina, (SP) São Paulo, and (TO) Tocantins.

Distribution – Paraguayan Chaco, Bolivian Chaco (Departments of Beni, Santa Cruz, and Tarija), Argentina (Provinces of Jujuy, Formosa, Chaco, Salta, and Tucumán) and Brazil (Mato Grosso do Sul and southwestern part of the State of Mato Grosso) (MYERS & CARLETON, 1981; CARLETON & MUSSER, 1989). CARLETON & MUSSER (1989) extended its distribution to Ceará and Pernambuco states in Brazil, but as argued by BONVICINO & WEKSLER (1998), this assessment was based on misidentification of specimens that actually belong to *O. stramineus* (USNM 528416 and USNM 304583).

External measurements (in mm, from MYERS & CARLETON, 1981) – Total length=223.4 (185-280, n=90), T 129.0 (105-150, n=90), F 24.8 (18-30, n=90), E 16.6 (13-19, n=90).

Cranial measurements – See table 1.

Karyotype – 2n=58, AN=74 (MYERS & CARLETON, 1981; Tab.2).

Habitat – *Oligoryzomys chacoensis* occurs in forest, thorn scrub, and grassland in Chaco. MYERS & CARLETON (1981) commented that hind feet of *O. chacoensis,* as in *O. nigripes*, are relatively short when compared to more terrestrial *Oligoryzomys* species.

Reproduction – MYERS & CARLETON (1981) reported an average of 4.6 embryos (range 2-5) in 10 pregnant females and suggested that reproduction occurred around January, February, July, with few births in June (winter).

Oligoryzomys fornesi (Massoia, 1973).
(Figs.1, 4E)

Type-locality – Argentina - Province of Formosa: Department of Río Pilcomayo, Naineck, Ceibo 13.

Distribution – In Brazil, it occurs in Cerrado (Distrito Federal, Minas Gerais, and Goiás states) and Caatinga (Pernambuco State). It also occurs in Argentina (Province of Formosa) and Paraguay.

Diagnosis – One of the smallest *Oligoryzomys* species, characterized by (1) chestnut-brown-yellowish dorsal coloration, with abundant dark guard hairs resulting in a heterogeneous pelage, ventral color light yellow-gray, (2) short incisive foramen not reaching M1, (3) mesopterygoid fossa distant from M3, and (4) a 2n=62, AN=64 karyotype.

External measurements – HB 75.3±8.9 (60-84, n=8); T 100.1±8.0 (90-111, n=8); F 22.6±0.7 (22-24, n=8); E 12.7±0.5 (12-13, n=7); W 14.0 ±3.1 (9-20, n=11).

Cranial measurements – See table 1.

Karyotype – 2n=62, AN=64 (Fig.4E), as previously reported (BONVICINO & WEKSLER, 1998; Tab.2 and taxonomic remarks). The karyotype of *O. fornesi* has been erroneously attributed to either *O. flavescens* or *O. eliurus* in previous studies. MYERS & CARLETON (1981) attributed 2n=62-66 to *O. fornesi*, though their sample actually consisted of two karyotypically discontinuous species: *O. fornesi* (2n=62, AN=64) and *O. flavescens* (2n=64-66, AN=66-68) (BONVICINO & WEKSLER, 1998). Karyotypes of *O. fornesi* and *O. flavescens* are discontinuous because a 2n=63 karyotype has not been reported. Furthermore, these two taxa also differ in morphological traits (such as length of incisive foramen that is greater in *O. flavescens* than in *O. fornesi*). ANDRADES-MIRANDA *et al.* (2001) considered the 2n=62, AN=64 karyotype as belonging to *O. eliurus*, but we disagree from their interpretation. Specimens with 2n=62, AN=64 analyzed by us showed the same morphological attributes described for *O. fornesi* (BONVICINO & WEKSLER, 1998) and are different from those attributed to *O. eliurus* in its original description (WAGNER, 1845). Furthermore, we agree with MYERS & CARLETON (1981) that *O. eliurus* is conspecific with *O. nigripes* (see above). Finally, the type locality of *O. eliurus* is Ytararé, State of São Paulo, in the Atlantic Forest, while the 2n=62, AN=64 karyotype has been recorded only in specimens from the core of the open vegetation morphoclimatic domains in Brazil and Paraguay (Cerrado, Caatinga, and Chaco; Fig.1) but never in the Atlantic Forest or in its limits with the Cerrado.

Habitat – In Brazil, this species mainly occurs in open vegetation formations but is also found in forest formations of the Cerrado (data on the habitat utilization in Caatinga are unavailable). It is sympatric (in the same line trap) with *O. nigripes* and *O. stramineus*. MYERS & CARLETON (1981) reported that *O. fornesi* is sympatric with *O. chacoensis* in Paraguay, while BONVICINO & WEKSLER (1998) found that *O. fornesi* and *O. flavescens* are sympatric in one locality (Curuguaty).

Reproduction – No reproductive data is available.

Taxonomic remarks – The taxonomy history of *O. fornesi* is complex. Initially described as a subspecies of *O. microtis*, *O. fornesi* was raised to full specific status by MYERS & CARLETON (1981). OLDS & ANDERSON (1987) placed it again as a subspecies of *O. microtis* and CARLETON & MUSSER (1989) placed it as a junior synonym of *O. microtis*. We consider *O. fornesi* and *O. microtis* as different species because they are karyotypically different (Tab.2). Phylogenetic analyses of cytochrome *b* sequence data corroborated this proposition, placing *O. microtis* and *O. fornesi* in different evolutionary lineages (MYERS *et al.*, 1995). Furthermore, these species occupy different morphoclimatic domains (*O. fornesi* in Cerrado, Chaco, and Caatinga, *O. microtis* in the Amazon biome). Although the present taxonomic arrangement is supported by karyotypic, molecular, and biogeographic data, it is clear that a thorough morphological analysis will facilitate species diagnoses.

Oligoryzomys flavescens (Waterhouse, 1837).
(Figs.1, 4F)

Type-locality – Uruguay - Maldonado.

Diagnosis – A small-sized species, characterized by (1) dorsum with bright brownish-orange hairs finely intermixed with dark hairs, (2) lateral brighter orange coloration, without defined limits with yellow-gray ventral coloration, (3) incisive foramen long usually reaching first molar, (4) fossa mesopterygoid distant from M3, and (5) an 2n=64-66, AN=66-70 karyotype.

Distribution – In Brazil, it occurs in Atlantic Forest, from the State of Bahia to the State of Rio Grande do Sul, and in gallery forest (a link to the Atlantic Forest) in the Cerrado of Central Brazil. It also occurs in Paraguay, Uruguay, and Argentina.

External measurements – HB 87.8.3±5.7 (81-93, n=4); T 109.7±17.7 (97-1304, n=3); F 23.5±1.3 (22-24, n=4); E 15.0±0.8 (15-16, n=4), W 18.8±2.6 (15-21, n=4).

Cranial measurements – See table 1.

Karyotype – Karyotypic analysis of 6 specimens of *O. flavescens* showed 2n=64-66, AN=66-68 (Fig.4F, Tab.2). As described by SBALQUEIRO *et al.* (1991), the basic diploid and autosome fundamental numbers of this species are 2n=64, AN=66; variation in diploid and autosome fundamental number being due to acrocentric or metacentric B chromosomes. The *O. microtis* karyotype, 2n=64, AN=66, apparently shares a similarity in 2n and AN with one karyotypic variant of *O. flavescens*. However, there are some differences in the morphology of biarmed autosomes: in *O. microtis*, one of the two biarmed chromosome pairs is the largest of the autosome complement and the other is a small pair, while in *O. flavescens* the two biarmed pairs are small-sized.

Habitat – *Oligoryzomys flavescens* was captured at lower altitudes in disturbed Atlantic forest regions, although this species also occurs at high altitudes (1,800m) in Parque Nacional de Caparaó.

Reproduction – Data on pregnant females were never reported.

DISCUSSION

Significant morphological and karyotypic differences were observed between *Oligoryzomys rupestris* sp.nov. and other species of *Oligoryzomys*, while *O. moojeni* sp.nov. was similar to other species of the genus, especially those of small body-size group (*sensu* BONVICINO & WEKSLER, 1998). Additionally, *O. moojeni* sp.nov. is found in habitats of the Cerrado morphoclimatic domain, like "cerrado *sensu stricto*" and "campo úmido", which also harbor other congeneric species, such as *O. stramineus* and *O. fornesi*. Conversely, *O. rupestris* sp.nov. is one of only two mammal species known to be endemic to "campos rupestres" (see next).

Oligoryzomys rupestris sp.nov. shows a unique pelage pattern among *Oligoryzomys*, with a contrasting coloration between head and body. The head is gray, while the remaining of the body is of a lighter yellow-brownish coloration, similar to the other *Oligoryzomys* species. The presence of a white fur patch behind the ears is another distinctive characteristic of *O. rupestris* sp.nov. in respect with other *Oligoryzomys* species. Both characteristics are found in some oryzomyine taxa (*e.g.*, *Oryzomys subflavus* and *Nesoryzomys*, respectively) but is the first time to be reported for *Oligoryzomys*.

The cranial morphology of *O. rupestris* sp.nov. drastically differs in respect to the carotid circulatory pattern of all other *Oligoryzomys* because *O. rupestris* sp.nov. exhibits a reduced stapedial foramen in its auditory bullae. This, coupled with lack of sphenofrontal foramen and the alisphenoid-squamosal groove, characterizes the derived pattern 3 of the carotid circulation, as defined by VOSS (1988; see also CARLETON, 1980; CARLETON & MUSSER, 1993 for illustrations). Conversely, all species of *Oligoryzomys* examined to date show a well-developed stapedial foramen but still lack the sphenofrontal foramen and groove characteristic of the derived pattern 2. This pattern was considered to be one of the diagnostic characters of *Oligoryzomys* by CARLETON & MUSSER (1989), and is a synapomorphic trait of this genus (WEKSLER, 2004). Within oryzomyines, pattern 2 is found only in *Oligoryzomys* and in the *Oryzomys megacephalus* species group (*e.g., O. megacephalus*, *O. perenensis*, *O. yunganus*, *O. seuanezi*, and *O. oniscus*), while pattern 3 is found among some oryzomyine taxa (*e.g.*, *Nectomys*, *Holochilus*, *Oryzomys palustris*, *Oryzomys subflavus*, *Pseudoryzomys*). Pattern 2 is, apparently, an evolutionary intermediary state between the primitive condition (a carotid circulation with stapedial and sphenofrontal foramina plus a groove; pattern 1 of VOSS, 1988) and the pattern 3. According to this interpretation, the pattern observed in *O. rupestris* sp. nov. can be interpreted as a autapomorphy in respect with pattern 2 observed in the presumed *Oligoryzomys* ancestor of *O. rupestris* sp.nov.

Oligoryzomys rupestris sp.nov. shows the smallest diploid and fundamental numbers among *Oligoryzomys* species described to date (Tab.2). While *O. rupestris* sp.nov. shows 2n=46, diploid number in remaining *Oligoryzomys* species varies from 52 to 70, encompassing all likely diploid numbers between these extremes (52, 54, 56, 58, 60, 62, 64, 66, 68, 70). Similar differences are observed in autosome fundamental number that accounts for 52 in *O. rupestris* sp.nov. but varies from 58 to 82 in other congeneric species, suggesting a series of Robertsonian rearrangements and inversions for deriving the karyotype of *O. rupestris* sp.nov. from other *Oligoryzomys* karyotypes. A similar reduction of diploid and fundamental numbers was also observed in the karyotype of another, undescribed, species of *Oligoryzomys* (Tab.2; *Oligoryzomys* sp.2) reported by SILVA & YONENAGA-YASSUDA (1997). These authors pointed that *Oligoryzomys* sp.1 (= *O. rupestris* sp.nov.) and *Oligoryzomys* sp.2 were karyotypically very similar, probably sister taxa.

Oligoryzomys rupestris and its putative sister species (*Oligoryzomys* sp.2 of SILVA & YONENAGA-YASSUDA, 1997) are found only in a vegetation type known as "campos rupestres" (literally 'rocky fields'). This consists of thin and small wooded savanna vegetation with rocky outcrops (EITEN, 1994). The main cluster of "campos rupestres" is located in the Serra do Espinhaço formation, in the Brazilian states of Bahia and Minas Gerais, where the collecting sites of *Oligoryzomys* sp.1 (= *O. rupestris* sp.nov.) and *Oligoryzomys* sp.2 reported by SILVA & YONENAGA-YASSUDA (1997) were located. The Chapada dos Veadeiros, the second largest formation of "campos rupestres", is the only other place where *Oligoryzomys rupestris* sp.nov. has been collected. "Campos rupestres" show a high endemicity of plant species belonging to the Velloziaceae, Eriocaulonaceae and Melastomataceae (EITEN, 1994) while *Oligoryzomys rupestris* sp.nov. and *Oligoryzomys* sp.2 are the only mammalian taxa apparently endemic to this vegetational type. This might be due to dearth of knowledge on the taxonomy of the mammalian fauna of the Cerrado, especially in respect with two other small mammals predominantly collected in "campos rupestres" of Chapada dos Veadeiros: *Galea aff. flavidens* and *Thrichomys* sp.nov. (BONVICINO *et al.*, in press).

ACKNOWLEDGMENTS

To Dr. J.A.Oliveira (Museu Nacional - Rio de Janeiro – MN) for helping with skulls photographs; to Drs. L. Flamarion B. de Oliveira (MN), A.Langguth (Universidade Federal da Paraíba), J.Marinho (Universidade de Brasília), P.Myers (University of Michigan Museum Zoology), D.Oren (Museu Paraense Emílio Goeldi), and M.Carleton (United States National Museum) for access to collections, and to H.Seuánez for reviewing the manuscript. We are indebted to R.Santori (Universidade do Estado do Rio de Janeiro), P.S.D´Andrea, E.Vieira (Fundação Instituto Oswaldo Cruz) and G.Marroig (Universidade de São Paulo) for supplying specimens collected in Araras, Rio Claro, Sumidouro, Faz. Intervales, Teresópolis, Nova Friburgo, and Faz. Canoas; to R.Finoti, J.Freitas, B.Lemos, S.Lindbergh, L.Maroja (Universidade Federal do Rio de Janeiro), and A.C.Paula (IBAMA) for helping in field work. License for collect specimens were supplied by the Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA). This work was supported by IBAMA, Conselho Nacional de Desenvolvimento Científico e Tecnológico, Instituto Oswaldo Cruz, and Smithsonian Institution.

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APPENDIX 1

Gazzetter of localities shown in figure 1. In addition to the localities reported in the present analysis, the following studies were also consulted: ANISKIN & VOLOBOUEV (1999), ANDRADES-MIRANDA *et al.* (2001), ALMEIDA & YONENAGA-YASSUDA (1991), BONVICINO *et al.* (2001), BUENO *et al.* (1987), BONVICINO & WEKSLER (1998), BRUM-ZORRILA *et al.* (1988), ESPINOSA & REIG (1991), LIMA *et al.* (2003), MASSOIA (1973), MYERS & CARLETON (1981), OLDS & ANDERSON (1989), SBALQUEIRO *et al.* (1991), SILVA & YONENAGA-YASSUDA (1997), and YONENAGA *et al.* (1976).

BRAZIL – PARAÍBA, (1) Mamanguape 6°50'19"S 35°07'34"W, (2) Pirauá 7°31'07"S 35°30'18"W, (3) Natuba 7°38'29"S 35°32'00"W; PERNAMBUCO, (4) Exú 7°30'43"S 39°43'27"W, (5) Macaparana 7°33'17"S 35°27'11"W, (6) Buíque 8°37'S 37°09'W, (7) Angelim 8°53'25"S 36°17'09"W, (8) Correntes 9°07'44"S 36°19'49"W, (9) Bom Conselho 9°10'11"S 36°40'47"W; ALAGOAS, (10) Matriz Camaragipe 9°09'06"S 35°32'00"W; GOIÁS, (11) Minaçu 13°31'59"S 48°13'12"W, (12) Fazenda Vao dos Bois, Teresina de Goiás 13°46'35"S 47°15'53"W, (13) Cavalcante 13°47'51"S 47°27'30"W, (14) Alto Paraíso de Goiás 14°07'57"S 47°30'36"W, (15) Colinas do Sul 14°09'05"S 48°04'42"W, (16) Flores de Goiás 14°26'55"S 47°03'01"W, (17) Niquelândia 14°28'26"S 48°27'35"W, (18) Mambaí 14°29'16"S 46°06'47"W, (19) Uruaçu 14°31'29"S 49°08'27"W, (20) Mimoso de Goiás 15°03'22"S 48°09'41"W, (21) Corumbá de Goiás 15°55'25"S 48°48'31"W; DISTRITO FEDERAL, (22) Brasília 15°46'47"S 47°55'47"W; MATO GROSSO, (23) Cáceres 16°04'14"S 57°40'44"W; MATO GROSSO DO SUL, (24) Corumbá 19°00'33"S 57°39'12"W; BAHIA, (25) Pico das Almas 13°33'S 41°56'W, (26) Fazenda Sertao do Formoso, Jaborandi 14°48'00"S 45°57'40"W, (27) Rio Una, 10km ESE Sao José 15°13'S 39°02'W; MINAS GERAIS, (28) Fazenda Canoas, Juramento 16°50'53"S 43°35'13"W, (29) Peirópolis 19°44'S 47°45'W, (30) Caparaó National Park 20°19'S 41°43'W, (31) Passos 20°43'S 46°37'W, (32) Viçosa 20°45'14"S 42°52'55"W, (33) Itamonte 22°17'02"S 44°52'12"W; ESPÍRITO SANTO, (34) Venda Nova 20°20'23"S 41°08'05"W, (35) Monte Verde 20°39'S 41°48'W; RIO DE JANEIRO, (36) Sumidouro 22°02'59"S 42°40'29"W, (37) Nova Friburgo 22°15'S 42°31'W, (38) Teresópolis 22°24'44"S 42°57'46"W, (39) Itaguaí 22°51'08"S 43°46'31"W; SÃO PAULO, (40) Araraquara 21°47'40"S 48°01'32"W, (41) Río Claro 22°24'41"S 47°33'41"W, (42) Santa Maria da Serra 22°34'02"S 48°09'38"W, (43) Americana 22°44'25"S 47°20'04"W, (44) Pedreira 22°44'31"S 46°54'05"W, (45) Taubaté 23°01'35"S 45°33'19"W, (46) Caçapava 23°06'S 45°43'W, (47) Guararema 23°25'S 46°02'W, (48) Itapetininga 23°35'50"S 48°03'11"W, (49) Casa Grande 23°37'S 45°57'W, (50) Guaratuba 23°45'S 45°55'W, (51) Intervales 24°13'S 48°05'W, (52) Pedro de Toledo 24°16'29"S 47°13'58"W, (53) Iguape 24°42'29"S 47°33'19"W; PARANÁ, (54) Ponta Grossa 25°05'42"S 50°09'43"W, (55) Curitiba 25°25'4'0' 49°16'23"W, (56) Piraquara 25°26'30"S 49°03'48"W; SANTA CATARINA, (57) Itá 27°12'16"S 52°19'23"W, (58) Florianópolis 27°35'48"S 48°32'57"W; RIO GRANDE DO SUL, (59) Esmeralda 28°03'13"S 51°11'25"W, (60) Torres 29°20'07"S 49°43'37"W, (61) Alto Ferrabraz 29°35'S 50°56'W, (62) Sapiranga 29°38'17"S 51°00'25"W, (63) Pontal do Morro Alto 29°46'15"S 50°11'15"W, (64) Osório 29°53'12"S 50°16'11"W, (65) Emboaba 29°58'S 50°12'W, (66) Tramandaí 29°59'05"S 50°08'01"W, (67) Faxinal 30°18'S 51°41'W, (68) Mostardas 31°06'25"S 50°55'16"W, (69) Pelotas 31°46'19"S 52°20'33"W, (70) Taím 32°30'S 52°35'W; BOLIVIA – SANTA CRUZ, (71) San Ignacio 16°23'S 60°59'W, (72) Ingeniero Mora 18°08'S 63°12'W; TARIJA, (73) Tiqupa 20°56'S 63°21'W, (74) Villa Montes 21°19'S 63°25'W, (75) Taringuiti 21°28'S 63°17'W, (76) Tarija 21°31'S 64°45'W, (77) Entre Rios 21°32'S 64°12'W, (78) Río Lipeo 22°41'S 64°26'W; PARAGUAY – ASUNCIÓN, (79) Agua Dulce 20°01'S 59°46'W; PRESIDENTE HAYES, (80) Estancia Laguna Porá 22°20'S 59°26'W, (81) Puerto Piñasco 22°43'S 57°50'W, (82) Juan de Zalazar 23°06'S 59°18'W, (83) La Golondrina 25°06'S 57°34'W; BOQUERON, (84) Dr. Pedro P. Peña 22°27'S 62°21'W, (85) Fortín Guachalla 22°27'S 62°20'W, (86) Fortín Teniente Pratts Gil 22°41'S 61°33'W; AMAMBAY, (87) Pedro Juan Caballero 22°34'S 55°37'W, (88) Cerro Corá 22°37'S 56°30'W; CONCEPCIÓN, (89) Concepción 23°24'23"S 57°26'04"W; CANENDIYU, (90) Curuguaty 24°31'S 55°42'W; CAAGUAZÚ, (91) Carayaó 25°11'S 56°24'W, (92) Coronel Oviedo 25°25'S 56°27'W, (93) Sommerfeld Colony 25°26'S 55°43'W; CORDILLERA, (94) Tobatí 25°15'S 57°04'W; CENTRAL, (95) Asunción 25°16'S 57°40'W, (96) Luque 25°16'S 57°34'W; PARAGUARI, (97) Sapucay 25°40'S 56°55'W, (98) Parque Nacional Ybicuí 25°42'S 57°06'W; ITAPUA, (99) Río Pirapó 26°40'S 56°38'W,

(100) San Rafael 27°08'S 56°23'W, (101) Encarnación 27°20'S 55°54'W; MISIONES, (102) San Antonio 26°42'S 56°53'W, (103) San Francisco 26°52'S 57°03'W, (104) San Pablo 26°52'S 57°03'W, (105) Ayolas 27°24'S 56°54'W; URUGUAY – ARTIGAS, (106) Artigas 30°24'S 56°28'W; SALTO, (107) Salto 31°25'S 57°00'W; DURAZNO, (108) Durazno 33°05'S 56°05'W; RIO NEGRO, (109) Fray Bentos 33°08'S 58°18'W; COLONIA, (110) Martin Chico 34°10'S 58°13'W, (111) Colonia del Sacramento 34°28'S 57°51'W; CANELONES, (112) Canelones 34°32'S 56°17'W; MONTEVIDEO, (113) Montevideo 34°53'S 56°11'W; MALDONADO, (114) Maldonado 34°54'S 54°57'W, (115) Punta del Este 34°58'S 54°57'W; ARGENTINA – JUJUY, (116) Maimara 23°35'S 65°24'W, (117) Léon 24°03'S 65°26'W; FORMOSA, (118) Naineck 25°13'S 58°07'W, (119) Riacho Pilagra 26°11'S 58°11'W; TUCUMÁN, (120) Burruyacu 26°30'S 64°55'W, (121) El Cadillal 26°40'S 65°16'W, (122) El Infiernillo 26°40'S 65°46'W, (123) Horco Molle 26°47'S 65°18'W, (124) Concepción 27°20'S 65°35'W; MISIONES, (125) Caraguatay 34°44'00"S 58°15'19"W, (126) Río Paranay 26°37'S 54°46'W, (127) Río Urugua-í, 30 km Pto. Bertoni 26°41'S 54°49'W; CHACO, (128) Las Palmas 27°04'S 58°42'W; CÓRDOBA, (129) Río Cuarto 33°08'S 64°21'W; BUENOS AIRES, (130) Parana Delta River 34°12'S 58°18'W, (131) Diego Gaynor 34°17'S 59°14'W, (132) Capilla del Señor 34°18'S 59°06'W, (133) 25 km SE Buenos Aires 34°36'S 58°27'W, (134) Ezeiza, Punta Lara 34°50'17"S 58°31'02"W, (135) Berazategui 36°24'S 56°58'W, (136) General Lavalle 36°24'S 58°27'W, (137) Balcarce 37°50'S 58°15'W, (138) Monte Hermoso 38°55'S 61°33'W.