

## A new species of *Monodelphis* (Didelphimorphia: Didelphidae) from the Brazilian Atlantic Forest

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### ABSTRACT

A new species of the didelphid marsupial genus *Monodelphis* is described from southeastern Brazil. The new species is closely related to *Monodelphis kungsi* Pine, 1975, and other members of the *M. adusta* group, but differs from those species and from other congeneric taxa by unique external and cranial characters and by cytochrome-*b* and nuclear DNA sequences. Diagnostic morphological characters of the new species include uniformly brownish dorsolateral pelage without distinct stripes or other sharp pigment discontinuities; diminutive eyes and ears; a remarkably long and narrow rostrum; apparent loss of an interparietal ossification; and the presence of diastemata between C1 and P1, P1 and P2, c1 and p1, p1 and p2, and p2 and p3. The new species is known from the Atlantic Forest (Mata Atlântica) of southeastern Brazil, where it occurs sympatrically with four other congeners (*M. americana*, *M. iheringi*, *M. scalops*, *M. dimidiata*) and seems to be restricted to montane habitats.

### INTRODUCTION

Short-tailed opossums (*Monodelphis*) represent one of the most speciose genera of New World marsupials and occur in a wide variety of habitats from eastern Panama to northern Argentina. Currently, 21 named species of *Monodelphis* are recognized in six major clades, as indicated by recent phylogenetic analyses of the genus based on dense taxonomic sampling and multiple unlinked genes (Pavan et al., 2014). In addition, it has been suggested that four divergent genetic lineages represent undescribed taxa: of these, “species 1” and “species 2” belong

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to the *M. adusta* group, whereas “species 3” and “species 4” belong to the *M. brevicaudata* group (Pavan et al., 2014: fig. 2).

*Monodelphis* “species 1” was first mentioned in an unpublished thesis by Gomes (1991), who called it “*Monodelphis macae*” (an unavailable manuscript name) based on a specimen from Macaé, Rio de Janeiro. Subsequently, the species was referred to by Pine and Handley (2008) as “*Monodelphis* species E” based on a specimen from Itatiaya, Rio de Janeiro. Later, Pavan et al. (2014) included three representatives of this taxon (from São Paulo, Minas Gerais, and Espírito Santo) in their phylogenetic analyses, providing genetic evidence for its distinctive sequence characteristics, and recovering this lineage as sister to an ecogeographically widespread species, *M. kunsi* Pine, 1975 (fig. 1). Most recently, Vilela et al. (2015) included yet another specimen (from São Paulo) in their phylogenetic analyses, which essentially corroborated Pavan et al.’s (2014) results concerning its phylogenetic relationships.

Morphological examination of specimens corresponding to “*Monodelphis macae*” of Gomes (1991), “*Monodelphis* species E” of Pine and Handley (2008), and “species 1” of Pavan et al. (2014) and Vilela et al. (2015) have revealed that this form is distinctive in several cranial and external features that distinguish it from all other species of *Monodelphis*.

## MATERIAL AND METHODS

Specimens listed in this report are deposited in the following collections (in the United States except as noted otherwise): AMNH (American Museum of Natural History, New York); ANSP (Academy of Natural Sciences of Drexel University, Philadelphia); CM (Carnegie Museum of Natural History, Pittsburgh); FMNH (Field Museum, Chicago); KU (Biodiversity Research Center and Natural History Museum, University of Kansas, Lawrence); MBUCV (Museo de Biología de la Universidad Central de Venezuela, Caracas, Venezuela); MCN-M (Coleção de Mamíferos, Museu de Ciências Naturais da Pontifícia Universidade Católica de Minas Gerais, Belo Horizonte, Brazil); MN (Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil); MPEG (Museu Paraense Emílio Goeldi, Belém, Brazil); MSU (Michigan State University, Michigan); MUSM (Museo de Historia Natural de la Universidad Nacional Mayor de San Marcos, Lima, Peru); MVZ (Museum of Vertebrate Zoology, University of California, Berkeley); MZUSP (Museu de Zoologia da Universidad do São Paulo, São Paulo, Brazil); OMNH (Sam Noble Oklahoma Museum of Natural History, Oklahoma); TTU (Museum of Texas Tech University, Lubbock); UFMG (Universidade Federal de Minas Gerais, Belo Horizonte, Brazil); USNM (National Museum of Natural History, Smithsonian Institution, Washington DC). Uncatalogued specimens currently housed at MZUSP and collected by M.T. Rodrigues are herein referred to by their field numbers (MTR).

Descriptive terminology for external and craniodental morphology follows Wible (2003) and Voss and Jansa (2009), and capitalized color nomenclature follows Ridgway (1912). External measurements and weights were transcribed from specimen labels or field notes. The former included: total length (nose to fleshy tail tip, TL), length of tail (basal flexure to fleshy tip, LT), length of hind foot (heel to tip of longest claw, HF), and length of ear (from notch, Ear). Head-and-body length (HBL) was computed by subtracting LT from TL.

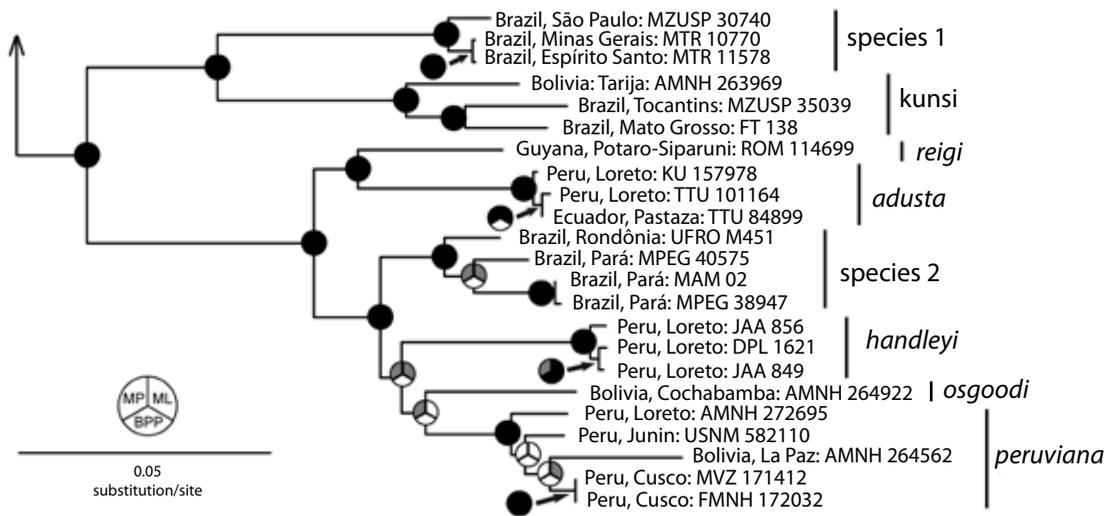


FIGURE 1. Phylogenetic relationships of species of the *Monodelphis adusta* group based on a maximum-likelihood analysis of DNA sequence data from one mitochondrial and four nuclear genes (4983 aligned sites; after Pavan et al., 2014). Support statistics from maximum-parsimony (MP) and maximum-likelihood (ML) bootstrap analyses are indicated at each resolved node along with Bayesian posterior probabilities (BPP). White wedges indicate MP and ML bootstrap frequencies  $\leq 50\%$ , gray indicates bootstrap frequencies between 50% and 75%, and black indicates bootstrap frequencies  $\geq 75\%$ . For Bayesian statistics, white indicates BPP  $< 0.95$ , whereas black indicates BPP  $\geq 0.95$ . See Pavan et al. (2014:201, 202) for methodological details.

Craniodental measurements were recorded to the nearest 0.01 mm using digital calipers under stereo microscopes (6–25 $\times$ ). These measurements were rounded off to the nearest 0.1 mm throughout the text. The following dimensions were recorded as illustrated by Giarla et al. (2010): condylo-basal length (CBL), measured from the occipital condyles to the anteriormost point of the premaxillae; palatal length (PL), measured from the anteriormost point of the premaxillae to the postpalatine torus, including the postpalatine spine (if present); palatal breadth (PB), measured across the labial margins of the upper fourth molar (M4) crowns, at or near the stylar A position; length of molars (LM), measured from the anteriormost labial margin of M1 to the posteriormost point on ipsilateral M4; width of M3 (WM3), measured from the labial margin of the crown at or near the stylar A position to the lingual apex of the protocone; zygomatic breadth (ZB), measured at the widest point across both zygomatic arches.

## RESULTS

### *Monodelphis pinocchio*, new species

Figures 3–5

**HOLOTYPE:** The holotype consists of the skin, skull, and postcranial skeleton of an adult male (MN 78680, original field number PRG 1345) collected on 15 October 2004 by P.R. Gonçalves at Reserva Florestal do Morro Grande, Cotia, São Paulo, Brazil, 23.06° S, 46.92° W (fig. 2: locality 5).

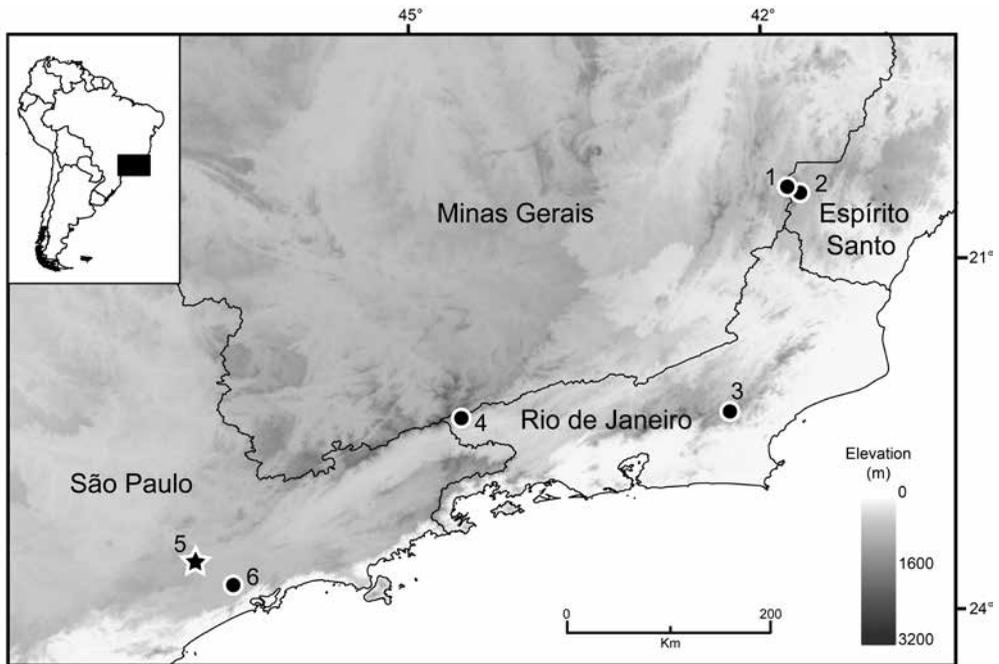


FIGURE 2. Collecting localities of *Monodelphis pinocchio*. Numbers are keyed to localities mentioned in the text.

**PARATYPES AND ASSOCIATED SEQUENCE DATA:** In addition to the holotype, I examined several other specimens herein referred to *Monodelphis pinocchio*, including: (1) the skin and skull of an adult male (MZUSP 2793) collected in November 1909 by E. Garbe at Serra de Macaé, Rio de Janeiro (“Serra Macahé, Río” on the original specimen’s tag), at 22.32° S, 42.33° W (fig. 2: locality 3); (2) the skin of an adult male (AMNH 61547, original number EGH 3) collected on 3 February 1922 by E. G. Holt at Pico das Agulhas Negras, Alto do Itatiaia, Rio de Janeiro, Brazil (“Brazil: Alto Itatiaia. Serra do Itatiaia”) at 22.38° S, 44.63° W (fig. 2: locality 4); (3) the skin, skull, postcranial skeleton, and preserved tissues of an adult male (MZUSP 30740, original number ITM 135) collected on 23 October 2001 by R. Rossi and J.W.A. Santos at Riacho Grande, São Bernardo do Campo, São Paulo, at 23.8° S, 46.58° W (fig. 2: locality 6); (4) the skin, skull, postcranial skeleton, and preserved tissues of an adult male (MN 78651, original number PRG 1316) collected on 11 October 2004 by P.R. Gonçalves at the type locality (fig. 2: locality 5); and (5) a skin in alcohol with skull removed of an adult female (uncataloged MZUSP specimen, original number MRT 15815) collected on 5 November 2008 by M.T. Rodrigues at Serra do Caparaó, Espírito Santo, Brazil, 20.47° S, 41.73° W (fig. 2: locality 2).

DNA sequences from one mitochondrial gene (*cytochrome-b*), two autosomal exons (IRBP exon 1, BRCA1 exon 11), one autosomal intron (SLC38 intron 7), and one X-linked intron (OGT intron 14) from MZUSP 30740 were included in the phylogenetic analyses of Pavan et al. (2014) and are deposited in GenBank with accession numbers KM071555, KM071120, KM071031, KM071217, KM071312. A *cytochrome-b* sequence from MN 78651 was included in the phylogenetic analyses of Vilela et al. (2015).

TABLE 1. Measurements (mm) and weights (g) of adult male specimens of the *Monodelphis adusta* group.

	<i>adusta</i> <sup>a</sup>	<i>handleyi</i> <sup>b</sup>	<i>kunsi</i> <sup>c</sup>	<i>peruviana</i> <sup>d</sup>	<i>pinocchio</i> <sup>e</sup>	<i>osgoodi</i> <sup>f</sup>	<i>reigi</i> <sup>g</sup>	<i>ronaldi</i> <sup>h</sup>
HBL	99 (93–125) 9	128 (117–142) 3	80 (71–90) 17	95 (85–109) 5	94 (88–103) 4	96	121	142
LT	55 (40–63) 8	71 (69–74) 3	40 (34–49) 17	55 (47–62) 5	51 (50–54) 4	62	74	72
HF	16 (15–17) 8	17 (16–18) 3	12 (10–14) 17	16 (12–18) 5	13 (11–13) 4	15	15	20
Ear	12 (11–14) 6	15 (14–15) 3	10 (5–12) 17	12 (10–16) 5	9 (7–10) 3	10	13	14
Weight	26 (17–33) 5	55 (49–65) 3	11 (9–19) 13	18 (15–24) 5	–	–	–	70
CBL	28.4 (25.7–30.9) 8	32.0 (31.1–33.1) 4	22.9 (21.2–24.2) 8	25.4 (24.3–27.1) 5	26.0 (25.6–26.5) 4	26.0	30.4	35.3
PL	15.3 (14.0–16.6) 10	17.6 (17.0–18.3) 4	11.8 (10.9–12.7) 8	14.1 (13.2–16.5) 6	14.6 (14.5–14.9) 4	–	17.2	19.8
PB	9.4 (8.8–10.0) 10	11.0 (10.8–11.3) 4	7.2 (6.9–7.7) 7	8.5 (7.5–9.9) 5	7.2 (6.9–7.3) 4	7.6	–	12.6
LM	6.1 (5.8–6.3) 10	7.3 (7.2–7.5) 4	4.9 (4.6–5.1) 9	5.7 (5.3–6.1) 6	4.9 (4.9–5.0) 4	–	6.2	8.1
WM3	2.1 (1.9–2.2) 10	2.6 (2.5–2.8) 4	1.7 (1.6–1.8) 9	1.9 (1.7–2.2) 6	1.5 (1.5–1.6) 4	–	–	3.1
ZB	15.2 (13.2–16.6) 9	17.9 (16.5–18.8) 4	11.9 (11.1–13.3) 7	12.8 (11.8–14.2) 5	12.7 (12–13.4) 4	12.5	14.9	20.7

<sup>a</sup> The mean, the observed range (in parentheses), and the sample size for measurements of the following series: AMNH 47189, 67274, 68136, 75232, 136158, KU 157978, MSU 20250, TTU 101164, 84865, 98923, USNM 280894.

<sup>b</sup> The mean, the observed range (in parentheses), and the sample size for measurements of the following series: AMNH 276709, 276698, MPEG 41787, MUSM 23809–23810.

<sup>c</sup> The mean, the observed range (in parentheses), and the sample size for measurements of the following series: ANSP 18191, MCN-M 1256, 1420, 1465, 1531, 1570, 1607, 2304, 2964, MN 64323, 64411, 64424, MPEG 43016, 43017, MZUSP (MTR 20361), OMNH 22265, 22266, UFMG 1965, UFMG (original number 318), UFMG (original number 324).

<sup>d</sup> The mean, the observed range (in parentheses), and the sample size for measurements of the following series: AMNH 272781, FMNH 169811, 172032, MUSM 7157, 15318, MVZ 173928.

<sup>e</sup> The mean, the observed range (in parentheses), and the sample size for measurements of the following series: AMNH 61547, MN 78651, 78680, MZUSP 2793, 30740.

<sup>f</sup> The holotype (CM 5242; data from Doutt, 1938).

<sup>g</sup> The holotype and only known adult specimen (MBUCV 2358; data from Lew and Pérez-Hernández, 2004).

<sup>h</sup> The holotype and only known specimen (MUSM 17027, measured by R.S. Voss).



FIGURE 3. A, Dorsal, B, lateral, and C, ventral views of the holotype skin of *Monodelphis pinocchio* (MN 78680). Scale bar = 50 mm.

ADDITIONAL SPECIMENS: DNA sequences from two additional specimens, apparently representing this species, were included in the analyses of Pavan et al. (2014), but the vouchers were not available for the present study. These are uncataloged MZUSP specimens collected by M.T. Rodrigues; the first, with field number MTR 10770, was collected on 26 October 2004 at Serra do Caparaó, Minas Gerais, 20.41° S, 41.84° W (fig. 2: locality 1); the second, MTR 11578, was collected on 8 November 2005 at Serra do Caparaó, Espírito Santo, 20.47° S, 41.73° W (fig. 2: locality 2).

DISTRIBUTION: *Monodelphis pinocchio* is known only from the Atlantic Forest (Mata Atlântica) of southeastern Brazil, where it has been collected in the states of São Paulo, Rio de Janeiro, Minas Gerais and Espírito Santo (fig. 2).

DESCRIPTION: *Monodelphis pinocchio* is a small species, substantially larger than *M. kunsii*, but much smaller than most other congeners, including some members of the *M. adusta* group (e.g., *M. handleyi* and *M. ronaldi*; table 1). Dorsal and lateral pelage uniformly brown (near Olive-Brown)<sup>2</sup> from crown to rump, without distinct stripes or other sharp pigment discontinuities (fig. 3). Hairs of middorsal fur 5–6 mm long at shoulders, near Light Olive-Gray basally and brownish (Olive-Brown) distally. Ventral hairs 3–4 mm long, light grey (Pale Smoke Gray) basally and cream (Pale Olive-Buff) distally; self-whitish ventral markings absent. Pinnae very small and macroscopically naked, but densely covered internally and externally with very short and dark-brown hairs. Cranial (mystacial, genal, and supraorbital) vibrissae mostly dark, with the longest mystacial hairs generally extending behind eyes when laid flat against cheek, but not reaching the pinnae. (The genal vibrissae generally reach the pinnae and frequently extend beyond their posterior border. There is only one supraorbital vibrissa on each side.) Gular gland (indicated by a small area of discolored fur on the throat; fig. 3C) apparently present on AMNH 61547, MN 78651, 78680, and MZUSP 30740. Hands and feet covered dorsally with short, mostly brownish hairs. Ungual tufts short and sparse (restricted to the bases of the manual claws and reaching approximately the middle of the claws on feet). Scrotal skin brownish, covered with cream (Pale Olive-Buff) hairs. Mammary formula unknown. Tail about 55% of combined length of head and body, weakly bicolored (dark-brownish dorsally and lighter brown ventrally). Caudal scales (discernible mostly at the distal portion of the tail) arranged predominantly in spiral series.

Skull small, conspicuously elongated, and somewhat flattened in lateral profile (figs. 4, 5). Rostrum remarkably long and narrow, longer than braincase; infraorbital foramen dorsal to anterior root of M1; lacrimal foramina (two on each side) exposed laterally on anterior orbital margin; interorbital region hourglass shaped, with rounded supraorbital margins, and shallow inter- and postorbital constrictions, but without any trace of postorbital processes; sagittal crest absent even in largest adult males examined; nuchal (occipital) crest present; interparietal apparently absent<sup>3</sup>; no parietal-mastoid contact on posterior braincase; zygomatic arches delicate and markedly convergent anteriorly; incisive foramina extending from level of third upper

<sup>2</sup> The pelage of MZUSP 2793 appears to be faded, with the dorsal fur near Buffy Brown.

<sup>3</sup> See Voss and Jansa (2009:34) for discussion of the usual didelphid condition, in which the interparietal is wedged between the left and right parietals anterior to the lambdoid crest. In *Monodelphis pinocchio*, the midparietal suture extends posteriorly to the lambdoid crest.

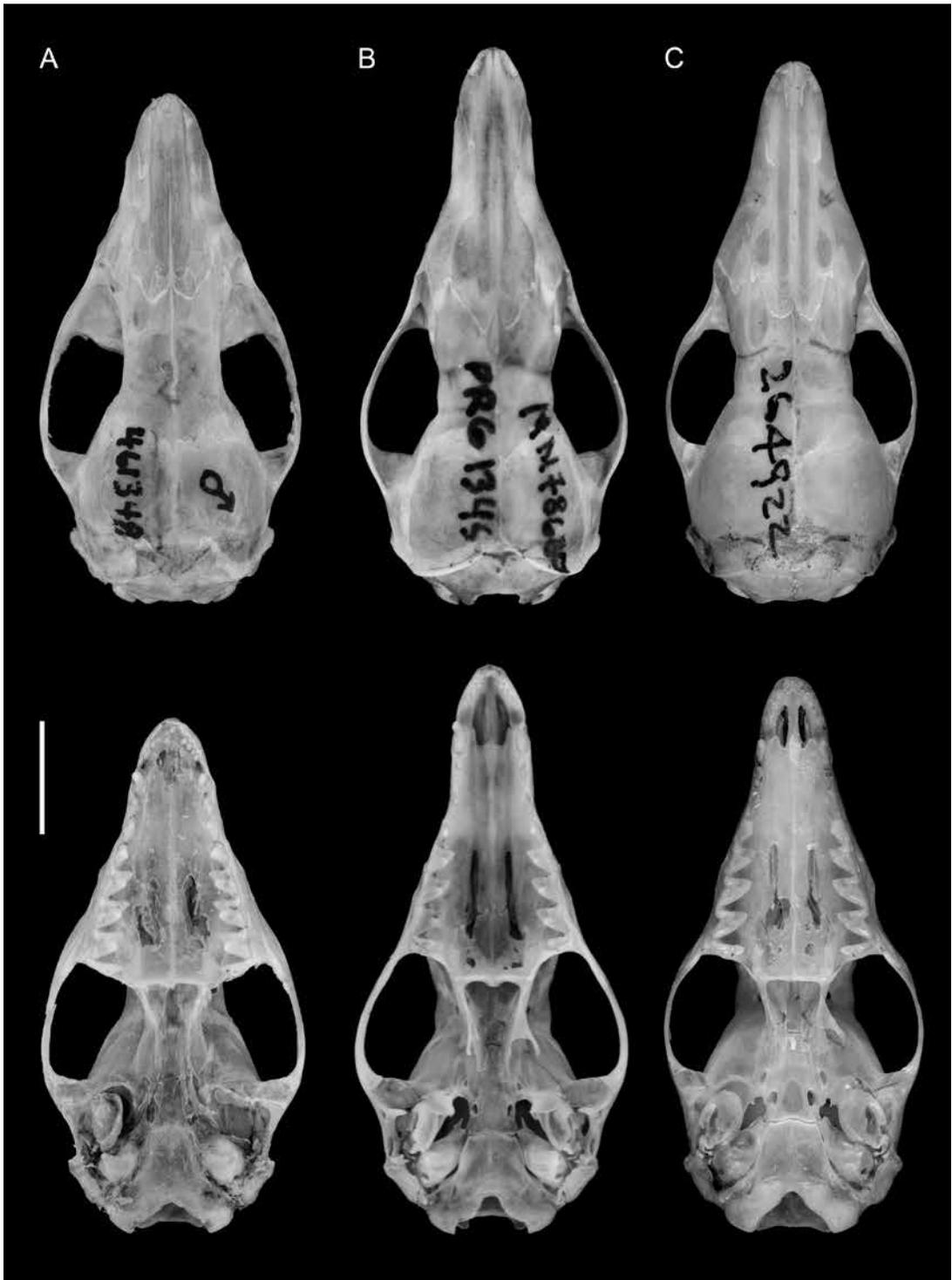


FIGURE 4. Dorsal and ventral cranial views of **A**, *Monodelphis kunsii* (USNM 461348, male); **B**, *M. pinocchio* (MN 78680, male); and **C**, *M. osgoodi* (AMNH 264922, female). Scale bar = 5 mm.

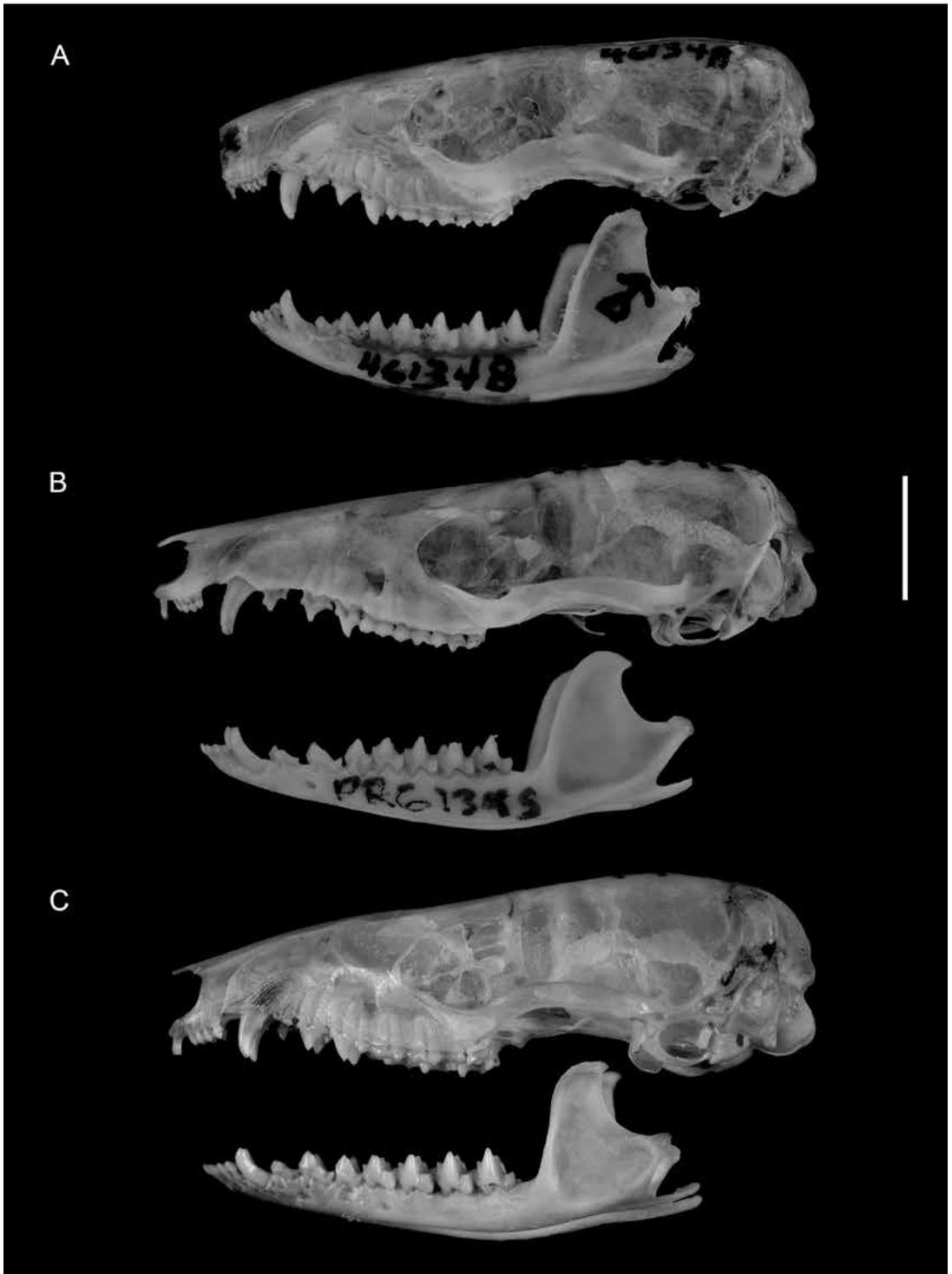


FIGURE 5. Lateral cranial and mandibular views of **A**, *Monodelphis kunsii* (USNM 461348, male); **B**, *M. pinocchio* (MN 78680, male); **C**, and *M. osgoodi* (AMNH 264922, female). Scale bar = 5 mm.

incisors to middle or posterior part of upper canines; maxillopalatine fenestrae long, extending from level of P3 or M1 (usually near the P3/M1 commissure) to level of M3 metacone; small palatine fenestrae present unilaterally or bilaterally (except in MZUSP 30740, in which palatine fenestrae are bilaterally absent); posterolateral palatal foramina small and complete, not extending anteriorly between M4s; sphenopalatine foramen located dorsal to posterolateral palatal foramen on each side; tympanic wing of alisphenoid small and uninflated, widely separated from ipsilateral rostral tympanic process of petrosal; rostral tympanic process elongated and triangular, widely separated from caudal tympanic process (fenestra cochleae exposed); anterior process of malleus exposed between ectotympanic and tympanic wing of alisphenoid (close to the Glaserian fissure); extracranial course of mandibular nerve not enclosed by bone (secondary foramen ovale absent; see Voss and Jansa, 2003); stapes columelliform and imperforate; basisphenoid concealed by the alisphenoid in lateral view (not exposed through sphenorbital fissure in posteromedial orbit); distinct infratemporal crest of alisphenoid absent; paroccipital process small and rounded.

Crowns of I2–I5 increasing in width from front to back; upper and lower canines simple, without accessory cusps in males (but indistinct anterior and posterior cusps are present on MTR 15815, the only female specimen examined); diastemata present between C1 and P1 and between P1 and P2; P2 slightly wider than P3; P2 and P3 subequal in height. Diastemata present between c1 and p1, p1 and p2, and p2 and p3; p2 clearly wider and taller than p3; cingulids of lower molars undeveloped; entoconid of m1–m3 small or indistinct.

**ETYMOLOGY:** The specific epithet is a noun in apposition and refers to the fictional wooden doll (Pinocchio, from the book “The Adventures of Pinocchio” by Carlo Collodi), in allusion to the elongated rostrum shared by this species and its namesake.

**COMPARISONS:** Members of the *Monodelphis adusta* species group (“Clade E” of Pavan et al., 2014: including *M. adusta*, *M. handleyi*, *M. osgoodi*, *M. peruviana*, *M. reigi*, *M. ronaldi*, and *M. pinocchio*) differ from other congeneric species by (1) lacking distinct stripes in the dorsal pelage (versus stripes present, e.g., as in *M. americana*) or other sharp pigment discontinuities (such as reddish flanks, e.g., as in *M. brevicaudata*); (2) having the infraorbital foramen positioned dorsal to M1 (versus dorsal to P3 or to the P3/M1 commissure, e.g., as in *M. domestica*); (3) lacking contact between the parietals and the mastoid (versus parietals and mastoid in contact, e.g., as in *M. scalops*); (4) having a small tympanic wing of the alisphenoid that is separated by a wide gap from the rostral tympanic process of petrosal (versus a large alisphenoid tympanic wing narrowly separated from the rostral tympanic process, e.g., as in *M. iheringi*); (5) having a triangular rostral tympanic process that does not conceal the fenestra cochleae in ventral view (versus a broad, rounded rostral tympanic process that conceals the fenestra cochleae, e.g., as in *M. gardneri*); (6) having the anterior process of the malleus exposed distally between the ectotympanic and the alisphenoid tympanic wing (versus anterior process of the malleus not exposed distally, e.g., as in *M. emiliae*); (7) lacking a secondary foramen ovale (versus secondary foramen ovale present, e.g., as in *M. americana*); (8) having a columelliform, imperforate, or microperforate stapes (versus a triangular or subtriangular stapes with a large obturator foramen, e.g., as in *M. glirina*); and (9) having the basisphenoid laterally concealed by the alisphenoid (versus basisphenoid laterally exposed, e.g., as in *M. touan*).

Within the *Monodelphis adusta* group, *M. pinocchio* can be readily distinguished from *M. handleyi*, *M. ronaldi*, and *M. reigi* by its smaller size (table 1). Although *M. reigi* (illustrated by Lew and Pérez-Hernández, 2004: fig. 3)<sup>4</sup> somewhat resembles *M. pinocchio* by its relatively long rostrum, and distinct diastemata among C1/P1/P2 and c1/p1/p2/p3 (none of which are observed in *M. handleyi* or *M. ronaldi*), this species has shorter incisive foramina that extend posteriorly only to the anterior margin of C1, and zygomatic arches that are more rounded anteriorly (not so strongly convergent anteriorly as in *M. pinocchio*).

*Monodelphis pinocchio* averages smaller than *M. adusta* and *M. peruviana* in all measured external dimensions, and is consistently smaller in three craniodental dimensions (PB, LM, WM3) that exhibit nonoverlapping variation in our samples (table 1). Additionally, *M. pinocchio* has a visibly longer and narrower rostrum, distinct diastemata among C1/P1/P2 and c1/p1/p2/p3 (diastemata are diminutive or absent in *M. adusta* and *M. peruviana*), and lacks a distinct interparietal ossification (a distinct interparietal [sensu Voss and Jansa, 2009] is present in *M. adusta* and *M. peruviana*).

Although *Monodelphis pinocchio* was recovered as sister to *M. kunsi* by the phylogenetic analyses of Pavan et al. (2014) and Vilela et al. (2015), these species are externally and cranially dissimilar. Among other differences, *M. pinocchio* is consistently larger (especially in HBL, LT, CBL, and PL; table 1), has longer pelage (middorsal fur at shoulders 5–6 mm versus ca. 3 mm in *M. kunsi*), has darker dorsal pelage (near Olive-Brown versus Buffy Brown to Olive-Brown in *M. kunsi*), has more anteriorly convergent zygomatic arches and a more elongated rostrum (fig. 4), has distinct diastemata among C1/P1/P2 and c1/p1/p2/p3 (gaps that are diminutive or absent in *M. kunsi*), and lacks a distinct interparietal bone (the interparietal is large in *M. kunsi*). Other, subtler differences can be detected by careful side-by-side comparisons, but these traits are more than sufficient for positive identification. Because specimens with these distinct sets of phenotypic traits also have highly divergent molecular sequences (e.g., 11.1%, uncorrected, at the cytochrome-*b* locus; Pavan et al., 2014: supporting information, table 3) they clearly merit recognition as valid species.

*Monodelphis osgoodi* resembles *M. pinocchio* in pelage traits and body size, but *M. pinocchio* has shorter feet and a shorter tail (table 1), a visibly longer and narrower rostrum (fig. 2), a narrower palate (table 1), wider diastemata among C1/P1/P2 and c/p1/p2/p3, and a sphenopalatine foramen that is dorsal to the posterolateral palatal foramen on each side (the sphenopalatine foramen is anterior to the posterolateral palatal foramen in *M. osgoodi*).

## DISCUSSION

The *Monodelphis adusta* group includes all of the members of similarly named species groups identified by Lim et al. (2010) and Solari (2010) plus *M. kunsi*, *M. pinocchio*, and an unnamed lineage from lowland Amazonia (“species 2” of Pavan et al., 2014). Phylogenetic

<sup>4</sup> This species, known only from the tepuis of eastern Venezuela and western Guyana, is represented by a single adult specimen (inaccessible to me, in Caracas), and two examined juveniles in the ROM (see Lim et al., 2010).

TABLE 2. Records of sympatry among Atlantic Forest Species of *Monodelphis*.

	<i>americana</i>	<i>dimidiata</i>	<i>iheringi</i>	<i>pinocchio</i>	<i>scalops</i>
<i>americana</i>	—				
<i>dimidiata</i>	sympatric <sup>a</sup>	—			
<i>iheringi</i>	sympatric <sup>b</sup>	sympatric <sup>c</sup>	—		
<i>pinocchio</i>	sympatric <sup>c</sup>	sympatric <sup>f</sup>	sympatric <sup>h</sup>	—	
<i>scalops</i>	sympatric <sup>d</sup>	sympatric <sup>g</sup>	sympatric <sup>i</sup>	sympatric <sup>j</sup>	—

<sup>a</sup> São Paulo, Biritiba Mirim; São Paulo, Santo André (Pavan et al., 2014); Rio de Janeiro, Parque Nacional do Itatiaia (Vilela et al., 2015; this report: *M. americana* MN 78911, 42026, MZUSP 11695; *M. dimidiata* AMNH 61546, MN 24552).

<sup>b</sup> Espírito Santo, Cariacica, Reserva Biológica Duas Bocas (Agrizzi et al., 2012; Duda and Costa, 2015).

<sup>c</sup> Rio de Janeiro, Parque Nacional do Itatiaia (this report: *M. pinocchio* AMNH 61547).

<sup>d</sup> Rio de Janeiro, Parque Nacional do Itatiaia (this report: *M. scalops* MN 42023, 42025).

<sup>e</sup> São Paulo, São Bernardo do Campo, Riacho Grande (this report: *M. iheringi* MZUSP 30638; *M. dimidiata* MZUSP 30698, 30726).

<sup>f</sup> São Paulo, São Bernardo do Campo, Riacho Grande (Pavan et al., 2014); Rio de Janeiro, Parque Nacional do Itatiaia (this report).

<sup>g</sup> São Paulo, São Bernardo do Campo, Riacho Grande (Pavan et al., 2014); Rio de Janeiro, Parque Nacional do Itatiaia (this report).

<sup>h</sup> São Paulo, São Bernardo do Campo, Riacho Grande (this report: *M. pinocchio* MZUSP 30740).

<sup>i</sup> São Paulo, Capão Bonito, Fazenda Sakamoto (Vilela et al., 2015); São Paulo, São Bernardo do Campo, Riacho Grande (this report: *M. scalops* MZUSP 30629, 30702, 30757).

<sup>j</sup> São Paulo, São Bernardo do Campo, Riacho Grande; Minas Gerais, Parque Nacional do Caparaó (Pavan et al., 2014); São Paulo, Cotia, Reserva Florestal do Morro Grande (Vilela et al., 2015); Rio de Janeiro, Parque Nacional do Itatiaia (this report).

analyses based on combined mitochondrial and nuclear gene sequences strongly support the monophyly of this group (Pavan et al., 2014), and the nine morphological traits listed above (under Comparisons) seem likely to include several that will optimize as synapomorphies in combined phylogenetic analyses of molecular and morphological data (Pavan et al., in prep.). Vilela et al. (2015) also recovered the monophyly of this group based on their analyses of mitochondrial and nuclear gene sequences, but they suggested recognizing a distinct “*Monodelphis kunsi* group” for *M. kunsi* and *M. pinocchio* (“species 1” in their analysis). This difference of opinion about informally designated clades is obviously not substantive.

Unlike *Monodelphis kunsi*, a widespread species inhabiting primarily dry forest in central South America, *M. pinocchio* is known from just a few moist-forest localities in southeastern Brazil (fig. 2). Although altitudinal data are not recorded on any specimen labels, maps and other sources of geographic information (e.g., Hijmans et al., 2005) suggest that elevations at localities where the species has been collected range from about 790 to 2380 m. Presumably, *M. pinocchio* is a montane species. The fact that so few representatives of *M. pinocchio* are available in collections might be due to either a scarcity of this species in nature or the almost exclusive traditional use of live traps for mammal inventories (such traps are known to be ineffective for capturing some species of *Monodelphis*; Pardini and Umetsu, 2006; Umetsu et al., 2006; Duda and Costa, 2015). Of the eight specimens reported here, six were collected in the past 15 years, soon after pitfall traps began to be more widely used for collecting small ter-

restrial mammals in South America (Voss et al., 2001; Pardini, 2004; Umetsu et al., 2006). I have information on capture method for only three specimens of *M. pinocchio*, but all these were taken in pitfall traps. Sustained sampling by this relatively new method can be confidently predicted to result in better documented geographic range data for *M. pinocchio*.

With the description of *Monodelphis pinocchio* and the new synonymies suggested by recent molecular analyses<sup>5</sup>, five valid species of *Monodelphis* are now known from the Atlantic Forest of southeastern Brazil. Among these species, sympatry has been observed for all possible pairwise combinations (table 2), although syntopy (same-habitat occupancy) is confirmed only for *M. iheringi* and *M. americana* (at Reserva Biológica Duas Bocas, Espírito Santo; Duda and Costa, 2015). Remarkably, four Atlantic Forest species are known to occur together at two localities (*M. dimidiata*, *M. iheringi*, *M. pinocchio*, and *M. scalops* at São Paulo, São Bernardo do Campo, Riacho Grande; *M. americana*, *M. dimidiata*, *M. pinocchio*, and *M. scalops* at Rio de Janeiro, Parque Nacional do Itatiaia), the maximum sympatric diversity yet recorded for the genus. To date, sympatry outside the Atlantic Forest has been documented for a maximum of three species of *Monodelphis*. According to Solari et al. (2001), *M. "adusta"* (presumably *M. peruviana*), *M. emiliae*, and *M. "brevicaudata"* (presumably *M. glirina*) are sympatric in the lower Urubamba region of eastern Peru, whereas *M. glirina*, *M. touan*, and *M. "aff. kungsi"* are said to be sympatric at the Floresta Nacional de Carajás in northern Brazil (Martins et al., 2012). Few as they are, these observations suggest that the Atlantic Forest of southeastern Brazil may be a region of uniquely high diversity for *Monodelphis*, and that the terrestrial-insectivorous niche that these small marsupials are thought to occupy (Emmons and Feer, 1990; Fonseca et al., 1996; Pine and Handley, 2008; Pinotti et al., 2011) can be subdivided in at least some local communities.

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<sup>5</sup> *Monodelphis theresa* as a junior synonym of *M. scalops*; *M. rubida* and *M. umbristriata* as junior synonyms of *M. americana* (see Pavan et al., 2014).

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