



Original investigation

A new species of *Monodelphis* (Didelphimorphia: Didelphidae) from southeastern Peru

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Abstract

A new species of short-tailed opossum (*Monodelphis*) is described from the lowland forest of southeastern Peru. The new species is similar and more related to *Monodelphis adusta* Thomas, 1897, but is comparatively larger, and lighter in color. Other species known to occur in the area (*M. emiliae* and *M. glirina*) have no closer resemblance to the new species. Other characters useful to distinguish this new species are a heavy, broad, and extremely flattened skull, with a conspicuous sagittal crest. The premaxilla is short and the upper incisor rows are wide apart. During the comparisons of the new species with *M. adusta*, it became clear that two subspecies of the latter could be recognized and morphologically diagnosed: *Monodelphis a. adusta* and *M. a. peruviana*. Their distributions are limited to the south and to the north, respectively, by the Amazon River. The name *M. melanops*, described from Panama is a junior synonym of *M. a. adusta*, but *M. osgoodi*, described from the highlands of Bolivia is a valid species, and probably has no close relationships to either *M. adusta* or the new species here described.

Key words: *Monodelphis*, Peru, systematics, taxonomy

Introduction

In common with other exclusively Neotropical genera of Didelphimorphia, *Monodelphis* Burnett, 1830 is still poorly known in all respects, including its systematics. Although this is the most diverse genus of living opossums, with 15 recognized species (GARDNER 1993), only one systematic work has dealt with the whole genus (GOMES 1991). Most of the recent research includes studies on the taxonomic status of a single or a few species (LEMONS et al. 2000; PINE 1975, 1976, 1977, 1979; PINE and ABRAYAYA

1978; PINE and HANDLEY 1984; PINE et al. 1985; SORIANO 1987; VENTURA et al. 1998; VOSS et al. 2001).

PACHECO et al. (1995) recorded five species of *Monodelphis* from Peru. Two of these are from lowland rainforests (*brevicaudata* and *emiliae*), other two (*osgoodi* and “*theresa*”) are from montane forests, and the fifth one (*adusta*) occurs on both, lowland and montane forests. For animals from western Amazonia south of the Amazon, previously referred to *M. brevicaudata*, Voss et al.

(2001) used the name *M. glirina* (Wagner, 1842). Specimens of the five species are easy to identify by using size, coloration, and skull measurements.

In a recent collection made in the lowland humid forests of southeastern Peru, I found a specimen of *Monodelphis* that could not be assigned to any previously named or reported species. After comparing this specimen with others in various collections, I herein describe it as a new species.

Material and methods

Specimens examined

Specimens studied are stored in the following collections: the Museo de Historia Natural, Universidad Nacional Mayor de San Marcos (MUSM, Lima), the National Museum of Natural History (NMNH, Washington, DC), the Carnegie Museum (CM, Pittsburgh), the Field Museum (FMNH, Chicago), and the Natural Sciences Research Laboratory, The Museum, Texas Tech University (TTU, Lubbock). Following is a detailed list of the specimens used in the descriptions, comparisons, and preparation of tables. Specimens are arranged by species, country and specific locality.

Monodelphis adusta adusta (9): Panama, Darien, Tacarcuna, 3200 ft (USNM 309263, male), Darien, Cana, 2800 ft (USNM 179609, male, type of *Peromys melanops*); Colombia, Antioquia, La Cabaña, 1200 m (FMNH 70538, female), Magdalena, Santa Marta, 400 m (USNM 280894, male); Ecuador, Napo, Lumbaqui (USNM 534286, male); Peru, Loreto, Maynas, Est. Biol. Allpahuayo (TTU 73228, male; 73496, male; 73753, male; 73868, male)

Monodelphis adusta peruviana (12): Peru, Huanuco, Hda. San Antonio, 3000 ft (FMNH 23773, female; 23774, male; 23775, male; 23776, male; USNM 259433, male); Huanuco, Hda. Exito, 3000 ft (FMNH 23772, male; 24756, male), Huanuco, Hda. Buena Vista, 3500 ft (FMNH 23778, female; 23780, female), Cusco, La Convencion, 1000 m (USNM 588019, female), San Martin, Moyobamba, 860 m (FMNH 19362, male, type of *Peromys peruvianus*; 19361, female)

Monodelphis osgoodi (5): Peru, Cusco, Ocobamba Valley, 9100 ft (USNM 194379, male); Junin, Vilcabamba, 2015 m (USNM 582110, female), Puno, Oconeque (FMNH 52714, male); Bolivia,

Cochabamba, Incacahaca, 2500 m (CM 5248, male, paratype of *Monodelphis peruvianus osgoodi*), Cochabamba, Ayopaca (FMNH 74861, male)

Monodelphis new species (1): Peru, Madre de Dios, Manu, Pakitza, 365 m (MUSM 17027, male, the type only)

Measurements

I consider age class 5 of PINE et al. (1985) to represent adult *Monodelphis* (i. e., individuals with permanent teeth fully erupted and in place, but M4 with little or no wear). Because of sex dimorphism in opossums, measurements of males and females are listed separately in Table 1. External measurements (Head-plus-body length [HBL], length of tail [LT], length of hind foot [HF], length of ear [E], and weight [W]), were taken from the collector's tags.

Craniodental measurements are those of VOSS et al. (2001), except for M3M3 (see PINE 1981). These measurements and the description of how they are taken, follow:

Condylbasal length (CBL): from the occipital condyles to the anteriormost point of the premaxillae.

Maxillary tooththrow (MTR): crown length, from the anterior margin of the canine to the posterior margin of M4.

Molar length (LM): crown length of M1–4, measured on the labial side of the tooththrow.

Molar breadth (M3M3): the greatest distance between the most lateral (labial) points on the upper third molars.

Least postorbital breadth (LPB): measured at the narrowest point across the frontals behind the orbits.

Zygomatic breadth (ZB): greatest breadth across the zygomatic arches.

Results

Monodelphis ronaldii, new species

Holotype: Adult male, skin and skull in good condition (the mandibular rami are separated but otherwise complete), MUSM 17027. The skin looks overstuffed. Specimen caught by HORACIO ZEBALLOS PATRÓN, field number 0377, for the project "Amazon Biodiversity", of Duke University's Center for Tropical Conservation, on 11 November 1994. Type locality: Pakitza, Manu Re-

Table 1. External and craniodental measurements (in mm) for relevant specimens of *Monodelphis a. adusta*, *M. a. peruviana*, and *M. ronaldi* new species. Additional measurements of two specimens from Venezuela and one from Colombia (all females) taken from SORIANO (1987).

Taxa	<i>adusta</i>	<i>adusta</i>	<i>peruviana</i>	<i>peruviana</i>	<i>ronaldi</i>
n/sex	4 females	4 males	2 females	4 males	1 male
Local	Colombia and Venezuela	Loreto	Huánuco	Huánuco	M. Dios
HBL	100.25	109.25	96.50	96.50	141.50
LT	51.25	54.75	52.00	53.75	72.50
HF	14.25	15.00	15.00	16.00	20.00
CBL	25.96	27.68	26.78	(3) 27.37	35.32
MTR	10.44	11.42	11.05	11.07	14.50
LM	.	6.19	5.90	6.01	8.08
M3M3	8.43	9.07	9.45	8.86	12.79
LPB	5.40	5.36	5.44	(3) 5.37	5.31
ZB	13.61	14.75	14.49	(3) 14.60	20.70

served Zone, Department of Madre de Dios, southeastern Peru. Pakitza is at 11°56' S, 71°17' W, and the elevation is 356 m (PACHECO and VIVAR 1996).

Distribution: Known only from the type locality. Pakitza is on the left bank of the Río Manu, in the Río Madre de Dios basin. A brief description of the main habitats at Pakitza is given by PACHECO and VIVAR (1996). Based on the elevation of the type locality (less than 400 m), *Monodelphis ronaldi* would be a lowland species.

Etymology: I am pleased to name this species for Dr. RONALD H. PINE, who began the task of describing the great diversity of *Monodelphis* more than 20 years ago. Without his dedication to this work, our knowledge of this genus would be far more incomplete.

Diagnosis: Uniform Broccoli Brown (RIDGWAY 1912) to pale sepia in dorsal view, with underparts a creamy buff throughout, and without midventral cream or whitish stripe or stripes. Dorsal fur very short (3 mm), shorter than in *M. adusta peruviana* and more like in *M. a. adusta* (see below). The tail is short, slightly longer than half of the head-plus-body length. Skull heavy, broad, and extremely flattened, with well-developed frontal processes joining to form a conspicuous sagittal crest (Fig. 1 a). Zygomatic arches are proportionally wide, with

almost parallel sides. Very narrow postorbital constriction. Sides of the nasals, at the maxillo-frontal suture, are almost parallel (Fig. 1 b). There is a large and single lacrima foramen, probably owing to coalescence of dorsal and ventral ones. Short premaxilla; incisors rows wide apart, forming an almost right angle. First upper incisors are fairly close to the second ones (Fig. 1 c). Molars are large and massive, with well-developed anterior cingula. A small gap is present between the lower premolars preventing their contact.

Description: *Monodelphis ronaldi* is a medium-sized species (HB > 140 mm), larger than the sympatric *M. adusta peruviana* in every external and craniodental measurement (Tab. 1), but somewhat smaller than *M. glirina* or *M. emiliae*. *Monodelphis ronaldi* is a uniform Broccoli Brown in dorsal view, with no evidence of dark dorsal stripes, or of lateral reddening or yellowing. Midline of the dorsum pale sepia throughout. The underparts are mostly self-colored creamy buff, with throat gland present but not conspicuous. There is a small patch of gray-based hairs in the middle of belly. Dorsal fur short and velvety, not longer than 4 mm. This type of fur extends onto the base of tail for less than 5 mm. The feet are short and furred dorsally with pale buffy and silver hairs. The tail is short and



a



b



c

Fig. 1. Skull of the holotype (MUSM 17027) of *Monodelphis ronaldi*. a) Lateral view showing the flattened shape, a low sagittal crest, and the enlarged upper canines. b) Dorsal view showing the relative size of the rostrum and braincase, and the shape of the zygomatic arches. c) Ventral view showing the development of the upper molars, the almost parallel premolar rows and the palatal vacuities.

stout, of approximately half of the head-plus-body length; pale fuscous on dorsal view, with fine whitish hairs on the ventral surface, giving it a paler look.

Skull is stout and extremely flattened, with very well-developed frontal processes that join over the postorbital constriction, forming a low but conspicuous sagittal crest

which joins with the lambdoidal crest (Fig. 1 a). The zygomata are almost parallel-sided, only slightly narrower anteriorly. Postorbital constriction very pronounced, giving the skull an hourglass shape in dorsal view, with the braincase smaller than the rostrum (Fig. 1 b). The anteorbital foramen has the posterior border roughly straight. A large and single lacrimal foramen is located on the anterior edge of the orbit. Palate with short incisive foramina, their posterior borders reaching merely to the anterior borders of canines; medial fenestrae (following Voss et al. 2001) short, especially their palatine portions, reaching from the middle of M1 to the anterior border of M3. The premaxillae are short, with first upper incisor fairly close to the second one. Incisor rows very divergent, forming a right angle between them (Fig. 1 c); upper canines enlarged. Premolar rows are almost parallel. The upper molars are large, with the width across the outer borders of M3s (M3M3) more than 35% of the greatest length of skull (CBL) (Tab. 1). Anterior cingula of molars are well-developed and conspicuous. Bullae are small, without processes on the anterior surface. The ectotympanics have been lost in the type specimen. Lower premolars set close to each other but not in contact. Mandibular rami not excessively bowed, with comparatively low coronoid processes.

External measurements of the holotype: Head-plus-body length 141.5 mm, length of tail 72.5 mm, length of hind foot 20 mm (c. i.), ear (from notch) 14 mm; weight 70 g.

Discussion

Comparisons with sympatric species

The single specimen comes from Pakitza, a relatively well-known locality in the rainforest of southeastern Peru (see PACHECO et al. 1993; PACHECO and VIVAR 1996). Only *Monodelphis glirina* had previously been collected at Pakitza; *M. adusta* was known from Cusco Amazonico (WOODMAN et al. 1991), and *M. emiliae* and *M. glirina* had

been collected by the Amazon Biodiversity project at Cocha Cashu (C. L. MITCHELL, pers. comm.). Along the lower Urubamba (at Camisea, northwest Cusco), all of these species were collected during an assessment of mammalian diversity (SOLARI et al. 2001).

None of these lowland species could be confused with *Monodelphis ronaldei*, which is much larger and paler than *M. adusta*, and also lacks the prominent reddish areas of the pelage as displayed by *M. glirina* and *M. emiliae*. *Monodelphis ronaldei* bears more similarities to *M. adusta* than to *M. emiliae* or *M. glirina*. *Monodelphis ronaldei* and *M. adusta* have more-or-less uniform brownish coloration, comparatively small size (HB less than 150 mm), and almost naked tails. Their skulls are flattened also, especially at the region of the frontals, and both have low and small bullae. However, *M. ronaldei* possesses a low but conspicuous sagittal crest over the postorbital constriction and a single lacrimal foramen, which lies at the anterior edge of the orbit. On the other hand, there is no evidence of a sagittal crest in *M. adusta*, and two small lacrimal foramina are present but do not form part of the orbital margin.

Taxonomic remarks

There is some confusion in regard to the application of the names *Monodelphis adusta* (THOMAS 1897), from western Cundinamarca, Colombia, *M. melanops* (GOLDMAN 1912), from eastern Panama, and *M. peruvianus* (OSGOOD 1913), from Moyobamaba, Peru. From the descriptions, the animals appear to be very similar to each other except for some variation in the extent of the buffy pectoral area. The last name to be associated with this group of species was *Monodelphis peruvianus osgoodi* DOUTT, 1938, with type locality in Cochabamba (2600 m), Bolivia. DOUTT (1938) compared *osgoodi* with the type of *peruvianus* and with a series from Huánuco, Peru. Some of the cranial characters used to distinguish *osgoodi* from *peruvianus* were: smaller skull, more delicate and more slender construc-

tion of the skull, a proportionally and absolutely narrower palate, and smaller teeth. I examined type material, the original descriptions, and relevant specimens for all of these taxa in order to address this taxonomic problem.

Previous treatments of this group of nominal species have frequently placed most of the names as junior synonyms of *Monodelphis adusta*. Thus, CABRERA (1958) placed *peruvianus* and *osgoodi* in *M. adusta*, but did not even mention *melanops* because it was extralimital to the geographic coverage of his publication. HANDLEY (1966) disagreed with CABRERA (1958), asserting unequivocally that *melanops* and *peruvianus* represent no more than individual variants of *M. adusta*, while stating that *M. osgoodi* is probably specifically distinct. However, the first statement of the specific distinctness of *M. osgoodi* was made by PINE (in KIRSCH and CALABY 1977). Similar treatment was given by GARDNER (1993) in the latest published list of species. Because *M. osgoodi* is a montane species and probably represents a different group, it is not further treated here.

Comparisons of specimens identified as of *Monodelphis adusta* (sensu stricto) with those previously referred to as *M. melanops* (including the type) have convinced me that only one species is involved. Size in both is small to medium; dorsal fur is very short (3 mm), velvety, brownish, with an ill-defined blackish area on the posterior dorsum and the rump, tail blackish, manus and hind foot fuscous. Frontal bones are flattened, upper premolars very close together, but not crowded, and the rostrum is relatively wide, as showed by measurements of the palate. Comparisons of series referable to these two nominal taxa from Colombia and Panama also support conspecificity. Both often display a midventral white or cream stripe which may or may not be conspicuous. Craniodental measurements show a large overlap (Tab. 1). Therefore, I have concluded that *Peramys melanops* does not deserve even subspecific rank. As the older name, *Monodelphis adusta* (Thomas, 1897) becomes the proper designation for all of

the populations in Panamá, Colombia, Venezuela, Ecuador, and Peru, to the east of the Andes and north of the Amazon.

Examination of the holotype and a paratype of *Monodelphis peruvianus* reveals differences between them and the original description of *M. adusta*. Head-plus-body length is bigger in *adusta* than in *peruvianus*, while the dorsal fur is slightly longer (4 mm) in *peruvianus* than in *adusta*. Dorsal coloration of *peruvianus* is chocolate brown, without blackening on the rump. Although the skulls of *peruvianus* are narrower than those of *adustus*, several of the skull measurements overlap. I compared a series from Iquitos, referable to *adusta* (sensu stricto), with a series from Huánuco, representing *peruvianus*, and found the same differences. Because of all of these morphometric differences and the geographic separation by the Amazon, I consider *peruvianus* to be a recognizable subspecies of *Monodelphis adusta*, with its populations extending from central Peru to north and central Bolivia, east of the Andes.

Synonymy for this species would stand as follows:

Monodelphis adusta adusta (Thomas, 1897)

Peramys adustus Thomas, 1897

Peramys melanops Goldman, 1912

Monodelphis adusta peruviana (Osgood, 1913)

Peramys peruvianus Osgood, 1913

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on unavailable specimens (e. g., the type of *adusta* in the Natural History Museum, London), or direct access to specimens in the Smithsonian (i. e., type of *melanops* and paratype of *osgoodi*). R. H. PINE, B. D. PATTERSON (FMNH), and V. PACHECO (MUSM) reviewed previous drafts; how-

ever, any remaining errors are my responsibility. Finally, I am very grateful to S. KLUTZNY (TTU) by her kindly translation of the german abstract, and also to B. COLLANTES by his help with the photographic artwork.

Zusammenfassung

Eine neue Art von *Monodelphis* (Didelphimorphia: Didelphidae) aus dem südöstlichen Peru

Eine neue Art des kurzschwänzigen Opossums (*Monodelphis*) aus den Tieflandwäldern des südöstlichen Peru wird beschrieben. Die neue Art ist nahe verwandt mit *Monodelphis adusta* Thomas, 1897, und dieser sehr ähnlich, aber verhältnismäßig größer und von hellerer Farbe. Die diagnostischen Merkmale dieser neuen Art sind ein schwerer, breiter und extrem flacher Schädel mit einem auffallendem Sagittalkamm. Das Prämaxillare ist kurz, die oberen Schneidezähne stehen weit auseinander. Zwei Unterarten von *M. adusta* können morphologisch unterschieden werden: *Monodelphis a. adusta* und *M. a. peruviana*. Ihre geographische Verbreitung wird durch den Amazonas auf den Süden beziehungsweise den Norden beschränkt. *M. melanops*, beschrieben aus Panama, ist ein jüngeres Synonym von *M. a. adusta*, aber *M. osgoodi* aus dem bolivianischen Hochland ist eine gültige Art.

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