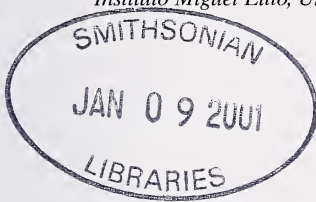




## Mouse opossums (*Didelphimorphia*, *Didelphidae*) of northwestern Argentina: Systematics and distribution

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### Abstract

We present a systematic revision of the mouse opossums of northwestern Argentina; included are three genera and eight species, *Gracilinanus* (new for the region), *Micoureus*, and *Thylamys*. Two subspecies of *Thylamys* are elevated to species. The distribution of each of the taxa was determined using specimen records. External and cranial descriptions, measurements, and comments on the taxonomy and natural history of each species are given.

Key words: Mouse opossums, systematics, taxonomy, distribution, Argentina.

### Introduction

The small didelphid marsupials of the Neotropics have been the focus of much speculation with respect to species composition and the taxonomic status of the different forms. The tribe Marmosini (sensu GOIN 1995) represents the most important radiation of extant didelphids in the Neotropics. About 33 species are known (GARDNER 1993); their distribution is extensive both latitudinally and altitudinally (TATE 1933).

THOMAS (1888) united the mouse opossums in the subgenus *Micoureus*, in the genus *Didelphys*. Later, CABRERA (1919, 1957) divided the group into two subgenera, *Marmosa* and *Thylamys*, which were included in the genus *Marmosa*. The most extensive revision of the group was that of TATE (1933), who divided the genus *Marmosa* (sensu Cabrera 1919) into five informal groups: *cinerea*, *murina*, *noctivaga*, *microtarsus*, and *elegans*. More recently, MARSHALL (1981), REIG et al. (1985, 1987), and GARDNER and CREIGHTON (1989) suggested that the genus *Marmosa* be separated into distinct genera based on marked differences in anatomy and genetics.

The recognized genera differ according to the authors; MARSHALL (1981) and REIG et al. (1985, 1987) recognized *Marmosa*, *Micoureus*, and *Thylamys*; whereas GARDNER and CREIGHTON (1989) also recognized *Gracilinanus* and *Marmosops*. The latter taxonomic arrangement currently is the one that is generally accepted (GARDNER 1993; MCKENNA and BELL 1997). HERSHKOVITZ (1992) placed the above genera in the Family Marmosidae.

Until now, two genera of mouse opossums were known for northwestern Argentina, *Thylamys* and *Micoureus* (GARDNER 1993; MCKENNA and BELL 1997). In this study we present a taxonomic revision of the mouse opossums of northwestern Argentina, an area where there has been a general lack of information concerning the distribution of each species and where the taxonomy has been confusing.

## Material and methods

Study area: Northwestern Argentina includes the provinces of Jujuy, Salta, Tucumán, Catamarca, and Santiago del Estero (Fig. 1), with an area of about 470 000 km<sup>2</sup>. Due to its location in the subtropics and its complex relief, which varies from 500 to 6000 m in altitude, a number of climates and habitats as well as corresponding variations in vegetation characterize the area. These include the following phytogeographic provinces: High Andean, Puna, Prepuna, Monte, Yungas, and Chaco (CABRERA 1977; CABRERA and WILLINK 1973; REDFORD and EISENBERG 1992).

General: We examined 277 specimens from northwestern Argentina. Specimens were examined from the following collections: AMNH: American Museum of Natural History, New York; BMNH: British Museum of Natural History, London; CEM: Colección Elio Massoia y Flía, Buenos Aires, Argentina; CML: Colección Mamíferos Lillo, Facultad de Ciencias Naturales e Instituto Miguel Lillo, Universidad Nacional de Tucumán, Tucumán, Argentina; IADIZA-CM: Colección Mastozoológica, Instituto Argentino de Investigaciones de Zonas Áridas, Mendoza, Argentina; MACN: Museo Argentino de Ciencias Naturales Bernardino Rivadavia, Buenos Aires, Argentina; OMNH: Sam Noble Oklahoma Museum of Natural History, Norman, Oklahoma; and specimens whose final disposition has not yet been determined and that are designated by the acronym of the collector, ARG: Catalog of specimens from Argentina at the Sam Noble Oklahoma Museum of Natural History; PIDBA: Programa de Investigaciones de Biodiversidad Argentina, MMD: M. Mónica Díaz, and PO: Pablo Ortiz. Standard external measurements and characteristics were recorded in the field when specimens were prepared, or copied from labels of museum specimens. Cranial measurements were taken with digital calipers to the nearest 0.05 mm following BARQUEZ et al. (1999) and MYERS et al. (1990).

Localities: Localities for each species were plotted using maps of the Instituto Geográfico Militar del Ejército Argentino, the Automóvil Club Argentino, and KEEGAN and KEEGAN (1993). The geographic coordinates of the localities were obtained using a global positioning system (GPS) or were determined with maps or from the literature (PAYNTER 1985). Some localities could not be located because of imprecise citation or lack of data.

## Results

### Genus *Gracilinanus*

The genus *Gracilinanus* includes nine species and is widely distributed across the forests and woodlands of the Neotropics (HERSHKOVITZ 1992). GARDNER (1993) recognized six species in the genus and did not recognize the three species (*kalinowskii*, *longicaudus*, and *perijae*) described by HERSHKOVITZ (1992). In Argentina two species are known, *G. agilis* and *G. microtarsus*. Herein we expand the distribution of *G. agilis chacoensis* to include northwestern Argentina.

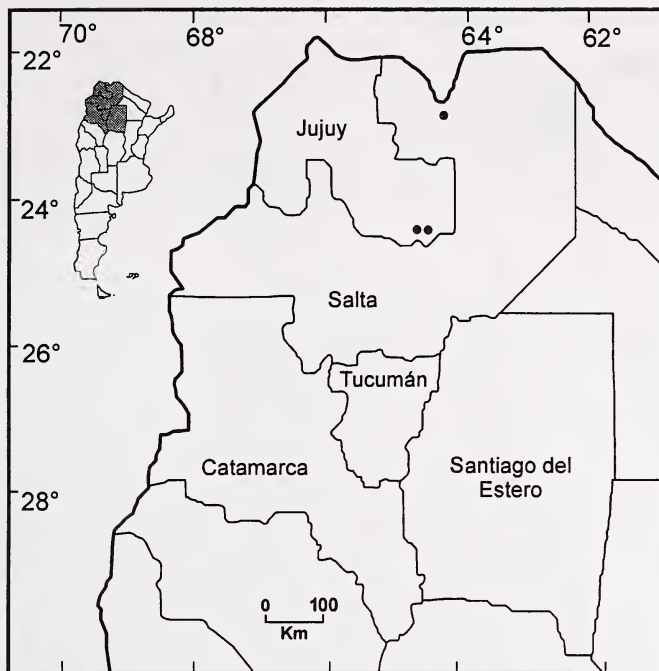
*Gracilinanus agilis* (Burmeister, 1854)

*Gracilinanus agilis chacoensis* (Tate, 1931)

Distribution in Argentina: This species was known from the provinces of Corrientes, Chaco, Formosa, Misiones, Entre Ríos, and Buenos Aires (MASSOIA and FORNES 1972; CONTRERAS 1982, 1984); we extend the distribution to include northwestern Argentina based on specimens from the provinces of Jujuy and Salta.

Specimens Examined (n = 21) (Fig. 1): Argentina. Jujuy: Ingenio La Esperanza, 24°14' S 64°52' W, 1 (CEM); Santa Bárbara, 1 (AMNH). Salta: Ingenio San Martín del Tabacal, Lote "Milagros", 23°16' S 64°15' W, 18 (CML). Paraguay. Sapucay, 1 (BMNH, holotype).

Description: The snout is short and pointed, and the tail long and prehensile. The pelage is short and velvety. The dorsum is ochraceous brown, the sides the same color as the dorsum; the bases of the hairs are gray. The venter is pale washed with ochraceous or whitish yellow; the hairs are unicolored. Periocular rings are present, moderate in size, dark brown or black; cheek and feet the same color as the venter. Ears are ochraceous brown. The tail is bicolored, the coloration the same as that of the dorsum and venter.



**Fig. 1.** Localities of occurrence of *Gracilinanus agilis*. Insert indicates the location of the provinces of northwestern Argentina.

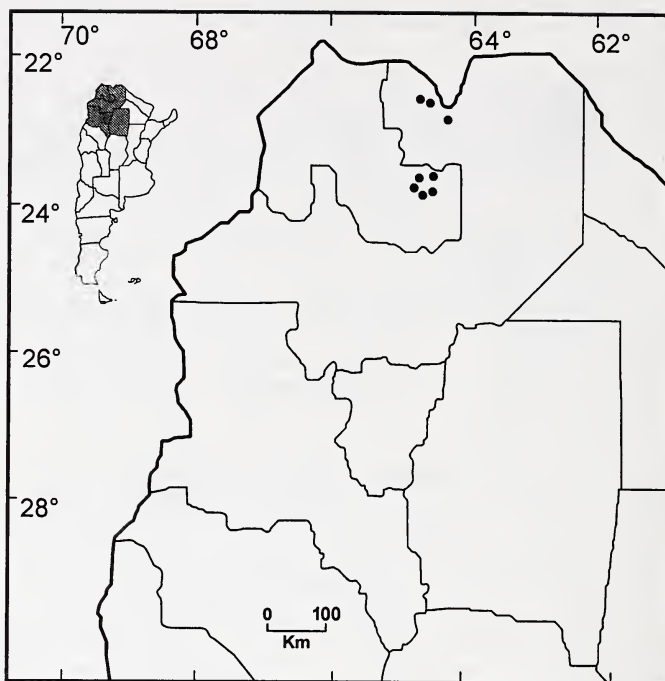
The skull is characterized by a short, wide rostrum, and an inflated interorbital region with a marked postorbital constriction. In adult specimens the supraorbital edges are incipient. The nasal bones widen abruptly at the frontomaxillary suture. The third upper pre-molar is smaller than or subequal in size to the second upper pre-molar.

**Comments:** These records are the first for this taxon in northwestern Argentina, although its presence was highly probable due to the proximity of its distribution in western Formosa Province and southern Bolivia (MASSOIA and FORNES 1972; ANDERSON 1997).

In Argentina this species typically inhabits gallery forest, although it may be found to occur in other habitats (OLROG and LUCERO 1981; REDFORD and EISENBERG 1992; EMMONS 1990), such as cultivated areas (MASSOIA and FORNES 1972). Two of the localities, Ingenio La Esperanza and Ingenio San Martín del Tabacal, listed in the Specimens Examined, are in areas where sugar cane is grown. The natural history of this species in Argentina is poorly known; some data were reported by MASSOIA and FORNES (1972) for northeastern Argentina.

### **Genus *Micoureus***

This genus contains four species, the distribution of two species (*M. constantiae* in the northwest and *M. demerarae* in the northeast) reach the northern limit of Argentina (CABRERA 1957; MASSOIA 1972; GARDNER 1993). EMMONS (1990) did not recognize *M. demerarae* and *M. constantiae* as being different; however, presently they are considered to be different species (GARDNER 1993).



**Fig. 2.** Localities of occurrence of *Micoureus constantiae*.

*Micoureus constantiae* (Thomas, 1904)

*Micoureus constantiae budini* (Thomas, 1919)

Distribution in Argentina: Northwestern Argentina, in the provinces Jujuy and Salta (CABRERA 1957; OLGROG and LUCERO 1981; MARES et al. 1989; REDFORD and EISENBERG 1992).

Specimens Examined (n = 11) and Additional Records (Fig. 2): Argentina. Jujuy: Aguas Negras, 23°45' S 64°56' W, 5 (2 CML; 3 MACN); Aguas Negras, Camping, Parque Nacional Calilegua, 23°45' S 64°56' W (Personal observation of the authors); Caimancito, 23°44' S 64°36' W, 1 (MACN); Calilegua, 23°46' S 64°47' W, 1 (CEM); Mesada de las Colmenas, 1 150 m, 23°42' S 64°52' W (HEINONEN and BOSSO 1994); Río San Francisco, altura de Yuto, 500 m, 23°39' S 64°27' W, 1 (BMNH holotype). Salta: 43.7 km NW of the Junction of Argentine Highways 50 and 18, on road to Isla de Cañas, 22°57' S 64°33' W, 1 (PIDBA); Orán, 23°08' S 64°20' W, 1 (CML); Parque Nacional Baritú, desembocadura Arroyo Santelmita, 700 m, 22°31' S 64°37' W, 1 (CML).

Description: This is the largest mouse opossum in northwestern Argentina. The tail is long and naked for its entire length, only the part nearest the body is haired, the scales are arranged in a spiral. The dorsal coloration is grayish brown with yellowish hues and becomes brighter on the sides, the bases of the hairs are gray. The periorcular rings are broad and dark in color (brown or black). The ears are dark brown. The hairs of the venter are ochraceous, and extend to the cheek, throat, and chin. In some specimens the ochraceous color of the venter is stronger. The feet are ochraceous and the tail is dark brown with light spots at the tip. Unfortunately the type specimen of *Marmosa budini* (BMNH 20.1.7.134) in the British Museum is discolored. In the skull, the rostrum is long and wide; the interorbital region has pronounced pointed supraorbital processes; lambdaoidal crests are present, but not very evident; the sagittal crest is absent; the nasal bones ex-

pand markedly at the frontomaxillary suture; paraoccipital processes are present, but are not well developed; the tympanic bullae are small.

Comments: Records of this species are scarce and the majority are restricted to protected areas, Parque Nacional Calilegua in Jujuy and Parque Nacional Baritú in Salta. All records are known only from the Yungas phytogeographic province.

At Aguas Negras in June a lactating female, with an ochraceous venter, was captured. At the same locality, stomach contents consisted of hemipterans parts and vegetation. A young individual was captured in August.

### Genus *Thylamys*

Unlike the majority of the mouse opossums, which are found in the tropical and subtropical forests, the genus *Thylamys* inhabits principally arid and open areas (MARES 1973; MARES and BRAUN 2000; PALMA 1995; PALMA and YATES 1996). This is the most polytypic genus of marsupials in northwestern Argentina and raises the most questions regarding the taxonomic composition of each species. For many years, investigators synonymized the various species and subspecies principally in two taxa, *Thylamys elegans* or *T. venustus*. Currently, five species are recognized: *T. elegans*, *T. pusillus*, *T. macrura*, *T. pallidior*, and *T. velutinus* (GARDNER 1993). Some authors consider forms of *T. elegans* in northwestern Argentina as *T. venustus* (HEINONEN and BOSSO 1994; PALMA 1995; GALLIARI et al. 1996; DÍAZ et al. 1997; MARES and BRAUN 2000), restricting *T. elegans* to Chile, thus increasing the total number of species in the genus to six. According to some authors, three species (*T. pallidior*, *T. venustus* and *T. pusilla*) are found in northwestern Argentina (GARDNER 1993; GALLIARI et al. 1996; DÍAZ et al. 1997; MARES and BRAUN 2000). This genus is in need of revision as evidenced by the numerous taxonomic problems.

Here we recognized six species for northwestern Argentina: *T. cinderella*, *T. pallidior*, *T. pusilla*, *T. sponsoria*, *T. venustus*, and *Thylamys* sp. *T. cinderella* and *T. sponsoria* were previously considered to be subspecies of *Marmosa elegans* (THOMAS 1902, 1921; CABRERA 1957) or *Marmosa venustus* (TATE 1933).

#### *Thylamys cinderella* (Thomas, 1902)

Distribution in Argentina: In northern Argentina this species is known in the provinces of Jujuy and Tucumán (TATE 1933); recently specimens from Salta Province have been documented.

Specimens Examined (n = 59) and Additional Records (Fig. 3): Argentina. Jujuy: 4 km W jct Hwys 34 and 3, along Hwy 3, 23°48' S 64°48' W, 1 (CM); Caimancito, 400 m, 23°44' S 64°36' W, 1 (BMNH); Caimancito, 600 m, 23°44' S 64°36' W, 1 (FMNH); Caimancito, 700 m, 23°44' S 64°36' W, 1 (MACN); Junction of road to Puesto Viejo and Highway 34, 4 km E, on road to Puesto Viejo, 24°29' S 64°59' W, 4 (MMD); Jujuy, 1258 m, 24°12' S 65°19' W, 5 (BMNH); Laguna La Brea, 23°56' S 64°28' W, 1 (MMD); Laguna La Brea, 25 km W Palma Sola (Hwy. 1), 23°56' S 64°28' W, 1 (OMNH); León, 24°02' S 65°26' W (THOMAS 1918 as *Marmosa elegans cinderella*); León, 1500 m, 24°02' S 65°26' W, 5 (BMNH); On highway 9 at the border with Salta, at a campground on the way to El Carmen, 4600 ft., 24°28' S 65°21' W, 16 (4 ARG, 6 CML; 6 IADIZA-CM); Oyeros, 3 km N, 24°30' S 65°00' W, 1 (MMD); Santa Rita, 2 km NW, on provincial road 1, 24°28' S 64°50' W, 2 (MMD); Santa Rita, 4 km NW, on provincial road 1, 24°27' S 64°50' W, 1 (MMD); Villa Carolina, 500 m, 24°16' S 64°43' W (THOMAS 1920 as *Marmosa elegans cinderella*); Villa Carolina, Río Lavallén, 500 m, 24°16' S 64°43' W, 3 (BMNH); Yuto, 23°38' S 64°28' W, 4 (1 CML; 3 AMNH). Salta: Aguaray, FCCNA, 700 m, 22°16' S 63°44' W, 4 (MACN); Güemes, Highway 34, km 1383, 24°40' S 65°03' W, 1 (MACN); Playa Ancha, 1 (MACN); Río Mojotoro, bridge of Ferrocarril Belgrano, 24°40' S 65°03' W, 1 (MMD); San Ramón de la Nueva Orán, 23°08' S 64°20' W, 1 (CML); Tartagal, Laguna de Las Catas, 22°16' S 63°52' W, 1 (CML). Tucumán: Cerro de Raco, 26°43' S

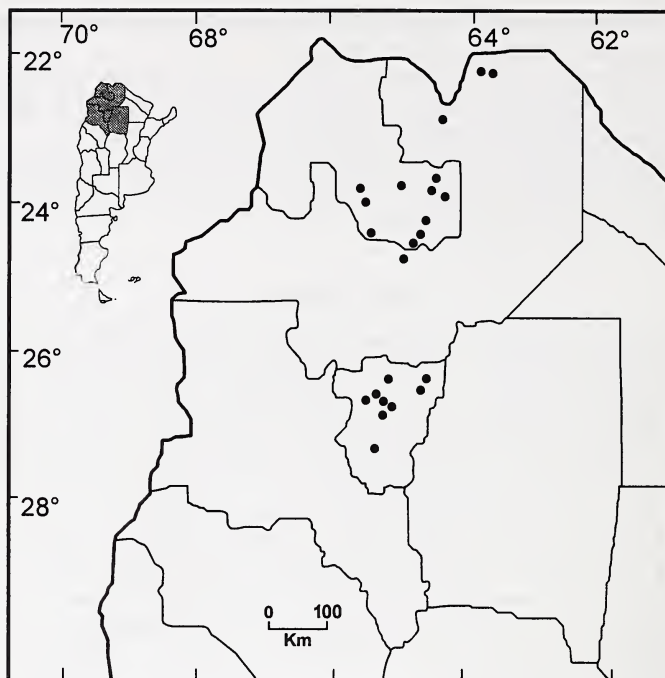


Fig. 3. Localities of occurrence of *Thylamys cinderella*.

65°30' W; Cerro de Tafi Viejo, 26°44' S 65°16' W; Cerro del Campo, 26°35' S 64°57' W; Concepción, 27°20' S 63°35' W (TATE 1933 as *Marmosa venusta cinderella*); Finca El Jagüel, 4.5 km W provincial road 304, on the way to Requielme, 26°28' S 64°48' W, 1 (PID-BA); Ñorco-Vipos (cited as Norreo-Vipos), 26°29' S 65°22' W (TATE 1933 as *Marmosa venusta cinderella*); Raco, 1000 m, 26°38' S 65°26' W, 1 (MACN); Tucumán, 450 m, 26°50' S 65°13' W, 1 (BMNH holotype); "Tucumán", no specific locality; Villa Nougues, San Pablo, 26°51' S 65°23' W (TATE 1933 as *Marmosa venusta cinderella*).

Description: Dorsal coloration is grayish, although some specimens are somewhat brownish; some specimens have a dark mediodorsal area. The bases of the hairs of the venter are gray and the tips are white or cream; hairs of the chest are unicolored, white or yellowish. The pelage of young individuals is shorter and darker compared with that of adults. Pointed supraorbital processes are present, which are very evident in adult specimens. In young animals these processes are not evident, but the edges of the supraorbital region are pronounced from an early age. The zygomatic arches are well expanded. Lambdoidal crests are pronounced.

Comments: *Thylamys cinderella* has been considered as a subspecies of *venustus*, but here we elevate the taxon to a distinct species based on characters that clearly differentiate it from the other species in the region, *T. sponsoria*, and because the two have been found in geographic sympatry.

TATE (1933), in spite of showing sympatry between *T. cinderella* and *T. sponsoria*, considered the two taxa as subspecies of *T. venustus*. However, there are errors in his specimens examined. Some of the same individuals were listed for both taxa. For example, he cited León and Caimancito (cited as Carmencito) for *T. venusta cinderella* and *T. v. sponsoria*, but in both cases the reference is for the same specimens. The specimens from "Serra de Tucumán" in the AMNH that TATE (1933) identified as *cinderella* are here reidenti-

fied as *sponsorio*. Specimens of this species are known, principally, from the Chaco, although some were collected in the Yungas but in arid areas near the Chaco.

On highway 9 at the border with Salta, at a campground on the way to El Carmen, in February, a female with open vagina, a lactating female, and a young individual were collected. Young were also collected at Laguna La Brea in May and at Finca El Jagüel in April.

*Thylamys pallidior* (Thomas, 1902)

Distribution in Argentina: In arid areas (Prepuna, Puna, Monte, and northern Patagonia), from Jujuy south to Chubut.

Specimens Examined (n = 38) and Additional Records (Fig. 4): Argentina. Catamarca: Belén, 27°39' S 67°02' W; Chumbicha, 0.5 km E of Hwy 38 along Hwy 60, 457 m, 28°52' S 66°14' W (MARES et al. 1997); Chumbicha, 1.5 km E of Hwy 38, along Hwy 60, 28°52' S 66°14' W, 1 (CML); Chumbicha, 600 m, 28°52' S 66°14' W (THOMAS 1919 a as *Marmosa elegans pallidior*); Chumbicha (cited as Chumbiche), 28°52' S 66°14' W; Hualfín (cited as Gualfín), 27°14' S 66°50' W (TATE 1933 as *Marmosa pallidior*); Inmed. N Andalgalá, Río Andalgalá, 27°34' S 66°16' W; Minas Capillitas, 3200 m, 27°20' S 66°25' W; of Hwy 62, 8 km E jct. Hwy 1 and 62, 27°36' S 66°15' W; of Hwy 62, 8 km E jct. Hwy 62 and 1, E of Andalgalá, 27°36' S 66°15' W (MARES et al. 1997); Otro Cerro, 28°44' S 66°17' W (TATE 1933 as *Marmosa pallidior*); Quirós, 28°45' S 65°07' W (MARES and BRAUN 2000); Río Andalgalá, 3 km N Andalgalá, 27°34' S 66°16' W (MARES et al. 1997). Jujuy: 11 km E of Humahuaca, 2 km E of Pucará on road to Cianzo, 23°12' S 65°16' W, 1 (ARG); 9 km NW Bárcena, 23°57' S 65°30' W, 2 (ARG); Abra Pampa, 22°43' S 65°42' W, 4 (3 CML; 1 MACN); Abra Pampa, 3500 m, 22°43' S 65°42' W, (THOMAS 1919 b as *Marmosa elegans pallidior*); Abrapampa, 3500 m, 22°43' S 65°42' W, 1 (BMNH); Alfarcito, 2600 m, 23°37' S 65°23' W, 1 (BMNH); Casabindo, 22°58' S 66°05' W (TATE 1933 as *Marmosa pallidior*); Casabindo, 4000 m, 22°58' S 66°05' W, 6 (BMNH); Casabindo, 4000–4500 m, 22°58' S 66°05' W (THOMAS 1919 b as *Marmosa elegans pallidior*); Cerro Casabindo, 4500 m, 22°56' S 66°07' W, 2 (BMNH); Cuesta del Hurón, 29 km W Cineguillas on provincial road 64, 3835 m, 22°06' S 66°03' W, 3 (MMD); Curques, 24 km N Susques, on provincial road 74, 4100 m, 23°14' S 66°23' W, 1 (MMD); Humahuaca, 23°12' S 65°21' W (THOMAS 1919 a as *Marmosa elegans pallidior*); La Quiaca, 17 km W, 3 km S of road 5, 22°09' S 65°44' W, 1 (MMD); Laguna de Pozuelo, no specific locality, 2 (MACN); Maimará, 23°37' S 65°28' W (TATE 1933 as *Marmosa pallidior*); Maimará, 2230 m, 23°37' S 65°28' W, 2 (BMNH); Maimará, 2300 m, 23°37' S 65°28' W, 1 (MACN); Maimará, 2500 m, 23°37' S 65°28' W, 2 (MACN); Mina Pirquitas, 31 SE, on road 74 b, Sierra de Quichagua, 22°54' S 66°19' W, 4200 m, 2 (MMD); Miyuyoc, 22°51' S 65°18' W, 1 (MMD); Salar Cauchari, 31 km N Cauchari, on road 70, 3840 m, 23°50' S 66°47' W, 1 (MMD); Sierra de Tilcara, 4500 m, 23°35' S 65°12' W, 1 (MACN). Salta: 30 km E Cachi, 2600 m, 25°09' S 66°00' W (MARES and BRAUN 2000). Tucumán: Near Amaicha del Valle, 26°36' S 65°55' W, 1 (PO); Pichao, Sierra de Quilmes, 26°21' S 66°03' W, 1 (CML); Tañí del Valle, 26°52' S 65°41' W (TATE 1933 as *Marmosa pallidior*). Bolivia. Oruro: Challapata, 3800 m, 1 (BMNH holotype).

Description: The dorsal coloration is pale gray, although some specimens have brownish tones, the sides are lighter, and the venter is pure white. The feet are white or grayish and the ears are grayish or drab. Periocular ring is black and very thin, and the cheeks are white. The finely haired tail is bicolored, gray or drab dorsally and yellowish-white ventrally. The braincase is globose in form and the zygomatic arches are slightly expanded. The rostrum is long, narrow, and pointed. The interorbital region lacks pronounced supraorbital edges. Tympanic bullae are large and are separated by a small space.

Comments: This species was described by THOMAS (1902) as a subspecies of *T. elegans*. MATSCHIE (1916) and TATE (1933) treated the taxon as a valid species; the former within

the genus *Thylamys* and the latter in the genus *Marmosa*. Later, it was considered as a subspecies of *T. pusilla* (CABRERA 1957; OLRG 1979), and currently it is considered as a valid species (GARDNER 1993). In Jujuy Province it is found only in the Puna phytogeographic province, whereas further south it occupies other and areas (Monte and Patagonia). The majority of the specimens were collected from rocky areas with little vegetation (spine shrubs, cactus, and grass). In Catamarca Province along the border with the Santiago del Estero Province the distribution overlaps that of *T. pusilla*, which is found typically in the Chaco. PALMA (1995) established the distribution of the species as the rocky hillsides of the Andean Altiplano of Argentina and Bolivia, and broadened the distribution to northern Chile.

The locality of Sierra de Zenta used by Budin on the MACN specimen corresponds to Sierra de Tilcara, which is located east of Maimará. The specimens cited by MARES et al. (1996) as *T. pallidior* for Tucumán Province we considered here as *T. pusilla*.

In February, at Cuesta del Hurón, we recorded a lactating female with an open vagina that had an ochraceous venter. Young individuals were collected in February at Cuesta del Hurón, in March at Cerro Casabindo, 4500 m and Maimará, 2230 m; and in April at Alfarcito, 2600 m.

*Thylamys pusilla* (Desmarest, 1804)

Distribution in Argentina: In the provinces of Formosa, Corrientes, Chaco, Entre Ríos, Salta, Santiago del Estero, and Tucumán.

Specimens Examined (n = 18) and Additional Records (Fig. 4): Argentina. Salta: 5 km S Tolloche, on Vinalito Rd., 25°30' S 63°32' W (DÍAZ et al. 2000; MARES et al. 1981 as *Marmosa pusilla*; OJEDA and MARES 1989 as *Marmosa pusilla*); 6 km W of Piquirenda Viejo, 22°21' S 63°50' W (MARES and BRAUN 2000); 90 km NNW of Tucumán (TATE 1933 as *Marmosa pallidior*); Campo Grande, 17 km E Santo Domingo, 24°37' S 63°20' W, 1

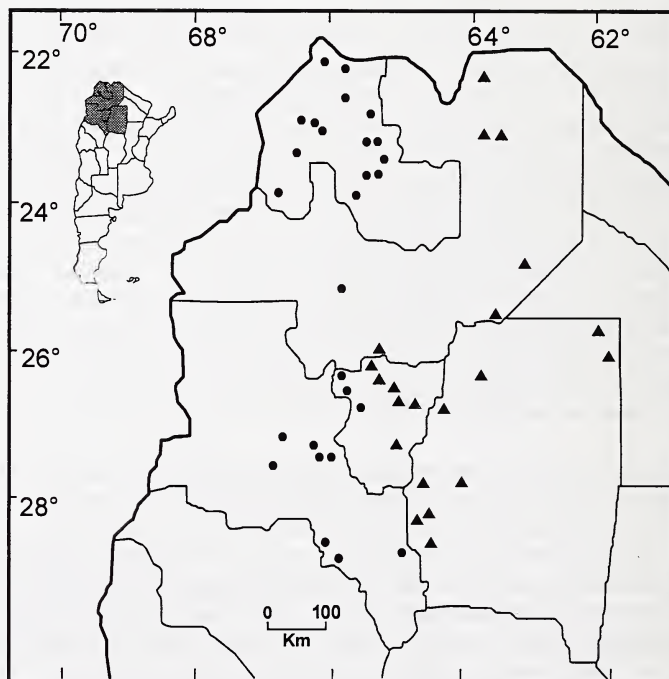


Fig. 4. Localities of occurrence of *T. pallidior* (circles) and *T. pusilla* (triangles).



(CML); Departamento Capital, no specific locality, 1 (MACN); Dragones, 23°16' S 63°21' W, 1 (not collected); Hickman, 23°12' S 63°34' W, 1 (CML); Los Colorados, 17 km E Santo Domingo, 24°37' S 63°20' W, 1 (CML); Puesto Campo Grande, 17 km E Santo Domingo, 24°37' S 63°20' W, 1 (CML). Santiago del Estero: 15 km SE Picada de Olmos, on road 16, W of Los Pirpintos, 26°06' S 62°10' W, 2 (CML); 6 km S, 2 km E Pampa de los Guanacos, ca. 120 m, 26°17' S 62°01' W (MARES and BRAUN 2000); Estancia Guampacha, 27°59' S 64°45' W (MASSOIA and LATORRACA 1992 as *Thylamys elegans pallidior*); Estero, 26°37' S 63°39' W; Lavalle (cited as La Valle), 28°12' S 65°08' W (TATE 1933 as *Marmosa pallidior*); Lago Muyo, not located, 2 (CML); Virgen del Valle picnic area on Highway 64 between Santa Catalina and La Puerta Chiquita, 28°09' S 64°50' W, 1 (CML); Robles, 27°55' S 64°08' W (CABRERA 1934 as *Marmosa janetta pulchella*); San Antonio, 26°46' S 64°37' W, 2 (MACN); Villa La Punta, 28°23' S 64°45' W (MASSOIA and LATORRACA 1992 as *Thylamys elegans pallidior*). Tucumán: Cerro Medici, 26°37' S 65°12' W (CAJAL 1981); El Bracho, 400 m, 26°59' S 65°11' W, 2 (CML); El Cadillal, 26°37' S 65°12' W, 1 (CML); Estación Vipos, 26°29' S 65°22' W (TATE 1933 as *Marmosa pallidior*); Las Mesadas, 26°27' S 65°30' W, 1 (CML); San Pedro de Colalao, 26°14' S 65°29' W, 1 (CML); Tápia, 26°36' S 65°18' W (TATE 1933 as *Marmosa pallidior*).

Description: This species is very similar in coloration to *T. pallidior*, although the dorsal coloration is browner, and in some specimens grayer. The venter is pure white and this coloration extends to the cheek. The feet are white and the ears are grayish or drab. The periocular rings are black and very thin. The braincase is globose in form and the zygomatic arches are greatly expanded. The rostrum is short and wide. The supraorbital processes of the interorbital region are pronounced. The tympanic bullae are small compared to *T. pallidior*.

Comments: According to PALMA (1995) the species is found in the Chaco and Monte Desert of Argentina. According to our study, specimens from the Monte desert are *T. pallidior*. We restrict the distribution of this species to the Chaco and the area of transition with the Yungas.

#### *Thylamys* sp.

Specimens Examined (n = 7) (Fig. 6): Argentina. Jujuy: Cerro Calilegua, El Duraznillo, 3000 m, 23°28' S 64°55' W, 1 (CML). Tucumán: La Higuera, 26°23' S 65°26' W, 6 (CML).

Description: The pelage is short and dark, typical of young individuals. The dorsum is grayish brown and is darker along the midline; the specimens from La Higuera are browner. The venter is yellowish gray, grayer in comparison with specimens of *T. sponsoria* and *T. cinderella*. The specimen from Jujuy has black periocular rings and those from La Higuera have brown rings. Cranially, these specimens correspond to young individuals that have a deciduous premolar or an erupting permanent third upper premolar. The skulls are large and are similar to those of adults of others species of *Thylamys* examined. The supraorbital edges are pronounced and the rostrum is well developed.

Comments: The specimen from Jujuy was identified by OLROG (1979) as *Marmosa pusilla pallidior*, but its characters do not correspond to those of this group. HEINONEN FORTABAT and CHEBEZ (1997) cited *T. elegans pallidior* for Parque Nacional Calilegua, probably following OLROG (1979).

The specimens listed as *Thylamys* sp. do not correspond to any of the described species of *Thylamys*, based on the description and comparisons of the different species and subspecies. The specimens are young but the size corresponds to that of (older) adult specimens of other species. The largest species in the genus described to date is *Marmosa janetta*, which was placed in synonymy with *T. elegans* (GARDNER 1993). Because there are few specimens with these characters, it is not possible to make accurate comparisons of the cranium. Additional specimens of adult age are needed to accurately determine to which taxon these specimens correspond.

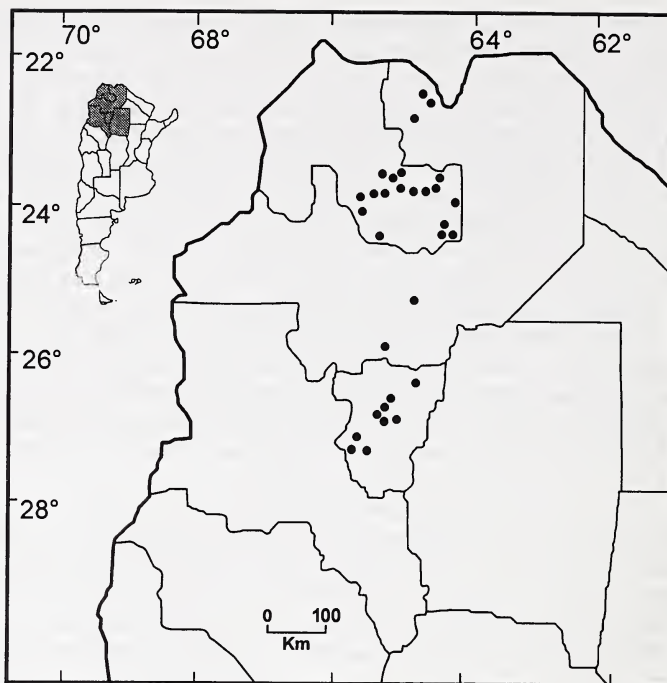


Fig. 5. Localities of occurrence of *T. sponsoria*.

*Thylamys sponsoria* (Thomas, 1921)

Distribution in Argentina: To date, only known for Jujuy Province. Here we extend the distribution to include the provinces of Salta and Tucumán.

Specimens Examined (n = 118) and Additional Records (Fig. 5): Argentina. Jujuy: 9 km NW Bárcena, 23°57' S 65°30' W, 1 (ARG); Abra de Cañas 23°40' S 64°54' W, 2 (MACN); Abra de Cañas, 1700 m, 23°40' S 64°54' W (HEINONEN and BOSSO 1994 as *Thylamys venustus*); Abra de Cañas, El Monolito, 1700 m, 23°40' S 64°54' W, 6 (CML); Aguas Negras, 23°45' S 64°56' W, 1 (MACN); Aguas Negras, 600 m, 23°45' S 64°56' W, 1 (MACN); Arroyo La Horqueta, 3 km SE Laguna de Yala, 2100 m, 24°07' S 65°27' W, 1 (MMD); Arroyo La Horqueta, 6 km SE Laguna de Yala, 2100 m, 24°07' S 65°27' W, 1 (MMD); Arroyo Yuto, 13 km SW Yuto, 23°40' S 64°37' W, 2 (MMD); Caimancito, 550 m, 23°44' S 64°36' W (HEINONEN and BOSSO 1994 as *Thylamys venustus*); Calilegua, 23°46' S 64°47' W, 2 (1 CEM; 1 FMNH); Cerro Hermoso, 23°35' S 64°53' W, 3 (MACN); El Simbolar, 25 km SW Palma Sola, 24°11' S 64°28' W, 3 (2 CM; 1 OMNH); Higuerrilla, 23°36' S 65°05' W (TATE 1933 as *Marmosa venusta sponsoria*); Higuerrilla, 2000 m, 6 (BMNH); Mesadas de las Colmenas, 23°42' S 64°52' W, 5 (MACN); Mountains W of Yala, no specific locality, 1 (FMNH); Near Yala (cited as Near Vala), no specific locality (TATE 1933 as *Marmosa venusta sponsoria*); On highway 29 (east off of hwy 9), 10 km west of Tiraxi, 23°59' S 65°23' W, 1 (ARG); Palma Sola, 24°00' S 64°19' W, 1 (AMNH); Parque Nacional Calilegua, no specific locality, 1 (MACN); Río Blanco, 9 km SW San Antonio, 1443 m, 24°25' S 65°23' W 2 (PIDBA); Río Tesorero, 4 km N Tiraxi, on provincial road 29, 23°59' S 65°18' W, 2 (MMD); Río Tiraxi, 1.5 km E Tiraxi, on road 29, 23°59' S 65°19' W, 1 (PIDBA); Santa Bárbara, 24°17' S 64°24' W, 1 (AMNH); Sunchal, Sierra de Santa Bárbara, 24°14' S 64°27' W (TATE 1933 as *Marmosa venusta sponsoria*); Sunchal, Sierra Santa Bárbara, 1200 m, 9 (BMNH, including the holotype); Sunchal, Sierra Santa Bárbara,

1400 m, 1 (BMNH). Salta: 3.9 km N Potrerillos, along provincial road 6, 26°04' S 65°30' W, 1 (ARG); 43.7 km NW of the Junction of Argentine Highways 50 and 18, on road to Isla de Cañas, 22°57' S 64°33' W, 6 (PIDBA); Río de las Conchas, 2 km N and 6 km W of Metán, 25°18' S 61°01' W, 1 (PIDBA); Río Santa Maria, 1 (MACN); Vado de Arrazayal, 20 km NW Aguas Blancas, 22°33' S 64°32' W, 2 (CML). Tucumán: Aconquija, 3000 m, no specific locality, 1 (MACN); Biological Reserve Horco Molle, near Residencia, 26°45' S 65°21' W, 2 (CML); Cerro San Javier, 26°47' S 65°23' W, 1 (MACN); Cerro San Javier, 1000 m, 1 (MACN); Concepción, 27°20' S 63°35' W, 14 (MACN); Horco Molle, 26°45' S 65°21' W, 1 (CML); Horco Molle, 650 m, 6 (CML); Las Agüitas, El Taficillo, 26°42' S 65°22' W, 1 (CML); Parque Provincial El Cochuna, 27°18' S 65°54' W, 1 (CML); Piedra Tendida, 8 km W Dique El Cajón, 26°30' S 64°52' W, 1 (PIDBA); Reserva Provincial La Florida, 7 km W Ibatín, on Río Pueblo Viejo, 27°13' S 65°37' W, 4 (3 ARG; 1 PIDBA); San Javier, 1000 m, 26°47' S 65°23' W, 2 (MACN); San Javier, Estación Biológica R. Schreiter, 1 (MACN); San Miguel de Tucumán, 4000 ft., 26°50' S 65°13' W, 15 (AMNH); San Miguel de Tucumán, 4500 ft., 1 (AMNH); Villa Nougues, 26°51' S 65°23' W, 1 (CML).

**Description:** This species cannot be differentiated from *T. cinderella* based on coloration, although the structures of the cranium are very different. Unlike *T. cinderella* the supraorbital region lacks pointed processes; only in adult individuals are they slightly pronounced, but they never form processes, and in young individuals there is no evidence of edges. The rostrum is longer and narrower, and the zygomatic arches are less expanded. The lambdoidal crests are less developed compared with *T. cinderella*.

**Comments:** The majority of the specimen records are from the Yungas. In Jujuy Province, at the locality of 9 km NW Bárcena, an ecotonal area between Yungas and Prepuna, this species was captured with *T. pallidior*, a species typical for higher elevations in the province. On the other hand, we found numerous specimens from the type locality of *T. cinderella* and from areas nearby.

The locality "Near Yala" cited by TATE (1933) for a specimen in the FMNH, is written as "Mountains W of Yala" on the original tag.

A female with a young attached to a nipple was captured in December at Aguas Negras and a lactating female was captured in February at the locality on highway 29 (east off hwy 9), 10 km west of Tiraxi. Specimens with incrassate tails (fat storing) were collected in May at Río Blanco, in June at El Simbolar, and in July at Arroyo La Horqueta. Youngs were captured in January at Horco Molle, in February at Reserva La Florida, in March at San Miguel de Tucumán, and in July at Arroyo La Horqueta.

*Thylamys venustus* (Thomas, 1902)

**Distribution in Argentina:** The distribution of the species in Argentina is problematic, since different revisions have treated *T. sponsoria* and *T. cinderella* as belonging to *elegans* or *venusta*. We restrict the distribution in Argentina to northwestern Salta Province.

**Specimens Examined** (n = 8) (Fig. 6): Argentina. Salta: 27 km W Agua Blanca, 22°45' S 64°40' W, 1 (MACN); Angosto del Río Pescado, 22°33' S 64°32' W, 1 (MACN); Finca Yakulica, Angosto del Río Pescado, 22°33' S 64°32' W, 1 (MACN); Parque Nacional Baritú, Arroyo Santelmita, 22°31' S 64°37' W, 1 (MACN); Parque Nacional Baritú, Cerro Chaguar, 22°35' S 64°37' W, 1 (MACN); Parque Nacional Baritú, Finca Yakulica, Río Pescado, 22°33' S 64°32' W, 2 (CML). Bolivia. Cochabamba: Paratani, 2800 m, 1 (BMNH holotype).

**Description:** Size smaller than the other species of *Thylamys*. The dorsal coloration is cinnamon brown with the sides lighter. The venter is cream, the bases of the hairs are gray except on the chin, throat, and along the midline of the chest. The periocular rings are thin and black, the cheeks are yellowish-white, and the ears are brown. The feet are cream. The tail is bicolored, dark brown above and grayish below; the proximal portion is almost unicolored. The rostrum is wide and short; the zygomatic arches are moderately

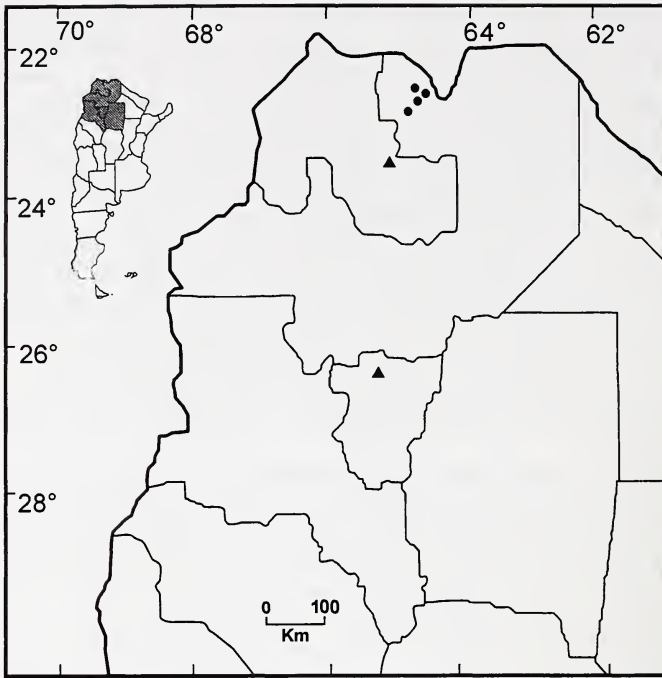


Fig. 6. Localities of occurrence of *Thylamys* sp. (triangles) and *T. venustus* (circles).

expanded. The interorbital region has edges that are slightly pronounced only in adult individuals. The dentition corresponds to old age for the majority of the specimens examined, but the size is smaller in comparison with the other species mentioned above of the same age.

Comments: According to our comparison with the type specimen of *venustus*, the majority of the specimens from northwestern Argentina do not correspond with this species, principally owing to the small size that characterizes this species. Based on our records this species is only present in northern Salta Province along the border with Bolivia.

TATE (1933) proposed a distribution from Cochabamba, Bolivia to the headwaters of the Río Bermejo. CABRERA (1957) suggested that TATE's (1933) results indicated that this area was a zone of overlapping between *M. e. venusta* and *M. e. cinderella*. OLRG (1959) also considered *venusta* as a subspecies of *elegans*, together with *cinderella* and *janetta*, with an allopatric distribution in northwestern Argentina. ANDERSON (1997) described the southern distribution of the species in Bolivia, along the border with Argentina. However, his sample may have included some of the species mentioned in the present study, based on our examination of the measurements published for some of the specimens. The specimen localities listed in the present study correspond to a distribution similar to that suggested by CABRERA (1957). This area contains relatively undisturbed forest; the known localities are located in Parque Nacional Baritú or in nearby areas.

#### Key to the species

1. Pelage with a tricolor pattern; tail accumulates fat seasonally; nasal bones more or less parallel, not expanded at the frontomaxillary sutures (Fig. 7a); third upper premolars larger than the second . . . . . Genus *Thylamys*...3

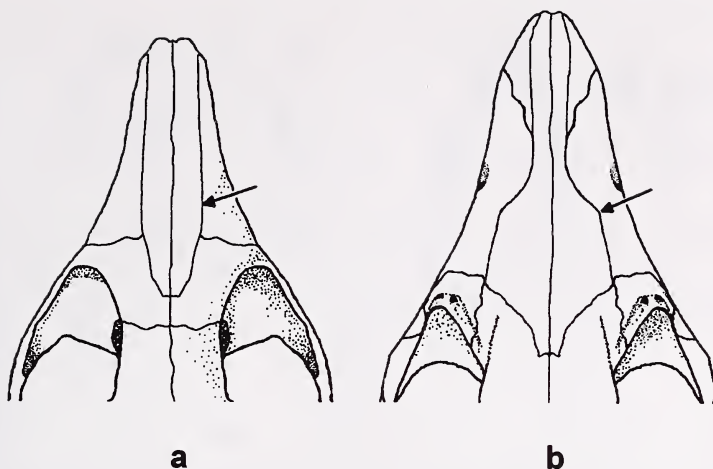


Fig. 7. Dorsal view of the anterior part of the skulls of *Thylamys* (a) and *Gracilinanus* (b) showing the differences in the nasal bones (arrow).

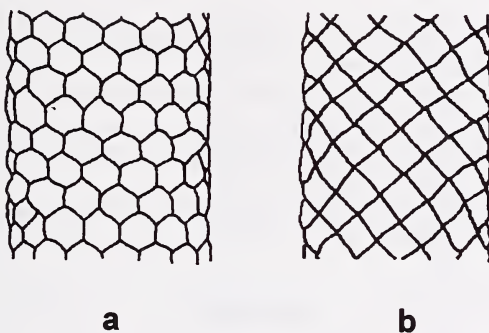
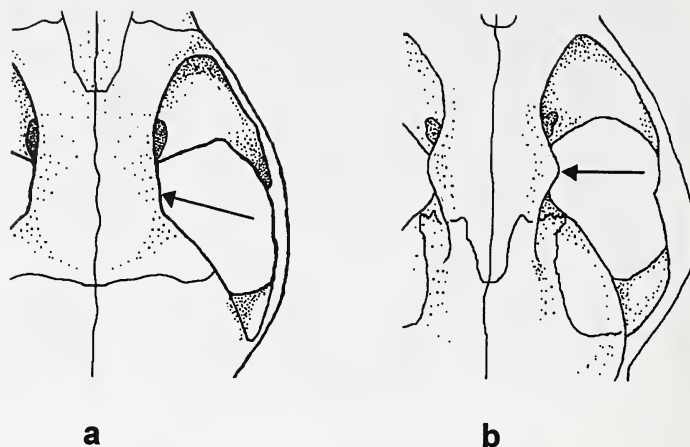


Fig. 8. View of the caudal scales of *Gracilinanus* (a) and *Micoureus* (b).

- 1'. Pelage without tricolor pattern; tail does not accumulate fat seasonally; nasal bones expanded abruptly at the frontomaxillary sutures (Fig. 7 b); third upper premolars less than or subequal to the second . . . . . 2
2. Caudal scales annular (Fig. 8 a); supraorbital processes absent; greatest length of the skull less than 30 mm; length of head and body less than 110 mm . . . *Gracilinanus agilis*
- 2'. Caudal scales spiral (Fig. 8 b); supraorbital processes well developed; greatest length of the skull greater than 32 mm; length of head and body greater than 130 mm . . . . . *Micoureus constantiae*
3. Hair of the venter pure white; length of head and body less than 95 mm; greatest length of the skull less than 26 mm . . . . . 4
- 3'. Hair of the venter with gray bases; length of head and body greater than 100 mm; greatest length of the skull greater than 26 mm . . . . . 5
4. Dorsal coloration grayish; interorbital region without marked supraorbital processes (Fig. 9 a); auditory bullae large; snout elongated; found in the Puna, Prepuna, and Monte . . . . . *Thylamys pallidior*
- 4'. Dorsal coloration brownish; interorbital region with marked supraorbital processes (Fig. 9 b); auditory bullae not especially large; snout not elongated; found in the Chaco . . . . . *Thylamys pusilla*



**Fig. 9.** Dorsal view of the interorbital region of the skulls of a) *Thylamys pallidior* showing the absence of supraorbital processes (arrow), and b) *Thylamys pusilla* showing the well marked supraorbital processes (arrow).

5. Interorbital region with pointed supraorbital processes or pronounced edges (Fig. 9 b); found in the Yungas and the Chaco . . . . . *Thylamys cinderella*
- 5'. Interorbital region with smooth edges, in adult specimens the edges are slightly pronounced (Fig. 9 a); found in the Yungas . . . . . 6
6. Adults with condylo-incisive length, in general, greater than 27 mm; zygomatic arch expanded, breath greater than 16 mm . . . . . *Thylamys sponsoria*
- 6'. Adults with condylo-incisive length, in general, less than 27 mm; zygomatic arch not expanded, breath less than 16 mm. . . . . *Thylamys venustus*

## Discussion

The taxonomy and distribution of the various taxa of the marsupials of Argentina are in an initial stage of knowledge. This probably is due to the lack of specimens and data for some regions as well as to the lack of collecting efforts. On the other hand, few studies of marsupials have included specimens from Argentina; for this reason the specific identity and the limits of the distribution of the species in Argentina have not been well presented in previous publications (e. g., PALMA 1995).

Based on our revision, we include a new genus for northwestern Argentina, *Gracilinanus*, with a new species for the region, *G. agilis*. Two subspecies of *Thylamys* are elevated to species, *T. cinderella* and *T. sponsoria*, which have until now been considered subspecies of *T. venustus*. Therefore, according to this study, eight species are known to occur in northwestern Argentina: *G. agilis*, *M. constantiae*, *T. cinderella*, *T. pallidior*, *T. pusilla*, *T. sponsoria*, *T. venustus* and *Thylamys* sp.

In a comparison of the diversity of marsupials in northwestern Argentina (11 species) to that of the northeast (16 species), the diversity of the latter is greater. However, only four species of mouse opossums are known for the northeast: *G. agilis*, *G. microtarsus*, *M. demerarae*, and *T. pusilla* (GARDNER 1993; MARES and BRAUN 2000); *G. agilis* and *T. pusilla* are species shared between both regions. *Thylamys formosa* has been recorded for northeastern Argentina (CABRERA 1957; OLROG 1959; OLROG and LUCERO 1981; REDFORD and EISENBERG 1992), but this taxon was considered a synonym of *G. agilis* by GARDNER (1993) and HERSHKOVITZ (1992).

**Table 1.** Measurements (in mm, except for weight, which is in g) of species of marmosines. Mean, range (in brackets), and sample size are given for each measurement.

Character	<i>Gracilinanus agilis</i>	<i>Micoureus constantiae</i>	<i>Thylamys cinderella</i>	<i>Thylamys pallidior</i>
ToL	197.0 (178.0–233.0)	351.9 (276.0–394.0)	207.0 (169.0–251.0)	196.3 (169.0–234.0)
	3	11	40	22
TL	108.0 (98.0–126.0)	201.8 (155.0–225.0)	116.2 (92.0–140.0)	100.2 (87.0–111.0)
	3	11	45	28
HFL	15.3 (14.0–16.0)	25.3 (24.0–27.0)	13.9 (11.0–17.0)	13.0 (10.0–20.0)
	3	8	46	26
EL	15.7 (15.0–17.0)	26.5 (22.4–29.0)	21.3 (15.0–25.4)	21.5 (13.0–26.0)
	3	11	46	25
W	12.0 (12.0–12.0)	83.4 (63.0–108.0)	18.9 (10.5–34.0)	18.5 (12.0–30.0)
	2	5	32	13
CIL	24.2 (22.9–25.5)	38.9 (35.9–41.7)	27.1 (22.6–30.6)	25.6 (24.1–26.3)
	3	5	26	3
ONL	25.4 (23.8–27.2)	40.2 (37.4–42.8)	27.4 (18.8–31.5)	26.1 (24.9–26.8)
	6	6	27	3
BB	9.7 (9.4–10.2)	14.5 (13.3–15.4)	10.7 (9.5–11.4)	10.5 (10.0–10.9)
	6	7	29	3
PC	5.1 (4.8–5.3)	6.9 (6.3–7.2)	4.5 (3.8–5.6)	4.6 (4.3–5.1)
	6	9	28	3
ZB	13.6 (12.4–14.3)	22.0 (13.7–26.6)	14.8 (11.6–17.2)	13.7 (13.1–14.1)
	6	7	29	3
MB	9.8 (9.3–10.2)	14.5 (14.2–14.8)	10.4 (9.0–11.6)	10.1 (9.8–10.3)
	5	4	25	3
LR	9.1 (8.2–9.8)	15.0 (14.1–16.7)	10.3 (8.3–11.8)	9.7 (9.2–10.0)
	5	6	30	3
LN	10.2 (8.8–11.1)	18.7 (16.3–20.2)	12.9 (12.4–13.2)	– –
	6	4	3	–
LMxT	9.6 (9.3–9.9)	15.9 (15.3–16.5)	10.4 (7.7–11.5)	11.4 (9.6–14.0)
	6	7	30	3
PL	12.5 (11.7–13.4)	21.0 (19.2–22.8)	13.9 (11.8–15.4)	13.4 (12.0–14.4)
	5	6	28	3
C-C	3.9 (3.4–4.2)	7.3 (6.6–8.4)	4.3 (3.3–5.0)	3.9 (3.8–4.0)
	6	7	30	3
M-M	7.5 (7.2–7.7)	12.8 (11.4–13.6)	8.2 (6.6–9.5)	8.8 (8.6–9.0)
	6	8	30	3
LM	17.4 (16.8–18.8)	29.3 (24.6–32.1)	19.2 (10.1–22.8)	18.7 (17.6–19.4)
	5	9	30	3
LMdT	9.8 (9.4–10.1)	16.6 (15.5–17.3)	10.9 (9.8–12.0)	11.2 (10.3–12.7)
	5	9	30	3

Table 1. Continued

Character	<i>Thylamus pusilla</i>	<i>Thylamus sp</i>	<i>Thylamys sponсорia</i>	<i>Thylamys venustus</i>
ToL	185.7 (141.0–217.0)	220.6 (199.0–215.0)	222.1 (148.0–271.0)	220.4 (200.0–244.0)
TL	14 97.5 (75.0–123.0)	7 118.4 (110.0–130.0)	91 126.8 (75.0–151.0)	6 128.0 (115.0–146.0)
HFL	15 13.6 (10.0–24.0)	7 14.1 (9.0–15.0)	95 15.6 (7.0–29.0)	7 14.0 (11.1–16.9)
EL	15 18.2 (12.0–23.0)	7 19.9 (12.0–25.0)	75 21.2 (11.0–29.5)	7 20.5 (16.5–23.0)
W	16 16.3 (10.0–22.0)	7 – –	92 26.9 (9.0–46.0)	6 22.5 (15.0–28.0)
CIL	12 24.4 (20.0–26.9)	– 27.6 (26.7–28.2)	36 28.5 (21.8–31.8)	4 27.8 (26.0–29.2)
ONL	16 25.1 (20.9–27.0)	6 28.7 (27.6–29.5)	65 29.1 (23.0–32.3)	7 28.4 (26.6–30.0)
BB	16 9.9 (9.3–10.7)	6 11.1 (10.4–11.6)	65 11.1 (9.9–11.9)	7 11.0 (10.4–11.5)
PC	17 4.7 (4.2–5.5)	7 5.4 (4.7–5.9)	67 5.0 (4.1–6.6)	8 4.8 –
ZB	19 14.2 (13.0–15.3)	7 15.6 (15.1–16.0)	50 15.4 (11.9–17.7)	1 15.1 (14.2–16.7)
MB	13 9.8 (9.5–10.1)	6 10.7 (10.3–11.0)	67 10.9 (8.9–11.8)	8 10.7 (10.2–11.5)
LR	2 8.8 (8.5–9.1)	6 10.7 (10.3–11.2)	62 11.0 (8.2–12.3)	7 10.6 (9.5–11.5)
LN	3 10.2 (9.5–11.0)	7 – –	65 12.1 (9.6–13.4)	8 11.7 (10.2–12.8)
LMxT	3 11.7 (9.2–13.1)	– 11.1 (10.7–11.4)	12 11.4 (8.7–15.0)	5 11.1 (10.7–11.6)
PL	18 13.0 (11.5–14.1)	7 15.1 (14.7–15.5)	74 15.1 (12.3–17.1)	8 14.7 (13.7–15.7)
C-C	11 3.7 (3.0–4.2)	5 4.0 (3.8–4.1)	60 4.4 (3.3–5.4)	8 4.6 (4.2–5.3)
M-M	19 7.8 (6.1–8.5)	7 9.2 (7.8–9.7)	71 8.8 (6.2–10.1)	8 8.7 (8.0–9.7)
LM	17 18.4 (16.0–20.0)	7 20.5 (18.7–21.5)	70 20.7 (16.0–29.6)	8 20.1 (18.4–21.8)
LMdT	18 10.9 (9.8–11.6)	7 11.5 (11.1–12.0)	78 11.6 (8.8–13.4)	8 11.3 (10.7–11.8)
	19	7	78	8



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## Zusammenfassung

### *Mausopossums (Didelmorpha, Didelphidae) aus dem Nordwesten Argentiniens: Systematik und Verbreitung*

Es werden die Ergebnisse einer systematischen Revision der Mausopossums aus dem Nordwesten Argentiniens dargestellt. Drei Gattungen, *Gracilinanus*, *Micoureus*, *Thylamys*, und acht Arten werden behandelt. Die Gattung *Gracilinanus* ist eine neuer Nachweis für diese Region. Für zwei Subspezies von *Thylamys* wird Artrang vorgeschlagen. Für jede Art werden Fundorte, Beschreibungen der äußeren Gestalt und des Schädels, Maße sowie Kommentare zur Taxonomie und zur Naturgeschichte gegeben.

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