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Akodon cursor (Rodentia: Cricetidae)

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Abstract: *Akodon cursor* (Winge, 1887) is a Sigmodontinae rodent commonly called the cursorial akodont. This small cursorial mouse has homogenous dorsal pelage that can range from dark to golden brown and it is 1 of 41 species in the genus *Akodon*. It is endemic to Brazil, South America, and is found in the Atlantic Forest, being the most abundant sigmodontine rodent of this large area. Deforestation within the range of *A. cursor* may not affect this species, because it is tolerant of human disturbance. Currently the International Union for Conservation of Nature and Natural Resources regards it as a species of "Least Concern."

Key words: Atlantic Forest, Brazil, cursorial mammal, rodent, sigmodontine, South America

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Akodon cursor (Winge, 1887)
Cursorial Akodont

Habrothrix cursor Winge, 1887:25. Type locality "Lagoa Santa, Minas Gerais."

Akodon cursor: Thomas, 1902:60. First use of current name combination.

Akodon arviculoides cursor: Gyldenstolpe, 1932:101. Name combination.

Akodon cursor cursor: Vieira, 1955:416. Name combination.

CONTEXT AND CONTENT. Order Rodentia, suborder Myomorpha, superfamily Muroidea, family Cricetidae, subfamily Sigmodontinae, tribe Akodontini, genus *Akodon* (Musser and Carleton 2005). Forty-one species constitute the genus (Musser and Carleton 2005). *A. cursor* is a member of the *cursor* species group (Geise et al. 2001; Gonçalves et al. 2007; Rieger et al. 1995; Smith and Patton 2007) and is monotypic.

NOMENCLATURAL NOTES. The *cursor* species group, with either 4 or 5 species (see "Diagnosis"), exhibits weak morphological boundaries in the Atlantic coastal area of Brazil (Geise et al. 2001). *A. cursor* and *A. montensis* are morphologically similar and potentially sympatric. Classical morphological characters poorly delineate the species boundaries of these 2 taxa (Geise et al. 2001, 2005; Liascovich and Reig 1989; Silva and Yonenaga-Yassuda 1998) and even though the 2 species can be discriminated by size and craniodental measurements, such differentiation cannot be done in the field with living specimens (Geise et al. 2004, 2005). Consequently, the morphological similarity between 2 or more congeneric species in this group has reduced the utility of data provided during fieldwork without the preparation of voucher specimens. Furthermore, the usage of nonvalid synonyms has increased the number of papers with incorrect taxonomic identifications. Because no specimen with a diploid number of 14, 15, or 16 has been collected south of Paraná State in Brazil, but only individuals with a diploid number of 24 or 25 (the diploid number assigned to *A. montensis* by Liascovich and Reig [1989]), there seems little doubt that *A. cursor* does not occur in extreme southern Brazil or in either Argentina or Paraguay. Therefore, papers that do not confirm identifica-

Fig. 1.—Male *Akodon cursor* (Universidade Federal de Pernambuco 1739, field number PHA 648) adult, from Aldeia, Camaragibe Municipality, Pernambuco State, Brazil (7°57′49.5″S, 34°59′16.5″W). Photograph used with permission of the collector and photographer, Paulo H. Asfora.

tion by means of genetic tools are subject to misinformation due to specimen misidentification. All publications prior to 1989 or those that do not specify how specimens were identified to species level should be scrutinized carefully to avoid incorrect species assignment. Additional data on *A. cursor* can be gleaned from the literature, mainly for other topics not covered here; however, I have not included information from publications where there is a high likelihood of incorrect identification of species.

DIAGNOSIS

Akodon cursor (Fig. 1) is distinguished in samples of *Akodon* (*cursor* species group) from coastal Brazil by having a diploid number (2n) of 14, 15, or 16. There are 2 opinions of what comprises the *A. cursor* species group. One view supports *A. paranaensis* (Paraná akodont), *A. reigi* (Reig's akodont), *A. montensis* (montane akodont), and *A. cursor* (Gonçalves et al. 2007) and the other supports *A. mystax* (Caparaó akodont), *A. paranaensis*, *A. reigi*, *A. montensis*, *A. cursor*, and *A.* spp. aff. *cursor* (Smith and Patton 2007). Because the cytochrome-*b* sequence of *A. mystax* used by Smith and Patton (2007) in their analysis corresponds to samples collected by Geise et al. (2001) in Itatiaia, *A. mystax* included by Smith and Patton corresponds to *Akodon paranaensis* (2n = 44) from Gonçalves et al. (2007). To differentiate *A. cursor* from all other *Akodon* species karyological data have traditionally been used (Gonçalves et al. 2007; González et al. 1998). *A. cursor* also can be differentiated from all other species of *Akodon* by using a combination of molecular, cytogenetic, and morphological characters. Until recently, *A.* spp. aff. *cursor* was considered a different species (Geise et al. 2005; Smith and Patton 2007), but it is now described as a karyotypic variant of *A. cursor* (Fagundes and Nogueira 2007; Geise et al. 2001; Pereira 2006). When compared to *A. montensis*, *A. cursor* can be distinguished by having significantly larger values for all cranial measurements as well as different karyotypes and mitochondrial DNA (mtDNA) sequences (Fagundes et al. 1997; Geise et al. 1998, 2004, 2005), because using only traditional external morphological features does not permit an easy distinction. Sympatric occurrence is not frequent between *A. cursor* and *A. montensis*, the former occurring in the northern part of the state of Paraná up to Paraíba State, along the Atlantic Forest (see "Distribution"). However, some confusion occurred in the past, until the name *A. cursor* was applied to specimens with a diploid number of 14, 15, or 16 chromosomes. A specimen with 14 chromosomes was collected near the type locality of *A. cursor* (Rieger et al. 1995), leading subsequent authors to associate such a karyotype to this species (e.g., Fagundes and Nogueira 2007; Geise et al. 1998, 2001; Sbalqueiro and Nascimento 1996), contrary to *A. montensis*, with a diploid number of 24 or 25. In an analysis of 20 craniometric characters, the most useful in distinguishing *A. cursor* and *A. montensis* from each other was the length of the upper molar series, always >4.4 mm in *A. cursor* and <4.4 mm in *A. montensis* (Geise et al. 2005; Gonçalves et al. 2007). The presence of a gall bladder in *A. cursor* is another feature that allows correct identification, because it is absent in *A. montensis* (Geise et al. 2004). The low number of voucher specimens of *Akodon* sp. (2n = 10) does not allow a separation through measurements, but this species differs by having a completely different karyotype and it is not sympatric with *A. cursor*. *Akodon* sp. (2n = 10) is currently captured in areas of Cerrado (Silva and Yonenaga-Yassuda 1998), and in the Amazon (Floresta Nacional de Carajás, Pará State [Ardente 2012]).

Akodon cursor and *A. lindberghi* (Lindbergh's akodont) can be differentiated by their size; *A. lindberghi* is smaller in all cranial and standard external measurements, but both the length of the upper molar series (3.84 mm ± 0.13 *SD* in *A. lindberghi* and 4.48 ± 0.19 mm in *A. cursor*) and maximum skull length (23.79 ± 0.6 mm in *A. lindberghi* and 20.32 ± 1.35 mm in *A. cursor*) are the best parameters for distinguishing these 2 species (Gonçalves 2006). The karyotype of *A. lindberghi* is characterized by 2n = 42 (Geise et al. 1996). *A. mystax* also is smaller in all measurements in relation to *A. cursor* (Gonçalves et al. 2007). *A. paranaensis* and *A. reigi* are difficult to distinguished from one another, but easily differentiated from *A. cursor* by their darker pelage (uniform dark brown in both *A. paranaensis* and *A. reigi*) and being smaller in all measurements (Christoff et al. 2000). The anterodorsal border of the zygomatic plate is rounded in *A. cursor* and squared in *A. paranaensis* and *A. reigi* (Gonçalves 2006). All 3 species (*A. mystax*, *A. reigi*, and *A. paranaensis*) have the same 2n = 44 karyotype (Bonvicino et al. 1997; Christoff et al. 2000; González et al. 1998).

GENERAL CHARACTERS

Akodon cursor is a small-bodied rodent with a tail length that is always shorter than the head and body length (77.9% to 77.4% for males and females, respectively [Geise 1995]). The dorsal pelage is homogenous dark to golden brown; the lateral portions grade imperceptibly to paler tones; and the venter is grayish to yellowish with unicolored hairs, and with a small white area in the gular region in some specimens. Guard hairs are present; these are brown at their base, orange brown in midshaft, and dark brown distally. The underfur is dark gray. Also, completely black hairs that are slightly longer than the guard hairs are sparsely distributed across the dorsal and lateral areas of the body. The vibrissae are short, reaching only to the anterior portion of the ears. A weakly developed blackish orbital ring is present. The ears are covered with short hairs of the same dark to golden brown color of the dorsal pelage, although sometimes

Fig. 2.—Dorsal, ventral, and lateral views of skull and lateral view of mandible of an adult male *Akodon cursor* collected in Fazenda Intervales, Capão Bonito, São Paulo State, Brazil (24°20′S, 48°25′W), field number MAM 266, archived at the Museu de Zoologia da Universidade de São Paulo (MZUSP 29232). Condylobasal length is 30.5 mm. Photos made by Guilherme Garcia used with permission.

appearing paler due to their shorter length and more sparse distribution. The tail is unicolored. Some specimens have a creamy white spot on top of the head between the pinnae. The digits have short claws covered by sparse white hairs that extend beyond their tips (Geise 1995).

The skull (Fig. 2) is short and broad; the supraorbital region has rounded margins, not ledges; the neurocranium is teardrop in shape; the infraorbital notch is not visible from above; and the zygomatic arches are nearly parallel. The upper incisors are opisthodont. The incisive foramen has rounded lateral margins and extends occasionally to the anterior margin of M1. The posterior palate has depressions; the palatal bridge is short and narrow; the mesopterygoid fossa is narrow, extending to the posterior border of M3 and with either a rounded anterior margin or a small median projection. The foramen ovale is present, larger than the lacerate foramen; stapedial and sphenofrontal foramina and a squamosal groove are usually present. The zygomatic plate has a rounded anterior border that does not reach the maxillary; the jugal is small (Geise 1995).

Males are larger than females in most dimensions. Mean measurements (± *SD*, mm, *n* in parentheses) of 19 craniodental features for males and females, respectively, were: length of head and body, 120.40 ± 9.30 (212), 115.15 ± 10.02 (198); length of tail, 93.16 ± 11.11 (206), 89.70 ± 9.21 (196); length of ear, 18.71 ± 2.61 (170), 18.35 ± 2.20 (162); length of hind foot, without claws, 24.33 ± 2.24 (160), 23.85 ± 1.92 (159); length of hind foot, with claws, 26.73 ± 2.11 (191), 26.15 ± 2.04 (181); condyloincisive length, 28.10 ± 1.27 (254), 27.14 ± 1.19 (223); length of diastema, 8.20 ± 2.63 (263), 7.93 ± 0.40 (233); length of palatal bridge, 4.21 ± 0.00 (265), 4.14 ± 0.34 (230); length of upper molar toothrow, 4.49 ± 0.17 (266), 4.46 ± 0.18 (228); breadth across molars, 5.97 ± 0.31 (265), 5.89 ± 0.30 (230); height of skull, 8.65 ± 0.31 (267), 8.46 ± 0.28 (230); length of rostrum, 11.62 ± 0.60 (263), 11.32 ± 0.63 (224); width of rostrum, 5.57 ± 0.36 (265), 5.31 ± 0.33 (228); zygomatic breadth, 15.43 ± 0.73 (230), 14.92 ± 0.71 (192); length of auditory bulla, 4.790 ± 0.127 (257), 4.77 ± 0.29 (220); least interorbital width, 5.39 ± 0.19 (267), 5.29 ± 0.29 (230); breadth of braincase, 12.26 ± 0.44 (249), 11.99 ± 0.43 (221); height of mandible, 6.70 ± 0.41 (257), 6.53 ± 0.37 (213); length of mandible, 15.20 ± 0.75 (263), 14.78 ± 0.72 (224). These values were based on data previously published (Geise et al. 2005) plus additional, newly collected samples (collected by LG). Mass (g) for the same set of specimens, males and females, respectively, was: 54.20 ± 11.70 (201), 43.23 ± 10.57 ($n = 180$). Additional measurements for sexes combined are available in Percequillo et al. (2007); those same specimens were measured by the author (LG) and included in the data above.

Measurements (mean ± *SD*) taken by the author of 4 syntypes (Natural History Museum of Denmark, Copenhagen, numbers 6, 221, 222, and 237) were: condyloincisive length, 29.64 ± 0.40 mm; upper molar series, 4.51 ± 0.07 mm; least interorbital breadth, 5.01 ± 0.11 mm. An analysis of the previously described craniodental measurements taken by the author from 590 specimens revealed pervasive geographic variation, with Mahalanobis distances among samples ranging from 2.2 to 50. Size and shape differentiation patterns among localities were similar. Morphological differentiation was independent of geographic distribution and genetic (DNA or chromosomal) distances.

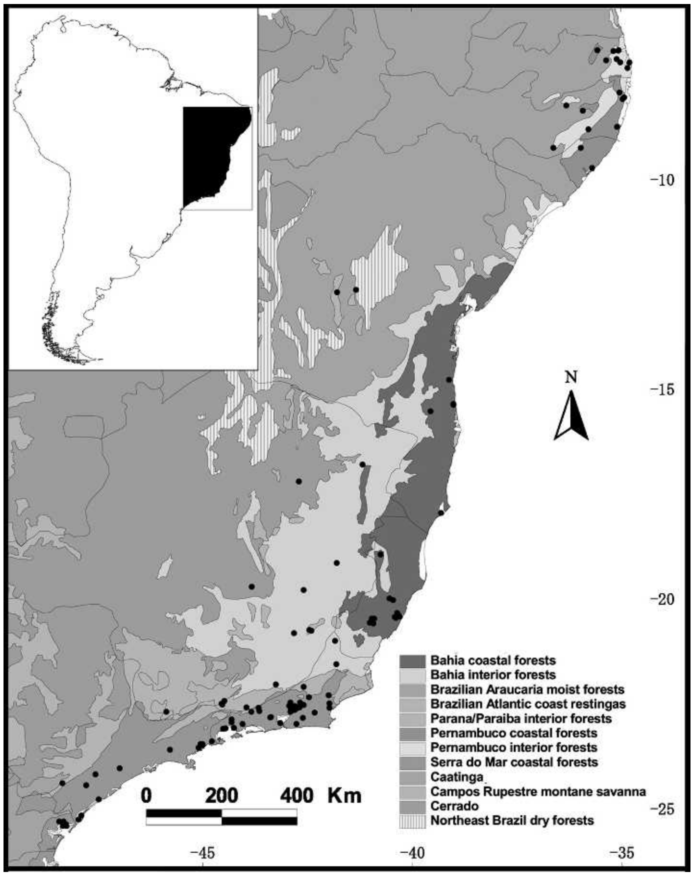

Fig. 3.—Geographic distribution of *Akodon cursor* (International Union for Conservation of Nature and Natural Resources 2008; Reis et al. 2006). Dots correspond to collecting sites made by LG or collaborators.

DISTRIBUTION

Akodon cursor occurs mainly in the Atlantic Forest of eastern Brazil, from the states of Paraíba in the north to Paraná in the south (Fig. 3), a span of about 18.5° in latitude. Localities range from sea level to 1,170 m. Based on the ecoregions defined by Dinerstein et al. (1995), this species occurs primarily in Bahia coastal forest, Bahia interior forest, and Serra do Mar coastal forest, but it also extends into the isolated mesic forests in the Caatinga (Brejos Nordestinos, sensu Ribeiro et al. [2009]) in Pernambuco State and in the vegetation type collectively called Restinga (or Coastal Shrubland), which characterizes the sand barrier beaches and plains along the coastal Atlantic Forest (Cerqueira et al. 1993). Pereira and Geise (2007) recorded the species in the Chapada Diamantina (Bahia State, 11°–14°S, 41°–43°W), a part of the Serra do Espinhaço, some 300 km inland from the Atlantic Ocean (Parrini et al. 1999), an area surrounded by the semiarid vegetation of the Caatinga and Cerrado. There, isolated forest remnants are related to those of the Atlantic Forest (Câmara 2003). Parts of the distribution mapped by Eisenberg and Redford (1999) and described by Musser and Carleton (2005) for *A. cursor* incorrectly include specimens and localities of *A. montensis*. The distribution as described herein corresponds only to localities where identifications have been confirmed by chromosomal or molecular data. This distribution agrees with that provided by Reis et al. (2006) and the *International Union for Conservation of Nature and Natural Resources Red List of Threatened Species* (International Union for Conservation of Nature and Natural Resources 2008). Pardiñas et al. (2003) cited the occurrence of 3 specimens from Argentina that they recorded as *Akodon* cf. *A. cursor*, identified in part by the presence of a gall bladder. Because these specimens lack genetic and morphometric data to confirm their identification, it is unclear at the present if *A. cursor* extends beyond the southern border of Brazil.

According to Reig (1987), a fossil record from the Pleistocene of Buenos Aires was referred to as *A. cursor*, which was a misidentification, because those specimens are *A. montensis* (Pardiñas 1995, 1999).

FORM AND FUNCTION

Form.—The baculum is longer than the glans (based on 5 individuals examined by LG); the proximal baculum is narrow, with the proximal face slightly curved toward the ventral part of the penis; base is rounded with a discrete bifurcation. On the ventral face, the baculum is slightly concave, the angle more acute in transition between the proximal and ventral faces. The apex of the baculum is little pronounced. The cartilaginous baculum has 3 well-developed digits, the middle one longer and ventrally curved.

Presence of the gall bladder is variable among sigmodontine rodents and its distribution is phylogenetically informative (Voss 1991). Within the tribe Akodontini the gall bladder was lost independently in 2 lineages, including the genus *Akodon*. A gall bladder was present, however, in all 132 individuals of *A. cursor* examined by Geise et al. (2004). These findings are at odds to those of Voss (1991), who reported a lack of gall bladder in specimens of *A. cursor*. This discrepancy is most likely due to the complex taxonomic history of *A. cursor* and *A. montensis*, as described in the "Nomenclatural Notes." The individuals reported by Voss (1991) as *A. cursor* were collected in Paraguay and the lack of genetic and morphometric identification makes precise identification difficult. As indicated in the "Distribution" section, the presence of *A. cursor* in that region is not confirmed. On the other hand, *A. montensis* is distributed in an area extending from Rio de Janeiro State in Brazil to Uruguay (Ximénez and Langguth 1970), the province of Misiones in Argentina (Massoia and Fornes 1965), and Paraguay (Pardiñas et al. 2003). This evidence indicates that specimens of *Akodon* without a gall bladder reported by Voss

(1991) actually belong to *A. montensis*, in agreement with the findings of Geise et al. (2004).

The stomach of 1 male (UFPE 1739, collection of the Federal University of Pernambuco) corresponds to the unilocular hemiglandular type defined by Carleton (1973).

Function.—Cerqueira et al. (2003) studied laboratory populations of *Akodon cursor* derived from 2 different microhabitats in the Restinga da Barra de Maracá (Rio de Janeiro State) in an effort to determine nutritional and water requirements. These 2 samples differed in their preferred food, with the population derived from Restinga scrub vegetation feeding primarily on arthropods, roots, fruits, and seeds and the population from marsh vegetation preferring roots and fruits. The relative consumption of proteins and lipids between these samples varied significantly (protein: $U = 6.0$, $P = 0.04$; lipids: $U = 4.0$, $P = 0.02$). Contrary to food requirements, no difference was observed in sodium or potassium excretion, suggesting that urine concentration capacity was the same.

ONTOGENY AND REPRODUCTION

Reproduction.—Based on several long-term studies, each done in a different area, *Akodon cursor* reproduces year-round, with females sexually active in all months studied although with birthing concentrated in the dry season (June–September). At Poço das Antas Biological Reserve (Rio de Janeiro State), Feliciano et al. (2002) captured females in reproductive condition in all but 3 months (April, June, and September) of a yearlong study. Juveniles were recorded in all months except March, with the highest frequency in the middle dry season and late wet season. On Ilha do Cardoso (coast of São Paulo State), Bergallo and Magnusson (1999) recorded sexually active females in all months without any pattern over a 2-year period, although a slight decrease in sexual activity occurred between June and August. Males at this site had their largest testis size in September and October as well as during the rainy season, but testis size per se was not related to pregnancy rates ($P = 0.998$). Bergallo and Magnusson (1999) found few juveniles ($n = 3$) and subadults ($n = 6$) with a peak in adult capture frequency during the dry season both years. At Sumidouro (Rio de Janeiro State), D'Andrea et al. (2007) captured pregnant females and juveniles in the dry season, indicating birth periods at the end of the wet season and during the dry season. Cerqueira et al. (1993), Gentile et al. (2000), and Olmos (1991) found similar results. Litter size in 2 studies ranged from 2 to 4 (D'Andrea et al. 2007) and from 2 to 9 ($\bar{X} = 5.6$—Mello and Mathias 1987). Gestation length was 23 days (Mello and Mathias 1987).

De Couto (2007) studied reproductive biology in a captive colony of *A. cursor* originally established by individuals from 6 separate localities from southeastern Brazil. In captivity, the gestation period was similar to that found in the wild (Mello and Mathias 1987), with a mode of 23 days, and without differences between lactating females (i.e., nursing a previous litter) and nonlactating females. A postpartum estrus occurred within 5 days following birth. No seasonality in reproductive activity was observed, but this could be an artifact of the constancy of the laboratory conditions. Mean litter size ($\pm$ *SD*) was 4.64 $\pm$ 1 young ($n = 398$); sex ratio at birth was equal. Mean mass ($\pm$ *SD*) at birth for males was 3.95 $\pm$ 0.456 g ($n = 292$) and for females was 3.88 $\pm$ 0.40 g ($n = 261$). Aulchenko et al. (2002) found similar mean litter size of 4.2 $\pm$ 1.6 young in another laboratory colony.

ECOLOGY

Population characteristics.—Long-term studies at a variety of sites within the range of *Akodon cursor* consistently show that this species is always one of the most common members of the small mammal assemblage. In the Serra de Órgãos (Rio de Janeiro State), *A. cursor* was the most abundant of the 15 species of small mammals (8 marsupials and 7 rodents) collected by Prevedello et al. (2008). In a secondary forest fragment at Viçosa (Minas Gerais State), *A. cursor* was usually the most abundant of all small mammal species, with a high recapture rate (Lessa et al. 1999). Finally, D'Andrea et al. (2007) obtained similar results at Sumidouro (Rio de Janeiro State), where *A. cursor* was the 2nd most abundant species, with numbers increasing during the winter months and adults of both sexes captured throughout the year and at a similar sex ratio.

Population size in forest fragments at Poço das Antas Biological Reserve (Rio de Janeiro State) increased significantly following fire, with an mean ($\pm$ *SD*) of 30.4 $\pm$ 15.2 individuals/ha in comparison to 7.8 $\pm$ 4.2 individuals/ha prior to the fire. Feliciano et al. (2002) and Figueiredo and Fernandez (2004) attributed this shift both to increased immigration from the grassland matrix surrounding the forest patch as well as to increased reproduction. The insectivorous diet of *A. cursor* also may contribute to its success in fragments after fires, because conflagrations tend to enhance the abundance of leaf-litter invertebrates (Figueiredo and Fernandez 2004). In this reserve, survival rates of *A. cursor* did not vary much throughout the year, and recruitment rates peaked at early and middle dry season (May and August, respectively), with adult individuals the most frequent recruits (48.5%). Feliciano et al. (2002) found that population size peaked at the transition between dry and wet seasons (August) and was usually higher in the wet season, with survival rates correlated to monthly rainfall ($P < 0.05$). In a 20-month study, Pires et al. (2002) found *A. cursor* to be one of the most common species, both in forest fragments and in open grasslands, including 8 fragments in this same area. According to Pardini (2004), unlike the other sites, *A. cursor* was not the most frequently captured small mammal at Una, in Bahia State.

Space use.—Based on detailed habitat studies, *Akodon cursor* also occurs in small forest fragments composed of Campo Antrópico, Capoeira, and Floresta Nativa Secundária (Lessa et al. 1999), but also can be found in grasslands and young second-growth areas, mainly at sites with increased leaf litter and dense herbaceous cover (Gentile and Fernandez 1999). Individuals are strictly terrestrial, based on both a decade-long study of vertical habitat use by small mammals (Prevedello et al. 2008) and a shorter, 2-year study (Pardini 2004) in Bahia State.

Eight fragments analyzed in the Poço das Antas Biological Reserve (Pires et al. 2002) showed that these fragments were composed primarily of palms (*Astrocaryum aculeatissimum* and *Attalea humilis*) with a dense understory along the edges rich in secondary species, such as *Vanillomospis erythropappa*, *Clidemia neglecta*, vines, bracken (*Pteridium aquilinum*), and some pioneer trees (e.g., *Trema micrantha*). Grasslands surrounded forest fragments. The longest distance from one fragment to another was 675 m, the shortest 335 m. Females moved among fragments less frequently than did males and were always captured in the same fragments; this result is consistent with similar observations described by Gentile and Cerqueira (1995).

Pardini (2004) described the habitat used by *A. cursor* at Una (southern Bahia State), where the landscape is composed of 49% mature forest within a heterogeneous matrix of open areas (pastures = 27%), secondary forest (15%), shaded cocoa plantation (6%), and rubber tree plantation (2%). The climate is hot and wet with no dry season. Small mammals were trapped over a 20-month period. At this site *A. cursor* was common at fragment edges and was seldom caught in the interior of mature forest. This observation is consistent with the observations of Vieira (1999) and Pires et al. (2002), both of whom connected *A. cursor* to occupancy of disturbed habitats within the lowland Atlantic Forest.

In the Restinga of Barra de Maricá (Rio de Janeiro State), *A. cursor* was documented in a 30-m-wide band of marginal vegetation close to a lagoon. The dominate vegetation was *Typha domingensis* and together with 18 other plant species, forms an herbaceous bushy stratum less than 1 m in height; soil is covered by grasses. In the main portion of the Restinga formation, *A. cursor* was found in a scrub community composed of species of Myrmetacea, Erythroxylaceae, Bromeliaceae, Cactaceae, Apocynaceae, and Anacardiacea, with a canopy up to 6 m. Individuals of *A. cursor* show high movement frequency (from 0 to 30 m). Mean ($\pm$ *SD*) residency of individuals was 4.55 $\pm$ 2.10 months (n = 36—Gentile and Cerqueira 1995). Individual home ranges spanned 0.12–0.68 ha with an overall mean ($\pm$ *SD*) of 0.28 $\pm$ 0.14 ha ($n = 24$). Home-range size also did not correlate with population density and did not vary with season; in a sample of 10 males and 10 females, the mean ($\pm$ *SD*) home-range size for males (0.37 $\pm$ 0.15 ha) was significantly larger than that of females (0.19 $\pm$ 0.07 ha—Gentile et al. 1997). Fernandez (1989) found similar home-range sizes at the same study site.

Diet.—Fonseca and Kieruff (1989) and Stallings (1989) classified *Akodon cursor* as an insectivore–omnivore, but did not provide detailed dietary analyses. Carvalho et al. (1999), however, examined diet composition at Poço das Antas, where food intake was primarily leaf-litter arthropods, with Hymenoptera (68.4%) the most frequent order found in fecal samples, followed by Arachnida (36.8%), Coleoptera (42.1%), Lepidoptera (15.8%), Hemiptera (21.1%), Diptera (5.3%), and Isoptera (15.8%). *Cecropia* seeds and other nonidentified seeds were found in 11.1% and 88.9%, respectively, of fecal samples. Feliciano et al. (2002) related higher population sizes in the rainy season to diet preferences for insects and other invertebrates, both of which are more available during that period of the year.

Diseases and parasites.—Endoparasites infecting *Akodon cursor* in the abdominal cavity included *Litomosoides chagasfilhoi* and *L. silvai* (Nematoda: Filarioidea—Neto and Souza 1997; Padilha and Faria 1977). Moraes et al. (2003) and Carvalho et al. (2001) recorded the ectoparasitic fleas *Adorapsylla antiquorum*, *Craneopsylla minerva*, *Polygenis atopus*, *P. dentei*, *P. pradoi*, and *P. rimatus* (Insecta: Siphonaptera) on *A. cursor*.

Interspecific interactions.—The Brazilian Atlantic Forest has a rich small mammal fauna, and *Akodon cursor* has been found sympatric (Bonvicino et al. 2002; Cerqueira et al. 1993; Feliciano et al. 2002; Geise 1995; Geise et al. 1996; Geise and Pereira 2008; Gentile et al. 2000; Lessa et al. 1999; Olifiers et al. 2007; Pereira and Geise 2007; Pereira et al. 2001, 2008; Pinheiro and Geise 2008) with a number of other sigmodontine rodents (*Abrawayaomys ruschii* [Ruschi's rat], *A. lindberghi*, *A. montensis*, *Cerradomys subflavus* [flavescent oryzomys], *Euryoryzomys russatus* [russet oryzomys], *Hylaeamys laticeps* [Atlantic Forest oryzomys], *Juliomys pictipes* [Contreras's juliomys], *J. rimofrons* [cleft-headed Juliomys], *Necromys lasiurus* [hairy-tailed akodont], *Nectomys squamipes* [Atlantic Forest nectomys or rato-d'água], *Oecomys catherinae* [Atlantic Forest oecomys], *Oligoryzomys fornesi* [Fornes's colilargo], *O. nigripes* [black-footed colilargo], *Oxymycterus dasytrichus* [Atlantic Forest hocicudo], *Rhagomys rufescens* [rufescent rhagomys], and *Rhipidomys itoan*), echimyid rodents (*Euryzygomatomys spinosus* [guiara], *Phyllomys nigrispinus* [blacked-spined Atlantic tree-rat], *P. pattoni* [rusty-sided Atlantic tree-rat], *Thrichomys inermis* [highlands punaré], *Trinomys dimidiatus* [soft-spined Atlantic spiny-rat], *T. iheringi* [Ihering's Atlantic spiny-rat], and *T. setosus elegans* [hairy Atlantic spiny-rat]), and squirrels (*Guerlinguetus aestuans* [caxingelê]), as well as didelphid marsupials (*Caluromys philander* [bare-tailed woolly opossum or cuíca-lanosa], *Gracilinanus microtarsus* [Brazilian gracile opossum or guaiquica], *Didelphis aurita* [big-eared opossum or gambá], *D. albiventris* [white-eared opossum or saruê], *Marmosa murina* [Linnaeus's mouse opossum], *Marmosops incanus* [gray slender opossum], *Metachirus nudicaudatus* [brown four-eyed opossum or jupati], *Micoureus paraguayanus* [Tate's woolly mouse opossum], *Monodelphis americana* [northern three-striped opossum or cuíca-de-três-listras], *M. domestica* [gray short-tailed opossum or catita], and *Philander frenatus* [gray four-eyed opossum or cuíca-de-quatro-olhos]).

Miscellaneous.—Cell fusion and karyotypic analyses from specimens kept in captivity document the capability of *Akodon cursor* as a model for constructing hybrid panels for the unambiguous identification of human chromosomes in hybrid cells (Bonvicino et al. 2001). This capability is important in the identification of human *HPRT1* mutation responsible for Lesch–Nyhan syndrome (Rivero et al. 2001).

HUSBANDRY

Akodon cursor adapts readily to laboratory conditions, with long-standing colonies maintained at 2 Brazilian research institutions (Laboratório de Ecologia de Vertebrados, Ecology Department, Institute of Biology, Federal University of Rio de Janeiro, and Laboratório de Biologia e Parasitologia de Mamíferos Silvestres Reservatórios, Instituto Oswaldo Cruz, Fundação Oswaldo Cruz). De Couto (2007) described husbandry conditions as follows: individual animals are kept in polypropylene cages measuring 30 by 20 by 13 cm. Breeding males and females are maintained in larger cages (41 by 34 by 17 cm). Cages are lined with wood shavings or vermiculite with shredded paper provided as potential nesting material. Cages are washed and disinfected once a week with a 1% potassium permanganate solution and insecticide. Water bottles are autoclaved weekly. Air is sprayed daily with a 1% sodium hypochlorite solution. Animal rooms are maintained at an air temperature between 22°C and 26°C with humidity between 60% and 80% and a natural daylight cycle is employed.

BEHAVIOR

Akodon cursor is a docile species in the laboratory with individuals easy to handle. Pregnant females build globular nests in captivity and rarely abandon their litters. Aggressive behavior has been observed between mated pairs and between males and their young. Consequently, for captive maintenance De Couto (2007) suggested that mated individuals should be separated after birth of their litter.

GENETICS

Cytogenetics.—*Akodon cursor* is polymorphic in diploid (2n) and number of autosomal arms (AN) number, both within and among populations. Diploid number varies from 14 to 16 with AN ranging from 18 to 25 (Fagundes et al. 1997, 1998; Geise et al. 1998; data gathered by LG). This karyotypic variation results from pericentric inversions in chromosomes 2, 4, and 6; centric fusion with pericentric inversion in chromosomes 1 and 3; trisomy of chromosome 7; and the presence of XO females. In specimens with 2n = 14, the 1st pair is composed of 2 large metacentrics; those with 2n = 15 have 1 large metacentric and 2 different submetacentrics (each of which corresponds to 1 arm of the large metacentric), and specimens with 2n = 16 have 2 submetacentric pairs (Fagundes et al. 1997). For simplicity, the author considered each of the 3 diploid numbers to have autosomal pairs as 2, 3, 4, 5, and 6. Alternatively, Fagundes et al. (1997) gave pair 1 for 2n = 14, "pair 1" for 2n = 15, and pairs 1a and 1b for both submetacentrics. Pairs 2, 3, and 5 are heteromorphic and polymorphic, with a different combination of acrocentric and metacentric–submetacentric chromosomes. Pair 4 is always a medium-sized metacentric and pair 6 is always a very small metacentric. Both X and Y chromosomes are acrocentric, the X being a small element in comparison with the other chromosomes and the Y a very small element (Fagundes et al. 1997, 1998; Geise et al. 1998).

The 2n = 14 karyotype is most common (64.7%), followed by 2n = 15 (21.5%) and 2n = 16 (13.8%), among 442 individuals examined (Geise et al. 2007). The most common karyomorph combination is 2n = 14 with AN = 18 and 2n = 14 with AN = 19. Frequencies of rearrangements are in Hardy–Weinberg equilibrium at each locality where samples sizes are adequate. Although karyomorph frequencies vary among localities there is no apparent geographic structuring; localities with similar frequencies of karyomorphs do not cluster (Geise et al. 1998; Pereira 2006). In Rio de Janeiro and Espírito Santo states only the 2n = 14 and 2n = 15 karyotypes occur. In the northeastern part of the species range, only the 2n = 16 form has been found. In contrast, the frequency of each karyotype was equivalent in samples from São Paulo, Minas Gerais, and Paraná states (Souza et al. 2004).

Molecular genetics.—Rieger et al. (1995) reported that the 2n = 14 and 2n = 16 karyomorphs shared the same set of allozyme alleles, with a Nei distance between them of only 0.022. The allozyme tree, when combined with chromosome numbers, indicated monotypy of each karyomorph. Polymerase chain reaction–restriction fragment length polymorphism analysis of the mitochondrial cytochrome-*b* gene indicated a phylogeographic break in the species' range, with samples from Pernambuco and Bahia states clustering separately from those from Espírito Santo and São Paulo states (Fagundes and Nogueira 2007).

Geise et al. (2001) evaluated the phylogeographic structure of *Akodon cursor* based on the mtDNA cytochrome-*b* gene, with most specimens identified by karyotype. Christoff (1997), Fagundes (1997), and Fagundes et al. (1997, 1998) assigned individuals with 2n = 14–16 to *A.*

cursor, whereas Geise (1995), Geise et al. (1998, 2001, 2004), and Rieger et al. (1995) restricted *A cursor* to the 2n = 14 karyomorph and used *A.* aff. *cursor* to refer to the 2n = 15 and 2n = 16 specimens. Geise et al. (2001) found that haplotypes from the 2n = 14 karyomorph were reciprocally monophyletic relative to 3 sequences from 2n = 16 individuals. However, Geise et al. (2007) and Pereira (2006), with a larger data set that included all 3 karyomorphs, came to a different conclusion using the same cytochrome-*b* gene sequence. These authors identified 45 haplotypes that fell into 2 geographic groups; one included mainly samples north of the Rio Jequitinhonha in Paraíba, Bahia, and Minas Gerais states, and the other included all southern samples from São Paulo, Rio de Janeiro, Espírito Santo, Minas Gerais, and Bahia states. The 2 groups differed by an average molecular distance (Kimura 2-parameter) of 3.6%. The mean distance between individuals with 2n = 14 and 2n = 15XO to 2n = 16 was 3.3%. Greater genetic divergence was recorded among isolated populations, such as that from the Chapada Diamantina, relative to the Atlantic coast rather than between the different karyomorphs. Furthermore, the occurrence of the same haplotype in individuals with different diploid numbers, especially those with either 2n = 14 and 2n = 16, indicate that these 2 karyomorphs belong to the same species. Hence, the name combination *A.* aff. *cursor*, used in earlier literature to refer to the 2n = 15–16 karyotype, is inappropriate. Rather, *A. cursor* is a single, valid species, one that exhibits a remarkable degree of both cytological and molecular polymorphism.

Population genetics.—Individuals from 12 Atlantic Forest fragments and a continuous forest area close to Rio de Janeiro City were analyzed in regard to genetic population analysis through microsatellite data (Cunha 2005). Populations exhibited high levels of variation, with no differentiation between fragments and the main forest, almost all loci being in Hardy–Weinberg equilibrium. Population structure indicates that there is no isolation by distance, suggesting that the fragmentation of the Atlantic Forest is not a barrier for dispersal of *Akodon cursor* (Cunha 2005), or time of fragmentation is too recent.

CONSERVATION

Akodon cursor does not appear to be under any threat, and the *International Union for Conservation of Nature and Natural Resources Red List of Threatened Species* (International Union for Conservation of Nature and Natural Resources 2008) regards it as a species of "Least Concern." *A. cursor* has been collected regularly in the Atlantic Forest region of Brazil and has routinely been considered among the most abundant sigmodontine rodents of this large area (Feliciano et al. 2002; Pardini 2004; Rieger et al. 1995). The species is tolerant of human disturbance given that it is trapped in areas containing plantations and close to tourist trails in Parque Nacional da Serra dos Órgãos, and found more frequent at fragment edges compared to interiors of mature forest (Bonvicino et al. 2002; Olifiers et al. 2007; Pardini 2004; Pires et al. 2002; Vieira 1999).

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