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Short Communication

Chromosome study of Anteaters (Myrmecophagideae, Xenarthra) - A preliminary report

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Abstract

Anteaters belong to the Order Xenarthra / Family Myrmecophagidae and are the only members without teeth. There are three genera with four living species in the family Myrmecophagidae: *Myrmecophaga tridactyla* (giant anteater), *Tamandua tetradactyla* (southern lesser anteater), *Tamandua mexicana* (northern lesser anteater), and *Cyclopes didactylus* (silky anteater). The karyotypes of *M. tridactyla* (2n = 60), *T. tetradactyla* (2n = 54) and *C. didactylus* (2n = 64) have already been described. In the present paper, three female and two male specimens of giant anteater and one lesser anteater male were analyzed. The results indicate the existence of a new karyotype in the genus *Tamandua*, with 2n = 56 chromosomes, which can represent a new lesser anteater species. The karyotype of *M. tridactyla* was also described, supporting previous reports.

Key words: Anteater, chromosomes, Myrmecophagidae.

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Introduction

The Order Xenarthra comprises three living groups: anteaters, armadillos and tree sloths. These animals are found from the south-central and southeastern United States to southern South America (Nowak, 1999; Wetzel, 1985). This order is composed of thirty living species, divided into four families: Dasypodidae (armadillos), Myrmecophagidae (anteaters), Bradypodidae (three-toed sloths), and Megalonychidae (two-toed sloths) (Wetzel, 1985). The species *Priodontes maximus* (giant armadillo), *Tolypeutes tricinctus* (Brazilian three-banded armadillo), *Bradypus torquatus* (collared sloth) and *Myrmecophaga tridactyla* (giant anteater) are classified as vulnerable by the IUCN (International Union for Conservation of Nature). Collared sloths and the Brazilian three-banded armadillo are endemic in Brazil. A high degree of anatomical and physiological modifications for feeding purposes is found in the family Myrmecophagidae: the muzzle is tubular, strait and long, ending with a small mouth about 20 mm in diameter, and most of the facial musculature is reduced (Naples, 1999). A viscous and adherent mucus is produced in the elongated sticky tongue, which helps to capture ants and termites (Naples, 1999).

Most xenarthrans have a karyotypic constitution that varies from 2n = 48 to 2n = 65 chromosomes, except for *Tolypeutes matacus*, with 2n = 38 chromosomes (Jorge *et al*., 1977). Of the thirty species known to date, only nineteen had their karyotypes described or reported. The karyotypes of the family Myrmecophagidae vary between 2n = 54 and 2n = 64. A remarkable difference in karyotypes exists between *Cyclopes didactylus* (2n = 64) and other species of the family Myrmecophagidae (Jorge *et al*., 1985a). A mechanism of reversible fusion/fission and reciprocal translocation was proposed by Jorge *et al*. (1985b) to explain the reduction in chromosome number from 64 to 54 in *Tamandua* and *Myrmecophaga*, respectively. The karyotype of *Tamandua tetradactyla* was described by Hsu (1965), although illustrations of the chromosomes were not available. The G-banded karyotype was described by Jorge *et al*. (1977). According to Hsu (1965), although their chromosomes are very similar, these two species have phenotypic differences, especially regarding the body size and weight of *T. longicaudata*, which are greater than those of *T. tetradactyla*. However, Wetzel (1975, 1985) described a distribution of *Tamandua* species displaying several variations in coat colors from southern Mexico to

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northern Argentina and Uruguay. Wetzel (1975) considered the genus *Tamandua* as comprising two species, *T. tetradactyla* (the black-vested form) and *T. longicaudata* (Wagner) (lacking a complete vest), or only one species: *T. tetradactyla*, subdivided into three subspecies: the nonvested or partially vested *T. tetradactyla longicaudata*, and the melanistic forms *T. tetradactyla nigra* (Geoffroy), and *T. tetradactyla quichua* (Thomas). Moreover, Wetzel (1985) considered that there were four species in the family Myrmecophagidae: *Cyclopes didactylus*, *Myrmecophaga tridactyla*, *Tamandua mexicana*, and *Tamandua tetradactyla*.

The purpose of this study was to describe the karyotype of a lesser anteater species and of five specimens of giant anteaters, all from southeastern Brazil. The reduction in chromosome number of Myrmecophagidae is also discussed.

Material and Methods

In the present work, three female and two male specimens of *Myrmecophaga tridactyla* (giant anteater) and one male of the genus *Tamandua* (lesser anteater) were studied. The animals belonged to the Zoological Garden of Belo Horizonte, Minas Gerais, Brazil. Two female and one male giant anteaters were born in the Zoo. The lesser anteater was found in the coastal region of the Atlantic Rainforest in São Paulo State, Brazil. From each animal 10 mL of whole blood were collected, using heparin. Leukocyte cultures were prepared from whole blood, using phytohemagglutinin as a stimulant for cell division, incubated at 37 °C for 72 h, followed by colchicine or colcemid and hypotonic treatment.

Results and Discussion

The cytogenetic analysis of the animals studied showed the following karyotypic constitutions: 2n = 56 with a new karyotype in one specimen of the genus *Tamandua* (Figure 1 and Table 1), and 2n = 60 chromosomes in *M. tridactyla* ,as reported by Hsu (1965) (Figure 2 and Table 1). Distinct karyotypic patterns are established in this paper for the family Myrmecophagidae: *Tamandua tetradactyla* (southern lesser anteater), with 2n = 54 chromosomes (Hsu, 1965; Hsu and Benirschke, 1969; Jorge *et al*., 1977), has the smallest number of chromosomes in the family Myrmecophagidae. Until 1975, the species *T. tetradactyla* was separated into two species: *T. tetradactyla* (Linné, 1758, in Wetzel, 1975) and *T. longicaudata* (Wagner, 1844, in Wetzel, 1975). Wetzel (1975) analyzed morphological characters such as cranial structure and showed that both species could be considered as a single one, denominated *T. tetradactyla*.

Hsu (1965) described the karyotype of *T. tetradactyla* (from Mexico), and Jorge *et al*. (1977) described the karyotype of *T. longicaudata* (from Colombia), both with

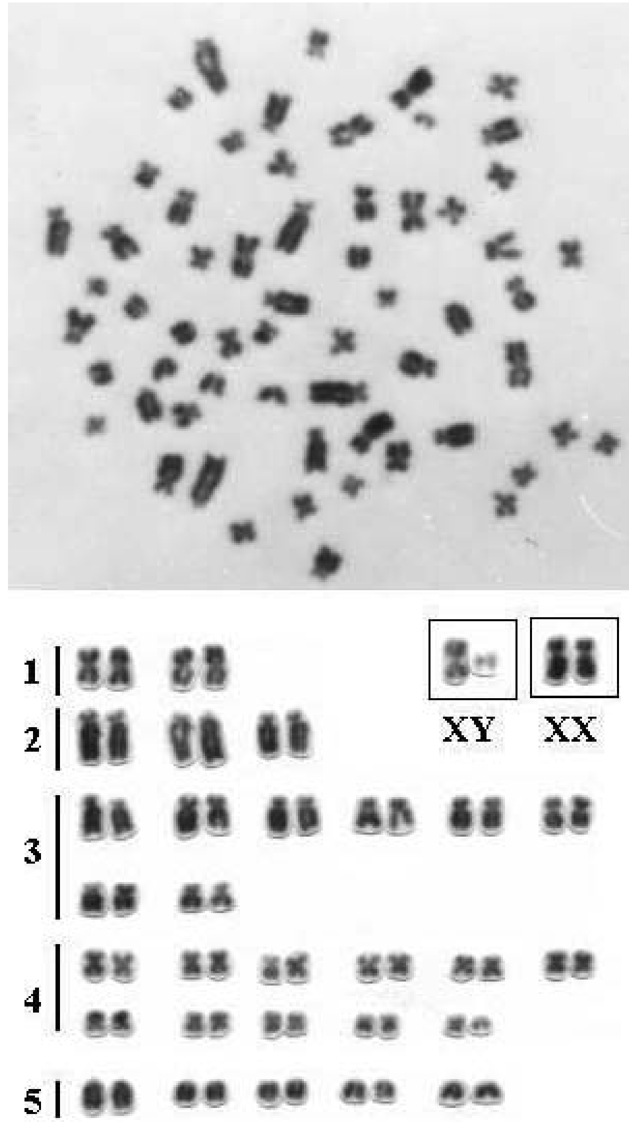

Figure 1 - Karyotype of *Tamandua sp*. with 2n = 56 chromosomes. The X chromosome is a large metacentric, and the Y chromosome is a small acrocentric.

2n = 54 chromosomes. The results of these chromosome analyses corroborate the results of geographical distribution studies, weight and size, as well as of other data on body morphology obtained by Wetzel (1975). The karyotype of the genus *Tamandua* does not exhibit acrocentric chromosomes, except for the Y chromosome. *T. tetradactyla* has four pairs of large metacentric chromosomes, while *Tamandua sp*. has three pairs in group I (Figure 1 and Table 2). Group II is composed of three pairs of large submetacentric chromosomes that are constant for both species. Group III exhibits seven pairs of medium-sized submetacentrics in *T. tetradactyla* and nine submetacentrics in *Tamandua sp*. Group IV is formed by twelve pairs of metacentrics, from medium to small in size. The X chromosome is a large metacentric, with a size

Table 1 - Chromosome constitution of the anteaters analyzed in this study, according to diploid number, number of pairs per group and chromosome morphology.

Species / Diploid number	Group	Number of pairs	Chromosome morphology
Tamandua 2n = 56	I	03	large metacentrric
	II	03	large submetacentric
	III	09	medium submetacentric
	IV	12	medium to small metacentric
	Sex	X	large metacentric
	Sex	Y	small acrocentric
Myrmecophaga tridactyla 2n = 60	I	02	large metacentric
	II	03	large submetacentric
	II	08	medium submetacentric
	IV	11	medium to small metacentric
	V	05	Acrocentric
	Sex	X	large metacentric
	Sex	Y	small acrocentric

equivalent to the third pair of autosomes in both species. The Y chromosome is a small acrocentric. The difference between both species is basically the number of chromosomes in groups I and III. This difference may be explained by the fusion process: two pairs of group III of the species with 2n = 56 would originate the extra pair in group I of the species with 2n = 54, as well as an additional structural chromosome rearrangement. In the species with 2n = 56, most autosomes are small-sized metacentrics, probably arisen from the fusion of acrocentrics, which are also found in other genera of this family. The presence of a fourth metacentric pair (2n = 54) can be explained by the fusion of two pairs of submetacentrics present in the karyotype with 2n = 56, followed by a loss of chromosome material.

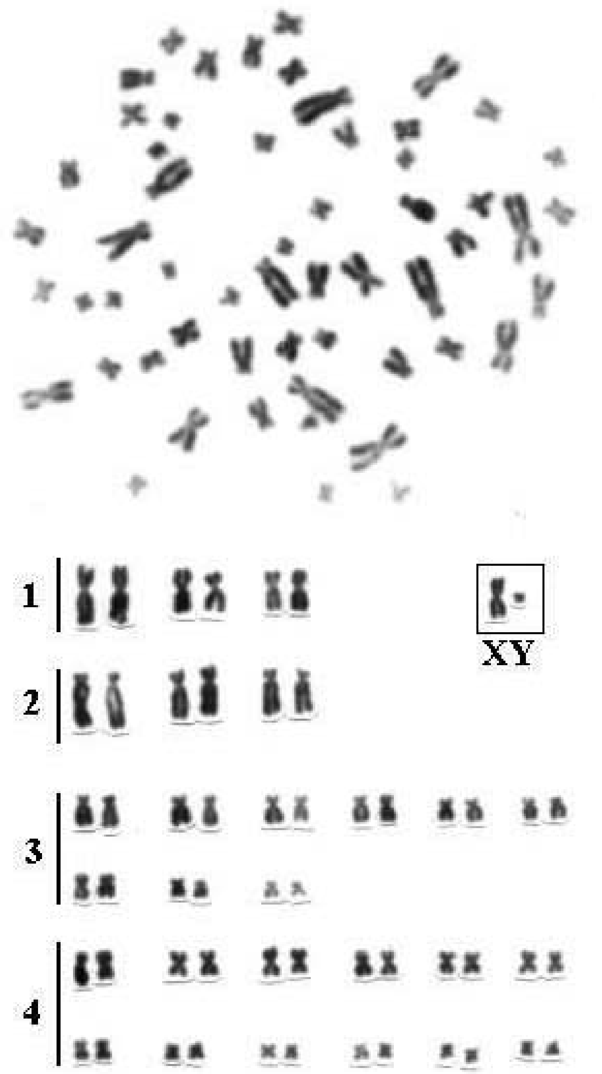

Figure 2 - Karyotype of *Myrmecophaga tridactyla* with 2n = 60 chromosomes showing the X and Y chromosome morphology. The two X chromosomes of a female are exhibited in the karyotype.

Table 2 - Karyotypes of anteater species, according to Wetzel (1985) and Nowak (1999).

Species	Collection sites	Sex	2n	X	Y	References
Tamandua tetradactyla	Philadephia Zoo, U.S.A.	M	54	third pair	Small submetacentric	Hsu and Benirschke (1969)
	Colombia	F	54	submetacentric	Unknown	Jorge *et al*. (1977)
	Chiapas, México	F	54	unknown	Unknown	Hsu (1965)
Cyclopes didactylus	Japurá River, Amazonas State, Brazil	F	64	unknown	Unknown	Jorge *et al*. (1985a)
	Manaus, Amazonas State, Brazil	M	64	third pair submetacentric	Smallest chromosome	Jorge (2000)
	Manaus, Amazonas State, Brazil	F	64			
Myrmecophaga tridactyla	Herman Park Zoo	F	60	unknown	Unknown	Hsu (1965)
	Fundação Zoobotânica / MG	F	60	third pair metacentric	Acrocentric	Present paper
		M	60			
Tamandua sp.	Atlantic Rainforest – São Paulo State, Brazil	M	56	third pair metacentric	Acrocentric	Present paper

In the present work, the existence of a new karyotype in the genus *Tamandua* is evident. This may represent a new species, different from those previously described by Hsu (1965) and Jorge *et al*. (1977). This new species is bigger in weight and size and is different from *Tamandua mexicana* (whose karyotype has not yet been described).

Regarding the giant anteater (*M. tridactyla*), Hsu (1965) found 2n = 60 chromosomes (Table 2), which is confirmed in the present work (Figure 2). This species has an extra group of acrocentrics (group V), as compared to the species described previously. The X chromosome is metacentric and has the same size as the third pair of group I, and the Y is the smallest chromosome of all.

As for the silky anteater (*Cyclopes didactylus*), whose karyotype was described by Jorge *et al*. (1985b) and Jorge (2000), it has the largest diploid number in the family Myrmecophagidae, 2n = 64 (Table 2) and a greater total number of acrocentrics. The data obtained by molecular analysis (Delsuc *et al*., 2001; Delsuc *et al*., 2002; Barros *et al*., 2003) indicate that the genus *Cyclopes* diverged from the genera *Tamandua* and *Myrmecophaga* about 33 MYA. The reduction of the diploid number by fusion of acrocentrics seems to be a tendency in this family. Detailed cytogenetic studies of the species from different parts of America regarding body size, weight and color are necessary in order to characterize the species with respect to chromosome structure.

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