Cariótipos de representantes brasileiros do gênero *Zygodontomys* (Rodentia, Sigmodontinae)

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Karyotypes of Brazilian representatives of genus *Zygodontomys* (Rodentia, Sigmodontinae)

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Abstract

In this article we are reporting two cytotypes found in representatives of *Zygodontomys* genus trapped in two localities of Brazilian Amazon. From the locality of Surumú were analysed 12 individuals (cytotype 1) which showed 2n=86/FN=96 -100, presenting the two largest pairs (1 and 2) as subtelo-submetacentrics, 4 or 5 medium to small biarmed pairs, the remainder being acrocentrics. In Tartarugalzinho were caught 7 specimens which displayed 2n=84/FN= 96-98 (cytotype 2). In both cytotypes the sex pair is composed by a large (sized between pairs 2-3) submetacentric X chromosome and a median subtelocentric Y chromosome. The G-, C-, and NOR-bancing were performed in the 2n=86 karyotype, being the largest pairs be identified by G-banding. The C-bands occurred at the centromere of the majority of the autosomes and the short arm of the X and the whole Y chromosomes were heterochromatic. The NOR-bands were prevalently seen at the short arm of one medium and one small acrocentric pairs. Comparing the individuals studied in Brazil with those reported in Venezuela is observed that, although the same or similar diploid numbers, the morphology of the chromosomes of these taxa is quite different, the karyotypes of the specimens from Brazil having a smaller number of biarmed elements. The sexual pair is distinct also, the difference basically concerning to the size of the Y chromosome, these karyotype differences may corresponding to different taxa.

Introduction

Zygodontomys Allen, 1897 is a rodent genus which, due its ambiguous phylogentic affinities, is settled as incertae sedis in the South American Sigmodontinae subfamily (Reig, 1987; Voss, 1991; Musser and Carleton, 1993). The genus was revised by Hershkovitz (1962) and Voss (1991) who distinguish its species by a singular set of morphological characters comprising external proportions, mammae number, qualitative details of cranial structure, molar occlusal morphology and root numbers, and characters of viscera. They are terrestrial, nocturnal rats which feed on seeds, fruits, and insects, and in Venezuela are identified as reservoirs of the Arenaviridae Guanarito which causes hemorrhagic fever (Fulhorst *et al.*, 1999).

The genus inhabits mainly the open savannas of Central America (southeast Costa Rica through Panama, including some islands) and of the northern of the South America, from Colombia, Venezuela, and Guianas, to Brazil north of the Amazon River (Musser and Carleton, 1993). There was an extensive disagreement about the number of species recognized in *Zygodontomys*, varying from one (Hershkovitz, 1962), four (Reig, *et al.*, 1990) up to 10 species (Tate, 1932). Currently, Voss (1991) and Musser and Carleton (1993) mention only two species, *Z. brevicauda* (including three subspecies) with the same distribution of the genus, and *Z. brunneus* restricted to north of Colombia.

Zygondotomys had its karyotype analysed in Venezuela (Reig, *et al.*, 1990) and high diploid numbers reported (but without description or illustration of the chromosomes) in several countries of the north of South America (Gardner and Patton, 1976; Voss, 1991). In Brazil, representatives of this genus were not chromosomally investigated. In this article we are reporting in the Brazilian Amazon the occurrence of the 2n=84 and depicting the G-, C-, and NOR-banded 2n=86 undescribed karyotype for the genus.

Material and Methods

The sample includes 12 individuals (8 males and 4 females) from Surumú, state of Roraima (trapped in several sites between 3°58'→4°27' N; 60°13'→61°16' W) and 7 (4 males and 3 females) specimens caught in the locality of Tartarugalzinho, state of Amapá (01°17' N; 50°48' W), both sites located in Amazon biome as can be seen in the map of Figure 1. Skins and skulls of the animals studied are deposited in the Mammals Collection of the Museu Nacional, Rio de Janeiro (voucher specimen numbers are in Appendix).

Mitotic preparations were made employing the technique of Baker *et al.* (1982). C-, G- and NOR- banding were performed following Sumner (1972), Seabright (1971), and Howell and Black (1980), respectively.

Fig. 1

Results

All the specimens of Roraima showed 2n=86 with an autosomal arm number (FN, used herein to designate only the number of autosomal arms) ranging from 96 to 100 (cytotype 1, Table 1). Their karyotypes present the two largest pairs (1 and 2) as subtelo-submetacentrics, 4 or 5 medium to small biarmed pairs, the remainder being acrocentrics (Fig. 2a). The 7 rats of Amapá showed 2n=84 and a FN of 96 to 98 (cytotype 2, Fig. 2b). This karyotype, apparently, is the same as that of the cytotype 1, minus a pair which could not be identified due to the high number of chromosomes, probably being a small. In both cytotypes the sex pair is composed by a large (sized between pairs 2 - 3) submetacentric X chromosome and a median subtelocentric Y chromosome.

Table 1

The G-, C-, and NOR-banding were performed in the 2n=86 karyotype only. By G-banding the largest pairs could be identified (Fig. 2a). The C-bands occurred at the centromere of the majority of the autosomes being usually absents in pair No. 1 (sometimes a second pair appeared without C-band also). The short arm of the X and the whole Y chromosomes were heterochromatic (Fig. 3a). The NOR-bands were seen at the short arm of one medium and one small acrocentric pairs but in two metaphase plates (out of 10) a third par, a medium acrocentric, showed a nucleolar organizer region in its long arm (Fig. 3b).

Fig. 2

Discussion

Comparing the individuals that we studied in Brazil with those of Venezuela analysed by Reig *et al.* (1990) and named of *Z. microtinus* (according to Musser and Carleton, 1993, a *brevicauda* synonym) is observed that, although the same (84) or similar (86 and 88) diploid numbers, the morphology of the chromosomes of these taxa is quite different, the karyotypes of the specimens from Brazil having a smaller number of biarmed elements

(NF=96 -100 vs. 116-118 in Venezuela). The sexual pair is distinct also, the difference basically concerning to the size of the Y chromosome (Table 1). These karyotype differences could correspond to different taxa, a subject that deserves further investigations. The individuals of both countries, however, present an accumulation of heterochomatin, a character that can be consider as a peculiarity of the genus.

Fig. 3

Previously, *Zygodontomys* was grouped with the Akodontini (Thomas, 1916; Ellerman, 1941; Cabrera, 1961; Gardner and Patton 1976), but Tate (1932) considered it to belong to the Oryzomyini and Hershkovitz (1962) joined it to the Phyllotini. The diploid numbers which we observed in *Zygodontomys* representatives from the Brazilian Amazon (84 and 86) are high and are inside of the range (82-88) of those reported by other authors (see Table 1). These values characterize *Zygodontomys* for being the genus with the largest number of chromosomes amongst the American sigmondontines and one of the highest described in mammals. These findings apart definitively *Zygodontomys* from the Akodontini because studying *B. lasiurus* in " Campos do Sul" domain (in several places around the parallel 30 South) and in the Brazilian Cerrado (ca. of 17°S) we always found a 2n=38 (unpublished data). From a chromosomal standpoint the high-numbered complement of *Zygodontomys* placed it near a primitive oryzomyine stock because their very high chromosomal numbers are more common in members of this tribe than in representatives of the remaining tribes of the Sigmondontinae subfamily. This position was find also by Steppan (1995) and Steppan and Sullivan (2000) who, analysing the phylogenetic relationships of the South American rodents based on morphological plus some molecular characters, settled *Zygodontomys* in an oryzomyine clade.

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References

ALLEN J. A. 1897. Additional notes on Costa Rican mammals, with descriptions of new species. *Bull. Am. Mus. Nat. Hist.* **9** 31-44.

BAKER R. J., Haiduk M. W., Robbins L. W., Candena A. and Kcop B. F. 1982. Chromosomal studies of American bats and their systematic implications (*In*: Mammalian Biology in South America. Vol 6, pp 1-539. Edited by M. A. Mares and H. H. Genoways). Special Publications Series, Pymatuning Laboratory of Ecology, University of Pittsburgh.

CABRERA A. (1961). Catalogo de los mamiferos de America del Sur. Rev. Mus. Argent. Cienc. Nat. 4 1-732.

ELLERMAN J. R. 1941. The families and genera of living rodents, vol. 2. Muridae. London: British Museum (Natural Histiry).

FULHORST C. F., Ksiazek T. G., Peters C. J. and Tesh R. B. 1999. Experimental infection of the cane mouse *Zygodontomys brevicauda* (family Muridae) with Guanarito virus (Arenaviridae), the etiologic agent of Venezuelan hemorrhagic fever. *J. Infect. Dis.* **180** 966-69.

GARDNER A. L. and Patton J. L. 1976. Karyotypic variation in chromosomal evolution in the Neotropical cricetine complex. *Occas. Pap. Mus. Zool.*, Louisiana State University **49** 1-48.

HERSHKOVITZ P. 1962. Evolution of Neotropical cricetine rodents (Muridae), with special reference to the Phyllotini group. *Fieldiana: Zool.* **46** 1-524.

HOWELL W. M. and Black D. A. 1980. Controlled silver-staining of nucleolar organizer regions with protective colloidal developer: a 1-step method. *Experientia* **36** 1014.

KIBLISKY P., Löbig I., Reig O. A. 1970. Estudio cromosómico em diversas poblaciones del ratón llanero *Zygodontomys microtinus* Thomas. *Acta Cient. Venezolana* **21** (Suppl. 1) 35.

MUSSER G. G. and Carleton M. D. 1993. - Family Muricae. Pp. 501-706 (*In: Mammals species of the world - a taxonomic and geographic reference*. Wilson D. E. and Reeder D. M., eds.). 2nd edition. Smithsonian Institution Press, Washington, DC, xviii + 1206 pp.

PEREZ-ZAPATA A., Aguilera M., Ferrer A. and Reig O. A. 1984. El cariotipo de una población de *Zygodontomys* sp. (Rodentia, Cricetidae) del Delta del Orinoco. *Acta Cient. Venezolana* **35** (Suppl.1) 227.

REIG O. A. 1987. An assessment of the systematics and evolution of Akodontini, with the description of the new fossil species of *Akodon* (Rodentia-Cricetidae). *Fieldiana: Zool.* **39** 347-399.

REIG O. A., Aguilera M. and Perez-Zapata A. 1990. Cytogenetics and karyosystematics of South American oryzomyine rodents (Cricetidae: Sigmodontinae). II. High numbered karyotypes and chromosomal heterogeneity in Venezuelan *Zygodontomys*. *Z. Säugetierkd.* **55** 361-370.

STEPPAN S. J. 1995. Revision of the leaf-eared mice Phyllotini (Rodentia:Sigmodontinae) with a phylogenetic hypothesis for the Sigmodontinae. *Fieldiana: Zool.* **80** 1-112.

STEPPAN S. J. and Sullivan J. 2000. The emerging statistical perspective in systematics: a comment on Mares and Braun. *J. Mammal.* **81** 260-270.

SUMNER A. T. 1972. A simple technique for demonstrating centromeric heterochromatin. *Exp. Cell Res.* **75** 304-306.

SEABRIGHT M. A. 1971. A rapid banding technique for human chromosomes. *Lancet* **2** 971-972.

TATE G. H. H. 1932. The taxonomic history of the South and Central American cricetid rodents of the genus *Oryzomys*. Part 2: subgenera *Oligoryzomys, Thallomyscus* and *Melanomys*. *Am. Mus. Novitates* **580** 1-17.

VOSS R. S. 1991. An introduction to the Neotropical muroid rodent genus *Zygotontomys*. *Bull. Am. Mus. Nat. Hist.* **210** 1-113.

APPENDIX

Voucher specimens - *Zygodontomys brevicauda* cytotype 1: AN 790, 791, 792, 818, 904, 935, 946, 951, 985, 986, 987, 990 (Surumú, state of Roraima, between 3°58'-4°27' N and 60°13'-61°16' W); cytotype 2: AN 324, 343, 351, 380, 381, 386, 391 (Fazenda São Bento, Tartarugalzinho, state of Amapá, 01°17' N; 50°48' W).

Figure legends

Figure 1. Collection points: 1. *Z. brevicauda* cytotype 1, Surumú, state of Roraima. 2. *Z. brevicauda* cytotype 2, Tartarugalzinho, state of Amapá.

Figure 2. a. *Z. brevicauda* cytotype 1 (from Surumú), 2n=86/FN=100, female, Giemsa staining; b. *Z. brevicauda* cytotype 2 (from Tartarugalzinho), 2n=84/FN=96, male, G-bands.

Figure 3. a. *Z. brevicauda* cytotype, 2n=86, male, C-bards. The arrows indicate the sex pair; b. *Z. brevicauda*, 2n=86, NOR-banding.

Table 1. Species, localities, diploid and autosomal arm (FN) numbers, X and Y chromosome morphologies reported in this study and in the literature.

Species	Locality	2n	FN	X	Y	References
	Brazil:					This work
Z. brevicauda cytotype 1	Surumú	86	96-100	LS	AM	
Z. brevicauda cytotype 2	Tartarugalzinho	84	96-98	LS	AM	This work
Z .microtinus	Venezuela:					
	15 localities	84	116-118	ST	SST	Reig *et al.* (1990)
	Isla Guara	88				
Z. brevicauda	Costa Rica	82	Karyotype not showed			Voss, 1991
	Venezuela	84				
Z. microtinus	Venezuela	84	Karyotype not showed			Kiblisky *et al.* (1970)
Z. brevicauda	Costa Rica	84	Karyotype not showed			Gardner and Patton (1976)
Z. microtinus	Colombia	88	Karyotype not showed			Gardner and Patton (1976)
Z. microtinus	Venezuela	88	Karyotype not showed			Perez-Zapata *et al.* (1984)

LS: submetacentric large; AM: acrocentric medium; ST: subtelocentric; SST: small subtelocentric.

Figure 1

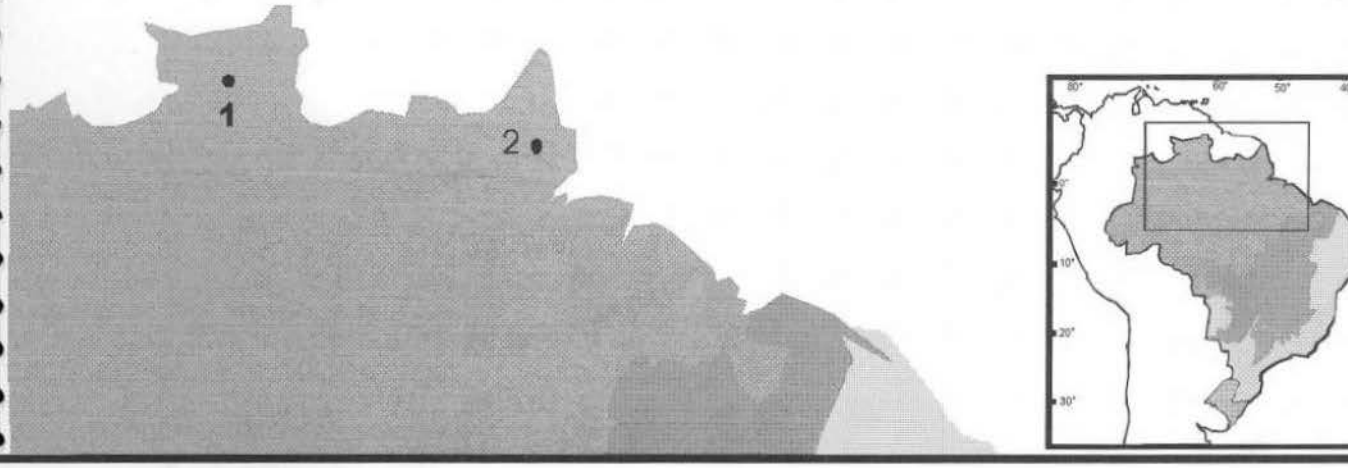

Figure 2

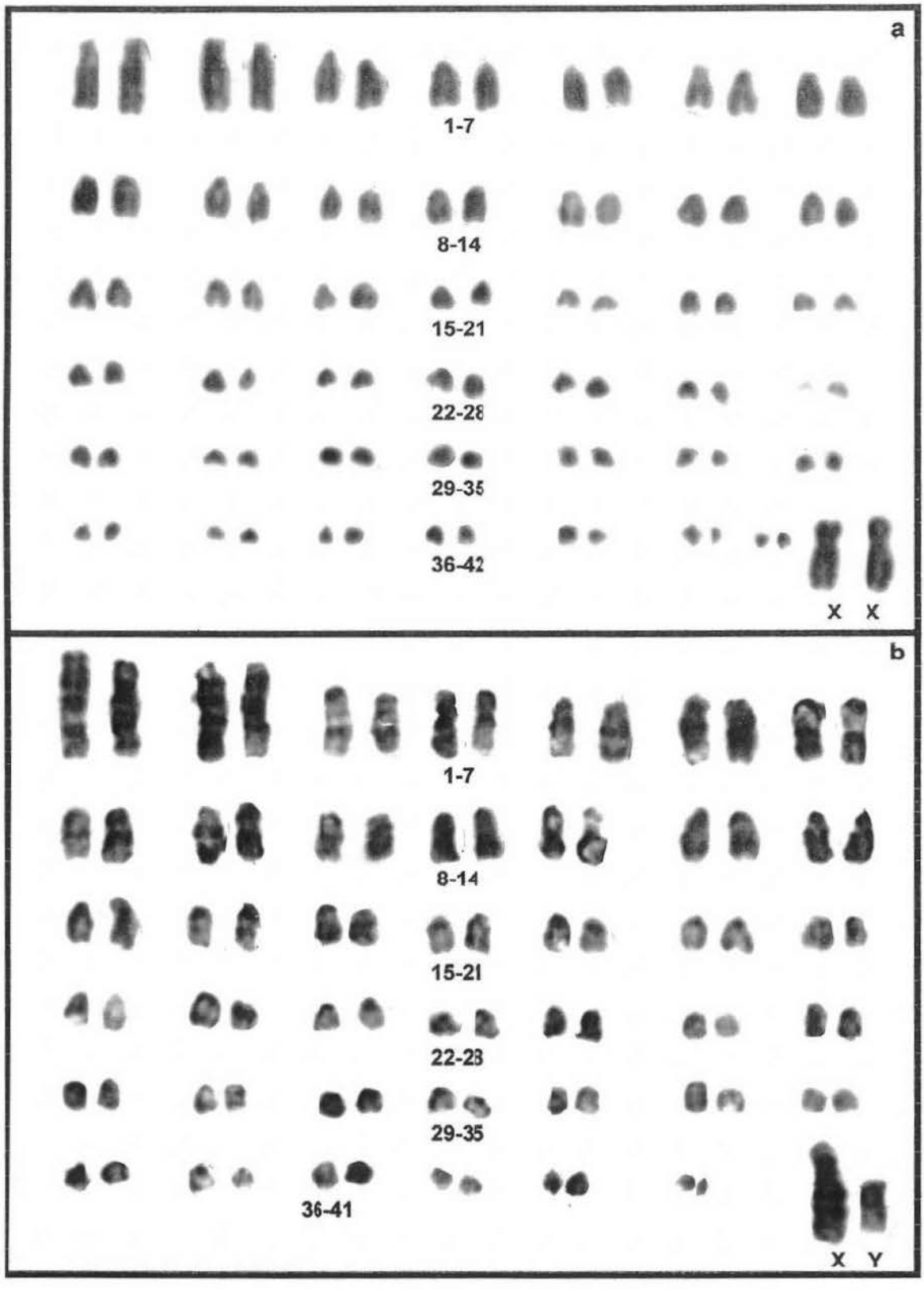

Figure 3