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The karyotype of *Brucepattersonius griserufescens* Hershkovitz, 1998 (Rodentia, Sigmodontinae) with comments on distribution and taxonomy

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Abstract

We karyotyped three *Oxymycterus* species (*O. hispidus*, *O. roberti*, and *O. caraparoe*) and *Brucepattersonius griserufescens*. *B. griserufescens* (2 n = 52/FN = 52–53) differed from the other three karyologically identical species (2 n = 54/FN = 64). Furthermore, comparisons of *O. hispidus* and *O. caraparoe* G-band karyotypes with data in the literature indicated that these species were karyologically identical with *O. roberti*, *O. angularis*, *O. rutilans*, *Oxymycterus* sp., *O. rufus*, *O. paramensis*, *O. nasutus*, and *O. akodontius*. Morphological characteristics allowed the distinction of two consistent groups, one including *O. iheringi* and *B. griserufescens*, characterized by reduced claws and a small body size, and another, of typical *Oxymycterus* species, with well-developed claws and medium or large body size. Finally, our data extended the distribution on the *iheringi* species group to Rio de Janeiro and Espírito Santo states in Brazil.

Key words: *Brucepattersonius*, *Oxymycterus*, karyotype

Introduction

Extensive karyological studies have been carried out in akodontine rodents showing striking variations in diploid chromosome number and morphology (Yonenaga et al. 1976; Kasahara 1978; Furtado 1981; Maia and Langguth 1981; Yonenaga-Yassuda et al. 1983). Within this tribe, however, the genus *Oxymycterus* is characterized by a karyotypic stability (2 n = 54 / FN = 64; Kajon et al. 1984; Vitullo et al. 1986; Svartman 1989), leading to the postulation that this genus was monokaryomorphic (Vitullo et al. 1986). Contrary to other related genera (e. g. *Akodon*) which include cryptic species, like the karyotypically distinctive *Akodon cursor* (2 n = 14) and *Akodon montensis* (2 n = 24; Yonenaga-Yassuda et al. 1975), *Oxymycterus* is characterized by distinct phenotypic differences coexisting with a marked karyological invariance.

The aim of this study was to investigate the karyotype of specimens identified as *Brucepattersonius griserufescens* Hershkovitz, 1998 and *Oxymycterus caraparoe* Hershkovitz, 1998 and compare our findings with karyological data on other related species.

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Material and methods

We collected specimens of one *Brucepattersonius* and three *Oxymycterus* species from 3 different Brazilian localities: (1) Parque Nacional de Caparaó (PNC), Minas Gerais and Espírito Santo states (20°19′–20°37′ S and 41°43′–42°53′ W; altitude 1,300–2,700 m), (2) Itamonte, Rio de Janeiro State (22°23′ S and 44°38′ W; altitude 2,200 m), and (3) Parque Nacional da Chapada dos Veadeiros (PNCV), Goiás State (13°51′–14°10′ S and 47°25′–47°42′ W; altitude 700–1,500 m) (Fig. 1). Species identification was based on (1) cranial morphology, (2) body size and (3) pelage coloration. Skins and skulls were deposited in the mammals collections of the Museu Nacional (MN, Rio de Janeiro, Brazil) and the Field Museum of Natural History (FMNH, Chicago, USA).

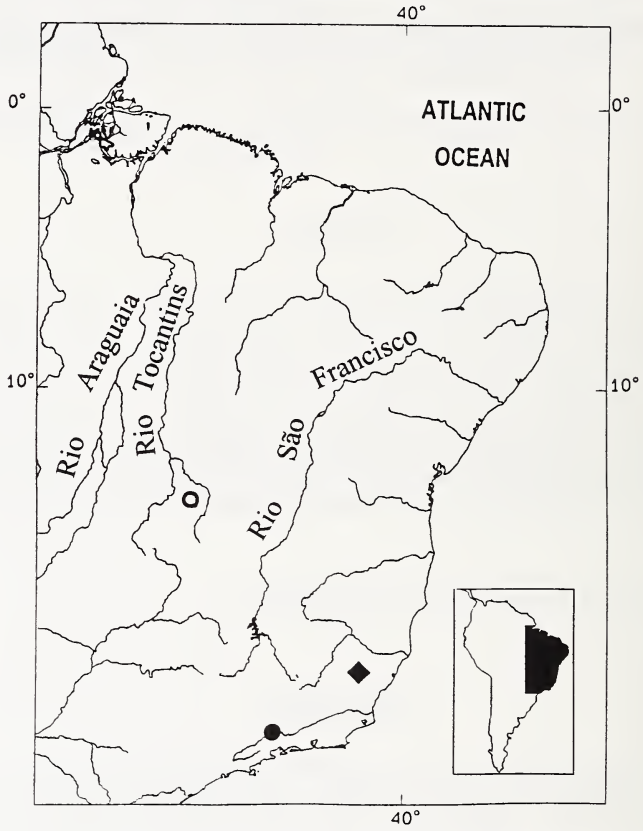

Fig. 1. Collection localities: ◆ Parque Nacional de Caparaó, ○ Parque Nacional da Chapada dos Veadeiros and ● Itamonte.

We collected 26 *B. griserufescens* from PNC (males MN 32213, 32236-37, females MN 32009-14, 32016, 32211-12, FMNH-PH 10174, 10184, 10218) and Itamonte (males LG 104, 108, 111, VPF 49, CRB 1337, 1338, females VPF 82, 86, CRB 1299, 1330, 1331). Nine *Oxymycterus hispidus* were collected from PNC (males MN 32002-06, FMNH-PH 10128, females MN 32007-08, FMNH-PH 10353). Thirty two *Oxymycterus caraparoe* were collected from PNC (males MN 31983-87, 31991, 31996, 31998, 32000, 32204, 32235, FMNH-PH 10060, 10094, 10154, 10211, females MN 31989-90, 31993-95, 31997, 31999, 32203, FMNH-PH 10069, 10168, 10421, MN 31992) and Itamonte (females, field number VPF 48, 51, LF 2178, 2170, 2172). Twenty six *Oxymycterus roberti* were collected from PNCV (males, field number CRB 1011, 1091, 1118-19, 1121, 1123, 1130, 1132-34, 1139, 1150, and females CRB 1090, 1102-03, 1105, 1116-17, 1120, 1128-29, 1131, 1135, 1137, 1147, 1151).

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We karyotyped 12 *B. griserufescens* (MN 32009, VPF 49, 82, 86, LG 104, 108, 111, CRB 1299, 1330, 1331, 1337, 1338), 3 *O. hispidus* (MN 32006, 32007, FMNH-PH 10128), 5 *O. caraparoe* (MN 31987, 31993, FMNH-PH 10168, LF 2170, 2172) and 18 *O. roberti* (CRB 1103, 1105, 1116, 1117, 1118, 1119, 1120, 1121, 1123, 1128, 1129, 1130, 1131, 1132, 1139, 1147, 1150, 1151). Chromosome preparations were obtained from bone marrow cultures in RPMI 1640, 20% foetal calf serum, ethidium bromide (5 µg/ml) and colchicine 10^{-6} M for two hours or from primary cultures of kidney epithelium in Dulbecco MEM medium with 10% foetal calf serum following 5 hours of colchinization with ethidium bromide for the last 2 hours. C- and G-banding was carried out as described by Sumner (1972) and Seabright (1971), respectively.

Results

Species identification and habitat

Specimens were identified and classified by cranial morphology, and, additionally, by simple external characteristics. *O. hispidus* and *O. roberti* are large body-sized species (mean weight of captured specimens = 87.2 g and 88.6 g, respectively). They can be distinguished from one another by pelage coloration; the former by its grayish belly and the latter by its yellow-orange belly. *O. caraparoe* is a medium body-sized species (mean weight = 44.8 g) with a yellowish belly and *B. griserufescens* is a small body-sized species (mean weight = 25.1 g) with a gray to gray-yellowish belly. Identification of specimens captured in PNC was confirmed by Prof. Philip Hershkovitz (pers. comm.).

Specimens were captured in the following phytophysionomies: *O. roberti* in "campo úmido" and "vereda" (at altitudes of 700 and 1,200 m); *O. hispidus* in sub montane forest (at 1,000 to 1,300 m); *O. caraparoe* in mountain scrub and humid mountain forest (at 1,800 to 2,700 m); and *B. griserufescens* in mountain scrub, humid mountain forest, and sub montane forest (at 1,300 to 2,700 m). These findings extended the distribution of specimens similar to *O. iheringi* to Rio de Janeiro and Espírito Santo states (Brazil).

Karyotypic analysis

In the single *B. griserufescens* from Caparaó and in 9 Itamonte specimens, karyotypic analysis showed 2 n = 52 / FN = 52. The autosomal complement is composed of 24 pairs of acrocentric chromosomes and 1 medium-sized biarmed pair. The X chromosome is a large-sized submetacentric and the Y chromosome is a small acrocentric. C-banding showed that heterochromatin was present at the pericentromeric region of all chromosomes and that the short arm region of the biarmed chromosome pair was entirely heterochromatic. G-banding allowed unequivocal identification of homologous chromosomes (Fig. 2). Two other *B. griserufescens* from Itamonte showed 2 n = 52 / FN = 53 due to a pericentric inversion in one member of pair N° 2. In one of these two specimens, pair N° 25 was heteromorphic due to size differences, although this variation was not present in all cells. This variation was apparently due to loss of euchromatic material in the smaller member of this autosome pair.

Karyotypic analyses of G-band chromosomes of *O. hispidus* and *O. caraparoe* showed 2 n = 54 / FN = 64; these species were karyologically identical with one another and with several, previously reported, *Oxymycterus* species (see below). Similarly, the conventionally stained karyotype of *O. roberti* was identical with them. The autosomal complement of these species is composed of 6 pairs of biarmed chromosomes (1 large subtelocentric pair, 3 medium-sized metacentric pairs, 2 small metacentric pairs) and 20 pairs of acrocentric chromosomes varying gradually in size. The X chromosome is a medium-sized submetacentric and the Y chromosome is a small acrocentric.

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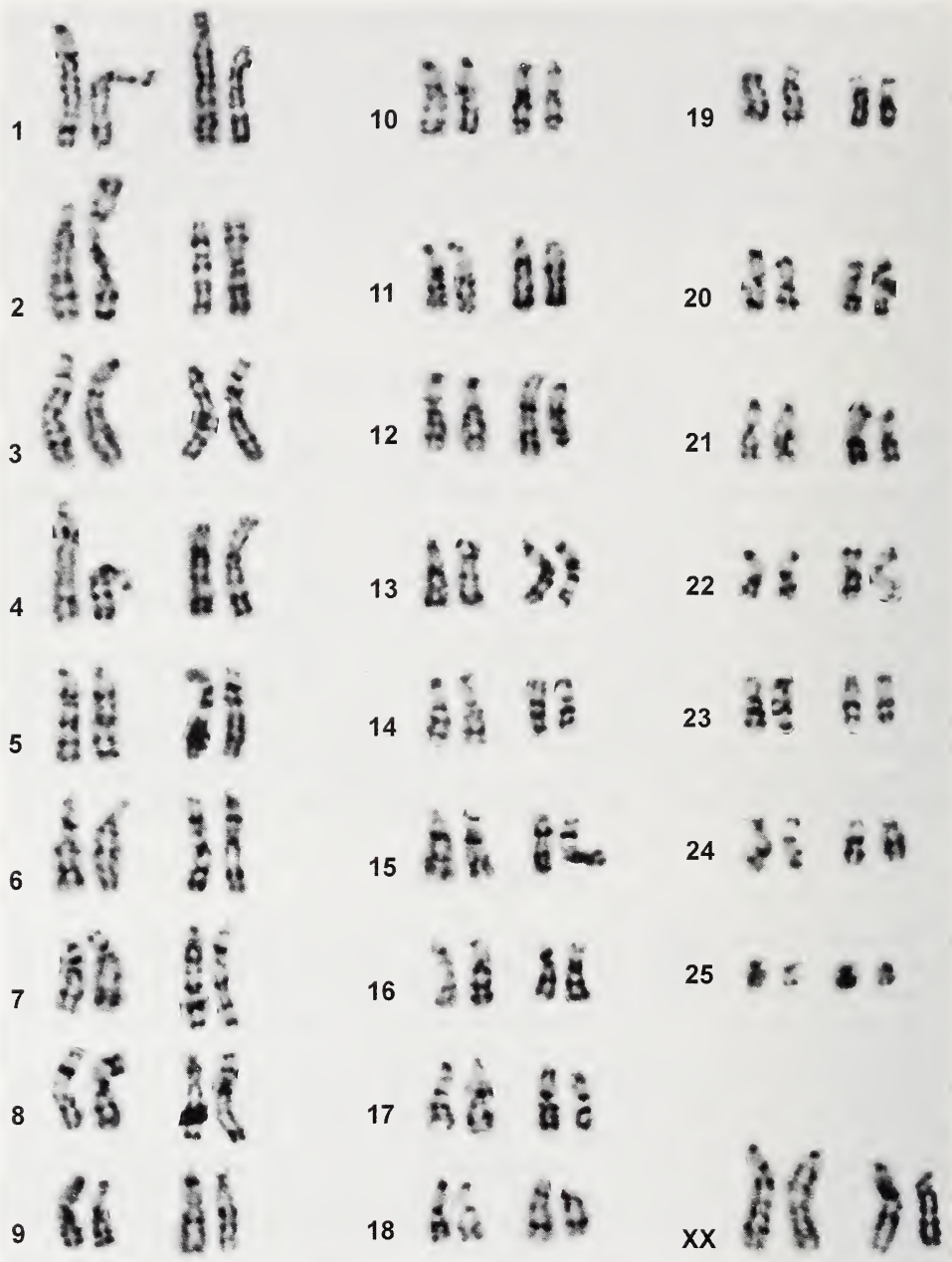

Fig. 2. G-band karyotype of *Brucepattersonius griserufescens* (female specimen, VPF 82). Note heteromorphic pair n° 2 due a pericentric inversion and heteromorphic pair n° 25 due to size differences.

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Discussion

Our findings indicated that *B. griserufescens* was karyotypically different from all *Oxymycterus* species so far studied, and these differences are consistent with the inclusion of *B. griserufescens* in a different genus. On the other hand, karyotypic comparisons of *O. hispidus* and *O. caraparoe* showed that these two species were identical despite their evident phenotypic differences; the former being a large-sized species with a gray belly, and the latter a medium-sized species with a yellow belly. Further comparisons with published data clearly indicated that morphologically different species of this genus were karyotypically identical. This was the case with the *O. hispidus* and *O. caraparoe* studied here and *O. roberti* and *Oxymycterus* sp. from Brasília (Svartman 1989), which were also karyologically identical with *O. angularis* from Pernambuco State (Souza 1981), *O. rutilans* from Santa Catarina State (Bueno pers. com.), and *Oxymycterus* sp. from São Paulo and Paraná states (Yonenaga-Yassuda 1975). They were also identical with 3 different allopatric species (*O. rufus*, *O. paramensis*, and *O. nasutus*; Vitullo et al. 1986) and with *O. akodontius* (Kajon et al. 1984). Moreover, 2 species (*O. rufus* and *O.* aff. *roberti*) were shown to be identical by comparative protein analysis (Hamel 1985).

Our findings indicate that the genus *Oxymycterus* includes a monokaryotypic (2n = 54 / FN = 64) and morphologically consistent species group consisting of *O. akodontius*, *O. angularis*, *O. hispidus*, *O. nasutus*, *O. paramensis*, *O. roberti*, *O. rufus*, and the *O. caraparoe* from Caparaó-Itamonte, karyologically different from *B. griserufescens* with a 2n = 52 / FN = 52–53 karyotype. In addition to karyotypic attributes, morphological characteristics such as reduced claws and small body size allow for the distinction of *O. iheringi* (karyotype unknown) and *B. griserufescens* from typical *Oxymycterus* species, with stronger feet, well-developed claws, and medium or large body sizes. *Oxymycterus* are akodontine rodents adapted to semi fossorial habitats whose frontal feet are very long, curved, and sturdy (Hinojosa et al. 1987); these characteristics are shared by all *Oxymycterus* species but are not valid for *O. iheringi* and *B. griserufescens.*

O. iheringi was initially included in *Oxymycterus*, although as an atypical species of this genus (Thomas 1896). Later studies (Thomas 1909), however, included *iheringi* in a new genus (*Microxus*), a taxonomic arrangement that was later maintained by Moojen (1952). Alternatively, Cabrera (1961) included *iheringi* in the subgenus *Akodon* (*Microxus*) despite differences in geographic distribution between *iheringi* and other *Microxus* species (see Gyldenscolpe 1932). Reig (1987), however, considered *iheringi* (following Massoia and Forbes 1963) a valid *Oxymycterus* species, while *Microxus* was considered a different Akodontini genus when studying type specimens of *Microxus mimus* and *Microxus bogotensis.*

On the other hand, molecular studies showed that *Microxus* (represented by *M. mimus*) did not deserve a generic status because it grouped with several *Akodon* species while *Oxymycterus* species were tightly grouped in a distinct clade (Smith and Patton 1993) although in this report *O. iheringi* was not studied. Recent taxonomic arrangements have also re-included *iheringi* in the genus *Oxymycterus* (Musser and Carleton 1993). However, morphologic data clearly indicated that this inclusion is questionable in view of the controversial taxonomic arrangements reported in the literature. Our karyotypic and morphological data indicate that *B. griserufescens* is different from *Oxymycterus* species as postulated by Hershkovitz (1998). Its morphologic similarities with *O. iheringi* indicate that these two species must be congeneric.

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mens collected in Itamonte. We are grateful to Dr. A. Langguth for translating the summary. This work was supported by Field Museum of Natural History, Barbara Brown Research Found, IBAMA, Museu Nacional, CNPq, INCa-FAF (Brazil).

Zusammenfassung

Der Karyotyp von Brucepattersonius griserufescens Hershkovitz, 1998 (Rodentia, Sigmodontinae) mit Bemerkungen zur Verbreitung und Taxonomie

Der Karytotyp von vier Arten der Gattungen *Oxymycterus* und *Brucepattersonius* wurde untersucht: *O. hispidus*, *O. roberti*, *O. caraparoe* und *B. griserufescens.* Der Karyotyp von *B. griserufescens* (2n = 52/FN = 52–53) unterschied sich von dem der drei anderen Arten, die alle einen 2n = 54/FN = 64 Karyotyp aufwiesen. Ein Vergleich der G-Bandkaryotypen von *O. hispidus* und *O. caraparoe*, mit Daten aus der Literatur zeigte, daß diese Arten den gleichen Karyotyp haben wie *O. roberti*, *O. angularis*, *O. rutilans*, *Oxymycterus* sp., *O. rufus*, *O. paramensis*, *O. nasutus* und *O. akodontius.* Nach morphologischen Merkmalen lassen sich zwei Gruppen unterscheiden. Eine davon umfaßt *O. iheringi* und *B. griserufescens* mit reduzierten Krallen und kleinem Körper, die andere die typischen *Oxymycterus*-Arten mit gut entwickelten Krallen und mittelgroßem bis großem Körper. Nach unseren Daten läßt sich das bekannte Verbreitungsgebiet der *O. iheringi*-Artengruppe bis nach Rio de Janeiro und den Espirito Santo Staaten (Brasilien) erweitern.

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