

Karyotypic study of *Callicebus coimbrai*: a rare and threatened primate species from Brazil

RODRIGUES^{1,2,*} LUÍS REGINALDO R., MARCELO CARDOSO DE SOUSA³, JULIO C. PIECZARKA^{1,4} and CLEUSA Y. NAGAMACHI^{1,4}

¹ Departamento de Genética, CCB, UFPA, Belém, Pará, Brasil.

² Laboratório de Genética & Conservação, UFPA, Santarém, Pará, Brasil.

³ Universidade Tiradentes, Aracajú, Sergipe, Brasil.

⁴ CNPq Researcher.

Abstract — The genus *Callicebus* comprises 28 species distributed in the Amazonia and Atlantic forest biomes. This paper describes the karyotype of *C. coimbrai*, a rare and threatened species and compares it with related species (*C. personatus* and *C. nigrifrons*). The karyotype was characterized by G-, C-sequential and NOR banding. *C. coimbrai* presented 2n=44 chromosomes, with G-banding pattern similar to that observed in *C. personatus* (2n=44) and *C. nigrifrons* (2n=42). The karyotypic divergence between *C. coimbrai* and *C. nigrifrons* is explained by a single rearrangement of centric fusion/fission. The chromosomal data obtained suggest a closer association between *C. coimbrai* and *C. personatus* than with *C. nigrifrons*.

Key words: Atlantic Forest, *Callicebus*, endangered species, G-bands, karyotype

INTRODUCTION

The titi monkeys (*Callicebus* Thomas, 1903) are a complex and specious group distributed allopatrically from Amazonian to Atlantic forest biomes. The systematics and phylogeny of this group are still unresolved. HERSHKOVITZ (1988; 1990) recognized 13 species grouped into four assemblages. This scheme was modified to five groups: *donacophilus*, *moloch*, *cupreus*, *torquatus* and *personatus* (KOBAYASHI 1995); and the number of species was elevated to 28 (VAN ROOSMALEN *et al.* 2002).

The *personatus* group comprises five species endemic to the Brazilian Atlantic Forest: *C. personatus*, *C. nigrifrons*, *C. melanochir*, *C. barbarabrownae* and *C. coimbrai*. This biome has a high level of species diversity and endemism, but strongly threatened by the environmental degradation resulted from the colonization process (MORELLATO 2000). The species of *personatus* group are distributed in scattered forest remnants

in the Northeastern and Southeastern Brazil (VAN ROOSMALEN *et al.* 2002).

C. coimbrai was recently described from five specimens collected in the Sergipe State between the Rio São Francisco and Rio Real (KOBAYASHI and LANGGUTH 1999). This species is considered typical from the Atlantic coastal forest not occurring in the inland areas of caatinga. Additional sightings in Sergipe and Bahia States enlarged the area of *C. coimbrai* and showed its distributional limits (SOUSA 2000; 2003).

The cytogenetics of *Callicebus* has been studied since the late 1960 decade (for revision: EGOZCUE *et al.* 1969; DE BOER 1974; BENIRSCHKE and BOGART 1976; MINEZAWA and BORDA 1984; PIECZARKA and NAGAMACHI 1988; MINEZAWA *et al.* 1989; STANYON *et al.* 2000; BARROS *et al.* 2000; 2003; RODRIGUES *et al.* 2001; 2004; BONVICINO *et al.* 2003; NAGAMACHI *et al.* 2003). This genus presented a high level of karyotypic differentiation with some examples of striking shuffled karyotypes. The diploid numbers range from 2n=50 found in *C. donacophilus* (DE BOER 1974; MINEZAWA and BORDA 1984; BARROS *et al.* 2003) *C. hoffmannsi* (RODRIGUES *et al.* 2001) and *C. pallescens* (STANYON *et al.* 2000; DUMAS *et al.* 2005) to 2n=16 in *C. lugens* (BONVICINO *et al.* 2003), the latter being the lowest diploid number found in the Order Primates.

* Corresponding author: Laboratório de Genética & Conservação, Universidade Federal do Pará, Campus de Santarém, Rua Marechal Rondon S/N, CEP 68.040-440, Santarém, Pará, Brazil; phone/fax: 0055 (21) 93-3064-9051; e-mail: ribeiro@ufpa.br

Cytogenetics studies in *C. nigrifrons* (NAGAMACHI *et al.* 2003) and *C. personatus* (RODRIGUES *et al.* 2004) revealed diploid numbers of $2n=42$ and 44, respectively. Both species diverged by a single event of centric fusion/fission. These data support the validity of the *personatus* group as an independent lineage with a distinct karyotype configuration as previously hypothesized (KOBAYASHI 1995). In the present study we report the first time the karyotype of *C. coimbrai* and its relationships with the other members of *personatus* group.

MATERIALS AND METHODS

One male specimen of *Callicebus coimbrai* was studied. It was caught by local inhabitants from Nossa Senhora da Glória, Sergipe State ($10^{\circ} 14' S$; $37^{\circ} 29' W$). The animal had a beige grayish coat,

blackish face and foot, and orange tail. The collect site is characterized by small fragments of deciduous forest and large extension of deforested areas for pastures and farming.

A blood sample was collected and sent to the laboratory at Federal University of Pará where it was processed the lymphocyte culture and chromosome preparations. The slides were submitted to G-banding with Wright's stain following VERMA and BABU (1995), C-banding following SUMNER (1972) and Ag-NOR staining (HOWELL and BLACK 1980). The karyotype was arranged following RODRIGUES *et al.* (2004).

RESULTS AND DISCUSSION

The specimen studied herein presented a karyotype with 44 chromosomes, with 13 bi-armed pairs and 8 acrocentrics. The X chromo-

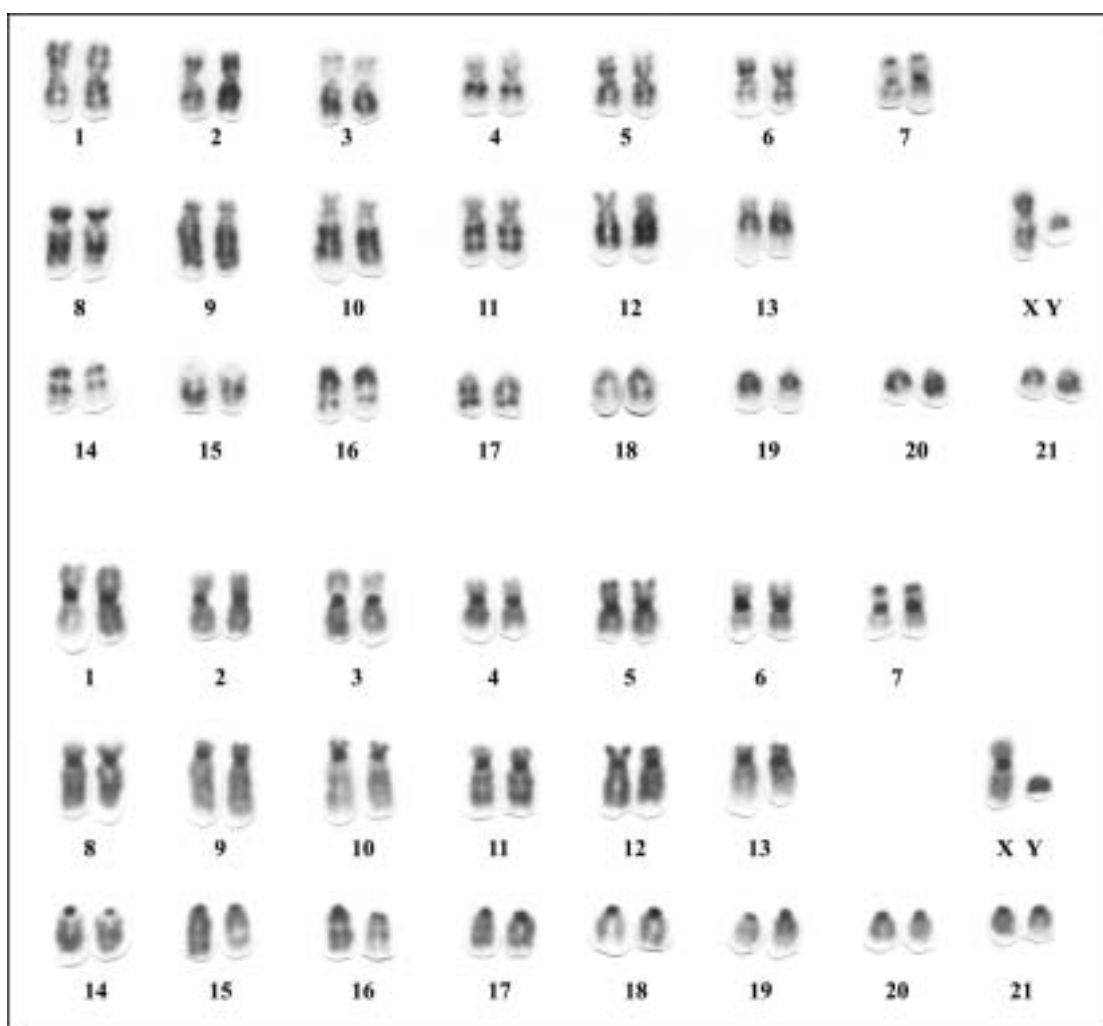


Fig. 1 — Karyotypes of *C. coimbrai*, G-banded (above) and C-sequential banded (below).

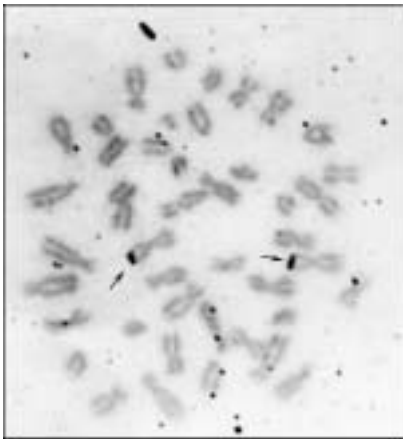


Fig. 2 — Metaphase with Ag-NOR labeling. The arrow-heads show the position of the NORs.

some is a submetacentric and the Y is a small acrocentric. The G- and sequential C-banding patterns are presented in Fig. 1. *C. coimbrai* presented a similar G-banding pattern as described to *C. personatus* (RODRIGUES *et al.* 2004) and diverges from *C. nigrifrons* by the same rearrange-

ment than *C. personatus*: a centric fusion or fission.

The constitutive heterochromatin is distributed in the centromeric region of all the chromosomes and distal position in the pairs 5, 7 and 12. The C-banding pattern of *C. coimbrai* is slightly different from that observed in *C. personatus* and *C. nigrifrons*. The Y chromosome is strongly heterochromatic in *C. coimbrai* but not in *C. nigrifrons*. The Y of *C. personatus* could not be compared.

The NOR, Fig. 2, were evidenced on the tip of the chromosome 3. The karyotypes of *C. personatus* and *C. nigrifrons* presented NORs at the same location (NAGAMACHI *et al.* 2003; RODRIGUES *et al.* 2004).

Morphological analysis demonstrated a closer association between *C. personatus* and *C. nigrifrons* than with *C. coimbrai* indicating that *C. coimbrai* is well defined as a full species (KOBAYASHI and LANGGUTH 1999). This association is concordant with the distributional patterns (Fig. 3) since *C. personatus* and *C. nigrifrons* are geographically neighbors and separated from *C. coim-*

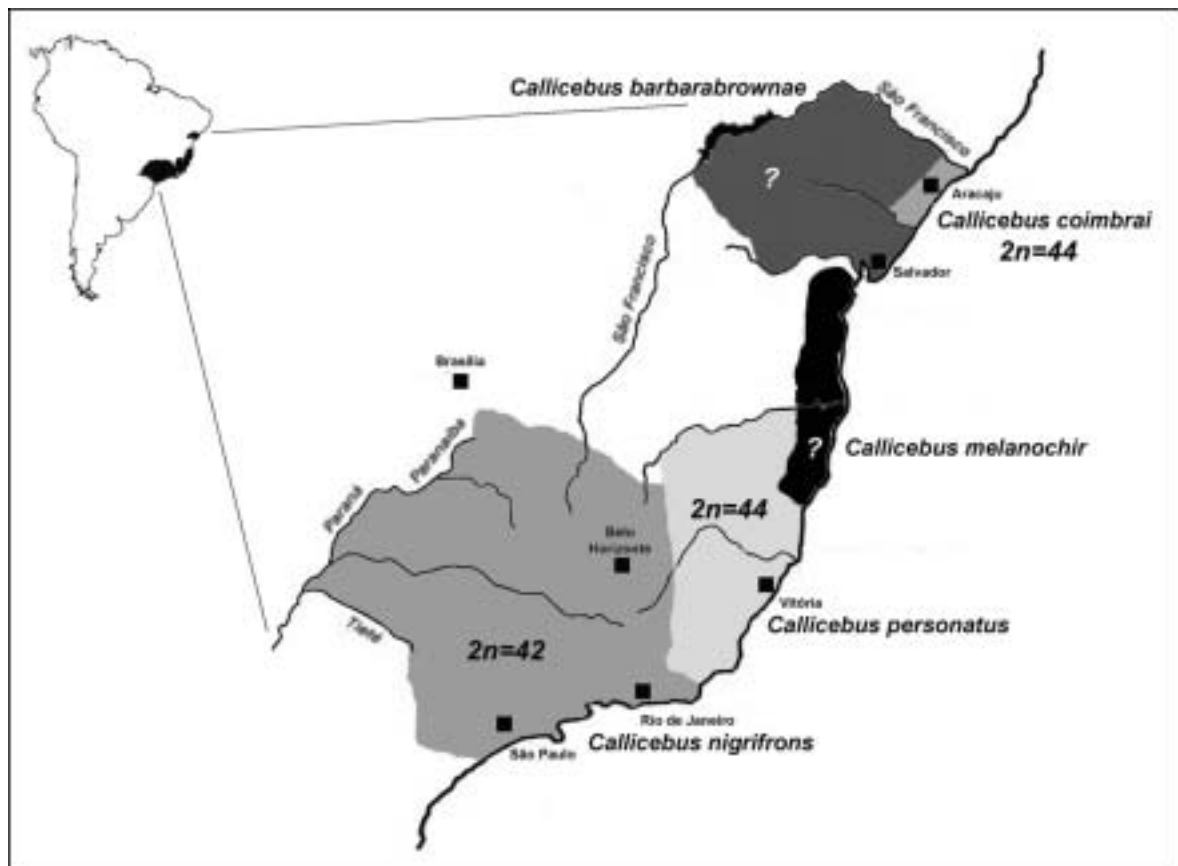


Fig. 3 — Map of the Brazilian Coast showing the occurrence areas of the *Callicebus personatus* group and karyotypic data.

brai by the occurrence areas of *C. melanochir* and *C. barbarabrownae* (VAN ROOSMALEN *et al.* 2002). However, the karyotypic data obtained herein indicates a stronger association between *C. coimbrai* and *C. personatus* than with *C. nigrifrons*.

C. nigrifrons is the southern most distributed species of the group and seems to be more divergent in chromosomal aspects. Karyotypes of *C. melanochir* and *C. barbarabrownae* are still unknown and will be important for a better understanding of the chromosomal relations among the representatives of *personatus* group. The karyotype with $2n=44$ chromosomes seems to be the less derived in the *personatus* group, what would explain the similarity between *C. personatus* and *C. coimbrai* despite of their morphological and geographical differences.

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