Nucleolar organizer regions in *Sittasomus griseicapillus* and *Lepidocolaptes angustirostris* (Aves, Dendrocolaptidae): Evidence of a chromosome inversion

Marcelo de Oliveira Barbosa¹, Rubens Rodrigues da Silva¹, Vanessa Carolina de Sena Correia¹, Luana Pereira dos Santos¹, Analía del Valle Garnero² and Ricardo José Gunski²

¹Universidade Federal do Tocantins, Ciências Biolóigicas, Instituto de Biologia e Saúde Pública, Laboratório de Genética, Porto Nacional, TO, Brazil.
²Universidade Federal do Pampa, São Gabriel, RS, Brazil.

Abstract

Cytogenetic studies in birds are still scarce compared to other vertebrates. Woodcreepers (Dendrocolaptidae) are part of a highly specialized group within the Suboscines of the New World. They are forest birds exclusive to the Neotropical region and similar to woodpeckers, at a comparable evolutionary stage. This paper describes for the first time the karyotypes of the Olivaceous and the Narrow-billed Woodcreeper using conventional staining with Giemsa and silver nitrate staining of the nucleolar organizer regions (Ag-NORs). Metaphases were obtained by fibular bone marrow culture. The chromosome number of the Olivaceous Woodcreeper was 2n = 82 and of the Narrow-billed Woodcreeper, 2n = 82. Ag-NORs in the largest macrochromosome pair and evidence of a chromosome inversion are described herein for the first time for this group.

Keywords: cytogenetics, woodcreepers, Ag-NOR, chromosomal inversion.

Received: August 28, 2012; Accepted: November 23, 2012.
pH 6.8 phosphate buffer solution and at least 20 metaphases per specimen were analyzed to determine the diploid number and chromosome morphology.

The nucleolar organizer regions were detected with colloidal silver nitrate according to the protocol of Howell and Black (1980). The morphological classification of the chromosomes was performed following Guerra (1986).

*S. griseicapillus* had a diploid number of 82 chromosomes (Figure 1). The first ten pairs were considered macrochromosomes and the other 31 pairs, microchromosomes. Among the autosomal macrochromosomes, pair 3 was acrocentric and all the other nine pairs were telocentric. Pairs 1 and 2 were of similar length. The Z chromosome was acrocentric and had the same size as pairs 4 and 5. The W chromosome was a small telocentric equivalent in size to pairs 8 and 9. The largest telocentric pair had a subcentromeric secondary constriction (Figure 1) where the Ag-NOR was located (Figure 2).

*L. angustirostris* had a diploid number of 82 chromosomes (ten macrochromosome pairs and 31 microchromosome pairs) (Figure 3). Chromosomes pairs 1, 3 and 4 were acrocentric, whereas the other autosomal macrochromosomes were telocentric. Pair 1 had satellitized short arms. The Z chromosome was an acrocentric of the same size as pairs 4 and 5 and the W chromosome was a small telocentric. The Ag-NORs were located in the largest chromosome pair (Figure 4).

This is the first karyotype description from species of the family Dendrocolaptidae. Although they belong to different genera, *S. griseicapillus* and *L. angustirostris* exhibited similar karyotypes in terms morphology, with predominantly telocentric chromosomes and only a few acrocentrics. This is in contrast with observations in other

![Figure 1 - Metaphase and partial karyotype of a female specimen of *Sittasomus griseicapillus* (2n = 82). The thin arrow indicates the secondary constriction.](image1)

![Figure 2 - Giemsa - Ag-NOR sequential staining of a metaphase of *Sittasomus griseicapillus* (2n = 82): (A) conventional Giemsa staining, (B) Ag-NOR staining.](image2)

![Figure 3 - Metaphase and partial karyotype of a female specimen of *Lepidocolaptes angustirostris* (2n = 82).](image3)
Passeriformes families, in which some chromosomes are metacentric/submetacentric. Only pairs 1 and 4 differed in morphology between the two species. The diploid numbers were in accordance to those usually observed in the order Passeriformes (around 80 chromosomes).

The species of Dendrocolaptidae analyzed herein had karyotypes similar to those of Furnarius rufus and Lochmias nematura, which belong to the family Furnariidae, considered a sister group of Dendrocolaptidae and are the only known species of Furnariidae that have been karyotyped (Lucca and Rocha, 1992). F. rufus and L. nematura have predominantly telocentric and a few acrocentric chromosomes, morphologically very similar to the chromosomes of the species that we studied.

The presence of Ag-NORs in pair 1, the largest macrochromosome pair, is described herein for the first time in the class Aves (Figures 2 and 4). Previous studies showed that Ag-NORs were associated with secondary constrictions on macrochromosomes equivalent in size to pair 9 in Pitangus sulphuratus (Passeriformes) and Guira guira (Cuculiformes), to pair 3 of Mimus saturninus (Passeriformes) (Rocha and Lucca, 1988), and in the secondary constrictions forming the satellite on pair 7 of Buteo albicaudatus (Accipitridae) (Lucca, 1985).

The presence of NORs in the largest macrochromosome pair of Dendrocolaptidae species further substantiates the fact that not only microchromosomes and smaller macrochromosomes are responsible for nucleolar organization in Aves. It is possible that additional species in this group exhibit NORs in the largest macrochromosomes.

The largest chromosomes of S. griseicapillus and L. angustirostris underwent a chromosome inversion that altered their morphology and changed the position of the NOR. The presence of constitutive heterochromatin close to the NOR may have facilitated rearrangements in this region (Lucca, 1985). Our results point towards possible chromosome rearrangements that need confirmation by further Ag-NORs analyses of additional populations and specimens.

Acknowledgments

Our thanks go to Mr. José de Oliveira Negre, owner of the Gruta da Serra farm, for his kindness in allowing us to collect samples on his land, to colleagues at the Instituto de Biologia e Saúde Pública at the Universidade Federal do Tocantins (UFT) and to the University, to our colleague Mário Angel Ledesma for his guidance and contributions to the study, to the Brazilian Environment Agency (IBAMA) for the licenses to collect samples, to the National Council for Scientific and Technological Development (CNPq) and the Tocantins State Agency for Science and Technology (SECT-TO) for funding the study, and to all those who contributed to our work in any way.

References


Internet Resources

Associate Editor: Yatiyo Yonenaga-Yassuda

License information: This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.