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Cytotaxonomic diagnoses of two Neotropical swift species: *Streptoprocne biscutata* and *Streptoprocne zonaris* (Aves: Apodidae)

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Abstract

Specimens of *Streptoprocne biscutata* and *Streptoprocne zonaris* were studied cytogenetically in order to identify the features of their karyotypes and to increase our knowledge of the karyotypical constitutions of family Apopidae in the Neotropical region. Analysis of *Streptoprocne biscutata* revealed 2n= 64 (22 macrochromosmes + 42 microchromosomes) whereas *Streptoprocne zonaris* is characterized by 2n= 66 (18 macrochromosmes + 48 microchromosomes). It was not possible to recognize chromosomes related to sex determination in either species. We make available chromosome data that will prove useful to a global biological characterization of Apodidae, contributing to a reconnaissance of study of avian diversity in the Neotropics.

Key words: Chromosomes, *Streptoprocne biscutata*, *S. zonaris*, Apodidae, avian, cytogenetics

Introduction

South America is often described as “the avian continent” because more than 2920 species of birds live there (Sick 1997). Of the countries in South America, Brazil has one of the largest avian faunas in the world sheltering 1590 of a total of 9020 recognized species (Rocha et al. 1996).

The family Apodidae belongs to the order Apodiformes (comprising swifts and related birds) and is widely distributed with representatives on almost all continents (Pichorim 2002), however the great majority of them are in the Tropical region. According to Chantler and Driessens (1995), of the 92 living species of swifts known from the tropics, 23 exist in South America. Most of the South American species are included in the sub-

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family Cypseloidinae where, among others, the genus *Streptoprocne* is exclusively Neotropical. The genus comprises three species: *Streptoprocne semicolaris*, endemic to Mexico and *Streptoprocne zonaris* that is widely distributed thorough the South and Central Americas. In addition, *Streptoprocne biscutata* is distributed thorough the east of Brazil, from the state of Piauí to the state of Rio Grande do Sul, reaching the north of Argentina at the province of Missiones (Meyer de Schauensee 1982; Chantler and Driessens 1995; Sick 1997).

The order Apodiformes remains poorly known from a cytogenetic point-of-view. Of the 428 or so known species, just three have had their karyotypes described. A subspecies, *Appus affinis affinis* had its karyotype determined with 2n= ±70 where 7 pairs are macrochromosomes and 28 pairs are microchromosmes (Yadav et al. 1995). Another study revealed that *Apus pacificus* is characterized by 2n= 62 (14 macrochromosomes and 48 microchromosomes). Conversely, in *Hirundapus caudacutus*, the diploid number of 64 chromosomes (12 macrochromosomes and 52 microchromosomes) has been reported (Xiaozhuang et al. 1988).

The species belonging to the genus *Streptoprocne* follow the same aforementioned situation as no chromosome data are currently available in the literature. In this paper we increase knowledge of the chromosome data in Apodiformes, describing and comparing the karyotypes of *Streptoprocne biscutata* and *Streptoprocne zonaris.*

Material and methods

We studied 5 specimens of *Streptoprocne biscutata* and 5 specimens of *Streptoprocne zonaris* from the Vila Velha Statewide Park, in the city of Ponta Grossa, state of Paraná, Brazil (Figure 1). Mitotic-metaphases for these birds were obtained by the technique of short-term culture of pulp feather purposed by Gianonni et al. (1993). Macrochromosome morphology was determined by procedures described by Levan et al. (1964), karyotype arrays were modified from the current avian karyotype presentation (chromosomes in a decreasing order of size), allowing for a better identification of the karyotype formula (metacentrics + submetacentrics + acrocentrics).

Results and discussion

The specimens of *Streptoprocne biscutata* that were studied are characterized by the diploid number 2n= 64 chromosomes of which 18 are macrochromosomes and 46 are microchromosomes. The partial karyotypical formula is therefore 4M+4SM+10A (Figures 2a, b; Table 1). In the studied specimens of *Streptoprocne zonaris* it was possible to verify the existence of a diploid number 2n= 66, comprising 18 macrochromosomes and 48 microchromosomes. The partial karyotypical formula of *Streptoprocne zonaris* is 4M+2SM+12A (Figures 3a, b; Table 1).

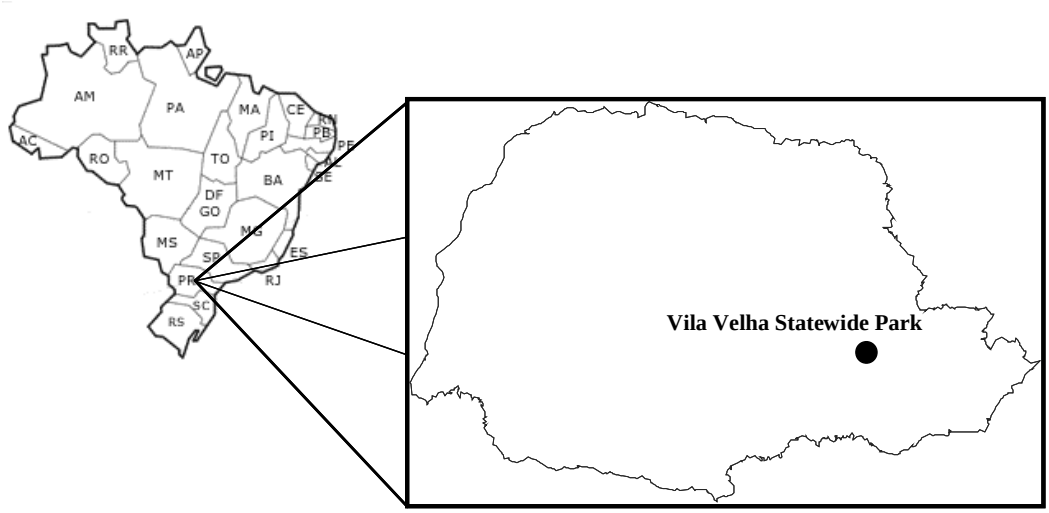

FIGURE 1. Geographic localization of the Vila Velha Statewide Park, Ponta Grossa, state of Paraná, South of Brazil.

Characterization of the karyotypes of *Streptoprocne zonaris* and *Streptoprocne biscutata* reveal variation in diploid number in the order of ±2 chromosomes (Table 1). When these partial karyotypes are compared across species it is possible to observe their extreme likeness although some subtle differences can be also verified: *Streptoprocne biscutata* has one submetacentric pair more than *S. zonaris*, whereas the opposite is true for the acrocentric pairs (Figures 2b and 3b; Table 1). Although our present analysis has no phylogenetic purpose, it is inevitable that an understanding of these differences will have use in the future for further characterization of species within Apodiformes.

TABLE 1. Summary of the karyotypical data known for the Apodidae species. M= metacentrics; SM=submetacentrics; A=acrocentrics.

Species	2n	Partial karyotypical formulae	Reference
Streptoprocne biscutata	±64	4M+4SM+10A	present study
Streptoprocne zonaris	±66	4M+2SM+12A	present study
Apus affini affinis	±70	8M+6SM	Yadav et al. (1995)
Apus pacificus	±62	6M+6SM+8A	Xiaozhuang et al. (1988)
Hirundapus caudacutus	±64	4M+6SM+10A	Xiaozhuang et al. (1988)

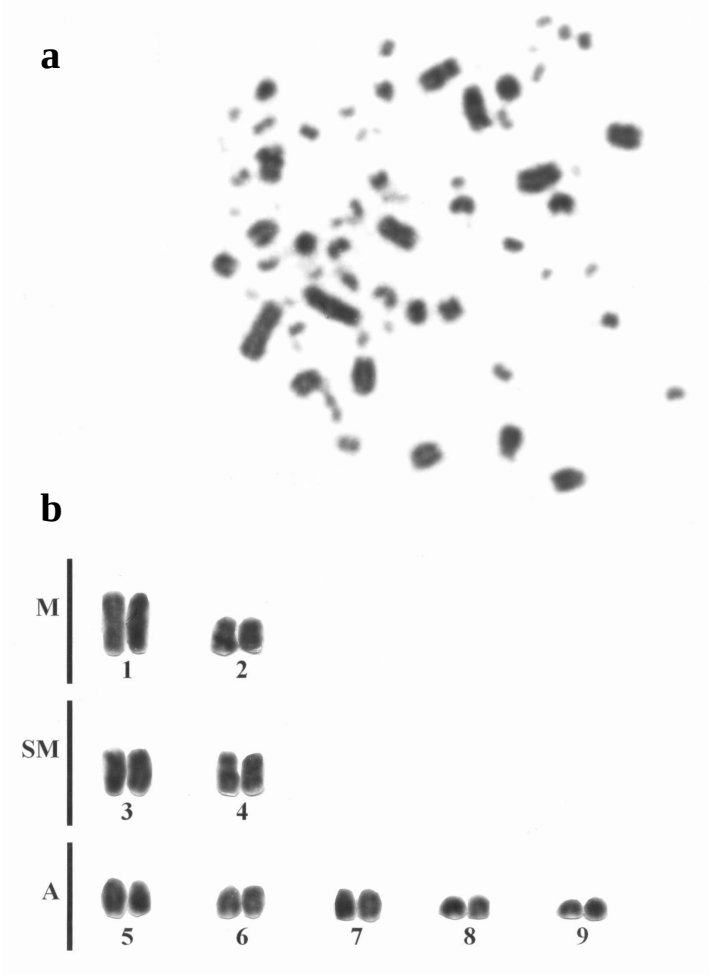

FIGURE 2 – Chromosomes of *Streptoprocne biscutata*. **a.** A mitotic-metaphase showing the macro and microchromosomes. **b.** Partial karyotypical macrostructure.

As a result of our analyses, several hypotheses can be advanced to explain the subtle differences in the karyotypes between the two *Streptoprocne* species.

The first hypothesis, but not necessarily the most probable one given its complexity, would be the occurrence of a pericentric inversion involving acrocentric and submetacentric pairs in both species. The second hypothesis and probably that requiring the least cellular energy, would be the occurrence of a large deletion in the short arm of the minor submetacentric pair of *S. biscutata*, given arise to an acrocentric pair in *S. zonaris*. In addition, the resulting acentric fragments could be confused with microchromosomes, what would determine the variation of ±2 chromosomes found in the diploid numbers of both species.

New chromosomal data for *Streptoprocne biscutata* and *S. zonaris* combined with those described by Xiaozhuang et al. (1988) for *Apus pacificus* and *Hirundapus caudacutus* demonstrate that probably very few chromosomal rearrangements are involved in the differentiation of the karyotypes of these birds. Thus, these data globally analysed seem to suggest a remarkable maintenance of the partial karyotypical macrostructures being these composed by a large number of acrocentric chromosomes followed by submetacentrics and metacentrics (Table 1). In addition, comparing the size of the chromosomes composing the acrocentric and metacentric pairs, it also seems that they are quite similar. In counterpart, differences can be also observed. Thus, the submetacentric chromosomes of *Streptoprocne biscutata* and *S. zonaris* seem to be smaller than those from *Apus pacificus* and *Hirundapus caudacutus* (Xiaozhuang et al., 1988).

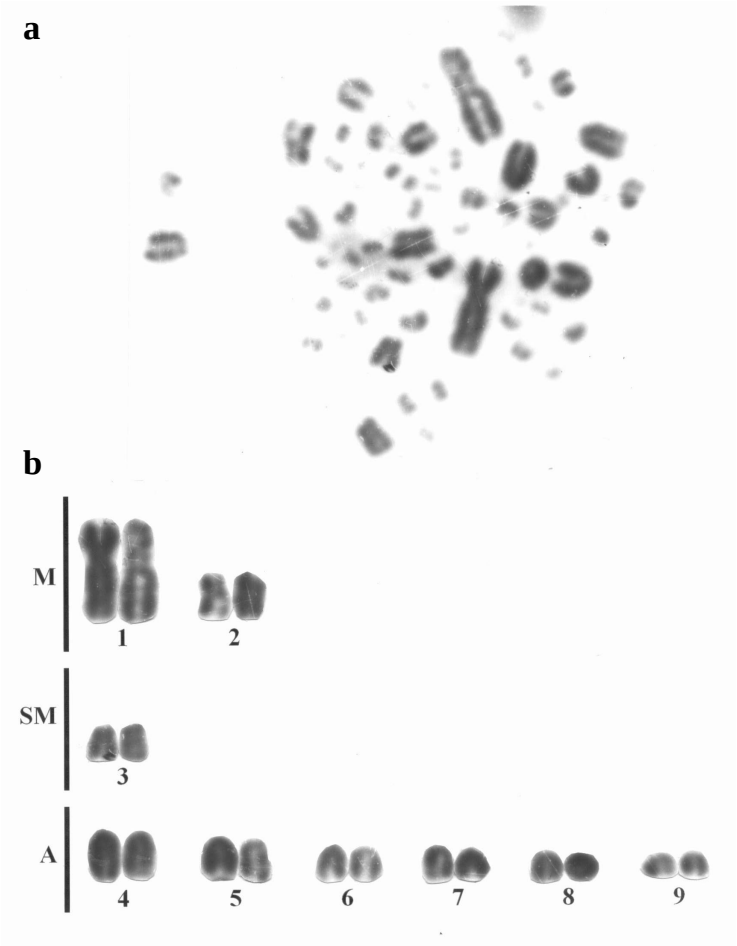

FIGURE 3. Chromosomes of *Streptoprocne zonaris*. **a.** A mitotic-metaphase showing the macro and microchromosomes. **b.** Partial karyotypical macrostructure.

The karyotype data purposed for *Apus affinis affinis* (Yadav et al, 1995) reveal a relative discontinuity as regards to the maintenance of partial karyotypical macrostructures in Apodidae. In general, this species present its partial karyotypical macrostructure composed by just metacentric and submetacentric chromosomes. In addition, these chromosomes seem to be very smaller than those from *Streptoprocne biscutata*, *S. zonaris*, *Hirundapus caudacutus* and *Apus pacificus*. Therefore, these general differences here observed between the karyotypes from *Apus pacificus* and *Apus affinis affinis* seem to suggest that this genus may not be monophyletic, although it makes necessary more resolute studies in the attempt to understand the obscure relationship between the karyotypes from *Apus affinis affinis* and *Apus pacificus* and subsequently with the others Apodidae genera and species.

Finally, the descriptive and comparative analyses made in the present study reinforce the importance of a global species characterization involving morphometric, meristic, etological and genetic characters in the attempt to understand the evolutionary behavior of these through the evolutionary scale and also contributing to the reconnaissance of the diversity of this avian group in the Neotropical region.

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References

Chantler, P. & Dreissens, G. (1995) *Swifts, a Guide to the Swifts and Treeswifts of the World*. Pica Press, Sussex, UK, 137 pp.

Giannoni, M.L., Foresti, F., Falcone, C. & Ferrari I. (1993) An inexpensive method for chromosome preparations from feather pulp in birds, using short term treatment with colchicines in vitro, demonstrated on *Amazona amazonica* (Psittacidae). *Revista Brasileira de Genética*, 16 (2), 477-483.

Levan, A., Fredga, K. & Sandberg, A.A. (1964) Nomenclature for centromeric position on chromosomes. *Hereditas*, 52, 201-220.

Meyer de Schauensee, R. (1982) *A Guide to the Birds of South America*. 2nd ed. Academy of Natural Sciences, Philadelphia, 302pp.

Pichorim, M. (2002) The breeding biology of the biscutate swift (*Streptoprocne biscutata*) in southern Brazil. *Ornitologia Neotropical*, 13, 61-84.

Rocha, G.T., Santos, M.S. & Lucca, E.J. (1996) Cytogenetics of the family Tinamidae (Tinamiformes – Aves). *Brazilian Journal of Genetics*, 19, 3, 110.

Sick, H. (1997) *Ornitologia Brasileira*. Editora Nova Fronteira, Rio de Janeiro, 292 pp.

Bian, X., B., Li, Q & Zhang, H. (1988) *Chromosome Atlas of Birds*. NiaOlei, Ranset Tupu, 238pp.

Yadav, J.S., Arora, R.B. & Yada,v A.S. (1995) Karyotypes of two species of Indian birds and localization of nucleolus organizer regions. *Cytobios*, 82, 159-169.

