CHROMOSOMAL POLYMORPHISM IN SEVERAL POPULATIONS OF DEER (GENUS *MAZAMA)* FROM BRAZIL*

POLIMORFISMO CROMOSÓMICO EN VARIAS POBLACIONES DE CIERVOS (GÉNERO *MAZAMA*) DE BRASIL*

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Additional keywords

Cytogenetic studies. Deer.

Palabras clave adicionales

Estudios citogenéticos. Ciervos.

SUMMARY

The Cervidae are very interesting mammals because of the karyotype variation and the presence of supernumerary chromosomes. The number of chromosomes in this family varies from 2n=6 (female *Muntiacus muntjak vaginalis)* to 2n= 80 *(Cervus porcinus)*. On basis of cytogenetic studies, tandem fusion and Robertsonian fusion, have led the reduction in the number of chromosomes of *M.m. vaginalis* (2n= 6) to *M.m. reevesi* (2n= 46). For the South American deers, a small number of papers on cytogenetic and taxonomy mainly on the genera *Mazama*, are available up to date.

In the present study, the chromosomes of 54 specimens of 5 species of *Mazama* from several region from Brazil and Paraguay, have been karyotyped:

Mazama americana (7 specimens analyzed): 2n= 48 to 53; autosomal polymorphism in a large chromosome. 2 to 6 supernumeraries; FN = 46 to 57.

Mazama gouazoubira (14 specimens analyzed): 2n= 68 to 70; 0 a 3 supernumeraries. FN= 70 Characterized by having all pairs of acrocentric, except two animals with a centric fusion.

Mazama americana X Mazama nana: (2 specimens analyzed). 2n= 45. Three to 4 supernumeraries; FN= 56.

Mazama rondoni (2 specimens analyzed): 2n= 68 to 70. Five to 6 supernumeraries. FN= 72 to.

Mazana bororo (2 specimens analyzed): 2n= 34. Four to 5 supernumeraries. FN= 46.

Mazama nana (28 specimens analyzed): 2n= 36 to 40. One to 7 supernumeraries. FN= 56 to 60 In all of them, the Y chromosome is metacentric and the smallest of the group. The X chromosome is the first or seventh in order of size. The notable chromosome polymorphism in number, probably will be explained in terms of centromeric fusion, fission and tandem fusion, to making use of banding techniques.

RESUMEN

Los Cérvidos son mamíferos muy interesantes a causa de la variación cariotípica y la presencia de cromosomas supernumerarios. El número de

*Supported by: FAPESP, FAPEMIG, CNPq - Brazilian Research Grant's

cromosomas en esta familia varía desde 2n= 6 (hembra de *Muntiacus muntjak vaginalis)* hasta 2n= 80 (*Cervus porcinus*). Los estudios citogenéticos han revelado que la fusión en tándem y la fusión Robertsoniana han llevado a la reducción en el número de cromosomas de *M.m. vaginalis* (2n= 6) a partir de *M.m. reevesi* (2n= 46). En el caso de los ciervos sudamericanos, una reducida bibliografía sobre la citogenética y la taxonomía, sobre todo del género *Mazama,* está disponible en la actualidad.

En este estudio, se cariotiparon 54 especímenes de 5 especies del género *Mazama* procedentes de diversas regiones de Brasil y Paraguay.

Mazama americana (7 especímenes analizados): 2n= 48 hasta 53; polimorfismo autosómico en un cromosoma grande. De 2 a 6 supernumerarios; FN= 46 a 57.

Mazama gouazoubira (14 especímenes analizados): 2n= 68 hasta 70; de 0 a 3 supernumerarios. FN= 70. Caracterizados por tener todos los pares acrocéntricos, excepto dos animales con una fusión céntrica.

Mazama americana X Mazama nana: (2 especímenes analizados). 2n= 45. Entre 3 y 4 supernumerarios; FN= 56.

Mazama rondoni (2 especímenes analizados): 2n= 68 hasta 70. De 5 a 6 supernumerarios. FN= 72.

Mazama bororo (2 especímenes analizados): 2n= 34. De 4 a 5 supernumerarios. FN= 46.

Mazama nana (28 especímenes analizados): 2n= 36 hasta 40. De 1 a 7 supernumerarios. FN= 56 hasta 60. En todos ellos, el cromosoma Y es metacéntrico y el más pequeño del grupo. El cromosoma X es el primero o el séptimo en orden de tamaño. El notable polimorfismo cromosómico en número, probablemente pueda explicarse, haciendo uso de las técnicas de bandeo cromosómico en términos de fusión centromérica, fisión y fusión en tándem.

INTRODUCTION

The family Cervidae is suitable for cytogenetic investigation by the extensive variation in the chromosome number and the presence of supernumerary chromosomes. For the south american deer, specially the genus *Mazama,* there are a few published reports on cytogenetics, and still remain numerous questions over cytotaxonomy of that group of animals. On the taxonomy view, there is a controversy among the species described by Allen (1915) and Ribeiro (1919). Czernay (1987) considered the species *M. americana, M. nana, M. rufna, M. bricenii* and *M. chunyi* for the south american *Mazama.* Cabrera (1960) suggests a phylogenetic classification for south american mazamas as: *M. americana, M. chunyi, M. gouazoubira* and

Table I. *Review of chromosome findings in the species* Mazama americana. (Revisión de los hallazgos cromosómicos en la especie *Mazama americana*).

Origen	2N	Bs	NF	Reference
?	68	-	74	Taylor *et al.* 1969
México	49/50	-	71/72	Jorge and Benirscke, 1977
Paraguay	52	5	56	Neitzel, 1987
Brazil	48 to 54	2 to 6	54/56	Duarte, 1992
Brazil	44 to 53	2 to 6	48 to 57	Present paper

2n = diploid number; Bs = B chromosomes; NF = fundamental number

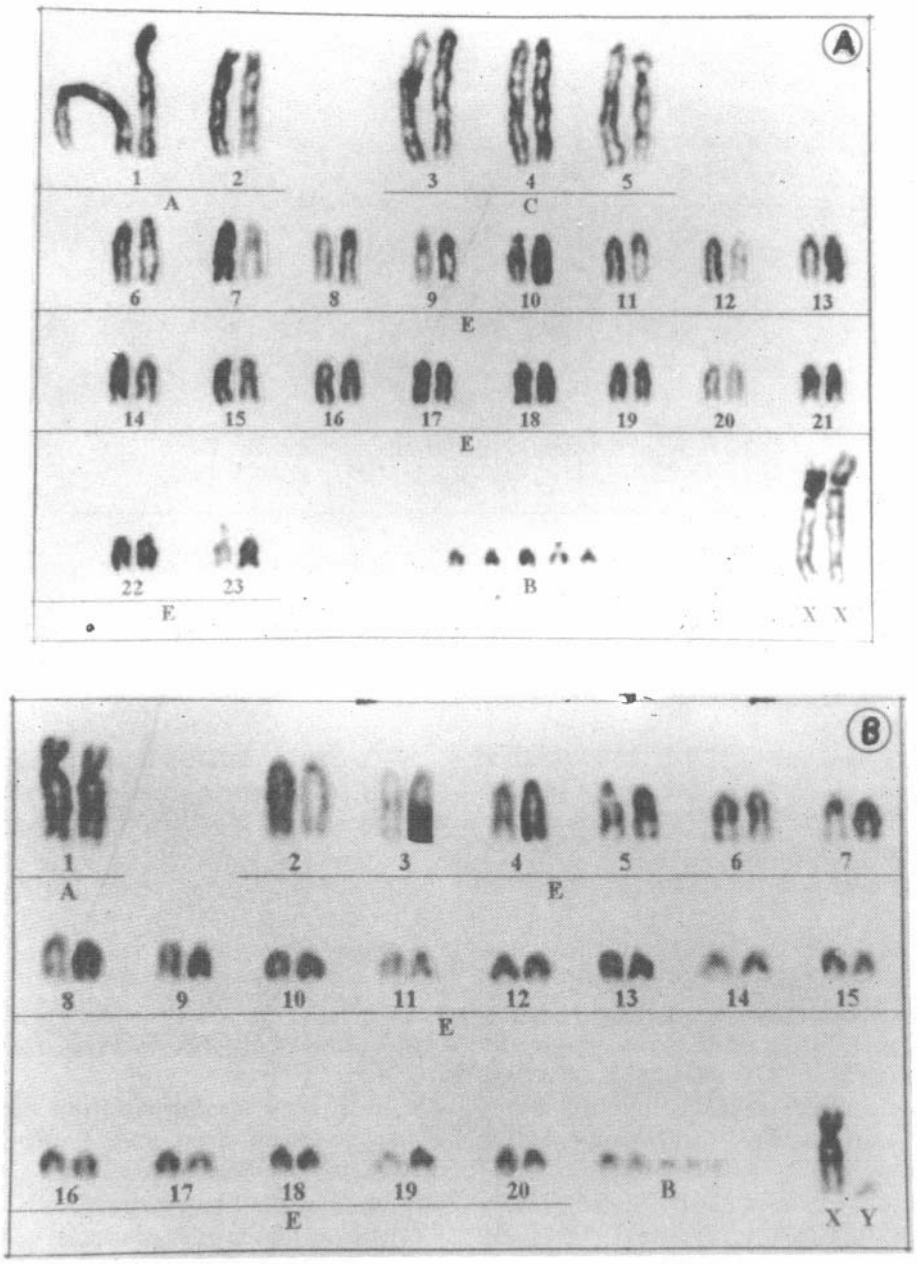

***Figure 1**. Karyotype of two specimens (A and B) of* Mazama americana. *Other seven different types of karyotype were found.* (Cariotipo de dos especímenes (A y B) de *Mazama americana*. Otros siete diferentes tipos de cariotipo fueron hallados).

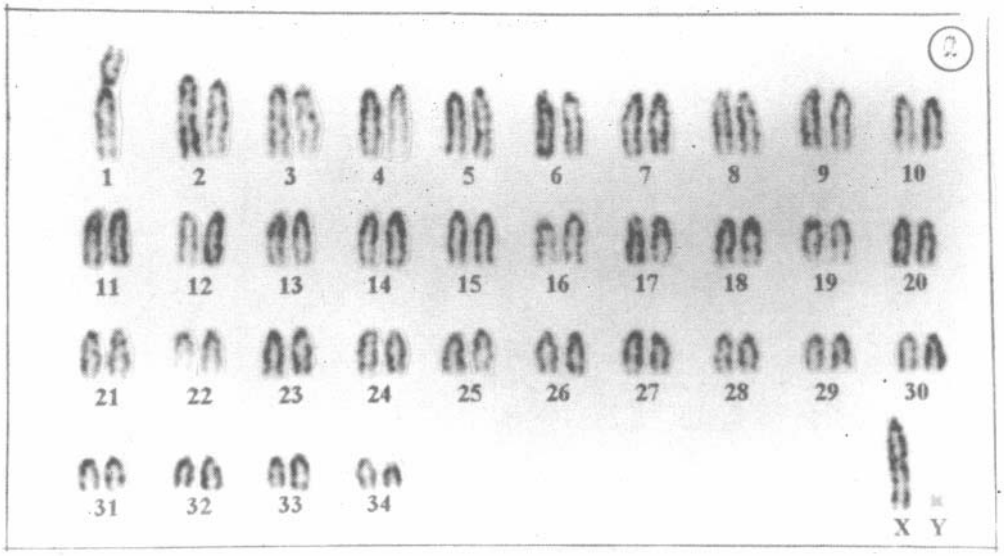

Figure 2. *Karyotype of* Mazama gouzoubira *characterized by NF = 70 (2n = 69). Note the presence of a metacentric chromosome, probably caused by centric fusion.* (Cariotipo de *Mazama gouzoubira* caracterizado por NF = 70 (2n = 69). Obsérvese la presencia de un cromosoma metacéntrico probablemente causado por una fusión céntrica).

M. rufina. Duarte (1992) describes another species *M. bororo,* from state of Sao Paulo (Mata Atlantica), Brazil. Other karyotype varieties suggest the existence of greater number of species in South America.

Also, the cytogenetic of the genus *Mazama* remains unresolved. Thus, *Mazama americana* described by several authors (Taylor *et al.,* 1969, Jorge and Benirscke, 1977, Neitzel, 1987 and Duarte, 1992), reveal a diploid number varying between 49 to 68 chromosomes. The chromosome number of *M. gouzoubira* described by Neitzel (1987) is 2n=70. However, Duarte (1992) found specimen carriers of the centric fusion and B chromosomes. Additionally, the group of *M. nana* with 2n=35, and four B chromosomes.

From this information and controversy, the present paper intends to analyse the most of the specimens from the genus *Mazama,* in order to investigate the chromosome polymorphism and the role chromosomal rearrangements in karyotype evolution.

MATERIALS AND METHODS

Fifty four specimens from natural reserve population and Zoological Gardens from Brazil and Paraguay were used. Excursions or expeditions were organized making use of special vehicle to travel to Amazonia (state of Para), lowlands in the state of Mato Grosso, state of Sao Paulo, Minas Gerais, Santa Catarina and Paraná (Brazil), in order of

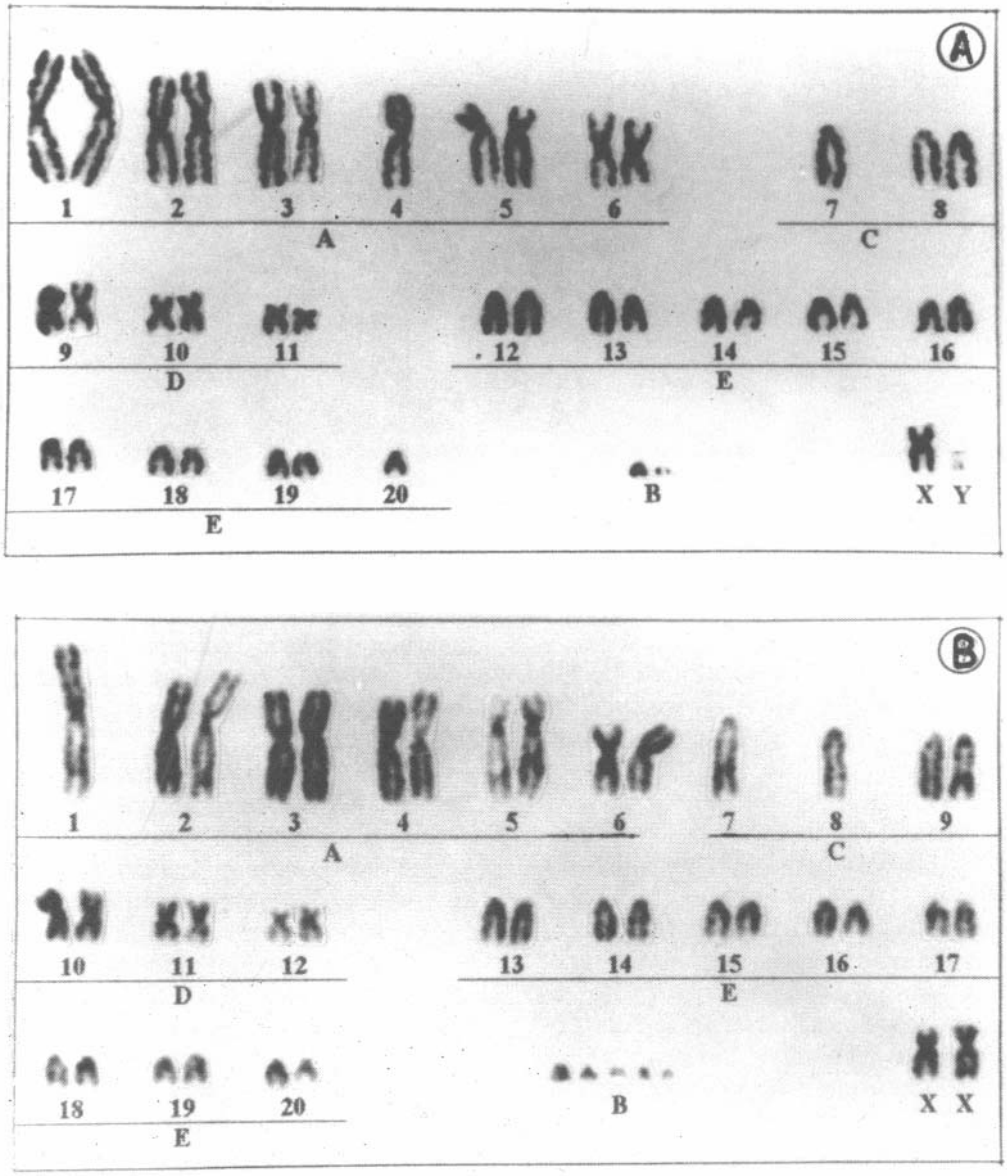

Figure 3. *Kariotypes of two specimens (A and B) of* Manama nana *showing the chromosomes unpaired, characteristic of this species.* (Cariotipos de dos especímenes (A y B) de *Manama nana* mostrando los cromosomas desparejados característicos de esta especie).

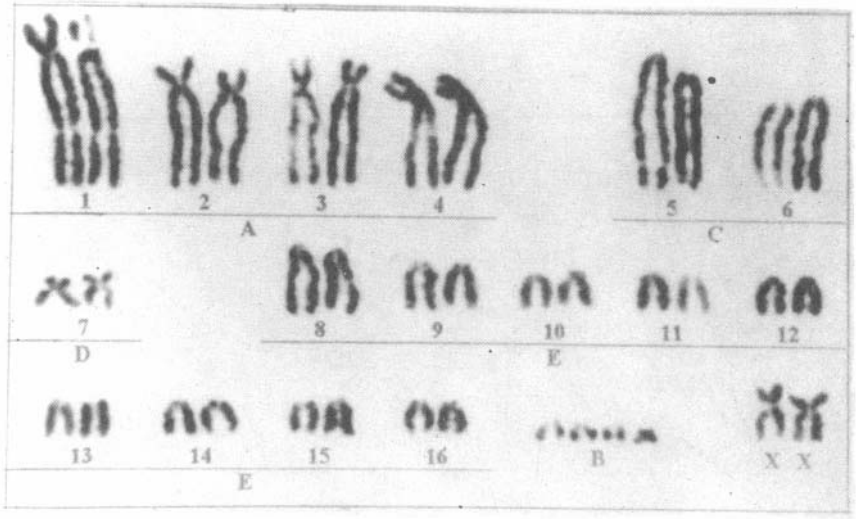

Figure 4. *Karyotype of female* Mazama bororo. (Cariotipo de hembra de *Mazama bororo*).

collect blood, skin biopsies and morphological data, as weight, body measurements, etc.

Heparinized peripheral blood drawn from jugular vein was cultured for 72h following the usual procedure by Moorhead *et al.* (1960) with modifications.

RESULTS AND DISCUSSION

It was the aim of this first part of this work to karyotype the most specimens of the genus *Mazama,* in order to characterize each species in terms of chromosome number and morphology. The 52 specimens of species karyotyped are:

M. americana (8 specimens analysed); 2n= 48 to 53; autosomal polymorphism in the large chromosomes **(table I** and **figure 1)**;

M. gouazoubira (14 specimens analysed); 2n= 70. Characterized by having all pairs of acrocentric, except two animals with a centric fusion. One to 3 supernumeraries in 3 animals **(figure 2)**;

M. bororo (2 specimens analysed); 2n=34. Four to 5 supernumeraries **(figure 3)**;

M. nana (28 specimens analysed); 2n=35 to 40. One to 6 supernumeraries **(figure 4)**.

Our results on *M. americana* **(figure 1)** show a variable karyotype, also with different number of B chromosomes. As pointed out by several authors, Taylor (1969); Jorge and Benirscke (1977); Neitzel (1987) and Duarte (1992), the polymorphism which characterize the Cervidae, have been observed in *M. americana.* Besides the material has been collected from far way places such as south of Brazil, Paraguay and Amazonia, we may not discard the possibility of mixed form in the populations. The questions is if those differences would be

related with different species.

M. gouazoubira can be identified by NF= 70 (all chromosomes are acrocentric) in most of 14 animals. In some of them the reduction of chromosome number has been apparently caused by centric fusion **(figure 2)**. The pattern of chromosomal rearrangements as well as the presence of B chromosomes point out the origen of supernumeraries as centromeric fragments from chromosome breakage.

The twenty nine specimens of *Mazama nana,* the karyotype varied from 2n= 36 to 2n= 40 and the presence of supernumeraries **(figure 4)**. This notable polimorphism with unpaired large chromosomes may be atributable to hybridization happened in the Zoological Gardens, considering that most of *M. nana* were born in captivity. Inquirement on the fertility and the origin of this great karyotype variability, would be useful in further studies.

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