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Occurrence of sexual chromosome, of the type ZZ/ZW, in *Ancistrus* cf. *dubius* (Loricariidae, Ancistrinae) of the Paraguay River Basin, Mato Grosso, Brazil

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Abstract — Fifteen specimens of *Ancistrus* cf. *dubius* of the Paraguay River Basin (Serra das Araras /Barra dos Bugres, Mato Grosso state, Brazil) were studied cytogenetically with characterization and of constitutive heterochromatin and nucleolar organizer regions (NORs) evidenced by C-bands, flurochrome GC-rich DA/CMA_3 and silver-staining. For the first time, chromosomic heteromosphism related to sex, of the type ZZ/ZW, was observed in Ancistrinae fish. Thus, in the karyotype of males a pair of Z acrocentric chromosomes, represented by a single component in the females karyotypes, was verified. However, the latter presents an exclusive W acrocentric chromosome. The karyotype formula (18M+10SM+16ST/A in males and in females) and diploid number (2n=44), verified here increases the variation of the diploid chromosome number in Ancistrinae to 2n=44 to 2n=52. These results are discussed in relation to karyotipic evolutionary tendencies for the Loricariidae family.

Key Words: Ancistrinae, karyotype, Loricariidae, sex chromosomes.

INTRODUCTION

The Loricariidae, which are endemic in the Neotropical region and commonly known as catfishes, occupy the second place in number of species of the Teleostei fish. According to ISBRUCKER (1980) about 600 species have already been described and they are distributed between 70 genera, 6 subfamilies (Lithogeninae, Neoplecostominae, Loricariinae, Hypoptopomatinae, Ancistrinae and Hypostominae). These fish are widely distributed in the Neotropical region and occupy many varied habitats thus demonstrating a large capacity for adaptation in opposition to phylogeny classification that is not solved.

The subfamily Ancistrinae has been little studied in relation to the karyotipic structure, presenting until now a range of diploid number from 2n=38 to 52 chromosomes (ALVES *et al.* 2003). There is no report of differentiated sexual chromosome morphology for the Ancistrinae species until the present study.

Despite the number of species that has been karotyped is relatively low, compared to the biological diversity of the Loricariidae, there are few examples of sexual chromosome systems reported in these fish. However, heteromorphic chromosomes of the type XX/XY or ZZ/ZW occur in species of different subfamilies, as in Hypostominae, Hypoptopomatinae and Loricariinae (ARTONI and BERTOLLO 2001).

Therefore, this study presents data which show an increase of the variability of diploid number among the Ancistrinae and describes the presence of a system of sexual chromosomes of the type ZZ/ZW which is discussed in comparison to other species of Loricariidae that present sexual chromosomes.

MATERIALS AND METHODS

Fifteen specimens (7 male and 8 female) of *Ancistrus* cf. *dubius* (Loricariidae, Ancistrinae) were collected in streams of the Serra das Araras, nearly Pousada Currupira, belonging to the Paraguai River watershed in Barra dos Bugres, Mato Grosso state, Brazil, were cytogenetically studied.

The chromosome preparations were obtained by the air drying method that was adapted for fish by BERTOLLO *et al.* (1978). The constitutive heterocromatin C-band was detected according to SUMNER

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(1972) and the nucleolar organizer region (NORs) were detected by impregnation with silver nitrate (HOWELL and BLACK 1980). Regions rich in GC bases were identified by staining with the fluorochrome chromomicina A_3 according to SCHWEIZER (1976). The chromosome were organized in three karyotype group (metacentric, submetacentric and subtelo/acrocentric) and put in decreasing order of size according to criteria previously adapted for this group of fish (ARTONI AND BERTOLLO 1996).

RESULTS AND DISCUSSION

The Ancistrinae subfamily is still little studied in relation to its karyotipic structure (ARTONI and BERTOLLO 2001). The karyotype of *Ancistrus* cf. *dubius* (2n= 44, 18M+10SM+16ST/A in males and females) is now described for the first time, thus showing increase the diploid number variation in the subfamily (Figure 1). The distribution of constitutive heterocromatin is basically pericentromeric in few chromosomes of the complement, with the exception of chromosome Z witch presents a large heterocromatic block on its long arm, while the nucleolus organizer regions (NORs) are the only regions witch fluoresce when stained with A_3 chromomycina, occupying practically all the short arm of a pair of submetacentric chromosomes, showing a probable chromosome heteromorphism between female and male (Figure 2).

The Ancistrinae, despite little information about its chromosomes, are presented little conserved in relation to karyotipic structure. Between other Loricariidae such as the Hypostominae, distinct groups also show different tendencies of karyotipic evolution. For example, the genus *Hypostomus* presents a wide variation of the chromosome number (2n=52 to 80) accompanied by a large variability in the chromosome formula (ARTONI and BERTOLLO 2001). On the other hand in the subfamily Hypoptopomatinae a divergent situation is verified in which the tendency is to maintain the chromosome number 2n=54 is spite of variation in relation to location of the NORs standards of C-bands, chromosomal morphology and presence of supernumerary and sexual chromosome (ANDREATA *et al*. 1992, 1993, 1994). Taking this into account, it is a fact that the Loricariidae are marked by events of karyotipic evolution that to a smaller of larger degree altered the karotipic and chromosomal structures of the species.

A comparative analysis of the karyotype of the male and female of *Ancistrus* cf. *dubius* indicates heteromorphism associated with sex, where the female represent the heterogametic sex in a sexual chromosome system of ZZ/ZW. The chromosome Z and W belong to the acrocentric class. The chromosome Z, easily identified by a large block of heterochromatin on the long arm, is a relatively larger in size than the characteristic euchromatic W chromosome, and possibly the smallest of the acrocentric chromosomes.

In Neotropical fish which presents sexual chromosomes differentiated morphologically, the most possible hypothesis to explain this differentiation is the accumulation of constitutive heterochromatin followed by other structural events, as in *Leporinus* (GALETTI *et al.* 1992, 1993). Structural arrangements, on the other hand, are more related to multiple systems of sexual chromosomes, as in *Apareiodon* (MOREIRA-FILHO *et al.* 1980, 1993), *Eignmania* (ALMEIDA-TOLEDO *et al.* 1984), and *Hoplias* (BERTOLLO *et al.* 1997). In *Ancistrus* cf. *dubius* the accumulation of heterochromatin on the Z chromosome and loss of this heterochromatic segment on the W chromosome must have occurred in a way that in the current situation of the W chromosome conserved only the homologous euchromatic region of the euchromatic segment of the Z chromosome. Other catfish show a similar situation that is uncommon among fish species with ZZ/ZW sexual chromosome systems, as in *Loricariichthys platymetopon* (SCAVONE and JULIO JR. 1995), and *Hypostomus* sp (ARTONI *et al.* 1998), where a structural event seems to have played an important step in the differentiation of these sexual chromosomes.

Like, the majority of Neotropical fish that do not presents sexual chromosome morphological differentiation (MOREIRA-FILHO *et al.* 1993) the catfish of the family Loricariidae also are in the majority homomorphitic in relation to the presence of sexual chromosomes in the species analyzed about this aspect until now (ARTONI and BERTOLLO, 2001). Even although different species, genera and subfamilies of the Loricariidae show sexual chromosomes as a result of recurrent events or even in a permanent way, in some cases, this does not reflect an exclusive synapomorphism for the group since they are not in the phylogenic base of the family. In birds and mammals the ZW and XY sexual chromosomes are respectively characteristics of plesiomorphic ancesters for diversification of these groups (ANSARI *et al.* 1988; GRAVES 1987).

The Ancistrinae constitutive a large group of monophiletic species and the presence of sexual Chromosomes must have an important citotaxonomic role in the identification of these species as well as helping the philogenetic analysis the group.

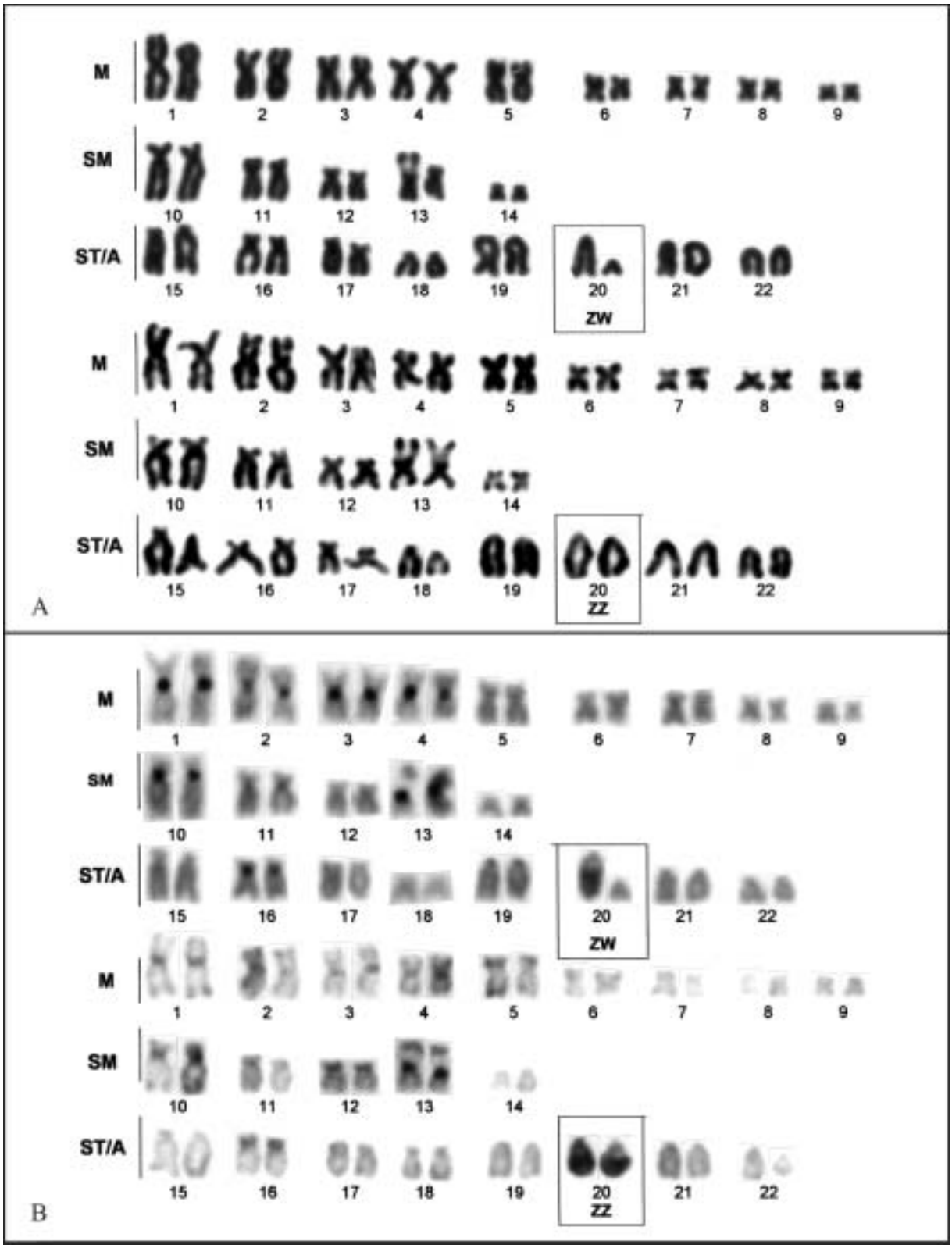

Fig. 1 — Karyotype of female and male of *Ancistrus* cf. *dubius,* respectively, are showing the sex chromosome in the boxes. (**A**) Stained with Giemsa. (**B**) C-banded, showing heterochromatic block on the sex chromosomes.

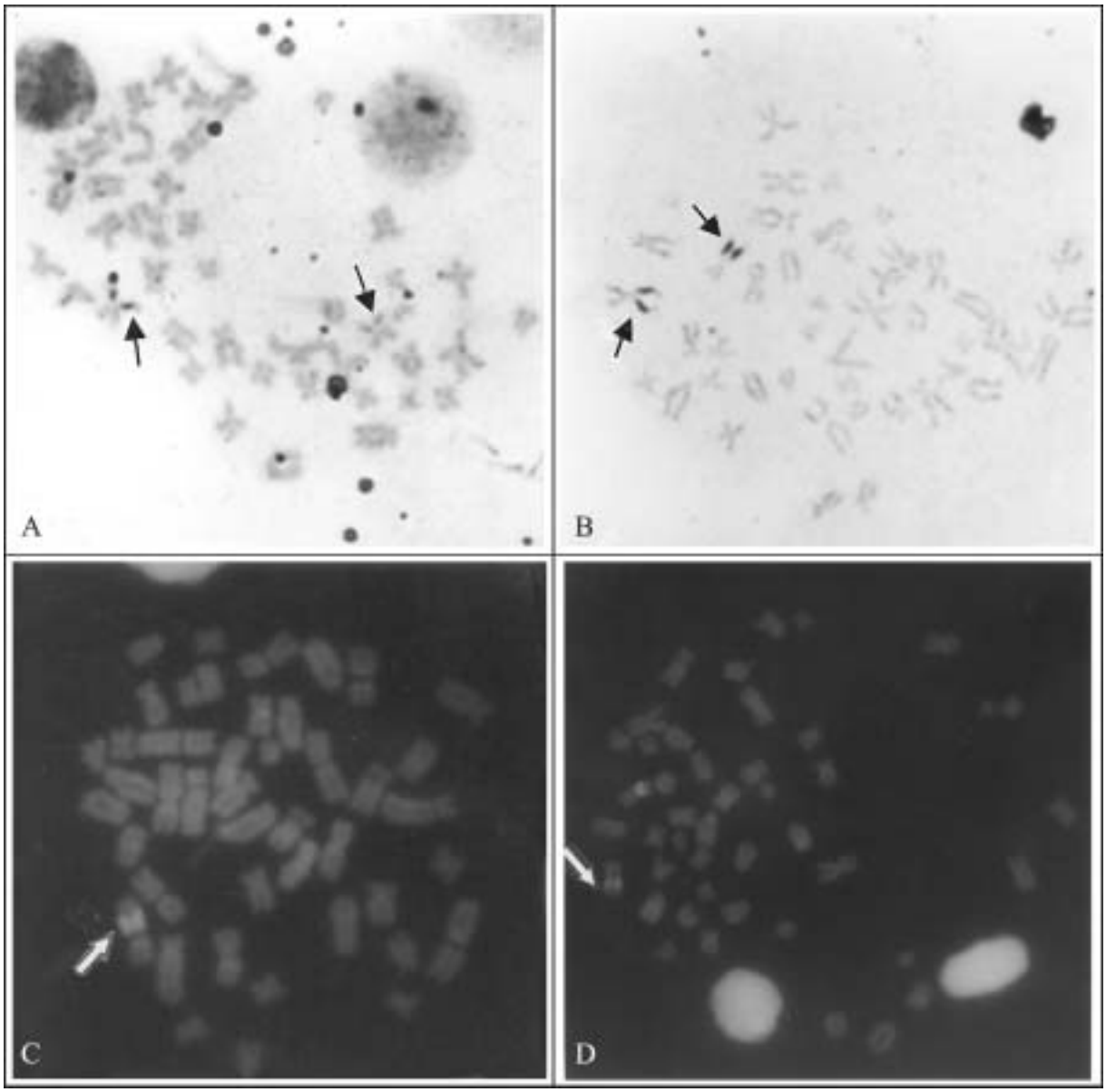

Fig. 2 — Female and male metaphases, respectively, of *Ancistrus* cf *dubius*. A and B showing the nucleolus organizer regions, impregnation with silver nitrate. C and D with A_3 chromomycin„ evidencing probable NORs polymorphism.

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