Genetics and Molecular Biology, 29, 4, 653-655 (2006)

www.sbg.org.br

Short communication

Evidence of an XX/XY sex chromosome system in the fish *Dormitator maculatus* (Teleostei, Eleotrididae)

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Abstract

The fish *Dormitator maculatus* has a chromosomes number of 2n = 46, females having a karyotype of 14 M, 28 SM, 2 ST and 2A and males 13 M, 28 SM, 3 ST and 2A. The presence of a heteromorphic pair in the males and a corresponding homomorphic pair in the females suggest the occurrence of an XX/XY sex chromosome system in *D. maculatus*. The putative X chromosome has a pericentromeric C-band positive segment and the putative Y chromosome a C-band positive short arm.

Key words: fish cytogenetics, karyotypes, Ag-NORs, C-band, sex chromosomes.

Received: June 22, 2005; Accepted: March 15, 2006.

Although only about 10% of karyotyped fish display differentiated sex chromosomes, seven systems involving male heterogamety (XY, X0 and X_1X_2Y), female heterogamety (ZW, Z0 and ZW_1W_2) and an unusual WXZ system in the platyfish have been described (Devlin and Nagahama, 2002). The ZZ/ZW system is the most common sex chromosome system and the XX/X0 (ten species) and ZZ/Z0 (three species) systems, are the most rare (Devlin and Nagahama, 2002). Cytogenetic differences detected between sex chromosomes include: additions or deletions of C-band positive segments (Phillips and Ihssen, 1985; Andreata *et al*., 1992, 1993; Cano *et al*., 1996; Stein *et al*., 2001), reductions in chromosome size (Park and Kang, 1979), increases in chromosome size (Galetti *et al*., 1981) and chromosome rearrangements (Uyeno and Miller, 1971; Thorgaard, 1978; Bertollo *et al*., 1983; Almeida Toledo *et al*., 1984; Pezold, 1984; Vitturi *et al*., 1991).

The family Eleotrididae is comprised of about 35 genera and 150 species inhabiting tropical and subtropical areas worldwide (Nelson, 1994). Fish of this family are mainly marine but some species live in brackish and freshwater (Nelson, 1994). The subfamily Eleotridinae is represented in the Neotropical region by six genera, including the genus *Dormitator* (Kullander, 2003). The present paper describes the karyotypes, nucleolus organizer regions (NORs) and distribution of C-band positive segments of *Dormitator maculatus* and reports the occurrence of a putative case of an XX/XY sex chromosome system in this species.

Seven males and five females *Dormitator maculatus* from the Itinga River, Mongaguá, São Paulo state, Brazil were karyotyped. Mitotic chromosome preparations were obtained from kidney and gill tissues using the air-drying technique of Bertollo *et al*. (1978). Chromosome morphology was determined on the basis of arm ratio, as proposed by Levan *et al*. (1964) and chromosomes were classified as metacentric (M), submetacentric (SM), subtelocentric (ST) or acrocentric (A). Silver staining of nucleolar organizer regions (Ag-NORs) followed the technique proposed by Howell and Black (1980) and C-banding was performed as described by Sumner (1972).

We found a *D. maculatus* chromosome number of 2n = 46, with females having a karyotype of 14 M, 28 SM, 2 ST and 2A (Figure 1a) and males 13 M, 28 SM, 3 ST and 2A (Figure 1b). The silver staining of the chromosomes revealed that the Ag-NORs were terminally located on the short arms of a larger SM pair (pair 10) (Figure 1a). Several faintly stained C-band positive segments were visible on many autosomes, mainly at the centromeric or pericentromeric position and distributed over the short arms of some chromosomes (Figure 2). The putative X chromosome had a pericentromeric C-band positive segment (Figure 2a) and

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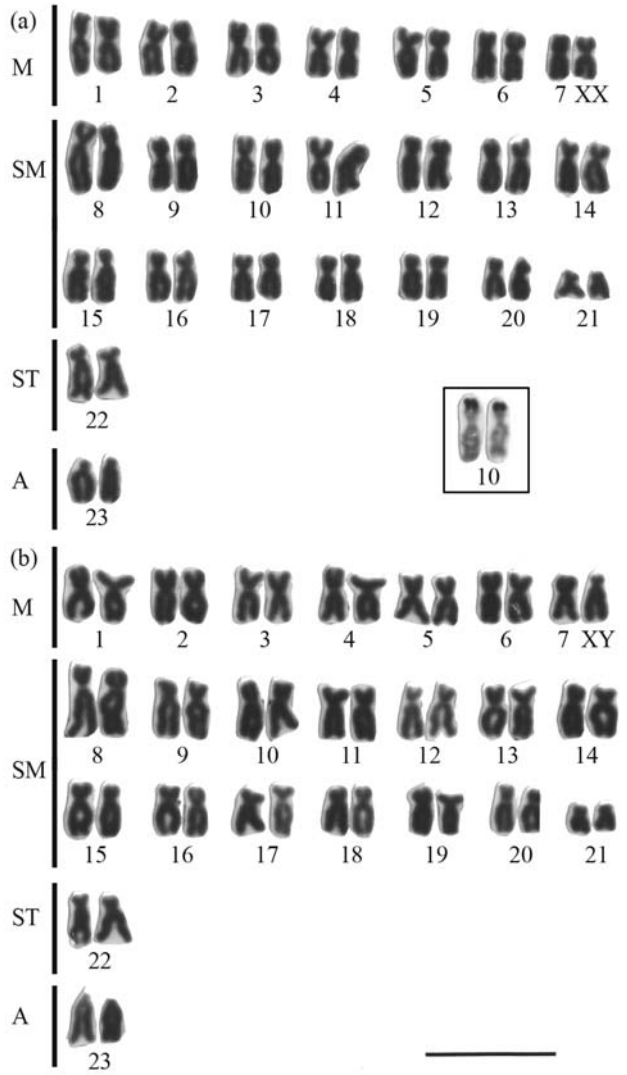

Figure 1 - Giemsa stained karyotypes of *Dormitator maculatus*. (a) Female; (b) Male. The Ag-NOR-bearing chromosome pair is shone in the in-

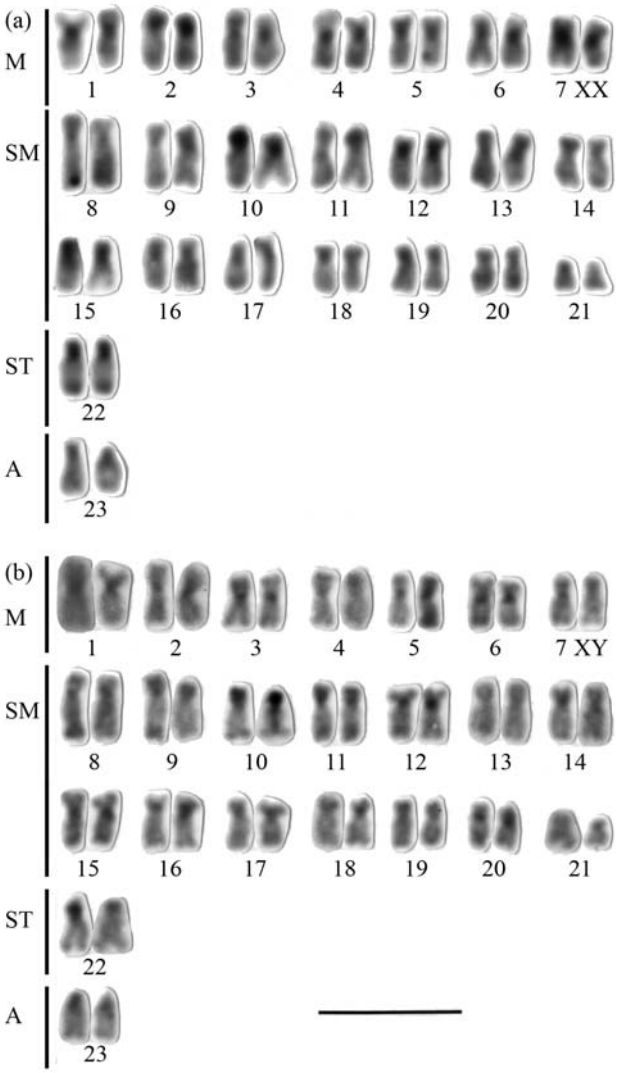

Figure 2 - C-banded karyotypes of *Dormitator maculatus*. (a) Female; (b) Male. Bar = 10 μm.

the putative Y chromosome a heterochromatic short arm (Figure 2b).

Cytogenetic studies conducted in eleven species of Eleotrididae show that the diploid number ranges from 2n = 44 to 48 among ten species investigated (Klinkhardt *et al*., 1995). However, Nogusa (1955) reported the occurrence of 2n = 62 chromosomes in the Eleotrididae species *Mogrunda obscura*. An interesting characteristic of the members of Eleotrididae is the common occurrence of many uniarmed chromosomes, thus differing from the karyotype of *Dormitator maculatus* that has mainly biarmed chromosomes. A recent cytogenetic investigation of specimens of *Awaous strigatus* (Eleotrididae) from Belém (Pará state, Brazil) suggested the occurrence of an X_1X_2Y sex chromosome system in this species (I.L. Souza, personal communication).

The presence of a heteromorphic pair in the males and a corresponding homomorphic pair in the female *D. maculatus* suggest the occurrence of an XX/XY sex chromosome system in this species. The morphological difference observed between the homologues chromosomes of the heteromorphic pair was probably due to the occurrence of a pericentric inversion, changing a primitive M chromosome from a homomorphic pair to an ST chromosome. Ohno (1974) considered the occurrence of a chromosome inversion to be the first step in the evolution of sex chromosomes, and recent studies have shown that this type of chromosome rearrangement is very important (if not the most important) rearrangement in species evolution (Livingstone and Riesenberg, 2003; Navarro and Barton 2003). Further studies including additional chromosome banding techniques will be very useful to confirm the presence of an XX/XY sex chromosome system in *Dormitator maculatus*.

Acknowledgments

The authors are grateful to Dr. J.L. Figueiredo for the taxonomic identification of the specimens. The Brazilian agencies FAPESP and CNPq provided funds to support this study.

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Associate Editor: Yatiyo Yonenaga-Yassuda