CHROMOSOMAL ANALYSIS IN A FISH STOCK OF TILAPIA (PISCES: PERCIFORMES: CICHLIDAE)

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Abstract

Were studied specimens of *Oreochromis niloticus* from the Fish breeding Section of the Marilia University (São Paulo State, Brazil). Mitotic chromosome preparations (conventionally and Ag NOR stained) were carried out in the Animal Genetics Lab at Marília University between August 17th 1999 and August 24th 2000. The analysed specimens showed 2n=44 chromosomes organized in the karyotypical formulae of 2M+2SM+16ST+24A. NORs were located in the short arms of the 7th and 15th pairs. Were not observed chromosomal heteromorphisms related to the sexual determination. The results are in accordance with the previous karyotype description of O. niloticus.

Keywords: Cytogenetic; Ichthyology; Perciformes; Oreochromis niloticus.

Resumo

Foram estudados espécimens de *Oreochromis niloticus*, oriundos do Setor de Piscicultura da Universidade de Marília. As preparações cromossômicas foram conduzidas no Laboratório de Genética Animal da Faculdade de Ciências Agrárias entre o período de 17 de agosto de 1999 e 24 de agosto de 2000. Tais procedimentos foram estabelecidos com base nos protocolos de obtenção de cromossomos mitótico-metafásicos em peixes e na identificação das regiões organizadoras de nucléolo (NORs). A amostra foi caracterizada pela presença de 2n=44 cromossomos que são organizados na fórmula cariotípica de 2M+2SM+16ST+24A. As NORs foram identificadas nos braços curtos dos 7.º e 15.º pares. Não foram observados heteromorfismos cromossômicos relacionados à determinação sexual, tal como aqueles que estão presentes em outras famílias de peixes. Os resultados obtidos estão em concordância com as descrições cariotípicas prévias das espécies de peixe aqui estudadas.

Palavras-chave: Citogenética; Ictiologia; Perciformes; Oreochromis niloticus.

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Introduction

The fish cytogenetic studies have contributes in a significant way to a better understanding of the genetic, evolutive and systematic problems of this fish group (OZOUF-COSTAZ & FORESTI, 1992).The fact that the fishes have a basal position at the vertebrate phylogeny, performing a half of this group (NELSON,1994), occupe wide-range habitats and present a series of chromosome peculiarities, makes them a quite favorable material for studies on genetics and evolution.

The freshwater fish fauna is quite rich, but there is on complete survey available for genetic-quantitative studies (MENEZES, 1996). In South America there are around 2200 species distributed in 29 families, 36 subfamilies and 523 genera belonging to the Ostariophysi superorder (GILBERT, 1976; MENEZES, 1996)

Due to favorable environmental conditions, large species diversity and the need of food production, fishex have been a source of alternative protein , of low productive cost and consumption as well.

Based on what was aforementioned, it is evident the need of chromosome studies on the exotic and Brazilian fish species that are widely used in the fish breeding programs.

Due to its high productive potential and its adaptation ability to different environmental conditions, the Tilapia species, more specifically *Oreochromis niloticus* has been widely cultivated in several regions of the world and also in Brazil.

The purpose of the present work was to evaluate the karyotypical constitution of the *Oreochromis niloticus* fish stock normally produced at the Fish breeding Section of the Marília University (São Paulo State, Brazil).

Material and methods

This study was carried out in the Animal Genetics Lab at de Marília University between August 17th 1999 and August 24th 2000. The *O. niloticus* specimens were previously injected with an yeast solution to improve the mitotic index (COLE & LEAVENS,1971)

Mitotic – metaphase chromosomes were obtained by the procedures suggested by FORESTI *et al.* (1993).

After performed the chromosome spreads and staining, 176 metaphases from 16 individuals were analyzed by optical microscopy at imersion (100 times)

The nucleolar organizer regions (NORs) were detected following the protocol of HOWEL & BLACK (1980).

The karyotype organization was performed through the arms relation index according to LEVAN et al. (1964).

Results

The analysis of 176 metaphases of O. niloticus showed that 98.86 % of them had 2n = 44 chromosomes organized in a karyotypical formulae of 2 metacentrics, 2 submetacentrics, 16 sebtelocentrics and 24 acrocentrics (2M+SM+16ST+24A – Figure 1).

The nucleolar organizer regions (NORs) were detected at the terminal portion of the shorts arms of the 7th and 15th pairs (Figure 1 in detail).

Discussion

The cytogenetic studies related to the fish species with some zootechnical potential are still rare. One of the main applications for such studies would be the establishment of an idea about the karyotypical constitutions of the parental generation by the analysis of the chromosomal sets from their progeny.

According to OZOUF-COSTAZ & FORESTI (1992), these considerations corroborate to the idea of the need to characterize, by the karyotypical and other genetic markers, natural populations or species that are interesting for fish breeding programs.

The usefulness of the chromosomal studies for characterizing the parental chromosomal sets, is to identify the possible origins of abnormal progeny development, by means of the result of a normal breeding or by means of the production process interspecific hybrid species (ARAI, 1984).

However, hybridization experiments in the fish breeding programs linked to a consistent chromosomal analysis are considered as being rare (ALMEIDA – TOLEDO et al., 1987 ; KHASAMA & KOBAYASHI , 1990)

Considering what was aforementioned, the observed results in the present investigation suggest the probable existence of an uniformity related to the karyotype constitution of this sample of *Oreochromis niloticus*.

Based on the results, it is suggested that favorable abiotic conditions are maintained. The identification, at the chromosome number (2n) and/or at them structure of any aberrations, suggests the probable maintenance of the meiotic and mitotic homeostasis in the parental generation and in the zygote phase of the progeny, respectively, probably due to the existence of favorable environmental conditions direcly related to the success in the production.

Such inference seems to be coherent, since the identification of chromosome aberrations, be them related to the diploid number or to the structure of the chromosomes shows or suggests the probable origin of the productive losses.

OLIVEIRA et al. (1996), studying a cultivated sample of *Oncorrhynchus mykiss* (Rainbow trout) detected the existence of variability related to the NORs phenotype. According to the authors, such diversity would be the result of the occurrence of a paracentric heterozigote inversion, occurring in about 27% of the analyzed specimens. The no identification of homozigote individuals for such inversion could be representing a lethal condition for this chromosome rearrangement, leading to the productive losses.

The results of the present work could also suggest the development of a wide and similar study in other cultivated populations of *O. niloticus*. This purpose is based on the results obtained by COLIHUEQUE (1999) in the chromosomal study on Chilean populations of *Oncorhynchus kisutch* (Coho Salmon). Such study detected he occurrence of triploid individuals and a wide variability related to the centromeric index as well, leading to the detection of an interpopulational polymorphism that suggested different origins for those founded population units.

The broadening of the chromosome evaluations and the improvement of the analysis resolution in another populations of *Oreochromis niloticus* could reveal, or at least suggest, the origins of the founder lot and contribute to the planning of breeding procedures, once that such species has an expressive acceptance in the Brazilian fish market.

Conclusions

The studied sample of *Oreochromis niloticus* is characterized by present the same diploid number and chromosome formulae when compared to the previous karyotype descriptions for this fish species.

The NORs phenotype reveal the existence of ribosome cistrons at two chromosome pairs and it is also according to this caracter description for the studied species.

Based on the previous observations is still concluded that is occurring a genomic homeostasis in the stock *O. niloticus* from the Fishbreeding Section of Marilia University.

It was not possible identify, by the actual analysis, the occurrence of chromosomal systems related to the sexual determination in *O. niloticus*.

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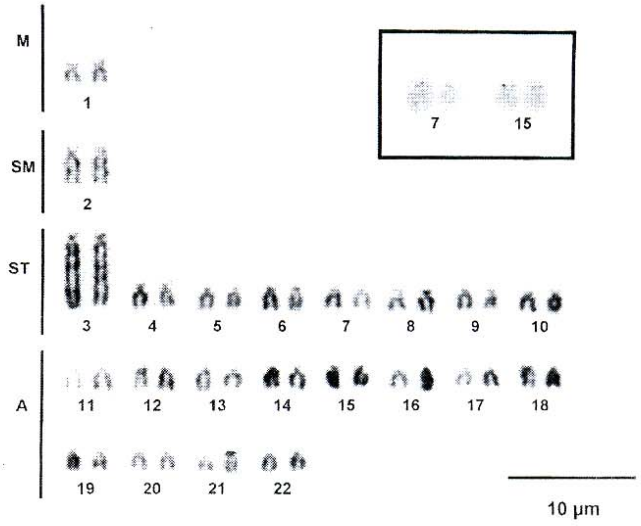

Figure 1 – Standard karyotype detected in the population sample of *Oreochromis niloticus*; Giemsa staining. In the box the chromosome pairs responsible for the nucleolar organization.

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