SUMMARY

CYTOGENETICS OF THE POLYPLOID SPECIES OF CYPRINIFORMES FISH.

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The order Cypriniformes contains the largest diversity of polyploids among vertebrates. Most of the over 250 polyploid species have between 100 and 150 chromosomes in their body's cells, whereas diploid species typically have 50 chromosomes. Polyploidy induces differentiation of the genome, which may become a diver of diversification and speciation. The appearance of stable polyploids requires reorganization of the genome, which is partly induced by the diploidization process. Gradual conversion from polyploidy into diploidy is done through genetic changes that differentiate duplicated genes and chromosomes. This genomic reorganization may affect, among others, on the activity and distribution of ribosomal genes and DNA telomere sequences, commonly analyzed and used in cytogenetics.

The aim of the study was the cytogenetic characteristics of native, polyploid species, the crucian carp *Carassius carassius* (Cyprinidae) and the weatherfish *Misgurnus fossilis* (2n=100) (Cobitidae) targeted to identify species-specific markers and an attempt to indicate the genomes cytogenetic features of these species, which could reflect the processes of polyploidization and diploidization associated with their origin. In this study for the first time the chromosomal distribution of 18S, and 28S rRNA 5,8S and 5S rRNA genes as a very informative feature was used by fluorescence in situ hybridization (FISH) with 28S rDNA and 5S rDNA probes. Furthermore, using the FISH technique the telomeric DNA was identified in the chromosomes of *M. fossilis*. In order to show the chromosomal distribution of active nucleolus organizer regions (AgNORs) and GC-rich sites the sequential staining with silver nitrate ($AgNO_3$) and chromomycin A_3 (CMA_3) fluorochrome was performed. In turn, chromosome staining with DAPI fluorochrome enabled the observation of AT-rich sites.

Selected methods have allowed identification the cytogenetic species specific features of both investigated species. The karyotype of *C. carassius* (2N=100; 20m + 36SM + 44STA, NF=156) characterized by four 28S rDNA sites found terminally in the short arms of two SM and two STA chromosomes. Chromosome regions consisting of 28S rDNA corresponded to $AgNO_3$ positive and GC-rich, and poorly of AT pairs chromatin. The 5S rDNA loci were located predominantly in a pericentromeric position of 10 or 12 STA chromosomes.

The karyotype of *M. fossilis* (2n=100; 16M + 20SM + 64STA, NF=136) characterized frequently by four 28S rDNA sites found in the short arms of two SM and two STA chromosomes. With the exception of one female which had two 28S rDNA sites. Chromosome regions consisting of 28S rDNA corresponded to $AgNO_3$ positive and GC-rich chromatin. In all individuals size polymorphism of AgNORs and rDNA clusters was identified. The 5S rDNA loci were located predominantly in a pericentromeric position of eight or six STA chromosomes.

The chromosomal distribution of the 28S RNA gene, rather than the 5S RNA, has proven to be a more stable feature of the genomes of both species. Intraspecific variation in the number and size of the 5S rDNA regions confirmed the dynamic nature of regions composed of these repeats in both investigated species.

Karyotypes of polyploid species such as *C. carassius* (2N=100) and *M. fossilis* (2n=100) characterized by multiple 28S rDNA (in two pairs of chromosomes) and 5S rDNA sites (in five or four pairs of chromosomes, respectively) which may reflect their polyploid origin. Reduction of the NOR sites observed in one female of *M. fossilis* might be considered as a part of the rediploidization process.

The presented results provided new data about the cytotaxonomy and the functional structure of the chromosomes of the crucian carp *C. carassius* and the weatherfish *M. fossilis* in the context of tetraploidization and rediploidization processes in the genome of these polyploid species.

Olsztyn, 10 czerwca 2017