

The role of chromosomal variability in the formation of the genetic structure of farm animals



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Introduction

The work is devoted to the study of the chromosomal polymorphism of somatic cells of certain species of farm animals of the *Bovidae* family, the development of cytogenetic parameters of various indicators of productivity and reproductive function, and further effective use in the breeding process.

By means of comparative cytogenetic analysis the participation of individual chromosomes in aberrations was investigated, the dependence of individual cytogenetic characteristics of chromosomal variability on pedigree and species affiliation was determined, intercellular and individual polymorphism of the number of active NOR chromosomes was established, and the positive correlation with the significance of milk chromosomes with significance of chromosomal sets in species of animals belonging to different genera and evolutionary changes in karyotype were analyzed.

Material & Methods (font 66)

Experimental work was performed during 2016-2020 on the basis of the laboratory of genetics of the Institute of Animal Breeding and Genetics named after M. V. Zubets of NAAS. The biological material of Roman sheep (from the Bach and family PG, n=35), the Sokil breed (LLC Golosiivo, n=33), and the Ukrainian Carpathian- mountain breed (FG Radvan-Nova, n=25); cows of Ukrainian red-mottled dairy breed (of SE "DG" Khristinovske "IRGT nd. MV Zubets NAAN", n=74) and gray Ukrainian breed (of SE "Polivanovka" IZK NAAN, n=15 and Golosiivo LLC, n=28); Asian root, which is bred in Ukraine river buffalo (Holosiivo LLC, n=49) were used for the research.

7259 metaphase chromosome preparations from 259 animals were examined by microscopy. Preparation of drugs, analysis

Results

Cytogenetic studies revealed the species and breed features of the chromosomal variability of farm animals of the *Bovidae* family. The chromosomal variability of sheep in different directions of productivity was investigated: Roman, Sokil and Ukrainian Carpathian-mountain breeds. From the analyzed 916 metaphase plates, of 35 sheep of Roman breed the share of aberrant cells is 15,22%. The total average level of heteroploidy is 8,11%, the frequency of structural aberrations of chromosome is 7,11%. Cytogenetic analysis of 792 metaphase plates of 33 Sokil sheep showed that the proportion of aberrant cells was 20,92%, of which heteroploid cells were 15,64%, and cells with structural chromosome aberrations were 5,28%. The analysis of 722 metaphase plates of 25 sheep of Ukrainian Carpathian- mountain breed found that the proportion of aberrant cells was 19,22%, of which heteroploid cells – 9,46%, cells with structural chromosome aberrations – 9,76%.

Features of chromosomal variability of sheep depending on their productive qualities are established. Sheep of Roman breed showed a lower frequency of aberrant cells compared to Sokol and Ukrainian Carpathian-mountain breeds. In Sokol sheep, the frequency of aneuploid cells (13.60%) was found to be almost twice as high as in other studied animal breeds.

In the course of the study, specific chromosomal rearrangements and associations of two acrocentric chromosomes were identified in individual animals of the Roman breed. The difference in individual indicators of chromosomal variability in sheep was determined depending on their reproductive capacity. Thus, in the ewes of the Roman breed with trifles in the brood, a 4,76% higher frequency of structural chromosomal aberrations was found, comparing to ewes with twins. Individual variability in the number of NORs in the chromosomes of sheep of the Roman breed with different reproductive function was revealed. The NOR activity is higher in the group of animals that bring 3 or more lambs.

The chromosomal variability of cattle – gray Ukrainian and Ukrainian red-mottled dairy breeds was investigated. It was found that the frequency of aberrant cells is 3,5 times higher in animals of gray Ukrainian breed than in animals of Ukrainian red-billed milk breed (32,11% and 8,85% respectively). In the karyotypes of individual cows, translocations of the Robertsonian type 1/29 and cells with monosomy by sex chromosomes were detected. In a cow with an inventory number 6040 in SE "Khristinovske" a set of chromosomes 2n=59 was found. Using G-banding, the presence of a Robertsonian translocation involving chromosomes 13 and 23 pairs was determined. Due to the presence of large blocks of centromeric heterochromatin in the translocated chromosome, it was assumed that the de novo translocation was formed.

Associations of signs of chromosomal instability and reproductive capacity in cows of Ukrainian red-rumped dairy breed were established. Based on the analysis, it was concluded that the most stable karyotype have cows with average productivity, whereas animals with low and high rates of milking revealed an increased frequency of chromosomes aberrations of different nature.

Results of analysis of the polymorphism of Ag-stained chromosomes in the studied animals of gray Ukrainian and Ukrainian red-breasted