

Genetic variability of wild carp (*Cyprinus carpio haematopterus*) in Ukraine

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The main objects of commercial fish farming in Ukraine are carp, among which the wild carp has important value, such as it has higher resistance to the action of the complex of negative exogenous factors compared to carp [1]. The results of breeding studies have proven that the most effective in Ukrainian fish farming is the crossbreeding of Ukrainian breeds carp with wild carp. Interest to the hybridization of carp with wild carp has increased due to the deterioration of the ecological conditions of cultivation, against the background of which breeding of carp often turns out to be insufficiently effective [2].

The goal of investigations is to study the genetic peculiarities of the structure of broodstocks of wild carp and evaluate its genetic variability by analyzing of alleles and genotypes division by the specific protein systems and cytogenetic indicators.

Polymorphism analysis of protein systems was performed using the method of electrophoresis in a polyacrylamide gel. As protein markers for assessing the genetic structure of wild carp stocks, the distribution of allelic and genotypic frequencies by loci encoding a number of fish blood proteins was considered: transferrin (TF), albumin (ALB) and esterase (EST, 3.1.1.1) [3]. Cytogenetic analysis was performed using the micronucleus test and analysis of apoptosis frequencies. Selection and processing of biological material of fish, as well as statistical processing of the obtained data, was performed using generally accepted methods [4]. In order to assess the variability of the genetic structure of the wild carp, the distribution of allelic frequencies and genotypic variants by loci was considered: transferrin (TF), albumin (ALB) and esterase (EST, 3.1.1.1). By the all detected alleles at transferrin locus, a significant frequency Tf C₂ (0.390) was noted in the group of wild carp from the farm "Velykiy Lyubin" and the Tf C₁ allele (0.391) in carp from Sumyrybhosp OJSC. Statistically significant differences were established in the distribution of observed and expected genotypes in groups of wild carp from "Sumyrybhosp" by all loci: TF ($\chi^2 = 27.85$; $P < 0.01$), ALB ($\chi^2 = 4.58$; $P < 0.05$), EST ($\chi^2 = 8.27$; $P < 0.01$) and in carp from fish farm "Velykiy Lyubin" by the TF locus ($\chi^2 = 13.71$; $P < 0.05$) and the EST locus ($\chi^2 = 10.99$; $P < 0.001$), which indicated an unbalanced state of their genetic structure. The observed level of heterozygosity 74% in the wild carp from farm "Velykiy Lyubin" significantly exceeded the expected 57.1%. In the group of wild carp from farm "Karpatskyi Vodogray" was equilibrium state according to the established values of the observed ($N_o = 58.6\%$) and expected ($N_e = 55.4\%$) level of heterozygosity. According to the F_{st} indicator, which characterizes the differences between subpopulations according to the described loci and

largely depends from the distribution of allele frequencies, the greatest value was found for the EST locus ($F_{st}=0.069$). But, generally, the degree of differentiation between the wild carp populations turned out to be weakly expressed with the coefficient $F_{st}=0.047$, which indicates their high genetic affinity.

The analysis of cytogenetic indicators frequencies of wild carp from three fish farms showed that the wild carp from fish farms “Sumyrybhosp” and “Dzerelelo” are characterized by a lower frequency of erythrocytes with micronuclei (EMN) ($3.3\pm 0.3\%$), ($3.2\pm 0.3\%$), lymphocytes with micronuclei (LMN) ($2.1\pm 0.2\%$), ($1.9\pm 0.2\%$), and apoptosis ($4.2\pm 0.3\%$), ($4.3\pm 0.3\%$), compared to the group from fish farm “Carpathian Vodogray”, where these indicators were as follows: EMN ($4.7\pm 0.3\%$), LMN ($2.4\pm 0.2\%$) apoptosis ($5.6\pm 0.4\%$). This results indicates about a lower level of destabilization of chromosomal apparatus of wild carp from the fish farm “Sumyrybhosp” at the time of investigation.

References

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