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Article in *Molecular Phylogenetics and Evolution* · March 2019

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Phylogeny, phylogeography and hybridization of Caucasian barbels of the genus *Barbus* (Actinopterygii, Cyprinidae)

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ARTICLE INFO

Keywords:

Cyprinidae
Phylogeny
Barbus
Taxonomy
Caucasus
Hybridization

ABSTRACT

Phylogenetic relationships and phylogeography of six species of Caucasian barbels, the genus *Barbus* s. str., were studied based on extended geographic coverage and using mtDNA and nDNA markers. Based on 27 species studied, matrilineal phylogeny of the genus *Barbus* is composed of two clades – (a) West European clade, (b) Central and East European clade. The latter comprises two subclades: (b1) Balkanian subclade, and (b2) Ponto-Caspian one that includes 11 lineages mainly from Black and Caspian Sea drainages. Caucasian barbels are not monophyletic and subdivided for two groups. The Black Sea group encompasses species from tributaries of Black Sea including re-erected *B. rionicus* and excluding *B. kubanicus*. The Caspian group includes *B. ciscaucasicus*, *B. cyri* (with *B. goktschaicus* that might be synonymized with *B. cyri*), *B. lacerta* from the Tigris-Euphrates basin and *B. kubanicus* from the Kuban basin. Genetic structure of Black Sea barbels was influenced by glaciation-deglaciation periods accompanying by freshwater phases, periods of migration and colonization of Black Sea tributaries. Intra- and intergeneric hybridization among Caucasian barbines was revealed. In the present study, we report about finding of *B. tauricus* in the Kuban basin, where only *B. kubanicus* was thought to inhabit. Hybrids between these species were detected based on both mtDNA and nDNA markers. Remarkably, Kuban population of *B. tauricus* is distant to closely located conspecific populations and we consider it as relic. We highlight revealing the intergeneric hybridization between evolutionary tetraploid ($2n = 100$) *B. goktschaicus* and evolutionary hexaploid ($2n = 150$) *Capoeta sevangi* in Lake Sevan.

1. Introduction

Polyploid cyprinids are a large group widely distributed in Eurasia and Africa. The freshwater fishes of the genus *Barbus* s. str. are a tetraploid lineage ($2n = 100$) of Eurasian barbines (Berrebi and Tsigenopoulos, 2003; Ráb and Collares-Pereira, 1995; Vasiliev, 1985)

composed of 35 valid species and widely distributed from Iberian Peninsula in Western Europe to Transcaspien region (the Atrek basin) in the Central Asia (Eschmeyer et al., 2017). This lineage is phenotypically and genetically distinct from another tetraploid lineage of Eurasian barbels, the genus *Luciobarbus* (Doadrio, 1990; Doadrio et al., 2002; Levin, 2004).

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