



Cladocera Species in the Water Bodies of the Republic of Karakalpakstan and the Fergana Valley

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ABSTRACT

The article provided information about nine species, which belong to the Cladocera order in lakes of different sizes and ecological conditions, including Lake Davut, Lake Akcha, Lake Qorateren, and Lake Saykol in the Republic of Karakalpakstan and seven species in the lakes of Fergana Valley. *Daphnia galeata* found in Akcha and Sariqamish lakes was identified by molecular genetic methods and proved to be a new species in the Republic of Karakalpakstan. During the conducted studies in the lakes of the Republic of Karakalpakstan, 2 species of Cladocera were recorded in Lake Akcha, 3 species in Lake Qorateren, 2 species in Lake Davut, 7 species in Lake Saykol. Whereas, in the Fergana Valley, 9 species were determined in Lake Sariqamish, 5 species in Lake Toda, 2 species in Lake Ettikol, and 3 species in Lake Kolgandaryo.

INTRODUCTION

Nowadays, the biodiversity of aquatic ecosystems have been widely investigated in the whole world. Given that the influence of the current anthropogenic factor is growing and the ecosystems in natural waters are changing, the faunistic analysis of aquatic organisms in the regions has become one of the important tasks to be accomplished. As a result of changes in the rivers of the Amudarya basin, the water level in the lakes has decreased. It is scientific and practical importance to assess the current state of the representatives of *Cladocera*, one of the groups of organisms in the aquatic ecosystem, to analyze its faunal composition, study its economic significance, substantiate scientific conclusions and put them into practice.

Along with the acceleration of pisciculture development, the issue of natural food production of the valuable fish species arises on an industrial scale. Conducted experiments have shown that some species of *Cladocera* can be produced in large quantities. In this regard, it is necessary to look for such species of crustaceans, whose

biology requires the possibility of obtaining high production at any time of the year and the search for fish species that do not adversely affect larvae.

Cladoceras' habitats are diverse: plankton, benthos, periphyton, neiston live in interstitial water bodies and various levels of polluted water, freshwater, saline and brackish water bodies.

The role of *Cladoceras* in the natural self-cleaning of water bodies is great. Cladoceras are used in biotesting of natural water and wastewater (**Abdinazarov, 2018**). Ways of using these organisms as bioindicators of water basins were used in ecological monitoring of water basins of Fergana, Andijan, Namangan regions.

In the middle of the 19th century, Russian researchers initiated the studies on the water basins of Uzbekistan. Initially, the researches were related to fishing in the Aral Sea. S. A. Zernov, L. S. Berg's researches on ichthyology and hydrobiology are of particular importance in the study of fauna of the Aral Sea, in the early 1920s. By 1920, the establishment of the Central Asian State University and the Aral Fishing Station led to the considerable development of ichthyological and hydrobiological researches. **Krineva (1992)** identified 59 species of zooplankton organisms in Lake Karateren. Species of *Cladoceras*, including *Sida cristalinana*, *Pleuroxus laevis*, *Simosephalis vetulus*, *Acroperus harpae* in the phytophilic complex and *Diaphanosoma brachiurum*, *Moina dubia* in the pelankton complex were recorded in the context of this research.

Academician A.M. Mukhamediev made radical shifts in scientific research of hydrobiology in the middle and second half of the last century. In their research on Lake **Mukhamediev (1964)** determined several species of *Cladoceras*, including *Sida cristalinana*, *Daphnia longispina*, *Simosephalis vetulus*, *Moinaq micrura*, *Bosmina lonirostris*, *Pleuroxus laevis*, *Acroperus harpae*, *Alona costata*.

In the summer, crustaceans of the genus *Daphnia* dominate in the freshwater ponds. The lack of clear taxonomic features in identifying species of this generation, as well as the large number of hybrids among species, make difficulties for most specialists **Mukhortova et al. (2011)**.

According to A.M.Muhamediev, the fauna of *Cladocera* in Fergana Valley is represented by 64 species, 24 genus and 5 families. Analysis of this list, on the basis of current data, requires a number of changes. For example, *Daphnia carinata* King is not found in the Palearctic, but the species *Daphnia similis* Benzie is found in this area. D.V.Berner and G.M.Rakhmatullaeva also showed that, *Ceriodaphnia reticulata* was replaced by a similar species *Ceriodaphnia turkestanica* in Uzbekistan. Two species *Moina brachiata* (Jurine) and *M. micrura* Hellich are hidden in Uzbekistan under the name *Moina rectirostris* Leydig. The *Moina weberi* Richard species is also one of the most controversial species to date. It is assumed that there exist another species close to it in Uzbekistan. According to Korovchinsky, the taxonomy of *Latonopsis ferganica* Muchamediev and *Macrothrix shadini* Muchamediev species is also unclear.

MATERIALS AND METHODS

The Republic of Uzbekistan has lakes of different sizes and different ecological conditions, some of which have extremely high salinity levels and without living organisms (in the lakes of the Republic of Karakalpakstan). Our research is focused on the study of Cladoceras in these lakes.

The specimens were obtained in the open parts of the watershed, in the middle and near the shore, i.e. from the litoral zones, by means of a Jedi net that filters zooplankton organisms from 50-100 liters of water. The distribution of these organisms in a waterbody depends mainly on water temperature, light, the amount of oxygen in the water, the presence of carbon dioxide and other substances. Some species of these organisms are viable even if the oxygen in the water is less than 0.2 ml/l. Crustaceans also develop significantly as lower algae develop. The absence of these organisms in water bodies leads to changes in the food chain.

Specimens of zooplankton organisms were obtained from Lake Akcha, Lake Qorateren, Lake Davut and Lake Saykol in the Republic of Karakalpakstan, furthermore, from different points of the basins in Andijan, Namangan and Fergana regions. The collection materials stored at the Institute of Zoology of the Academy of Sciences of the Republic of Uzbekistan, Fergana State University, Kokand State Pedagogical Institute, the National University of Uzbekistan were also studied.

Studies have shown that the *Daphnia magna* species, which belongs to the Daphniidae family, is common in Lake Sariqamish. The occurrence of these species as a dominant species has also been noted in our previous studies. However, during the study period, we also encountered small amounts of *D. pulex* and *D. curvirostris* (with ratio 1:12 for *Daphnia magna*) (Madumarov, 2021).

Identifiers of species were used by Manuylova (1964), Mukhamediev (1986), Korovchinsky (1992), Benzie (2005). In addition, molecular genetic methods were used. Genomic DNA purification was performed using the ThermoScientific GeneJet (Termofisher com) DNA isolation kit protocol, a PCR-amplification method - using Sintol kit reagents to study the sequence of nucleotides in the 12S region of mitochondrial DNA. DNA sequencing was performed using ABI PRISM® BigDye™ Terminator v.1 set of reagents, and the reaction products were recorded in an automatic sequencer SeqStudio Genetic Analyzer (Appliedbiosystems) (Ebru Özdemir 2016).

We consulted with Professor Kuchbaev A.E., Head of the Laboratory of Molecular Zoology, one of the leading specialists of the Institute of Zoology of the Academy of Sciences of the Republic of Uzbekistan in the use of molecular genetic methods in the accurate identification of the species *Daphnia galeata*.

RESULTS AND DISCUSSION

The Aral ecological catastrophe affected all parts of the biosphere of the largest Aral region and adjacent territories. Limnic ecosystems have changed especially strongly, which has affected the hydrological regime of water bodies and hydrobionts inhabiting them. Due to the sharp shortage of water entering the delta, many reservoirs have switched to a different source of food. As is known, earlier the lake systems of the lower reaches of the Amudarya were formed on the freshwater runoff of this river. Under the influence of the disturbed hydrological regime, which coincided with the excessive supply of biogenic elements, these water bodies were transformed, and their self-purification potential was significantly reduced. Today, many lakes are characterized by a sharp change in the limnic state, expressed by eutrophication processes. For the first time, monitoring and analysis of Cladocera 4 lakes of Karakalpakstan and 4 lakes of the Fergana Valley was carried out.

During the conducted studies in the lakes of the Republic of Karakalpakstan, 2 species of *Cladocera* were recorded in Lake Akcha, 3 species in Lake Qorateren, 2 species in Lake Davut, 7 species in Lake Saykol. Whereas, in the Fergana Valley, 9 species were determined in Lake Sariqamish, 5 species in Lake Toda, 2 species in Lake Ettikol and 3 species in Lake Kolgandaryo (Table 1).

Structure of *Daphnia galeata*. The body has an ovoid structure and is subject to change. The eyes are small and have spots. Sometimes the cover part is advanced.

Daphnia galeata is common in Central Asian watersheds. It develops from March to November in Akhangaron, Charvak, Tuyabuguz, Andijan, Karkidon, Akdarya, Talimarjan, Tudakul, Arnasay reservoirs and in the water basins of Fergana region. It is dominant from May to September. Its reproduction also occurs in winter months in Uzbekistan, when the water temperature is 22-26 °C, and the ovary contains 12 to 28 eggs (**Kuzmetov 2019**).

Moreover, other representatives of Cladocera can be met, including *Simocephalus exspinosus* 1841, *Simocephalus serrulatus* 1941 Lake Saykol (Amudarya), *Ceriodaphnia cornuta* Sars, 1885, *Ceriodaphnia* cf. *reticulata*, 1820 Lake Saykol (Amudarya), *Ceriodaphnia* lake 1896, Lake Qorateren (Takhtakopir). In almost all lakes, the *Moina macrocopa* is predominant.

Table 1. List of species of Cladocera order

Taxa	1	2	3	4	5	6	7	8
<i>Alona rectangular</i>					+			
<i>Daphnia longispina</i>		+					+	
<i>D. galeata</i>	+				+			
<i>D. similis</i>			+	+				
<i>Diaphanosoma mongolianum</i>						+		+
<i>Bosmina longirostris</i>					+	+		+
<i>Simocephalus vetulus</i>					+	+		
<i>Simocephalus exspinosus</i>				+				
<i>Simocephalus serrulatus</i>				+				
<i>Scapholeberis kingi</i>					+			
<i>Ceriodaphnia cornuta</i>				+				
<i>Ceriodaphnia cf reticulata</i>				+				
<i>Ceriodaphnia dubia</i>		+						
<i>Ceriodaphnia turkestanca</i>					+			
<i>Chdorus sphaericus</i>					+	+	+	
<i>Moina macrocopa</i>	+	+	+	+				
<i>Moina micrura</i>					+			+
<i>Moina lipini</i>						+		
<i>Pleuroxus adeuncus</i>					+			

The Republic of Karakalpakstan

1. Lake Akcha
 2. Lake Qorateren
 3. Lake Davut
 4. Lake Saykol
- Fergana region
5. Lake Sariqamish
 6. Lake Toda
 7. Lake Ettikol
 8. Lake Kolgandaryo

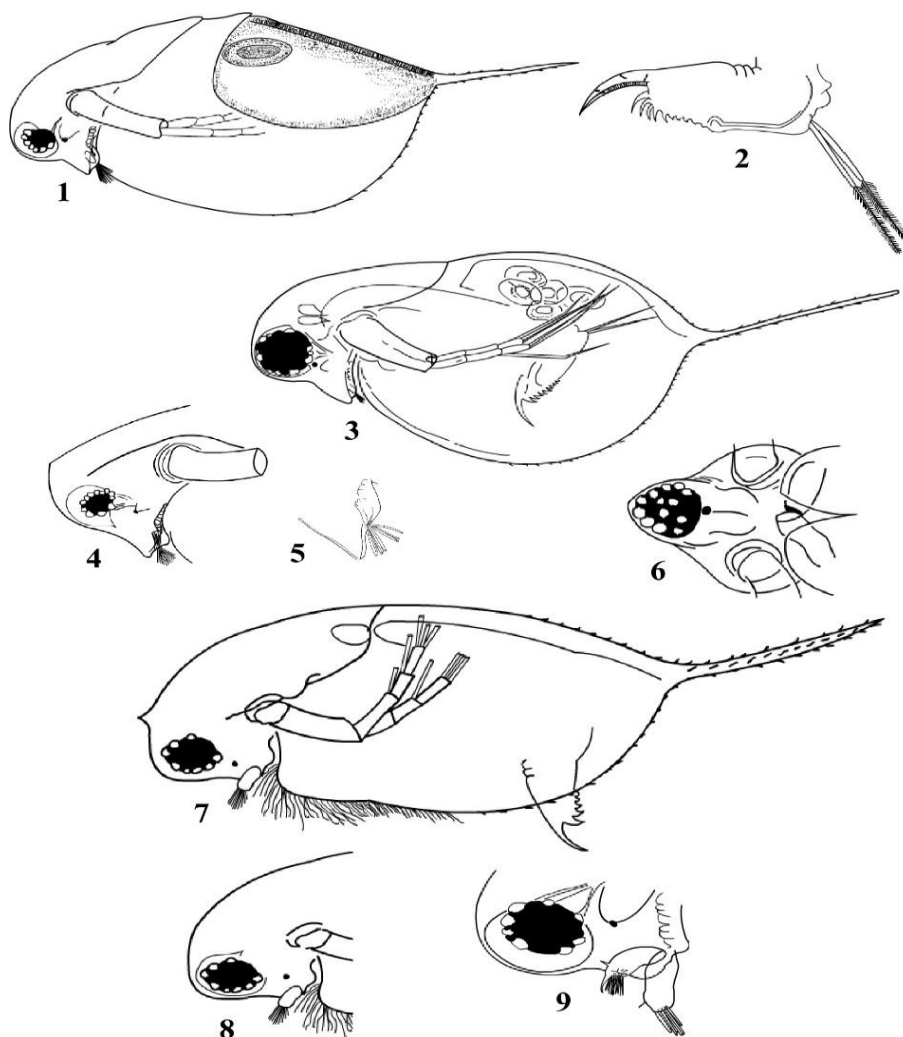


Fig 1. The structure of *Daphnia galeata* (original. Author: Madumarov). 1-ehippial female, 2-postabdomen, 3-pathogenetic females, 4-head part, 5-rostrumi, preview of head, 7- general structure of male, 8-head part, 9-I antenna.

CONCLUSION

In summary, a comprehensive analysis of Clodacera has been conducted in Uzbekistan. As a result of the study, *Daphnia galeata* was recorded for the first time in the territory of northern Karakalpakstan in Uzbekistan. Its morphology, biology, and thematic dynamics were studied.

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