The first evidence about the algae flora of the reservoirs of the «Aschisayskaya Steppe» plot (State Nature Reserve «Orenburgsky»)

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Abstract. The first data about the algae flora of the water bodies of the «Aschisayskaya Steppe» plot of the State Nature Reserve «Orenburgsky» are presented. 217 species and intraspecies taxa of microalgae belonging to the phyla Chlorophyta, Euglenozoa, Bacillariophyta, Ochrophyta, Streptophyta, Miozoa and Cyanobacteria were found in five reservoirs of the plot. New species for the territory of the Orenburg Region, as well as rare species for Russia are noted, their characteristics and micrographs are given. The obtained data expands the current understanding of the range of the identified taxa.

1 Introduction

The State Nature Reserve «Orenburgsky» was established in 1989 with the aim of preserving steppe landscapes, as the most affected as a result of large-scale anthropogenic impact, mainly plowing and overgrazing of livestock. Currently, the reserve consists of five plots, Aschisayskaya Steppe is the most eastern of them. This plot, with an area of 72 km^2, is the standard of the steppe landscapes of the western part of the Turgay table land country [1].

The main tasks of nature reserves include not only the protection, but also the study of unique and typical landscapes to be preserved. A comprehensive survey of the protected area and observation of various components of ecosystems (both zonal and azonal) allows us to form a holistic view of the state and dynamics of the ecosystems of reserves and the direction of changes in natural processes. Based on the data reflected in the Annals of Nature of the Reserve "Orenburgsky" [2], scientific research conducted on the territory of the Aschisayskaya Steppe affected many directions, but the study of algae in the water bodies has never been carried out. Therefore, the aim of this research was to study the algae flora of water bodies of the «Aschisayskaya Steppe» plot of the State Nature Reserve «Orenburgsky».

2 Material and Methods

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The "Aschisayskaya Steppe" plot is located in the Svetlinsky district of the Orenburg region and is almost entirely located in the basin of the wide and highly branched Aschisai Beam, which flows into Aike Lake. The beam is relict in nature and has been preserved without major changes since the Neogene - since the era of the formation of gypsum-bearing gray-red-colored clays. It is embedded in the plain of the ancient peneplen, the absolute marks of which range from 320-330 m [1].

Hydrographic network of the Aschisayskaya Steppe is represented by flat-bottomed hollows with lake-like extensions. Runoff through them is carried out only in spring and during periods of heavy rainfall. The permanent watercourses are absent. The protected area includes the Zhurmankol Lake basin [1].

The object of the study was 22 qualitative and quantitative algological samples. They were taken in 2020 in five reservoirs of the « Aschisayskaya Steppe» plot (State Nature Reserve «Orenburgsky»): Verkhneashchisaysky pond (N51°02'45,43" E61°11'18,14"; N51°02'37,99" E61°11'15,65"; N51°02'38,64" E61°11'02,85"); Aschisai Beam (N51°01'26,68" E61°12'58,11"; N51°01'15,80" E61°14'24,79"; N51°01'15,21" E61°14'26,34"); Prikordonny pond (N50°57'43,44" E61°12'56,37"); Povorotnoe Lake (N51°01'37,91" E61°12'11,10"); Zhurmankol Lake (N50°58'45,3" E61°09'08,1").

Algae and Cyanobacteria were examined in a live and fixed states by light microscopy, phase contrast microscopy and scanning electron microscopy under a «Primo Star» (Carl Zeiss), «Axio Scope.A1» (Carl Zeiss), «Tescan Mira3» microscopes at the Center for the Identification and Support of Gifted Children "Gagarin "(Orenburg). For algae and Cyanobacteria species identification the identification keys [3-7] and articles [8-11] were used. Taxonomy and nomenclature are given according to the on-lineAlgaeBase database https://www.algaebase.org [12].

3 Result and Discussion

As a result of studies, 217 species and infraspecies taxa belonging to phyla Chlorophyta, Euglenozoa, Bacillariophyta, Ochrophyta, Streptophyta, Miozoa и Cyanobacteria were revealed in the reservoirs of the « Aschisayskaya Steppe» plot.

The most interesting, in our view, were the water samples from two reservoirs: Zhurmankol Lake and Prikordonny pond.

Zhurmankol Lake is the largest lake of the plot (the diameter of the lake is about 700 m), occupying a basin of suffusion-tectonic origin. The water of the lake belongs to the bicarbonate class, the calcium-sodium group, fresh, the water hardness is about 2,1 mg. eq/L. The lake is filled with meltwater, there is no recharge with groundwater. Pure water in summer less than 1/4 of the area. Prevailing depths – 0,7–1,0 m [1]. The lake is almost completely overgrown with *Phragmites australis* (Cav.) Trin. ex Steud. The water body is a nesting place for waterfowl, and is also used for drinking by wild boars.

134 species and infraspecies taxa were revealed in the algae flora of the Zhurmankol Lake, at the same time, the most species-rich and numerous was Chlorophyta (44,6% of the total number of species and infraspecies taxa; 54,3% of the absolute abundances of algae). Representatives of families Scenedesmaceae (*Scenedesmus acuminatus* (Lagerheim) Chodat, *Tetradesmus obliquus* (Turpin) M.J.Wynne, *Acutodesmus acutiformis* (Schröder) Tsarenko & D.M.John), Selenastraceae (*Ankistrodesmus fusiformis* Corda), Phacotaceae (*Pteromonas torta* Korshikov) were registered as dominants. The Bacillariophyta were the second most diverse group (31,1% of the total number of species and infraspecies taxa). Among them, *Stauroneis anceps* Ehrenberg, *Cocconeis placentula* var. *euglypta* (Ehrenberg) Grunow, *Craticula cuspidata* (Kutzing) D.G.Mann, *Stephanodiscus hantzschii* Grunow had the most frequency of occurrence. Algae of other phyla (Euglenozoa, Ochrophyta, Streptophyta, Miozoa, Cyanobacteria.) accounted for

24.3% of the total species richness. Euglenozoa was 9% of this number, and this phylum was represented by 12 species and infraspecies taxa belonging to genera *Monomorphina* Mereschkowsky, *Trachelomonas* Ehrenberg, *Euglenaformis* M.S.Bennett & Triemer, *Phacus* Dujardin, *Lepocinclis* Perty. *Trachelomonas rotunda* Svirenko (fig. 1, c) was noted as new species to the algae flora of the Orenburg region. The representatives of other phyla were less diverse. It is noteworthy that a high diversity and number of chrysophycean stomatocysts (Ochrophyta) were found in the lake (fig. 1, e-h). The study of stomatocysts serves as an additional criterion in assessing the diversity of Chrysophyceae in the reservoir [13]. Only three species were identified of the vegetative forms of Chrysophyceae. However, a species (fig. 1, d) was found among them morphologically identical to *Mallomonas skvortsovii* Gusev et al., which was detected in Dong Nai Province: Dak Lua swamp in Cat Tien National Park (Vietnam) and described as a new species in 2016 [9]. The literature data about finding of *M. skvortsovii* in the water bodies of Russia are absent.

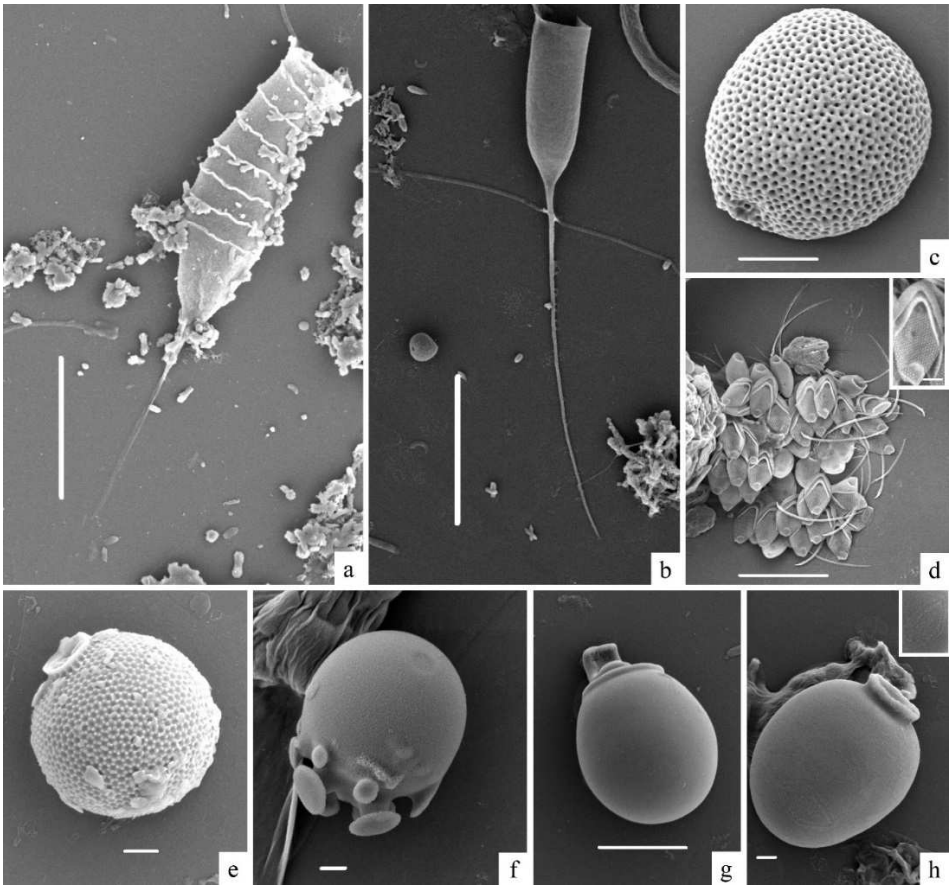

Fig. 1. Algae species new or rare for algae flora of Orenburg region. Stomatocysts (SEM): a - *Dinobryon suecicum* var. *longispinum*; b - *Dinobryon faculiferum*; c - *Trachelomonas rotunda*; d - *Mallomonas skvortsovii*; e - stomatocyst 178, Zeeb & Smol, 1993; f - stomatocyst 136, Duff & Smol in Duff et al., 1992; g - stomatocyst 135, Duff & Smol in Duff *et al.*, 1992; h – (?) stomatocyst 118, Zeeb et al. 1990. Scale bar, µm: a, b, d – 10; c, g – 5; e, f, h, d (enlarged fragment) – 1.

Prikordonny pond is a small pond with a mirror-like water surface of 246×150 m and a depth of about 2 m at the sampling point. Thickets of *Salix sp.* are marked along the coast,

thickets *Typha latifolia* L., *Scirpus lacustris* L., *Phragmites australis* (Cav.) Trin. ex Steud – in the water.

Chrysophyceae (Ochrophyta) was predominated in the reservoir, moreover, both vegetative forms and stomatocysts were numerous and diverse. We have identified representatives of the genera *Dinobryon* Ehrenberg, *Kephyrion* Pascher, *Pseudokephyrion* Pascher, *Mallomonas* Perty, *Synura* Ehrenberg. Among the algae found in the studied reservoir, a number of forms were assessed as rare or new for the algae flora of the Orenburg region. Among them should be noted Dinobryon faculiferum (Willén) Willén (fig. 1, b) and *Dinobryon suecicum* var. *longispinum* Lemmermann (fig. 1, a), which are also rare for the territory of Russia.

Algae species new or rare for algae flora of Orenburg region*:*

Trachelomonas rotunda Svirenko (fig. 1, c). Lorica from broadly oval or obovoid to strawberry shaped, 11.7–15.0 µm in diameter, densely punctate; anterior end broadly oval and slightly depressed at the top, sometimes slightly off-centre; apical pore 2.0–2.5 µm in diameter. Anterior end with a small fold at one side of pore [14]. The specimens found by us correspond to the diagnosis of the species.

Common, probably cosmopolitan, reported from Europe, Asia, South America and North America. Occurs in ponds and ditches [14].

Mallomonas skvortsovii Gusev et al. (fig. 1, d). Scales are large, tripartite. Dome large, with parallel ribs (up to 10). Body scales suboval, 6.0–6.7 × 3.2–3.5 µm. Apical scale is slightly asymmetrical, 5.4 × 3.0 µm. Proximal border wide, with internal struts. Posterior flange narrow and smooth. Anterior flange with papillae. V-rib is prominent, wide, with internal struts. There is a single pore at the base of the V-rib. Anterior submarginal rib is absent. Shield with densely and regularly arranged in distinct rows papillae [9].

This species was only found at the type locality (Dong Nai Province: Dak Lua swamp in Cat Tien National Park, Vietnam) [9].

The fragment of algae, which we found, bears scales of 5.5-5.9 × 3.0-3.2 µm with a protruding, wide, V-rib. There is a pore at the base of the V-rib. Shield with regularly arranged in rows papillae.

Dinobryon faculiferum (Willén) Willén (= *Dinobryon petiolatum* Willėn) (fig. 1, b). Solitary cells. Lorica is cylindrical, the walls are smooth, thin, colorless, length 16-29 µm, width 4-5 µm. Lorica is directly cut off in the upper part, less often it is somewhat expanded, in the basal part it is conically narrowed and pointed, with elongate and think process (up to 40 µm) [10].

It is noted in the composition of phytoplankton of fresh and brackish reservoirs: Arctic, Baltic sea, Gulf of Naples, Loch Kinord (Scotland), Sweden; rare [10, 15, 16]. On the territory of Russia, it's registered in the water bodies of Karelia and the Neva Bay of the Baltic Sea; rare [10].

Lorica of the specimens we found were slightly smaller than indicated in the diagnosis: the length varied in the range from 10.8 µm to 13.9 µm, width 3.8-4.0 µm; the length of the process was 22.0-23.0 µm.

Dinobryon suecicum var. *longispinum* Lemmermann (fig. 1, a). Solitary cells. Lorica is a little asymmetric, length 19–23 µm, width 4–6 µm. Lorica is cylindrical with an obliquely cut mouth in the upper part, slightly stretched in the middle part, with elongated in the tip (length up to 15 µm) [10]. The specimens found by us correspond to the diagnosis of the taxa.

According to the literature data, it is described as a rather rare species in the reservoirs of North America, Europe and Russia (Russia North) [10]. *D. suecicum* var. *longispinum* was first observed on the territory of the Orenburg region at 1989 [17] and has not been detected again until now.

Thus, as a result of the studies, it was shown that the algae flora of the water bodies of the "Aschisayskaya Steppe" plot (State Nature Reserve «Orenburgsky») is quite diverse. During the study, new taxa to the algae flora of the Orenburg region were discovered, a number of which are rare for Russia. The data obtained by us expand the current understanding of the areal of the identified taxa. It should be borne in mind that these are the first studies of algae in the reservoirs of the "Aschisayskaya Steppe" plot, and further research will contribute to addition the already available data.

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