



A new species of the genus *Aulacoseira* (Bacillariophyta)

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ABSTRACT

The study of algal material from water bodies in the Olekminsky State Nature Reserve using scanning electron microscopy revealed the diatom species *Aulacoseira yakutiaensis* sp. nov. that is new to science. The new species is morphologically similar to another species of the genus, *A. lacustris*, but differs from them in quantitative characteristics such as diameter and height of the valve, striae and areolae density in 10 µm, and also a robust ringleist.

Keywords: water bodies, Olekminsky Nature Reserve, Yakutia, electron microscopy, diatoms, *Aulacoseira*

РЕЗЮМЕ

Генкал С.И., Габышев В.А., Габышева О.И. Новый для науки представитель рода *Aulacoseira* (Bacillariophyta). Изучение альгологического материала из водоёмов Олекминского государственного природного заповедника методом сканирующей электронной микроскопии позволило выявить новый для науки вид диатомовых водорослей – *Aulacoseira yakutiaensis* sp. nov. Новый вид морфологически сходен с другим видом рода *Aulacoseira* – *A. lacustris*, однако отличается от него количественными характеристиками, такими как диаметр и высота створки, плотность штрихов и ареол на 10 мкм, а также наличием мощного ринглейста (кольцевидного выступа).

Ключевые слова: водоем, Олекминский заповедник, Якутия, электронная микроскопия, диатомовые водоросли, *Aulacoseira*

The genus *Aulacoseira* Thwaites was described in the 19th century (Thwaites 1848) and currently includes 154 species (Guiry & Guiry 2026). The first taxonomic summary of centric diatoms contains 15 species, varieties, and forms of the genus *Aulacoseira* (Davydova & Moiseeva 1992). In the modern identification key of Centrophyceae, 23 species are included in the list of this genus (Genkal et al. 2020). Over the past few years, the species composition of the genus *Aulacoseira* has been expanded; several species that are new to the flora of Russia have been revealed (Genkal et al. 2022) and two species *A. makarovae* Genkal et I.S. Trifonova and *A. chukotkaensis* Genkal that are new for science have been described (Genkal et al. 2022, Genkal 2023).

The field material was collected on the territory of the Olekminsky State Nature Reserve in August 2024 and August 2025. The reserve is located in the permafrost zone, within the middle taiga subzone in the area of the sharp continental climate of Central Siberia. This area is characterized by a significant annual amplitude of air temperature fluctuations. The minimum temperature in January is -60°C, the maximum temperature in July is +34°C (Gvozdetzky & Mikhailov 1978).

The snow cover remains stable for about 200 days. The duration of the growing season is 101 days. The hydrographic network of the protected area belongs to the Lena River catchment basin and is represented by the tributaries of the Olekma River and the upper part of the Amga River catchment basin. We studied different types of water bodies located in the floodplain of the Olekma River, including two small oxbow lakes and one swamp (Table 1). Whereas the swamp is located in the protected area of the Olekminsky Nature Reserve, the lakes are within its borders. The swamp is a marshy, moss-covered surface of a flat depression in the landscape. The lakes are located on the left bank of the Olekma River valley; they are elongated in shape, up to 1 km long and up to 100 m wide. The shores of the lakes are heavily overgrown and represent the so-called floating mat of aquatic plants on the surface of the water body. A total of three algal samples were collected, including plankton, moss extract, and biofilm from the surface of lake silt deposit (Table 1). Plankton and moss extract were collected with an Apstein net (SEFAR NITEX filter fabric, mesh size 15 µm), the biofilm from the lake sediment was collected

Table 1. Information on the type of samples and sampling sites on the territory of the Olekminsky State Nature Reserve in 2024 and 2025.

Name of water object	Date of sampling	Water temp., °C	Type of sample			Latitude, North	Longitude, East	Elevation a.s.l., m
			Plankton	Moss extract	Biofilm			
Lake 3	13.08.2024	23.3			121	59°01'55.6»	121°45'26.7»	170
Swamp 1	14.08.2024	19.2		126		59°11'05.3»	121°45'42.1»	167
Lake 21	25.08.2025	17.8	62			59°01'31.7»	121°43'49.6»	176

with a spatula. All algological samples were fixed by adding formaldehyde. The organic matter from diatom valves was removed by cold burning (Balonov 1975). The suspension of the cleaned valves was spread on the stub and dried at room temperature. The dry shells were gold-coated using an IB-3 ion sputter-coater (Eiko, Japan). The material was studied using a JSM-6510LV scanning electron microscope.

The chemical analysis of water samples collected in parallel with algological samples was performed according to the methods described by Semenov (1977). The water temperature was measured with a Checktemp digital thermometer (Hanna Instruments, Woonsocket, RI, USA), the pH values were measured by a potentiometric method using an IPL-101 Multitest device (SEMIKO NPP, Novosibirsk). The water salinity is calculated as a sum of anions and cations: sulfate anions were determined by the turbidimetric method, chlorides were determined by the mercurimetric method, bicarbonates, by the back titration; calcium, by the titration method with Trilon B, potassium and sodium cations, by atomic emission spectrometry using the AAS Analyst400 atomic absorption spectrometer (Perkin Elmer, United States). The watercolor index and nutrients (ammonium ion, nitrite ion, nitrates, phosphates, total phosphorus, total iron, and silicon) were determined by a photometric method using a PE-5300 VI spectrophotometer (EKROHIM, St. Petersburg). The content of difficult-to-oxidize organic substances (COD) was determined by photometric method using a Fluorat-02-2M liquid analyzer (Lumex GC, St. Petersburg, Russia). The water in the studied lake 21 is fresh, with low ions content and was well warmed up during sampling and had neutral pH.

Main physical and chemical variables were measured in the studied Lake 21 only as most representative for the Olekminsky State Nature Reserve waterbodies. The water was highly colored, the organic content according to the COD value was high. The content of ammonium nitrogen was high. The content of nitrite nitrogen and nitrate nitrogen, as well as silicon and mineral phosphorus, was low. The total iron concentration was high (Table 2).

According to the classification of Wetzel (2001), Lake 21 is a β -eutrophic water body, both in terms of the content of mineral nitrogen and the concentration of total phosphorus, as well as in terms of the ratio of the content

Table 2. Average values of the main physical and chemical parameters of the studied Lake 21 in the Olekminsky State Nature Reserve.

Variables	Mean values
Water temperature, C°	17.80
pH	6.86
Color, Pt/Co°	171
COD, mgO L ⁻¹	94.95
TDS, mg L ⁻¹	81.55
N-NH ₄ , mg L ⁻¹	0.93
N-NO ₂ , mg L ⁻¹	< 0.006
N-NO ₃ , mg L ⁻¹	0.21
Mineral nitrogen, mg L ⁻¹	1.15
Ptot, mg L ⁻¹	0.04
P-PO ₄ , mg L ⁻¹	< 0.05
Si, mg L ⁻¹	2.38
Fetot, mg L ⁻¹	1.13
N/P Ratio	29

of mineral nitrogen to mineral phosphorus. The increased color of water and high concentrations of total iron, ammonium nitrogen, and COD recorded for lake 21 are due to natural causes and possible global climatic changes. It is known that due to insufficient drainage of permafrost soils and additional runoff from the catchment area as a result of intensive permafrost melting, the water bodies of the cryolithozone are often oversaturated with carbon and organic matter (Elovskaya 1987). In addition, the melting of permafrost could result in the release of previously frozen organic matter and nutrients and their entry into surface waters (Reyes & Lougheed 2015, Fouché et al. 2020).

During the study of materials, valves of *Aulacoseira* were identified; in our opinion, they belong to a species that is new to science, the description of which is given below.

***Aulacoseira yakutiaensis* Genkal et Gabyshev sp. nov.**
(Fig. 1)

Cells are cylindrical, tightly linked with linking spines into chains. Valve dimensions: diameter 6.4–13 μ m, mantle height 3.4–7.2 μ m. Valve face flat or slightly convex, irregularly spaced areolae at the valve margin are present. Rest of valve face is smooth. The spines vary in shape; they are anchor-shaped, spatulate with small lateral processes at the edges, fingered, bifurcated at the end; they are present at the valve face/valve mantle junction. Valve mantle has longitudinal, straight rows of round areolae, 25–32 rows in 10 μ m, 30–40 areolae in a row in 10 μ m. Collar with a robust ringleist. Girdle is composed of several opened copulae.

Holotype. A nameless lake 21, 23 VIII 2025, Genkal Gabyshev25(2) Slide No. 692 (marked here in Fig. 1a), Papanin Institute for Biology of Inland Waters, Russian Academy of Sciences (IBIW RAS).

Type location. A nameless lake 21 on the left bank of the Olekma River valley, 59°01'31.7"N 121°43'49.6"E (WGS 1984), Russia.

Etymology: The species is named after the Republic of Yakutia.

Distribution. Yakutia, Russia. *A. yakutiaensis* was also found in other water bodies of the nature reserve mentioned in Table 1.

Note: The species *A. yakutiaensis* is similar to *A. lacustris* (Grunow) Krammer (Houk et al. 2017, Pl. 203, figs 1–10) but differs from it in quantitative characteristics (a smaller diameter and height of the valve, a greater number of striae and of areolae in 10 μ m), and also a robust ringleist.

CONCLUSIONS

The study made it possible to identify a species of diatoms, *Aulacoseira yakutiaensis*, which is new for science, and to expand the taxonomic spectrum of this genus for the flora of Russia.

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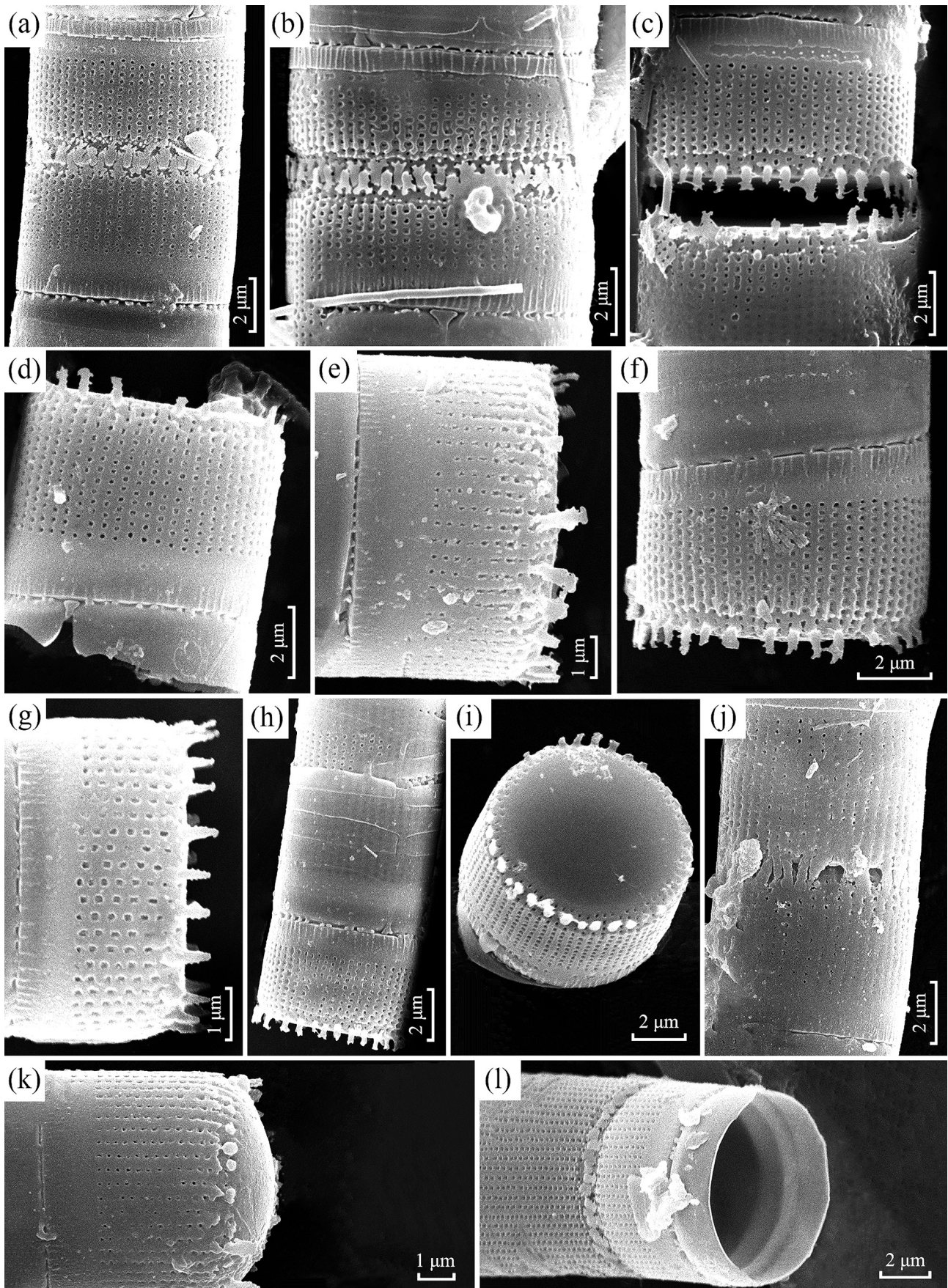


Figure 1 Electronic micrographs of *Aulacoseira yakutiaensis* sp. nov. (SEM): a–l – external views, valves with spinae; h – opened copulae, i – valve face surface, l – robust ringleist

Conflict of interest: The authors declare no conflicts of interest.

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