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COSMARIUM MANDOSII VAN WESTEN & COESEL 2020 *(ZYGNEMATOPHYCEAE, STREPTOPHYTA)*, NEW SPECIES FOR UKRAINE, THE SECOND RECORD IN THE WORLD AFTER AUTHORS DESCRIPTION IN THE NETHERLANDS

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COSMARIUM MANDOSII VAN WESTEN & COESEL 2020 *(ZYGNEMATOPHYCEAE, STREPTOPHYTA)* – НОВИЙ ДЛЯ УКРАЇНИ ВИД, ДРУГА ЗНАХІДКА В СВІТІ ПІСЛЯ ЙОГО ПЕРШООПИСУ В НІДЕРЛАНДАХ

ABSTRACT

A new species of desmid algae - *Cosmarium mandosii* Van Westen & Coesel 2020, first described in the Netherlands in 2020, was discovered in the quarry pond "Zemsnariad" (Mlynovyshche Lake) in Chernihiv city (Ukraine).

The aim of the study was to investigate the morphology of a representative of the species *C. mandosii*, discovered in the quarry pond (Chernihiv city), as well as to provide a taxonomic list of algae *Zygnematophyceae, Streptophyta* of the quarry pond "Zemsnariad".

Samples for algological analysis (periphyton of submerged parts and old leaves of *Phragmites* sp. and squeezed liquid *Ceratophyllum demersum*) were collected in June 2024 in the quarry pond "Zemsnariad", which is located within Chernihiv city, close to its historical part. Both live samples and those fixed with 4 % formalin (for further storage and examination) were studied. Microscopic examination of the samples was carried out using light microscope Zeiss Imager A2 and Canon R6 camera. Some chemical parameters of the water were determined: 1) pH and electrical conductivity using portable multimeters H&M COM-100 and H&M PH-200; 2) the content of ions NO_3^-, SO_4^{2-}, NH_4^+, Cu^{2+}, Zn^{2+}, Mn^{2+}, Fe_{total} according to regulated methods in the local state laboratory of the Ministry of Health of Ukraine. It was established that the dimensional features of the representative of the species *C. mandosii* found in Chernihiv coincide with the data of other authors. This is the first published discovery of *Cosmarium mandosii* Van Westen & Coesel 2020 outside the Netherlands after the first description of this species in 2020. The algoflora of Ukraine is enriched with a new rare species. This is also the first published study of *Zygnematophyceae*, *Streptophyta* algae of the quarry pond "Zemsnariad" (Chernihiv, Ukraine). *C. mandosii* was discovered together with 18 other taxa of desmid algae.

The area of *C. mandosii* distribution in Europe was expanded. Illustrations of the Ukrainian material were provided. "Zemsnariad" quarry pond (Mlynovyshche Lake) is a locality of the new for Chernihiv Polesie species *Cosmarium vexatum* West 1892, and the new for Ukraine and rare for the world species *C. mandosii*.

Key words: *Cosmarium mandosii,* desmid algae, quarry pond, Polesie, biodiversity of the transformed environment, Chernihiv

АНОТАЦІЯ

Новий вид десмідієвих водоростей - *Cosmarium mandosii* Van Westen & Coesel 2020, вперше описаний у Нідерландах у 2020 році, виявлено у кар'єрній водоймі Земснаряд (оз. Млиновище) в місті Чернігові (Україна).

Метою роботи було дослідити морфологію представника виду *C. mandosii,* виявленого у кар'єрній водоймі (м. Чернігів), а також навести таксономічний список водоростей *Zygnematophyceae*, *Streptophyta* кар'єрної водойми Земснаряд (оз. Млиновище).

Проби для альгологічного аналізу (перифітон занурених частин і старих листків *Phragmites* sp. і віджата рідина *Ceratophyllum demersum*) відбирали у червні 2024 році в кар'єрній водоймі Земснаряд (оз. Млиновище), яка знаходиться в межах м. Чернігова, близько до його історичної частини. Досліджували як живі зразки, так і фіксовані 4 %-ним формаліном (для подальшого зберігання та дослідження). Мікроскопічне дослідження зразків проводили за допомогою світлового мікроскопа Zeiss Imager A2 та камери Canon R6. Визначали деякі хімічні параметри води: 1) pH і електропровідність з використанням портативних мультиметрів H&M COM-100

і H&M PH-200; 2) вміст іонів NO_3^-, SO_4^{2-}, NH_4^+, Cu^{2+}, Zn^{2+}, Mn^{2+}, $Fe_{заг}$ за регламентованими методиками в місцевій державній лабораторії Міністерства охорони здоров'я України.

Встановлено, що розмірні особливості знайденого в Чернігові представника виду *C. mandosii* співпадають із даними інших авторів. Це перша оприлюднена знахідка *Cosmarium mandosii* Van Westen & Coesel 2020 за межами Нідерландів після першоопису цього виду в 2020 році. Альгофлора України збагатилася новим рідкісним таксоном. Ця публікація є першим оприлюдненим дослідженням водоростей *Zygnematophyceae, Streptophyta* кар'єрного ставка Земснаряд (оз. Млиновище) (Чернігів, Україна). *C. mandosii* було виявлено разом із ще 18 таксонами десмідієвих водоростей.

Розширено ареал розповсюдження *C. mandosii* в Європі, надано ілюстративний матеріал української клітини. Кар'єрна водойма Земснаряд (оз. Млиновище) – це локалітет нового для Чернігівського Полісся виду *Cosmarium vexatum* West 1892, та нового для України і рідкісного для світу виду *C. mandosii*.

Ключові слова: *Cosmarium mandosii,* десмідієві водорості, кар'єрна водойма, Полісся, біорізноманіття трансформованого середовища, Чернігів

Algological samples collected in the quarry pond "Zemsnariad" (Mlynovyshche Lake) in Chernihiv in 2024. Samples were not very rich in *Zygnematophyceae* species – 19 taxa in total (compare Shyndanovina, 2024) but one interesting *Cosmarium* species attracted our attention and was identified as *Cosmarium mandosii* Van Westen & Coesel 2020. The aim of the study was to investigate the morphology of a representative of the species *C. mandosii*, discovered in the quarry pond (Chernihiv city), as well as to provide a taxonomic list of algae *Zygnematophyceae*, *Streptophyta* of the quarry pond "Zemsnariad".

The authors of this species indicated that this species is probably quite common in Europe (Netherlands, Austria, Czech Republic, France), but *C. mandosii* should be compared with two morphologically similar species: *C. vogesiacum* Lemaire and *C. polonicum* Raciborski. Further in the differential diagnosis the authors provided the following details:

The difference between *C. mandosii* is in the general shape of the cell and the structure of the ornamentation of the central part of the half-cell, which is very clearly seen when the cell is in the apical view.

C. polonicum like *C. vogesiacum* is characterized by cells slightly larger in length compared to width and trapezoidal semicells. The cells of *C. mandosii* are approximately the same in length and width, shape of their semicells is elliptical-oblong (or bean-like), which makes their appearance noticeably different (see Van Westen & Coesel, 2020).

Locality: the quarry pond "Zemsnariad" (Mlynovyshche Lake) is situated in one of the hystorical parts of Chernihiv city, that is called Liskovytsia (Fig. 1).

Fig. 1. View of the quarry pond "Zemsnariad" (Mlynovishche Lake) and Liskovytsia district from the bell tower of the Trinity-Ilyinsky Monastery. Photo by © Vynogradov A.I., 2019

Liskovytsia is a historical district of Chernihiv city, stretching from the foot of the Dytynets (inner center of an old town) fortifications to the Bogorodychna (Theotokos) Lavra, founded by St. Anthony of the Caves.

The territory of Liskovytsia includes Vovcha Slobidka, Boldyny Hills, Kholodny Yary and part of the floodplain near the Holy Grove and Lake Mlynovyshche, the historical name of which is associated with the water mills of the Yelets Monastery, which were once built on the banks of the Strizhen River.

The "Zemsnariad" quarry pond was formed on the place of the old bed of the Strizhen River as a result of several transformations caused by human activity.

Initially, in 1863, a dam was built for the purposes of building the St. Petersburg - Kyiv tract. As a result of this construction, the bed of the Strizhen River was changed and directed into another part of the Desna River (Fig. 2).

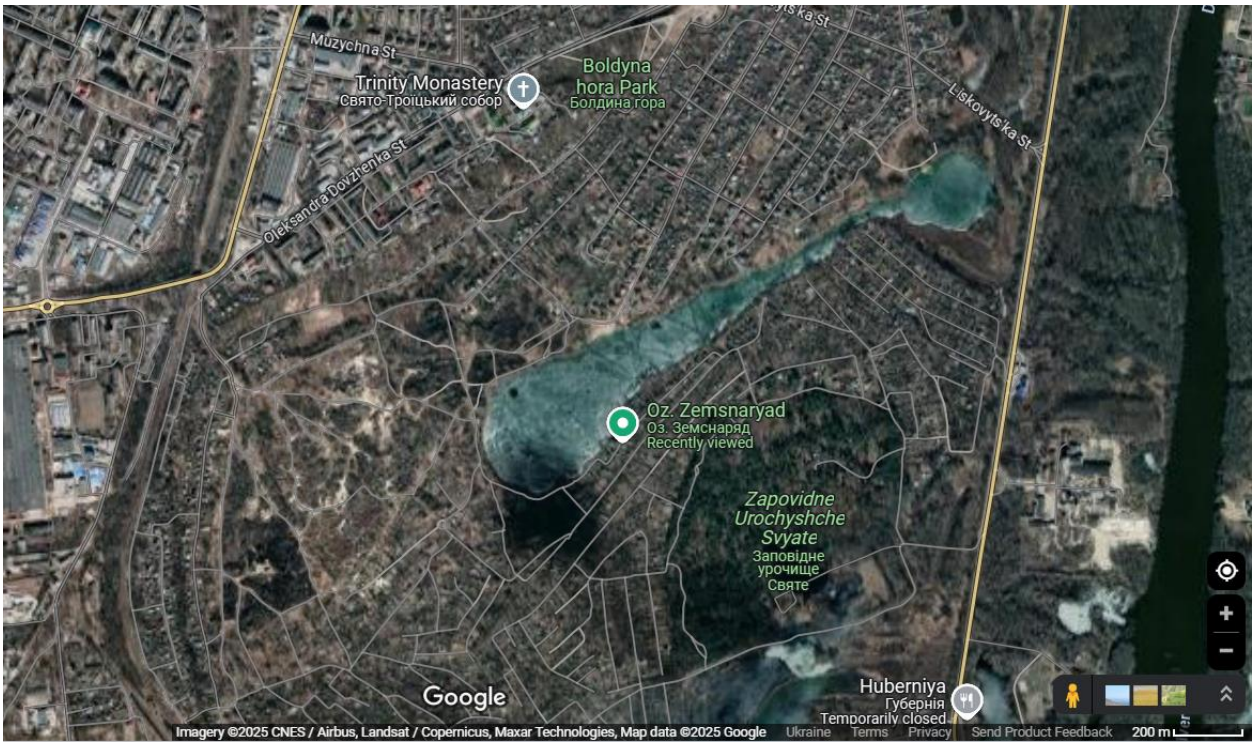

Fig. 2. View of the quarry pond "Zemsnariad" (Mlynovyshche Lake) among the urban area of Chernihiv city. Imagery: ©CNES/Airbus, Landsat/Copernicus, Maxar Technologies, 2025. Map data: ©Google, 2025

Further transformation took place in the end of the 20th century and was associated with the sand extraction by open excavation and hydraulic fill methods. After the completion of the sand extraction works and filling the basin with ground and rain waters, a local name "Zemsnariad" (means dredging machine) appeared and is still being used by inhabitants of Chernihiv in parallel to its historical name "Mlynovyshche Lake".

The pond is located in the floodplain (right bank) of the Desna River, and it is fed with ground and rain waters. The total area of the pond is 0,26 km^2, length – 1,2 km, average width 0,07 km, maximum width – 0,1 km, coordinates: 51°28'18"N 31°17'22"E (Fig. 2). The banks are flat and alternate with wetland or marshy areas in some low places. The pond freezes in winter (Fig. 3).

Fig. 3. "Zemsnariad" (Mlynovishche Lake) frozen in winter. Photo by I. Shyndanovina

The samples were examined alive as well as fixed with 4 % formalin for further storage and examination. Water chemical variables (pH and electrical conductivity) were determined by H&M COM-100 and H&M PH-200 portable multimeters. Microscopic examination of the samples was carried out using light microscope Zeiss Imager A2 equipped with Canon R6 digital camera.

The hydrochemical parameters (ion concentrations) of "Zemsnariad" pond (Mlynovishche Lake) were measured in the local state laboratory of the Ministry of Health of Ukraine. The hydrochemical parameters of the pond are: pH: 7.4; EC: 1050, ion concentrations are indicated in Table 1.

Table 1

The hydrochemical parameters of "Zemsnariad" Pond (Mlynovishche Lake)

№	Ion designation	Ion concentration, mg/L
1.	NO_3^-	<0.2
2.	SO_4^{2-}	72.9
3.	NH_4^+	0.57
4.	Cu^{2+}	<0.1
5.	Zn^{2+}	<0.1
6.	Mn^{2+}	<0.01
7.	Fe_{total}	<0.1

The following publications were used in the identification process: Palamar-Mordvintseva, 1986; Palamar-Mordvintseva, 2005; Lenzenweger, 1999; Coesel & Meesters, 2007; Van Westen & Coesel, 2020; Van Westen, 2024.

Cosmarium mandosii Van Westen & Coesel 2020 was found in samples collected in June 2024: periphyton of submerged parts and old leaves of *Phragmites* sp. and squeezed liquid of *Ceratophyllum demersum* L. (Fig. 4).

Fig. 4. Quarry Pond Zemsnariad (Mlynovyshche Lake), one of the points of samples collection in June 2024

Diagnosis: cells are approximately the same in length and width, deeply constricted. Sinus linear, closed for the most part, basal angles are widely rounded. Semicells are elliptically elongated, bean-shaped when viewed from the front. The semicell has two swellings (median nodules) in the center that carry a different number of granules. A row of four granules can be seen above the isthmus. The edges of the semicell, as well as the area between the edge and the middle, are provided with evenly distributed small granules. Semicells are round in the side view, elliptical in the apical view, with two noticeable median nodules on both sides. Chloroplast is with one central pyrenoid.

Microphotographs of living material in three projections and ornamentation of the central part of the semicell are reproduced on Fig. 5.

Only one cell was measured. The dimensions of the Ukrainian cell are within the size range given for the material from the Netherlands (Table 2).

Cosmarium mandosii Van Westen & Coesel 2020 was found together with another 18 taxa of desmid algae (see Table 3):

Closterium Nitzsch ex Ralfs – 5 taxa; *Cosmarium* Corda ex Ralfs – 11 taxa; *Pleurotaenium* Nägeli – 1 taxon; *Staurastrum* Meyen ex Ralfs – 2 taxa.

Cosmarium vexatum West 1892 is a new species for Chernihiv Polesie.

Despite the anthropogenic pressure, "Zemsnaryad" quarry pond (Mlynovyshche Lake) is a locality of rare species of desmid algae. 19 taxa, including *C. mandosii*, are new for the flora of desmids of Ukraine, and *Cosmarium vexatum* West 1892 is a new species for Chernihiv Polesie. This gives an additional reason (Shyndanovina, 2024) to the statement that transformed by man ecosystems (for example, quarry pond) can be a valuable locality of desmid algae diversity.

The area of *Cosmarium mandosii* Van Westen & Coesel 2020 distribution in Europe expends to the Chernihiv Polesie (Ukraine). Additionally, *Cosmarium vexatum* West 1892 distribution in Ukraine also includes Chernihiv Polesie now.

The illustrations of the Ukrainian material presented in this publication will serve as a comparative basis for floristic studies of desmid algae.

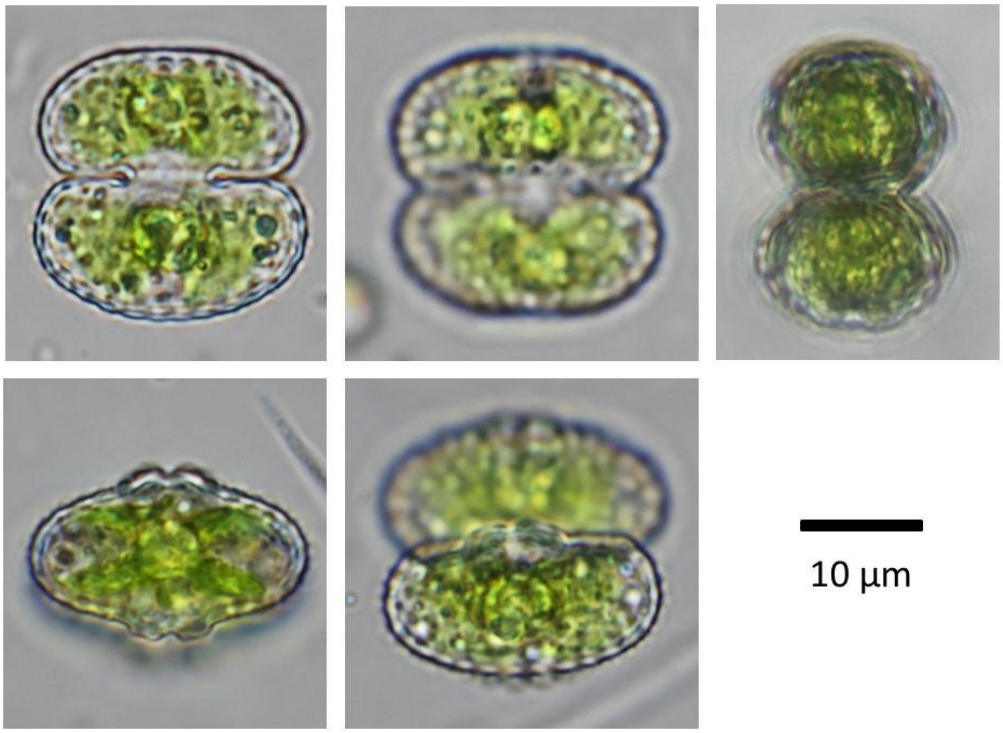

Fig. 5. *Cosmarium mandosii* Van Westen & Coesel 2020, microphotographs of the cell found in the quarry pond "Zemsnariad" (Mlynovyshche Lake) Chernihiv (Ukraine). Photos by I. Shyndanovina

Table 2

Comparative table of dimension of *Cosmarium mandosii Van Westen & Coesel 2020* by different authors

Dimensional features	Our cell from "Zemsnariad", µm	Van Westen & Coesel, 2020, µm	Westen, 2024, µm
Length	23.19	20-25	22-27
Breadth	23.38	19-24	21-25
Thickness	15.21	12-14	13.5-15
Isthmus	7.90	7-9	7-9
Length / breadth ratio	0.99	-	0.98-1.11

Table 3

Taxonomic list of Desmidiales (Zygnematophyceae, Streptophyta) of the quarry pond Zemsnariad (Mlynovyshche Lake)

Rank	Name	Author
Class	***Zygnematophyceae***	**Round ex Guiry 2013**
Subclass	***Zygnematophycidae***	**Melkonian, Gontcharov & Marin 2019**
Order	***Desmidiales***	**Bessey 1907**
Family	***Closteriaceae***	**Bessey 1907**
Genus	***Closterium***	**Nitzsch ex Ralfs**
	1 *Closterium acerosum*	Ehrenberg ex Ralfs 1848
	2 *Closterium aciculare*	T.West 1860
	3 *Closterium ehrenbergii*	Meneghini ex Ralfs 1848

Rank	Name	Author
	4 *Closterium moniliferum*	Ehrenberg ex Ralfs 1848
	5 *Closterium tumidulum*	F.Gay 1884
Family	***Desmidiaceae***	**Ralfs 1848**
Genus	***Cosmarium***	**Corda ex Ralfs**
	1 *Cosmarium botrytis*	Meneghini ex Ralfs 1848
	2 *Cosmarium granatum*	Brébisson ex Ralfs 1848
	3 *Cosmarium laeve*	Rabenhorst 1868
	4 *Cosmarium mandosii*	Van Westen & Coesel 2020
	5 *Cosmarium obtusatum*	(Schmidle) Schmidle 1898
	6 *Cosmarium punctulatum*	Brébisson 1856
	7 *Cosmarium regnellii*	Wille 1884
	8 *Cosmarium reniforme*	(Ralfs) W.Archer 1874
	9 *Cosmarium subgranatum*	(Nordstedt) Lütkemüller 1902
	10 *Cosmarium subimpressulum*	Borge 1894
	11 *Cosmarium vexatum*	West 1892
Genus	***Pleurotaenium***	**Nägeli, 1849**
	1 *Pleurotaenium trabecula*	Nägeli 1849
Genus	***Staurastrum***	**Meyen ex Ralfs, 1848**
	1 *Staurastrum crenulatum*	(Nägeli) Delponte 1877
	2 *Staurastrum punctulatum*	Brébisson 1848

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