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Yurii Karpenko, Olha Mekhed, Svitlana Kyryienko

**COSMARIUM TAXICHONDRIFORME EICHLER & GUTWINSKI 1895 –
THE FOURTH RECORD OF A RARE DESMID (ZYGNEMATOPHYCEAE, STREPTOPHYTA)
IN CHERNIHIV POLESIE**

Юрій Карпенко, Ольга Мехед, Світлана Кириєнко

**COSMARIUM TAXICHONDRIFORME EICHLER & GUTWINSKI 1895 –
ЧЕТВЕРТА ЗНАХІДКА РІДКІСНИХ ДЕСМІДІЄВИХ
(ZYGNEMATOPHYCEAE, STREPTOPHYTA) НА ЧЕРНІГІВСЬКОМУ ПОЛІССІ**

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ABSTRACT

Purpose. Adding new distribution and microphotographs of a rare taxon of the genus *Cosmarium* found in a small pond in Chernihiv Polesie. Review of the history of this taxon study in Ukraine and its taxonomy, infraspecific taxa characters are compared discussed.

Methodology. The new locality of *C. taxichondriforme* is situated at the border of the landscape reserve of national significance "Zamglai" that is one of the largest eutrophic swamps in the Chernihiv Polesie.

During the field research of the Zamglai bog complex, algal samples were collected from a small pond (2000 m²) situated along the road to Hrybova Rudnia village from route E95, at the distance of 1,8 km village and 0.8 km from the route. The samples were fixed with 4 % formalin for further study in laboratory conditions; pH and electrical conductivity of water were measured with a portable pH and conductivity meter. Microscopic examination of the samples was carried out using a light microscope equipped with a camera for taking microphotos. Identification manuals and monographs of the leading Ukrainian (Palamar-Mordvitseva, 1986, 2005) and European desmidiologists (Lenzenweger, 1999) were used for species identification. The iconotype provided in the original description of the newly recorded taxon (Eichler & Gutwiński, 1895) was used.

Scientific novelty. The fourth record in the Ukrainian desmidioflora and a new locality in Chernihiv Polesie of a rare taxon from the genus *Cosmarium* is documented. Previously it was discovered 26 years ago (Palamar-Mordvitseva & Shindanovina, 1998) in Soseske bog nearby Olyshivka village Chernihiv rayon and oblast. This is the first publication of Ukrainian cells microphotographs.

Conclusions. All records of this taxon in Ukraine are in Chernihiv Polesie. We hope this publication will provide good illustrative and informative basis for further findings of *C. taxichondriforme* in other regions of Ukraine. Sampling small water bodies should not be neglected.

Keywords: *Desmidiaceae*, Chernihiv Polesie, small water bodies

АНОТАЦІЯ

Мета роботи. Рідкісний таксон роду *Cosmarium*, знайдений в маленькій водоймі Чернігівського Полісся. Огляд історії вивчення цього таксону в Україні та його систематики, розглянута порівняльна характеристика внутрішньовидових таксонів. Представлені мікрофотографії та новий локалітет його розповсюдження.

Методологія. Новий локалітет *C. taxichondriforme*, розташований на кордоні ландшафтного заказника загальнодержавного значення «Замглай», що є одним з найбільших на Чернігівському Поліссі евтрофних боліт.

В ході проведення експедиційних досліджень болотного комплексу «Замглай» були відібрані альгологічні зразки в маленькій водоймі (2000 м²), що розташована вздовж дороги, що з'єднує трасу E95 з селом Грибова Рудня. Зразки були зафіксовані 4 %-ним формаліном для подальшого дослідження у лабораторних умовах. рН та електропровідність води визначали портативним приладом. Мікроскопічне дослідження проб здійснювалось за допомогою світлового мікроскопу, обладнаного фотокамерою для мікрофотофіксації. Визначники та монографії провідних українських (Паламар-Мордвінцева, 1986, 2005) та європейських десмідіологів (Lenzenweger, 1999) використовувались для визначення видів. Використовували іконотип виду з первісного його опублікування (Eichler & Gutwiński, 1895).

Наукова новизна. Четверта знахідка в Україні рідкісного таксону роду *Cosmarium*, остання публікація була 26 років тому назад (Palamar-Mordvitseva & Shindanovina, 1998) для болота Сосенське, поблизу села Олишівка Чернігівського району, Чернігівської області. Це перша публікація мікрофотографій українських клітин *C. taxichondriforme*.

Висновки. Всі опубліковані знахідки даного таксона в Україні в Лівобережному Поліссі. Маємо надію, що дана публікація, що містить добрий ілюстративний та інформативний матеріали надасть можливість для подальших знахідок *C. taxichondriforme* в інших регіонах України. Маленькі водойми не можна оминати увагою.

Ключові слова: *Desmidiaceae*, маленькі водойми, Чернігівське Полісся

Introduction

Cosmarium taxichondriforme Eichler & Gutwinski was first introduced by two Polish authors Bogumir Eichler and Roman Gutwiński (Eichler & Gutwiński, 1894) under the name *Cosmarium pseudotaxichondrum* Eichler & Gutwinski 1884: 240, no fig. Later authors apparently realized existence of *C. pseudotaxichondrum* Nordstedt 1878: 20, pl. 2: fig 5, and in (Eichler & Gutwiński, 1895) changed name to *C. taxichondriforme* Eichler & Gutwinski 1895: 169, pl. IV: fig. 23. This taxon was found at the environs of Międzyrzec town (now Międzyrzec Podlaski town in Poland, in Bielsko-Biala County, Lublin Voivodeship). This region belongs to Polesie and is situated in its western part. This town is situated at the distance of 70 km from the border of Ukraine.

In Ukraine this taxon was first recorded by Rayevska in 1950 in Rybne Lake situated in the environs of Kyiv city in the North-Eastern part. There are no drawings of this taxon but the author indicated the dimensions of the Ukrainian material: length 36-40 μm , width 36-40 μm , isthmus 10-11.5 μm , thickness 22-24 μm .

Next record dates back to 1953 by the same author and about the same locality (Frolova-Raevskaya, 1953). It is in fact the summary of the Rybne Lake algoflora study: in total 318 species and 48 infraspecific taxa of algae were found in this lake, from them 89 species and 12 infraspecific taxa of desmids were recorded.

This publication does not provide any drawings or cells description as well.

In 1981 G.M. Palamar-Mordintseva introduced a new genus *Pachyphorium* Palamar-Mordvintseva (1981: 223) and the next publication on this taxon in Ukraine (Palamar-Mordvintseva, 1982) was under the name of *Pachyphorium taxichondriforme* (Eichler & Gutwinski) Palamar-Mordvintseva. In this publication the author provides diagnosis of this taxon and the dimensions: length 31-41.5 μm , width 31-47 μm , isthmus 10-15 μm , thickness 17-22 μm . There are also two drawings: one

after West & West, 1905, plate LVI, fig. 8 and another is original (Palamar-Mordvintseva, 1982, p. 502, plate 133, fig. 6). New exact locality in Ukraine is not specified, only noted: small bogs, Ukraine, Kyiv region (also in Leningrad and Pskov regions of Russian Federation, and Latvia). In (Palamar-Mordvintseva, 1986) the same information on this species was published with indication of distribution in Ukraine in Left-Bank Polesie (Kiev region).

The new locality of *C. taxichondriforme* in Ukraine was added in 1998 (Palamar-Mordvintseva & Shindanovina, 1998) in Sosenske bog within Sosenskyj hydrological reserve in Chernihiv region. The authors did not provide neither dimension nor drawing of this taxon.

So far in Ukraine there were published three localities and one drawing of this species with face and apical views with no reference to a locality (see Fig.3 for the first drawings of this taxon in Poland and Ukraine).

According to the modern taxonomy and nomenclature of the Conjugatophyceae, genus *Pachyphorium* Palamar-Mordvintseva is not accepted taxonomically (Guiry 2013) and we still consider this alga within the genus *Cosmarium* Corda.

In this paper the authors report on a new geographical record for this scarce desmid species.

Materials and methods

Locality:

The new locality of *C. taxichondriforme* is situated at the border of the landscape reserve of national significance "Zamglai" that is one of the largest eutrophic swamps in the Chernihiv Polesie. A small pond (2000 m^2) situated along the road to Hrybova Rudnia village from route E95, at the distance of 1,8 km village and 0,8 km from the route (Chernihiv district, Ripky region, Ukraine, 51°56'12.6"N, 31°03'01.7"E).

The algal samples were collected in August 2018, at water temperature of 21.5°C, pH 7.5, conductivity 33-35 $\mu\text{S}/\text{cm}$. Figure 1 shows the location of the pond.



Fig.1. Google Maps view of the location of the sampling site

Ecological variables were measured with EZODO 8200M pocket multimeter (EZODO, Taiwan). Identification was done based on R. Lenzenweger’s *Desmidiaceenflora von Österreich* (1999), and Palamar-Mordvintseva (1986).

Microphotographs were made with a Canon EOS 1000D digital camera.

Results and discussion

This taxon was not very frequent in samples. It can be easily identified by the basal angular wall thickening and its deep undulated sinus that is closed for 1/3 of its length nearby isthmus and further slightly open for the rest its

length. The basal angles are thickened. This taxon has a central chloroplast with one pyrenoid. The dimensions of our observed cell (1 cell was measured) are bigger than those of Eichler & Gutwiński (1895) but within the dimensions indicated by Rayevska (1950) and Palamar-Mordvintseva (1982, 1986). *C. taxichondriforme* dimensions measured by different authors presented in Table 1.

The general outline of the cells with face, side and apical views and a face view of the live cell are presented in microphotographs at Fig. 2.

Table 1

Dimensions of *Cosmarium taxichondriforme* Eichler & Gutwinski 1894 cells as measured by different authors

| Dimensional features | Our cell from a pond near Hrybova Rudnia, μm | Eichler & Gutwiński (1895), μm | Rayevska (1950), Rybne Lake, μm | Palamar-Mordvintseva (1982, 1986), μm |
|------------------------|---|---|--|--|
| Length | 41.7 | 31-32-29-34-35 | 36-40 | 31-41.5 |
| Breadth | 38.9 | 31-34-31-0-34 | 36-40 | 31-47 |
| Thickness | 23.6 | 17-18-17-20-20 | 22-24 | 17-22 |
| Isthmus | 14.0 | 11-10-11-0-11 | 10-11.5 | 10-15 |
| Length / breadth ratio | 1.07 | 0.94–1.04 | 1.0 | 0.88-1.0 |

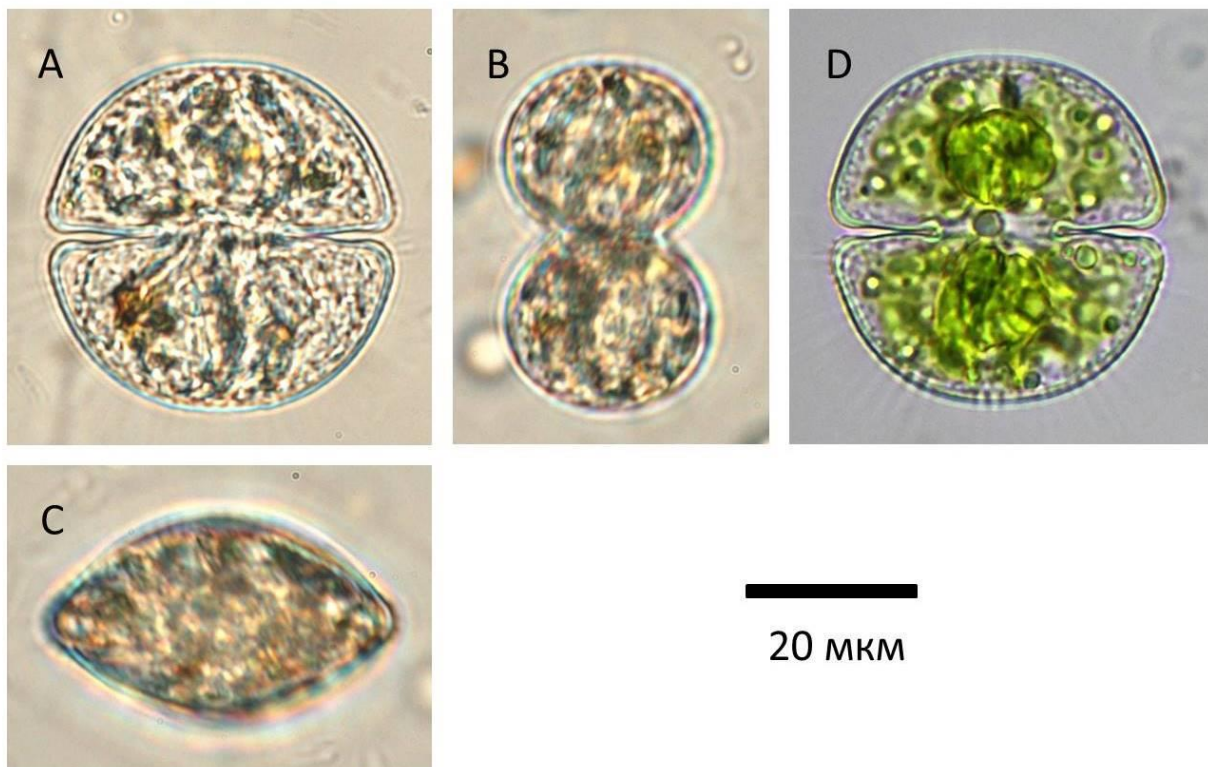


Fig. 3. Microphotographs of *Cosmarium taxichondriforme* Eichler & Gutwinski 1895. Front view (A), lateral view (B), apical view (C), live cell outline (D)

Generally, 5 infraspecific taxa (varieties) of *C. taxichondriforme* including type one are known to date (Eichler & Gutwinski 1895; Grönblad 1960; Krieger & Gerloff 1962; Coesel 1979, 1991). Morphologically our cell is different from var. *depressum* Eichler & Gutwinski in size (last one is much smaller – 20-26 μm long, 23-24 μm wide, isthmus 6-7 μm , thickness 15-17 μm) and in shape (its semicells viewed from the front and from the side are dorsally truncated and therefore quite depressed).

C. taxichondriforme var. *planipes* Grönblad characterized by linear median constriction and well distinguished in this feature from our specimen. The vertical view of those two algae is similar (Grönblad 1960: figs. 56, 57).

C. taxichondriforme var. *skujae* Krieger & Gerloff was described by Krieger & Gerloff (1962) based on Skuja (1928) and Allorge & Lefèvre (1925) descriptions and drawings. It is slightly similar to our specimen in dimensions (42-52 μm long, 40-47 μm wide, thickness 25-30 μm , isthmus 14-18 μm , but distinctly different from our algae in having longer cells, slightly rounded protracted basal angles, heavily convex and slightly truncated apex (Krieger & Gerloff, 1962: 33, plate 10, fig. 2 a-b).

C. taxichondriforme var. *nudum* (Turner) Coesel 1991: 58 (basionym: *C. taxichondrum* Lundell var. *nudum* Turner 1892: 60, pl.8: fig. 64; synonym: *C. taxichondriforme* var. *nudum* (Turner) Coesel, *nom. inval.* 1979: 392, *nomen*) also similar to our specimen in general shape of the cell but very significant distinguishing features of this variety include two pyrenoids per semicell instead of one in our specimen.

All previous comparisons with descriptions of *C. taxichondriforme* infraspecific taxa known to date give us clear confidence what our specimen belongs to the type variety of *Cosmarium taxichondriforme* Eichler & Gutwinski. Main morphological characteristics of this taxon are: quite large cell dimensions, undulated sinus, one pyrenoid in each semicell, and characteristic outline of the semicell. Eichler & Gutwinski (1895: 169) in protologue of this species indicated shape of the cell as “in aspect frontali, habitu *Cosmarii taxichondri* Lund. var. *nudi* Turner”, which is almost circular in outline (Turner 1893: 60, pl. VIII, fig. 64). The same, almost circular or semicircular (to trapeziform), slightly depressed shape of the cells mentioned in Coesel (1991) and depicted in Krieger & Gerloff (1962: pl. 10, fig. 1a).

In Palamar-Mordvintseva (1982, 1986) original drawings of this species shows very strong trapeziform cell outline with practically flat or even truncate apex (Fig. 3 A). Such shape of the cells is different from the shape shown by drawings of Eichler & Gutwinski (1895) (Fig. 3 B). As known (Palamar-Mordvintseva, 2005: 5), main systematic characteristics which plays significant role in identification of desmids are:

shape of the cells, sinus structure, cell wall patterns and chloroplast shape and architecture. Based on this axiom, we can assume what *Cosmarium taxichondriforme* Eichler & Gutwinski *sensu* Palamar-Mordvintseva may be a new, not yet described variety of this species. Detailed studies of the cell morphology of intraspecific taxa of this species are important to confirm this assumption.

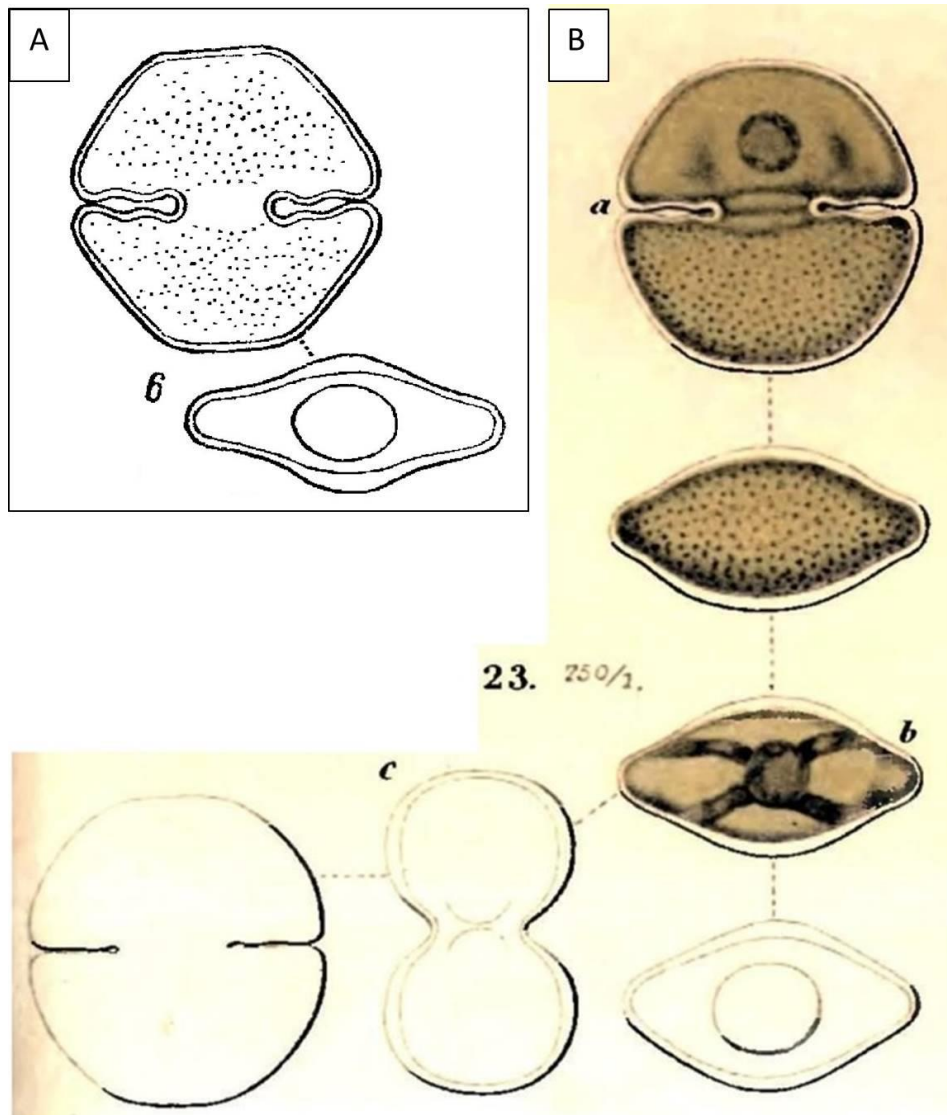


Fig. 3. Original drawings of *Cosmarium taxichondriforme* Eichler & Gutwinski 1895: by Palamar-Mordvintseva, 1986, p. 260, plate 59, fig 6 (A) and by Eichler & Gutwinski, 1895, plate IV, fig.23 (B)

Conclusions

Our publication is the fourth documentation of *Cosmarium taxichondriforme* Eichler & Gutwinski 1895 in Ukraine. All these four records refer to the Left-bank Polesie (part of the Ukrainian Polesie situated on the left bank

of Dnipro river). Our publication provides the first light microscope images as well as updated dimensions of Ukrainian population of this interesting species. We also hope that future findings of this taxon will bring light to better understanding of *Cosmarium taxichondriforme* and its infraspecific taxa.

Заява інституційної ревізійної ради / Institutional Review Board Statement

Не застосовується / Not applicable.

Заява про інформовану згоду / Informed Consent Statement

Не застосовується / Not applicable.

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Information about the authors:

Karpenko Yu. [*in Ukrainian: Карпенко Ю.*]¹, Ph.D.inBiol. Sc., Assoc. Prof., email: yuch2011@i.ua

ORCID: 0000-0002-1703-8473 Scopus-Author ID: 57225225632

Department of Ecology, Geography and Nature Management, T.H. Shevchenko National University "Chernihiv Colehium"
53 Hetmana Polubotka Street, Chernihiv, 14013, Ukraine

Mekhed O. [*in Ukrainian: Мехед О.*]², Candidate of Biological Sciences, Doctor of Pedagogical Sciences, professor, email: mekhedolga@gmail.com

ORCID: 0000-0001-9485-9139 Scopus Author ID: 6506181994 ResearcherID: AAC-7333-2021

Department of Biology, T.H. Shevchenko National University "Chernihiv Colehium"
53 Hetmana Polubotka Street, Chernihiv, 14013, Ukraine

Kyryienko S. [*in Ukrainian: Кирієнко С.*]³, Ph. D. in Biol. Sc., Assoc. Prof., email: vettavl@ukr.net

ORCID:0000-0002-2960-8656

Department of Ecology, Geography and Nature Management, T.H. Shevchenko National University "Chernihiv Colehium"
53 Hetmana Polubotka Street, Chernihiv, 14013, Ukraine

¹ Study design, data collection, statistical analysis, manuscript preparation.

² Manuscript preparation.

³ Study design, data collection, statistical analysis, manuscript preparation.