

A NEW FOR SCIENCE GENUS *BICHLOROPLASTA* (CHLAMYDOMONADACEAE, CHLOROPHYTA)

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ABSTRACT

A new genus *Bichloroplasta* (Clamydomonadaceae, Chlorophyta) from small ephemeral water basin in Plovdiv (Bulgaria) is described and pictured. The new found species is of particular interest with the following characteristic features: two cup shaped chloroplast, each of them with a pyrenoid; the cells have a stigma (only on one of chloroplasts); the presence of 4 (5) apical pulsating vacuoles; its cellular sheath has two (folds) ribs.

Key words: *Chlorophyta, Clamydomonadaceae, new genus, ephemeral water*

INTRODUCTION

The green algal family Chlamydomonadaceae includes many unicellular green flagellates that represent economically and taxonomically important components of both freshwater and marine environments in the world. The family is an assemblage of ecologically, reproductively, and morphologically diverse array of biflagellate and quadriflagellate taxa. Two chlamydomonadalean genera, *Chlamydomonas* and *Carteria*, have been the focus of recent phylogenetic investigations (Buchheim et al., 1996).

MATERIAL AND METHOD

In the winter of 11.02.2011, in small ephemeral water basin with 1 m² area and 15 cm depth containing rainwater or melted snow in a syenite rock of „Sahat tepe”, Plovdiv town, Bulgaria (42°14'548"N 24°74'580"E) we found "blooms" due primarily to the species, which is the subject of this article. We traced the bloom, which lasted more than a month (to 17.03.2011). This small ephemeral water basin was dried up in April 2011 and remained dry grass green coating on the bottom.

During the cold months of the next three years we observed the new found interesting algae (17.03.2012, 02.04.2013, 26.03.2014). On each visit has been ascertained "blooms" of a species and some of the accompanying algae. Thus the species was monitored for four years. The study of the material collected was performed with light microscope Olympus CX31 in the Department of Biology and Aquaculture at the Trakia University.

RESULT AND DISCUSSION

The new found species is of particular interest with the following characteristic features:

1. - two cup shaped chloroplast, each of them with a pyrenoid;
2. - the cells have a stigma (only on one of chloroplasts);
3. - the presence of 4 (5) apical pulsating vacuoles;
4. - its cellular sheath has two (folds) ribs.

In the above features, our species apparently belongs to the family Chlamydomonadaceae, Chlorophyta, but stay away from his green four flagella genus (*Carteria*, *Tetratoma*, *Costatochloris*), which have their representatives in similar form to a cells. The last have a one chloroplast and distinguished of our species in all the above mentioned features (Pascher, 1911, 1932; Skuja, 1948; Ettl, 1983). The species of the genus *Scherffelia*, in which cells have two chloropalast - is with highly flattened cells.

Foregoing gives us reason to believe that we have come to the taxon that is representative of a new genus. Along the most characteristic feature of it (the presence of two chloroplast) we give the

name *Bichloroplasta*, and for species epithet use the name of our respected colleague from Bratslava - František Hindak.

***Bichloroplasta* *gen. nov.**

Description: The cells have a shape close to a sphere, and some of the adults - width less exceeds their length (fig. 1); while the young are slightly flattened along the longitudinal axis (fig. 2). The cells have a large (wide 3.7 – 5.0 µm and high 1.0 – 1.5 µm) four top papilla, from which go out flagellums. The last are equal to the length of the cell up to 1.5 times longer than it. The cell walls is thick, with two (folds) ribs (fig. 3). In most cases the ribs start from the papilla, pass by the cell, and end at their rear pole without unite in a ring. A relatively rare the ribs are connected into the rear pole, and more rarely, they are short, only developed in the most convex part of the cel (fig. 3).

Very characteristic feature of our species is the presence in the cell of two chloroplasts (fig. 1). They are cup-shape equal in size and occupy almost the entire cell (rarely one is a slightly larger). Each of the chloroplast have a pyrenoid, which is located in the thickened part, as the location varies - from the rear end to the middle of the cell. Pyrenoid in both chloroplasts most frequently are equal but in some cases differ slightly in shape and size. Although rarely are found individs in which one of the chloroplasts has 2-3-(4) smaller pyrenoid (fig. 4). Pyrenoid have enveloped by the rod-shaped starch grains (fig. 5), which in cross section look like small round grains. The stigma is small, orange, slightly convex, and is situated in the equatorial or a little backward on one of the chloroplasts (fig. 1). The cells have 4 (rarely 5) apically located pulsating vacuoles (fig. 1). The nucleus is large, lying in front of the cell immediately under the pulsing vacuoles.

We found and the case of an individ who has only one chloroplast occupying only half cell. It has a stigma and pyrenoid.

Table 1. Sizes and biometric characteristics of the cells in *Bichloroplasta hindaki* gen. et sp. nov. (n = 32)

| Characteristics | Min. | Max. | max/min | x±Sx | SD | CV |
|-----------------|------|------|---------|-----------|-------------|--------------|
| Length (µm) | 10.0 | 26.0 | 2.50 | 17.0±0.63 | 3.90 ± 0.44 | 22.91 ± 2.59 |
| Width (µm) | 11.2 | 26.0 | 2.23 | 17.8±0.53 | 3.29 ± 0.37 | 18.46 ± 2.09 |
| Length/ Width | 64 | 115 | 1.80 | 93.0±4.0 | 0.24±0.03 | 25.8±29.0 |

Reproduction: not observed.

Sizes: cells are long 10.0 - (17.0) – 26.0 µm and 11.2 - (17.8) – 26.0 µm wide (table 1); papilla - wide 3.7 – 5.0 µm and long 1.0 – 1.5 µm; flagella are equal or 1.5 times longer than the cell.

Habitat: small ephemeral water basin (with 1 m² area) in a syenite rock of „Sahat tepe”, Plovdiv town, Bulgaria, being filled during the colder months of the year - from February to April with rain or snow water (15 cm).

Diagnosis: Cellulae regulariter sphaericum, aut leviter planis perpendicularis costis; membrana crassa, mit latae papilla, duo inferiores costae parte; chloroplaste binis aeuqale longitudinalis costas, parte incrassata; pirenoidibus in incrassata parte chloroplasti dispositis; stigma 1 in parte media uno chloroplasti dispositis; vacuolis contractilibus, quattuore (or cinquie), apicalibus; nucleo nucleolato supra medias; flagellis cellulis longioribus.

For now of the genus is known only *Bichloroplasta hindaki*.

***Bichloroplasta hindaki* sp. nov.**

Description: The cells have a shape close to a sphere, long 10.0 - (17.0) – 26.0 µm and 11.2 - (17.8) – 26.0 µm wide. The cells have a large (wide 3.7 – 5.0 µm and high 1.0 – 1.5 µm) four top papilla, from which go out flagellums. The last are equal to the length of the cell up to 1.5 times longer than it. The cell walls is thick, with two (folds) ribs (fig. 3). The cell has two chloroplasts (fig. 1) with cup-shape equal in size and occupies almost the entire cell. Each of the chloroplast have a pyrenoid, which is located in the thickened part, as the location varies - from the rear end to the middle of the cell. Pyrenoid have enveloped by the rod-shaped starch grains (fig. 5), which in cross section look like small round grains. The stigma is small, orange, slightly convex, and is situated in the equatorial or a little backward on one of the chloroplasts (fig. 1). The cells have 4 (rarely 5) apically located pulsating vacuoles (fig. 1). The nucleus is large, lying in front of the cell immediately under the pulsing vacuoles.

Diagnosis: Cellulae regulariter sphaericum, aut leviter planis perpendicularis costis; membrana crassa, mit latae papilla, duo inferiores costae parte; chloroplaste binis aequale longitudinalis costas, parte incrassata; pirenoidibus in incrassata parte chloroplasti dispositis; stigma 1 in parte media uno chloroplasti dispositis; vacuolis contractilibus, quattuore (or cinque), apicalibus; nucleo nucleolato supra medias; flagellis 1,5 plo cellulis longioribus.

Propagatio: non observata.

Dimesiones: cellulae 10.0 - (17.0) – 26.0 µm longae, 11.2 (17.8)- 26.0 µm latae. Flagellis 1,5 plo cellulis longioribus;

Habitat: parvum tempus litotelm Plovdiv, Bulgaria, durante mensibus frigidis II - IV.

Typus: figura nostra 1- 5.

Accompanying species: during the four collection (11.02.2011, 17.03.2012; 02.04.2013, 26.03.2014) on material from the object we found the following accompanying algae: Cyanophyta - *Chroococcus turgidus* (Kützing) Nägeli; Euglenophyta: *Euglena* sp., *Notosolenus apocamptus* - both species rarely found in the material; Chlorophyta: *Chlamydomonas* sp., *Haematococcus fluviatilis* Flotow, *Eudorina elegans* Ehrenberg, *Hyalogonium fusiforme* (Korsch.) Ettl, *Ulotrix* sp.; Bacillariophyta sp. div.

*Etymology: The generic name comes from two chloroplasts typical for the genus, and the species name is dedicated to eminent colleague of phycology František Hindak.

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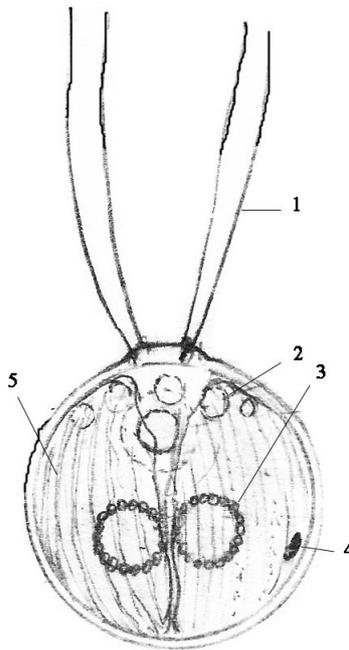


Figure 1. *Bichloroplasta hindaki* gen. et sp. nov.: 1 – flagellum, 2 – vacuole, 3 – pyrenoid, 4 – stigma, 5 – chloroplast.



Figure 2. *Bichloroplasta hindaki* gen. et sp. nov. young cell – front and posteriorly.

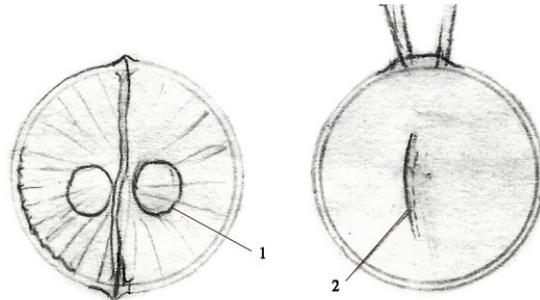


Figure 3. *Bichloroplasta hindaki* gen. et sp. nov. posteriorly cell: 1 – pyrenoid, 2 – fold.

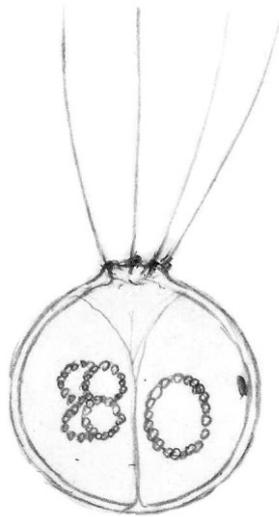


Figure 4. *Bichloroplasta hindaki* gen. et sp. nov. cell - chloroplast with 4 smaller pyrenoid.



Figure 5. *Bichloroplasta hindaki* gen. et sp. nov. pyrenoid.