FIRST EVIDENCE OF *PLANKTOTHRIX AGARDHII* (CYANOPROKARYOTA) IN THE UKRAINIAN MARINE COASTAL WATER

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Introduction. In 2020, *Plantothrix agardhii* (Gomont) Anagnostidis & Komárek, 1988 (synonyms: *Oscillatoria agardhii* Gomont) was noticed in the coastal marine phytoplankton at the northwestern part of the Black Sea. *P. agardhii* is a widespread freshwater cyanobacterial species which is common for the temperate and tropical zones. It is a cosmopolitan and β-mezosaprob. The species is a filamentous phytoplankton without trichomes, that can rarely be found in benthos communities. *P. agardhii* creates harmful algae blooms in freshwaters waterbodies, but it can also grow in high biomass in brackish waters (Tsarenko, Wasser & Nevo, 2006; Churro, Azevedo, Vasconcelos & Silva, 2017). It produces microcystins, type of hepatotoxins. That means they have a toxic effect on hepatocytes of the liver and muscle cells (Chorus & Bartram, 1999).

Planktothrix sp. in Ukrainian marine water was first reported in 2010, when it was found in summer-autumn phytoplankton communities at the Danube region (Terenko & Nesterova, 2015). However, it was identified only to the genus name.

The aim of this study is to show the evidence of new freshwater cyanobacteria, which settled a stable population in the autumn-winter phytoplankton of 2020. Adjacent conditions for its growth and distribution will be also discussed.

Materials and methods. Phytoplankton samples were collected at the northwestern part of the Black Sea in October–December 2020. The reverse filtration method was used to concentrate water samples (1.5–2L) using nucleopore filters with a pore size of 1.5 μm. All samples were condensed to 30–45 mL and then fixed with a 40 % solution of neutralized formaldehyde to the final concentration of 4 %. The identification of cyanobacteria was performed in fresh, not fixed samples in vivo. Quantitative count of *Planktothrix* filaments was carried out in a Nagotte counting chamber with a volume of 0.05 mL using a light microscope "Mikmed-2" with 300–600 magnification. The average length of *Planktothrix* filaments (trichomes) of 139 μm was used for further calculations. Additionally, temperature, salinity, pH, concentrations of dissolved phosphorus, nitrogen and oxygen in water samples were measured by the standardized methods.

Results. The first finding of *P. agardhii* in the phytoplankton of the northwestern part of the Black Sea was on October 2, 2020, at the station (coordinates 31.174 E, 46.627 N), located under the influence of the Dnieper-Bug Estuary brackish water. The number of filaments was 57.61 x 10^3 filam·L^{-1} and biomass was 259.85 mg·m^{-3}. The water temperature and salinity were 20.00 ºC and 13.86 ‰, respectively. Presumably, the Dnieper-Bug Estuary would be the source of this species because a small bloom of *P. agardhii* with the number of trichomes 167.01 x 10^3 filam·L^{-1} and biomass of 1.10 g·m^{-3} was observed on October 1, 2020, at the station located near its mouth.

Two months later, *P. agardhii* was again recorded in the coastal phytoplankton of Odessa Bay on December 23, 2020. The number of trichomes at the open coastal station with coordinates 30.768 E, 46.428 N was 69.30 x 10^3 filam·L^{-1}, associated with a biomass 159.00 mg·m^{-3}. At a semi-closed station (30.773 E, 46.441 N), where piers and breakwaters are installed, the number of trichomes was lower (1.69 x 10^3 filam·L^{-1}) associated with a biomass 3.84 mg·m^{-3}. The growth occurred at a seawater temperature of 3ºC and salinity of 14.6 ‰. Both stations are monitored once a week on the year-round basis, that allowed us to analyze other environmental changes as well. *P. agardhii* biomass was higher at the open coastal area. The

increase of all forms of phosphorus, nitrite-nitrogen, total nitrogen, and pH was observed from 16 to 23 of December. Only nitrate-nitrogen has dropped down twice from the previous week. Mineral nitrogen is one of the main components for the growth of *Plantothrix sp*., which has probably triggered its development. Moreover, during this period, we noticed the decrease in oxygen concentration at the open station to 78.1 %.

Conclusion. For the first time a population of freshwater species of cyanobacteria *P. agardhii* was registered in the autumn-winter phytoplankton in 2020. The presumable source of this species would be from the Dnieper-Bug Estuary, where massive development was observed at some moments earlier. The species can exist in a wide range of temperatures and sufficiently high salinity of marine environment. However, the number of works connecting to blooms of this species in high salinities is still rare. The population of the species found in the coastal recreational zone was influenced by rivers outflows. Based on the literature, this species carries toxins. Nearby this considered area, the Khadzhibey Estuary is an artificially closed region of the main part of the Black Sea. It has experienced new regular blooms of *P. agardhii* since April 2019. Our observations and analyses confirmed that this population is toxic and capable to produce microcystins (data not published yet). However, it is not sure that all these populations of *P. agardhii* in the Khadzhibey Estuary, the Dnieper-Bug Estuary and coastal water in Odessa have the same origin. Therefore, this shows the importance of a continuous monitoring program aimed at identification of toxic species of phytoplankton in marine coastal population and studing the mechanism of outflow influences on this region.

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