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Cyanobacteria and microalgae in the coastal air: insights from a 5-year study in the Gulf of Gdańsk Region

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Bioaerosols are microorganisms or their fragments emitted from the surface of the sea or terrestrial environment to the atmosphere. So far, scientific research has focused much more on viruses, bacteria, and fungi, which has led to a weaker recognition of the presence of cyanobacteria and microalgae in the air compared to other microorganisms.

This study exclusively focuses on cyanobacteria and microalgae noted in the atmosphere within the Gulf of Gdańsk region (Poland). It serves as a summary of 5 years of research conducted by our team on these microorganisms, delving into both the obtained results and the challenges encountered in studying cyanobacteria and microalgae in the atmosphere.

Within this research, the quantity and taxonomic composition of cyanobacteria and microalgae present in atmospheric aerosols and rainfall in the Gulf of Gdańsk area were determined. Samples of cyanobacteria and microalgae were collected both at a research station located one kilometer from the shoreline and during research cruises in the Gulf of Gdańsk. Furthermore, meteorological factors influencing the abundance of these microorganisms in the atmosphere were identified. Using modern sampling techniques employing a 6-stage microbiological impactor, the aerosol size fraction containing microorganisms was determined. Flow cytometry, light microscopy, and epifluorescence microscopy were used in the research.

The results obtained indicated that the quantity of cyanobacteria and microalgae in the air of the coastal zone of the Gulf of Gdańsk varied from 0 to 1685 cells m⁻³. In rainwater, their quantity ranged from 100 to 342 × 10³ cells L⁻¹. Between 2018 and 2020, a total of 35 cyanobacteria or microalgae were isolated from the collected samples. Furthermore, in the course of seasonal studies focusing specifically on cyanobacteria and microalgae in 2020, 29 taxa were identified. Additionally, the capability of cyanobacteria and microalgae present in the atmosphere to produce toxins as well as to degrade harmful substances present in atmospheric dust was assessed. Moreover, based on the taxonomic composition, the potential harm of the identified organisms to human health was preliminarily assessed.

These studies contribute to raising awareness regarding the pollution of air by biological particles, with particular emphasis on tourist areas along coastal regions. The research indicates that the presence of cyanobacteria and microalgae in the air should be monitored throughout the year, especially during toxic blooms in the seas. Furthermore, these research findings suggest that during periods of intense phytoplankton blooms in the sea, not only should active use of water bodies be avoided, but also proximity to these areas. Moreover, the conducted research and the obtained results shape further avenues of investigation and potential development of research methods in the field of cyanobacteria and microalgae inhabiting the atmosphere.

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