A MUCILAGINOUS DIATOM BLOOM IN THE MIDDLE ADRIATIC

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Abstract
In June and July 2002 a mucilaginous bloom appeared in the middle Adriatic Sea in coastal water and the open sea. Microscopic analysis revealed the diatoms *Skeletonema costatum, Nitzschia closterium* and *Pseudonitzschia seriata* complex were associated with the bloom in the coastal water, whereas in a sample from the open waters, filamentous cyanobacteria were abundant as well as diatoms. Unusually high surface temperature and concentration of orthophosphate were recorded during the bloom in Kaštela Bay.

Key-words: Adriatic Sea, mucilaginous bloom, diatom

Introduction

The presence of mucilage or marine snow is a phenomenon that has been known for a long time. It is characteristic in eutrophic waters of the northern Adriatic where mucilage events harm tourism and fisheries. The extracellular release of organic matter by marine phytoplankton is a normal physiological process which is closely related to the rate of the photosynthesis and constitutes up to 5 μg C l^{-1} h^{-1} of the total primary production in coastal waters (1). In June and July 2002 this phenomenon was recorded in the middle Adriatic Sea. The aim of this paper is to determine which phytoplankton species have caused the bloom, and what ecological factors favored it.

Materials and Methods

During the mucilage bloom samples were taken in Kaštela Bay and in Brač channel (coastal water). One sample was taken in the open sea, near the islands Silba and Premuda. Temperatures were recorded *in situ* by CTD. Abundance and structure of phytoplankton community were determined using the Utermöhl method (2). Nutrients concentrations were determined on an AutoAnalayzer II system, using modified automated methods (3). Oxygen concentrations were determined by Winkler method (4).

Results

Surface temperature ranging from 23.2 to 25.1^{0}C were recorded in Kaštela Bay during June, whereas the 12-year average value is 21^{0}C. Unusually high concentrations of orthophosphate in both surface and bottom layers were recorded (Tab. 1). High concentration of silica was recorded in the surface layer.

Table 1. Ranges of oxygen saturation (%) and nutrients concentrations (mmol m^{-3}) in surface and bottom layer in Kaštela Bay.

	O_2%	N-inorganic	PO4	SiO4
Surface layer	123–152	1.47–2.16	0.117–1.010	3.18-5.88
Bottom layer	81–100	1.35–2.79	0.008–0.966	1.14–3.35

In May, the diatoms *Chaetoceros curvisetus* and *Chaetoceros affinis* dominated the phytoplankton community in Kaštela Bay with concentrations up to 1.1 x 10^6 cells L^{-1}. During the mucilaginous bloom, the most abundant species in Kaštela Bay were *Skeletonema costatum Nitzschia closterium* and *Pseudonitzschia seriata* complex with concentrations of 1.9 x 10^6 cells L^{-1}, 2.0 x 10^5 cells L^{-1} and 1.1 x 10^5 cells L^{-1} respectively. In the Brač channel *N. closterium* (Fig.1) prevailed with concentrations of 1.7 x 10^6 cells L^{-1}. In the open sea filamentous cyanobacteria were abundant as well as pennate diatoms. A few days after the appearance of the bloom, the dinoflagellates *Prorocentrum micans, Gymnodinium* spp., *Amphidinium carterae, Alexandrium* sp., as well as microflagellate sp. embedded in mucilage appeared in the coastal waters. Bottom hypoxia or anoxia was not recorded during or after the bloom.

Discussion

The formation of mucilage was mostly associated with diatoms, though in the open sea filamentous cyanobacteria were abundant, implying that ecological factors are more responsible for mucilage formations than specific phytoplankton species. High temperature and imbalance in nutrient ratio seems to play important roles in mucilage formation (5,6). Nutrient limitation can stimulate mucilage production by marine phytoplankton. Experimental study reveals that under phosphorus limitation the diatom *N. closterium* releases high amounts of extracellular polysaccharide, while *Chaetoceros* sp. and *S. costatum* are the best producers of extracellular polysaccharide under nitrogen limitation (6). There is no one unique nutrient-limiting factor that is responsible for extracellular release of polysaccharide by marine phytoplankton.

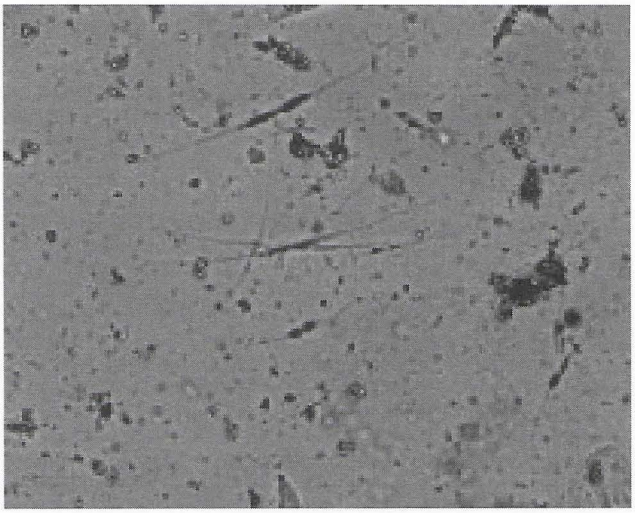

Fig. 1. Diatom *N. closterium* prevailed in mucilage bloom in Brac channel.

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