ABUNDANCE AND COLONIZATION OF ATTACHED DIATOMS IN THE ZRMANJA ESTUARY, ADRIATIC SEA

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Abstract

The colonisation of a periphyton community on Plexiglas plates was observed in the oligotrophic karstic Zrmanja Estuary (eastern Adriatic coast), during the summer of 2000. Maximum periphyton biomass was detected at days 19-25 (chlorophyll *a* 1630-1674 ng cm^{-2}). The dominant periphitic microalgae were diatoms (maximum concentration of fucoxanthin 1371.4 ng cm^{-2}, maximum abundance 1.8 x 10^7 cells cm^{-2}). Among the 69 determined taxa, the highest species diversity was found in the genera *Navicula* (13 taxa), *Nitzschia* (12 taxa) and *Achnanthes* (6 taxa). The diatom *Amphora coffeaeformis* var. *coffeaeformis* (C.A. Agardh) Kützing dominated throughout the entire colonisation period (100% frequency of appearance, abundance up to 1.6 x 10^6cells cm^{-2}).

Keywords : Diatoms, Estuaries, Adriatic Sea.

Introduction

Diatoms dominate benthic microalgae in temperate brackish waters [1]. Ecological conditions of the highly stratified Zrmanja Estuary, in the eastern part of the Adriatic Sea, have been poorly investigated [2]. The main goal of the presented research is to record the presence, abundance and colonization of attached diatoms on Plexiglas surfaces in the Zrmanja Estuary.

Methods

The colonisation of the periphytic community on Plexiglas plates was measured every three days during July 2000. Plates were inserted in a metal frame, anchored three meters off the bank, and 35 cm below the water surface. Substrates were vertically positioned and parallel to the water current. Samples were scraped off the plate surfaces with a scalpel and an adapted toothbrush, after rinsing with water. After acid cleaning, diatoms were identified under inverted microscope (magnifications 1000, 400 x) using standard manuals. Cells (200-300) were counted by inverted microscope [3]. Diatoms were presented by the frequency of appearance (f %) and abundance (a), expressed as number of cells per cm^2. Biomarker pigments were analysed using high-performance liquid chromatography (HPLC).

Results and discussion

Thermohaline stratification and low water inflow (avg. 1.43 m^3sec^{-1}) provided favourable conditions for periphyton colonisation during the summer. The surface salinity varied between 8 and 14, and temperature between 19 and 24 °C. The colonisation period could be differentiated into three phases: the lag phase (lasting 13 days), growth phase (13-25 days) and decline phase (after 25 days).

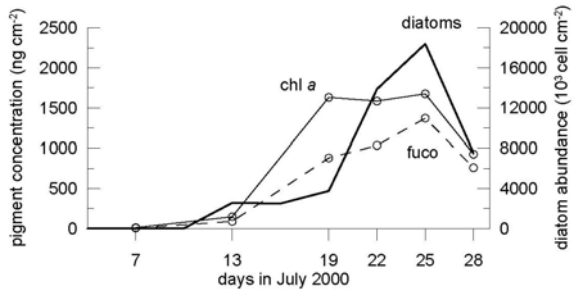

Fig. 1. Distribution of diatom abundance and concentrations of pigments chlorophyll *a* and fucoxanthin, in the upper reach of the Zrmanja Estuary, during July, 2000.

Chemotaxonomic analyses provided evidence of maximum periphyton biomass (chlorophyll *a* 1630-1674 ng cm^{-2}) during the second phase (19-25 days), and dominance of fucoxanthin among other accessory periphyton pigments (figure 1). Diatom assemblage was composed of 69 taxa, with highest species diversity in the genera *Navicula* (13 taxa), *Nitzschia* (12 taxa) and *Achnanthes* (6 taxa). The records of maximum diatom abundance (1.8 x 10^7 cells cm^{-2}) corresponded with maximum pigment fucoxanthin concentration (1371.4 ng cm^{-2}), which were detected at the end of second phase (figure 1).

The dominant diatoms (table 1) were *Amphora coffeaeformis* var. *coffeaeformis* (C.A. Agardh) Kützing, *Licmophora gracillis* (Ehrenberg) Grunow, *Navicula veneta* Kützing, *Nitzschia longissima* (Brébisson) Ralfs (*Nitzschia closterium* (Ehrenberg) and *Synedra tabulata* (C.A. Agardh) Kützing (frequency of appearance >72% n=18 and abundance >10^6 cells cm^{-2}) (table 1). Among fifteen pioneer species, *Navicula* sp. (356 cells cm^{-2}) and *N. gregaria* Donkin (127 cells cm^{-2}) dominated in the first 10 days of succession. The species *N. veneta* and *L. gracillis* also dominated as initial colonizers that were mainly found throughout the entire period of colonisation (table 1). The diatoms *Synedra tabulata*, *L. gracillis* and *Nitzschia longissima* (*N. closterium*) were found as both attached and planktonic taxa living in the surrounding water column. The domination of diatom *A. coffeaeformis* var. *coffeaeformis* throughout entire colonisation period (table 1) relates to its characteristics as a holoeurihaline and cosmopolitan taxon that prefers summer growing conditions [4]. The diatoms *Melosira moniliformis* (O.F. Müller) Agardh and *Falacia* sp. were found to be dominant species in the end of the second growth phase.

Tab. 1. Dominant diatoms during colonisation on Plexiglas plates (Zrmanja Estuary, July 2000).

taxa / day	4	7	10	13	16	19	22	25	28	sum a	f (%)
Licmophora gracillis	25	195	751	160410	126800	52622	276424	284032	309392	1512065	94
Synedra tabulata	18	195	626	218740	10139	105244	138212	213024	154696	1097858	94
Haslea spicula *	13	39	127	15221	30416	7810	138212	102708	154696	555077	72
Navicula veneta	173	78			253600	52622	691060	639072	1701656	3662724	72
Amphora coffeaeformis var. coffeaeformis	13	78	8633	2012412	1648400	3578296	15617956	13633536	6265188	55598208	100
Nitzschia longissima or *N. closterium*	1	39	127	289205	126800	3905	2626028	2875824	464088	6694891	80
Melosira moniliformis **			3	43748			1382120	1540620		2966491	22
Falacia sp.**	13		127		10139	7544	691060	994112	154696	2022328	56

(underlined values > 65% of total abundance (a) in cells cm^{-2}; * only frequent (f), **only abundant).

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