INFLUENCE OF THE LIGHT CLIMATE (QUANTITY AND QUALITY) ON THE COUPLING BETWEEN MIGRATION, PHOTOSYNTHESIS AND CELL DIVISION IN MICROPHYTOBENTHIC DIATOMS

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Coastal ecosystems are one of the most productive areas in the world. Their productivity is mainly supported by the microphytobenthos (MPB) which inhabits estuarine intertidal mudflats. MPB in muddy sediments is dominated by motile forms ('epipelic') diatoms which can exert vertical migration as a function of the tidal and diurnal cycles, and of the light climate. It is commonly accepted that photosynthesis occurs during emersion and the cellular division occurs during the dark periods of immersion. The specific aims of this experiment were 1) to decipher how the light environment influences the MPB migration and its coupling with photosynthesis, 2) to better understand the coupling between MPB migration and the cell cycle. In a first step, we achieved to preserve the MPB migration rhythm in laboratory conditions in freshly collected mud. Migration measurements have been carried out over more than 1 year on muddy sediments (Aiguillon Bay, Atlantic coast) in order to integrate seasonal/tidal cycle influence. It was continuously recorded for sequential periods of 24 h with an Imaging-PAM fluorometer. The chlorophyll fluorescence was used a as proxy for the MPB biomass at the surface of the mud. Different light intensities (from 10 to 320 µmol photon.s^{-1}.m^{-2}) and qualities (blue, green, red, white) were tested. MPB photosynthetic parameters and pigment content were punctually recorded during migration. As a comparison, the same measurements were performed on sandy sediments (Bourgneuf Bay, Atlantic coast) which MPB is less motile. We showed that the amplitude of diurnal migration is influenced by the intensity and the quality of light. It increases with the light intensity until a threshold; 130 µmol photon.s^{-1}.m^{-2} being an optimum. Migration is positively influenced by blue and green radiations, even at low intensity, and even in sandy sediments. In parallel, lens tissues were used to harvest the diatom cells at the surface and in the sediments (0.25 cm depth). The DNA content of the cells was analyzed by flow cytometry in order to measure the stage of the cell cycle. Different diatom populations at different stages of their cell cycle were discriminated; they correspond to different size classes of epipelic diatoms (i.e. 'small, medium and large'). We showed that diatom cells divide when they are in the sediments (i.e. during immersion), as expected. Based on these data, further experiments will explore the direct coupling, and its dynamics, between light (intensity/quality) migration, photosynthesis and the cell cycle of MPB diatoms.