Nitrogen fixation by epiphytic and epibenthic diazotrophs associated with seagrass meadows along the Tanzanian coast, Western Indian Ocean.

Author(s)

Hamisi, M. I.; Lyimo, T. J.; Muruke, M. H. S.; Bergman, B.

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Abstract

Seasonal, diurnal, and age-dependent variations in nitrogen fixation (nitrogenase activity) by epiphytic diazotrophs colonizing the seagrasses Halodule uninervis,Cymodocea rotundata, Thalassodendron ciliatum, and Thalassia hemprichii, and by epibenthic diazotrophs associated with seagrass-vegetated and nonvegetated sediments, were estimated at 2 sites along the Tanzanian coast, Western Indian Ocean. Acetylene reduction-gas chromatography showed that nitrogenase activity values were significantly higher ($p=0.0004$) at the site with low nutrient levels (Mjimwema) than at the site with higher nutrient levels (Ocean Road). The nitrogenase activity ranged from 10 to 192 nmol N g^{-1} h^{-1} for H. uninervis, 7 to 80 nmol N g^{-1} h^{-1} for C. rotundata, 10 to 75 nmol N g^{-1} h^{-1} for Thalassia hemprichii, and from 4 to 61 nmol N g^{-1} h^{-1} for Thalassodendron ciliatum. Nitrogenase activity values in sediments covered by seagrasses were significantly higher than in surrounding nonvegetated sediments ($t=4.021$, $p=0.0005$). Significant variations in nitrogenase activity were apparent depending on leaf age and season, with highest activity being found in mid-aged leaves during the northeastern monsoon (NEM), and in older leaves during the southeastern monsoon (SEM). Daytime nitrogenase activity was appreciable on above-ground seagrass parts, while rhizosphere activity peaked at night-time. Collectively our data show that diazotrophs (cyanobacteria and other bacteria) are associated with seagrasses (leaves and roots), and potentially constitute an integral part of the ecosystem. They show highly dynamic nitrogenase activity and a succession in seagrass colonization, and we concluded that their presence may contribute to the productivity of the seagrass beds.

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