Fundam. Appl. Limnol. 191/4 (2018), 289–298
published online 13 July 2018, published in print September 2018

Article

Growth and oxidative stress response of aquatic macrophyte *Myriophyllum spicatum* to sediment anoxia

Keerthi Sri Senarathna Atapaththu[1], Mahfuza Parveen[2, 3], Takashi Asaeda[2, 4, *] and M. Harun Rashid[2, 5]

With 6 figures

Abstract: Understanding the interaction between aquatic plants and environmental factors is important for aquatic ecosystem management. Information on the interaction between aquatic plants and sediment anoxia is scarce to our knowledge, and the responses of these plants against the former stress are largely unknown. Here, we investigated the biochemical mechanisms of growth impairment of *Myriophyllum spicatum* as affected by sediment anoxia. Three regimes of oxidative redox potentials (ORP), viz. control (+280 mV to +350 mV), reduced (+5 mV to –30 mV) and strongly reduced (–230 mV to –180 mV) were set in laboratory microcosms, and the experiment lasted for 14 days. A field investigation was carried out at the Moto-Arakawa River (Saitama, Japan) to detect plant responses at different ORP regimes in natural conditions. A decrease in plant growth coupled with a significant reduction in chlorophyll content was observed in plants exposed to anoxic conditions. Exposure to anoxic sediments induces an oxidative stress in *M. spicatum*, where a severe stress was observed under a strongly reduced environment. We detected significant positive correlations between antioxidant enzyme activities and ORP, where this relationship is more noticeable for plant roots than shoots in field samples. These results suggest that sediment anoxia affects the growth of *M. spicatum* by exerting oxidative stress and impairing photosynthesis. Therefore, the results of this study provide a basis for understanding the mechanism and consequential changes in plant growth in anoxic environments, with such information explaining the habitat preferences of macrophytes, thus contributing to improved planning strategies beneficial for ecosystem management.

Keywords: abiotic stress; photosynthesis; reactive oxygen species; antioxidative enzymes; redox-potential

Abbreviations: APX: Ascorbic peroxidase; CAT: Catalase; GPX: Guaiacol peroxidases; IAA: Indole acetic acid; ORP: Oxidative redox-potential; ROS: Reactive oxygen species; RGR: Relative growth rate; SGR: Shoot growth rate

Authors' addresses:

[1] Department of Limnology and Water Technology, Faculty of Fisheries and Marine Sciences & Technology, University of Ruhuna, Matara, Sri Lanka

[2] Department of Environmental Science and Technology, Saitama University, 255 Shimo-okubo, Sakura-ku, Saitama 338-8770, Japan

[3] Department of Environmental Science and Disaster Management, Daffodil International University, Bangladesh.

[4] Research Institute of Chuo University, Kasuga, Bunkyo, Tokyo 112-8551, Japan

[5] Department of Agronomy, Bangladesh Agricultural University, Mymensingh, Bangladesh

[*] Corresponding author: asaeda@mail.saitama-u.ac.jp

www.schweizerbart.de
DOI: 10.1127/fal/2018/1070
1863-9135/18/1070 $ 2.50