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Ecophysiology of filamentous green algae in astatic saline-alkaline ponds

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Abstract

Around forty shallow saline-alkaline ponds are located in the National Park Neusiedler See - Seewinkel. These small, endorheic water bodies are characterised by high nutrient levels and elevated conductivities. Salty ponds are very rare ecosystems in central Europe. Therefore these waterbodies are one of the major subjects of protection in the Nationalpark.

The climate of the region is semi-arid and because of high summer evaporation the water level of the ponds is usually reduced during summer. Some of the salty ponds may even dry out. Every year, dense mats of filamentous green algae develop during springtime, which finally cover large areas of the ponds. These mats are likely to play a key role in the functioning of the ecosystems. Mats of filamentous algae increase habitat complexity: they provide feeding places and refuges from predators thus leading to an increase of macrofaunal diversity (LAURINGSON&KOTTA 2006; PIECZYNSKA et al. 1999). Norkko et al. found a huge abundance of invertebrates of more than 1000 individuals g^{-1} dry mass (DM) in algae mats surpassing even densities recorded for seagrass communities (NORKKO et al. 2000). Furthermore, filamentous algae act as a substrate for epiphytes, which serve as a food source for epiphyte grazers (DODDS 1991). Therefore it is likely that the mass occurrence of filamentous green algae in the Seewinkel ponds has a high influence on the ecosystems and increases biodiversity.Moreover filamentous green algae can act as a buffer against a shift to phytoplankton dominance thus maintaining a clear-water state and they account for up to 90% of total primary production in the ecosystem (GUBELIT & BEREZINA 2010; IRFANULLAH & MOSS 2005). In addition to the important effects mentioned above, *Chlidonias hybridus* was found breeding on these mats in the National Park (DVORAK et al. 2010).

Figure 1: Map of the investigated pond; dots indicating the position of the five mesocosms

In our study we focused on the biomass development and seasonal succession of such algae mats in one of the ponds. The study covered a period between April and September and included also weekly measurements of water chemistry parameters. Moreover we investigated the ability of these algae to cope with desiccation by carrying out desiccation and recovery experiments in the laboratory.

Na^+ and HCO_3^- were the most dominant ions reaching a maximum in the mid of September, when the pond was nearly dried out; phosphorus concentrations indicated hyper-eutrophic conditions. Maximum algae biomass was reached in July, measured in mesocosms, which were installed in the pond. At this time, floating algae mats covered a large part of the pond surface. The high biomass values clearly indicate, that such mass development of filamentous green algae plays an important role in the functioning of the pond ecosystems.

Desiccation and recovery experiments were carried out with vital as well as senescent algae mats in the laboratory using the non-invasive pulse amplitude modulated (PAM) fluorescence technique, which is an excellent tool for getting information of the overall photosynthetic performance of the algae. The vitals as well as the senescent algae showed a very low recovery potential after desiccation. The low ability to regenerate after desiccation is quite surprising because usually specimens occurring in periodically desiccating habitats show quite a high recovery potential.

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