GRANGIRARD Lara (2015): Impact of atmospheric pollutants on testate amoeba assemblages of European peatbogs : A contribution to the international project PEATBOG

Abstract

Most natural ecosystems are suffering by climate change and anthropogenic pollution. In peatland ecosystems one of the most serious consequences of environmental change concern their functional role as a carbon sink. Thus, it is of major importance to find and assess effective tools to monitor their health. Testate amoebae (TA) are involved in various biogeochemical cycles in soils (especially N and C cycling) and are widely recognized as being efficient bioindicators as they respond quickly and specifically to different environmental gradients. Changes in micro-environmental conditions can lead to shifts in density, biodiversity (species diversity metrics), and community composition depending on the sensitivity of each species to a given environmental stress or gradient as well as indirect effects through trophic or other biotic linkages. A first aspect of this study is to observe the geographical patterns of pollution and climatic gradients in Europe. Then, the main aim of the study is to assess the patterns of TA community structure and species distribution according to 1) broad geographical and climatic gradients, 2) microtopography and 3) pollution deposition with special concerns for nitrogen and heavy metals. In addition we attempt to define ecological optima and tolerances per species for nitrogen and heavy metals deposition.

The distribution of 69 testate amoeba species was analyzed in relation to 25 environmental variables (3 geographical variables, 6 climatic variables and 17 variables relating to pollution loads) by means of multivariate statistical techniques. Statistical analyses were performed using relative abundances of TA from 108 samples collected in one hollow and one hummock of 54 ombrotophic mires distributed across Europe and covering broad climatic and pollution deposition gradients. Constrained ordinations (MFA, RDA), transfer functions (WA) and indicator species (IndVal) analyses indicated that certain assemblages of species and individual taxa were related to more than one significant environmental factor, with longitude, micro-habitat, nitrogen deposition (as NH_x) and Pb being the most significant. Taken separately and without geographic or climatic effects, nitrogen deposition and lead contamination clearly inducing TA communities. Species showed distinct responses on a micro--environmental scale and indicated the existence of assemblages of sensitive or tolerant taxa. The results confirm that testate amoebae are sensitive to atmospheric pollution. The study further suggests that they could be useful microbial indicators of pollution levels in ombrotrophic bogs.