Sensitivity of groundwater and surface water crustaceans to chemical pollutants and hypoxia: implications for pollution management

F. Mösslacher

Institute of Limnology, Austrian Academy of Sciences

With 3 figures and 3 tables

Abstract: In order to test the hypothesis that groundwater organisms are more sensitive to stressors than surface water organisms, this study compares the responses of surface and groundwater isopods, cyclopoid copepods and ostracods to inorganic chemicals (potassium chloride and potassium nitrate) and low oxygen concentration (10% oxygen saturation, hypoxia) in laboratory experiments. Isopods displayed the highest sensitivity to the chemicals (LC50 values for KCl: Proasellus slavus vindobonensis = 285 mg/l, and Asellus aquaticus = 355 mg/l), ostracods turned out to be most tolerant (LC50 values for KCl: Fabaeformiscandona wegelini = 1932 mg/l, and Pseudocandona sp. = 2018 mg/l). Comparing the response of species within one taxonomic group (isopods, copepods, and ostracods), the exclusive groundwater species (stygobites) were more sensitive to the chemicals than closely related surface water species (see above). The stygobite species displayed no differences between the metabolism measured under normoxic and hypoxic conditions. A copepod, Acanthocyclops vernalis, collected in a hypoxic groundwater habitat, showed small metabolic differences (i.e., the metabolic rate measured in hypoxia amounted to 61.8 ± 5.5 % of the metabolism in normoxia), compared to a copepod, Diacylops bicuspidatus, collected in a normoxic groundwater habitat (27.3 ± 6.9%). Due to the low difference between the metabolic rates, the stygobite organisms and A. vernalis were best adapted to low oxygen concentrations among the tested species.

The hypothesis was supported by this study. The high sensitivity of the groundwater crustaceans to the chemical stressors suggests that existing groundwater quality criteria are insufficient to protect the groundwater biota and ecosystem, and further ecotoxicological studies with groundwater organisms are required.

Key words: groundwater, crustaceans, toxicity tests, respiration, pollution.

Author’s address: Institute of Limnology, Austrian Academy of Sciences, Gaisberg 116, 5310 Mondsee, Austria. Present address: Schrammstr. 2, 85055 Ingolstadt, Germany.

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