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Distribution patterns of terricolous and saxicolous lichens in extreme desert conditions

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The investigation of biodiversity in stressful habitats is of great interest because it elucidates relationships between organisms and their environment, as well as revealing the mechanisms of their survival and adaptation to extreme conditions. Deserts represent such stressful habitats where harsh climate and limited resources greatly influence the formation of biota. In order to understand the link between microscale environmental variability in extreme arid conditions and lichen biodiversity patterns, we conducted the present study. For this purpose, the structure and distribution of lichen communities on soil and cobbles at six stations at "Evolution Canyon" III (EC III), Nahal Shaharut, in the extreme southern Negev, Israel, were examined. The opposite slopes of the canyon represented specific ecological niches characterized by sharply different microclimatic conditions. The following characteristics of lichen communities were studied: species richness, systematic diversity, biogeographical elements, frequencies and distribution of species, their morphological and anatomical characteristics, reproductive strategy, and ecological peculiarities. In the research site three environmental variables were evaluated: soil moisture, and temperatures of soil and cobbles. The Canonical Correspondence Analysis was used to study the influence of these ecological variables on the distribution of lichen species.
The lichen diversity of EC III was very poor and comprised 12 species (3 cyanoliches on soil vs. 9 phycolichens on cobbles). Most of them belong to a specific group of arid endemic elements, adapted to survive in extreme arid conditions in the deserts of the Levant. The harsh desert conditions of the canyon negatively influence the reproductive ability of lichens. This influence is expressed in the decreased sizes of fruit bodies in some species, and the frequent occurrence of sterile specimens among lichens found in the canyon. A comparative analysis of structure and distribution of lichen communities on soil and cobbles on different slopes of the research site revealed that while soil moisture and temperatures of substrates influenced the distribution of saxicolous lichens, these factors had no effect on the distribution of terricolous lichens.