
Ecosystem Construction At The Edge of Life : Effects of Cushion Plants on High-Mountain Soil Communities

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Résumé

One of the main characteristics of high-altitude ecosystems is the presence of cushion plants, which with their dense, mat- or dome-shaped morphology, buffer the severe environmental constraints inherent to mountain ecosystems (high UV radiation, extreme temperature variations). Cushion plants are considered keystone species in high alpine ecosystems, creating favourable local environment for other organisms by modifying climatic and edaphic conditions. While cushion plants have attracted attention as keystone species for their facilitating effect on other plants, their role as ecosystem engineers, through their ability to modify abiotic constraint and the biophysical characteristics of their soil, has been neglected. Yet, cushion plants offer a unique opportunity to study how abiotic filtering can be modelled by biotic agents, and how interspecific variation in engineer species contribute to create diverse ecosystems. To bridge this knowledge gap, we focused on more than one hundred cushion plants from 9 different species inhabiting ecosystems above 2500m-altitude in the Western Alps. The complex communities hosted by cushion plants, from bacterial and fungi to micro-invertebrates, were studied using metabarcoding on Environmental DNA, along with the local physico-chemical characteristics of the soil and plant traits. Using Structural Equation Models, we unveiled how cushion plants modify local environmental conditions, both by their sole presence and by their intrinsic characteristics and shape in return unique communities of organisms, specific to each plant species. Our results also highlight how a community of engineer plant species support a rich biodiversity in high-mountain environments. Finally, with cushion plants, we questioned the interplay of biotic and abiotic factors as strong drivers of community composition at the altitudinal margin of life.

Mots-Clés: Alpine Ecology, Ecosystem Engineer, Plant, Soil Interactions, Environmental DNA

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