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Editorial

Plant–Soil Interactions in Karst Regions

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Karst regions have a shallow soil layer, discontinuous soil cover, high rock exposure rate, calcium-rich and alkaline soil, and a fertile but small total soil. Karst plants have a clear adaptability to special and abundant niches, and their configuration patterns in this type of region are very important for revealing the mechanism of community succession and formulating specific ecological management [1]. At present, there are many studies on the water deficit stress of karst plants, ranging from the molecular to the community level. In fact, mineral nutrients are likely to limit the restoration of vegetation in karst regions. However, the current research results on soil nutrients are insufficient, and the nutrients in plants may also be an area of research deserving greater attention [2]. Microorganisms connect soil and plants, participate in karst above-ground nutrient cycles, and promote ecosystem stability and health, and they play an important role in the restoration of karst vegetation. However, less is known about soil microbial community diversity and its assembly mechanism in different vegetation types in karst areas. Moreover, the diversity, functional trait variation, and assembly of vegetation communities are the result of the interaction between karst plants and soil, which illustrates their complex relationship.

To address this urgent topic, we aimed to collect a variety of manuscripts that illustrate “Plant–Soil Interactions in Karst Regions”. A total of 12 high-quality articles were published after rigorous online peer review. The articles present topical examples of world-class research, including soil organic carbon, growth rates of soil water content, soil stoichiometric ratios, fine root turnover traits, functional trait variation, assembly of vegetation and bacterial communities, and soil free-living nitrogen-fixing bacteria. We are thus delighted to present this book, which is a compilation of these selected articles.

Here, we outline the key research activities and highlights of the publications included in this book.

First of all, karst soil moisture is an important factor affecting plant growth. Gu et al. selected four plant community structure types as the research objects: arbor + herb (AH), shrub + herb (SH), arbor + shrub + herb (ASH), and herb (H) [3]. A soil moisture sensor was used to monitor the soil moisture content in the 0–70 cm soil layer, to analyze the variation characteristics of soil moisture content and to explore the differences under different plant community structure types. Secondly, eight of the articles addressed the role of soil chemical properties in the karst vegetation. Lan et al. have focused on the effects of different rocky desertification degrees (RDDs) on plant diversity and soil fertility in northern Guangdong over long periods of time [4]. Zou et al. found that 18 years after the Grain for Green program, the soil chemical properties of available nitrogen (AN), total phosphorus (TP), total nitrogen (TN), and soil organic matter (SOM) of grassland were significantly different from those of farmland [5]. Li et al. compared the contents of soil organic C (SOC) and total N (TN) in karst and non-karst forests [6]. Zhang et al. found that leaf stoichiometry was strongly influenced by species diversity, whereas branch stoichiometry was mainly influenced by leaf and species diversity; the environmental factors influencing the stoichiometric characteristics of leaves and branches were mainly altitude, soil pH, and total soil P [7]. Lu et al. suggest a complex reaction of SOC, soil TN, and soil TP concentrations and stoichiometry to the vegetation restoration mode, particularly in the topsoil [8]. Wang et al. indicated that rock outcrops controlled the SOC contents in the studied regions. The slope position, gradient and aspect influenced the composition and distribution of vegetation, which influenced the evolution of rocky desertification [9]. Pan et al. showed that the variations in these five parameters of fine root turnover were mainly explained by fine root nutrients and the interactive effects between fine root and soil nutrients [10]. Zhang et al. also explored the adaptability of endangered plants in degraded karst habitats through functional trait variation, using three endangered woody plants in karst peak-cluster depression [11]. They found that plant functional traits were influenced by soil and topographic factors, and the relationship between them varied by species. Thirdly, plants associated with symbiotic nitrogen-fixers and soil free-living nitrogen-fixing bacteria are good indicators for detecting the source of nitrogen in natural ecosystems. Liang et al. investigated the community composition and diversity of soil free-living nitrogen-fixing bacteria and plants, as well as the soil properties in 21 shrub plots (including different topographies and plant types) [12]. Fourthly, karst lithological differences make habitats and soil heterogeneity more complex, and vegetation has developed certain morphological and physiological structural characteristics to adapt to these special environments, which will most likely lead to differentiation in vegetation functional characteristics. Zhou et al. investigated a total of 3170 individuals from 123 species and analyzed the relationship between the species compositions and the functional characteristics of two karst forest areas with different lithology (i.e., limestone and dolomite karst) [13]. Finally, as the spatial scale changes, the ecological processes and mechanisms that determine community patterns change. He et al. established a medium-sized forest plot in an evergreen and deciduous broad-leaved mixed forest and found that the dispersal-based neutral process is the prominent driver for forest community structure in a typical karst forest environment [14].

In summary, the articles included in this book highlight the interaction between water content, organic carbon, bacterial community in karst soil and fine root turnover traits, functional trait variation, and assembly of vegetation community. The results will be of great scientific value in improving the understanding of adaptive strategies of plants in degraded karst habitats. Our sincere thanks go to the authors of each article for their excellent contributions. We are also grateful to the editors and all the reviewers for their suggestions and assistance with the book's publication.

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