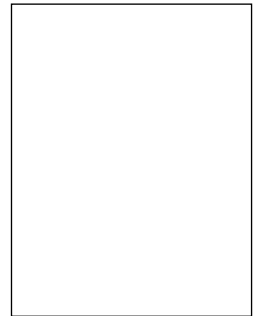


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Pyrosequencing reveals significant changes in microbial communities along the ecological successions of biological soil crusts in Tengger Desert of China

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ABSTRACT

Biological soil crusts (BSCs) have important ecological functions in arid and semi-arid lands, but it remains poorly understood about the changes in microbial communities along the BSCs succession under *in situ* field conditions. In this study, 454 pyrosequencing was employed to assess the microbial composition of four BSCs types in Tengger desert of China: algae, lichen (cyanolichen and green algae-lichen), and moss crusts, representing early, middle and final successional stages of BSCs, respectively. The results showed the highest diversity of microbial communities inhabiting on lichen, while the lowest was observed on***. The members within five phyla including *Proteobacteria*, *Actinobacteria*, *Cyanobacteria*, *Bacteroidetes* and *Acidobacteria* accounted for about 72 to 87% of total prokaryotic sequences in different BSCs. The most dominant eukaryotic microorganism was *Ascomycota*, accounting for 47 to 93% of the total eukaryotic sequences. Along with the succession direction, the proportions of photoautotrophic *Cyanobacteria*, *Chlorophyta* and *Diatomea* declined, and heterotrophic microorganisms such as bacteria and fungi increased. Statistical analysis showed clear divergency of microbial taxa at class level among the differential succession stages of BSCs. The moss crusts were farthest from the rests in the prokaryotic composition, algal crusts were the most different in eukaryotic microorganisms, and two kinds of lichen relatively closer in both compositions. The ordination analysis showed that the variations of community structure among BSCs could be explained best by the abundance of *Cyanobacteria* and *Ascomycota*, and soil physiochemical properties including soil mechanical composition, moisture content and electrical conductivity. In conclusion, our results have shown that *Cyanobacteria* and *Ascomycota* likely play an important role in evolutions of BSCs structure and functions and highlight the importance of environmental factors in shaping microbial structures of BSCs in Tengger Desert of China.

Key Words: biological soil crusts, microbial composition, pyrosequencing, development succession, driving factors

INTRODUCTION

Biological soil crusts (BSCs) are the organic complex on the surface layer of soil and colonized by cyanobacteria primarily (Mazor *et al.*, 1996), then bacteria, eukaryotic algae, fungi, lichens and moss may grow (Belnap and Lange, 2001; Cabala and Rahmonov, 2004). They are widely distributed in arid and semi-arid region (Belnap and Lange, 2001). They have important functions on the stability of the surface soil, reduction of wind and water erosion, and the soil fertility (Eldridge and Greene, 1994; Belnap and Lange, 2001; Yeager *et al.*, 2004; Bowker *et al.*, 2006). The process of the formation, development and maturity of BSCs under the driving of various ecological factors and time is the BSCs succession, and during the succession the advantage biology are replaced (Lange *et al.*, 1992; Zaady *et al.*,

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