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不同丛枝菌根真菌侵染对土壤结构的影响

Compare different effect of arbuscular mycorrhizal colonization on soil structure

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作者	单位	E-mail
彭思利	西南大学资源环境学院, 重庆 400716; 中国科学院成都山地灾害与环境研究所, 成都 610041; 中国科学院研究生院, 北京 100039	
申鸿	西南大学资源环境学院, 重庆 400716	
张宇亭	西南大学资源环境学院, 重庆 400716	
郭涛	西南大学资源环境学院, 重庆 400716	guotaosd@swu.edu.cn

中文摘要:

为了定量化比较研究接种丛枝菌根真菌后,根际、菌根际和菌丝际土壤结构的变化,采用四室分根装置,比较中性紫色土接种不同AM真菌后,菌根际、根际、菌丝际和非根际土壤平均重量直径(MWD)、几何平均直径(GMD)和大于0.25mm团聚体总量($R_{0.25}$)的变化。结果表明:接种3个菌种后菌丝际EEG和有机质含量均呈高于菌根际的趋势。菌丝密度和易提取球囊霉素相关蛋白(EEG)与MWD、GMD和$R_{0.25}$呈显著正相关,菌根际和菌丝际土壤水稳性$R_{0.25}$与菌丝密度显著正相关,相关系数分别为0.777和0.671。接种*G. mosseae*的菌根际土壤$R_{0.25}$值显著高于其它分室土壤,而接种*G.etunicatum*的菌丝际土壤$R_{0.25}$值显著高于其它分室土壤。试验结果在一定程度上说明不同菌种对土壤结构均有不同程度的影响,反映了丛枝菌根真菌生态功能的多样性。

English Summary:

Soil structure plays important roles in soil ecosystem functioning as it controls water, gas and nutrient fluxes in soil. Aggregate stability is used as an indicator of soil structure. Current approaches to investigate the soil aggregation dynamic in soils have been influenced considerably by the hierarchical model of the aggregation process in which primary particles and clay microstructure are bound into microaggregates (20-250 μm), and larger macroaggregates (>250 μm up to several millimeters diameter) are formed by the binding together of microaggregates and smaller macroaggregates. Many physical, chemical and biological factors (and their interactions) contribute to soil aggregation, yet among the biological aspects, mycorrhizas are recognized as being of special importance. Arbuscular mycorrhizal (AM) fungi form mutualistic symbiosis with more than 80% of the higher plant species. The contribution of AM to soil structure varied at different hierarchical levels: plant community, individual root, and the soil mycelium.

In previous studies, most experiments were carried out with pot or other single compartment devices, this made it difficult to clarify different effects of mycorhiza symbiosis on soil aggregation. In present study,the split root device with four compartments was used to quantitatively compare the change of soil aggregates in mycorrhizosphere, rhizoshere, hyphosphere and bulk soil. The results showed that there were significant positive correlation between hyphal length density, easy extractable glomalin (EEG) and mean weight diameter(MWD), geometric mean diameter(GMD)and the amount of larger macroaggregates (>250 μm up to several millimeters diameter, $R_{0.25}$). The correlation coefficient between water stable aggregates and hyphal length density in mycorrhizosphere soil and hyphosphere soil was 0.777, 0.671 respectively. The GMD and MWD of $R_{0.25}$ in hyphal compartment were higher than those in root compartment but were lower than those in mycorrhizal compartment, which means mycorrhizal hyphae had greater effect than root did, but less effects than mycorrhizae did, on formation and stabilization of soil aggregates,. The different ability of different AM fungi to improve soil structure revealed the function diversity of AM fungi. More AM fungal species and soil types will be considered in following studies.

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