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沙质草地生境中大型土壤动物对土地沙漠化的响应

Responses of soil macro-fauna to land desertification in sandy grassland

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中文摘要:

沙质草地沙漠化过程中土壤动物群落结构变化是沙漠化生物过程中的一个重要方面,对于掌握沙漠化过程中生物退化规律和提出合理沙漠化防治对策具有重要指导作用。选取处于不同沙漠化阶段的流动沙地、半流动沙地、半固定沙地、固定沙地和丘间低地5种生境类型,采用手拣法对其大型土壤动物群落进行了调查。共获得36个动物类群,属于8目32科,优势类群为蚁科,常见类群有22个类群,两个类群的个体数共占群落个体总数的93.33%;稀有类群有13个类群,其个体数占群落个体总数的6.67%。结果显示,丘间低地、固定沙地、半固定沙地和半流动沙地大型土壤动物群落个体数量、类群数和多样性显著高于流动沙地($P<0.05$);固定沙地大型土壤动物生物量显著高于其它生境类型($P<0.05$);沙质草地严重沙漠化显著地影响大型土壤动物多样性及其生物量。并且,不同土壤动物类群个体对不同沙漠化阶段生境的适应性存在一定差异,产生了不同的响应模式。土壤有机碳和酸碱度以及土壤含水量差异是影响大型土壤动物类群分布与生长的主要因素。研究表明,固定沙地是大型土壤动物的适宜沙地生境,具有较多的个体数量和较高的生物量;丘间低地、半固定沙地、半固定沙地和流动沙地影响大型土壤动物存活,其个体数量和生物量较低。

English Summary:

Changes in soil macro-fauna community structure, as a major aspect of biological processes of desertification, are very important for us to understand the laws of biological degradation in sandy grassland and to take proper policy to desertification control. Meantime, it is very important for the restoration of soil faunal diversity in desertification, which further beneficial for the fixation of mobile sand land and desertification control. A survey of soil macro-faunal community was conducted by hand sorting in five habitats which represented various desertification stages, such as mobile sand land, semi-mobile sand land, semi-fixed sand land, fixed sand land and inter-dune land. The relation of soil faunal diversity and biomass to desertification was analyzed to assess the influences of desertification development on biological processes in Horqin Sand Land. According to the classification of soil macro-fauna, there were 36 faunal groups which belonged to 32 families and 8 orders. The dominant group was Formicidae with 22 common groups accounting for 93.33% of the total, and with 13 rare groups accounting for 6.67% of the total. It was shown that there was a significantly lower abundance, group richness and diversity of soil macro-faunal community in mobile sand land than in other four habitats ($P<0.05$), while no significant differences ($P>0.05$) were found in soil faunal abundance, group richness and diversity between semi-mobile sand land, semi-fixed sand land, fixed sand land and inter-dune land. In addition, fixed sand land had the highest biomass amongst the five habitats ($P<0.05$), while there were no significant differences ($P>0.05$) in soil faunal biomass between mobile sand land, semi-mobile sand land, semi-fixed sand land and inter-dune land. Based on soil faunal abundance and biomass, results of NMDS analysis confirmed that there were strong differences between mobile sand land and other four habitats including semi-mobile sand land, semi-fixed sand land, fixed sand land and inter-dune land, which indicated that there was a significant influence of severe desertification on soil faunal diversity. The changes in soil organic carbon, soil pH, and soil water content among these habitats were the main factors determining the distribution and growth of soil macro-fauna. For example, Tenebrionidae larvae tended to live in the soil conditions with rich organic carbon such as fixed sand land, where there were more individuals of Tenebrionidae larvae with higher biomass. These results suggest that the soil faunal biomass is closely correlated with the characteristics of biological individuals from soil faunal community in desertification, and some faunal groups have already adapted to different desertification environment and take a suitable survival way in each habitat. Fixed sand land having higher density, group richness and biomass of soil macro-fauna is a better habitat for soil fauna living, in comparison to semi-mobile sand land, semi-fixed sand land and inter-dune land. There also are negative responses of soil faunal diversity to desertification development in sandy grassland. So it is very evitable to take measures for desertification control to increase soil faunal and biological diversity, which in turn is beneficial for the fixation of mobile sand land and restoration of ecosystem in sandy habitats.

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