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研究论文

CO_2浓度和温度升高对红桦根际微生物的影响

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摘要 应用自控、封闭、独立的生长室系统，研究升高的大气CO_2浓度（环境CO_2浓度+350（±25）μmol•mol-1，EC）和温度（环境温度+2.0（±0.5）℃，ET）及其交互作用（ECT）对不同栽植密度条件下红桦根际土壤可培养微生物数量的影响。结果表明：（1）EC显著增加了高密度条件下根际细菌数量；在整个生长季中，最大的根际细菌数量增加出现在7月份；而EC对低密度处理的根际细菌数量影响不显著。除了5月和6月份，ET在其余月份均显著增加了根际细菌数量，但是与密度处理没有有意义的相关；ECT对高低密度处理的根际细菌数量均未产生有统计意义的影响。（2）EC对低密度条件下的根际放线菌数量有显著增加，而对高密度条件下的根际放线菌数量无显著影响；ET和ECT对高低密度条件下的根际放线菌数量均未产生有统计意义的影响。（3）EC和ET对高低密度条件下的根际真菌数量无显著增加，而ECT显著增加了根际真菌数量。

关键词 CO_2浓度升高；温度升高；根际微生物；密度；红桦

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Effects of elevated atmospheric CO_2 concentration and increased temperature on Betula albo-sinensis rhizospheric microbe

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Abstract It is well known that atmospheric CO_2 concentration and temperature are increasing as a consequence of human activities. In past decades, considerable efforts have been put into investigating the effects of climate change on processes of forest ecological system. In general, studies have been mainly focused on the effects of elevated atmospheric CO_2 on plant physiology and development, litter quality, and soil microorganisms. Studies showed that there was variation in the responses of root development and below-ground processes to climate between different plant communities. Since the concentration of CO_2 in soil is much higher(10～50 times) than in the atmosphere, increasing levels of atmospheric CO_2 may not directly influence below-ground processes. Rhizosphere was defined as the small district in soil that was influnced by living roots. In the small district, microbial population was great, the study and utilization of the rich microbial resource pool has been paid more and more attention to. However, there was lack of information and studies about the effect of elevated CO_2 concentration and increased temperature on rhizospheric microbe as so far.
Betula albo-sinensis, as a dominate tree species of sub-alpine dark coniferous in the west Sichuan province, which plays an important role in the structure and function of this kind of forest ecosys

tem. In our study, effects of elevated atmospheric CO_2 concentration (350±25)μmol•mol^{-1}, increased temperature (2.0±0.5)℃ and interaction between elevated CO_2 concentration and increased temperature on the number of rhizospheric microbe were studied by the independent and enclosed-top chamber' system under high-frigid conditions. Responses of rhizospheric bacteria, actinomycetes and fungi number of Betula albo-sinensis under different densities(high density with 86 stems•m^{-2}, low density with 28 stems•m^{-2}) to elevated CO_2 concentration and increased temperature were analyzed and discussed. Results of the present study indicate that in comparing with the control, treatment EC increased the number of rhizospheric bacteria under high density significantly, in one growing season, the greatest increment of rhizospheric bacteria in July. However EC had no effect on the number of rhizospheric bacteria under low density. Except May and June, treatment ET increased the number of rhizospheric signifcantly. The effect of treatment ECT on the number of rhizospheric bacteria under different density was not significant. Under treatment EC, the number of rhizospheric actinomycetes with low density increased significantly, however, treatment EC did not increase the number of rhizospheric actinomycetes with high density. Simultaneously, treatment ET and ECT did not affect the number of rhizospheric actinomycetes. Finally, treatment EC and ET did not increase the number of rhizospheric fungi under different density, but in treatment ECT, the number of rhizospheric fungi under high density increased significantly.

Key words Carbon dioxide enrichment; Elevated temperature; Rhizospheric microbe; Density; Betula albo-sinensis

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