

樟子松根内真菌分子生态网络复杂性与稳定性

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摘要: 【目的】根内真菌通过复杂的相互作用发挥其生态功能影响宿主植物生长发育, 但其互作网络复杂性和稳定性特征及其影响因素尚不明确。【方法】为揭示樟子松 (*Pinus sylvestris* var. *mongolica*) 天然林和人工林根内真菌网络复杂性与稳定性特征及其对环境因素的响应, 以呼伦贝尔沙地樟子松天然林和不同引种地 (呼伦贝尔沙地、科尔沁沙地和毛乌素沙地) 不同林龄 (中龄林、近熟林和成熟林) 人工林为研究对象, 采用分子生态网络分析法对根内真菌群落网络复杂性和稳定性进行比较分析, 为樟子松人工林科学管理提供理论依据。【结果】1) 樟子松根内真菌网络均以正相关关系为主, 而天然林网络负相关关系比例更高; 人工林根内真菌网络复杂性高于天然林, 且毛乌素沙地网络最为复杂, 不同引种地人工林网络复杂性在近熟林达到最大值。2) 子囊菌门 (Ascomycota) 为天然林和人工林主要关键真菌类群; 在属水平上, 主要为丝盖伞属 (*Inocybe*)、美口菌属 (*Calostoma*)、*Cladophialophora* 等。腐生菌与其他真菌联系密切, 病原菌作为关键菌群存在于人工林。3) 天然林网络稳定性更强, 科尔沁沙地人工林网络稳定性高于其他人工林; 不同引种地人工林网络稳定性均在中龄林达到最大值。4) 根内真菌网络复杂性主要受年平均温度和年平均降水量以及土壤养分含量影响, 而网络稳定性与环境因子无显著相关关系。【结论】环境因素和林龄塑造了根内真菌网络复杂性和稳定性的时空动态, 天然林根内真菌网络更稳定可能有利于林木生长, 人工林通过更复杂的网络满足养分需求; 腐生营养型真菌与其他真菌联系密切, 病原菌作为关键菌群可能对人工林生长和健康有消极影响。

Complexity and stability of molecular ecological network of root-associated fungi associated with

Pinus sylvestris var. *mongolica*

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Abstract: 【Objective】 Root-associated fungi exert ecological functions to affect the growth of host plants through complex interactions, but the complexity and stability of networks and the influencing factors remain unclear. 【Method】 To illuminate the complexity and stability of molecular network of root-associated fungi (RaF) associated *Pinus sylvestris* var. *mongolica* and investigate the environmental driving factors, we select natural forests and plantations (half-mature, nearly mature and mature forest) in the Hulunbuir Desert, Horqin Desert, and Mu Us Desert to determine RaF network by using molecular ecological network analysis. 【Result】 1) The interactions of RaF are dominated by positive correlation and there is stronger competition among fungi in natural forest; The complexity of RaF network in plantations is higher than natural forest, and RaF network in the Mu Us Desert is the most complicated; With the stand aging, the complexity reaches the maximum in nearly mature plantation. 2) Ascomycota is the main key fungi flora. The main genera are *Inocybe*, *Calostoma*, *Cladophialophora* and so on. Saprophytic closely contact with others in plantation and natural forest, but pathotrophic fungi appear as keystone in plantation forest. 3) Compared with plantations, RaF network of natural forests has higher stability, and the stability of RaF network of Horqin Desert is higher than others. In different deserts, the stability reaches the maximum in the half-mature plantation. 4) Complexity of RaF network is significantly correlated with average annual temperature, mean annual precipitation and soil nutrient, but there is no significantly correlation between stability of network and environmental factors. 【Conclusion】 The environment and stand ageing shape the spatial variation of RAF network complexity and stability. The stronger stability in natural forests is beneficial to forest growth. Plantations meet the growth demand through more complied network. Saprophytic closely contact with others, but pathotrophic fungi may have negative effect on the growth and health of plantations.