

杉木(*Cunninghamia lanceolata*)吸收根和丛枝菌根对不同环境因子的响应

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摘要:【目的】为了解树木细根分枝与丛枝菌根共生之间的关系, 以及它们对环境条件的响应。【方法】本研究以分布在中国亚热带不同环境条件下的 11 个杉木人工林为研究对象, 研究与杉木 1 级根资源获取策略有关的性状 (1 级根/2 级根分枝比、丛枝菌根 (AM) 侵染率) 与环境因子包括年平均降水量 (MAP)、年均温 (MAT)、土壤 C、土壤 N、土壤 P、土壤 pH 的关系。【结果】1 级根/2 级根分枝比对环境条件更为敏感。1 级根/2 级根分枝比与 MAT 呈正相关, 但与土壤 C、土壤 N 和土壤 pH 呈负相关 ($P < 0.05$), 表明恶劣环境条件下, 杉木生长出更多的 1 级根以促进对土壤资源的吸收。而 1 级根的丛枝菌根 (AM) 侵染率对环境因子的敏感性相对较低, 只与土壤 pH 呈正相关 ($P < 0.1$), 这表明土壤酸度抑制丛枝菌根共生体的生长。然而, 1 级根/2 级根分枝比与丛枝菌根 (AM) 侵染率两者呈显著负相关 ($P < 0.05$)。【结论】环境因子是控制细根分析和丛枝菌根产生的重要因子, 但不同的环境因子的影响作用不一样。1 级根/2 级根分枝比与丛枝菌根 (AM) 侵染率两者呈显著负相关正好说明了在环境因子影响下, 这两个性状的变化方向相反。

关键词: 吸收根; 分枝比; 丛枝菌根侵染率; 杉木; 环境因子

Responses of absorptive root and mycorrhizal colonization of Chinese fir (*Cunninghamia lanceolata*) to varied environmental conditions

Abstract: 【Objective】To understand the relationship between root branching and mycorrhizal symbioses, as well as their responses to varied environmental conditions. 【Method】11 Chinese fir (*Cunninghamia lanceolata*) plantations distributed in different environmental conditions in Subtropical China were selected to assess the relationship between root tip traits related to nutrient foraging (branching ratio of 1st order roots to 2nd order roots, arbuscular mycorrhizal (AM) colonization) and their environmental variables including mean annual precipitation (MAP), mean annual temperature (MAT), soil C, soil N, soil P, and soil pH. 【Result】Root branching was more sensitive to environmental conditions than mycorrhizal symbioses. The branching ratio and AM colonization of Chinese fir were significantly related to several environmental variables. The branching ratios were positively correlated with MAT, but negatively correlated with soil C, soil N, and soil pH ($P < 0.05$), suggesting that harsh environmental conditions can promote absorptive root branching. To our surprise, the AM colonization of absorptive roots was not as sensitive to environmental factors as branching ratio. However, the AM colonization of absorptive roots was positively correlated with soil pH ($P < 0.1$), indicating that soil acidity controls mycorrhizal symbioses. Moreover, the branching ratio was significantly negatively correlated with AM colonization ($P < 0.05$). 【Conclusion】Environmental conditions significantly regulate fine root branching and its mycorrhizal symbioses, but with different controlling variables. The negatively correlated relationship of branching ratio and AM colonization shows that environmental factors regulate absorptive root traits in different ways.

Keywords: Absorptive roots; Branching ratio; Arbuscular mycorrhizal (AM) colonization; Chinese fir; Environmental conditions