

荒漠草本和灌木根叶性状协调变异的差异

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摘要: 植物性状在其资源获取和养分循环中具有重要作用, 研究植物性状的变异和关联, 有助于我们理解植物对环境的适应策略及其群落构建机制。然而, 结合系统发育, 就有关不同生活型的荒漠植物细根和叶片性状的变异及性状之间的关联还知之甚少。本研究以干旱区常见荒漠植物(灌木和草本)为研究对象, 采用主成分、Pearson 相关、系统发育独立比较、混合线性模型和方差分解等方法探讨了 10 个细根和叶片性状的变异与关联。结果表明: (1) 所有叶片性状和大部分细根性状(除 RPC、RCC 和 RCN)的种间变异对总体变异的贡献大于种内变异。(2) 不同生活型植物叶片及细根性状的协变和权衡策略不同。草本 LNC 与 LPC 及 RNC 与 SRL 负相关, 而灌木 LNC 与 LPC 以及 RNC 与 SRL 无显著相关性; 灌木和草本 TD 与 SLA 均呈极显著负相关, 而灌木 AD 与 RTD 负相关, 草本 AD 与 RTD 无显著相关性。(3) 荒漠灌木支持叶经济谱假设, 且属于“快速投资-收益”获取型策略, 但草本可能不支持叶经济谱假设, 而草本和灌木细根性状的变异均表现出多维, 且与根系经济谱的推断不一致。(4) 叶片性状、细根性状之间有一定的协变或权衡关系, 它受系统发育的影响。综上所述, 叶片和细根性状的变异主要来源于种间, 但种内变异在细根中亦不容忽略。此外, 不同生活型植物叶片及细根的协变和权衡策略存在差异。今后的研究应从生活型角度深入探究植物性状在种内和种间等不同尺度上的变异与关联。

Harmonization and differences in root and leaf traits among herbaceous and shrub species in the desert, China

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Abstract: Plant traits play an important role in their resource acquisition and nutrient cycling, and the study of variation and associations of plant traits can help us to understand the adaptive strategies of plants to their environment and their community building mechanisms. However, little is known about the variation of fine root and leaf traits and the associations between traits in desert plants of different life types in the context of phylogeny. In this study, we investigated the variation and associations of 10 fine root and leaf traits using principal components, Pearson correlation, phylogenetically independent comparisons, mixed linear modeling, and variance decomposition for common desert plants (shrubs and herbs) in arid zones. The results showed that (1) interspecific variation for all leaf traits and most fine root traits (except RPC, RCC and RCN) contributed more to the overall variation than intraspecific variation. (2) The covariation and trade-off strategies for leaf and fine root traits differed among life-types. Herbaceous LNC was negatively correlated with LPC and RNC with SRL, while shrub LNC was not significantly correlated with LPC and RNC with SRL; both shrub and herbaceous TD were highly significantly

negatively correlated with SLA, while shrub AD was negatively correlated with RTD, and herbaceous AD was not significantly correlated with RTD. (3) Desert shrubs support the hypothesis of a leaf economic profile and are a "fast investment-return" acquisition strategy, but herbs may not support the hypothesis of a leaf economic profile, and the variation in fine root traits for both herbs and shrubs was multidimensional and inconsistent with the inference of a root economic profile. (4) There is some covariation or trade-off between leaf traits and fine root traits, and it is influenced by phylogeny. In summary, variation in leaf blade and fine root traits mainly originated from interspecifics, but intraspecific variation in fine roots should not be neglected. In addition, the covariation and trade-off strategies of leaf blade and fine root differ among life types. Future studies should investigate the variation and association of plant traits at different scales, such as intraspecific and interspecific, from the point of view of life types.