Opposing community assembly patterns for dominant and non-dominant plant species in herbaceous ecosystems globally

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June 28, 2021

Abstract

Dominant and non-dominant plants could be subject to different biotic and abiotic influences, partially because dominant plants modify the environment where non-dominant plants grow, causing an interaction asymmetry. Among other possibilities, if dominant plants compete strongly, they should deplete most resources forcing non-dominant plants into a more constrained niche space. Conversely, if dominant plants are constrained by the environment, they might not fully deplete available resources but instead ameliorate some of the environmental constraints limiting non-dominants. Hence, the nature of the interactions between the non-dominants could be modified by dominant species. However, when plant competition and environmental constraints have similar effects on dominant and non-dominant species no difference is expected. By estimating phylogenetic dispersion in 78 grasslands across five continents, we found that dominant species were clustered (underdispersed), suggesting dominant species are likely organized by environmental filtering, and that non-dominant species were either randomly assembled or overdispersed. Traits showed similar trends, but insufficient data prevented further analyses. Furthermore, several lineages scattered in the phylogeny had more non-dominant species, suggesting that traits related to non-dominants are phylogenetically conserved and have evolved multiple times. We found some environmental drivers of the dominant—non-dominant disparity. Our results indicate that assembly patterns for dominants and non-dominants are different, consistent with asymmetries in assembly mechanisms. Among the different mechanisms we evaluated, the results suggest two complementary hypotheses seldom explored: (1) Non-dominant species include lineages adapted to thrive in the environment generated by the dominant species. (2) Even when dominant species reduce resources to non-dominant ones, dominant species could have a stronger effect on—at least—some non-dominants by ameliorating the impact of the environment on them, than by depleting resources and increasing the environmental stress to those non-dominants. The results show that the dominant–non-dominant asymmetry has ecological and evolutionary consequences fundamental to understand plant communities.

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