
Cold tolerance, niche conservatism, and the phylogenetic structure of grass assemblages worldwide

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Abstract

Since their origins in warm and closed habitats, the shift to open and dry habitats might have triggered rapid diversification of grasses beginning about 55 Ma years ago. Although some recent studies substantially improved our understanding of the radiation of grasses, the discrepancies observed in the responses of different grass lineages along climatic and latitudinal gradients remain poorly understood.

In our study, we gathered geographic, functional trait and phylogenetic information for the Poaceae family at the species level, c. 11000 species. Through analysis of diversification and of the geographic variation in the phylogenetic diversity and structure of grass assemblages, we tested how evolution of cold tolerance and adaptation to arid environment in grasses explain the unusually shallow latitudinal gradient. Phylogenetic information provided new insights into the evolution of grasses, revealing contrasting patterns resulting from differences in long-term historical drivers. We also showed that climate change stability during Late Quaternary strongly influences patterns of grass endemism, consistent with results from other taxa. Finally, because the limited accuracy of occurrence data, especially for a large and less well-known group such as Poaceae, is a substantial problem at such large spatial extents, downscaling methods of species distribution models to estimate fine-grain presence/absence of grass species will be also presented.

Together, our results provide a better understanding of the current spatial distribution of grass assemblages and established the grass family as a model group for macroecological studies, on par with tree species or with the major vertebrate groups.

Keywords: diversification, functional traits, grasses, niche conservatism, phylogenetics

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