Intraspecific trait plasticity to N and P of the wetland invader, Alternanthera philoxeroides under flooded conditions

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Abstract

Interactions between invaders and resource availability may explain variation in their success or management efficacy. For widespread invaders, regional variation in plant response to nutrients can reflect phenotypic plasticity of the invader, genetic structure of invading populations, or a combination of the two. The wetland weed Alternanthera philoxeroides (alligatorweed) is established throughout the southeastern USA and California, and has high genetic diversity despite primarily spreading clonally. Despite its history in the USA, the role of genetic variation for invasion and management success is only now being uncovered. To better understand how nutrients and genotype may influence A. philoxeroides invasion, we measured the response of plants from 26 A. philoxeroides populations (three cp haplotypes) to combinations of nitrogen (4 or 200 mg/L N) and phosphorus (0.4 or 40 mg/L P). We measured productivity (biomass accumulation and allocation), plant architecture (stem diameter and thickness, branching intensity) and foliar traits (toughness, dry matter content, percent N, percent P). A short-term developmental assay was also conducted by feeding a subset of plants from the nutrient experiment to the biological control agent Agasicles hygrophila, to determine whether increased availability of N or P to its host influenced agent performance, as has been previously suggested. A. philoxeroides haplotype Ap1 was more plastic than other haplotypes in response to nutrient amendments, producing more than double the biomass from low to high N and 50-68% higher shoot:root ratio than other haplotypes in the high N treatment. A. philoxeroides haplotypes differed in 7 of 10 variables in response to increased N. We found no differences in short-term A. hygrophila development between haplotypes but mass was 23% greater in high than low N treatments. This study is the first to explore the interplay between nutrient availability, genetic variation, and phenotypic plasticity in invasive characteristics of the global invader, A. philoxeroides.

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