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ORIGINAL RESEARCH

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Long-term acclimation to reciprocal light conditions suggests depth-related selection in the marine foundation species *Posidonia oceanica*

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Abstract

Phenotypic differences among populations of the same species reflect selective responses to ecological gradients produced by variations in abiotic and biotic factors. Moreover, they can also originate from genetic differences among populations, due to a reduced gene flow. In this study, we examined the extent of differences in photo-acclimative traits of *Posidonia oceanica* (L.) *Delile* clones collected above and below the summer thermocline (i.e., −5 and −25 m) in a continuous population extending along the water depth gradient. During a reciprocal light exposure and subsequent recovery in mesocosms, we assessed degree of phenotypic plasticity and local adaptation of plants collected at different depths, by measuring changes in several traits, such as gene expression of target genes, photo-physiological features, and other fitness-related traits (i.e., plant morphology, growth, and mortality rates). Samples were also genotyped, using microsatellite markers, in order to evaluate the genetic divergence among plants of the two depths. Measures collected during the study have shown a various degree of phenotypic changes among traits and experimental groups, the amount of phenotypic changes observed was also dependent on the type of light environments considered. Overall plants collected at different depths seem to be able to acclimate to reciprocal light conditions in the experimental time frame, through morphological changes and phenotypic buffering, supported by the plastic regulation of a reduced number of genes. Multivariate analyses indicated that plants cluster better on the base of their depth origin rather than the experimental light conditions applied. The two groups were genetically distinct, but the patterns of phenotypic divergence observed during the experiment support the hypothesis that ecological selection can play a role in the adaptive divergence of *P. oceanica* clones along the depth gradient.

KEYWORDS

ecological selection, gene expression, light cline, photo-physiology, reciprocal transplant, seagrasses

1 | INTRODUCTION

Patterns of genetic and phenotypic variation of plant and animal populations are closely related to the magnitude of environmental heterogeneity in which they live (Conover, Duffy, & Hice, 2009; Endler, 1977; Hice, Duffy, Munch, & Conover, 2012) and are often independent from geographic distances (Richardson, Urban, Bolnick, & Skelly, 2014). Differential response of distinct populations to local