Assessing the importance of genetic and ecological factors for the occurrence of patchy flowering in *Posidonia oceanica*

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The occurrence of sexual reproduction and flowering synchronization of angiosperms has been widely studied and may be induced by external or internal cues. Although factors such as predator satiation and pollination efficiency may explain why synchronization can increase individual fitness, the actual mechanisms of synchronization are obscure for the majority of plant species. In this study we aimed to assess the importance of ecological and genetic factors in shaping flowering heterogeneity of *Posidonia oceanica* at the small spatial scale (metres), where shoots and patches were subjected to similar levels of the major potential external drivers such as temperature and light availability. We assessed four external ecological factors (vegetative tissue production, leaf nitrogen and carbon content and herbivory) and three genetic factors (heterozygosity, relatedness and clonality). We sampled six patches with contrasting flower abundances at three different localities and analysed whether spatial heterogeneity in the abundance of flowers was due to (1) clone identity and clone synchronization, (2) variation in nutrient availability per individual, potentially caused by spatial heterogeneity in herbivory rates (or nutrient re-location *via* clonal integration) or (3) kin selection and sibling synchronization. Moreover, we also investigated if levels of genetic diversity, specifically observed heterozygosity as a proxy for individual fitness, differ between flowering patches and patches with low flower abundance.
We show that genetic factors play a major role: Both internal relatedness and heterozygosity have a significant positive interaction with the abundance of flowers. Moreover, vegetative tissue production and the number of clones per patch were negatively correlated with the number of flowers, although at a low level of significance. Sharing of clones within localities was almost exclusively among patches with high flower abundance and patches with low flower abundance, respectively. Our results support the kin selection hypothesis and indirectly the resource-budget hypothesis, as well as an interaction between genetic factors and environmental factors as cause for the observed heterogeneous flowering patterns. Overall, the results shed new light onto the mechanisms explaining flowering synchronization in *P. oceanica*.

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