DISCUSSING THE ADAPTIVE VALUE OF DEVELOPMENTAL TRAITS IN MEDITERRANEAN PINES

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While the term adaptation is ubiquitous in current research on forest trees facing climate change, we still know too little about the contribution of single traits to total fitness in such long-lived organisms. Vegetative growth is commonly assumed to be a proxy of fitness when studying local adaptation of tree populations, but this may not be the case under moderate or severe environmental restrictions for plant growth. In particular, given well-known trade-offs between plant processes (e.g. growth, reproduction, defense), developmental phase changes are likely to be genetically based. Published data on various woody species indicate that both vegetative and reproductive phase changes are under strong genetic control and, at the same time, subject to wide ecotypic differentiation, which is meaningful from an evolutionary point of view. Mediterranean pines show widely differing life histories, both between and within species, but quantitative genetic data on key developmental aspects are so far very scarce. We conducted several field common garden experiments in Aleppo pine (*Pinus halepensis* Mill.), maritime pine (*P. pinaster* Aiton.) and Canary Island pine (*P. canariensis* C.Sm.), gathering data on plant size (height, diameter or stem volume) and survival in all species together with shoot ontogenetic status in *P. pinaster* and *P. canariensis* and female cone counts in *P. pinaster* and *P. halepensis*. Depending on the trial type (provenances, half-sib progenies or both), we used either population × site interactions or genetic parameters (coefficient of additive genetic variance, strict sense heritability, Q_{ST} and genetic correlations) to separate genetic and environmental effects. Developmental traits such as vegetative heteroblastic change, threshold size for female reproduction and early reproductive allocation generally showed higher additive genetic variation and often higher genetic differentiation between populations than did vegetative growth itself. On the other hand, various genetic correlations between growth and reproduction (positive, null or negative) confirm contrasting life-history strategies with strong evolutionary implications.

Keywords: additive genetic variation, life-history, ontogeny, reproduction