13th November 2019

Dear *Molecular-Ecology* Editor,

We wish to submit our manuscript entitled “Life-history trade-offs and the genetic basis of fitness in *Arabidopsis thaliana*” as an original research article for publication in *Molecular Ecology*.

Understanding the extent to which local adaptation is shaped by tradeoffs between allocation to different life-history functions, and by increased ability to acquire resources in the local environment is a central problem of life-history evolution. In this study, we used a uniquely suited genetic resource to investigate genetic correlations between components of fecundity (number of fruits and number of seeds per fruit), between fecundity and survival, and between offspring number and size in the annual herb *Arabidopsis thaliana*. In two years, we quantified seed size and seed production per fruit in reciprocal transplant experiments including two locally-adapted ecotypes from Italy and Sweden, and a RIL population derived from these parental lines, and we combined these data we previously published information about survival and fruit production. We found generally positive correlations between components of fitness, and QTL mapping revealed that these correlations were reflected in positive pleiotropic effects of underlying loci. The results show that adaptive differentiation between the two focal populations has involved the evolution of increased ability to acquire resources under local environmental conditions allowing for correlated increases in both survival and fecundity.

We suggest this manuscript is of broad interest to readers of *Molecular Ecology* because it relates to three very general debates in evolutionary biology. Firstly, we believe that our conclusion that local adaptation is driven by selection for increased overall condition, with correlated changes in components of fitness, is an important insight into how selection has driven divergence among natural populations. Secondly, our investigations of genetic correlations are relevant to long-standing debates in life-history evolution about how and why adaptive traits constrain one another. In particular, the concordance of positive genetic correlations and positive pleiotropy at individual QTL allows us to directly link relationships among life-history traits at the phenotypic level with the underlying genetic loci. Finally, by quantifying both seed size and seed number we address the extent to which investment in individual offspring limits increased fecundity. Although such a trade-off is predicted by theory and can be detected in comparisons across species, little is known about its genetic basis within species. The topics of local adaptation, life-history evolution and optimal clutch size are relevant across taxa, so we firmly believe this manuscript will be of interest to a broad range of evolutionary biologists.

Thank you for taking the time to consider our manuscript for publication, and we look forward to hearing from you.

Yours sincerely,

Thomas Ellis, Froukje Postma, Christopher Oakley and Jon Ågren