The moulding of intra-specific diversity by selection under ecological inheritance

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Organisms continuously modify their environment, often impacting the fitness of future conspecifics via ecological inheritance. When this inheritance is biased towards kin, selection favours modifications that increase the fitness of downstream individuals. How such selection shapes trait variation within populations, however, remains poorly understood. Using mathematical modelling, we investigate the coevolution of multiple traits in a group-structured population when these traits affect the group environment, which is then bequeathed to future generations. We examine when such coevolution favours polymorphism as well as the associations among traits that emerge. We find in particular that two traits become associated when one trait affects the environment while the other influences the likelihood that future kin experience this environment. To illustrate this, we track the coevolution of (a) the attack rate on a renewable resource, which deteriorates environmental conditions, with (b) dispersal between groups, which reduces the likelihood that kin suffers from such deterioration. We show this often leads to the emergence of two highly-differentiated morphs: one that readily disperses and depletes local resources; and another that maintains these resources and tends to remain philopatric. More broadly, we suggest that ecological inheritance can contribute to phenotypic variation and lead to complex ecological polymorphism.