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Evolution of dispersal under a fecundity-dispersal trade-off

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Abstract

Resources invested in dispersal structures as well as time and energy spent during transfer may often decrease fecundity. Here we analyse an extended version of the Hamilton-May model of dispersal evolution, where we include a fecundity-dispersal trade-off and also mortality between competition and reproduction. With adaptive dynamics and critical function analysis we investigate the evolution of dispersal strategies and ask whether adaptive diversification is possible. We exclude evolutionary branching for concave trade-offs and show that for convex trade-offs diversification is promoted in a narrow parameter range. We provide theoretical evidence that dispersal strategies can monotonically decrease with increasing survival during dispersal. Moreover, we illustrate the existence of two alternative attracting dispersal strategies. The model exhibits fold bifurcation points where slight changes in survival can lead to evolutionary catastrophes.

Keywords: Adaptive dynamics, critical function analysis, evolutionary branching, life history, emigration

1. Introduction

Dispersal is an elementary driver of ecology and evolution, which fundamentally shapes the distribution, abundance and diversity of species, and plays a key role in their persistence in the face of habitat fragmentation, climate change, and other adverse environmental impacts. Dispersal helps to avoid crowding, kin competition and inbreeding, and to escape from natural enemies. However, dispersal has multifarious costs (reviewed by Bonte et al.,