Evolution of dispersal in structured metapopulations - Evolutionary suicide and the effect of diploid inheritance

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We study the evolution of dispersal in a structured metapopulation model. The metapopulation consists of a large number of local populations living in habitat patches. Population dynamics within patches are density-regulated by realistic growth functions. Occasionally, local catastrophes kill a local population: all individuals in the affected patch die, yet the patch remains habitable. Under a given set of environmental conditions, a metapopulation may be viable and yet selection may favor dispersal rates that drive the metapopulation to extinction. Such evolutionary suicide can occur in this metapopulation for certain size-dependent catastrophe rates, or if there is an Allee effect in the local growth [3]. We also study how small population sizes, and resulting demographic stochasticity, affect the evolution of dispersal [1].

Most studies of evolutionary stable strategies assume clonal reproduction. At least in the simplest cases, more realistic genetic models yield results compatible with the clonal results. Here we study how diploid inheritance (with single locus and many alleles) affects the evolution of dispersal [2]. In a metapopulation model with small local population sizes both mutant homozygotes and heterozygotes appear locally although the mutant population is still globally rare. Therefore the diploid and clonal results are not expected to be similar. It turns out that there are differences between the clonal and diploid ESS dispersal rates. In a homogenous landscape the discrepancy is minor (less than 2%). The situation is completely different in a heterogeneous landscape: the discrepancy is already significant, but more importantly, there is a qualitative difference: clonal

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and diploid singular strategies do not necessarily have the same evolutionary stability. As a result, we can no longer be sure that if evolutionary branching [4] happens in a clonal model, it will happen also in a diploid model, or vice versa.

References

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