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Kalle Parvinen, Hisashi Ohtsuki, Joe Yuichiro Wakano

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Kalle Parvinen[a,b], Hisashi Ohtsuki[c], Joe Yuichiro Wakano[d,e]

[a]*Department of Mathematics and Statistics, FI-20014 University of Turku, Finland. E-mail: kalle.parvinen@utu.fi*
[b]*Evolution and Ecology Program, International Institute for Applied Systems Analysis (IIASA), A-2361 Laxenburg, Austria*
[c]*Department of Evolutionary Studies of Biosystems, School of Advanced Sciences, SOKENDAI (The Graduate University for Advanced Studies), Shonan Village, Hayama, Kanagawa 240-0193, Japan*
[d]*School of Interdisciplinary Mathematical Sciences, Meiji University, Tokyo 164-8525, Japan*
[e]*Meiji Institute for Advanced Study of Mathematical Sciences, Tokyo 164-8525, Japan*

Abstract

By investigating metapopulation fitness, we present analytical expressions for the selection gradient and conditions for convergence stability and evolutionary stability in Wright's island model in terms of fecundity function. Coefficients of each derivative of fecundity function appearing in these conditions have fixed signs. This illustrates which kind of interaction promotes or inhibits evolutionary branching in spatial models. We observe that Taylor's cancellation result holds for any fecundity function: Not only singular strategies but also their convergence stability is identical to that in the corresponding well-mixed model. We show that evolutionary branching never occurs when the dispersal rate is close to zero. Furthermore, for a wide class of fecundity functions (including those determined by any pairwise game), evolutionary branching is impossible for any dispersal rate if branching does not occur in the corresponding well-mixed model. Spatial structure thus often inhibits evolutionary branching, although we can construct a fecundity function for which evolutionary branching only occurs for intermediate dispersal rates.

Keywords: Adaptive dynamics; cooperation; evolutionary branching; natural selection