Evolution and consequences of dispersal plasticity in metapopulations

Allan Raffard*[1], Delphine Legrand[2], Julie Campana[2], Nicolas Schtickzelle[3], and Staffan Jacob[2]

[1]INRAE, CARRTEL – Univ. Savoie Mont Blanc – 74200 Thonon-les-Bains, France
[2]Station d'Ecologie Théorique et Expérimentale – Centre National de la Recherche Scientifique, Fédération de Recherche Agrobiosciences, Interactions et Biodiversité – France
[3]Université Catholique de Louvain = Catholic University of Louvain – Belgique

Résumé

Dispersal, the movement of individual leading to gene flow among populations, is an important process affecting ecological and evolutionary dynamics. Dispersal decisions can vary among individuals depending on their phenotype (dispersal syndrome) and the environmental conditions (dispersal plasticity). Dispersal plasticity and syndromes might play a key role in mediating metapopulation stability and persistence. They can allow or improve colonization of empty patches, limit extinction risks, and might thus increase metapopulation persistence and permit evolutionary rescue facing environmental changes. However, how dispersal plasticity and syndromes evolve under different scenario of environmental fluctuation in metapopulations and whether variability of these dispersal strategies affect metapopulation dynamics still lack of empirical evidence.
In this study, we performed two separate experiments in microcosms of the ciliate *Tetrahymena thermophila* with either isogenic population or standing genetic variation, to test 1) whether dispersal plasticity and syndromes mediate metapopulation dynamics under environmental fluctuation, and 2) explore how these strategies evolve in such environments. We tracked spatiotemporal metapopulations dynamics in two-patches metapopulations in response to four thermal fluctuation treatments (constant, temporal, spatial, and spatiotemporal variation).
We found that dispersal rate and plasticity of *T. thermophila* came with larger metapopulations size regardless of the temperature variability conditions. Interestingly, higher dispersal plasticity decreased the spatial variability of metapopulations, suggesting that it might buffer the effect of spatiotemporal variation. Furthermore, higher dispersal was selected for in the presence of temperature variability, but we did not found changes of dispersal plasticity between fluctuation treatments. Finally, populations evolved more complex patterns of dispersal syndromes, related to behavioral and morphological traits, depending upon temperature variability conditions. For instance, spatial variation led to an inversion of the plasticity of the correlation between behaviour and dispersal; active cells being the best dispersers in one case and vice versa. To conclude, the study of the evolution and plasticity of dispersal strategy and its consequences on metapopulation dynamics may generate insightful hypotheses regarding the functioning of ecological and evolutionary processes in spatially structured habitats.

*Intervenant

Mots-Clés: Dispersal, experiment, plasticity, metapopulation, evolution