The effect of dilution rate and transfer interval on eco-evolutionary dynamics of experimental microbial communities

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Abstract

All organisms are susceptible to the environment and changing environmental conditions can infer structural modifications in predator-prey communities. A change in the environment can influence, for example, the mortality rate of both the prey and the predator, or determine how long the interaction between both partners is. This may have a substantial impact on ecological, but also evolutionary dynamics. Experimental studies, in which microbial populations are maintained by a repeated dilution into fresh conditions after a certain period of time, are able to dissipate underlying mechanisms in a controlled way. By design, dilution rate (modifying mortality) and transfer interval (determining the time of interaction) are crucial factors, but they often receive little attention in experimental design. We study data from a live predator-prey (bacteria and ciliates) system used to gain insight into eco-evolutionary principles and apply a mathematical model to predict how various dilution rates and transfer intervals would affect such an experiment. We find the ecological dynamics to be surprisingly robust for both factors. However, the evolutionary rates are expected to be affected. Our work predicts that the evolution of the anti-predator defence in the bacteria, and the evolution of the predation efficiency in the ciliates, both decrease with higher dilution rate, but increase with longer transfer intervals. Our results provide testable hypotheses for future studies of predator-prey systems and we hope this work will help improving our understanding how ecological and evolutionary processes together shape composition of microbial communities.

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