
Selection for species interaction patterns revealed by experimental evolution of rhizosphere microbiota

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Abstract

”It is The Song, Not The Singers” is a theoretical account proposed by Doolittle and Inkpen (2018) which suggests that the nature of selection units could be processual rather than material. Selection units could be patterns of interactions such as co-occurrence networks between species of a microbial community (the ”song”), rather than entities such as genes, organisms or groups (the ”singers”). There is actually no empirical evidence demonstrating the validity of this account. We performed an artificial selection experiment for ten generations, in which rhizosphere microbiota was selected based on their positive or negative effect on plant growth, with a random selection control. We identified persistent singers and songs as those that were present during the selection process. We then tested the hypothesis that (a) singers, (b) songs (more precisely songs’ complexity, defined by their number of nodes) or (c) songs made by the persistent singers can be selected across generations. In each of these three cases, we searched for songs or singers that persisted either (i) whatever the evolutionary forces at stake (High, Low or Random selection treatments), (ii) specifically due to directional selection (not found in the random selection control), and (iii) due to directional selection but not due to founder effect, by excluding any initial differences between Low or High and Random at the beginning the experiment. We found selected singers whatever the case. We also found selected songs whatever the selection regime, thus validating that interaction patterns can be artificially selected, as proposed in the ITSNTS theory. Finally, we also found some songs made by the same singers across generations, but those were only due to a founder effect. Hence, we concluded that in microbial communities, singers and songs can be selected independently: selected singers are not necessarily part of a selected song, and selected songs do not have necessarily the same membership.

Keywords: Artificial selection, unit of selection, cooccurrence networks, microbiota

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