Dear Editor, dear members of the editorial board,

Please find enclosed the submission of our manuscript “Eco-evolutionary diversification of trait convergence and complementarity in mutualistic networks” to Ecology Letters.

In recent years, a great deal of progress towards understanding convergence, complementarity and nestedness in mutualistic networks has been made. Empirical mutualistic networks composed by several interacting species show high levels of trait convergence, complementarity and nestedness. Yet theories with co-evolutionary selection aiming to predict trait convergence, complementarity and nestedness suggest that there may be strong trade-offs between these variables that limit model predictions to match the empirical observations. For example, for weak or absent coevolutionary selection, trait values in animal and plant species can be highly variable and non-convergent but trait values of animal and plants species are positively correlated (i.e., complementarity). As coevolutionary selection intensifies, variation in the trait values of animal and plant species is reduced and converge but correlations between traits of interacting species are weakened (i.e., low pairwise complementarity). Whether co-evolutionary selection is required to explain trait convergence, complementarity and nestedness, the impact of population and diversification dynamics on quantitative trait divergence and convergence dynamics in species-rich mutualistic networks remains largely unexplored.

Here, we present a landscape genetics model to connect population and diversification dynamics to quantitative trait dynamics to study trait complementarity and convergence in species-rich mutualistic networks. After controlling by phylogenetically relatedness, our results show that population and diversification dynamics drive convergence and complementarity by producing a gradient of species phenotypes ranging from common and large trait variation plant and animal species to rare species with small trait variation. Our results also predict convergence values largely independent or positively correlated to trait complementarity and nestedness between plant and animals. Our model is in agreement with observed levels of complementarity and convergence for animals, but conflicts with convergence patterns for plants in an empirical plant-hummingbird mutualistic network. Our results indicate that combining the spatial structure of plant-animal trait diversification with population dynamics in a phenotypic difference model alter predictions in a direction that is more in line with observations, and hence are important to be included in future studies of evolutionary patterns in mutualistic networks.

Taken togehter, our results show no signs of trade-offs between convergence, complementarity and nestedness and suggest that diversification trait dynamics requires ecological, genetical and morphological processes associated to phenotype differences to reproduce key patterns of mutualistic networks, from trait convergence and complementarity to connectance and nestedness.

All the authors confirm these results are outstandingly novel relative to current co-evolutionary theory of mutualistic networks and to recent work by coauthors (pdf's attached with the submission).

We thank you in advance for the attention dedicated to this manuscript.

Yours sincerely,

Francisco Encinas-Viso
Rampal S. Etienne
Carlos J. Melián