Community Phenotypic Integration: a critical dimension of functional structure in community assembly

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Résumé

Functional ecology has been widely adopted to analyse and infer community structure for over two decades. The functional framework relies on constructing functional spaces for a given species pool by using traits directly or summarizing these traits into multivariate axes. Consequently, functional ecology studies routinely ignore correlations among functional traits or consider these noise that must be controlled for, rather than considering them as a signal that can and should be interpreted. Here, we argue that the trait correlation structure within a community represents an important component of community structure, offering important insights into the assembly process of communities. To characterize the trait correlation structure of a community, we extend the concept of Phenotypic Integration developed in evolutionary biology to community ecology. Phenotypic Integration, in the strict sense, refers to the magnitude of pairwise correlations among traits within the phenotype of a species or an individual. However, it can be extended to the analysis of the trait correlation structure of these phenotypes within entire communities. We used a dataset comprising about 700 lake-fish communities in Ontario, Canada, and 16 functional traits to demonstrate the significance of community pairwise trait correlation structure in improving our understanding of the processes underlying community assembly. Our preliminary results showed that Community Phenotypic Integration was negatively correlated with other functional metrics. However, a Structural Equation Model aimed to explain the variation in species richness with the latitudinal gradient, alongside Functional Richness and Functional Dispersion, and Community Phenotypic Integration, revealed that Community Phenotypic Integration had a strong and negative impact on species richness. Our results underscore that patterns of Community Phenotypic Integration provide additional insights not captured by commonly used functional metrics, accounting for previously unexplained variation in community structure.

Mots-Clés: Community Ecology, Functional Ecology, Fish, Functional traits

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