**Environmental and functional determinants of tree performance in a neotropical forest: the imprint of evolutionary legacy on growth strategies**

*Recommendation of the paper by Sylvain Schmitt, Bruno Hérault, et Géraldine Derroire. 2023. « High intraspecific growth variability despite strong evolutionary heritage in a neotropical forest ». bioRxiv, janvier, 2022.07.27.501745. https://doi.org/10.1101/2022.07.27.501745.*

The hyperdiverse tropical forests has long fascinated ecologists because the fact that so many species persist at low density at a local scale remain hard to explain. Both niche-based and neutral hypotheses have been tested, primarily based on analyzing taxonomic composition of tropical forest plots (Janzen 1970; Hubbell 2001). Studies of the functional and phylogenetic structure of tropical tree communities have further aimed to better assess the importance of niche-based processes. For instance, Baraloto et al. (2012) found that co-occurring species were functionally and phylogenetically more similar in a neotropical forest, suggesting a role of environmental filtering. Likewise, Schmitt et al. (2021) found influence of environmental filtering on the functional composition of an Indian rainforest. Yet these studies evidenced non-random trait-environment association based on the composition of assemblages only (in terms of occurrences and abundances). A major challenge remains to further address whether and how tree performance varies among species and individuals in tropical forests.

Functional traits are related to components of individual fitness (Violle et al. 2007). Recently, more and more emphasis has been put on examining the relationship between functional trait values and demographic parameters (Salguero-Gómez et al. 2018), in order to better understand how functional trait values determine species population dynamics and abundances in assemblages. Fortunel et al. (2018) found an influence of functional traits on species growth variation related to topography, and less clearly to neighborhood density (crowding). Poorter et al. (2018) observed 44% of trait variation within species in a neotropical forest. Although individual trait values would be expected to be better predictors of performance than average values measured at species level, Poorter et al still found a poor relationship.

Schmitt et al. (2023) examined how abiotic conditions and biotic interactions (considering neighborhood density) influenced the variation of individual potential tree growth, in a tropical forest plot located in French Guiana. They also considered the link between species-averaged values of growth potential and functional traits. Schmitt et al. (2023) found substantial variation in growth potential within species, that functional traits explained 40% of the variation of species-averaged growth and, noticeably, that the taxonomic structure (used as random effect in their model) explained a third of the variation in individual growth.

Although functional traits of roots, wood and leaves could predict a significant part of species growth potential, much variability of tree growth occurred within species. Intraspecific trait variation can thus be huge in response to changing abiotic and biotic contexts across individuals. The information on phylogenetic relationship can still provide a proxy of the integrated phenotypic variation that is under selection across the phylogeny, and determine a variation in growth strategies among individuals. The similarity of phylogenetic structure suggests a joint selection of these growth strategies and related functional traits during events of convergent evolution. Baraloto et al. (2012) already noted that phylogenetic distance can be a proxy of niche overlap in tropical tree communities. Here, Schmitt et al. further demonstrate that evolutionary heritage is significantly related to individual growth variation, and pleads for better acknowledging this role in future studies.

While the role of fitness differences in tropical tree community dynamics remained to be assessed, the present study provides new evidence that individual growth does vary depending on evolutionary relationships, which can reflect the roles of selection and adaptation on growth strategies. Therefore, investigating both the influence of functional traits and phylogenetic relationships on individual performance remains a promising avenue of research, for functional and community ecology in general.

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