New phylogenetic comparative methods to study phenotypic evolution during climatic changes

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Résumé

There is enormous variation in morphological diversity across fossil and modern vertebrates. However, how this diversity has evolved through geological time is still much debated and has been mostly assessed through the study of simple traits such as body-size despite morphology being inherently multi-dimensional. This continuing reliance on easily characterized (univariate) traits comes from the computational and statistical challenges of studying incomplete (damaged) fossil specimens, and of using modern high-dimensional datasets (e.g., 3D geometric morphometric data). Here, we propose new phylogenetic models of trait evolution that relate evolutionary rates to past climatic events with new methods that are capable of handling high-dimensional datasets with missing values. We used intensive simulations to assess the performances of the approaches and applied it to recently-published high-density 3D geometric morphometric datasets across tetrapods. We discuss preliminary results on the effects of past climatic changes - and in particular climatic optimums - on the evolution of morphological diversity in tetrapods. Finally, we discuss current challenges and ways to better incorporate the study of fossil and extant species in a common phylogenetic framework.

Mots-Clés: phylogenetic comparative methods, missing values, high, dimensions, 3D geometric morphometrics.

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