

Title: New Ways to Gain More Reliable Insights Into Adaptive Radiations - A Case in Anoles

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Abstract:

Adaptive radiations and their causes have long fascinated evolutionary biologists, and trait-dependent diversification models were a popular means to analyse them. However, the field has been grappling with various reliability issues in SSE models in the past years, and their correlative nature limits one's ability to make confident conclusions. Here, we first test the adequacy of SSE models for the data using posterior predictive simulations and calculation of a number of summary statistics on those simulations. This allows to identify whether the inference of trait-dependence was misled by the signature of other processes. Such adequacy tests go beyond a mere check of appropriateness of the model. The summary statistics capture properties of the data which can also inform us of how the model fails to adequately describe the data. Thus, we secondly further leverage this by formulating a number of competing causal scenarios, implementing them in an SSE model framework, and using the summary statistics from the adequacy test to further characterise any differences in the signatures the competing causal scenarios may have left on the data. We use *Anolis* lizards as an example, in which viviparity has often been linked to increased rates of lineage diversification. However, this result seems biologically questionable. Using the approach outlined above, we formulate a series of alternative causal scenarios and explore our ability to distinguish how plausible they are for this data. While no absolute proof for a particular scenario is possible, certain scenarios can be ruled out like this.