On comparative analyses involving non-heritable traits: why half a loaf is sometimes worse than none

William E. Kunin

Earth & Biosphere Institute and Institute for Integrative and Comparative Biology, University of Leeds, Leeds, UK

ABSTRACT

Question: Should phylogenetically informed (PI) analyses be used when not all variables in an analysis are heritable?

Methods: I simulated phylogenetic trees, with randomized traits (1) inherited with variation, (2) assigned directly to extant species, or (3) made partially dependent on a heritable variable, testing the frequency of ‘significant’ correlations between variables using conventional and two different PI techniques.

Results: ‘Significance’ was inflated in analyses of heritable variables, and this was corrected by both PI methods. However, where one variable was heritable and the other not, conventional analyses provided unbiased probability estimates. Modelled correlations between heritable and non-heritable traits were more readily detected by conventional analyses, but analyses involving ‘incorrect’ heritable traits sometimes showed spurious correlations.

Conclusions: The results suggest that PI analyses are inappropriate when only one of a pair of variables displays phylogenetic pattern. Where intrinsically non-heritable traits display phylogenetic pattern, conventional analyses are appropriate as an initial approach, but residuals should be tested for phylogenetic patterning.

Keywords: abundance, comparative method, correlated traits, distribution, heritability, independent contrasts, phylogenetic analyses.

INTRODUCTION

The use of interspecific comparisons is central to the study of ecology and evolutionary biology. The practice is particularly important in addressing issues that operate on temporal or spatial scales too vast to allow experimental manipulation, in particular the evolution of particular species characteristics. Thus if species with, for example, polygamous mating systems also tended to have pronounced sexual dimorphism, this might be taken as evidence that the two variables were linked in some way: perhaps the dimorphism evolved as a result of the increased sexual selection resulting from polygamy (e.g. Dunn et al., 2001). Until
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