Wing length canalisation and behaviour across birds: a phylogenetic meta-analysis of variance

Authors: Klaus Reinhold, Alfredo Sánchez-Tójar

Affiliation: Department of Evolutionary Biology, Bielefeld University, 33615, Bielefeld, Germany

Corresponding author: Klaus Reinhold (klaus.reinhold@uni-bielefeld.de)

Abstract

We examined the expectation that stronger stablising selection leads to a decrease in trait variation across species by investigating individual variation in wing length. We hypothesised that species that heavily rely on aerial feeding as well as long-distance migratory species show higher canalisation (lower *CV* values) in wing length than non-aerial feeders and non-migratory species. We collected summary statistics on wing length for males and females from the literature and analysed them using recently developed meta-analytic metrics for integrating phenotypic variance estimates. Our phylogenetic multilevel meta-analysis showed relatively low heterogeneity among *CV* values, indicating generalisability of the overall CV value (2.6%). Although not all pairwise comparisons were statistically significant, all our analyses consistently showed higher canalisation in aerial compared to non-aerial feeders, and in migratory compared to non-migratory species. We conclude that wing length in bird species relying on their wings more heavily is likely under stronger (stabilising) selection, which in turn would have led to the observed higher canalisation on this trait for those species. Our study showcases how to combine already available descriptive statistics for phenotypic traits with underused meta-analysis of variance approaches to test often-neglected evolutionary predictions at the variance level.

Keywords: meta-analysis of variance; evidence synthesis; avian; comparative analysis; coefficient of variation; canalization; replicability; generalizability; life-history evolution

Authors contributions

KR: Conceptualization; Data curation; Funding acquisition; Investigation; Methodology; Project Administration; Supervision; Writing – original draft; Writing – review & editing. AST: Data curation; Formal Analysis; Investigation; Methodology; Project Administration; Software; Supervision; Validation; Visualization; Writing – original draft; Writing – review & editing.

Acknowledgements

We would like to thank Oliver Heerwig for his help with data extraction, and Daniel W.A. Noble for kindly adding the possibility to easily back-transform *lnCV* values to the R package 'orchaRd'. This study was partially funded by the German Research Foundation (DFG: Deutsche Forschungsgemeinschaft) as part of the SFB TRR 212 (NC3)—Project No. 316099922 and 396782608.

Data and code availability statement

All data and code are available at the following Zenodo repository (http://doi.org/10.5281/zenodo.18152048), as well as in the connected GitHub repository (https://github.com/ASanchez-Tojar/meta-analysis_canalisation_bird_wing).