
The role of habitat heterogeneity in the taxonomic and functional diversity of Macaronesian spider communities

Paulo A. V. Borges^{*†1}, Jagoba Malumbres-Olarte^{1,2}, Marco Girardello¹, Pedro Cardoso^{1,2}, Isabel R. Amorim¹, Luis Crespo^{2,3}, Miquel Arnedo³, Mario Boeiro¹, Jose Carvalho^{1,2,4}, Rui Carvalho^{1,2}, Rosalina Gabriel¹, Lucas Lamelas-Lopez¹, Heriberto López⁵, Octavio Paulo⁶, Fernando Pereira¹, Antonio J. Pérez Delgado^{5,7}, Carla Rego¹, Maria Romeiras⁸, Alejandra Ros-Prieto¹, Pedro Oromí⁷, Brent C. Emerson⁵, and François Rigal⁹

¹Centre for Ecology, Evolution and Environmental Changes / Azorean Biodiversity Group and Universidade dos Açores (cE3c) – Universidade dos Açores Rua Capitão João d'Ávila, Pico da Urze, 9700-042 Angra do Heroísmo, Terceira, Açores, Portugal

²Laboratory for Integrative Biodiversity Research, Finnish Museum of Natural History, University of Helsinki, (LIBRe) – P.O.Box 17 (Pohjoinen Rautatiekatu 13), 00014 Helsinki, Finland

³Biodiversity Research Institute (IRBio), Department of Evolutionary Biology, Ecology and Environmental Sciences, University of Barcelona – Barcelona, Spain

⁴Centre for Molecular and Environmental Biology, Department of Biology, University of Minho – 4710-087 Braga, Portugal

⁵Island Ecology and Evolution Research Group (IPNA-CSIC) – C/ Astrofísico Francisco Sánchez 3, 38206 La Laguna, Tenerife, Canary Islands, Spain

⁶Computational Biology and Population Genomics Group, cE3c – Centre for Ecology, Evolution and Environmental Changes, DBA/FCUL – Campo Grande, P-1749-016 Lisboa, Portugal

⁷Dept. of Animal Biology and Edaphology and Geology, University of La Laguna (ULL), – 38206 La Laguna, Tenerife, Canary Islands, Spain

⁸Linking Landscape, Environment, Agriculture and Food (LEAF), – Instituto Superior de Agronomia (ISA), Universidade de Lisboa, Lisbon, Portugal

⁹Université de Pau et des Pays de l'Adour, Institut des Sciences Analytiques et de Physico-Chimie pour l'Environnement et les Matériaux, MIRA, Environment and Microbiology Team – Centre national de la recherche scientifique - CNRS (France) – UMR 5254, BP 1155, 64013 Pau, France

Abstract

Despite the fact that we have improved our understanding of how island age, size and isolation affect the structure of insular communities, we still fall short in knowing the effects of environmental (climatic and (micro)habitat) variability on the diversity and functional structure of island communities at different spatial scales, i.e., from small plots, to habitats, islands and archipelagos. In this work we use the Macaronesian archipelagos as a model to

*Speaker

†Corresponding author: pborges@uac.pt

understand the effects of environmental heterogeneity on the taxonomic and functional diversity of spider communities. By using standardised data from across four archipelagos with a range of climatic and (micro)habitat conditions, we tested two hypotheses related to the consequences of environmental heterogeneity: 1) variation in spider communities responds positively to heterogeneity at both regional and local plot scales; and 2) local environmental conditions act as a second functional filter for species into the communities that they ultimately form. Following the standardised sampling protocol COBRA, we collected spider specimens at 50 m x 50 m plots across eight Macaronesian islands. We generated community data from taxonomically identified and functionally characterised specimens and species, and obtained climatic and habitat data from satellite imagery. Through a series of null-models and hierarchical linear models, we tested the relationships between environmental variability and alpha and beta diversity for several functional groups. Habitat type, and environmental and (micro)habitat variability were correlated, with dry habitats having more heterogeneous climates and habitats. Spider communities were also more variable (greater beta diversity values) at both regional and local scales. The response of the functional structure of spider communities to environmental variability was reflected in the differences in the relative abundances of species belonging to different predatory guilds: web building species were more dominant in structurally more complex areas. Our findings point at the need to consider different spatial scales when investigating the effect of environmental heterogeneity on the assembly and structure of island communities.

Keywords: macroecology, Macaronesia, spider Communities, functional diversity, habitat structure