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Andrea S Meseguer

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RECOMMENDATION

The colonization history of largely isolated habitats

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Based on reviews by:
Florian Boucher, Simon Joly and two anonymous reviewers

Correspondence:
asanchezmeseguer@gmail.com

Andrea S Meseguer¹

¹ CNRS, UMR 5554 Institut des Sciences de l'Evolution (ISEM), Univ Montpellier – Montpellier, France

A recommendation of

Pirie MD, Kandziora M, Nuerk NM, Le Maitre NC, Kuppler ALM de, Gehrke B, Oliver EG, and Bellstedt DU. Leaps and bounds: geographical and ecological distance constrained the colonisation of the Afrotropics by *Erica*. *bioRxiv* 290791, ver. 5 peer-reviewed and recommended by *PCI Evol Biol* (2018). DOI: 10.1101/290791

The build-up of biodiversity is the result of *in situ* speciation and immigration, with the interplay between geographical distance and ecological suitability determining the probability of an organism to establish in a new area. The relative contribution of these factors have long interested biogeographers, in particular to explain the distribution of organisms adapted to habitats that remained largely isolated, such as the colonization of oceanic islands or land waters. The focus of this study is the formation of the afrotropics flora - patches of temperate vegetation separated by thousands of kilometers in Africa, with high levels of endemism described in the Cape region, the Drakensberg range and the high mountains of tropical east Africa [2]. The floristic affinities between these centers of endemism have frequently been explored but the origin of many afrotropics lineages remains enigmatic [1].

To identify the biogeographic history and drivers of biogeographic movements of the large afrotropics genus *Erica*, the study of Pirie and colleagues [3] develops a robust hypothesis-testing approach relying on historical biogeographic models, phylogenetic and species occurrence data. Specifically, the authors test the directionality of migrations through Africa and address the general question on whether geographic proximity or climatic niche similarity constrained the colonization of the Afrotropics by *Erica*. They found that the distribution of *Erica* species in Africa is the result of infrequent colonization events and that both geographic proximity and niche similarity limited geographic movements (with the model that incorporates both factors fitting the data better than null models). Unfortunately, the correlation between geographic and environmental distances found in this study limited the potential

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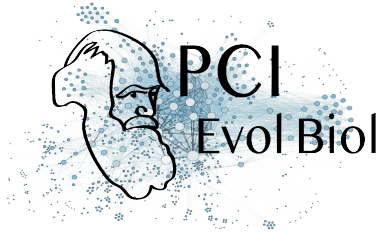
evaluation of their roles individually. They also found that species of *Erica* have dispersed from Europe to African regions, with the Drakensberg Mountains representing a colonization sink, rather than acting as a “stepping stone” between the Cape and Tropical African regions.

Advances in historical biogeography have been recently questioned by the difficulty to compare biogeographic models emphasizing long distance dispersal (DEC+) versus vicariance (DEC) using statistical methods, such as AIC, as well as by questioning the own performance of DEC+J models [4]. Behind Pirie et al. main conclusions prevails the assumption that patterns of concerted long distance dispersal are more realistic than vicariance scenarios, such that a widespread afrotemperate flora that receded with climatic changes never existed. Pirie et al. do not explicitly test for this scenario based on the idea that these habitats remained largely isolated over time and our current knowledge on African paleoclimates and vegetation, emphasizing the value of arguments based on empirical (biological, geographic) considerations in model comparisons. I, however, appreciate from this study that the results of the biogeographic models emphasizing long distance dispersal, vicariance, and the unconstrained models are congruent with each other and presented together.

Pirie and colleagues [3] bring a nice study on the importance of long distance dispersal and biome shift in structuring the regional floras of Africa. They evidence outstanding examples of radiations in *Erica* resulting from single dispersal events over long distances and between ecologically dissimilar areas, which highlight the importance of niche evolution and biome shifts in the assembly of diversity. Although we still face important limitations in data availability and model realism, the last decade has witnessed an improvement of our understanding of how historical and environmental triggers are intertwined on shaping biological diversity. I found Pirie et al.'s approach (and analytical framework) very stimulating and hope that will help movement in that direction, providing interesting perspectives for future investigations of other regions.

References

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- [3] Pirie MD, Kandziora M, Nuerk NM, Le Maitre NC, Kuppler ALM de, Gehrke B, Oliver EG, and Bellstedt DU. Leaps and bounds: geographical and ecological distance constrained the colonisation of the Afrotemperate by *Erica*. *bioRxiv* 290791, ver. 5 peer-reviewed and recommended by *PCI Evol Biol* (2018). DOI: 10.1101/290791.



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Appendix

Reviews by Florian Boucher, Simon Joly and two anonymous reviewers,
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