Biodiversity growth on the volcanic ocean islands and the roles of in situ cladogenesis and immigration: case with the reptiles

Jason Ali*[1] and Shai Meiri[2]

[1]The University of Hong Kong (HKU) – Pokfulam, Hong Kong, Hong Kong SAR China
[2]Tel Aviv University – Department of Zoology, Faculty of Life Sciences, Tel Aviv University, Tel Aviv, Israel

Abstract

Theoretical models explaining biodiversity growth on the volcanic oceanic islands assume that in situ cladogenesis is a major contributor. To evaluate this proposition, we examined the extent to which the process, rather than immigration and within-archipelago anagenesis, shapes reptile diversity on the volcanic oceans islands (the animals belonging to this group are particularly well suited for carrying out such a test). Occurrence data were compiled for the 194 terrestrial reptile species occupying 53 volcanically-constructed middle- to low-latitude landmasses worldwide. These included forms on 'model' archipelagos for evolution such as the Galapagos, Lesser Antilles, Canaries, Comoros, and the Mascarenes. Using phylogenetic data, we deduced which species resulted from in situ cladogenesis. Statistical models were then used to establish whether an island's area, age, maximum altitude, or isolation influenced the process. We also assessed whether the presence on a landmass of a non-sister congener exerted a control. Despite 273 native island-species records, there are only 8–12 cases of the phenomenon, including just two radiations. Diversification frequencies are uncorrelated with island area, age, maximum altitude, and isolation. Furthermore, there is no indication that the co-occurrence of non-sister congeners stymies the process. We therefore contend that in situ cladogenesis plays only a minor role in the accumulation of reptile diversity on individual oceanic islands; growth results primarily from immigration and between islands movements followed by anagenesis. This, however, is not a simple matter. Clusters that are far or challenging to get to have relatively few clades (3–8), some of which have many species (6–14), and all host at least one endemic genus. In these settings, diversity grows mainly by intra-archipelago transfer followed by within-island anagenetic speciation. In contrast, those island groups that are characterized by short distances and conducive transit conditions have been settled by many ancestor-colonizers (≥ 14), but each clade has few derived species (≤ 4). These archipelagoes lack especially distinctive lineages. Models explaining the assembly and growth of terrestrial biotic suites on the volcanic ocean islands thus need to accommodate these new insights.

Keywords: cladogenesis, island biogeography, biodiversity accumulation, reptiles, terrestrial vertebrates

*Speaker