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SPATIOTEMPORAL EVOLUTION OF NEOTROPICAL ORGANISMS

NEW INSIGHTS INTO AN OLD RIDDLE

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Examinator: Professor Nils Hallenberg

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Abstract

Nowhere else on Earth are there so many species of plants and animals as in the Neotropical region. Yet, many questions remain concerning the causes underlying such outstanding diversification.

In this thesis, I use a combination of molecular-based methods (phylogenetic inference, molecular dating, biogeographic reconstruction, analyses of diversification and extinction) together with geological, palaeontological, hydrological and climatological evidence to reconstruct the evolution of some Neotropical organisms in space and time. Diversification patterns obtained from case studies in the plant families Rubiaceae, Chloranthaceae and Campanulaceae are compared to published studies of other plants and animals, especially tetrapods (birds, non-avian reptiles, amphibians and mammals).

The uplift of the Northern Andes in the Neogene (~23 Ma to today) is concluded to have played a major role in promoting Neotropical diversification, by fostering allopatric speciation of lowland organisms and inducing adaptive radiations in newly formed montane habitats. In addition, its formation caused the end of a lowland corridor episodically invaded by marine incursions that separated the Northern and Central Andes, enabling the southward dispersal of boreotropical groups already present in northwestern South America.

The fact that most Neotropical plant groups are either Andean-centred or Amazonian-centred is explained by the long-lasting effect of the Palaeo-Orinoco and Lake Pebas as dispersal barriers between these two diversity centres. Finally, a new diversification model is proposed to explain the origin and evolution of organisms in two areas characterized today by unusually high levels of species richness and endemism: the Huancabamba region and western Amazonia. Under this model, speciation is proposed to have occurred over several million years in connection with the recolonization of previously submerged areas, by means of adaptive radiation of founder colonies and secondary contact of previously isolated populations.

KEYWORDS: Neotropics; Biodiversity patterns, Speciation models, Andean uplift, K/T Event; Biogeography, Phylogenetics, Molecular dating; Rubiaceae, Chloranthaceae, Campanulaceae, Tetrapods.