Testing for adaptive radiation and ecological constraint in a major lineage of rodents (Hystricomorpha, Caviomorpha)

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Ecological diversification was investigated in the rodent suborder Hystricomorpha. The main component of this clade, Caviomorpha, has radiated to 244 modern species in the Americas and Caribbean, and spans three orders of magnitude in body size (~60 g to ~60 kg). A molecular timetree was constructed using 22 fossil calibrations and a 5-gene supermatrix for 68% of caviomorph species, including all 54 living genera, plus related rodents in Africa and Asia. Body masses and ecological life modes of species were mapped on the timetree. Two family dyads in Octodontoidea are sister to each other with crown radiations starting ~18 Ma, but show different histories. The southern, arid-adapted radiation of Octodontidae (degus, viscacha rats) and Ctenomyidae (tuco-tucos) shows exponentially increasing rates of both species diversification and body-size disparification beginning ~5 Ma until the Recent. In contrast, the northern, mesic-adapted radiation of Echimyidae (spiny rats, tree rats) and Capromyidae (hutias) contains 18 lineages present since 10 Ma, with initially high evolutionary rates that then decline. Analyses within reconstructed life modes show that burrowers have smaller and less variable body sizes than tree-dwelling or terrestrial rodents. In the context of Simpson’s adaptive zones, Ctenomyidae is confined to the single zone of burrowing while Echimyidae-Capromyidae occupies at least two (burrowing and tree-dwelling). Thus, the latter clade may constitute an old adaptive radiation that has persisted after saturating available niches.