Lizards in the Caribbean: How geography influences animal evolution

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A new and potentially more revealing way of studying how animal evolution is affected by the geography of climate has been designed by researchers at The University of Nottingham and Harvard University.

The research, published in the prestigious journal, *The American Naturalist*, uses a new approach to investigate how animals across (interspecific) and within (intraspecific) species change in size along temperature gradients, shedding light on a 150-year-old evolutionary puzzle. Bergmann's rule—the tendency for warm-blooded animal body size to increase in colder environments—has long been controversial with debate around whether it applies to cold-blooded animals and how the rule applies within or among species.

Now, the team from Nottingham and Harvard has created a unified model to simultaneously study how interspecific and intraspecific patterns of animal size change through space. The researchers focused on two groups of Anolis lizard, one on Cuba and the other on nearby Hispaniola, the island occupied by Haiti and the Dominican Republic. They found that the size of lizards decreases with elevation on both islands, but their model revealed that different ecological and evolutionary processes are responsible on each island.

Dr Adam Algar, from The University of Nottingham's School of Geography, said: "Our new approach allows for the separation of intra- and interspecific components of the relationships between animal traits and the environment. We found that the similar body size gradients in

the lizards on both islands are constructed in very different ways. Even though lizards are smaller at high elevations on both islands, these body size patterns are underlain by very different processes. On Hispaniola, interspecific processes dominate, while on Cuba, intraspecific processes drive the pattern."

Martha Muñoz from Harvard University's Museum of Comparative Zoology and Department of Organismic and Evolutionary Biology, said: "Our results suggest that restricting analyses to either the intraspecific or interspecific levels can miss important patterns. Both must be considered. We believe our approach can help integrate a divided research programme by focusing on how the combined effects of intra- and interspecific processes can enhance or erode trait-environment relationships at large biogeographic scales".

The researchers think the different geographies of Cuba and its neighbour Hispaniola may account for some of the varying patterns observed on each island. Hispaniola's highland areas and their associated climatic gradients are far more extensive than on Cuba. Hispaniola has nearly 8,000 km^2 of habitat above 1,000m whereas Cuba has only 271 km^2 of highland habitat.

The greater extent of climatically extreme habitats suggests a greater potential for reduced dispersal of lizards and isolation by environment along tropical elevational gradients in Hispaniola. Conversely, climatically extreme habitat is more rare on Cuba so higher gene flow across elevations may limit the role of interspecific processes on this island.

More information: The full paper, 'Untangling intra- and interspecific effects on body size clines reveals divergent processes structuring convergent patterns in Anolis lizards', is available online: www.jstor.org/discover/10.1086/678084

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