University of Cyprus
Department of Biological Sciences

Ph.D. Thesis Defense

Student Presentation

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Building University Library, Room LRC019, Panepistimioupoli Campus

This seminar is open to the public

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"Environmental and genetic drivers of song variation in tinkerbirds"

The enormous biological diversity found on Earth, with its variable patterns of colours, sounds and shapes has long sparked the intellectual curiosity of the scientific community. This diversity is fuelled and maintained by a complex combination of factors, whether environmental, social, or genetic, whose effects can result in the continuous evolution of phenotypic traits. Such evolution of phenotypes is thought to be critical for the speciation process because differences between populations may act as a premating barrier to gene flow and ultimately lead to reproductive isolation even in species that might produce fertile hybrids.

Bird song represents one such phenotypic trait, acting as a behavioural premating barrier to gene flow between related species, as demonstrated across several avian taxa. For instance, in passerine birds, known for their striking vocal flexibility, song has been observed to vary across space because of vocal learning, resulting in the development and fixation of dialects that may maintain reproductive isolation. Indeed, avian taxa that can learn songs are characterised by higher speciation rates compared to species that cannot. Aside from the effects of cultural learning on songs, other factors, whether social, environmental, or genetic, can result in bird song variation, therefore providing fertile ground for assortative mating through mate choice via this sexually selected trait. However, the predominance of studies on song learners has left unexplored the mechanisms that may lead to song variation in avian systems that do not learn songs by means of auditory feedback but instead, have their songs coded in their genes. In such systems, genetic and environmental factors are thought to play a much more prominent role in shaping song variation.

For my Ph.D., I explored such questions by assessing the role of environmental, genetic and social factors in driving song variation in *Pogoniulus* spp. tinkerbirds (Order: Piciformes), for which recent evidence demonstrated that their songs develop innately. In the study described in chapter 2, I explored the effects of ambient noise produced by ocean surf on song frequency at local scales, and found evidence for upwards shifts in frequency with increasing noise levels and more widely with proximity to the coast. In Chapter 3, I investigated continent-wide indirect effects of the environment on bird song via its effect on morphology and found that as body size increases with latitude and elevation in accordance with Bergmann's rule, song frequency decreases. In chapter 4 I focused on identifying genes that underpin variation in song rhythm between two hybridizing species of tinkerbirds. Four candidate genes were identified, including two known to be associated with speech disorders in humans. Following on in Chapter 5, I examined how the genetically-based variation in rhythm and its stability might be affected by hybridization and how this, in turn, may result in assortative mating. I found that one species sang faster, more stable songs than the other, and admixture at candidate loci for song rhythm was also associated with less stable songs. There was evidence of character displacement in song stability, and assortative mating suggested females of one species prefer males of their own species that sing faster more stable songs. Overall, my thesis research suggests the frequency of innate songs is strongly influenced by environmental effects, but temporal rhythms are determined genetically, with the genes underlying them potentially playing an important role in reproductive isolation.