Flightless versus winged - Colonization and Speciation Processes on the Canary Islands

Axel Hochkirch & Yvonne Görzig, University of Osnabrück, FB 5, Division of Ecology, Barbarastr. 11, 49076 Osnabrück, Germany. hochkirch@biologie.uni-osnabrueck.de

Why Islands are wonderful
Old volcanic archipelagos represent excellent areas for the study of colonization and speciation processes, but also for examining the genetic diversification of morphological conserved taxa. The Canary Islands are known for their high biodiversity, containing a fauna mixed of Afrotropical, Mediterranean and endemic elements. The phylogeny of two Orthoptera genera with Canarian radiations have been studied and compared. The Canarian endemic genus Arminda is flightless and morphologically conserved, containing seven species, each of which is endemic to a single island. The fully winged genus group Sphingonotus (s.l.) occurs with approximately ten species of three genera on the Canary Islands, five of which are endemic.

Trying to resolve genetic data
For the genus Arminda two mitochondrial (12s rRNA, NDS) and two nuclear (ITS2, 28s rRNA) gene fragments were sequenced to gain phylogenetic information in order to infer a gene tree (2843 bp). The phylogenetic inference was obtained by three methods, UPGMA, neighbor joining and maximum parsimony. The sister genus Pezotettix (P. giornai, Italy) was used as outgroup. For the genus group Sphingonotus the mitochondrial gene NDS (1050 bp) was analysed. Several other Oedipodinae were used as outgroups (Acrotylus insubriticus, Locusta migratoria, Oedipoda caerulescens).

Nice ancient radiations … and terrible young lineages
The species of the flightless genus Arminda are comparatively old and represent a typical example for stepwise colonization and speciation from east to west. This example shows, that DNA barcoding could be very useful for such old but morphologically conserved species. A new endemic species from La Palma has been discovered by DNA sequencing.

Multiple invasions
The Sphingonotus species have probably reached the Canary Islands independently, without any stepwise colonization of other islands. S. willemsei, a species endemic to the Cañadas on Tenerife, represents a very young branch of the S. caerulans group. Its affinities to S. tubescens or S. caerulans remain unresolved. S. sublaevis from Gran Canaria is closely related to W. pachecoi (possibly only a subspecies). The other three endemic species (W. guancha, W. picteti, W. rugosa) represent ancient relics. The populations of W. picteti from La Gomera probably represent a new species.

Is sequencing not enough?
Apparently, the Sphingonotus group represents a young radiation with clear bioacoustic differences, but poor genetic resolution, comparable to the Chorthippus biguttulus group. This example shows, that DNA barcoding could be difficult in some young radiations. Sequencing of nuclear genes is planned to test the mtDNA data of Sphingonotus for introgression. In acoustic communicating insects, combinations of molecular and bioacoustic studies are needed in order to understand the pattern of radiation, mechanisms of reproductive isolation and the genesis of biodiversity.