

ScienceWatch - Darwin's Finches: Thirteen Species and Counting

“Many episodes of incipient speciation probably fail for every one that succeeds ... In the present case, it is too early to tell whether reproductive isolation is transitory or likely to be enduring.” – P.R. Grant & B.R. Grant

Darwin's finches are the iconic symbol of evolution. Encountering these varied but closely related species 175 years ago yielded insights that helped Charles Darwin formulate his theory of speciation by natural selection. Even today they serve as a model for studying how one species forms two.

A species may be defined as a freely interbreeding population that produces viable, fertile young. Simply put, if two organisms freely mate to yield babies and those babies can make babies, we are dealing with a single species. Explanations of speciation generally follow Darwin's 150-year-old concept: Colonization of a new area by a group, with concomitant physical separation from the parent group, followed by adaptations to the new habitat over time, can yield a barrier to interbreeding when the divergent groups subsequently encounter each other, yielding two species from one.

The finches are a classic example of this process. The founding immigrants arrived on the Galápagos archipelago from the South American mainland about two million years ago when the islands were newly formed and there were no competitors. This allowed them to colonize the islands unimpeded and adapt to the particular array of food sources—seeds, flowers, cactus, fruits, insects, grubs, etc.—found in each new habitat. Over time they formed 13 species differing in the size and shape of their beaks. But speciation is a dynamic process, so there is no reason why we shouldn't see the finch species number change if we watch them long enough.

That is exactly what the husband-and-wife team of Peter and B. Rosemary Grant, Princeton University, has done. They have spent the past 35+ years studying the finches and gaining remarkable insights into how these little birds evolved so rapidly (see *–The Quick-Change Artistry of Darwin's Finches*, ScienceWatch, October 2007 or at www.HRAS.org). Each year they spend 3-4 months living in a tent on the tiny Galápagos island of Daphne Major. They band and measure every bird on the island, also taking a blood sample for DNA analysis. In this way they follow the birds from birth to death and can construct a genealogy chart for each one. Decades of painstaking observations have allowed them to witness the birth of a new species, which is described in the December 1, 2009 issue of the *Proceeding of the National Academy of Sciences*.

In 1981 they captured an unusual medium ground finch (*Geospiza fortis*) male. It was larger than others of its kind. Its beak was pointier (Figures 1 & 2), resembling the

closely related cactus finch (*G. scandens*), and it sang a variant of the normal *G. fortis* song. Genetic analysis showed it was a hybrid between the medium ground finch and the cactus finch, and that it probably was an immigrant from the neighboring island of Santa Cruz. At present the Grants have followed the lineage of this bird for seven generations, spanning 28 years.

The immigrant hybrid male mated with a resident female ground finch that also happened to be carrying a few cactus finch genes. Since sons tend to sing like their fathers and daughters prefer their father's song, circumstances seemed to favor lots of inbreeding, and that is exactly what happened.

In the fourth generation a drought killed all the immigrant's descendants, except for a brother and sister who mated with each other. During the ensuing eight years and three generations these birds have been mating exclusively among themselves. In other words, they have undergone reproductive isolation, the hallmark of speciation, and the Grants consider them an incipient species.

The Grants are not sure if this newly formed species will emerge as a stable breeding population or disappear due to competition, inbreeding or interbreeding. Whatever the outcome, you can bet they will be watching.

Saul Scheinbach



Fig. 1
Native medium ground finch (left)
Immigrant medium ground finch (right)

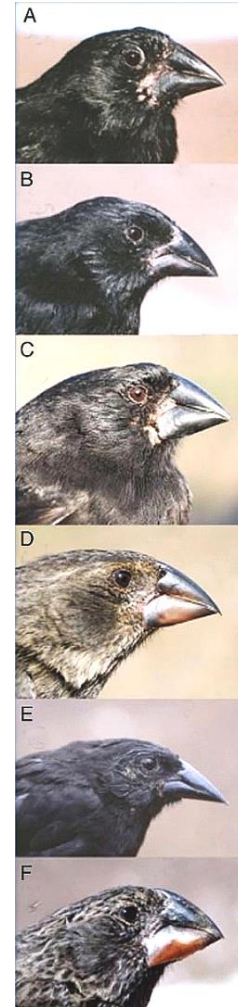


Fig. 2
A) Original immigrant
B) Son of immigrant
C) 5th generation
D) 6th generation
E) Cactus finch
F) Large ground finch