Heredity (2006) 97, 1

www.nature.com/hdy

NEWS AND COMMENTARY

Speciation

Marathon mollusc migrations

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Heredity (2006) **97,** 1. doi:10.1038/sj.hdy.6800833; published online 10 May 2006

A recent study of land snails from remote islands of the southern Atlantic Ocean (Gittenberger *et al*, 2006) makes the striking statement that, despite their physiology, these animals must have traversed many thousands of kilometres of open sea in order to reach their final destination. What is more, the study suggests that overseas travel was not a one-off event and that such voyages must have been successfully completed on at least two separate occasions: once from north to the far south, and once again from north to west. Gittenberger *et al* (2006) base these conclusions upon the evolutionary relationships, established using molecular data, among different but closely related snails found at the start and finish of these proposed journeys. What makes this study particularly noteworthy is the fact that the authors provide good evidence to suggest that carriage by humans does not explain this apparent ease of intercontinental travel.

Tropical island flora and fauna form excellent natural laboratories for adaptation and speciation studies (Grant, 1998) owing to their huge diversity of species and have afforded many insights into the patterns and processes underlying the creation of new species. However, despite advances in our understanding about how new island species arise, there is one generally noted, but rarely solved, puzzle that was commented upon by Darwin (1859) himself: how do organisms that are not capable of long distance dispersal colonise even the most remote regions? For instance, even the most far-flung islands of the Pacific Ocean are home to groups of snails that seem to have evolved *in situ* (Clarke and Murray, 1969), despite the obvious constraints on migration imposed by their physiology.

The *Balea* snails of the remote Tristan da Cunha islands of the southern Atlantic Ocean are a good example of this sort of puzzle, but in this particular case, researchers believe that they may have solved the mystery. These islands are several thousand kilometres from the mainland, and are home to several species of land snail that are found nowhere else. The molecular evidence presented by Gittenberger *et al* (2006) points to *Balea* snails from Tristan da Cunha as being derived relatively recently from European ancestors; the pattern of colonisation having involved crossing 9000 km of open ocean from the Azores in Europe to the southern Atlantic islands, with an additional migration between the Azores and western Europe.

The molecular evidence presented in support of this hypothesis concerning the pattern of migration is compelling. Not one, but two genes (one maternally, the other bi-parentally inherited) are used to make inferences about the relationships among species, and the results seem to be unequivocal in pointing to a recent European origin of the snails on Tristan da Cunha. Recent human introduction does not appear to explain the current distribution because the number of distinct species found in the different areas and the molecular differences between them suggest that they diverged many thousands of years ago.

Many studies that document the presence of sedentary species on isolated islands have speculated as to how the original founders arrived, but this study is exceptional in that the authors appear to have identified very close, if not the closest, species living in a distant geographic region. In many other studies it has not been possible to rule out colonisation from much more proximate regions (although still separated by barriers to movement, such as salt water). More broadly, this study is significant because it tells us that passive transport, perhaps by birds, is likely to have been important in an evolutionary sense and highlights the dramatic distances over which this could have occurred. The extreme geographic scale involved may explain why it is often difficult to find the closest mainland relatives of other groups of island species, for example land snails from the Pacific, which appear to be deeply diverged from continental taxa (Wade *et al*, 2001).

There are, however, still several unanswered questions. For example, it is suggested that *Balea* snails might have been particularly successful hitch-hikers because of their having very sticky slime, which could improve the chances of efficiently sticking to bird feathers. While this could be true, we cannot be sure that *Balea* had this characteristic at the time of the marathon migration as slime stickiness has been shown to evolve and be lost several times in other island land snails (Johnson *et al*, 2000). In any case, we would not necessarily expect those traits that favoured ease of hitch-hiking in the past to remain until the present day. These and many other sorts of characteristic might simply be lost during the process of adaptation and diversification of the original founders to create new species. Moreover, although passive movement by birds does seem to remain the most plausible explanation for Gittenberger *et al*'s (2006) results, there is still no direct evidence that it actually occurred. Darwin (1859) is purported to have carried out experiments several hundred years ago on the tolerance of land snails to water by sticking them to ducks' feet. Perhaps now it is time to try a similar approach using radio-tagged snails placed under bird wings or on floating plant material (no super-glue allowed).

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Editor's suggested reading

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