Fine scale population structure through space and time.

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Abstract

Terrestrial snails, with their diversity of interspecific forms, have provided biologists with fantastic material to study the evolution of ecotypes and the process of speciation. Snails have the advantage of shells that preserve well and exhibit trait variation readily perceived by taxonomists. Endemic to New Zealand is the genus of giant carnivorous *Powelliphanta* snails and three species of giant herbivorous *Placostylus*. Both genera display a range of phenotypic variation of shells within comparatively small geographic distances. The diversity within these snails has become a matter of high conservation interest, as many lineages occupy small or highly fragmented ranges that render them vulnerable to ongoing habitat loss, and predation by exotic pests. Combining mitochondrial sequence data and genotypes of microsatellite loci I documented the genetic structure within a species complex (*Powelliphanta* Kawatiri). Improved understanding of the distribution of this complex and the level of genetic diversity provided a picture of a naturally fragmented lineage, restricted to a particular ecological zone.

To investigate the evolution of *Placostylus ambagiosus* its mitochondrial genome and that of its sister species *P. hongii* were assembled and annotated. Gene order was consistent between the two *Placostylus* species although it varies slightly within the wider Sigmurethra suborder due to minor tRNA rearrangements. To distinguish the shell shape of spatially distinct populations of *Placostylus ambagiosus* two-dimensional geometric morphometric methods were used. This tool was used to study shell shape evolution through time. Stasis was found to be the most common evolutionary mode, however shell size followed a different model, in one population, an observation which would not be expected if gene flow was preventing local divergence. Investigation into the genetic structure of *Placostylus ambagiousus* (using RADseq) revealed a single admixed population illustrating gene flow had occurred between populations in the recent past. The formation and maintenance of locally adapted populations (ecotypes) within *Placostylus ambagiosus* does not seem to be prevented by gene flow within species.

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