

Isolation and re-connection: the formation of a ring-shaped speciation continuum in an odorous frog (*Odorrana margaretae*)

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March 10, 2021

Abstract

The Green Odorous Frog (*Odorrana margaretae*) around the Sichuan Basin of western China displays a ring-shaped distributional pattern and possesses multiple replicate contact zones between lineages at various levels of differentiation. To understand its unique speciation history and mechanisms, we obtained 1,540 SNPs from 29 populations and 227 individuals using ddRAD sequencing. Population structure analysis revealed three groups within the species: The West, the North & South, and the East groups. These groups were initially isolated at ~2.03 million years ago, and subsequent post-glacial expansion produced the current ring-shaped distribution around Sichuan Basin with three contact zones. Hybridization in those zones involved lineages with different levels of divergence and produced greatly different outcomes. Both the hybrid zones at southwest (S-W) and southeast (E-NS) of the Basin have extensive admixture and less barrier effect. Consequently, the southern region has the highest genetic diversity and becomes an ‘evolutionary melting pot’. In contrast, the hybrid zone at northwestern corner (N-W), which resembles the overlap zone between two expansion terminals of a ring species, has limited admixture with a narrow geographic cline, suggesting partial reproductive isolation between the northern and western populations. The three hybrid zones likely resemble three time points along a speciation continuum; while both E-NS and S-W hybrid zones are merging, the N-W zone may have passed the ‘tipping point’ and is destined for a complete reproductive isolation over time.

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