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Beyond Moa's Ark and Wallace's Line: extralimital distribution of new species of *Austronothrus* (Acari, Oribatida, Crotoniidae) and the endemicity of the New Zealand oribatid mite fauna

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Abstract

The genus *Austronothrus* was previously known from three species recorded only from New Zealand. *Austronothrus kinabalu* **sp**. **nov**. is described from Sabah, Borneo and *A. rostralis* **sp**. **nov**. from Norfolk Island, south-west Pacific. A key to *Austronothrus* is included. These new species extend the distribution of *Austronothrus* beyond New Zealand and confirms that the subfamily Crotoniinae is not confined to former Gondwanan landmasses. The distribution pattern of *Austronothrus* spp., combining Oriental and Gondwanan localities, is indicative of a curved, linear track; consistent with the accretion of island arcs and volcanic terranes around the plate margins of the Pacific Ocean, with older taxa persisting on younger island though localised dispersal within island arc metapopulations. Phylogenetic analysis and an area cladogram are consistent with a broad ancestral distribution of *Austronothrus* in the Oriental region and on Gondwanan terranes, with subsequent divergence and distribution southward from the Sunda region to New Zealand. This pattern is more complex than might be expected if the New Zealand oribatid fauna was derived from dispersal following re-emergence of land after inundation during the Oligocene (25 mya), as well as if the fauna emanated from endemic, relictual taxa following separation of New Zealand from Gondwana during the Cretaceous (80 mya).

Key words: taxonomy, morphology, systematics, mite, biogeography, south-western Pacific region, island

Introduction

The unique biota of New Zealand with its high degree of endemism has been the subject of competing biological and geological explanations of its origins (summarised by Gibbs, 2006; McDowall, 2008). That the biota was largely derived by vicariance from ancient Gondwanan ancestors present when New Zealand separated from West Antarctica during the Cretaceous 80 mya, the so-called 'Moa's Ark' hypothesis, has been challenged by molecular studies that suggest most or all of the terrestrial biota evolved following dispersal events after a period of marine inundation during the Oligocene around 25 mya (Cooper & Cooper, 1995; Landis *et al*., 2008). The debate hinges on whether most or all of the land area was submerged during the Oligocene drowning as asserted by some authors (Waters & Craw, 2006; Wallis & Trewick, 2009). However, as Giribet and Boyer (2010) point out, 'even if a large fraction of the terrestrial biota presently inhabiting New Zealand arrived via dispersal, there is compelling evidence for an archaic Gondwanan origin for some of New Zealand's invertebrates.' Such evidence focusses on Gondwanan relict taxa with resolved phylogenies and molecular dating (representing the minimum standard required to address the Oligocene drowning hypothesis), including pettalid mite harvestmen, the centipede genera *Craterostigmus* and *Paralamyctes* and the Onychophora (e.g. Allwood *et al*., 2010). Other potential taxa listed by Giribet and Boyer (2010) that may provide insights include Opiliones, Collembola and certain families of spiders and mites.

Oribatid mites have a continuous fossil record since the middle Devonian (c. 378 mya) and, based on molecular dating, are considered to have originated in the late Silurian (c. 435 mya) (Dabert *et al*., 2010) or possibly even earlier, in the Precambrian (571 ± 37 mya), with the Crotoniidae diverging from other oribatids ca.

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