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# Towards a comprehensive understanding of *Oxera*'s island life

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## Abstract

Since the introduction of the island life concept by Wallace, isolated oceanic and relatively young islands have been the place to be to study and unravel evolutionary patterns among original groups within the tree of life. In these regards, the quite old New Caledonian archipelago has been relatively neglected despite hosting a world-class biome, perhaps because no definitive cases of adaptive radiation have been detected there thus far. Here we present a detailed analysis of the radiation of the genus *Oxera* (Lamiaceae) based on a multidisciplinary study including domestication, interspecific hybridization, karyology, anatomy, systematics, phylogenetics, pollination biology, ecology, conservation and population genetics. New Caledonia is the main center of *Oxera* diversification with about 33 endemic species plus a few more taxa in Papua New Guinea, Australia and Pacific islands. We have shown that *Oxera* originated from a single and quite recent dispersal event in New Caledonia about 4.5 million years ago, and has successfully established and diversified at an outstanding net rate of up to one species per million years. Establishment and rapid initial diversification of *Oxera* in New Caledonia was probably facilitated by arid conditions that may have created new biota at the beginning of the Pliocene. Concurrently, *Oxera* also underwent major shifts in pollination syndromes, dispersal modes and life forms that are now exhibited by its extant major clades. More recently, the drivers of speciation within the main clades are most likely

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due to allopatry and habitat shifts in relation to climatic oscillations and soil morphogenesis. Ongoing population genetic studies on several species from different clades (e.g. within the monocaulous baladica clade and especially on the *Oxera baladica* species complex) are highlighting more recent stories, while the complete genome sequencing of a taxon (*Oxera pulchella* subsp. *grandiflora*) is likely to deepen our understanding of the past demographic history of several species and/or clades. *In fine*, we hope the results will be of interest for the conservation of the most critically endangered *Oxera* taxa.

**Keywords:** Oxera, New Caledonia, Lamiaceae, radiation, niche shifts, demographic history