Ten years of studying the biogeography, phylogeny, and taxonomy of *Ourisia*: A research synopsis[1]

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For those who regularly explore alpine areas of the North Island, the herbaceous, white-flowered species of *Ourisia* are familiar elements of the flora. But to fully appreciate this genus of 28 species, one must also travel to the mountains of the South Island, Tasmania and Andean South America. Over the past decade, I have carried out field work and biogeographic, phylogenetic, and taxonomic research on this beautiful and fascinating genus using data from morphology, geography, DNA sequences, and AFLP DNA fingerprinting. I divided the talk I gave at the July 2009 meeting of the Wellington Botanical Society into two main parts. The first part comprised an old-fashioned slide show of photographs taken during various collecting trips in Chile, Argentina, Peru, Tasmania, and (of course) New Zealand, showing the habit, flowers and habitats of nearly all of the species. During the second part, I summarised the important results of my *Ourisia* research and publications, and discussed the taxonomic implications.

The photographic journey started with the very first collections of *Ourisia* that we made in southern Chile in 1999, when I was a graduate student at the University of Texas at Austin (USA), just beginning my dissertation research on *Ourisia*. By "we" I mean me and my (non-botanist) husband, Mauricio López, who has unfailingly accompanied me in the field and done the bulk of the driving on just about all of our collecting adventures since then. The red-flowered *O. ruellioides* (Fig. 1) was one of the first of the 10 southern Andean *Ourisia* species we collected, and we found it on numerous occasions thereafter. Another red, tubular-flowered species is the large, subalpine *Ourisia coccinea,* with flowers up to 4 cm long, and which is replaced at higher elevations by its aptly named sister-species, the pink-flowered *O. alpina.* At the other morphological extreme is the tiny white-flowered *O. pygmaea,* which we nearly missed hidden on the banks of a small mountain stream. In a subsequent trip to

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Argentina in 2000, we found white-, pink- and purple-flowered forms of *Ourisia fragrans*, at high, rocky sites, as condors soared and dived above our heads. It took much more of an effort to get to the delicate, purple-flowered *O. brevifolia* (Fig. 2) on the southern tip of South America in Tierra del Fuego where, despite our efforts, we were disappointed that we did not find the elusive, minuscule, white-flowered *Ourisia fuegiana.*

Figure 1 (left). Leaves and inflorescence of *Ourisia ruellioides*, common throughout the southern Andes (Chile and Argentina), photographed on the banks of a stream in Nahuelbuta National Park, IX Region, Chile, December 1999. One of the four species of *Ourisia* with red corollas (see also Fig. 4). Photo: © Heidi M. Meudt.

Figure 2. *Ourisia brevifolia* subsp. *breviflora*, a locally common species throughout the southern Andes, photographed at Paso Garibaldi, Tierra del Fuego, Argentina, January 2001. Photo: © Heidi M. Meudt.

Figure 3. *Ourisia microphylla*, photographed in Laguna de Laja National Park, VIII Region, Chile, January 2000. One of three suffruticose species of *Ourisia,* and common throughout central Chile and across the border into Argentina. Photo: © Heidi M. Meudt.

The majority of *Ourisia* species are herbaceous rhizomatous perennials, but three species native to Chile and Argentina are suffruticose (small perennial subshrubs with a woody base). We were fortunate to find two of them in our travels: *Ourisia microphylla* (Fig. 3), a beautiful plant with long whip-like branches and tightly-packed decussate leaves, which formed pink-flowered carpets on volcanic soil, and *O. serpyllifolia,* a small species with purple corollas and yellow inside the corolla tube, which we were thrilled to find on rocky cliffs on a mountain pass near the Chile-Argentine border. We didn't find the fourth red-flowered species of *Ourisia, O. polyantha,* which is only known from a few localities in Chile but is nevertheless highly prized in alpine rock-gardening circles (Watson 2005).

We also travelled to Peru in 2000 to find as many of the five tropical Andean species of *Ourisia* as we could. After two weeks of searching several localities, we found two species: *Ourisia muscosa* ("moss-like" *Ourisia*) with small, white, radially symmetrical flowers a few millimetres across at nearly 5000 m above sea level, and *O. chamaedrifolia* (Fig. 4), with large, red, bilaterally symmetrical flowers in a humid grassland, at about 3700 m. The other tropical Andean species of *Ourisia* are known from few localities in Peru and Bolivia, including *O. cotapatensis,* which I described with Stephan Beck (Meudt & Beck 2003), who discovered this new species in the Yungas cloud forest of Cotapata National Park in Bolivia.

Figure 4. Flower (with orange-red corolla) and leaves of *Ourisia chamaedrifolia*, a tropical Andean species (ranging from Venezuela to Bolivia) photographed near Tres Cruces, Peru, June 2000. Photo: © Heidi M. Meudt.

Compared to their South American counterparts, the sole Tasmanian species (*O. integrifolia*) and the dozen New Zealand species are not nearly as colourful (white flowers only!), but they are still morphologically and ecologically diverse in high-elevation habitats. Because I discussed the New Zealand species (and putative hybrids) in a previous article (Meudt 2006a), I won't go into more detail here, but I showed slides of the New Zealand species and some hybrids that I saw on extensive collecting trips during the summers of 2001–2 and 2004–5.

After introducing all the beautiful species of *Ourisia*, I summarised the findings of my biogeographic, phylogenetic, and taxonomic research based on my own field collections and loans of specimens from herbaria around the world. One of the first results of my dissertation research was to show that *Ourisia* originated in southern South America, and subsequently dispersed to the tropical Andes, as well as to Tasmania and New Zealand, probably within the last 1–5 million years (Meudt & Simpson 2006). The two principal, highly supported monophyletic groups within *Ourisia* are characterised by habit as well as a suite of other morphological characters (Meudt & Simpson 2006, 2007), and for this reason I recognised these two clades at the subgenus rank in the resulting monograph (Meudt 2006b).

New Zealand *Ourisia* represents a recent species radiation, in which the closely related species are all derived from a common ancestor, and there is marked morphological and ecological divergence but low genetic divergence among the species. In our most recently published work, we used AFLP DNA fingerprinting to resolve relationships and test morphologically delimited species of New Zealand *Ourisia* (Meudt et al. 2009). Whereas AFLP was highly useful for questions of species delimitation, there was little support for many species relationships. The AFLP analyses largely agreed with the morphological data with respect to species limits, although it was clear that the two subspecies of *O. macrocarpa* are not each other's closest relative, and should be recognised at the species rank (as they were originally described) as *O. macrocarpa* and *O. calycina.*

I finished the talk by suggesting that research in the next *Ourisia* decade should be focused on pollination biology, breeding systems, and the current and past role of hybridisation. Data from these and other studies will allow a better understanding of the timing and mechanisms of speciation and morphological evolution in *Ourisia.* By performing such studies in both South America and New Zealand, there exists the most exciting prospect of carrying out a comparative analysis of the evolution of parallel species radiations in different areas of the Southern Hemisphere.

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