

# The Bulletin

OF THE NATIONAL TROPICAL BOTANICAL GARDEN

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Volume XXVII, No. 2

Summer 2010



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Message from Chipper — from the Director	1
Beauties, beasts, busts, and gods	5
A Season of Education — photostory	10
Following an inner voice in search of Rapa's rare Apostates — Tales from the Field	11
Weatherport in Upper Limahuli Preserve — photostory	18
Bound to Grow	21
Locations (tour information and maps)	28
Staff	29
Board of Trustees	32

ON THE COVER: Scientists have discovered that some plants in Hawai'i, such as this *Dubautia waialealae*, have evolutionary origins in North America. Would long-distance east-to-west dispersal also be the case for the origin of an endemic plant on remote Rapa in the Austral Islands? See story on page 11. Photo by Ken Wood

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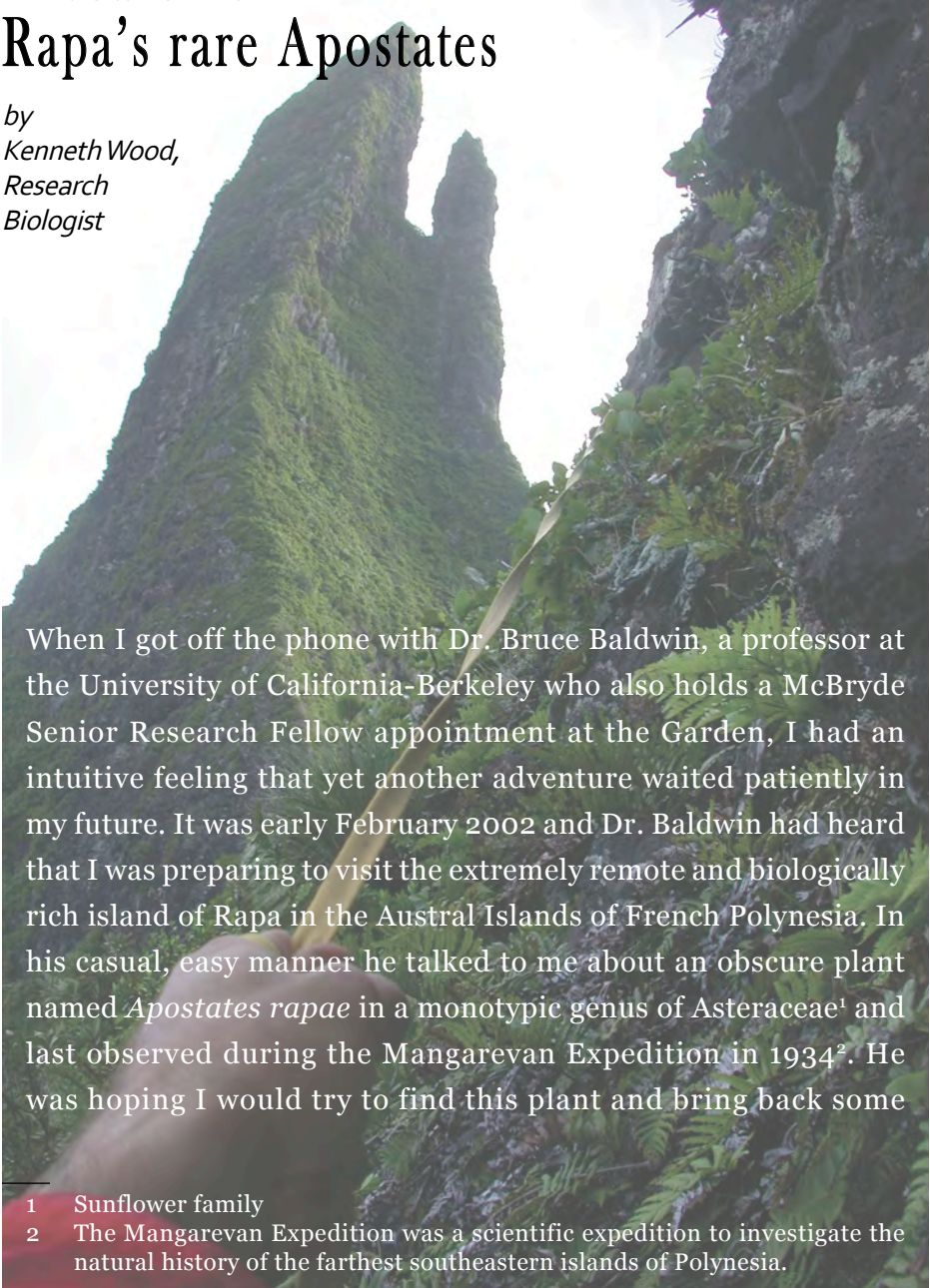
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# Following an inner voice in search of Rapa's rare *Apostates*

by  
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When I got off the phone with Dr. Bruce Baldwin, a professor at the University of California-Berkeley who also holds a McBryde Senior Research Fellow appointment at the Garden, I had an intuitive feeling that yet another adventure waited patiently in my future. It was early February 2002 and Dr. Baldwin had heard that I was preparing to visit the extremely remote and biologically rich island of Rapa in the Austral Islands of French Polynesia. In his casual, easy manner he talked to me about an obscure plant named *Apostates rapae* in a monotypic genus of Asteraceae<sup>1</sup> and last observed during the Mangarevan Expedition in 1934<sup>2</sup>. He was hoping I would try to find this plant and bring back some

1 Sunflower family

2 The Mangarevan Expedition was a scientific expedition to investigate the natural history of the farthest southeastern islands of Polynesia.

leaf material in silica gel for DNA extractions.

I admired Dr. Baldwin's efforts in resolving complex taxonomic mysteries by using molecular phylogenetic studies<sup>1</sup> and quickly agreed to assist him in solving the evolutionary relationships of *Apostates*. Dr. Baldwin and I had first worked together in August 1991 when we conducted field studies on members of the Hawaiian endemic genus *Dubautia* [see cover photo] which is part of an



Title page: A view from the author's perspective.

▲◀ Endemic to Rapa, this new species of *Pacifigeron* was discovered by NTBG staff during research in 2002.

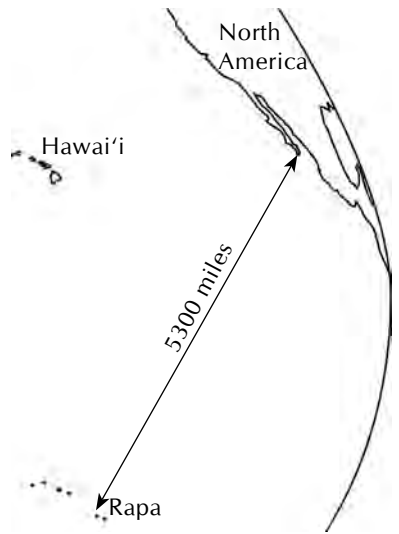
▲▶ This striking orange flower is *Fitchia nutans*, a primitive member of the sunflower family.

◀ *Sphaeropteris medullaris*, commonly known as black tree fern (indigenous), rises elegantly over Rapa's stunning coastline which is characterized by densely vegetated high cliffs and deep inlets and bays.

*All photos by author unless otherwise indicated*

<sup>1</sup> the study of evolutionary relatedness among various groups of organisms

insular lineage of plants known as the Hawaiian Silversword Alliance, and linked to a long-distance dispersal of Californian tarweeds in their evolutionary history. Since then, I have remained fascinated with the concept of migrating birds and the physical forces of winds and ocean currents contributing to the biota of remote oceanic islands. In his recently published paper, co-authored with the Garden's McBryde Chair Dr. Warren Wagner, Dr. Baldwin showed that temperate and boreal North America is also a much more important source of the Hawaiian flora than previously thought, including Hawaiian violets, mints, carnations, and geraniums, to name a few.



Before Dr. Baldwin had called, I was already studying publications on Rapa and reviewing herbarium collections at Bishop Museum in Honolulu. Much of what we know about the natural world comes from our study of biological specimens and I was eager to make further contributions doing field research for the NTBG. As part of the South Pacific, Rapa is a small 15 square-mile island that lies over 600 miles southeast of Tahiti, and is renowned for its steep central ridges, mist-shrouded spires, and fabulous black basalt seacliffs. It is volcanic in origin, around 5 million years old, with its highest summit breaching 2,132 feet at Mt. Perau. There are less than 300 people living on this remote outpost of Oceania and access is only by boat. With its low southern latitude Rapa has a cool subtropical/temperate climate unlike other Polynesian islands. Breadfruit does not grow and only a handful of coconut trees survive because of cold winters.

For such a relatively small island Rapa harbors a great diversity of organisms which have amazed biologists. Examples include a remarkable adaptive radiation of small, flightless weevils along with a profusion of endemic land snails and arthropods. It is the only island in the Austral group that still has native doves, namely the colorful endemic Rapan fruit-dove. Rapa also has a highly unique

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“follow the path to the end  
and you will find *Apostates*”

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flora, most of which are poorly represented in herbarium collections. My current checklist indicates there are 267 native taxa,

with 111 being endemic to the Austral Islands and 76 that only occur on Rapa. Besides the endemic genus *Apostates*, two other endemic genera of flowering plants evolved on Rapa, those being *Pacifigeron* (Asteraceae) and *Metatrophis* (Urticaceae<sup>1</sup>). For those who admire ferns, the pteridophyte flora is quite remarkable, with around 88 taxa, 21 of which are restricted to Rapa.

Most research projects like this require an inordinate amount of logistical preparations, so when I finally arrived on Rapa I was quite keen on beginning my field studies. The freighter I arrived on was scheduled to return in six weeks, which would give me a fair amount of time to document the flora. However, the days unraveled quickly and I was still unsuccessful in refinding Dr. Baldwin’s elusive *Apostates rapae*. My field methods were filled with finding obscure ways to ascend the craggy tooth-like summit spires that divide the island, many of which were surrounded by vertical cliffs which drop into narrow chasms and rough seas. Sometimes I would find myself in regions so wild and rich with the diversity of nesting sea birds, plants, and their associated insects that I would be overwhelmed with Rapa’s divine majesty. Numerous times my inner voice guided

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1 Nettle family

► The Rapan fruit-dove (*Ptilinopus huttoni*) is a very rare endemic member of Rapa's avifauna. While conducting forest inventories, Garden field biologists also collected data on the bird's habitat preferences and population numbers for use in future conservation efforts.

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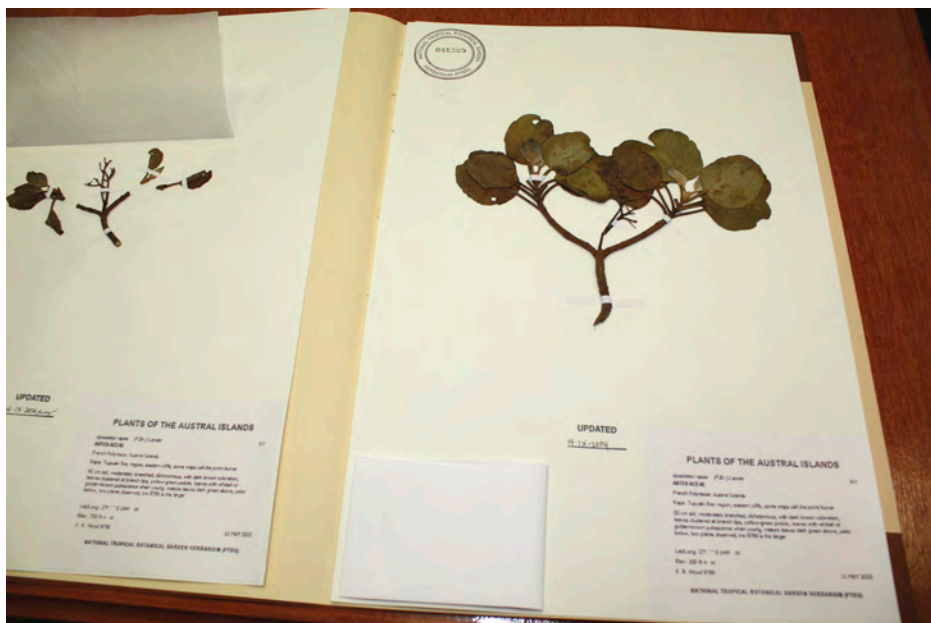
me, saying “follow the path to the end and you will find Apostates.” During those occasions, even when the way seemed impassable, I would find a route deeper into the folding pinnacles of Rapa's mist-shrouded summits. Yet at day's end Apostates never appeared and I thought it quite odd, as I have

learned to depend on that inner voice over my many years, and it is usually quite true. Many important collections, however, were made during these sojourns, which included new species of *Pacifigeron* and *Bidens*, *Acalypha*, and *Grammitis*<sup>1</sup> to name a few, in addition to over 1,500 herbarium specimens with duplicates – yet no *Apostates*.

Now time has its own way of sailing by and the day arrived for my ship to return. I was preparing my bags when Mayor Ben (the only person on the island with a ham radio) came and told me that our transport ship had hit a reef and would be delayed for another month. My associates were terribly disappointed, yet I quietly rejoiced in the opportunity to continue my forays into the island's hidden nooks and crannies. During this period I developed a deeper recognition of Rapa's plant communities and their distributions. Many research episodes involved accompanying the Rapan men on their small boat trips to different embayments of the island where they would

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1 Asteraceae, Euphorbiaceae (spurge family), and Polypodiaceae (finger fern family), respectively.



► The voucher, now dried, pressed, and in the Garden's herbarium, made by the author of the elusive *Apostates rapae*. Photo by Jon Letman

don wetsuits for cold water and spear fish for the community. They would drop me off along an unexplored headland coast and return for me at the end of the day, or I would hike cross-island back to the village.

It was during such a foray, on the very last day of my stay on Rapa, that I observed a few unusual plants on the northern seacliffs just to the east of Tupua'i Bay. At first I dismissed them and started heading back to the bay as I was pressed for time and it was getting close to when the divers would return to pick me up. But I stopped in my tracks and laughed, knowing I was incapable of walking away from a mystery. Having just explored the island for several months I should have been able to identify those cryptic plants, so I turned around, pulled out my binoculars, and took a closer look. To my amazement they were most definitely *Apostates*! Using the safest approach, I crossed a sea shelf and climbed a short ridge to position

myself above, then pulled out my climbing line and made my rappel straight to the plants to collect the final herbarium voucher of my Rapan adventure. Pausing in reflection it dawned on me that this was truly following the journey “to the very end”, just as my inner voice had guided. It was a reassuring and profound moment and time seemed to cease in my elation until I was called back from my reverie... hanging at the end of my climbing line and hearing the shouts and laughter of the fisherman returning for me. I hastened to their boat with my treasure, caught the freighter the following morning and felt that all too familiar heartache as I said my farewells to the beautiful island and her people.

With my portion of the research complete, it was Dr. Baldwin’s turn to make an even more amazing discovery concerning the origin of this South Pacific species. Using molecular phylogenetic techniques which look at DNA sequences, he conducted extensive taxonomic sampling within members of Asteraceae and found that *Apostates rapae* belongs within the New World “Bahia clade”<sup>1</sup> and had undergone an extreme long-distance dispersal event from southwestern North America. This means that the founding seeds had to find their way more than 5,000 miles, most likely by bird, to further evolve within the Rapan flora. It was most gratifying for me to assist Dr. Baldwin in proving the evolutionary connectedness between two places as seemingly disparate as Rapa and North America’s desert southwest.

The above amazing discoveries, and all that they imply, should give us pause to appreciate the extraordinary relationships between plants and migrating birds, along with a deeper sense of caring and respect for the life forms that have made their circuitous way naturally to the world’s most remote islands.

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1 a taxonomic group traced to a common ancestor, in this case the genus *Bahia* (Asteraceae)

This piece was just one of the articles featured in the print magazine  
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