

More *Schizeilema trifoliolatum* at Awhitu, SW Auckland

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During an exploration of remnant native bush on 9 March 2011, near the head of the large valley system locally known as 'Tasman Gully' on Auckland's Awhitu Peninsula, I was delighted to find a second population of *Schizeilema trifoliolatum* (Apiaceae) on the Peninsula. This small mat-forming herb was first noted during an Auckland Botanical Society field trip to Craig's Bush at Pollok in 2004, and was a major range extension to the known northern geographical limit (Cameron 2004). The new site, opposite the western end of Boiler Gully Road, extends the known northern limit by nearly 7 km. The site is physically

similar to the Pollok area but is steeper and even more exposed to the southwest winds - the main colony on a spur facing the southwest measures c.5 m². Several smaller patches were noted within 100 m to the north of the main colony. Plants appear to be smaller in general than those at Pollok although this may be because of increased light. The bush canopy, dominated by karaka (*Corynocarpus laevigatus*), puriri (*Vitex lucens*) and some tawa (*Beilschmiedia tawa*) is intact but it is open to light grazing by cattle. Plants were still in fruit (voucher: AK 322554).

Acknowledgement

I wish to thank the landowner Brenda Lowry for inviting me to take a walk through her property.

Reference

Cameron, E.K. 2004: A new record for the Auckland Region: *Schizeilema trifoliolatum* (Apiaceae). *Auckland Botanical Society Journal* 59: 148-150.

Rarotonga's threatened flora: an expedition to survey cloud forest endemics on the highest peaks

Tim Martin

Background

The Cook Island archipelago spans 12 degrees of latitude, from 9 to 21°, over a distance of approximately 1400 kilometres (north-south). Of the 15 islands, many are small, low-lying atolls, and only Rarotonga, one of the southern-most of the group, has any substantial height, with peaks to 653 m altitude.

The indigenous vegetation of the Rarotonga lowlands is, in many ways, similar to many of the other Cook Islands, and indeed, the wider tropical Pacific. The flat coastal plain, once covered with coastal forest, has been heavily modified by humans, and is now predominantly resorts, holiday houses, and restaurants. Only small fragments of Rarotonga's coastal forest, probably totalling less than a few hectares, remain.

Botanically, it is the vegetation and flora at higher altitudes that is particularly fascinating and unique. The combination of Rarotonga's geographical isolation from other land masses, and the scarcity of higher altitude cloud forest in this part of the Pacific, means that Rarotonga's cloud forests, in the mountainous interior of the island, support a suite of species found nowhere else on Earth. These cloud forest endemics, many of which were first collected and described by Thomas Cheeseman in 1899 (Cheeseman 1903), inhabit the highest peaks above 400 m (McCormack and Kunzle 1995), where frequent rain and cloaking

cloud create a humid, cooler environment. The total area of cloud forest on Rarotonga is only 150 ha.

The rampant growth of exotic weeds, and the disappearance of previously-known threatened plant populations, is causing growing concern about the future of Rarotonga's endemic flora. This led to Wildland Consultants, the company for which I work, and the Cook Islands Natural Heritage Trust (CINHT), collaborating to undertake an expedition to survey and document the conservation status of Rarotonga's endemic flora. This survey, in conjunction with Peter de Lange and Gerald McCormack (CINHT), was successfully completed in July 2010.

The Expedition

Having previously been to Rarotonga for two "hammock-lazing" family holidays, during which I spent much time contemplating the looming peaks from the coast, I thought I had a fair idea of the ruggedness of the terrain. So as well as undertaking a crash course in the Cook Island flora (courtesy of the Cook Islands Biodiversity Database [2010]), I diligently prepared my body for the onslaught by climbing Auckland's volcanic cones. In hindsight, training for an Ironman would have been more apt.

Peter and I arrived in Rarotonga after midnight, and immediately faced our first challenge - a game of Bicycle Origami (Extended Edition). This involved

getting Peter's mountain bike into the back of a rental car, that, rather sleep deprived, appeared to be no bigger than a moped. Then after settling into our accommodation, we managed a few hours sleep before our first climb. We awoke to a soul-warming mid 20s day, and given the late night, we decided to tackle Maungatea Bluff as a warm up. Maungatea Bluff forms the southern backdrop to Avarua, Rarotonga's only town, and is described in the track book as 3 hours return (McCormack and Kunzle 1995). The track book describes routes with reference to features such as taro patches and mango trees, which seems akin to describing a route in the Waitakere Ranges with instructions such as "turn left at the kanuka", or "take a sharp left at the ponga to avoid going over a cliff". Sure enough we lost the track about 5 m from the car, and so, on the basis that "cloud forest is up" we embarked on a "path of least resistance" climb. The lowland section of the track was predominantly the indigenous 'au (*Hibiscus tilaceus*), flattened by a succession of cyclones in the mid 2000s, and then regrown within a dense lattice of vines, including balloon vine (*Cardiospermum grandiflorum*), and mile a minute (*Mikania micrantha*). After crawling, scrambling, and falling through the undergrowth for what seemed an eternity, we gratefully emerged into what is termed "slope forest" (McCormack and Kunzle 1995). This less disturbed, and less weed-invaded community, is characterised by the indigenous species mato (*Homalium acuminatum*) and koka (*Bischofia javanica*), but exotic species are still frequent, including Governor's plum (*Flacourtia jangomas*) with its viciously spined trunk, Surinam cherry (*Eugenia uniflora*), ardisia (*Ardisia elliptica*), and occasionally, African tulip tree (*Spathodea campanulata*).



Fig. 1. Maungatea Bluff viewed from Avarua. Photo: T. J. Martin, 11 July 2010.

Moving towards the cries of the tropic birds, which acoustically mark the location of cliff faces, we eventually came to the dramatic face of Maungatea Bluff. Here we searched the foot of the cliffs for *Pilea bispala* (Urticaceae) which is presumed extinct on Rarotonga, and was last seen here in the 1920s. The *Pilea* is superficially similar in appearance to the

succulent-like jade tree (*Crassula ovata*) cultivated in Auckland gardens. Large areas near the cliffs are now cloaked in a dense blanket of balloon vine, covering the ground and ascending trees to heights of over 20 m, and the "presumed extinct" status of *Pilea* on Rarotonga could not be challenged. We then skirted the cliff face to the west, and after crossing a rocky gulch, climbed the steep edge of a vertical drop off to reach a small pinnacle at 300 m altitude. Here we first encountered *Metrosideros collina* and *Weinmannia samoensis*, and several of the Rarotongan endemics, including neinei (*Fitchia speciosa*), a stilt-rooted shrub with flowers like a giant, pendulous thistle (Fig. 2), and *Geniostoma rarotongensis* (very much like New Zealand *G. ligustrifolium*). Then, aware of the fading daylight, we undertook a hairy descent, which entailed climbing over the top of fallen 'au, in the gorge-like lower reaches of the Vaikapuangi Stream.



Fig. 2. Neinei (*Fitchia speciosa*) on Maungatea Bluff. Photo: T. J. Martin, 6 July 2010.

The following morning, having met up with Gerald, who reassured us that a track to Maungatea Bluff did indeed exist, we again set out (this time with a fair degree of reticence). Using the track, which was only marginally better than the previous day's route, we arrived at the bluff, and then headed up a small tributary of the Vaikapuangi Stream, that had its source near the top of the bluff. We collected *Rorippa sarmentosa* and an *Oxalis* (maybe *O. corniculata* agg.), growing on a damp slope under mato, and then ascended steeply past several Panga Tuatarata (rough tree fern, *Cyathea parksiae*), before breaking out into the fernland. This vegetation type occurs as extensive patches on the hill slopes of Rarotonga, and is dominated by a dense low tangle of tuanu'e (*Dicranopteris linearis*), with moumea (oriental blechnum, *Blechnum orientale*), and *Lycopodium cernuum*. 'Ua Motukutuku (*Melastoma denticulatum*) and *Metrosideros collina* are probably the most common indigenous shrubs within the fernlands, but many areas are becoming invaded by guava (both *Psidium guajava* and *P. cattleianum*). We then crossed a large slip on the ridge crest (visible in Fig. 1), where we saw the fernland orchid (*Spathoglottis plicata*) in full bloom, before

descending to the east through massive thickets of ana'e (kingfern, *Angiopteris evecta*). Here we tried to reach a site where *Cyrtandra lilianae*, a rare Rarotongan endemic, had been seen about 15 years ago. This species, in the same family as our *Rhabdothamnus* (Gesneriaceae) is known from only a handful of high altitude sites on Rarotonga, and some of these populations are known to have disappeared. However, time was not on our side and eventually, cut off by increasing vertical bluffs, we called it a day and headed back. On our return, we collected for later identification a *Plectranthus* sp. growing on a damp rock face with *Peperomia blanda*, and found our first Cook Islands myrsine (*Myrsine cheesemaniai*). This species was described by Thomas Cheeseman in 1899 as 'not uncommon on the high mountains of Rarotonga' (Cheeseman 1903), yet this tree was one of only four seen by us on this survey.

On our third day we met up with Colin Rattle, a local who would take us to the cloud forest on the summit of Te Kou. Colin was a delightful guide, his English accent wonderfully at odds with his fully native look – right down to the long beard, bare feet, and his lunch of a coconut, which he carried in a sack slung over a shoulder. Colin set a blistering pace up the steep slopes of Te Kou, where near-vertical rope sections through the forest gave way to more of the same, leading up through the fernlands. Either afflicted by a stomach bug, vertigo, or a lack of fitness (I couldn't claim altitude sickness at 588 m!) arrival at the top was a relief. Perched on the top of Te Kou is a broad, shallow basin cloaked in fernland and cloud forest, and with the mist swirling around and the sun trying to break through, it was a truly magical place (Fig. 3). The cloud forest on the rim of the basin was dominated by *Weinmannia samoensis*, which formed a low, gnarled canopy festooned with bryophytes. Here we found *Radiogrammitis cheesemaniai*, one of our targeted survey species, in abundance on the trunks of Panga Ko'u (cloud tree fern, *Cyathea affinis*) (Fig. 4). *Radiogrammitis cheesemaniai* is endemic to the cloud forest of Rarotonga, so has a maximum area of occupancy, globally, of only 150 ha. We then descended into the fernland of the basin, and after crossing a small stream, spread out to search for *Homalanthus nutans*. Here grew *Weinmannia*, *Freycinetia arborescens*, and neinei in abundance, with pua (*Fagraea berteronana*), and *Metrosideros* aff. *collina*. Heading towards the southern trig, Peter was the first to spot a *Homalanthus*, very close to a WWII trench. There are several of these trenches hidden in the undergrowth of Te Kou, and at less than a metre across but 2 m deep, they pose a significant hazard to the unwary. The *Homalanthus* had both flowers and unripe fruit, but most of the fruit were severely rat gnawed. Over lunch at the trig we speculated whether the introduced ship rat (*Rattus rattus*) could be contributing to the decline of this species, and caught our first glimpses of the coast through the billowing clouds. We then proceeded to search the upper basin

and the north-eastern rim, where we found a further three *Homalanthus* (but no seedlings or saplings), and two small populations of the Rarotongan endemics *Coprosma laevigata* and *Psychotria whistleri* (Rubiaceae), neither of which appear to be particularly common. Cognisant of time and failing daylight, we refilled our water bottles from the mountain top spring, and headed down hill, vowing to return someday to this other-worldly place.



Fig. 3. View over cloud forest from near the summit of Te Kou. Photo: T. J. Martin, 8 July 2010.



Fig. 4. *Radiogrammitis cheesemaniai*, a fern endemic to Rarotonga cloud forest, growing on *Cyathea affinis*. Photo: P. J. de Lange, 8 July 2010.

Day Four in the mountains was predicted to be the biggest challenge yet. Te Manga, Rarotonga's highest peak at 653 m, had been climbed once before by Peter, but with some foreboding he described it to me

as “one of the hardest climbs he had ever done”. Nearing the summit, the track climbs about 550 m altitude over a kilometre of track, with many dangling ropes with which to haul yourself up. However, Te Manga is “the gem” of Rarotonga’s cloud forest, with a high diversity of the targeted endemics, and a survey of the top was essential to our expedition (Fig. 5). At the start of the track we were joined by two friendly canines, which we thought would only accompany us until the terrain favoured those with opposable thumbs. The track at first climbed steeply through slope forest, and here we passed through forest dominated by mato, with scattered trees of the endemic *Mertya pauciflora*, and occasional shrubs of the rare endemic *Psychotria whistleri*. As we passed steeper and steeper obstacles the determined dogs somehow managed to find their way up, and at times posed a safety hazard as they bowled past us on exceedingly narrow tracks.



Fig. 5. View of Te Manga (the twin summit peak on the left) and Te Atakura, from Maungatea Bluff. Photo: P. J. de Lange, 7 July 2010.

At 400 m altitude we found the endemic *Garnotia cheesemanii* (Poaceae) on the eastern face of a razor-back ridge. We took a break from the climb to complete a census of the population, and to photograph the plant in habitat. A total of seven plants were growing on a rock-face amongst *Dianella* aff. *adenanthera*, *Procris pedunculata*, and *Hymenophyllum sanguinolentum* (Fig. 6), and were the only *Garnotia* we found on the survey.



Fig. 6. *Garnotia cheesemanii* on basaltic cliff with *Hymenophyllum sanguinolentum*, Te Manga. Photo: T. J. Martin, 9 July 2010.

In the upper cloud forest the way forward became increasingly difficult. Typically the track followed a razor-backed ridge, and was heavily overgrown with *Freycinetia arborescens* and neinei, which in places, replaced the track with a bouncy lattice of footholds and footfalls. The ridge here is pierced by a series of tooth-like pinnacles, over which the track ascends and falls, and on the top of one of these one of our canine companions finally lost its nerve. We proceeded on, four people and one dog, listening to the sorrowful moans of the deserted one grow more and more distant in the swirling mist. Then, nearing the summit, the cloud forest gives way to *Dicranopteris* fernland, clinging to the precipitous slopes. Here progress is permitted by old, but seemingly trustworthy ropes that dangle end on end, so that there is something to pull your way up on. Here we unsuccessfully looked for a previously recorded population of *Haloragis stokesii*. This is another Rarotongan endemic, unless a specimen from Rapa Island (Cook Islands Biodiversity Database 2011) proves to be the same species. *Haloragis stokesii* is similar to New Zealand’s *H. erecta* but with thicker, more leathery leaves with pronounced red colouration to the leaf tips. We suspect that the increased weediness of open ridge habitats has led to the decline of this species over the past few decades, and here, the invasive *Paspalum conjugatum* is now becoming locally abundant.

On the final ascent to the summit, the fernlands gave way to low woody growth. Here the vegetation is

similar but also strangely different to cloud forest of the northern North Island of New Zealand, with several key genera shared between the two regions. Kaiatea Ko'u (*Ascarina diffusa*), *Metrosideros* aff. *collina*, and kaiatea (*Weinmannia samoensis*), all from genera shared with New Zealand, are common canopy species, along with pua and the ubiquitous neinei. Just to the north-west of the lower summit we delved off into the undergrowth and relocated a previously known population of the fern *Acrophorus raiateensis* (Fig. 7). The population was growing in a shallow gut amongst dense low scrub dominated by *Histiopteris incisa*, *Blechnum orientale*, *Asplenium australasicum*, *Blechnum volcanicum*, and *Paspalum conjugatum*. We found approximately 50 plants, of all sizes, so this population at least seemed reasonably secure. Aside from here, this species is known from two plants in the summit crater of Te Kou, and from the cloud forest of the Society Islands.



Fig. 7. *Acrophorus raiateensis* near summit of Te Manga. Photo: T. J. Martin, 9 July 2010.

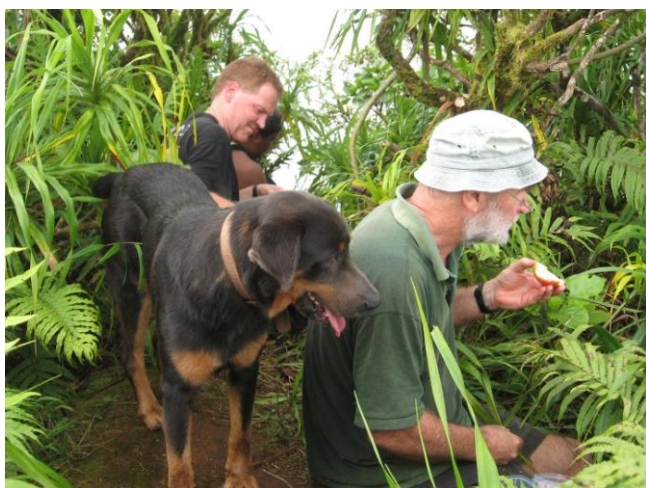


Fig. 8. "Sir Ed", Peter de Lange, Edwin Apera, and Gerald McCormack on the tiny, lower summit of Te Manga, 9 July 2010. Photo: T. J. Martin.

A final push brought us to the lower of the two Te Manga summits, and a well earned rest. After knighting the more intrepid of the two dogs "Sir Ed" for his effort, we each sought a place to sit on the tiny summit, and admired the 'view' – visibility was all of

10 m – while eating our lunch (Fig. 8). To our surprise and amusement, our local guide pulled out a newspaper, lit a cigarette, and celebrated the moment by reading the sports section.

The previous records of *Cyrtandra liliana* and *Sclerotheca viridiflora*, two more threatened endemics yet to be seen on this trip, were on a steep face below the ridge that links the highest peak of Te Manga, and Te Atakura. So after a short break we continued to the south-east, along an increasingly narrow and overgrown ridge. Gerald knew only approximately where the departure point was for our descent, so on arrival, we split into pairs, and still accompanied by Sir Ed, dropped over the side. The calls of Gerald and Peter soon heralded us to a steep gut where they had relocated a population of *Cyrtandra liliana*. Here approximately 12 mature plants grew amongst the thick stems of *Angiopteris*, and scattered *Macropiper latifolium* (Fig. 9). The population was reproducing, either from seed or vegetative reproduction, but must be regarded as critically endangered. This site is one of only three known sub-populations for this species, and it is restricted to the highest peaks of Rarotonga. Furthermore, even here in this remote location, the first invasive plants, such as mile a minute (*Mikania micrantha*) and ardisia, are starting to establish. In the same vicinity we also found four adults and three seedlings of *Sclerotheca viridiflora* (Campanulaceae), on the cliff-like faces of the upper ridges. One specimen was flowering, and true to its species name, sported a stunning green flower (Fig. 10). *Sclerotheca viridiflora* is one of the rarest of the Rarotonga endemics; only four sub-populations have ever been recorded, and two of these are known to have been lost in the last 20 years. Returning to the highest summit, we perused the visitor book, then began the trek back down.



Fig. 9. *Cyrtandra liliana* (broad, entire leaves with dark midvein) amongst *Angiopteris evecta* and *Macropiper latifolium*, steep east face below Te Manga summit. Photo: T. J. Martin, 9 July 2010.

Day Five called for a much-needed break from climbing, and some time to prepare the collected

specimens for entry through New Zealand customs. Having bought copious quantities of methylated spirits and vinegar from the local store, we pressed and soaked the specimens until they were inert and had a considerable stench, and air-dried the dozens of moss, liverwort, and lichen specimens. A leisurely afternoon then took us up the lower Papua Stream catchment, in the hope of relocating the *Cyrtandra rarotongensis* that reputedly grew beside Papua Falls. We found one plant here on the steep face above the plunge pool, competing with a dense cover of *Blechnum orientale*. Despite searches further up the catchment in similar habitats, this was the only one seen that day.



Fig. 10. *Sclerotheca viridiflora* in flower, Te Manga. Photo: P. J. de Lange, 9 July 2010.

On our final day, we headed up the Avana Valley in search of several old records of *Cyrtandra rarotongensis*, and *Lomagramma tahitensis*, an indigenous fern known only from one site on Rarotonga (Cook Island Biodiversity Database 2011). At first the route followed the course of the Avana Stream, through rolling fernlands and alluvial forest. We passed occasional plants of *Habenaria amplifolia*, an endemic ground orchid that grew on the boggy stream terraces, and a few trees of the Cook Islands myrsine. Reaching the upper catchment, our point of departure from the stream was marked on an old sketch map as a small tributary which was marked at its confluence by two planted crotons (*Codiaeum variegatum*). Finding one croton, which in hindsight was not “two” we used the stems of *Angiopteris* as handholds to complete a steep ascent, and found ourselves in the wrong catchment on a perilously steep hill slope. Knowing that we must have departed the Avana Stream prematurely, we sidled around towards the steep western face of Te Atakura, with the intention of dropping down into the intended valley from the top. A steep descent followed,

botanically punctuated with the discovery of an orchid (*Phaius terrestris*) in full bloom (Fig. 11). Then, reaching the valley floor, which thankfully did not comprise a series of vertical drops as feared, we relocated the patch of *Lomagramma tahitensis* (Fig. 12). This fern was the dominant ground cover over an area of around 400 m² and is similar in appearance to our *Blechnum filiforme*.



Fig. 11. *Phaius terrestris* in bloom, upper Avana catchment. Photo: P. J. de Lange, 11 July 2010.

Descending the stream towards the river, the steepening terrain became unexpectedly fortuitous. Forced to find a route around a waterfall, I sidled around a steep face, again relying on *Angiopteris* to prevent my fall. Then looking down below me, there was a single plant of *Cyrtandra rarotongensis* (Gesneriaceae) (Fig. 13). The plant was about 1.5 m tall and had a few flowers, and fruit, which when broken open appeared to contain seeds that weren't viable. Many species in this genus have specific pollinators (Wagner et al. 1990), and given the rarity of this species, even in seemingly remote, less weedy habitats, we wondered if the species is declining due to the loss of a pollinator. Certainly the scarcity of current records, the disappearance of known populations, and its preference for more modified, lower altitude habitats, is cause for serious concern for this species. If nothing is done, this species could be extinct within 20 years.

This find marked the end of our search for threatened plants on Rarotonga, but not the end of the challenge. Red eyed, and admittedly nervous about

the fate of my precious cargo, I came through New Zealand customs at 5 am with over 200 specimens. Unable to phone Wellington headquarters at that time of the morning, Customs withheld the specimens. And there began a two and a half month wait, whilst Ewen Cameron (Curator of Botany, Auckland Museum) wrangled with the Ministry of Agriculture and Fisheries (MAF) and the Environmental Risk Management Authority over their fate. Finally obtaining their release, this important collection is now being processed, and accessioned to the Auckland Museum Herbarium (AK). Threat assessments for each species, so that Rarotonga's threatened flora can be red listed with the IUCN, are being prepared, and using literature searches, the list of species we are assessing has been extended from 12 to 22 species.



Fig. 12. Gerald McCormack in the only known patch of *Lomagramma tahitensis* on Rarotonga, upper Avana Valley. Photo: P. J. de Lange, 11 July 2010.

Acknowledgements

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Fig. 13. *Cyrtandra rarotongensis* with flowers and fruit, upper Avana catchment. Photo: P. J. de Lange, 10 July 2010.

This work is very much 'in progress', but one highlight so far includes the identification of a fern (*Hymenophyllum sanguinolentum*) and two liverworts (*Rectolejeunea denudata* and *Stenolejeunea acuminata*), all previously thought to be New Zealand endemics. This is an indication of just how little is known about the botany of Rarotonga, and how much more there is to discover. Once all plant species endemic to Rarotonga are listed with the IUCN - at least nine of which could be ranked "Critically Endangered" - we hope to further this work by obtaining funding to broaden the scope to all Cook Island endemics, and to embark on much needed conservation action.