black-naped tern (*Sterna sumatrana*) – south coast by Hotel Nengone on Maré;
emerald dove – forest, Refuge de Farino;
red-fronted or horned parakeet ? – possibly two flying by Refuge de Farino;
glossy swiftlet – one of the commonest birds seen, throughout, including Maré;
New Caledonia friarbird – the only large honeyeater present, forest margin Refuge de Farino;
New Caledonian myzomela – red-headed (male), nectar feeding, forest margin Refuge de Farino & open forest Monts Koghis;
yellow-sided warbler (or fan-tailed gerygone) – forest margin Refuge de Farino;
rufous whistler – forest margin Refuge de Farino;
New Caledonian crow – the only crow in New Caledonia, forest margin Refuge de Farino, and on Maré where it has been introduced;
white-breasted woodswallow – forest margin near Refuge de Farino (on power lines) and flying near the entrance to Rivière Bleue;
striated starling – several together eating fruit, forest by road and start of track to Mt Mou;
red-bellied fruit-dove (immature) ? – single bright green bird with yellow crown & white by eye (belly not seen), coast forest by Hotel Nengone on Maré;
common waxbill* – (native to Africa), small flock in dry lawn, La Fao.

B. Same bird species as occurring in New Zealand (but the birds native to New Caledonia and NZ are frequently different races)**:**
little shag (pied form) – river near Bourail and by Nouméa;
reef heron (dark morph) – south coast by Hotel Nengone on Maré;
white-faced heron – by mangroves, Nouméa;
harrier – frequent over open country;
banded rail – roadside;
pukeko – roadside by swamps;
red-billed gull – Nouméa coast;
crested tern (*Sterna bergii*) – Nouméa coast;
spotted dove* – (native to Asia) Bourail & Nouméa;
rainbow lorikeet – common in Nouméa and forest margins - one observed attacking *Casuarina equisetifolia* cones (for the seed?);
shining cuckoo – abundantly heard in forest throughout, including Maré – its call lacked the downward note of the NZ race (this separate race doesn't migrate, unlike the NZ race that migrates to the Solomon Is);
kingfisher – forest margins, including Maré;
fantail – forest margin; Refuge de Farino and by the Tjibaou Centre;
Indian myna* – common throughout in modified areas, especially Nouméa;
silvereye (*Zosterops* ? *lateralis*) – probably same species as in NZ, but some may have been the similar widespread New Caledonian endemic *Z. xanthochrous*; forest margins;
house sparrow* – common in towns.

Notes - fruit bats were seen flying (rather bird-like) over Refuge de Farino at dusk, and small insectivorous bats were seen at night flying around a streetlight near the Refuge de Farino. No owls were heard at night.

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A Note on the Mosses of New Caledonia

Jessica Beever

During the Auckland Botanical Society trip to New Caledonia, 30 November – 11 December 2003, opportunity was taken to explore for mosses on this interesting fragment of Gondwanaland. I concentrated mainly on two families, Fissidentaceae and Pottiaceae, but collections were also made of other mosses, and further work on the specimens will be undertaken. Specimens will be lodged in the herbarium of the Auckland Museum (AK), with duplicates in NOU. Particularly useful literature has been the moss checklist for New Caledonia compiled by Pursell & Reese (1982) and a series of papers by Japanese *Fissidens* specialists (Iwatsuki 1982; Iwatsuki & Suzuki 1989; Iwatsuki & Suzuki 1990).

Fourteen taxa of *Fissidens* were collected. Of these, six, or possibly seven, are also recorded from New Zealand (Table 1).

Table 1. *Fissidens* collected in New Caledonia during Auckland Botanical Society expedition

Taxon	Taxon occurs also in NZ[1]	JEBeever Collection Numbers
F. bryoides Hedw. var. *schmidii* (Müll.Hal.) Chopra & Kumar	?[2]	98-34
F. ceylonensis Dozy & Molk.	-	97-94a; 97-97b; 97-99b, 98-14b
F. consociatus Thér.	-	98-08b; 98-42
F. crispulus Brid	-	98-80d
F. curvatus Hornsch.	+	97-92; 97-95a; 97-99a; 98-14e; 98-37
F. flabellulus Thwait. & Mitt.	-	97-98
F. flaccidus Mitt.	-	97-95b
F. laxus Sull. & Lesq.	-	97-97c
F. oblongifolius Hook.f. & Wils. var. *oblongifolius*	+	98-54; 98-80b
F. oblongifolius var. *hyophilus* (Mitt.) J.E.Beever & I.G.Stone	+	97-85; 98-16; 98-24; 98-25; 98-26; 98-58
F. pallidus Hook.f. & Wils.	+	97-97a; 98-01; 98-05c; 98-06; 98-10; 98-14a; 98-66
F. serratus Müll.Hal.	-	97-97d; 98-14d
F. tenellus var. *tenellus* Hook.f. & Wils.	+	98-14c
F. tenellus var. *australiensis* (A.Jaeger) J.E.Beever & I.G.Stone	+	97-97e

[1] Beever *et al*. (2002)

[2] *Fissidens bryoides* occurs in New Zealand, but subspecific taxonomy has not yet been clarified.

For these mosses it was interesting to compare the New Caledonian habitats with those in which they are found in New Zealand. *Fissidens oblongifolius* var. *oblongifolius* has a New Zealand type, collected by Joseph Hooker in the Bay of Islands, but is a rare species in New Zealand, and known only from the North Auckland Land District. In New Caledonia it was found in a shaded lawn at the entrance to the Parc Provincial de la Rivière Bleue and on silt over wooden steps on the Allée des Fougères track near the Auberge du Mont Koghi, in temperate montane forest. These sites are rather different from those known in New Zealand, where records are mainly from stream banks, or emergent boulders in streams. *Fissidens oblongifolius* var. *hyophilus* has a wider distribution in New Zealand, extending as far south as Nelson and Marlborough. Its habitats in New Caledonia were similar to those I am familiar with in New Zealand, on tree trunks, on rock, and in silt over exposed roots in indigenous forest. In addition, in New Caledonia it was found on silt over mortar in a derelict mini-golf course at the Mont Koghi auberge. I have never seen it in such a modified habitat in New Zealand. (Exploration of such potentially interesting moss sites had to be fitted in between competing botanical highlights within easy walk of the auberge - such as the insectivorous *Nepenthes vieillardii* complete with flowers and pitchers, and a huge houp tree (*Montrouziera cauliflora),* only just saved from the foresters' saws, as evidenced by deep scars at breast height on its trunk). The remaining four *Fissidens* that are also known in New Zealand, *F. pallidus, F. tenellus* var. *australiensis*, *F. tenellus* var. *tenellus*, and *F. curvatus* all extend south to at least Stewart Island, with the latter two being known from Campbell Island and the Auckland Islands as well. They thus show no hint of a tropical affiliation in their New Zealand distribution. *Fissidens pallidus, F. tenellus* var. *tenellus* and *F. curvatus* were found in similar habitats to those I know them from in New Zealand, as primary colonisers of bare soil. *Fissidens pallidus* was particularly common in the forest we walked through above Sarraméa towards the Plateau de Dogny. Recent damage to this forest was very evident, damage which, we were later told by local botanist Irène Létocart, was the result of Cyclone Erica in March 2003, nine months prior to our visit. This catastrophic event had created many new microsites for primary colonisers in the forest. These were evident as unstable soil banks, often under gaps in the canopy and hence with increased light availability, allowing light-demanding taxa such as *Fissidens curvatus* to invade. Freshly disturbed soil was also created on uplifted root plates of large trees toppled by the cyclone. On one such massive root plate we observed beautiful fruiting plants of *Pogonatum,* with their hairy calyptrae grading pink to white. Between their shoots the soil was covered in a very dense green mat of moss protonemata, referred to somewhat poetically as 'green gunge' by one of our party. This first stage of moss growth, before leafy shoots develop, would appear to be a rapid means of excluding other competing colonisers when it is produced so densely and persists, as was the case here. A few shoots only of *Fissidens pallidus* shared the root plate, in contrast to the dense colonies of *Fissidens pallidus* seen elsewhere on soil from which *Pogonatum* was absent. Two species of *Pogonatum* were identified on the root plate: *Pogonatum neo-caledonicum* Besch., endemic to New Caledonia, and *Pogonatum neesii* (Mull.Hal.) Dozy, a widespread Asian species which extends to New Caledonia and the east coast of Australia. This latter species has been described by Hyvönen (1989) in his monograph of the genus as 'an aggressive and very successful colonizer of bare ground', so it is perhaps the more likely candidate than the local *P. neo-caledonicum* for the role of 'green gunge' creator. With the exception of *Fissidens pallidus,* the New Caledonian specimens of *Fissidens* were morphologically very similar to New Zealand material. It was interesting to observe that the different curling patterns of the leaves on dry fronds of *Fissidens*, which have proved a useful

discriminating field character in New Zealand, held true in New Caledonia. New Caledonian material of *Fissidens pallidus* was, however, very variable in the shape and ornamentation of the leaf apex, varying from acuminate to broadly acute, with or without a few irregular teeth. This is a feature that I have also observed in Australian specimens, but does not seem to occur in New Zealand.

Exciting as it was to see familiar New Zealand *Fissidens* species in the forests of New Caledonia, so too for the unfamiliar: *Fissidens crispulus*, which has enormous axillary hyaline nodules; *Fissidens flaccidus* which has gemmae on rhizoids in the axils of the leaves, unlike anything I had seen before in *Fissidens;* and *Fissidens flabellulus* which has been a euphonious name, and not much more, to me since Tadashi Suzuki first introduced me to micro-*Fissidens* 20 years ago. Iwatsuki (1990) noted that, as a whole, the New Caledonian *Fissidens* flora is very closely related to that of tropical Asia. Many of the New Caledonian *Fissidens* species are colonisers of newly eroded soil and produce capsules freely, being monoecious. Their spores are small, less than 20 µm in diameter. He concluded that the suite of Fissidentaceae present in New Caledonia can be explained by spore dispersal by wind after the island separated from Australia.

The Pottiaceae are known as 'mosses of harsh environments' (Zander 1993), and so they proved to be in New Caledonia. A widespread tropical species, *Hemophilia involuta,* was collected from the concrete base of a shed, together with another, as yet unidentified, member of the family. A further as yet undetermined taxon, with impressively large papillae on the costa, was collected from mortar at the Auberge du Mont Koghi, and from bare exposed earth in a 'car-park' at the Col de Yaté. The cosmopolitan *Weissia controversa* was found on roadside and trackside soil banks in exposed sites, and in bare patches in lawn, much as it can be found in New Zealand. Other collections from exposed soil banks, tentatively placed in *Weissia* or *Trichostomum,* are proving as puzzling as their New Zealand counterparts.

The 'harshest environment' in which I collected Pottiaceae on the trip would have to be the hot dry ridge leading up to Mt Mou, where collecting was promptly aborted when my knife disturbed an ants nest. I saw the better part of valour and retreated for the rest of the day to a shady valley, where I was rewarded with *Fissidens oblongifolius* var. *hyophilus* growing on the silted edge of exposed horizontal roots, just as it does in the bird-burrowed areas of Tawhiti Rahi, Poor Knights Islands, much closer to home. Those who persevered up the hill did well too – Ross brought me back *Pulchrinodus inflatus* (Figure 1), which he reported was common along the upper part of the track in open maquis vegetation. This monotypic moss has an interesting distribution – New Caledonia, Tasmania and New Zealand, where it has records from North Cape to Fiordland (Allen 1987). Being very large and conspicuous its known range is probably fairly accurate – it is often noticed by amateurs and well-trained field assistants. Female sex organs have never been found in *Pulchrinodus*, and hence no capsules or spores – there appears to be no sexual reproduction. It has been moved by taxonomists from family to family as something of an enigma, since the only characters available, those of the gametophyte, are an unusual combination, giving it no obvious family placement. The generic name '*Pulchrinodus*' was coined by Allen (1987), its etymology being "a combination of the Latin adverb *pulchre*: beautifully, and the noun *nodus*: a knotty problem. The name is given in reference to the striking beauty of this moss and the puzzling systematic problem it presents." Recent molecular work by Stech *et al* (2003), aimed at unraveling the knot, indicates that *Pulchrinodus* occupies an isolated position in a grade diverging early within the diplolepidious mosses. I suggest it is a potential candidate for a moss of Gondwanic origin, with its present distribution perhaps reflecting ancient vicariance due to continental drift. It certainly warrants further molecular study.

Having previously been impressed by the similarity of the New Zealand moss flora to those of other parts of Gondwanaland I have visited, namely those of Australia, particularly Tasmania, and of Chile in South America, I naively expected more of the same in New Caledonia. Indeed, *Pulchrinodus inflatus* was just such an example. However, consideration of the moss flora as a whole gives a different picture. After visiting South America in 1997, I used the published checklist of Chilean mosses (He 1998) to calculate the degree of similarity of the Chilean moss flora to that of New Zealand (Beever 1999). One third of our moss species are also recorded in Chile. When the same exercise is done for New Caledonia (Table 2), there are far fewer species in common, only 8% of our flora. Such figures need to be interpreted with caution, as further collecting and taxonomic revisions continually modify the figures. For example, the detailed study of New Caledonian Fissidentaceae by Iwatsuki and Suzuki reduced the number of recorded species from 36 (Pursell & Reese 1982) to 28 (Iwatsuki and Suzuki 1989). It is likely that the total number of moss species accepted will reduce considerably in the future for both Chile and New Caledonia, whereas the list for the much better known New Zealand moss flora is likely to be more stable. Nevertheless, I believe the contrast in the affinity of our New Zealand moss flora to those of these two other chunks of Gondwanaland is real, and my impressions in the field in New Caledonia certainly add support to the calculations – we were in a foreign, and to a large extent tropical, moss world.

Figure 1. *Pulchrinodus inflatus*, terrestrial beside track to Mt Mou, in maquis vegetation (Ross Beever).

Members of the Calymperaceae were common. This predominantly tropical family has 42 species listed for New Caledonia (Pursell & Reese 1982) – our sole representative of the family in New Zealand, *Syrrhopodon armatus*, is known only from a few coastal sites, all north of latitude 37° S. Similarly, ten species of *Thuidium* are accepted for New Caledonia (Pursell & Reese 1982). Of these only one, *Thuidium cymbifolium*, is also found in New Zealand, where it is recorded only from the northern North Island. The New Caledonian tree-fern trunks bore mosses that were completely alien to us New Zealanders, and included spectacularly large plants belonging to the tropical genus *Spiridens*.

Table 2. Comparison of the moss floras of New Zealand, Chile and New Caledonia

	New Zealand	Chile	New Caledonia
Total moss species	523[1]	775[2]	622[3]
Moss species in common with NZ		176[4]	40
Moss species in common, as % of NZ flora		34%	8%

[1] Fife (1995)
[2] He (1988)
[3] Pursell & Reese (1982); Iwatsuki & Suzuki (1989)
[4] Beever (1999)

The journey across the Pacific Ocean to Chile is a third of the way round the world, but we arrived eventually at Valdivia at the same latitude as Palmerston North, and felt at home (Beever 1999). Our plane flight to New Caledonia, by way of contrast, was only two and a half hours, but we traveled northwards some 14 degrees of latitude, to a largely foreign bryoworld.

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