

## NATIVE INVASION – AMONG THE MOSSES OF CHRISTCHURCH

**BRYONY MACMILLAN**  
21 Bannister Place, Christchurch

### THE SETTING

As I crouched down outside the Hospital a passer-by asked “Are you alright? Have you lost something?” “No, thank you, just looking at the moss.” “Oh the mosses, they’re lovely aren’t they.” So encouraged I am presenting a preliminary survey. The study of the mosses is both reassuring and exciting. Reassuring because they shed spores and fragments which ensure that they always reappear in spite of road works or spraying, exciting because one can often find something different in the more secluded habitats.

Christchurch is a city of over 332,000 people spread over 452 square kilometres between the Waimakariri River, the Port Hills and the Pacific coast. Of this land 63% is rural. The altitude rises to 70 metres on the plains, and the average rainfall is 630 mm annually. Sources for dispersal of mosses to the area are the rich flora of Banks Peninsula to the south, and the foothills of the Southern Alps within an approximate radius of 50 kilometres to the north and west.

Features of the wider city which influence the floral associations are: 1, the abundance of spring-fed water ways (some 400 km) flowing as rivers, streams, swales, ditches, open water in wetland, or seasonally moist ground; 2, the abundance of open turfy ground in parks, golf courses, playing fields, cemeteries, lawns and roadside berms; 3, abundant trees, though the number of mosses growing on their trunks is severely limited by the generally low humidity, an average rainfall of only 630 mm, and frequent droughts; 4, the prevalence of concrete and brick in street kerbs and gutters, building foundations and walls, gravestones; 5, about 25 km of coastline of dunes (some carrying pine forests), estuaries and lagoon.

### THE CITY MOSSES

Of the 85 species recorded in recent times (Table 1) 20 per cent are found on stream- and river-banks, in open water, or on marshy ground. The most common are *Cratoneuropsis relaxa*, *Fissidens leptocladus*, *Philonotis*

**Table 1.** Mosses of the Christchurch City Council administrative district, excluding rural and natural areas of the Port Hills.

Species supported by a recent collection deposited in the Allan Herbarium, Landcare Research, Lincoln.

# =species endemic to New Zealand after Fife (1995).

\* =species considered to be naturalised in New Zealand.

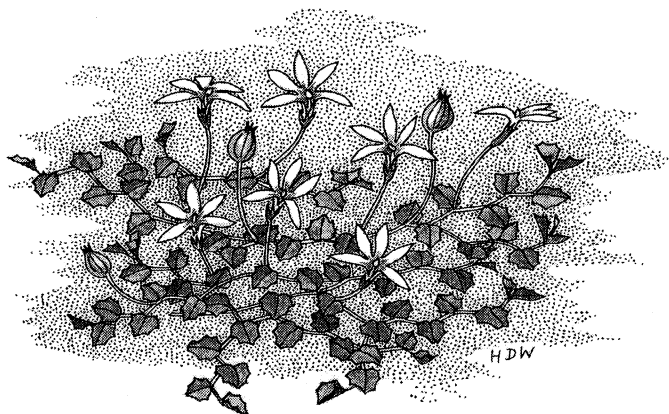
R = species restricted to Riccarton Bush.

Achrophyllum dentatum R	Echinodium hispidum R
Acrocladium chlamytophyllum	Fabronia australis
Amblystegium serpens	Fissidens asplenioides
Barbula calycina	Fissidens blechnoides
*Barbula unguiculata	Fissidens curvatus var. inclinabilis
Brachythecium albicans	Fissidens dealbatus R
Brachythecium paradoxum	Fissidens leptocladus
Brachythecium rutabulum	Fissidens rigidulus
Brachythecium salebrosum	Fissidens taylori var. taylori
Breutelia affinis	Funaria hygrometrica
#Bryobeckettia bartlettii	Grimmia pulvinata
Bryum argenteum	Hedwigia ciliata
Bryum billardierei var. platyloma	#Hennediella macrophylla
Bryum blandum	Hypnum cupressiforme
Bryum caespiticium	*Kindbergia praelonga
Bryum dichotomum	Lembophyllum divulgum
Bryum erythrocarpum complex	Leptobryum pyriforme
Bryum pseudotriquetrum	Leptodictyum riparium
*Calliergonella cuspidatum	Leptostomum inclinans R
Calyptrochaete brownii R	Leptotheca gaudichaudii
#Camptochaete angustata R	#Macromitrium grossirete
#Camptochaete pulvinata	Neckera pennata R
Campylopus clavatus	Orthotrichum hortense
Campylopus introflexus	Pendulothecium punctatum R
Ceratodon purpureus	Philonotis tenuis
Cratoneuropsis relaxa	Physcomitrium pyriforme
Cryphaea tenella R	Plagiomnium novae-zelandiae
Dicranoloma dicarpum	Pleuroidium nervosum
Dicranoloma robustum	Pohlia ochii
Didymodon australasiae	Polytrichum juniperinum
Distichium capillaceum	Pseudocrossidium crinitum var. crinitum
Ditrichum difficile	Ptychomnion aciculare
Drepanocladus aduncus	

Racomitrium curiiosissimum	#Syntrichia phaea
Racomitrium pruinatum	Syntrichia princeps
Racopilum convolutaceum	Thamnobryum pumilum R
Rhapidorrhynchium amoenum R	Thuidium furfurosum
Rhynchostegium laxatum	Tortula muralis
Rhynchostegium muriculatum	Tortula truncata
Rhynchostegium tenuifolium	Tridontium tasmanicum
Schistidium apocarpum	Triquetrella papillata
Sematophyllum contiguum	Zygodon intermedius R
Sphagnum cristatum	Trichostomoideae (family – species and genus not yet identified)
Syntrichia papillosa	

Species represented in herbaria or in the literature, but not found during the present survey. Collected by Robert Brown unless stated otherwise.

Acaulon apiculatum	Microbryum starckeanum
Bryum laevigatum	Orthotrichum assimile
Bryum pallescens	#Orthotrichum calvum
#Ditrichum buchananii	Orthotrichum tasmanicum
Fissidens adianthoides (T.W.N.Beckett)	Tortula areolata
	Tortula maritima



*Pratia angulata* pānakenake

*tenuis*, and *Racomitrium convolutaceum*, accompanied by several liverworts, which form green mats closely appressed to the moist earth. \**Calliergonella cuspidatum*, a bold, yellow-green moss, may be restricted in the Christchurch district to the south bank of the Waimakariri River and its backwaters. The straggling *Drepanocladus aduncus*, is common in pools in protected marshes. *Fissidens rigidulus*, *Leptodictyum riparium* and *Tridontium tasmanicum* are perhaps restricted to water flowing over concrete. The sanctuaries Otukaikino Wetland and Travis Wetland with their seasonally fluctuating water levels have yielded the rarer species. Curiosity led me to sample the pool in the unheated Fern House in the Botanic Gardens where large stiff-stemmed plants of *Fissidens rigidulus* floated. *Plagiomnium novae-zelandiae* with large round transparent leaves grows nearby on rocks splashed by a small waterfall, as it does on Banks Peninsula.

Open or turfy ground has 30 per cent of the flora – the most abundant being *Ceratodon purpureus*, \**Kindbergia praelonga*, *Bryum dichotomum* and *Bryum billardierei*. Untreated, unwatered lawns are likely also to have *Triquetrella papillata*, \**Brachythecium albicans* and *Pseudocrossidium crinitum*. Frequently colonising bare earth sites are *Ceratodon*, *Funaria hygrometrica*, *Bryum argenteum* and *Totula truncata*. The best developed moss fields are found on McLeans Island (no longer an island) on the south bank of the Waimakariri River, where the soils are silty sand or stony, supporting only thin grasses, small herbs, and scattered low woody species. Here, a dozen mosses form richly patterned carpets. Shaggy, silvery grey tufts of *Racomitrium pruinosum* and *R. curiosissimum*, red-brown spikes of *Polytrichum juniperinum* and green circles of *Bryum billardierei* form a firm turf with yellowish *Barbula calycina* and *Triquetrella papillata* interspersed. The wide open spaces, bounded by the grey line of the Port Hills to the south and the peaks of the Alps to the west, masked by distant pine shelter belts, and with a rich moss flora under one's feet, are breathtaking.

I can name confidently only two species which frequently grow in fissures of the bark of trees throughout the area. *Syntrichia papillosa* (formerly *Tortula*) forms bright green crusts on trunks up to 2–3 metres from the ground in winter and spring, drying to almost black in summer. Its most striking character is the abundance of loose propagules on the upper surfaces of the leaves. Max Visch (1976) illustrated the pattern of *Syntrichia* growing on European ash along the Heathcote River. *Hypnum cupressiforme* with curved shining leaves, is variable in form, grows lower on the trunks

and is not so persistent, but it is holding out on the bowl of the plane tree close to the cathedral in Cathedral Square. *Orthotrichum hortense*, *Sematophyllum contiguum*, *Rhynchostegium muriculatum*, and *Fabronia australis* are occasionally found. On shaded ground under deciduous trees the wefty, pale green \**Kindbergia praelonga* is abundant, with *Rhynchostegium laxatum* on the roots. Because of the soft straggling habit of \**K. praelonga*, small birds frequently weave it into their nests. In a study relating the presence of lichens, fungi, algae, mosses, and liverworts on tree trunks to atmospheric pollutants Johnson et al. (1998) found that total cover was highly correlated with pollution in Christchurch. However, I have found *Syntrichia papillosa* to be abundant and *Hypnum* and *Orthotrichum hortense* present on trunks at Edmonds Park, Ferry Road, where pollutants are at their maximum (L. E. Burrows pers. comm.). Nevertheless in the heart of Riccarton Bush, irrigated, and buffered from the urban atmosphere, 7 additional species were found growing on trunks at lower levels. Particular host trees are lemonwood, ribbonwood, narrow-leaved lacebark, and cabbage tree (Macmillan 1995).

The kerbs, gutters, and concrete paths and driveways are where most people are aware of mosses in the city. Bright green carpets and velvet cushions are formed by *Ceratodon purpureus* and *Tortula muralis* in winter and spring. Both bear abundant capsules. *Bryum dichotomum* and *Bryum argenteum* form silvery cushions or lines in crevices. *Funaria hygrometrica* grows on earth-clad concrete surfaces, sometimes forming a soft round cushion. While these species have world wide distributions they are included in the native flora of New Zealand. Their preference for lime or mortar substrates means that they are found throughout the city wherever a little dust is allowed to settle, and restricted only by constant foot falls. Even between the roar of buses at the Lichfield Exchange and Ballantyne's they are able to grow along the pavement. Cathedral Square is particularly rich in species just now while Bradley's Bier Garden remains a scene of mossy turf and exposed brick walls. The brown-green endemic *Syntrichia phaea*, which commonly grows on limestone, is found on driveways in the city. *Grimmia pulvinata* prefers the tops of walls and cornerstones of graves, well drained sites which mimic mountain rocks.

Coastal dunes have a dozen species, none restricted to this habitat, but forming characteristic associations. Some appear to be living on pure sand, which falls away from the rhizoids when you touch the plants. Others grow on plant debris from marram grass or pine trees that has accumulated in

hollows, and others depend on moist, rotten wood from fallen gorse or lupin. *Pinus radiata* plantations on the dunes, with their carpet of needles, can have an extensive ground cover, especially of *Hypnum cupressiforme*, *Bryum billardieri* and leafy liverworts. In a long-established pine forest I found a hair moss (*Dicranoloma robustum*) that perhaps had arrived from bush above the Waimakariri gorge, but now growing with the soft hum of waves on the beach within hearing.

While man-made habitats support quite a rich moss flora, they are transitory as plantations are felled, turf re-laid, gravestones cleaned. However as we enhance wetlands and establish other pre-human vegetation in suitable sites there are habitats for many more species to colonise from the Port Hills and foothills.

### HISTORICAL NOTES

Although early visiting collectors made frequent reference to the mosses of Banks Peninsula (Godley 1967), the plains of Canterbury did not attract their attention. The earliest mention is by J. F. Armstrong, resident Government Gardener, who listed 11 mosses from Riccarton Bush in his article on the vegetation of the Christchurch district (Armstrong 1870). *Funaria hygrometrica* was also listed from swamps and sand hills, and *Ceratodon purpureus* from sand hills. Unfortunately only specimens of these two and a *Ditrichum difficile* are preserved in the Armstrong Herbarium (currently housed in the Allan Herbarium at Landcare Research, Lincoln). His Riccarton Bush list is discussed by Macmillan (1995).

Robert Brown (1824–1906), a shoemaker living in Andover Street, was a devoted student of mosses and collected them in Christchurch in the 1880s (Fig. 1). He travelled widely in the South Island, and gave 22 papers on mosses to the Philosophical Society of Canterbury between 1892 and 1904. The greater part of Brown's herbarium was sent to England by his son George for study by H. N. Dixon, a leading muscologist of the early 1900s. George Brown also sent mosses to Kew in 1920. Both of these gifts are now in the British Museum, London, and therefore not readily accessible, but it will be necessary to study them if we are to compare what Brown collected in the environs of Christchurch with the flora of today. However, the following extract from Brown (1893) shows that he knew the mosses well: "During the year 1882 having been engaged in botanizing on the plains round Christchurch as far as the banks of the River Waimakariri, amongst a

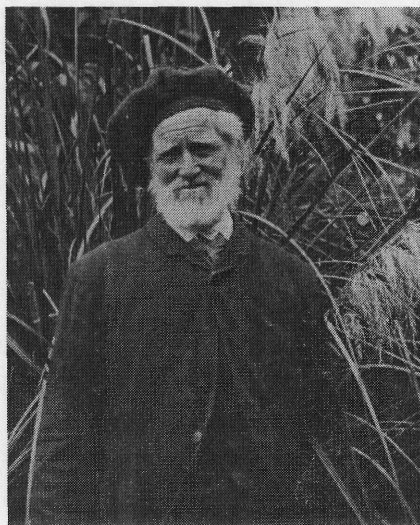


Fig. 1: Robert Brown (1824-1906), student of the mosses of Christchurch (with permission of the Macmillan Brown Library, University of Canterbury).

number of new mosses . . . . were three which could not be placed in any of the existing genera . . . .". Localities given in his papers include: banks of the River Avon; niggerheads, Wairarapa stream; sandy soil, Christchurch Domain; Styx marsh; old bed of River Waimakariri; damp sandy soil, Heathcote Estuary; plantations round the River Avon. Jette Lewinsky, a visiting muscologist from Denmark, when writing about the genus *Orthotrichum* which grows on tree trunks and branches, saw Brown's specimens at the British Museum and she reported that he collected four species along the Avon River in 1886 and 1895.

Thomas Naylor Beckett (1839–1906), an orchardist living in Ilam Road, preferred to travel to the Port Hills and the foothills for his moss collections from which he exchanged material with many overseas correspondents. His valuable herbarium was given to the Canterbury Museum, and is now also housed in the Allan Herbarium. His Christchurch localities include: damp clay, Fendalton; Styx; New Brighton. There are also specimens collected by Thomas G. Wright, friend of Beckett and Brown. Leonard Cockayne (1927) wrote about the bogs of St Albans, Marshlands, Horseshoe Lake, and River Styx of the 1890s, and mentions the presence of sphagnum moss under manuka. More recently mosses have been collected in Christchurch by Allan Fife, Colin Meurk, Daphne Banks, Arthur Healy, Kate McCombs, Margaret Simpson, and Bryony Macmillan.

#### ACKNOWLEDGEMENTS

Jessica Beever of Auckland has helped with the identification of *Fissidens* and Pottiaceae. Jeff Palmer, Archivist, Macmillan Brown Library, University of Canterbury, arranged for reproduction of the photograph of

Robert Brown from the archive of the Royal Society of New Zealand (Canterbury Branch), MB 157 1/1. The enthusiasm of Colin Meurk for the biota of Christchurch has been an inspiration.

#### REFERENCES

- Armstrong, J. F. 1870: On the vegetation of the neighbourhood of Christchurch including Riccarton, Dry Bush, etc. *Transactions of the New Zealand Institute* 2: 118-128.
- Brown, R. 1893: Notes on a proposed new genus of New Zealand mosses; together with a description of three new species. *Transactions of the New Zealand Institute* 25: 285-287.
- Cockayne, L. 1927: The vegetation and flora of the Canterbury Plain. *In: Natural History of Canterbury. ed. Speight, R.; Wall, A; Laing, R. M., Philosophical Institute of Canterbury, Christchurch.*
- Fife, A. J. 1995: Checklist of the mosses of New Zealand. *The Bryologist* 98: 313-337.
- Godley, E. J. 1967: A century of botany in Canterbury. *Transactions of the Royal Society of New Zealand., General 1*: 248-266.
- Johnson, P. N.; Burrows, L. E.; Galloway, D. J. 1998: Air Pollution Indicators. Summary Report prepared for the Ministry for the Environment.
- Macmillan, B. H. 1995: Mosses and liverworts. *In: Riccarton Bush: Putaringamotu. Ed. Molloy, B. Riccarton Bush Trust, Christchurch. Pp.194-203.*
- Visch, M. 1976: *Tortula papillosa*. *Canterbury Botanical Society Journal* 9: 21-24.