Bryophytes in the vicinity of Wombeyan Caves, New South Wales

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Downing, A.J., Oldfield, R.J. and Selkirk, P.M., (Macquarie University, NSW, 2109) 1995. Bryophytes in the vicinity of Wombeyan Caves, New South Wales. Cunninghamia *4(1):129–141.* Collections of bryophytes in the vicinity of Wombeyan Caves, 34°19'S, 149°58'E, indicate that the bryophyte assemblages on marble and associated calcareous soils are similar to those which occur on limestone and associated soils at sites previously investigated in south-eastern Australia. Species that grow in abundance on calcareous substrates at Wombeyan are either not common or not present on the granites and sandstones in the vicinity of Wombeyan Caves. The bryoflora is dominated by acrocarpous mosses and thallose liverworts. Many of the species growing on calcareous substrates at Wombeyan are more usually associated with calcareous soils of arid and semi-arid areas of Australia. Consistent with findings at other calcareous sites, a number of introduced and cosmopolitan species occur on marble-derived soils in heavily grazed, open grassy areas.

Introduction

Although the distribution of bryophytes on limestones in south-eastern Australia has been well documented (Brotherus & Watts 1912, Downing 1992, Downing et al. 1991, Downing & Selkirk 1993), there are no published records of bryophyte distribution on marble or soils derived from marble.

The Wombeyan Caves (34°19'S, 149°58'E, 600–650 metres above sea level) are located 125 km south-west of Sydney at the boundary between the Central Tablelands and the Central Coast botanical divisions of New South Wales on the eastern side of the Great Dividing Range. The caves occur in rounded hills in the valleys of Wombeyan and Mares Forest Creeks, tributaries of the Wollondilly River. The karst landscape at Wombeyan forms low hills and knolls in places incised by steeply-sided gorges. Unlike most of the popular tourist cave systems in south-eastern Australia, which are formed from limestone, the caves at Wombeyan are formed from marble. Wombeyan also differs from other eastern Australian limestone cave systems in having an underlying basement of impervious rock (Jennings et al. 1982).

The grey/white marble at Wombeyan is considered to be Late Silurian limestone that has been almost completely marmorised by surrounding Middle Devonian intrusive rocks such as granite, quartz porphyry, dacite tuff, hypersthene porphyry and a small outcrop of gabbro, which form the adjoining higher and steeper ridges and V-shaped valleys (Lishmund et al. 1986). With the exception of gabbro, all are igneous rocks that contain much quartz (Jennings et al. 1982). Carne & Jones (1919) analysed samples of marble from Wombeyan as being between 91.82% and 98.62% calcium carbonate.

At Wombeyan, the soil that occurs in the marble outcrops is unusual, consisting of grains of very coarse calcite sand and fine calcite gravel, together with dark-brown humus. In other, less rocky areas, marble weathers to produce red, calcareous, silty clay soils (Jennings et al. 1982). In contrast, igneous rocks in the vicinity of the caves weather to produce acidic, nutrient-deficient sandy soils (Clements 1982).

An early visitor to Wombeyan, Dr James Cox (1862) observed a sharp line of demarcation between the granite and marble country and the sudden change occurring in both vegetation and topography. From the top of the marble cliffs he considered it easy to map with accuracy the extent of the 'limestone' by the differing forms of vegetation. Cambage (1906) noted the sparse flora on the 'limestone' in the vicinity of the Caves compared with that on the granite and quartz porphyry nearby and commented on the similarity between the vegetation on the decomposed granite sands to the west of Wombeyan and the sandstone formations of the Blue Mountains. Similarly, Phipps (1950), in his survey of the geology of the Taralga–Wombeyan Caves district, commented that, despite their low-nutrient status, soils derived from granite, sandstone, conglomerate and shale in the vicinity of the Caves gave rise to heavier vegetation than did the 'limestone'.

More recently, Clements (1982) carried out a detailed study of the vegetation in the vicinity of the caves. On soils derived from igneous rocks, *Eucalyptus globoidea* and *Eucalyptus sieberi* dominate a forest community which has an understorey of shrubby vegetation that includes numerous species of Epacridaceae. In contrast, grassland is a significant feature of calcareous soils and is common on exposed, north-facing slopes. Woodland communities occur on sheltered, south-facing slopes and valleys (Clements 1982). *Brachychiton populneus* and *Ficus rubiginosa* both grow on marble outcrops. *Acacia chalkeri* grows in grassland on exposed marble ridges and occurs only at Wombeyan Caves (Harden 1991). Numerous exotic tree and shrub species have been planted in the valley of Wombeyan Creek and weeds such as *Conium maculatum, Cotoneaster glaucophylla, Pinus radiata, Prunus persica, Pyracantha rogersiana, Rosa rubiginosa* and *Verbascum thapsus* thrive on the calcareous soils.

Wombeyan has warm to hot summers and cool to cold winters with severe frosts and occasional light snowfalls. Rainfall figures for three surrounding weather stations, Moss Vale (672 m a.s.l., 990 mm per annum), Taralga (882 m a.s.l., 808 mm per annum) and Goulburn (702 m a.s.l., 679 mm per annum) (Bureau of Meteorology 1985) indicate that rainfall is relatively evenly distributed throughout the year. Wombeyan lies in the rainshadow of both the high plateau to the east and the ranges to the west, so its mean annual rainfall is likely to be less than the 808 mm recorded for Taralga (17km south-west) (Halbert & Michie 1982).

Methods

During four visits to Wombeyan Caves in 1992 and 1993, bryophytes were collected from marble, granite and sandstone and their associated soils. Epiphytic bryophytes were also collected at each site. Reference was made to collections of S. Claxton. Voucher specimens of all species collected will be deposited at the National

Herbarium of New South Wales. All collections were returned to the laboratory for identification. Nomenclature and authorities follow Streimann and Curnow (1989) for mosses; Scott and Bradshaw (1986) for liverworts and hornworts, and Harden (1990, 1991, 1992) for vascular plants (see Appendix 1). As a result of severe drought throughout 1992 and 1993, some annual and/or ephemeral species of bryophytes may not have been present when collections were made.

Results and discussion

Many more species of mosses and liverworts were collected from marble substrates than were collected from granite and/or sandstone (Table 1). Fifty-eight species of bryophytes, including 48 moss species and 9 liverwort species, were collected in the vicinity of the Caves. Of these, 39 moss and 8 liverwort species (81% of species present) were collected from marble; and 11 moss species (20%) (no liverworts) were collected from granite and sandstone.

Mosses were abundant on calcareous soils, not only on moist soil and rocks in shaded, sheltered areas, but also on hot, dry, exposed, sparse open grassland on the top of rounded knolls. The moss flora on marble and its derived soils was dominated by acrocarpous ('upright') mosses from two families: Pottiaceae with 18 species and Bryaceae with 8 species. Few pleurocarpous ('creeping') mosses (6 species) were collected from marble.

The moss flora on both granite and sandstone substrates was also dominated by acrocarpous mosses. The majority were from the Bartramiaceae, Dicranaceae, Ditrichaceae and Polytrichaceae families and were found exclusively on siliceous substrates.

Liverworts were collected from moist soil in sheltered and shaded habitats in soil-filled rock crevices, seepage areas and damp creek banks in gorges. One species, *Riccia limbata*, was collected from dry soil on an exposed marble knoll. The liverwort flora on marble was dominated by thallose liverworts from the Marchantiales, *Reboulia hemisphaerica, Targionia lorbeeriana, Lunularia cruciata* and *R. limbata*. Three leafy liverworts, *Frullania squarrosula, Lophocolea bidentata* and *Porella crawfordii*, were collected from marble. Eight moss and two liverwort species were collected from the bark of shrubs or trees.

A number of cosmopolitan (*Bryum argenteum*) and introduced species (*Aloina aloides* var. *ambigua* and *Trichostomum brachydontium*) were conspicuous components of the microbiotic crust at Wombeyan and were probably introduced through the practice of allowing sheep to graze on the marble outcrops (Cambage 1906, Clements 1982). The presence of introduced and cosmopolitan species has been observed elsewhere on limestones, where damage to soil and pastures by grazing animals appears to be reflected in the bryoflora in much the same way that introduced weeds (vascular plants) invade disturbed urban bushland (Downing 1992, 1993; Downing & Selkirk 1993).

The development of karst appears to play a significant part in the presence of so many arid zone bryophytes on marble at Wombeyan and on eastern Australian

Table 1. Bryophytes collected from calcareous and non–calcareous sites at Wombeyan (marble, non-marble), Jenolan (limestone, non-limestone), Googong (limestone, non-limestone), Tamworth (limestone, non-limestone), Wee Jasper (limestone), Mungo National Park (calcareous earth) and Nullarbor Plain (calcareous soils)

Key ᶜ=exclusive calciphile, #=exclusive calcifuge, *=calcareous substrate, M=marble, G=granite, S=sandstone, E=epiphyte, Sh=shale, Si=siltstone. a=this study, b=Downing 1992, d=Downing 1993, e=Downing et al. 1991, f=Downing & Selkirk 1993, g=Stoneburner et al. 1993.

MOSSES	Wombeyan Marble a	Wombeyan Non Marble a	Jenolan b d e	Googong b d	Tamworth & Attunga b d	Wee Jasper d	Mungo f	Nullarbor Plain g
Pottiaceae								
ᶜ*Aloina aloides* var. *ambigua*	M			*	*	*	*	
Barbula calycina	M		*	*	*	*		
Barbula crinita	M	E	*	* S	* Si	*	*	*
ᶜ*Barbula hornschuchiana*	M			*	*	*	*	*
Barbula unguiculata	M		*		*			
Desmatodon convolutus	M		*		* Si	*	*	*
Didymodon torquatus	M		*	*	* Si	*	*	*
ᶜ*Gymnostomum aeruginosum*	M		*	*	*	*		*
Tortella cirrhata	M		*					*
Tortula antarctica	M		* Sh	* S	*	*	*	*
Tortula muralis	M		*					
Tortula pagorum		E	*	* S	*	*	*	*
Tortula papillosa	M	E	*			*	*	
Tortula ruralis	M				*			
Trichostomum brachydontium	M	G E	*	* S	* Si	*		
Triquetrella papillata	M		*	* S	* Si	*		*
Weissia controversa	M	G	*	*	*	*		
Weissia controversa var. *gymnostoma*	M		*					

Bryaceae								
Bryum argenteum	M		* Sh	* S	* Si	*	*	
Bryum billarderi	M	G E	* Sh	* S	* Si	*		
Bryum campylothecium	M		* Sh	* S	* Si	*	*	
Bryum dichotomum	M	G	* Sh	* S	* Si	*	*	
Bryum pachytheca	M		*	*	* Si	*	*	
[c]Bryum radiculosum	M		*					
[c]Bryum torquescens	M			*	*	*		
Leptobryum pyriforme	M							
Fissidentaceae								
[c]Fissidens leptocladus	M		*			*		
Fissidens taylorii	M	G	*		* Si			
Fissidens vittatus	M		*	*	*	*	*	*
Brachytheciaceae								
Chamberlainia salebrosa	M		*					
Encalyptaceaec								
[c]Encalypta vulgaris	M		*	*		*		
Gigaspermaceae								
Gigaspermum repens	M		*	*	* Si	*	*	*
Grimmiaceae								
Grimmia laevigata		S	*	S		*		
Grimmia pulvinata	M		* Sh	* S		*		*
Hypopterygiaceae								
Hypopterygium rotulatum	M		*			*		
Lembophyllaceae								
Camptochaete arbuscula	M							

Table 1. continued.

	Wombeyan Marble a	Wombeyan Non Marble a	Jenolan b d e	Googong b d	Tamworth & Attunga b d	Wee Jasper d	Mungo f	Nullarbor Plain g
Leskeaceae								
°*Pseudoleskeopsis imbricata*	M	E	*	*		*		
Orthotrichaceae								
Orthotrichum assimile		E						
°*Orthotrichum cupulatum* var. *cupulatum*	M		*	*		*		
Racopilaceae								
Racopilum cuspidigerum var. *cuspidigerum*	M		*			*		
Thuidiaceae								
Thuidium sparsum	M		* Sh					
Bartramiaceae								
#*Breutelia affinis*		G						
Dicranaceae								
#*Campylopus introflexus*		G S	Sh	S				
#*Dicnemoloma pallidum*		G S	Sh					
#*Dicranoloma billarderii*		G						
Ditrichaceae								
#*Ditrichum difficile*		G	Sh	S				

Fabroniaceae							
Fabronia australis		E	*	*			
Polytrichaceae							
#Polytrichum juniperinum		G					
LIVERWORTS							
Aytoniaceae							
[c]Reboulia hemisphaerica	M		*			*	
Codoniaceae							
Fossombronia sp.	M		*		*	*	
Frullaniaceae							
Frullania probosciphora		E	*				
Frullania squarrosula	M	E	Sh	S			
Geocalycaceae							
Lophocolea bidentata	M		*				
Marchantiaceae							
Lunularia cruciata	M			*	*		
Porellaceae							
Porella crawfordii	M		*				
Ricciaceae							
Riccia limbata	M			*	*	*	*
Targioniaceaec							
[c]Targionia lorbeeriana	M		*			*	

limestones. The lack of surface water in karst landscapes can be extreme, even when annual rainfall exceeds 2000 mm and thus biological productivity is usually much lower on calcareous than non-calcareous rocks (Jennings 1985). Arid zone mosses and liverworts are able to survive in this extremely dry microenvironment and to cope with high light levels and extremely high soil surface temperatures (Amman 1928).

Our observations on the bryophyte flora on Wombeyan marble are consistent with findings from other limestone sites in Australia where we have found that bryophytes are more abundant, both in percent groundcover and in species number on calcareous substrates, than they are on non-calcareous substrates, such as sandstones, shales and siltstones (Downing 1992, Downing 1993, Downing & Selkirk 1993). Acrocarpous mosses dominate the limestone moss flora, with two families, Pottiaceae and Bryaceae, being most abundant in terms of number of species. Several species are considered to be indicator species, *Gigaspermum repens, Fissidens vittatus* and either *Bryum pachytheca* on drier soils or *Bryum dichotomum* in wetter situations (Downing 1993). All four species occur at Wombeyan.

The presence of open grasslands on exposed ridge tops and slopes with northerly aspects rather than *Eucalyptus* woodlands and forests that occur on nearby non-calcareous substrates may be an indication of the aridity of the karst geomorphology. Botanists and geologists have commented on the sparse vegetation on marble compared with that on other rock substrates at Wombeyan (Cambage 1906, Clements 1982, Cox 1862, Phipps 1950). The absence of eucalypts from the marble may benefit arid zone bryophyte species, by reducing the amount of smothering leaf litter, reducing bushfire hazards and by ensuring high light levels necessary to compensate for specialised morphology which protects photosynthetic structures.

In previous studies, the ratio of acrocarpous to pleurocarpous moss species on limestones and calcareous soils has been found to increase with decreased rainfall (Downing 1993). At Wombeyan, the ratio on marble substrates is 33:6, consistent with the trend established at other sites in New South Wales (Table 2).

Thallose liverworts from the Marchantiales, in particular from the Aytoniaceae, Marchantiaceae, Ricciaceae and Targioniaceae, and from the family Codoniaceae (Metzgeriales), dominate the marble liverwort flora at Wombeyan. Again, this is consistent with results from limestone sites in south-eastern Australia (Table 1).

In Australia there are very few bryophytes that are exclusively calciphiles or exclusively calcifuges. Some species such as *Aloina aloides* var. *ambigua, Encalypta vulgaris, Gymnostomum aeruginosum, Pseudoleskeopsis imbricata* and *Targionia lorbeeriana* are commonly accepted as calciphiles. Most species that do occur on calcareous substrates can be regarded as opportunists and grow on both calcareous and non-calcareous substrates (Downing 1993), although many appear to favour substrates with a greater percentage of calcium carbonate than others. Only 9 moss and 2 liverwort species collected from marble substrates at Wombeyan are considered to be exclusive calciphiles (Downing 1993) (Table 1).

Table 2. Mean annual rainfall and number of acrocarpous and pleurocarpous moss species that occur on marble at Wombeyan Caves, on limestone at Jenolan, Wee Jasper, Googong and Attunga, and on the calcareous soils of Mungo National Park

	Jenolan 33°47'S 150°05'E	Wee Jasper 35°07'S 148°40'E	Wombeyan 34°19'S 149°58'E	Googong 35°31'S 149°16'E	Attunga 30°56'S 150°50'E	Mungo 33°45'S 142°59'E
Mean annual rainfall (mm)	968	916	650–800	633	595	246
Acrocarpous species	37	35	33	24	19	22
Pleurocarpous species	10	7	6	1	1	0

At Wombeyan, six species from the four families Bartramiaceae, Dicranaceae, Ditrichaceae and Polytrichaceae appear to be exclusive calcifuges and were only collected from granite and/or sandstone. The calcifuge species collected at Wombeyan, *Breutelia affinis, Campylopus introflexus, Dicnemoloma pallidum, Dicranoloma billarderii, Ditrichum difficile* and *Polytrichum juniperinum,* all commonly occur on the sandstones and shales of the nearby Blue Mountains plateau. In contrast, the majority of species that grow on marble substrates at Wombeyan and on other eastern Australian limestone sites are not present or not common on shales and sandstones. These species have more in common with bryophyte assemblages that can be found on calcareous soils, which are extensive throughout semi-arid and arid areas of southern Australia. Many species collected at Wombeyan are present on calcareous earths and clays of Mungo National Park (33°45'S, 142°59'E, 91 m a.s.l) in far south-western New South Wales (Downing & Selkirk 1993) and on the calcareous soils of the Nullarbor Plains (Stoneburner et al. 1993) (Table 1).

In semi-arid and arid areas mosses and liverworts can be important as components of microbiotic soil crusts that may also include lichens, fungi, algae and cyanobacteria. At Wombeyan, microbiotic soil crusts can be found in the open grassland that occurs over the Victoria Arch and on the top of the rounded hillslopes adjacent to the Arch. The crusts are similar to those crusts at Mungo, both in appearance and in the bryophyte species present. Species abundant in, and common to, both locations include *Bryum argenteum, Bryum pachytheca, Didymodon torquatus, Gigaspermum repens* and *Riccia limbata*. Cyanobacteria and lichens are also abundant as components of the crusts at Wombeyan. In dry conditions, the crusts form low, rough, dark (reddish brown/brown/black) turfs 1–3 mm high. However, light rain or mist is sufficient to change the appearance to green as leaves and thalli unroll exposing photosynthetic tissue.

Mosses and liverworts that occur in arid and semi-arid areas of Australia and on calcareous soils and rocks, such as the Wombeyan Caves marble, in relatively high rainfall areas of eastern Australia, have many characteristics which enhance survival in an exposed, dry environment. In most cases, these characteristics serve to enhance

moisture retention, reduce water loss or protect photosynthetic tissue from high light levels. Possibly their greatest survival characteristic is the ability to reproduce from a few cells. Thus, mere stem or leaf fragments can grow rapidly after a rainfall event.

Some characteristics of species of Pottiaceae (the dominant moss family on marble at Wombeyan [18 species] and at Mungo National Park) that enhance survival include: dark pigmentation of leaves and stems; leaves twisted around the stem when dry; costa ('nerve'), thickened and glossy on abaxial surface of the leaf; costa exposed (and reflecting light) when the leaf is twisted around the stem; simple or complex papillae on leaf cells, leaf margins incurved or recurved and leaves with long hair points that enhance the uptake of moisture; leaves with photosynthetic papillae or lamellae on adaxial surfaces protected by overlapping hyaline tissue or by incurved leaf margins.

Species of Bryaceae possess some of these same characteristics, such as incurved or recurved leaf margins and long hair points. However, many species (*Bryum pachytheca, Bryum dichotomum*) produce gemmae (vegetative reproductive structures) in terminal or axillary clusters and/or rhizoidal gemmae ('tubers') on underground stems (*Bryum torquescens, Bryum radiculosum*). Gemmae appear to play a significant role in survival of these species in dry environments and are not unique to this family. *Tortula pagorum* (Pottiaceae) produces gemmae in the stem apex and *Tortula papillosa* (Pottiaceae) produces gemmae on the adaxial surface of its upper leaves. Both commonly grow on calcareous rocks and as epiphytes in limestone areas. At Wombeyan, *T. papillosa* was recorded both on marble and as an epiphyte.

The upper leaves of both *Bryum argenteum* and *Gigaspermum repens* are hyaline and provide a protective layer for green, photosynthetic lower leaves. *Gigaspermum repens* also has well developed underground stems that appear to play an important role in surviving both extreme drought and fire (Downing 1993).

Thallose liverworts, such as *Riccia limbata, Targionia lorbeeriana* and *Reboulia hemisphaerica*, have dark, glossy scales on the lower surface of the thallus. As conditions become increasingly dry, the edges of the thallus roll inwards, thus the glossy scales form an effective barrier that reduces evaporation of moisture and protects photosynthetic tissue on the upper surface of the thallus. *Riccia limbata* is an extremely common liverwort throughout Australia's arid areas and, although not confined to calcareous substrates, appears to thrive on them.

Many annual or ephemeral bryophytes avoid arid environments and grow only after rainfall events. Species such as the mosses *Entosthodon muehlenbergii* (*Funaria glabra*), *Funaria hygrometrica*, and the liverworts *Riccia crystallina* and *Riccia cavernosa*, have been recorded from eastern Australian limestone sites and commonly occur at Mungo National Park. They were not found at Wombeyan during this study, but may well occur there in other than the drought conditions experienced during the period in which collections were made.

Conclusion

Bryophyte assemblages on marble substrates at Wombeyan are similar to those found on limestone substrates in south-eastern Australia. Acrocarpous mosses, in particular Pottiaceae and Bryaceae, dominate the moss flora and thallose liverworts (Marchantiales) dominate the liverwort flora. Certain species, considered to be key elements of limestone bryoflora, *Didymodon torquatus, Gigaspermum repens, Bryum pachytheca, B. dichotomum* and *Fissidens vittatus*, were present on marble at Wombeyan.

Many of the species that occurred on marble at Wombeyan are species often associated with arid and semi-arid areas of Australia and have morphological characteristics that enhance their survival in dry environments. The development of karst landscapes is considered to be an important element in creating an arid microclimate on both limestone and marble in south-eastern Australia.

Certain introduced and cosmopolitan bryophyte species appear to be common in areas of grassland on marble at Wombeyan that are frequently grazed by sheep.

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Appendix 1. Authorities for bryophytes and vascular plants

Bryophytes

Aloina aloides (Schultz) Kindb.
var. *ambigua* (B.S.G.) Craig
Barbula calycina Schwaegr.
Barbula crinita Schultz
Barbula hornschuchiana Schultz
Barbula unguiculata Hedw.
Breutelia affinis (Hook.) Mitt.
Bryum argenteum Hedw.
Bryum billarderi Schwaegr.
var. *billarderi*
Bryum campylothecium Tayl.
Bryum dichotomum Hedw.
Bryum pachytheca C. Muell.
Bryum radiculosum Brid.
Bryum torquescens Bruch ex De Not.
Camptochaete arbuscula (Sm.) Rchdt.
Campylopus introflexus (Hedw.) Brid.
Chamberlainia salebrosa (Web. & Mohr) H. Rob.
Desmatodon convolutus (Brid.) Grout
Dicnemoloma pallidum (Hook.) Wijk & Marg.
Dicranoloma billarderii (Brid. ex anon.) Par.
Didymodon torquatus (Tayl.) Catches.
Ditrichum difficile (Dub.) Fleisch.
Encalypta vulgaris Hedw.
Entosthodon muehlenbergii (Turn.) Fife
(*Funaria glabra*)
Fabronia australis Hook.
Fissidens leptocladus C. Muell. ex Rodw.
Fissidens taylorii C. Muell.
Fissidens vittatus Hook. f. & Wils.
Fossombronia Raddi sp.
Frullania prosbosciphora Tayl.
Frullania squarrosula (Hook. f. & Tayl.) Tayl.
ex Gottsche et al.
Funaria hygrometrica Hedw.
Gigaspermum repens (Hook.) Lindb.
Grimmia laevigata (Brid.) Brid.
Grimmia pulvinata (Hedw.) Sm.
Gymnostomum aeruginosum Sm.
Hypopterygium rotulatum (Hedw.) Brid.
Leptobryum pyriforme (Hedw.) Wils.
Lophocolea bidentata (L.) Dumort.
Lunularia cruciata (L.) Dumort.
Orthotrichum assimile C. Muell.
Orthotrichum cupulatum Hoffm. ex Brid. var.
cupulatum
Polytrichum juniperinum Hedw.
Porella crawfordii Stephani
Pseudoleskeopsis imbricata (Hook. f. & Wils.) Ther.
Racopilum cuspidigerum (Schwaegr.) Aongstr. var.
cuspidigerum
Reboulia hemisphaerica (L.) Raddi
Riccia crystallina L.
Riccia cavernosa Hoffm.
Riccia limbata Bischoff in Gottsche, Lindb. & Nees
Targionia lorbeeriana K. Muell.
Thuidium sparsum (Hook. f. & Wils.) Reichdt.
Tortella cirrhata Broth.
Tortula antarctica (Hpe.) Wils.
Tortula muralis Hedw.
Tortula pagorum (Milde) De Not.
Tortula papillosa Wils.
Tortula ruralis (Hedw.) G.M.S.
Trichostomum brachydontium Bruch.
Triquetrella papillata (Hook. f. & Wils.) Broth.
Weissia controversa Hedw.
Weissia controversa Hedw. var. *gymnostoma* (Dix.)
Sainsb.

Vascular plants

Acacia chalkeri Maiden
Brachychiton populneus (Schott & Endl.) R. Br.
Conium maculatum L.
Cotoneaster glaucophylla Franchet
Eucalyptus globoidea Blakely
Eucalyptus sieberi L.A.S. Johnson
Ficus rubiginosa Desf. ex Vent.
Pinus radiata D. Don
Prunus persica (L.) Batsch
Pyracantha rogersiana Bean
Rosa rubiginosa L.
Verbascum thapsus L.