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Temperate-climate myxomycetes in Australia and the Southern Hemisphere

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Abstract**:** The paper present the results of a new field collection of myxomycetes (plasmodial slime moulds) on dead wood, dead bark and litter substrate in southeast New South Wales centred on Canberra (lat. 35° S, long. 149° E). The sample consists of 96 species from 493 collections. This survey is compared with four other surveys for similar substrates and similar temperate climate: southwest Western Australia, southeast Australia, New Zealand and Patagonia. The assemblages are similar in species composition and abundance, when allowance is made for the large random effect in the sampling. These five southern hemisphere assemblages have been combined into a composite assemblage. This composite assemblage is similar to those of the Iberian Peninsula (Spain and Portugal) and Britain, when allowance is made for the varying sampling of litter. This similarity may represent a single species assemblage occurring in both the Southern and Northern Hemispheres in areas of similar temperate climate.

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Introduction

Myxomycetes (plasmodial slime moulds) are a small group of fungus-like organisms with a two-stage life cycle; a single nucleate phase (amoeboid or flagellated), and a multinucleate (single cell) phase starting as a plasmodium and ending as a fruiting body (containing spores) generally 0.5-2 mm high. Identification is based on the dried fruiting body.

Pre 1995 records of Australian myxomycetes are listed by Mitchell (1995). Subsequent papers on myxomycetes on wood, on bark of dead logs, on dead bark on living trees, and on litter are reported by Ing & Spooner (1994), McHugh et al. (2003), Black et al. (2004), Jordan et al. (2006), Rosing et al. (2007), Davison et al. (2008) McHugh et al. (2009), Knight and Brims (2010), Lloyd (2014), Wellman (2015), Davison et al. (2017) and Wellman (2015, 2016). Myxomycetes on liana material are reported by Wrigley de Basanta et al. (2008), and those associated with snowbanks by Stephenson and Shadwick (2009). Many of these papers primarily increase the known species in Australia, and its states. As a result of these and other studies there is a reasonable species list for Australia. The list is weak mainly in central and northern Australia, and for species on litter.

The next stage in understanding the myxomycetes in Australia is finding the myxomycete species associations in each myxomycete province for each type of substrate. For each species association we need a large enough sample to obtain a reliable species list, with information on the relative importance of each species. This has been addressed to some extent by Wrigley de Basanta et al. (2008) for moist chamber cultures from lianas in tropical rain forests, Stephenson and Shadwick (2009) for the snowbank species, Knight and Brims (2010) for field collection on wood and bark substrate in temperate WA, and by Wellman (2015, 2016) for moist chamber cultures of dead bark across Australia.

Myxomycetes can be collected either by finding and collecting mature fruiting bodies in the field (field collection), or by collecting potential myxomycete substrates that may have spores and/or dormant structures (microcysts), growing the myxomycetes in the laboratory and identifying fruiting bodies that are produced (moist chamber culture). This paper is about myxomycetes obtained by field collection.

Australian myxomycetes are most often collected in the field on dead wood and bark. Analysis of this information is difficult as the species list is long (about one quarter of the myxomycetes species for the World), the species range from rare to common, and their occurrence is variable in time and space. To analyse this data it is necessary to have large samples to allow for random sampling effects. The main object of this paper is to analyse Australian temperate collections with new survey data from SE New South Wales, and compare these results with other temperate areas in the Southern and Northern Hemispheres.

Sampling sites and methods

The collections reported here were from the Australian Capital Territory (ACT) and adjacent south eastern New South Wales (NSW), centred on the city of Canberra (latitude 35° S, longitude 149° E) (Fig. 1). The area is a highland 'plateau' at about 600 m, with some incised gorges, and higher forested ranges to about 1200 m altitude, and a narrow coastal lowland strip 100 km to the southeast. Most of the collections were made within 60 km of Canberra, but a few were made on the coastal strip 150-200 km to the south and to the northwest. The area has a temperate climate. Average rainfall is about 600 mm per year on the plateau, with a higher rainfall to above 1000 mm per year in the higher forested mountains, and on the low altitude coastal strip and its bounding escarpment east of Canberra. Long-term average rainfall is fairly uniform throughout the year, but in any year there can be long periods of weeks or months with no significant rainfall. Most of the wooded area is eucalypt dry sclerophyll forest, with small areas of wet sclerophyll forest, temperate rainforest, or cool rainforest.

In dry sclerophyll forest myxomycetes fruiting bodies can usually be found by field collecting in autumn, and sometimes in late spring or summer. Few fruiting bodies are seen through the winter and early spring because it is too cold. Field collection was carried out a week or more after a suitable rainfall provided that, in the period after the rain, the temperature was not too high and humidity not too low. A forested area was found of suitable dryness; generally the mountains receive more rain, there is more shade, and the moisture evaporates more slowly. At any altitude the northwest slopes had a relatively dry forest while the southeast slopes had a relatively wet forest. Because many fallen trees and branches are difficult to lift because of their mass, much collecting concentrated on logs and branches that had fallen on tracks and roads and been subsequently cut up and moved into the forest, or in areas where there has been complete felling of the *Eucalyptus* or *Pinus radiata* forest in the last few years, but no burning of the residue. Myxomycete fruits are generally found a week or more after rain, on the shaded bottom half of the wood or bark, the last portion that is damp. All species that were found on a site were collected.

In spring and summer the main fruiting events are initiated by 10-50 mm rainfall, separated by weeks or months of none or minor rainfall, but relatively high temperatures and low humidity. Dry sclerophyll forest is in an environment where the common trees (*Eucalyptus* species) provide only 30% shade. Hence dead wood, bark and litter is very dry for much of the warmer half of the year. Most trees are evergreen with relatively thick rigid leaves, so the ground litter of leaves and twigs is packed loosely on the ground, and dries out relatively quickly after rain. Because of the above factors it is relatively easy to collect fruiting bodies of myxomycetes that occur on dead wood or dead thick bark, but relatively difficult to collect those that occur on damp litter. Myxomycetes on litter substrate were collected attached to dead wood/bark where this was close or touching compacted litter (for example on sites 927, 928, 930, 931, 932), with fruiting bodies on bark of the introduced cork oak (*Quercus suber*) where it is resting on its leaves (sites 926, 929), on flood debris of *Casuarina cunninghamiana* wood/bark, in needles and twigs with fruiting bodies on the wood/bark, and sites 917 and 922 with a mixture of *Eucalyptus* branches, leaves and twigs graded off the road with myxomycete fruiting bodies on the wood and leaves.

Field collection sampling may be biased towards species that are obvious (large, brightly coloured, or in a prominent position), or towards species that fruit in the autumn, but against species that occur on litter.

Identification of the dried myxomycete fruiting bodies was carried out mainly using Ing (1999), Stephenson (2003), Poulain et al. (2011), and the website 'Discover Life' (2016). Temporary microscope slides were made by soaking the material in alcohol and 5% KOH solution. Microscope slide mounts of many species were made to study the stalk, peridium, capillitium, and inflated spores by soaking the fruiting body in alcohol, then in 5% KOH solution, in water, and then in 'Brite' mountant (a USA furniture polish used for liverwort slides), and covering with a cover slip. Mounts of members of the Stemonitaceae were made by blowing spores off the fruiting body and putting it horizontally in the air space of a cavity slide. It was not possible to identify some fruiting bodies that were few in number, not mature, or partly colonized by fungi.

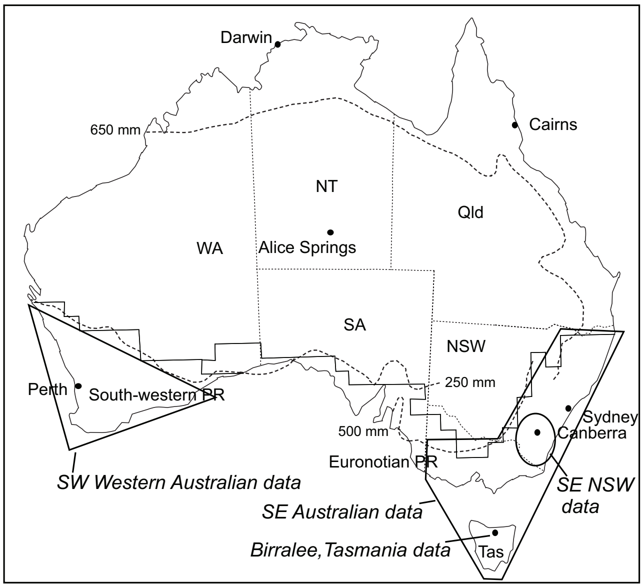

Figure 1. Location of the myxomycete collections. Field samples are discussed for the areas shown – Birralee-Tasmania, SW of Western Australia, SE New South Wales and SE Australia. The extent of the temperate climatic region is thought to be the area of the Euronotian and Southwestern Phytogeographic Provinces, limited approximately by contours of 250 mm and 500 mm mean annual rainfall**.**

Table 1. Species list for southeast New South Wales

The table lists the myxomycete species found, and their sites. The records are tabulated in Table 2 column 3. Western Victorian site 897* is in Table 2 column 4.

Arcyria affinis Rostaf, 931, 1091.

Arcyria cinerea (Bull.) Pers, 725, 753, 768, 821,856, 903, 907, 911, 913, 920, 924, 925, 926, 936, 943, 950.

Arcyria denudata Fr, 684, 903, 929.

Arcyria incarnata (Pers ex J. F Gmel) Pers., 897*, 901, 906, 914, 915, 920, 931, 951.

Arcyria insignis Kalchbr & Cooke, 750, 756, 855, 889, 911, 925, 950.

Arcyria obvelata (Oeder) Onsberg., 821, 832, 856, 897*, 901, 903, 911, 920, 923, 929, 942, 954, 1091.

Arcyria oerstedii Rostaf., 889, 891, 918, 923.

Arcyria pomiformis (Leers) Rostaf., 856, 920, 926.

Arcyria virescens G. Lister, 916.

Badhamia panacea (Fr.) Rostaf., 926.

Ceratiomyxa fruticulosa (Müll.) Mac., 715, 716, 784, 815, 842, 856, 889, 897*, 901, 903, 906, 911, 917, 918, 922, 944, 941, 950, 1092.

Clastoderma debaryanum A. Blytt., 953.

Comatricha alta Preuss., 924, 929.

Comatricha elegans (Racib) G. Lister, 917.

Comatricha ellae Härk., 911, 913, 906, 913 cf.

Comatricha laxa Rostaf., 856, 905, 920, 927.

Comatricha nigra (Pers ex J. F Gmel) J. Schröt., 856, 857, 889, 906, 911, 912, 919, 922, 923, 929.

Comatricha pulchella (C. Bab) Rostaf., 753, 754, 757, 856, 889, 913 aff, 918, 923.

Comatricha subalpina M. L. Farr et S. L Stephenson, 753, 901 cf, 906 cf.

Comatricha vineatilis Nann, -Bremek., 917.

Craterium minutum (Leers) Fr., 673.

Cribraria argillacea (Pers ex J. F Gmel) Pers., 760.

Cribraria cancellata (Batsch) Nann –Bremek., 815, 848, 856, 907, 909, 915, 925, 942, 943, 925, 954.

Cribraria intricata Schrad., 815.

Cribraria microcarpa (Schrad) Pers., 906, 914, 926, 929, 942, 946.

Cribraria mirabilis (Rostaf) Massee, 941, 943.

Cribraria rufa (Roth) Rostaf., 948.

Cribraria splendens (Schrad) Pers., 650, 731, 848, 897*, 909, 918, 923, 944.

Cribraria vulgaris Schrad., 856, 923.

Diacheopsis "parvula" 889 (see Poulain et al. 2011).

Dianema corticatum Lister, 751.

Diderma hemisphaericum (Bull) Hornem., 929.

Diderma radiatum (L.) Morgan, 897*.

Didymium minus (Lister) Morgan, 926.

Didymium nigripes (Link) Fr., 932.

Didymium squamulosum (Alb & Schwein) Fr., 915, 923, 926, 930, 932.

Enerthenema papillatum (Pers) Rostaf., 856, 859, 929.

Fuligo septica (L.) F. H. Wigg., 767, 903, 929, 943, 946, 1093.

Hemitrichia intorta (Lister) Lister, 919, 921 cf.

Hemitrichia leiocarpa (Cooke) Lister, 897* cf, 906, 917, 922, 923.

Hemitrichia serpula (Scop) Rostaf ex Lister, 1091.

Lamproderma arcyrionema Rostaf., 901, 906, 911, 924, 925.

Lamproderma scintillans (Berk & Broome) Morgan, 897*.

Leocarpus fragilis (Dicks.) Rostaf., 930.

Lycogala epidendrum (J. C. Buxb. ex L.) Fr., 784, 814, 856, 859, 903, 924, 945.

Metatrichia floriformis (Schwein) Nann –Bremek., 889, 924, 926, 929, 929, 952, 953.

Oligonema schweinitzii (Berk) G. W Martin, 746.

Paradiachea cylindrica (Bilgram) Hertel ex H. Neubert, Nowotny & K. Baumann, 898.

Paradiacheopsis fimbriata (G. Lister & Cran) Hertel ex Nann –Bremek., 915.

Physarum album (Bull) Chevall, 897*, 909, 911, 913, 914, 953.

Physarum bivalve Pers., 927, 928, 930, 932.

Physarum cinereum (Batsch) Pers., 723, 728, 856, 888, 910, 922, 926, 955.

Physarum compressum Alb, & Schwein, 932.

Physarum contextum (Pers) Pers., 756.

Physarum decipiens M. A. Curtis, 915, 920 cf.

Physarum flavicomum Berk., 679, 784, 846, 906, 907, 909, 912, 918, 922, 924, 925, 929.

Physarum globuliferum (Bull) Pers., 944, 941, 948.

Physarum leucophaeum Fr., 902, 922, 925, 929 943.

Physarum megalosporum T. Macbr., 858.

Physarum notabile T. Macbr., 888.

Physarum oblatum T. Macbr., 944 cf.

Physarum pusillum (Berk & M. A Curtis) G. Lister, 922.

Physarum vernum Sommerf., 932.

Physarum viride (Bull) Pers., 730, 741, 751, 768, 888, 897*, 902, 906, 907, 909, 911, 912, 913, 914, 917, 920, 922, 923, 925, 929, 941, 942, 943, 948, 1093.

Reticularia liceoides (Lister) Nann –Bremek., 857 cf.

Reticularia lycoperdon Bull., 930, 931.

Reticularia olivacea (Ehrenb) Fr., 856.

Reticularia splendens Morgan, 901, 904, 913 cf.

Stemonitis axifera (Bull). T. Macbr., 726, 733, 814, 856, 901, 903, 911, 913, 918, 929, 944.

Stemonitis flavogenita E. Jahn, 913.

Stemonitis fusca Roth, 676, 746, 784, 808, 823, 850, 897*, 903, 911, 920, 923, 947, 950, 1092.

Stemonitis herbatica Peck, 733, 906, 913, 922.

Stemonitis splendens Rostaf., 891, 894, 897*, 902, 906, 926, 929, 944, 949, 1092.

Stemonitopsis amoena (Nann -Bremek) Nann –Bremek., 908, 911.

Stemonitopsis typhina (F. H Wigg) Nann –Bremek., 717, 722, 756, 806, 814, 899, 903, 908, 929,942, 943, 950, 1090, 1093.

Trichia affinis de Bary, 751, 764, 889, 897*, 917, 950.

Trichia botrytis (J. F Gmel) Pers., 818, 824, 893, 925, 952, 953, 954.

Trichia contorta (Ditmar) Rostaf, 932.

Trichia decipiens (Pers.) T. Macbr., 1899. 925, 926, 929, 942, 922 cf, 889.

Trichia erecta Rex, 764.

Trichia persimilis P. Karst, 822, 952.

Trichia scabra Rostaf, 899.

Trichia varia (Pers.) Pers., 684, 744, 750, 754, 756, 848, 888, 927, 929, 953.

Trichia verrucosa Berk., 677, 719, 720, 744, 745, 761, 762, 764, 806, 815, 816, 818, 819, 820, 824, 842, 849, 901, 906, 915, 942, 1091.

Tubifera arachnoidea Jacq., 743, 760, 889.

Willkommlangea reticulata (Alb & Schwein) Kuntze, 917, 931.

Results

Table 1 lists the species identified. *Ceratiomyxa fruticulosa* has been included in the following text and tables although it is in Ceratiomyxaceae. Appendix 1 gives the localities where collections were made.

Extent of the temperate climatic area assemblage of myxomycetes in Australia

The geographic extent of any temperate field collection myxomycete species assemblage cannot be defined by the field collection records, because the records are very sparse near its likely boundary. However traverses across Australia looking at the myxomycetes found by moist culture of dead bark (Wellman, 2016) shows that in NSW the boundary between the temperate and southern arid region assemblages corresponds to the Euronotian/Eremaean Phytogeographic Region boundary, and, to the north, the boundary between other assemblages corresponds to other phytogeographic region boundaries, where these boundaries are from González-Orozco et al. (2014). Hence the most likely extent of the temperate region is one which corresponds to the Euronotian Phytogeographic Region in NSW, Victoria, Tasmania and South Australia, and to the South-Western Phytogeographic Region in Western Australia (Fig. 1). This temperate boundary follows a climatic boundary - the 500 mm mean annual rainfall contour in NSW, and the 250 mm mean annual rainfall contour in South Australia and Western Australia (Fig. 1).

Southern Hemisphere species lists

The extent of the various Australian collections is shown in Figure 1. Table 2 columns 1 to 5 summarize the Southern Hemisphere assemblages of temperate myxomycetes from field collections on dead wood, bark on dead wood and litter. The numbers give abundance estimates from collections or provinces. The following genera have not been included because their fruiting bodies are of small size, so that they are unlikely to be adequately sampled in field collections: *Echinostelium, Licea, Paradiacheopis,* and *Macbrideola,* except *Macbrideola oblonga*.

Table 2. Species assemblages from field collection in temperate climates.

Column 1, near Birralee, Tasmania, from Lloyd (2014), modified in a few details (pers. comm). **Column 2**, SW Western Australia, from Knight and Brims (2010). **Column 3**, SE New South Wales, (from Table 1). **Column 4**, SE Australian data in Australian Herbaria (Australia's Virtual Herbarium, 2016). **Column 5**, New Zealand, (Stephenson, 2003). **Column 6**, Patagonia and Tierra del Fuego, Argentina, South America (Wrigley de Basanta et al., 2010). **Column 7**, Total Southern Hemisphere temperate. Sum of columns 2-6. **Column 8**, Iberian Peninsula, Europe (Lado 1991). **Column 9**, Britain, Europe (Ing, 1999). **Unit in body of table**: **x**, present; **C**, collection; **P**, province; **‰**, number of collections or provinces per 1000. ##, in columns 8 and 9 not all species are listed. *, species that may live partly or wholly on litter. #, *Diderma radiata*; two sites in Tasmania (S.L. Stephenson UARKM 19974, 6482), and one site in Western Victoria - locality 897. **SH**: southern hemisphere **NH**: northern hemisphere

Country	Australia				NZ	Arg		Ibe	Bri
Hemisphere	SH						SH	NH	NH
Column	1	2	3	4	5	6	7	8	9
Area	Tas	WA	SE NSW	SE her	NZ	Pat	SH	## Ibe	## Bri
Collecting unit	C	C	C	C	P	C	‰	‰	‰
Latitude	41	30 35	35 37	33 39	35 47	40 55	30 55	40 51	50 56
Alwisia lloydiae	x								
Arcyria affinis	x	1	1	1	4		4	3	3
Arcyria cinerea	x	11	22	9	11	3	29	14	13
Arcyria denudata	x	3	3	8	10	4	15	14	13
Arcyria ferruginea	x	2		2	3	1	4	8	9
Arcyria glauca	x								
Arcyria globosa			1				0.5	2	
Arcyria incarnata	x	4	8	3	7	1	12	16	13
Arcyria insignis		1	8		3	1	7	1	0.1
*Arcyria major**					1		0.5	3	1
Arcyria minuta		5			1		3	2	3
Arcyria obvelata	x	11	13	7	6	2	21	14	13
Arcyria occidentalis		1					0.5		
Arcyria oerstedii			4		3		4	5	6
Arcyria pausiaca		4					2		
Arcyria pomiformis	x	11	11	2	4	1	15	11	13
Arcyria riparia	x								
Arcyria stipata		2			1		2	1	2
Arcyria virescens			1		2		2		
Badhamia affinis			1	2			2	3	4
*Badhamia apiculospora**					1		0.5		0.3
Badhamia capsulifera		1			2		2	1	5
*Badhamia foliicola**	x	5		7	2		7	14	6
Badhamia goniospora		1					0.5	1	
Badhamia panicea		1					0.5	3	
*Badhamia macrocarpa**					2		1	3	4
*Badhamia melanospora**					1		0.5		
Badhamia nitens	x				3		2		3
Badhamia panicea			1				0.5	3	11
Badhamia utricularis	x	1	1		5		4	9	12
Badhamia versicolor		1	1			1	2	2	2
Badhamia viridescens	x								0.2
Badhamiopsis ainoae			1				0.5	2	0.1
Calomyxa metallica	x	1	4		3	1	5	3	9
Ceratiomyxa fruticulosa	x	10	17	9	16	4	29	11	13
Clastoderma debaryanum	x	4	3		5		6	1	0.7
Colloderma oculatum		2			1		2	2	9
Colloderma robustum	x								
Comatricha alta	x		2	2	2		3	5	5

Column	1	2	3	4	5	6	7	8	9
Area	Tas	WA	SE NSW	SE her	NZ	Pat	SH	## Ibe	## Bri
Comatricha elegans	x	19	9		1		15	7	
Comatricha ellae		9	9	2			11	3	1
Comatricha laxa	x	2	6		3	1	6	7	7
Comatricha longipila		1					0.5		0.8
Comatricha mirabilis									0.1
Comatricha nigra	x	5	11	1	7	15	21	19	13
Comatricha pulchella		2	9		2		7	2	11
Comatricha pulchelloides		1					0.5		
Comatricha rigidirecta		1					0.5		1
Comatricha subalpina	x		3				2		
Comatricha tenerrima		1		1			1	1	7
Comatricha vineatilis		1	2		1		2		
*Craterium aureum**		1			2		2	3	7
*Craterium leucocephalum**		2			1		2	10	9
*Craterium minutum**	x	2	1	1	11		8	8	13
*Craterium obovatum**					2		1		
Cribraria argillacea		1	1		2		2	6	13
Cribraria aurantiaca		1			3	1	3	4	13
Cribraria cancellata	x	9	11	2	8	2	17	9	13
Cribraria dictydioides					1		0.5		0.4
Cribraria intricata			1	2	2		3	1	3
Cribraria macrocarpa	x			1	3		2		2
Cribraria microcarpa		3	6	2	4	1	8	3	1
Cribraria mirabilis		1	2		1		2	1	2
Cribraria persoonii					1		0.5	2	9
Cribraria rufa		3	1			2	3	1	11
Cribraria splendens			7	1	1		5	1	1
Cribraria stellifera cf			2				1		
Cribraria tenella		2					1		2
Cribraria violacea		2	4	1	2		5	3	3
Cribraria vulgaris			2	4	2		4	5	1
*Diachea leucopodia**		12		2	9		12	1	8
Diachea radiata		1					0.5		
*Diacheopsis depressa**					1		0.5		
Diacheopsis 'pavula'			1				0.5		
Dianema corticatum		1	7		2		5	1	2
Dianema depressum	x				2		1	1	3
Dianema harveyi					1		0.5	3	2
Dictydiaethalium	x								
Dictydiaethalium plumbeum	x		1	1	5		4	6	9
Diderma antarcticum						1	0.5		
Diderma asteroides		2		2	2		3	6	1
Diderma chondrioderma				1	2		2	1	4
Diderma cinereum		1		1	1		2	2	0.2
Diderma crustaceum	x	1		2			2		
Didrma deplanatum								1	5
*Diderma donkii**					1		0.5		1
*Diderma effusum**		1		5	2	1	5	3	8
Diderma globosum					1		0.5	3	5
Diderma gracile						5	3		
*Diderma hemisphaericum**		1	1		2		2	5	7
*Diderma miniatum**					1		0.5		
Diderma ochraceum					1		0.5		4

Column	1	2	3	4	5	6	7	8	9
Area	Tas	WA	SE NSW	SE her	NZ	Pat	SH	## Ibe	## Bri
Diderma peyerimhoffi						1	0.5		
Diderma radiatum#				3		1	2	2	2
Diderma robustum						2	1		
Diderma saundersii		1					0.5		
*Diderma spumarioides**				2	1		2	9	7
*Diderma testaceum**					1		0.5	1	2
*Didymium anellus**		1			1		1	3	3
Didymium applanatum	x								0.2
*Didymium bahiense**	x	3		1	5		5	6	
Didymium clavus	x	1		1	3		3	8	10
*Didymium difforme**		5	2	2	5	1	8	13	13
*Didymium dubium**		1		2	2		3	5	1
*Didymium iridis**					1		0.5	2	12
*Didymium megalosporum**		1			6		4		3
Didymium minus			1			2	2	6	5
*Didymium nigripes**	x		1	2	5	1	5	10	13
Didymium perforatum		1					0.5		0.1
*Didymium serpula**		3			1		2	2	4
*Didymium squamulosum**	x	4	7	5	11		14	20	13
Didymium verrucosporum		1					0.5	3	1
Elaeomyxa cerifera	x			2			1	1	0.1
Elaeomyxa reticulospora	x								
Enerthenema papillatum	x	11	16		3		16	9	13
Erionema aureum					1		0.5		
*Fuligo cinerea**		2			2		2	6	2
Fuligo megaspora		1					0.5		0.1
Fuligo septica	x	20	5	39	20	9	49	17	2
Hemitrichia calyculata		1			3		2	1	10
Hemitrichia clavata					1		0.5	5	5
Hemitrichia intorta	x		2				1	1	1
Hemitrichia leiocarpa	x		4	1	2		4	1	0.1
*Hemitrichia minor**		1			3		2	3	6
Hemitrichia serpula					7		4	1	0.3
Hemitrichia velutina	x								
Lamproderma arcyrionema		3	6	1	2	1	7	3	7
Lamproderma collinsii		1					0.5		
Lamproderma columbinum	x			3	2		3		10
Lamproderma echinulatum	x				5	1	3		2
Lamproderma elasticum	x								
Lamproderma						1	0.5		
Lamproderma scintillans		2	0	2	2		3	6	11
*Leocarpus fragilis**	x	8	1	9	7	4	15	14	13
Lepidoderma crassipes				1			0.5		
Lycogala conicum		1					0.5		1
Lycogala epidendrum	x	15	7	16		6	23	25	13
Lycogala exiguum				1	1		1	1	1
Lycogala flavofuscum					3		2	3	3
Macbrideola oblonga		2					1	1	
Metatrichia floriformis	x	4	7		17	12	21		13
Metatrichia vesparium					3		2	5	7
*Mucilago crustacea**	x			1	2		2	14	12
Oligonema flavidum						1	1	1	1
Oligonema schweinitzii		4	1				3	1	4

Column	1	2	3	4	5	6	7	8	9
Area	Tas	WA	SE NSW	SE her	NZ	Pat	SH	## Ibe	## Bri
Paradiachea caespitosa	x	1					0.5		
Paradiachea cylindrica			1				0.5		
Perichaena chrysosperma			1		1	1	2	3	9
Perichaena corticalis		8		1	2		6	7	12
Perichaena depressa		8		1	4	1	7	6	8
Perichaena pedata						1	0.5		1
Perichaena quadrata				1			0.5		
Perichaena vermicularis	x	3	9		2		7	10	5
Physarum album	x	2	5	4	10	5	14	18	13
*Physarum bitectum**		2			2		2	6	6
*Physarum bivalve**		1	5	4	3		7	8	11
*Physarum bogoriense**	x				2		1	1	
*Physarum braunianum**					1		0.5	4	
*Physarum cinereum**		7	7	4	19	1	20	8	10
Physarum citrinum		1			1		1		3
*Physarum compressum**	x	4	2	2	5		7	6	9
Physarum conglomeratum		1					0.5	2	2
Physarum contextum			1				0.5	3	4
Physarum daamsii		1					0.5		
Physarum decipiens		1	3		1		3	6	2
Physarum dictyospermum					1		0.5		
Physarum didermoides					1		0.5	1	3
Physarum famintzinii		1					0.5		
Physarum flavicomum	x		13		3		8	1	
Physarum globuliferum	x		3	2	3		4	1	1
*Physarum gyrosum**					2		1	1	
*Physarum honkongense**					1		0.5		
Physarum lateritium					2		1		1
Physarum lenticulare cf			1				0.5		
Physarum leucophaeum		1	4	1	11	1	9	9	13
*Physarum leucopus**					2		1	3	3
*Physarum licheniforme**					2		1		
Physarum limonium					1		0.5	1	1
Physarum luteolum	x	1					0.5	2	
Physarum megalosporum			1				0.5		
*Physarum melleum**		3		1	3		4	3	
Physarum notabile	x				1		0.5	1	0.5
Physarum nucleatum					1		1		1
Physarum nudum		1					0.5	2	0.2
*Physarum obscurum**					2		1		2
Physarum pezizoideum					2	1	2	4	
*Physarum pusillum**	x	8	1		8		9	8	6
Physarum robustum		1	2		1		2	4	7
Physarum serpula					1		0.5	2	
Physarum sessile		1					1	1	0.2
*Physarum straminipes**		1			2		2	5	3
Physarum vernum		2	1		3	1	4	6	5
Physarum virescens			1				0.5	1	8
Physarum viride	x	23	29	8	14	5	42	6	13
Prototrichia metallica	x				2		1	2	5
Reticularia intermedia		1					0.5		3
Reticularia jurana						5	3		10
Reticularia liceoides			1		2		2		2

Column	1	2	3	4	5	6	7	8	9
Area	Tas	WA	SE NSW	SE her	NZ	Pat	SH	## Ibe	## Bri
Reticularia lycoperdon		2	3	1	4		5	15	13
Reticularia olivacea		1	3				2	3	1
Reticularia splendens			3				2	2	
Stemonaria irregularis				1			0.5		
Stemonaria longa				1			0.5		0.1
Stemonitis axifera	x		12	6	11	9	20	5	12
Stemonitis flavogenita			1	1	1	2	3	4	12
Stemonitis fusca	x	6	13	14	8	11	27	15	13
*Stemonitis herbatica**	x		4	1	4		5	3	6
Stemonitis laxifila		1					0.5		
Stemonitis lignicola	x	3				1	2	1	2
Stemonitis marjana	x								
Stemonitis pallida	x				2		1	1	
Stemonitis smithii		1			1		1	2	2
Stemonitis splendens	x	4	10	1	8	1	13	3	1
Stemonitis virginiensis		2		1	1		2	8	2
Stemonitopsis amoena		2	4				3	2	2
Stemonitopsis gracilis	x	2					1		1
Stemonitopsis hyperopta	x				2		1	2	9
Stemonitopsis peritricha		1					0.5		
Stemonitopsis reticulata		1					0.5		0.1
Stemonitopsis typhina	x	6	13	3	8	1	16	6	13
Symphytocarpus					1		0.5	1	5
Symphytocarpus trechisporus	x								
Trichia affinis	x	8	6	2		18	18	3	13
Trichia botrytis	x	2	8		6	3	10	6	13
Trichia brimsiorum				1			0.5		
Trichia contorta		4	2	2	3	5	8	8	8
Trichia crateriformis					1		0.5		
Trichia decipiens	x	12	9	3	9	13	24	10	13
Trichia erecta			1	1	2		2		
Trichia favoginea		12		3	13	11	21	6	2
Trichia flavicoma						3	2	2	4
Trichia lutescens					3	3	3	3	2
Trichia munda		1		1			1		5
Trichia persimilis		9	2			4	8	3	13
Trichia scabra			1		3		2	5	10
Trichia varia	x	6	10	2	11	1	16	14	13
Trichia verrucosa	x	3	21	11	14	12	32	1	5
Tubulifera arachnoidea	x	4	3	5	8	2	12	8	13
*Willkommlangea reticulata**	x	4	2		5	3	7	2	2

Table 2, column 1. The Tasmanian data of Lloyd (2014) from near Birralee, with a few changes in identification. The data set is very important because it records many species on litter not recorded by other collectors. There are 79 species reported. The collections were all from the field, within 1 km of a house, throughout the year, in the period 2010-2014. They are from a range of forest types, all relatively wet. No abundance information is published.

Table 2, column 2. The Western Australian data is that given by Knight and Brims (2010). The abundance measure given is the number of samples in the herbarium given by Knight and Brims (2010). There are 131 species and 452 records. It is possible that some of these records are from moist culture, but the proportion is small. The herbarium documentation does not distinguish between field collection and moist culture samples.

Table 2, column 3. The SE NSW data is that discussed above. There are 96 species and 493 records.

Table 2, column 4. The SE Australian Herbarium data is that given for the temperate area within Victoria, ACT, Tasmania and NSW in Australia's Virtual Herbarium (2016), with the addition of site 897 in western Victoria from this paper. There are 79 species and 256 records.

Table 2, column 5. The New Zealand data are from Stephenson (2003). There are 153 species and 573 province records. The data set is the best in the Southern Hemisphere in relation to the number of samples, the number of collectors, and the number of years of collecting. The measure of abundance used is the number of provinces for which a species has been reported, as the number of collections is not easily obtained. The effect of using provinces rather than collections is to decrease the relative abundance for the commoner species relative to the rarer species, but the exact effect is unknown so a correction has not been applied.

Table 2, column 6. The Patagonian and Tierra del Fuego data from Argentina are from Wrigley de Basanta et al. (2010). There are 61 species and 216 records. The combined sample is rather small. It is biased to species fruiting over the short collecting time from late January to early February in 2005. The species collected from the two areas are similar, so the data from Tierra del Fuego have been included although it is of much higher latitude (55°S) than any other Southern Hemisphere survey areas.

European species lists

To identify differences and similarities between the temperate field survey species assemblages of the Southern and Northern Hemispheres a suitable Northern Hemisphere data set would have abundance data, be based on 2000 or more records, be collected over a wide range of ecological sites over many years, and be similar to the Southern Hemisphere areas in mean latitude and climate. The best data sets I could obtain are of the Iberian Peninsula (Spain and Portugal), and of Britain. The Southern Hemisphere, Iberian and Britain data sets are listed in Table 2, columns 7, 8 and 9, with the relative abundances expressed as abundance per thousand (collection or province) of the total species assemblage.

Table 2, column 7. This is a Southern Hemisphere temperate mean species assemblage. It is the sum of columns 2-6 expressed as records per thousand. The number of collection/province records is 2170 for the Southern Hemisphere.

Table 2, column 8. The Iberian Peninsula (Spain and Portugal) data used is that of Lado (1991). This dataset contains a small proportion of samples obtained by moist culture (Pando and Lado, 1990). The proportion is less than 80 in 1552 collections (<5%), and is unlikely to affect any of the conclusions given below. There were many collectors of field collection myxomycetes. They cover a large area, with many different habitats, and collected over many years. The range of latitude is 36-44°N, and the range in annual rainfall is generally 400-1000 mm. The measure of species abundance used is the number of provinces where the species has been recorded, out of a total of 59 provinces. The average climate is not a good match for the southern temperate climate as much of the area is too arid. However, most of this collection will be from the wetter areas within the Peninsula bounding ranges and from ranges rising above the plateau, because of the difficulty of field collecting in arid areas.

Table 2, column 9. The species assemblage of Britain is from Ing (1999). The collections are very large in number, the climate and terrain is relatively uniform, and the records cover a long period. The measure of species abundance used is the number of Watsonian vice-counties (the geographical framework for much biogeographic recording in the UK) for which the species has been recorded. There are 8400 vice-county records, over 112 vice-counties. Although this data set is mainly that of field collections, it is likely to have a small proportion of moist culture collections. The range of mean annual rainfall is generally 600-1000 mm, and the summer is relatively cool.

Discussion

Within Southern hemisphere data sets (Table 2 columns 1 to 6) there is reasonable agreement between which species are present, and which are common or rare. This similarity is consistent with the areas being in one Southern Hemisphere temperate 'province' with a uniform species composition.

There are 78 species found in the Southern Hemisphere but not in the Iberian Peninsula, while 84 species found in the Iberian Peninsula have not been found in the Southern Hemisphere. The only common species in the Southern Hemisphere not recorded in the Iberian Peninsula is *Metatrichia floriformis*. Species not yet found in the Southern Hemisphere but which are relatively common in the Iberian Peninsula are: three species which probably have not been collected because their physical appearance is unusual for a well preserved myxomycete *(Amaurochaete atra* (5‰), *Lindbladia tubulina* (6‰) and *Symphytocarpus flaccidus* (4‰)), and five other species: *Comatricha lurida* (5‰), *Diderma trevelyanii* (3‰), *Diderma umbilicatum* (4‰), *Didymium trachysporum* (4‰), and *Hemitrichia abietina*

(4‰). Five species are not very many, and the abundance of these species in the Iberian Peninsula is low. Hence the Southern Hemisphere assemblage is very similar to the Iberian assemblage, with similar species relatively abundant.

The species occurring in the Southern Hemisphere and Britain are remarkably similar. Species that do not occur in Britain are generally rare (1-2‰) in the Southern Hemisphere; except *Diderma gracile* (3‰), *Physarum melleum* (4‰) and *Physarum flavicomum* (8‰). Species that do not occur in Southern Hemisphere but occur in Britain are generally rare in Britain, or species found in an environment poorly collected in the Southern Hemisphere - e.g. tree stumps, and litter. Exceptions to this are *Cribraria piriformis* (9‰), *Diderma floriforme* (5‰), *Lycogala confusum* (3‰), *Lycogala terrestre* (8‰), and *Physarum psittacinum* (6‰). This English data set is very similar in abundant species to the Southern Hemisphere assemblage.

It is not believed that the numbers per thousand for the Southern Hemisphere in Table 2, give the exact abundance of species the field as there is a bias towards samples that are obvious (large, brightly coloured, or in a prominent position) such as *Fuligo septica* (36‰) and *Physarum viride* (35‰). There is also a bias against common, identifiable species such as *Ceratiomyxa fruticosa* which is easily recognized in the field but may not be collected because they are not significant, so that its collected abundance is lower than its actual abundance (Stephenson, 2003). In addition, both in herbarium collections, and in surveys where all species in a locality are collected, there is a bias towards uncommon species. The most commonly seen species have an abundance of 20-25‰ (eg. *Ceratiomyxa fruticulosa, Comatricha nigra, Metatrichia floriformis, Trichia decipiens, Trichia favoginea, Trichia verrucosa*), and species found only once in the Southern Hemisphere have an abundance of 0.5‰ (eg. *Paradiachea cylindrica, Lamproderma collinsii*), giving a ratio of 50:1. This ratio is believed to be far too low; the common species have a much higher relative abundance in the field. In part this is thought to be due to the common species not being adequately collected, and in part due to some of the uncommon species actually being of lower real abundance than in the table, they just happened to be collected. However these comments about the accuracy of the mean abundance are comments about detail; it is believed that the numbers do reflect their relative (but not absolute) abundance in the field.

The combined Southern Hemisphere species assemblage can be used to address the question of whether there are any species that are more common in the Southern than the Northern Hemisphere. *Trichia verrucosa* is very common in the forest of New Zealand (Stephenson, 2003) and southeast New South Wales, and in all the Southern Hemisphere temperate areas except southwest Western Australia (Table 2); so compared with the sparse distribution in the Northern Hemisphere in Discover Life (2015), there is strong evidence that it is more common in the Southern Hemisphere.

There are two extreme models of myxomycete species distribution and their abundance within a climatic zone (assuming a suitable substrate is available). In one model all species do not necessarily occur over the whole extent of the zone and their relative abundance may vary over the zone (varying assemblage); in the other model the species and their abundance is constant within the zone and there are abrupt boundaries at the climatic zone margins (constant assemblage). There is evidence to support both models. Evidence for a varying assemblage is given by distribution maps such as those for Britain and Ireland (Ing, 1982). Evidence for a constant assemblage is given by a study of corticolous myxomycetes on a 3300 km long traverse across Australia, where four species assemblages were found (with transition zones between), each assemblage being constant in composition along its traverse length (Wellman, 2016). If the main effect was that of the varying assemblage, then the rather different average climates of each of the seven species assemblies of Table 2 would result in each area being different in dominant species and their abundance. This does not appear to be so. I think the similarity in the assemblages (in Table 2) is support for the constant assemblage model, with the same temperate assemblage occurring both in the Southern and Northern Hemispheres. However, there are likely to be a few species more common to different regions.

Although the data sets are robust enough for qualitative comparisons, they are not sufficiently uniform in structure to use a statistical comparison. The main limitations are the abundance data not having the same frequency distribution, and the relatively poor sampling of litter substrate species in Spain and the Southern Hemisphere.

Conclusions

1. I present the results of collections of myxomycetes in southeastern New South Wales. These are field collections for wood and bark substrate giving 96 species from 493 collections.

2. Details of six independent collections of field collection myxomycetes from temperate areas of the Southern Hemisphere are tabulated. For the five surveys with an abundance measure, mainly dead wood and bark substrate, the observed species abundances are in rough agreement when allowance is made for a large random sampling error. The rough agreement is consistent with a single temperate species assemblage for the dead wood and bark substrate occurring at each of these five locations. In these five data sets the species that grow on a litter substrate have largely not been collected. The litter species are better represented in the sixth collection from northern Tasmania obtained in a relatively wet forest.

3. The combined data set of the five Southern Hemisphere assemblages is similar to that of the Northern Hemisphere Iberian Peninsula (Spain and Portugal) and Britain, which have similar latitude and similar climate and is consistent with a single assemblage for mid-latitudes with similar temperate climate.

4. The distribution of myxomycetes over a continent could occur as assemblages changing gradually, or as a limited number of constant assemblages with abrupt boundaries. This

paper and Wellman (2016), are consistent with the model of there being a limited number of species assemblages, each assemblage being fairly uniform over its extent, and each occurring around the world in areas of similar climate.

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References

Australia's Virtual Herbarium (2016). *http://avh.chah.org.au* Accessed June 2016.

Black, D.R., Stephenson, S.L. & Pearce, C.A. (2004). Myxomycetes associated with the aerial litter microhabitiat in tropical forests of northern Queensland, Australia. *Systematics and geography of plants* 74: 129-132.

Davison, E.M., Davison, P.J.N. & Brims, M.H. (2008). Moist chamber and field collections of myxomycetes from the northern Simpson Desert, Australia. *Australasian Mycologist* 27: 129-135.

Davison, E.M., Davison, P.J.N., Barrett, M.D., Barrett, R.L., McMullan-Fisher, S.J.M. (2017). Additions to the myxomycota of summer rainfall regions of tropical Australia. *Nova Hedwigia* 104: 47-64.

Discover Life (2015). Discoverlife website, <http://discoverlife.org>, accessed 2016.

González-Orozco C.E., Ebach M.C., Laffan S., Thornhill A.H., Knerr N.J., Schmidt-Lebuhn A.N., et al. (2014). Quantifying phytogeographical regions of Australia using geospatial turnover in species composition. *PLoS ONE* 9(3): e92558. doi:10.1371/journal.pone.0092558

Ing, B., (1982). *A provisional atlas of British myxomycetes*. Huntingdon, Biological Records Centre, Institute of Terrestrial Ecology.

Ing, B. (1999). *The myxomycetes of Britain and Ireland*. The Richmond Publishing Co. Ltd, Slough.

Ing, B. & Spooner, B.M., (1994). Myxomycetes from the Kimberley Region, Western Australia. *Botanical Journal of the Linnean Society* 116: 71-76.

Jordan, C.C., Brims, M.H., Speijers, E.J.; Davison, E.M., (2006). Myxomycetes on the bark of *Banksia attenuata* and *B. menziesii* (Proteaceae). *Australian Journal of Botany* 54: 357–65.

Knight, K.J. & Brims, M.H., (2010). Myxomycota census of Western Australia. *Nuytsia* 20: 283-307.

Lado, C., (1991). Catálogo comentado y síntesis corológica de los myxomycetes de la Península Ibérica e Islas Baleares (1788-1990). *Ruizia, Monografías del Real Jardín Botánico* 9, 1-142. Madrid

Lloyd, S. (2014). *Where the slime mould creeps, the fascinating world of myxomycetes.* Tympanocryptis Press, Birralee, Tasmania.

McHugh, R., Stephenson, S.L., Mitchell, D.W. & Brims, M.H. (2003). New records of Australian myxomycota. *New Zealand Journal of Botany* 41: 487-500.

McHugh, R., Mitchell, D.W., Brims, M.H., & Stephenson, S.L. (2009). New additions to the myxomycota of Australia. *Australasian Mycologist* 28: 56-64.

Mitchell, D.W. (1995). The myxomycota of Australia. *Nova Hedwigia* 60: 269-295.

Pando F. & Lado, C. (1990). A survey of the corticolous myxomycetes in Peninsular Spain and Balearic Islands. *Nova Hedwigia*, 50: 127-137.

Poulain, M., Meyer, M. & Bozonnet, J. (2011). *Les myxomycètes*. Fédération mycologique et botanique Dauphiné-Savoie, Sevrier, 2 volumes.

Rosing, W.C., Mitchell, D.W. & Stephenson, S.L. (2007). Corticolous myxomycetes from Victoria. *Australasian Mycologist* 26: 9-15.

Stephenson, S.L. (2003). *Myxomycetes of New Zealand*. Fungi of New Zealand, Volume 3. Fungal Diversity Research Series 11, Fungal Diversity Press, Hong Kong.

Stephenson, S.L. & Shadwick, J.D.L. (2009). Nivicolous myxomycetes from alpine areas of south-eastern Australia. *Australian Journal of Botany* 57: 116-122.

Wellman, P. (2015). Myxomycetes (slime moulds) of arid and semi-arid areas of northwest New South Wales, Australia. *Cunninghamia*, 15: 153-162.

Wellman, P. (2016). Distinctive corticolous myxomycete assemblages of tropical, temperate and arid regions of Australia. *Cunninghamia*, 16: 101-114.

Wrigley de Basanta, D., Lado, C., Estrada-Torres, A. & Stephenson, S.L., (2010). Biodiversity of myxomycetes in subantarctic forests of Patagonia and Tierra del Fuego, Argentina. *Nova Hedwigia* 90(1-2): 45-79.

Wrigley de Basanta, D., Stephenson, S.L., Lado, C., Estrada-Torres, A, & Nieves-Rivera, A.M. (2008). Lianas as a microhabitat for myxomycetes in tropical forests. *Fungal Diversity* 28: 109-125.

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Appendix 1. The location of the survey sites.
+ Sites that include litter-substrate species.

650, 35° 38.29'S, 149° 54.51'E, 766 m.
673, 35° 38.57'S, 148° 59.18'E, 1213 m.
676, 35° 31.06'S, 149° 32.56'E, 1071 m.
677, 35° 25.90'S, 149° 32.30'E, 1125 m.
679, 35° 26.60'S, 149° 32.67'E, 1121 m.
684, 35° 18.49'S, 148° 39.42'E, 1084 m.
715, 33° 53.60'S, 148° 00.23'E, 389 m.
716, 33° 54.42'S, 147° 55.20'E, 277 m.
717, 33° 58.85'S, 147° 59.02'E, 319 m.
719, 36° 10.65'S, 149° 30.94'E, 1086 m.
720, 36° 10.53'S, 149° 31.27'E, 1084 m.
722, 35° 38.79'S, 149° 31.55'E, 1056 m.
723, 35° 38.86'S, 149° 31.75'E, 922 m.
725, 35° 39.86'S, 149° 31.63'E, 914 m.
726, 35° 41.94'S, 149° 32.26'E, 1046 m.
728, 35° 19.82'S, 149° 02.27'E, 580 m.
730, 35° 31.26'S, 149° 34.29'E, 972 m.
731, 35° 30.32'S, 149° 36.08'E, 955 m.
733, 35° 29.93'S, 148° 45.87'E, 1504 m.
741, 35° 30.92'S, 149° 35.02'E, 1003 m.
743, 35° 29.26'S, 149° 37.11'E, 1002 m.
744, 35° 39.67'S, 148° 56.98'E, 1168 m.
745, 35° 39.80'S, 148° 57.03'E, 1142 m.
746, 35 °39.65'S, 148° 57.31'E, 1122 m.
750, 35° 40.15'S, 148° 50.11'E, 1060 m.
751, 35° 40.66'S, 148° 45.02'E, 1420 m.
753, 35° 29.02'S, 148° 53.84'E, 857 m.
754, 35° 29.06'S, 148° 53.81'E, 862 m.
755, 35° 19.82'S, 149° 02.27'E, 580 m.
756, 35° 44.04'S, 148° 29.11'E, 889 m.
757, 35° 43.16'S 148° 29.73'E, 1138 m.
760, 35° 54.69'S, 149° 02.07'E, 1397 m.
761, 35° 29.96'S, 149° 33.60'E, 1095 m.
762, 35° 30.27'S, 149° 32.83'E, 1087 m.
764, 35° 30.20'S, 149° 33.20'E, 1185 m.
767, 35° 41.08'S, 148° 57.92'E, 1152 m.
768, 35° 22.12'S, 148° 49.92'E, 886 m.
784, 35° 29.80'S, 149° 32.93'E, 1160 m.
806, 35° 23.66'S, 148° 49.67'E, 1123 m.
808, 35° 36 08'S, 149° 54.53'E, 816 m.
814, 35° 31.98'S, 149° 33.20'E, 950 m.
815, 35° 31.93'S, 149° 33.19'E, 956 m.
816, 35° 42.20'S, 149° 16.70'E, 1410 m.
818, 35° 23.45'S, 148° 48.45'E, 1264 m.
819, 35° 43.59'S, 148° 30.60'E, 1250 m.
820, 35° 43.97'S, 148° 30.59'E, 1303 m.
821, 35° 44.41'S, 148° 30.93'E, 1329 m.
822, 35° 38.61'S, 148° 26.65'E, 1117 m.
823, 35° 40.50'S, 148° 44.10'E, 1240 m.
824, 35° 40.85'S, 148° 47.69'E, 1523 m.
832, 35° 04.65'S, 150° 24.55'E, 314 m.
842, 35° 27.37'S, 148° 53.23'E, 932 m.
846, 35° 27.34'S, 148° 53.26'E, 937 m.
848, 35° 26.94'S, 148° 53.35'E, 1066 m.
849, 35° 26.84'S, 148° 53.48'E, 1091 m.
850, 35° 45.57'S, 149° 26.74'E, 1070 m.
855, 35° 18.48'S, 148° 39.41'E, 1004 m.
856, 35° 19.07'S, 148° 03.30'E, 856 m.
858, 33° 17.00'S, 149° 05.38'E, 920 m.
857, 35° 20.16'S, 149° 01.47'E, 659 m.
888, 35° 58.90'S, 148° 37.10'E, 450 m.
889, 34° 58.68'S, 148° 37.16'E, 435 m.
891, 35° 59.00'S, 148° 37.00'E, 420 m.
893, 35° 34.25'S, 149° 53.21'E, 834 m.
894, 35° 35.50'S, 149° 45.40'E, 290 m.
897, 37° 06.19'S, 142° 35.36'E, 202 m.
898, 35° 29.71'S, 149° 36.95'E, 975 m.
899, 35° 34.20'S, 149° 57.97'E, 350 m.
901, 35° 28.23'S, 148° 53.32'E, 877 m.
902, 35° 27.36'S, 148° 53.19'E, 928 m.
903, 35° 36.19'S, 150° 19.45'E, 52 m.
904, 35° 33.10'S, 149° 57.11'E, 789 m.
905, 35° 23.32'S, 148° 48.52'E, 1287 m.
906, 35° 23.30'S, 148° 49.90'E, 1000 m.
907, 35° 21.33'S, 148° 50.14'E, 863 m.
908, 35° 21.76'S, 148° 50.30'E, 834 m.
909, 35° 22.12'S, 148° 49.92'E, 888 m.
910, 35° 19.82'S, 149° 02.27'E, 580 m.
911, 35° 19.00'S, 148° 49.00'E, 971 m.
912, 35° 19.23'S, 148° 48.33'E, 1084 m.
913, 35° 19.00'S, 148° 48.26'E, 1138 m.
914, 35° 19.82'S, 148° 48.17'E, 1190 m.
915, 35° 23.32'S, 148° 48.52'E, 1291 m.
916, 35° 08.80'S, 150° 08.50'E, 580 m.
917, 35° 28. 52'S, 149° 34.27'E, 1034 m.
918, 35° 31.93'S, 149° 33.19'E, 956 m.
919+, 35° 21.90'S, 149° 04.00'E, 670 m.
920, 35° 21.99'S, 149° 03.98'E, 693 m.
921, 35° 28.79'S, 149° 34.47'E, 1061 m.
922+, 35° 29.00'S, 149° 33.40'E, 950 m.
923, 34° 57.91'S, 148° 37.80'E, 405 m.
924, 34° 50.48'S, 148° 37.74'E, 380 m.
925, 34° 58.43'S, 148° 37.76'E, 392 m.
926+, 34° 58.12'S, 148° 37.97'E, 383 m.
927+, 35° 16.80'S, 149° 04.70'E, 598
928+, 35° 19.15'S, 149° 04.15'E, 570 m.
929+, 35° 58.00'S, 148° 38.00'E, 440 m.
930+, 35° 16.80'S, 149° 04.70'E, 598 m.
931+, 35° 17.80'S, 149° 04.50'E, 560 m.
932+, 35° 19.20'S, 149° 04.10'E, 570 m.
944, 35 °18.99'S, 148° 48.93'E, 962 m.
941, 35° 18.96'S, 148° 48.83'E, 966 m.
942, 35° 18.97'S, 148° 48.62'E, 996 m.
943, 35° 23.46'S, 148° 49.60'E, 1102 m.
945, 35° 33.74'S, 149° 59.46'E, 196 m.
946, 37° 17.68'S, 149° 44.45'E, 688 m.
947, 37° 12.84'S, 150° 00.79'E, 20 m.
948, 36° 57.28'S, 149° 54.45'E, 16 m.
949, 36° 48.95'S, 149° 56.01'E, 30 m.
950, 37° 01.32'S, 149° 54.47'E, 85 m.
951, 36° 35.58'S, 149° 27.00'E.5
952, 34° 57.60'S, 148° 49.20'E, 440 m.
953, 34° 58.44'S, 148° 37.80'E, 367 m.
954, 34° 58.44'S, 148° 37.80'E, 367 m.
1090, 36° 33.70'S, 150° 02.20'E, 70 m.
1091, 36° 36.30'S, 151° 02.20'E, 10 m.
1092, 35° 58.00'S, 148° 38.00'E, 440 m.