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Further additions to the genus *Menegazzia* A. Massal. (*Parmeliaceae*) in Australia, with a revised regional key

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Abstract: An identification key to the 39 species of *Menegazzia* recorded for Australia and its offshore islands (including Tasmania) is presented. Distribution patterns are discussed and summarized. Mainland Australia supports 19 species, with seven endemics, and shares 12 species with Tasmania, six with New Zealand and one with South America. The new species, *Menegazzia williamsii* Kantvilas from New South Wales, is described and is characterized by an inflated, fragile, esorediate thallus containing stictic acid but lacking isopigmentosin, 2-spored asci and an inspersed epihymenium. In addition, *M. hypernota* Bjerke, formerly known only from New Zealand, is recorded from Tasmania for the first time.

Key words: biodiversity, lichen chemistry, lichenized fungi, new species, Tasmania, taxonomy

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Introduction

This paper continues the author's study of the genus *Menegazzia* A. Massal., a conspicuous, species-diverse component of the lichen biota of temperate Australasia (Kantvilas 2012*a*, *b*). Previous work concentrated mainly on the island of Tasmania, which, with 31 species, is an undisputed centre of speciation for the genus, especially in the moist cool temperate rainforests dominated by *Nothofagus* Blume. The genus is also well represented in temperate mainland Australia, particularly in upland areas along the eastern seaboard. These Australian species were first treated as a group by James & Galloway (1992) but further species were subsequently added by Kantvilas & Louwhoff (2004), Elix (2007), Kantvilas (2012*b*) and McCarthy & Elix (2017). The most recent checklist of lichens for Australia and its island territories (McCarthy 2018) lists 37 taxa, of which six are recorded solely from the mainland and one is restricted to Lord Howe Island, off the New South Wales coast.

In this paper, two further taxa are added, one of which is new to science, and a key to all the Australian (including Tasmanian) species is presented. A general introduction to the genus, including a discussion of previous research, diagnostic taxonomic characters, and ecological and distributional patterns was provided by Kantvilas (2012*a*) and is not repeated here.

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Material and Methods

This work is based primarily on herbarium specimens held in the Tasmanian Herbarium (HO), National Herbarium of New South Wales (NSW), National Herbarium of Victoria (MEL) and the Queensland Herbarium (BRI). Hand-cut apothecial and thallus sections were routinely mounted in water for observation and measurement, but subsequently eluted with 15% KOH or ammoniacal erythrosin for further examination. Dimensions of ascospores given in the species description are based on at least 50 observations and presented in the format: 5th percentile–*average*–95th percentile, with outlying measurements given in brackets. Routine chemical analysis of all specimens was undertaken using standard methods of thin-layer chromatography (Orange *et al.* 2010); solvent A was the preferred medium.

Medullary Chemistry in *Menegazzia*

After the basic morphological and anatomical characters such as general appearance, presence/absence and morphology of vegetative diaspores, and the number of ascospores per ascus, medullary chemistry is the critical taxonomic character in *Menegazzia*. Thin-

layer chromatography is recommended for routine specimen identification.

The major chemosyndromes were summarized by Kantvilas (2012*a*). The most common chemosyndrome in the Australian region is stictic acid, associated with some or all of a suite of biosynthetically-related compounds that include constictic acid, cryptostictic acid, menegazziaic acid and peristictic acid, some or all often only in trace concentrations, as well as minute traces of norstictic acid and 3-*O*-methylconsalazinic acid. However, there is consistent variation between the presence or absence of particular accessory compounds, such as lecanoric acid, in some taxa. An expanded inventory of chemosyndromes found in Australian and Tasmanian species is presented below.

Ia. Stictic acid syndrome: *M. aeneofusca, M. bjerkeana, M. caesiopruinosa, M. corrugata, M. eperforata, M. fissicarpa, M. fortuita, M. hypogymnioides, M. kantvilasii, M. neozelandica, M. nothofagi, M. platytrema, M. subpertusa, M. subtestacea, M. williamsii*.

Ib. Stictic acid syndrome, plus unknown orange pigments: *M. athrotaxidis*.

Ic. Stictic acid syndrome, plus echinocarpic acid and emodin pigments: *M. caliginosa*.

Id. Stictic acid syndrome, plus isopigmentosin and lacking menegazziaic acid: *M. elongata, M. endocrocea, M. grandis, M. lordhowensis, M. subbullata*.

Ie. Stictic acid syndrome, plus lecanoric acid: *M. myriotrema, M. ramulicola*.

IIa. Norstictic and connorstictic acids: *M. norstictica, M. sanguinascens*.

IIb. Norstictic and connorstictic acids plus lecanoric acid: *M. tarkinea*.

III. Caperatic acid: *M. abscondita, M. confusa*.

IVa. Protolichesterinic and lichesterinic acids, plus skyrin: *M. jamesii*.

IVb. Protolichesterinic and lichesterinic acids, plus secalonic acid: *M. pertransita*.

IVc. Protolichesterinic and lichesterinic acids: *M. minuta*.

V. Lecanoric acid (with cortical usnic acid): *M. globulifera*.

VI. Fumarprotocetraric acid: *M. conica, M. hypernota, M. petraea*.

VII. Unknown fatty acids: *M. inactiva*.

VIII. Alectoronic acid: *M. ultralucens*.

IX. Thamnolic acid, plus calycin: *M. enteroxantha*.

The stictic acid chemosyndrome also predominates in other regions of the world, for example, the temperate Northern Hemisphere (Bjerke 2003), East Asia (Aptroot *et al.* 2003; Bjerke 2004*b*; Moon *et al.* 2006; Bjerke & Sipman 2007), the Caribbean (Bjerke *et al.* 2016) and the Neotropics (Bjerke 2002). However, additional chemosyndromes are also known. For example, hypostictic, hypoconstictic and hyposalazinic acids occur in the New Zealand species *M. testacea* P. James & D. J. Galloway (Galloway 2007) and the South American species *M. dispora* (Nyl. ex Crombie) R. Sant. (Bjerke 2005). Psoromic acid is known from *M. dielsii* (Hillman) R. Sant. (Galloway 2007). Thamnolic acid characterizes *M. wandae* Bjerke from South America (Bjerke 2005) and *M. caviisidia* Bjerke & P. James from Japan (Bjerke 2004*b*). Also described from Japan is *M. squamatica* K. H. Moon *et al.*, which contains squamatic acid (Moon *et al.* 2006). New Guinea taxa appear to be remarkably chemically uniform, with most containing the stictic acid syndrome (Ia above) (James *et al.* 2001), but barbatic acid has been recorded consistently in *M. dissoluta* P. James *et al.* (Bjerke & Sipman 2007) as well as in *M. opuntioides* (Müll. Arg.) R. Sant. from South America (Bjerke 2005).

Distribution Patterns

Continental Australia represents a significant centre of speciation for *Menegazzia* with 20 species, including seven endemics. In comparison, Tasmania has 31 species with 13 endemics (Kantvilas 2012*a*; present paper) whereas New Zealand has 22 species with nine endemics (Galloway 2007; Kantvilas 2012*a*, *b*; present paper). However, on the basis of a cursory examination of herbarium

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collections, additional undescribed taxa occur in the latter region.

Distribution patterns of the species studied are summarized and compared in Table 1, which illustrates, not surprisingly, that continental Australia has the greatest number of species in common with Tasmania. It is noteworthy, however, that no species is shared with New Guinea.

The Australian endemics are all restricted to the coastal upland areas of New South Wales and Queensland where, with the exception of the saxicolous *M. fortuita* Elix & McCarthy, they occur as epiphytes in wet forests, usually dominated by *Nothofagus moorei* (Kantvilas 2012*b*; McCarthy & Elix 2017; G. Kantvilas, pers. obs.). The highly localized *M. lordhowensis* Elix is endemic to Lord Howe Island, an island renowned for its remarkable biota (Hutton 1986), 600 m east of the New South Wales coast. There remain, however, some uncertainties regarding the distributions of a few putatively endemic Tasmanian taxa. For example, Galloway (2007) lists *M. inactiva* P. James & Kantvilas as occurring in New Zealand but no New Zealand specimens of this taxon have been located, and this record is suspected to refer to the subsequently-described *M. abscondita* Kantvilas. Similarly, Bernasconi *et al.* (2002) report *M. kantvilasii* P. James and *M. subbullata* P. James & Kantvilas from South America but these identifications are considered doubtful. In their description of the former, these authors (*op. cit.*) refer to "hooded soralia", which are not present in *M. kantvilasii*, whereas in their description of *M. subbullata*, they do not mention the presence of isopigmentosin, the characteristic chemical marker for that species.

Additions

Menegazzia williamsii Kantvilas sp. nov.

MycoBank No.: MB 829912

Menegazziae elongatae P. James aliquantum similis et item sorediis destitutis, ascis 2-sporis, lobis fragillibus axillis constrictis sed isopigmentosum destituta, acidum menegazziaicum continenti et epihymenio crystallis minutis insperso differt.

Typus: Australia, New South Wales, Point Lookout, 30°29′24″S, 152°24′32·7″E, 1500 m alt., on twigs of *Banksia integrifolia* var. *compar* in scrub dominated by *Banksia* and *Olearia*, 16 April 2011, *M. Renner* 5298 (NSW—holotypus; AK—isotypus).

(Fig. 1)

Thallus loosely adnate, brittle and fragile, up to *c.* 7 cm wide, forming irregular rosettes on trunks and branches, or clasping small twigs, lacking soredia or isidia. *Lobes* 1·5–3 mm wide, loosely imbricate, inflated, mostly constricted at the axils, rather sparsely dichotomously branched as well as with short, toe-like laterals that arise ± perpendicularly to the main lobes. *Upper surface* perforate, grey-white, glossy, commonly streaked with black, especially along the lobe margins, epruinose, emaculate, smooth ± throughout and a little wrinkled only in the oldest parts. *Perforations* scattered, occasional, round, 0·15–0·3(–0·5) mm wide, with margins flush with the thallus surface or somewhat elevated, very rarely turned inwards. *Medullary cavity* byssoid, generally white in younger

TABLE 1. *Distribution patterns of the Australian species of* Menegazzia.

	Mainland Australia	Endemic to mainland Australia	Tasmania	Endemic to Tasmania	Occurring in Australia and Tasmania	Occurring in Australia and New Zealand	Occurring in Australia and South America	Occurring in Australia and New Guinea
Sorediate	5[1]	1	13	3	4	3	1	0
Isidiate	2	1	2	1	1	1	0	0
Sexual only	13[2]	6	16	9	7	2	0	0
Total	20[1]	7	31	13	12	6	1	0

[1]Excludes *M. castanea* which, in Australian territory, is known only from subantarctic Macquarie Island.
[2]Includes *M. lordhowensis*, endemic to Lord Howe Island off the coast of New South Wales.

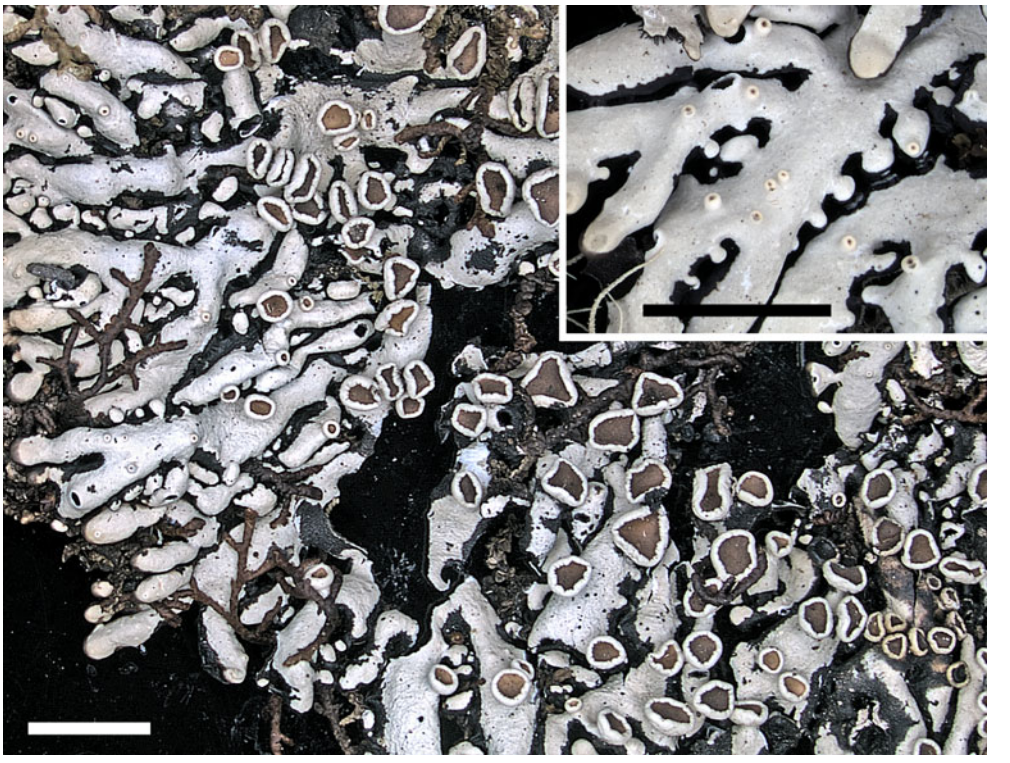

FIG. 1. *Menegazzia williamsii* (holotype). General habit showing inflated, loosely overlapping lobes and apothecia with an entire margin. Inset: toe-like laterals with constricted axils. Scale = 5 mm. In colour online.

lobes, soon becoming blackened in older parts.

Apothecia scattered or clustered, 1·5–3·5 mm wide, shortly pedicellate, rather obconical when young; thalline margin 0·2–0·5 mm thick, not inflated, smooth, glossy and entire, sometimes becoming a little crenulate and/or radially cracked when old; disc orange-brown to brown, epruinose, concave when young, later becoming ± plane. *Hymenium* 90–140 µm thick, orange-brown in the upper part, inspersed with minute crystals that fluoresce in polarized light and dissolve fleetingly yellowish in KOH; asci 2-spored; paraphyses with apices mostly unpigmented, 2–4 µm thick. *Ascospores* ovate to broadly ellipsoid, occasionally becoming brownish, (37–)38–*46·3*–54(–60) × (20–)22–*28·3*–34 µm.

Pycnidia scattered, immersed in the upper surface, mainly near the lobe tips, visible as minute black spots 0·5–0·8 mm wide. *Conidia* filiform to narrowly fusiform, 6–8 × 1 µm.

Chemistry. Atranorin (trace), stictic acid, constictic acid, cryptostictic acid (trace), peristictic acid (trace), menegazziaic acid (trace), 3-*O*-methylconsalazinic acid (trace); medulla K+ yellow, P+ orange, C–, KC–, UV–.

Etymology. This new species is named in honour of the renowned teacher, botanist and field naturalist, John Beaumont Williams (1932–2005), who co-collected some of the material on which the description is based and had an intimate knowledge of the botany of the New England region of northern New South Wales. The author fondly recalls excursions with John in 1988.

Remarks. This new species is highly distinctive, although it combines the salient

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features of several *Menegazzia* species. The fragile, inflated lobes, constricted axils, especially where the toe-like lateral lobes arise, and whitish grey, marginally black-streaked upper surface are all features suggestive of the Tasmanian endemic, *M. elongata* P. James. However, that species differs chemically by containing isopigmentosin and lacking menegazziaic acid (Kantvilas 2012*a*), and anatomically by lacking an inspersed hymenium, features also displayed by the fertile *M. endocrocea* Kantvilas and *M. lordhowensis* Elix, and by the sorediate *M. grandis* P. James and *M. subbullata* P. James & Kantvilas.

The inspersed hymenium is suggestive of *M. platytrema* (Müll. Arg.) R. Sant. and its relatives, *M. confusa* P. James, *M. norstictica* P. James and *M. subpertusa* P. James & D. J. Galloway, but these taxa all have more robust, non-inflated lobes that form neat, radiating rosettes. The abundance of toe-like laterals along the lobes of the new species is not dissimilar to the habit of *M. pertransita* (Stirt.) R. Sant., but that species and its relatives (e.g. *M. jamesii* Kantvilas & Louwhoff) have 8-spored asci. The enigmatic combination of characters displayed by the new species is illustrated by the many and varied species names that have been pencilled onto herbarium specimens in the past.

Distribution and ecology. The new species is highly localized in the Point Lookout area of New England, New South Wales, where it occurs as an epiphyte on trunks, branches and twigs in wet, sclerophyll-dominated scrub and forest, and in *Nothofagus moorei*-dominated rainforest. The author has not had the opportunity to study this species in the field and no additional data regarding associated species or microhabitat can be gleaned from herbarium specimen labels. It is quite remarkable that there are collections of this conspicuous species scattered throughout Australian herbaria spanning 40 years and several different collectors, all from this single locality.

Additional specimens examined. **Australia:** *New South Wales*: New England NP, 1971, *R. D. Seppelt* s. n. (MEL); adjacent to New England NP, *Nothofagus* gully W of radar tower, 30°29′S, 152°19′E, *c.* 1400 m alt., 1988, *R. W. Rogers* 10269 *& J. Williams* (BRI); radar tower near Point Lookout, 30°29′S, 152°20′E, *c.* 1500 m, 1988, *R. W. Rogers* 10233, 10258, 10258a, 10232, 10234a *& J. Williams* (BRI).

Menegazzia hypernota Bjerke

Syst. Biodivers. **2:** 45 (2004); type: New Zealand, Auckland Island, Terror Cove, on *Cassinia*, 10 Jan. 1963, *P. W. James* NZ1032/1, thallus 53 (holotype—BM!).

(Fig. 2)

Thallus loosely adnate, fragile, forming irregular, twig-clasping colonies of rather disorganized lobes, sorediate. *Lobes* 1–3 mm wide, inflated and cylindrical, with numerous, short, toe-like laterals and inflated, discrete apices. *Upper surface* perforate, grey-white, emaculate, smooth, streaked with black along the margins, brownish to black at the lobe apices. *Perforations* scattered, sparse to occasional, roundish, 0·1–0·8 mm wide, with margins flush with the thallus surface or elevated and cylindrical to conical. *Medullary cavity* byssoid, white in the younger lobes, becoming black in older parts. *Soralia* laminal or arising at the margins of the perforations, less commonly apical, ±roundish, 0·5–1 mm wide; soredia coarsely granular.

FIG. 2. *Menegazzia hypernota* (*Kantvilas* 228/16) habit. Scale = 5 mm. In colour online.

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Apothecia not observed in Tasmanian material; asci reported as 2-spored with ascospores 26–32 × 14–18 µm (Bjerke 2004*a*).

Pycnidia not seen.

Chemistry. Atranorin and fumarprotocetraric acid; medulla K−, C−, KC−, P+ red, UV−.

First described from New Zealand (Bjerke 2004*a*), this species is recorded here for the first time from Tasmania. It was collected from the twigs of *Nothofagus cunninghamii* (Hook.) Oerst. in a low, scrubby, alpine rainforest copse, where it grew in a diverse lichen community typical for this situation. Associated lichen species included *Coccotrema cucurbitula* (Mont.) Müll. Arg., *Leifidium tenerum* (Laurer) Wedin, *Lepra truncata* (Kremp.) A. W. Archer & Elix, *Megalospora lopadioides* Sipman, *Menegazzia corrugata* P. James and *Mycoblastus dissimilans* (Nyl.) Zahlbr. Medullary fumarprotocetraric acid is a relatively uncommon chemosyndrome in the Australian region and found only in the fertile, non-sorediate taxa, *M. petraea* Kantvilas and *M. conica* P. James. The Tasmanian specimen is sterile and contains additional traces of two UV+ orange pigments, detectable by TLC. Additional illustrations and descriptive data are given by Bjerke (2004*a*) and Galloway (2007).

Specimen examined. **Australia:** *Tasmania*: Crest Range, 43°17′28″S, 146°30′26″E, 980 m, 2016, *G. Kantvilas* 228/16 (HO).

Key to the species

1 Thallus sorediate or isidiate, with or without apothecia 2
Thallus neither sorediate nor isidiate, usually with apothecia 20

2(1) Thallus isidiate 3
Thallus sorediate 6

3(2) Thallus perforate 4
Perforations absent 5

4(3) Isidia inflated, subglobose, occurring in elevated, coralloid clusters that rupture or abrade and become sorediate; widespread on bark and rocks .. **M. nothofagi**
Isidia knob-like or, more commonly, elongate and cylindrical, simple or coralloid, never becoming sorediate; local in northern NSW rainforest..... **M. bjerkeana**

5(3) Upper surface olive-brown; medulla K−, P−, (protolichesterinic acid); isidia knob-like and resembling minute lobules; forming tiny thalli <1·5 cm wide on twigs; very rare Tasmanian endemic..... **M. minuta**
Upper surface pale olive-green to greyish green, brownish to black-brown at margins and apices; medulla K+ yellow, P+ orange (stictic acid); isidia soon becoming elongate and cylindrical; thallus typically forming rosettes to 8 cm wide on trunks; widespread ..... **M. eperforata**

6(2) Upper surface yellow (usnic acid); soralia mostly in laminal, helmet-shaped vesicles; medulla C+ red (lecanoric acid); restricted to high elevations (Tasmania) ..... **M. globulifera**
Upper surface a shade of brownish grey, grey or grey-green (atranorin); soralia in vesicles, pustules, at the margins of perforations or occurring directly on the upper surface; medullary reactions various but never C+ red..... 7

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7(6) Lobes mostly ≤1·5 mm wide; upper surface brown, brownish green to grey-green; soralia typically congested in the thallus centre, derived from inflated, subglobose to elongate vesicles that become abraded 8
Lobes mostly >1·5 mm wide; upper surface a shade of pale grey; soralia scattered and various (laminal, vesicular or pustular) 9

8(7) Upper surface brownish green to grey-green, conspicuously white maculate, especially towards the lobe apices; soredia sparse; widespread on bark and rocks ..... **M. nothofagi**
Upper surface brown; maculae absent or at most inconspicuous; soredia abundant and eventually spreading across the centre of the thallus; on rocks and soil, known only from the subantarctic islands ..... **M. castanea**

9(7) Medulla and soralia P– 10
Medulla and soralia P+ orange or red 12

10(9) Medulla KC–, UV– (fatty acids); lobes typically very fragile and inflated 11
Medulla KC+ red, UV+ white (alectoronic acid); lobes relatively robust, not markedly inflated ..... **M. ultralucens**

11(10) Containing caperatic acid; medulla in the throat of the perforations and elsewhere sometimes patchily pale orange ..... **M. abscondita**
Containing four unidentified fatty acids; medulla white near the perforations .... **M. inactiva**

12(9) Medulla K–, P+ red (fumarprotocetraric acid) ..... **M. hypernota**
Medulla K+ yellow or yellow→red, P+ orange (stictic, norstictic or echinocarpic acids) 13

13(12) Internal wall of medullary cavity orange-yellow, K+ purple, UV+ orange (emodin pigments); medulla containing echinocarpic acid ..... **M. caliginosa**
Internal wall of medullary cavity white to blackened, never orange and K+ purple; echinocarpic acid absent 14

14(13) Medulla containing isopigmentosin (visible as a yellowish green, UV+ yellow spot on TLC plates) and lacking menegazziaic acid; lobes rather fragile and inflated 15
Isopigmentosin absent; menegazziaic acid present; lobes generally robust 16

15(14) Lobes constricted in sausage-like segments and at the axils, usually unoriented, dispersed or imbricate; soralia laminal or at the inner surface of the margins of the perforations, not vesicular; common in rainforest and subalpine scrub in Tasmania ..... **M. subbullata**
Lobes forming rather loose, radiating rosettes, not sausage-like; soralia arising from elevated vesicles that rupture and flare; localized in New South Wales rainforest ..... **M. grandis**

16(14) Soralia developing from globose, helmet-shaped vesicles; occurring mostly in drier locations ..... **M. caesiopruinosa**
Soralia various, but never in helmet-shaped vesicles 17

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17(16) Margins of perforations conspicuously turned upwards and developing crescent-shaped soralia 18
Margins of perforations ±flush with the thallus surface, generally not sorediate; soralia mostly laminal, scattered and convex..... 19

18(17) Soralia arising from abraded, scattered pustules which become sorediate and resemble perforations; very rare Tasmanian endemic ..... **M. kantvilasii**
Pustules absent and all soralia developed at the margins of elevated perforations.... ..... **M. neozelandica**

19(17) Medulla K+ yellow (stictic acid complex); very common and widespread on bark, wood and rocks ..... **M. subpertusa**
Medulla K+ yellow→red (norstictic acid); rare..... **M. sanguinascens**

20(1) Asci 8-spored..... 21
Asci 2-spored..... 22

21(20) Medullary cavity at the lobe apices white with flecks of a bright yellow, K+ purple pigment (skyrin); highly localized in Tasmania and Victoria ..... **M. jamesii**
Medullary cavity white or suffused yellowish, K– or K+ reddish brown (secalonic acid); widespread and common ..... **M. pertransita**

22(20) Upper surface predominantly brownish, olive-brown, blackish brown or mottled grey-brown 23
Upper surface predominantly pale grey to greenish grey, with brownish tints restricted mainly to lobe apices 27

23(22) Lobes mostly 1·5–3·5 mm wide, mostly somewhat 'puffy' and inflated; apothecia with a swollen pedicel, conical to hemispherical; mostly corticolous at high elevations in Tasmania ..... **M. subtestacea**
Lobes mostly <1·5 mm wide, not inflated; apothecia soon flat and discoid (sometimes absent); exclusively on rocks 24

24(23) Medulla P+ red, K– (fumarprotocetraric acid); rare at high elevations in Tasmania ..... **M. petraea**
Medulla P+ orange, K+ yellow (stictic acid) 25

25(24) Lobes lacking perforations, with apices flattened and concave; very rare at high elevations in Tasmania ..... **M. hypogymnioides**
Lobes perforate, with apices inflated to slightly flattened, not concave 26

26(25) Ascospores 25–50 × 20–36 μm; widespread and common ..... **M. aeneofusca**
Ascospores 55–100 × 35–65 μm; restricted to the sandstone escarpments of eastern NSW ..... **M. fortuita**

27(22) Perforations very numerous and forming a lace-like network; lobes mostly 0·5–1 mm wide, usually markedly flattened to concave at the apices..... ..... **M. myriotrema**
Perforations sparse to abundant, scattered and not forming a lace-like network; lobes much broader, with apices inflated or only slightly flattened 28

28(27) Medullary cavity vivid yellow (calycin); thamnolic acid also present; restricted to the rainforests of NSW and Queensland ..... **M. enteroxantha**
Medullary cavity blackened, white or at most with faintly orange pigment at the tips of the lobes; calycin and thamnolic acid absent..... 29

29(28) Medulla P– (caperatic acid) ..... **M. confusa**
Medulla P+ orange or red (stictic, norstictic or fumarprotocetraric acids)..... 30

30(29) Medulla K– or dull brownish, P+ red (fumarprotocetraric acid); restricted to the rainforests of NSW and Queensland..... **M. conica**
Medulla K+ yellow or yellow→red, P+ orange (stictic or norstictic acids)..... 31

31(30) Medulla K+ yellow→red (norstictic acid) 32
Medulla K+ yellow (stictic acid) 33

32(31) Medulla containing additional lecanoric acid; thallus compact, with very sparse perforations; very rare Tasmanian endemic ..... **M. tarkinea**
Lecanoric acid absent; thallus forming neat, radiating rosettes, typically with numerous perforations; widespread..... **M. norstictica**

33(31) Margin of apothecia 0·5–1·5 mm wide, grossly inflated, corrugated and often obscuring the disc; lobes typically very wide (to 6 mm), inflated and conspicuously wrinkled; endemic to Tasmania ..... **M. corrugata**
Margin of apothecia 0·2–0·5 mm wide, not inflated, entire, crenulate or radially cracked, with the disc clearly exposed; lobes typically 1–4 mm wide, smooth or only slightly wrinkled 34

34(33) Medulla containing isopigmentosin (visible as a yellowish green, UV+ yellow spot on TLC plates) and lacking menegazziaic acid; epihymenium not inspersed .....
..... 35
Isopigmentosin absent, although other orange, UV+ orange pigments may be present; menegazziaic acid present; epihymenium inspersed with minute granules that fluoresce in polarized light and dissolve in KOH 37

35(34) Upper surface greenish, white maculate in the thallus centre; lobes not inflated; perforations sparse; endemic to Lord Howe Island ..... **M. lordhowensis**
Upper surface pale to dull grey, not maculate; lobes inflated; perforations numerous; endemic to Tasmania..... 36

36(35) Lobes forming sausage-like segments with markedly constricted axils, generally unoriented, dispersed or imbricate; epiphytic in wet forest, especially at higher elevations ..... **M. elongata**
Lobes not markedly constricted at the axils, generally in neat or irregular rosettes; restricted to granite rocks on coastal pinnacles ..... **M. endocrocea**

37(34) Apothecia markedly conical and with a distinctly swollen pedicel; restricted to the rainforests of NSW and Queensland..... **M. fissicarpa**
Apothecia generally concave when young and becoming plane, sessile or at most very shortly stalked at maturity 38

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38(37) Medulla containing three orange, UV+ orange pigments; margins of perforations flush with the thallus surface or slightly upturned; restricted to highland areas in Tasmania, mostly on conifers ..... **M. athrotaxidis**
No pigments present; margins of perforations usually flush or turned slightly inwards 39

39(38) Lobes highly fragile and inflated, with numerous toe-like laterals with constricted axils; restricted to northern NSW..... **M. williamsii**
Lobes robust, somewhat flattened and not inflated, lacking toe-like laterals..... 40

40(39) Medulla containing lecanoric acid in addition to stictic acid; thallus with very sparse perforations, typically very compact and enveloping twigs; rare Tasmanian endemic ..... **M. ramulicola**
Lecanoric acid absent; thallus usually with abundant perforations, typically forming neat rosettes; widespread and common, mostly on wood and bark, but sometimes also on rocks..... **M. platytrema**

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