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NOTES ON TASMANIAN RAINFOREST LICHENS

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Introduction

Cool temperate rainforest in Tasmania is composed of forest vegetation dominated by species of *Nothofagus, Eucryphia, Atherosperma, Athrotaxis, Lagarostrobos, Phyllocladus* or *Diselma* (Jarman & Brown 1983). It is found primarily in the wetter western half of the island, with outlying patches occurring in eastern Tasmania and in the north-eastern highlands. The vegetation is thought to be ancient, resembling parts of an early flora which occurred on the supercontinent of Gondwanaland prior to its breakup (Barlow 1981). Today, related forests occur in south-eastern Australia, New Zealand and southern South America. Rainforests in Tasmania contain a diverse, predominantly epiphytic lichen flora which has been the subject of recent investigations (Kantvilas *et al.* 1985; Kantvilas 1985; Kantvilas & James 1987). The present paper summarises the results from some of that work.

Floristics

At the present time 208 lichen species have been recorded from Tasmanian rainforest. Of these, 128 are macrolichens, including 35 fruticose, 76 foliose, 12 squamulose and 5 filamentous species. The remaining 80 species are mainly crustose lichens, but this group is still very poorly known throughout the whole Southern Hemisphere. Thus with further collection and study their number can be expected to more than double in Tasmanian rainforest.

Forty genera of macrolichens are represented, the most common of which are listed in Table 1. The largest of these are *Menegazzia* (14 species), *Pseudocyphellaria* (14), *Psoroma* (12), *Parmelia* s. lat. (11), *Sphaerophorus* (9) and *Collema* (6). Genera which are a major component of the Tasmanian lichen flora as a whole, but which are absent or only poorly developed in rainforest include *Xanthoparmelia, Cladonia* and *Cladia.*

Approximately 27% of the macrolichens have a blue-green algal component whilst a further 21%, including the dominant genera, *Pseudocyphellaria* and *Psoroma,* possess cephalodia (discrete "packages" of blue-green algae). Thus nearly one half of the rainforest macrolichens are capable of nitrogen fixation and may well contribute significantly to the nitrogen budget of the rainforest ecosystem. Studies in other forests of the world, notably in New Zealand and North America (e.g. Green *et al.* 1980), indicate that forest lichens can fix up to 10 kg of nitrogen per hectare per year.

Phytogeography

Approximately 60% of the Tasmanian rainforest lichens consist of species or genera confined to or centred in the southern cool temperate parts of the Southern Hemisphere, i.e. in Tasmania, New Zealand and southern South America. These include the dominant and most diverse genera, *Sphaerophorus, Pseudocyphellaria, Psoroma* and *Menegazzia,* and such smaller genera as *Leioderma, Degelia, Sagenidium, Psoromidium, Roccellinastrum, Siphula* and *Conotremopsis.* These genera tend to have few or no representatives in the Northern Hemisphere. Some wide-ranging genera have distinctly "southern" species, e.g. *Hypogymnia lugubris* and *Nephroma cellulosum.* In general, the Tasmanian rainforest lichen flora displays closest affinities to that found in analogous forests in New Zealand and approximately 76% of the Tasmanian species are common to both regions. 56% of the lichens are shared with the Australian mainland (mainly Victoria) and c. 20% with South America. Only about 5% of the flora is endemic. However, these estimates are likely to change as additional data, particularly from forests outside Tasmania, become available. The overall similarity between the lichen floras of these regions has been explained by their earlier conjunction with Antarctica in the supercontinent of Gondwanaland 80 million years ago. Fossil evidence indicates that *Nothofagus* was once widespread across Australasia, Antarctica and South America, providing evidence for the notion that at least this part of Gondwanaland possessed forests akin to the cool temperate rainforests of today (Barlow 1981). These forests also presumably possessed a lichen flora related to that occurring in such forests now.

Tasmanian rainforest also contains lichens which have "warm temperate" or "Australian" world distributions, e.g. *Cladia* spp., *Gymnoderma melacarpum* and *Baeomyces* spp. In Tasmania, these lichens are best developed in the drier, eucalypt-dominated eastern areas which in the past have seen frequent land connections with mainland Australia. The genera and species of this group tend to be centred in Australia and show some similarities to the floras of South Africa and

India. Tasmania is comparatively impoverished with respect to warm temperate lichens and possesses the more wide-ranging species. In rainforest, many "Australian" lichens are associated with disturbance. For example, *Gymnoderma melacarpum* and *Cladia schizopora* are virtually obligate epiphytes of *Eucalyptus*, a transient component of rainforest, whilst species of *Baeomyces* occur mostly on disturbed earth. Most species tend to be poorly developed in comparison with their lush development in eucalypt forest.

A third group of lichens occurring in Tasmanian rainforest includes cosmopolitan species which occur in most well-wooded, oceanic regions of the world. Examples include *Pseudocyphellaria crocata, Cladonia chlorophaea, C. ochrochlora, C. scabriuscula, Parmelia sinuosa, P. perlata, Lecanora atra, Usnea rubicunda, Thelotrema lepadinum* and *Lepraria incana.* Some of these are ubiquitous, wide-ranging species in Tasmania which only become common in rainforest in disturbed habitats. For example, where rainforest has been cleared for agriculture, isolated remaining trees often lose their typically "Southern Hemisphere" lichens in favour of cosmopolitan "weedy" species.

Distribution and Ecology

Few lichens recorded from rainforest in Tasmania are restricted to this vegetation. The chief factor controlling their distribution in Tasmania appears to be rainfall, and the majority of the species are found in a range of vegetation types occurring roughly within the 1600 mm/year isohyet. However, despite the widespread nature of so many of its constituent species, the rainforest flora is very distinctive, particularly in the presence of certain characteristic lichen communities. Moreover, many widespread species clearly attain their maximum development within rainforest.

Within the forest, the major factors influencing the distribution of lichens appear to be the availability of light, light-related factors such as temperature and exposure to desiccation, moisture availability and the physical properties of the substrate. The vascular plants present and the age of the forest are also important, but their effects can mostly be interpreted in terms of light and substrate characters.

In general, lichens are light-loving plants and consequently the interior of many rainforest communities is too shaded to support well-developed lichen communities. The impression of lushness in the epiphytic flora in most rainforest interiors is largely conveyed by mosses and liverworts, and where lichens are very conspicuous, this is usually because of the proliferation of only a few species, particularly *Pseudocyphellaria subvariabilis.* Thus lichens mostly attain their peak of diversity and luxuriance in more open situations. Similarly lichens tend to be poorly developed in excessively wet micro-habitats but are successful in sites which may dry out temporarily (such as tree canopies) or even in those which remain permanently dry. For example, a very marked wet/dry zonation develops on some old leaning trees and, in these cases, the dry undersides frequently support some of the most diverse, epiphytic communities dominated by the woolly filamentous lichen, *Sagenidium molle,* and several small, crustose species.

The texture, stability and moisture-holding capability of the substrate are responsible for many lichen distribution patterns. Foliose lichens predominate on smooth bark whereas bryophytes and fruticose lichens occur mostly on rough bark. The age of the bark is also important, particularly on those trees which have smooth bark when young but rough bark when old. This change is often associated with shedding of the bark which means that epiphytes in some habitats must be continually replaced. The effect occurs on *Nothofagus cunninghamii,* the tree which supports the most diverse epiphytic lichen flora of all the Tasmanian rainforest trees.

Several lichens show distinct host-preferences but in most cases, this is interpretable in terms of a preference for a particular feature of the bark rather than for the host itself. For example, species of *Sphaerophorus* are best-developed on rough bark, typically on *Nothofagus* or *Phyllocladus,* whilst *Cladonia* is most common on thick, spongy bark such as that of *Eucalyptus* or *Athrotaxis.* However, few lichens are absolutely restricted to a particular host and, when viewed across their entire range, the differences in lichens between different tree species tend to take the form of variations in amounts of a lichen rather than absolute presence or absence.

The vascular plants in the forest determine which microhabitats will be present but, due to poor host-specificity among the lichens, the presence of a particular tree or shrub is often less critical than the presence of certain physical characteristics. For example, differences in the canopy in the general proportions of small leaves such as those of *Nothofagus,* to the relatively larger foliage of *Atherosperma, Phyllocladus* or *Eucryphia* can be related to differences in the lichen flora. The presence or absence of an understorey and the nature of its foliage is also important. Tree ferns and large-leaved shrubs like *Anodopetalum* or *Anopterus* produce a much shadier, low level layer in the forest than do finer-leaved shrubs such as *Archeria* or *Trochocarpa.* Also important is the fact that nearly all Tasmanian rainforests consist entirely of evergreen species which convey a more or less constant density to each layer in the forest throughout the year.

The cover and diversity of lichens increases markedly from the forest floor up to the canopy. In most rainforests, the ground is too shaded to support well-developed lichen communities although the large, foliose, blue-grey species, *Peltigera dolichorhiza* and *Pseudocyphellaria dissimilis,* may be locally common on tree buttresses and logs. The lower parts of young, smooth tree trunks are usually colonised by green foliose species, in particular *Psoroma microphyllizans, Pseudocyphellaria subvariabilis* and *P. delisea,* and by the grey crustose lichen *Thelotrema lepadinum.* The dominant lichens on the low parts of moist rough-barked trunks are usually species of *Sphaerophorus,* e.g. *S. insignis* and *S. melanocarpus* and *Cladia aggregata.* These lichens are fruticose and their shrubby growth form enables them to form tufts which project through the dense mats of mosses and liverworts. The dry, seemingly bare sides of old trees are often inhabited by inconspicuous crustose lichens.

Above this basal zone lies a middle to upper trunk zone. Here the trunks are

much younger and project above the lowest and shadiest layers of foliage, but are nevertheless still shaded by the canopy above. This region is one of potentially high diversity because it features an intermingling of two disjunct floras, that of the base and that of the forest canopy. As well there are several lichens more or less confined to this region. The most conspicuous lichens are species of *Psoroma* and large floppy species of *Pseudocyphellaria*. There may also be an abundance of crustose lichens, particularly on smooth bark.

The uppermost zone of the forest is the canopy. Large, floppy, easily dislodged species of *Pseudocyphellaria* are virtually absent, most lichens are tightly appressed, and crustose lichens are common. Cover and diversity of bryophytes is also markedly reduced. The majority of species, including the dominant canopy genera *Menegazzia, Usnea* and *Parmelia,* are bright grey or pale coloured, presumably as an adaptation to reflecting high light intensities. This contrasts with the lower regions of the forest where most species are green or dark coloured.

The zones described here are broadly overlapping and differ from each other mostly in the relative amounts of species present, rather than in the absolute presence or absence of species. Thus they are not marked by sharp delimitations, but merely as a gradual blending of one type of flora into the next. Furthermore, the zones are not static but vary from tree to tree and place to place, depending on the characteristics of the host and the forest. For example, in very shaded forests, the ground flora may extend upwards onto the lower parts of trees. Conversely, in more open forests such as those which occur at high altitudes, the zones may be displaced downwards so that basal trunk species are either absent or confined to the ground whilst the majority of the lower trunk is occupied by middle zone lichens. Lichens are very finely-tuned to their environment, and it is likely that with a better understanding of their habitat ecology, they could be used to monitor and evaluate the micro-climate of the rainforest interior.

Conservation

Studies in England and western Europe have shown that fragmenting forests into small, isolated stands has a very deleterious effect on their epiphyte floras. It produces a general drying out of the site because of its smaller size, and increases the incidence of "weedy" non-forest species from outside. Indications are that many forest epiphytes lose their reproductive ability and the end result is that the forest flora is literally swamped by opportunistic species from the hinterland. Furthermore, once lost, the chances of a forest epiphyte re-invading the site at a later date is markedly reduced by the increased distance from other forests which may serve as sources of spores.

Whether this fate awaits Tasmania's forests due to man's influence remains to be seen. However, at this moment, there are many natural relict stands of rainforest in the state, such as on Tasman Peninsula, the Wellington Range and the East Coast. These are isolated in a "sea" of eucalypt forest and agricultural land, and are effectively in a similar position to their counterpart relicts in Europe. Their lichen flora already lacks many of the typical rainforest species, e.g. *Sphaerophorus* spp. and *Sagenidium molle,* and several others are often poorly

developed and infertile. Instead, lichens from surrounding vegetation are increasingly abundant.

Many of these rainforest relicts are easily accessible and often constitute the local fern gully and picnic spot. The tenuous foothold which some lichens are struggling to maintain at these sites must be appreciated, for an idle moment of collecting could eradicate a species from that area forever. It is well worth remembering that it is better to be remembered as a great conserver than as a great collector.

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Table 1.

Some more common macrolichen genera in Tasmanian rainforest. (A full key to all species is available in Kantvilas & James 1987).

Genus	No. of species in rainforest	Habitat	Distinguishing features
Baeomyces	2	soil at forest margins	thallus crustose, green or grey, with stalked pink or brownish apothecia (fruiting bodies)
Cladia	2	wood, bark or soil	fruticose; thallus hollow, with numerous holes
Cladonia	c.7	bark or soil, mostly at forest edge	fruticose; branches pointed or cup-shaped, occasionally with red fruiting bodies; arising from a squamulose (scaly) basal thallus
Coenogonium	1	smooth bark in shade	filamentous, forming a yellow-green woolly mat with bright orange apothecia

Collema	6	bark	foliose; dull olive green, very thin, gelatinous when wet
Gymnoderma	1	eucalypt buttresses and logs	fruticose; crowded, tiny, olive-brown branches with black, spherical apothecia
Hypogymnia	4	forest canopy	foliose with elongated lobes, bright grey above, shiny black below
Menegazzia	14	canopy and upper trunk and branches	foliose; upper surface mostly grey with distinct holes
Nephroma	2	trunks and branches, often in semi-shade	foliose; recognised by flat apothecia on the undersides of elongated lobes
Pannoparmelia	1	canopy	foliose; upper surface yellow, lower surface with black, cushion-like tufts of fungal filaments
Parmelia s. lat.	11	canopy and upper trunk and branches	foliose; mostly grey species attached by black "rootlike" structures (rhizines) on lower surface
Parmeliella	1	smooth bark in the understorey	squamulose (composed of leaf-like scales); dull blue-grey
Peltigera	1	forest floor on soil, logs and buttresses	foliose, large blue-grey species with flat apothecia on erect finger-like lobes
Philophorus	1	shaded, mossy trunks	fruticose; brown apothecia borne on bright green stalks, arising from a green crust
Pseudocyphellaria	14	throughout the forest, except in the canopy	foliose, usually very large; under-surface with small white or yellow spots
Psoroma	12	mostly on smooth bark in basal or middle trunk habitats	small foliose or squamulose, very tightly adnate
Sagenidium	1	old fissured dry trunks	filamentous, forming conspicuous woolly white patches
Sphaerophorus	9	mostly near the bases of trunks on rough bark amongst bryophytes	fruticose; branches mostly flattened (except in *S. tener*) with black powdery apothecia (mazaedia) at the underside of the tips
Sticta	4	usually shaded habitats on trunks	foliose; with conspicious white "craters" or holes in the under-surface.
Usnea	5	canopy	fruticose; "old man's beard"; yellowish or grey, pendulous, highly branched thallus

Glossary

apothecium - the fruiting body of a lichen
crustose - having an adpressed crust-like thallus
epiphytic - growing on another plant
filamentous - composed of fine, hair like threads
foliose - flat and leaf-like
fruticose - an erect or pendulous, shrubby growth-form
squamulose - composed of small, leaf-like scales
substrate - the surface on which a lichen grows
thallus - the body of a lichen

SUPERB FRUIT-DOVE IN TASMANIA

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The Super Fruit-dove *Ptilinopus superbus* is considered to be an accidental visitor to Tasmania. Green (1977, p.33) & Sharland (1981, p.92) include it as a Tasmanian species upon the basis of two records; Quamby, September 1872 and Eddystone Point, April 1970. The Queen Victoria Museum has since received two specimens which have been accessed into the research collection as study skins and a short skeleton.

Register number 1981/2/58 was found dead at Emita, Flinders Island by Peter and Jan Allen on 21 May 1981, apparently having killed itself when it flew into a window. It was a sub-adult male weighing 100gm with partially moulted body plumage.

Register number 1988/2/66 was found dead beneath Lambertiania pine trees at "Homewood", Parkham, near Elizabeth Town by Narinda Scott on 12 June 1988. The cause of death was not discernable though it probably died of malnutrition as its stomach was empty and it weighed only 85gm. It was a male with fully ossified skull and, like the previous specimen, body moult was incomplete.

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