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BRITISH LICHEN SOCIETY BULLETIN

PYRENOCARPS ON LST.

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Lichens of the Antarctic cold deserts

It is not generally known that the Antarctic contains a number of dry intensely cold areas which remain largely free of snow and ice. South Victoria Land is an example of an Antarctic cold desert where any snow mostly sublimes without melting or is blown away; others occur near McMurdo Sound. These areas contain very few visible signs of plant or animal life; even the soil is sterile. The principal habitat for life in these areas is actually under the surface of rocks where lichens known as cryptoendoliths occupy pore spaces often to a considerable depth. Only semitranslucent coarsely grained rocks such as weathered sandstones and granite are suitable. The rocks must be broken open in order to see the lichens.

These lichens were first discovered just ten years ago by an American microbiologist, Wolf Vishniac, who designed biological experiments for the Mars Viking landers. Specifically he was in Antarctica to study soil microbiology but also collected rock samples for Imre Friedmann, a specialist in endolithic algae in desert rocks. These samples came from a high elevation Beacon Sandstone formation which had never been visited by biologists. Vishniac unfortunately died in an accident shortly afterwards but the rock samples were retrieved and sent back to the U.S. Friedmann examined the samples and quickly realized that they contained lichens growing entirely under the rock surface. He coined the term cryptoendoliths and started a programme of Antarctic exploration in 1976 which continues to this day. Lichenologists who have participated include Y.Garty, L.Kappen and myself.

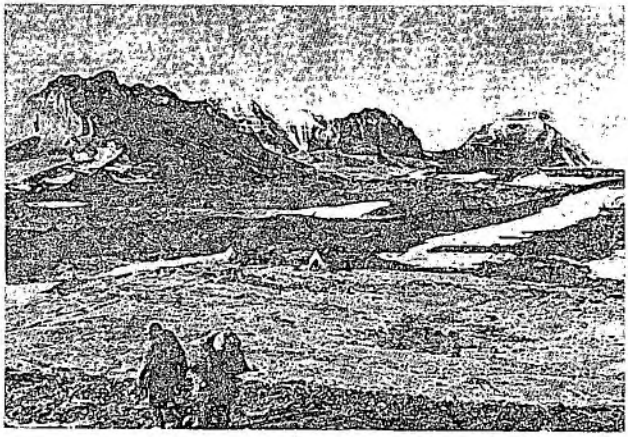
A typical cryptoendolithic lichen has an upper black zone c. 1mm thick, then a 2-4mm white zone and below this a conspicuous green zone. All zones are produced by fungal hyphae and unicellular green algae (often Trebouxia) in symbiotic association. Unidentified colourless bacteria are also regularly present. The zoning suggests the thallus is organised; haustoria and adpressoria are present at the fungal/algal contacts and lichen acids such as norstictic and gyrophoric are produced. The hyphae, which normally form a white woolly web amongst the rock crystals can

become coloured by iron compounds, probably haematite. This may be a result of local solubilizing of cementing substances in the rock. Medullary hyphae can penetrate to 20mm depth.

The life history of these lichens is affected by exfoliation of the rock surface which is partly a result of weathering and partly due to the activity of the organism in the rock. Lichens exposed by exfoliation usually dry out and crumble away. In favoured environments however, such as sheltered ledges, the cryptoendolithic lichens continue to grow on the surface of the rock changing to an epilithic growth form. Morphology changes to an areolate, plectenchymatous thallus and apothecia may develop. Buellia (B.pallida), Lecidea (L.capsulata, L. cf. auriculata), and Acarospora spp. have been identified. Cryptoendoliths may just be growth forms of well-known epilithic species or permanently adapted forms unknown elsewhere.

There is some evidence that the lichens are kept under the rock surface not by aridity or low temperatures but by rapid temperature fluctuations across the $0^{\circ}C$ level caused by gusting winds. In one series of observations lasting 42 min. rock surface temperature moved across $0^{\circ}C$ fourteen times with an amplitude of $7.7^{\circ}C$. Temperatures under the surface of the rock in the lichen zone remained above $0^{\circ}C$ during the same period. The lichens therefore appear to survive in an inhospitable environment without actually experiencing its extremes.

The ecosystem of the dry valley deserts is simple. Blue-green algae and phycobionts are the primary producers, mycobionts may be regarded as consumers, and colourless bacteria as decomposers.



An Antarctic cold desert: Linnaeus Terrace, Wright Valley, Asgard Mountains.

Secondary consumers and predators are absent. The unique adaptive achievement of the cryptoendolithic lichens is the ability of the mycobiont to change its growth form from plectenchymatous (a thick dense tissue) to filamentous while still maintaining thallus organisation and to revert back when conditions so permit. Since 1970 the Antarctic dry valleys have been considered the closest terrestrial equivalent of the Martian environment and hypotheses about the possibility of life on Mars were based on this comparison. Working in the Antarctic setting is like looking back in time 600 million years when all ecosystems functioned without higher forms of life.

The Antarctic cryptoendoliths are baffling, complex organisms and trying to study them in the field can be an exasperating experience. There are so many unanswered questions on their structure, mode of dispersal, metabolism and evolution that it will take many more years of study to understand them. (Note: For further information consult an article in Science 215:1045-1053, 1982 by E.I.Friedmann.).

MASON E. HALE

Report on the New Year meetings, 6-7 January 1984

The conversazione on the Friday evening, attended by 33 people, was a successful venture which we hope to repeat next year. Pleasant surroundings, an excellent buffet, together with a plentiful supply of alcohol, set the stage for the Book Auction. This highlight of the evening was skilfully masterminded by Mark Seaward and Frank Brightman who had no difficulty in persuading members to vie with each other for, amongst other treasures, early issues of the Lichenologist. Prices realised ranged from 20p to £15 or more and a grand total of over £300 was raised for the Society.

Forty-six people attended the A.G.M. After years of stability in the officers ranks there was, for us, quite a shuffling round of responsibilities. Joy Walker took over the mantle of Secretary; Dougal Swinscow filled the vacant post of Auditor; Frank Dobson is gradually taking over the job of Assistant Treasurer and

Chris Hitch, Peter James and Alexander O'Dare were elected onto Council. David Hawksworth is our new Vice-president, while Jack Laundon, after 20 years as Secretary, takes over the reins as President. Under Any Other Business it was noted that Peter James and David Hawksworth intend to put in an application for a grant at the end of the academic year which it is hoped will lead to the production of a new British Lichen Flora. Disappointingly few slides were shown at the end of the A.G.M.

As the talks at the Lecture Meeting, attended by about 80 members and guests, were all of considerable general interest they are reported more fully than usual.

Lichens in medicine

Professor Brian Fox started his talk by reminding us of the historical uses of lichens in medicine, mentioning some of the more horrifying and bizarre remedies, but nevertheless stressing that the medical knowledge of ancient man was the result of centuries of clinical trials, and we should not ignore them. Modern research has shown that usnic acid and evernic acid are active in the control of T.B. Lichenin (a lichen polysaccharide) when given to mice is an anti-tumour agent but has the effect of making the liver of a mouse enlarge and harden. If isolichenin, a closely related substance, is given to mice it still acts as an anti-tumour agent, but without the side effects on the liver. The questions to be answered are 'Why do these substances have this anti-tumour effect?' and 'Why does one produce side effects while its close relative does not?' Professor Fox then turned to plant lectins which can be extracted from a variety of organisms including lichens. Suitably modified, these can be used as stains to pick out different types of cells which would otherwise be indistinguishable from their neighbours. Work is progressing rapidly in this field. Finally Professor Fox spoke about the 'lichen pickers' disease' (a form of contact dermatitis attacking people exposed to both sunshine and lichens), pointing out that the cause of this was not as simple as was first supposed, but different patients react differently to different extracts of the lichen. As our basic knowledge of the biological activities of the many unique substances that lichens produce increases, we may find that there is more truth in their uses in folk medicine than we at present suppose.

Lichens as food

Frank Dobson's talk was lively and entertaining, but to the gourmet cook hoping to learn new recipes, a disappointment. The main culinary purpose today seems to be as an additive to make flour or curry go further or, in the case of Parmelia austrosinensis for covering smells from decaying meat. Lichens are eaten as a delicacy in Japan, but this has led to a conservation problem. In his summing up Dr Seaward commented that, having ordered some lichen soup in Japan, he enquired half way through the meal when it was going to come; he was told that he had already eaten it. During the last war the Russians extracted high quality sugar on a commercial scale from lichens, but the process was very expensive and is now thought to have ceased. There is a different story when we turn to food for stock. Reindeer depend on lichens for their food for about half the year, and conservation measures are taken by the Lapps to prevent over grazing of lichen pasture. The Scandinavians have been reported as saying that pigs and cattle fatten quicker if lichens are mixed with their food. Apparently, partly digested lichen from the musk ox is a great delicacy in the winter months being the only form of green vegetable.

The commercial exploitation of lichens

The main part of Tim Moxham's talk was concerned with his experiences in France, Yugoslavia and Morocco where he was studying lichens in the perfume industry, funded by a Churchill Travelling Fellowship. He spoke of thousands of tons of oakmoss (Evernia prunastri) and treemoss (Pseudevernia furfuracea) being collected and processed annually for use in the industry, both for their fragrance value and their ability to fix other perfumes so that the scent is released slowly from the wearer. The methods of collection and processing have changed little over the last 50 years. The collectors are from the very poorest levels of society and he contrasted the poverty of the collector e.g. gathering 1 kg oakmoss worth 10p takes 1-2 hours, with the affluence and wealth of the consumer. Working conditions in the processing plants with the hot Moroccan air filled with powered lichen dust would give British Health and Safety Officers a fit. Tim ended with a reference to conservation. Few studies have been made of the

growth and recolonisation of the lichens, but in Yugoslavia he was assured that the same area could be picked two or three times a year.

The Exhibition Meeting again attracted more paper exhibits than lichen specimens; soon it will be forgiveable not to bring a hand-lens. The following members are thanked for providing demonstrations.

ASHWELL, R. SEM of Diplotomma spores.
BARON, G. Seychelles lichens.
DALBY, C. The next lichen wall chart.
FOX, B.W. Coll and Tiree visit (photographs).
FOX B.W. Jubilee photographs.
HITCH, C.J.B. Lichens and philately (Lichen Moth stamp)
PURVIS, O.W. Lecanora handelii Steiner first British record.
RICHMOND PUBLISHING: Bookstall.
SEAWARD, M.R.D. Matilda Knowles. (poster)
SWINSCOW, T.D.V. Lichens and statues.

The following exhibit was displayed in 1983 but was accidentally omitted from the published list (Bulletin 52: 1-12):
CHESTER, T.W. Sulgrave Primary school-chidren's study of a disused railway bridge.

Field meetings broadsheet

Council has decided that notices of lichenological field meetings shall in future be published separately from the Bulletin as a broadsheet; the first is enclosed. Dr. C J B Hitch is entirely responsible for its assembly, and production. Please send any information suitable for the broadsheet to Dr. Hitch, The Whin, Snape, Saxmundham, Suffolk 1P17 1QY.

Ed.

Conversazione - Lecture Meeting 1985

Members may like to note in their diaries that the Society proposes holding a further evening Conversazione, book sale and exhibition meeting at the British Museum (Natural History) on Friday, 4 January 1985.

The theme of the afternoon lecture meeting following the A.G.M. on Saturday, 5 January 1985 will be Lichenology outside the

British Isles. We are hoping that this topic will attract some overseas members who might be prepared to speak on lichenology in their particular country. Speakers from overseas will be guests at the Conversazione the previous evening. Any prospective speakers please contact Jack Laundon or myself. Further details of both these events in the next issue.

JOY WALKER

Grapevine

B.L.S. watchdogs were out when David Attenborough tangled with lichens in his T.V. series, the Living Planet. He was, it seems, brought up on a rhyming dictionary that lists liCHen, stitCHin', kitCHen, not liKen, biKin', hiKin'. A day or two later the postman brought him a polite reproof from a B.L.S. council member. Poor David was suitably abashed. Witness his reply: "I'm sorry that I've used a non-U pronunciation. I've always used it, felt myself vindicated by the O.E.D. and so stuck to it. Perhaps it is time I changed but I'm afraid it cannot be for this series, but I will not forget your temperate and expert words". All to the well and good, you may say, even if reminiscent of St. Augustine's prayer, "Please God make me a good boy, but not just yet". The B.L.S. knight has carried the day. And yet.....

Grapevine suspects a chink in the shining Xanthorian armour. The latest O.E.D. states that "the pronunciation liCHen is given in Smart without alternative, and most of the later dictionaries allow it a second place, but it is now rare in educated use". Needless to say, given this expressed attitude, the O.E.D. gives it no place at all. (Perhaps in New-U-Speak, O.E.D. stands for Oxford Educated Dictionary. Grapevine, anyway, has always favoured the other place of learning.) Chamber's 20th Century Dictionary (1981 reprint), a more balanced tome, lists both pronunciations, with liKen in first place.

Two questions, then. First, why uniformity on such a point? Language is an organic affair, and England has steered clear of instituting an Academy. Second, why turn our backs entirely on a pronunciation allied to rural traditions that knew lichens as an integral part of their scenery, even knew them as "the

people of the rocks", and had traditions like the old Scottish warning to seamen not to wear lichen-dyed clothes on voyage, since what came from the rocks would return to them?

Another point raised by the Living Planet is weightier. An extra programme was shown to explain how the miles of material shot was vetted for transmission. A sequence showing lichens was excluded because "They're not photogenic enough". Various people involved with the series have privately expressed unease that some of the scientifically most interesting and surprising sequences weren't considered transmittable for the same reason. Such series give great enjoyment to us all, but they risk becoming armchair naturalism at its laziest and most self-indulgent when they concentrate on the unusual, the outre and the technicolour-photogenic. They end up by distancing "nature's wonders" from anything the average viewer thinks himself likely to encounter. A long way from Charles Kingsley's view of nature as ever at hand for those ready to bother looking about them.

To be fair to Auntie Beeb, however, she has recently put on two or three features of lichenological interest, e.g. God's Little Acre (BBC2, Jan 2). Grapevine's prize for the last six months goes to Radio 4 for The Garden Wall (The Living World, Feb 5) when the North Face and South Face conversed (to occasional church-organ accompaniment) about "centuries of co-ordination between lichens, mosses, birds, insects and small animals" in an attempt to convey the complexity of mural ecology, even if we were told that "fortune must arrange for fungus and alga to meet, if lichen propagation is to occur". So much for soredia, isidia, thalline fragments, etc.

Talking of walls and lichens, one of the best lichen tales Grapevine knows is the tradition at Malham that Charles Kingsley, strolling with a friend one evening below the vast limestone face of Malham Cove suddenly turned and said, "Look at those sooty marks on the rocks. Just like the prints a young chimney-sweep might make rushing from above to escape from something dreadful". Tradition has it that The Water Babies was born thus and that the black marks were lichens. Once again, as with the pronunciation liCHen, Grapevine is happy to defer to tradition.

VINIFERA

Country Diary - 7: Lizard Peninsula

It was one of the hottest days of summer. While the others at Trevithian donned shorts and gym shoes, I reached for climbing boots, thick socks and corduroy trousers. Though we all planned to spend the day on the Lizard, they were heading for the beach at Coverack while I was kitting up for lichen survey work.

The few roads across the peninsula are long and straight, and the level countryside of vast open heaths dotted with pine shelter-belts and airfields reminded me of Breckland. Stopping at Crousa Downs National Nature Reserve I tentatively stepped into a heathland dominated by gorse and dramatic lilac-flowered Cornish heath. The vegetation was so dense there was no possibility of even a Cladonia squamule surviving on the ground, but some scattered gabbro boulders looked promising. A painful journey through gorse revealed they were well covered with lichens which included Parmelia loxodes, Usnea flammea, Buellia verruculosa, Pertusaria pseudocorallina and P.excludens (remembered from Coll/Tiree at Easter). The Parmelia conspersa looked odd and devoid of isidia (. . . Better collect some - could be P.centrifuga, new to Britain - a lot of unusual plants on the Lizard. . . .). Another smaller yellow Parmelia also looked peculiar. Chips of gabbro vanished forever into the deep vegetation, but eventually enough material was collected for a later determination of P. mougeotii.

Further acquaintance with Crousa Downs revealed a mosaic pattern in the moorland imposed by frequent fires, which explains why so little grows on low boulders and why the only terricolous sites of note are tracks on which Baeomyces roseus and Trapeliopsis wallrothii were found. The best boulders turned out to be the largest. On these Parmelia caperata, Physcia tribacea, Candelariella coralliza, Acarospora smaragdula and Aspicilia caesiocinerea occur, often associated with slight bird manuring.

A couple of miles on in a further example of rocky heath, Main Dale NNR, an additional eleven species were encountered. Here I was relieved to find Sphaerophorous globosus, the only lichen mentioned from the Lizard in the Nature Conservation Review, and on the largest boulder, rendered all but inaccessible by gorse, a dense covering of Lasallia pustulata, an extension of its range by 40km according to The Atlas.

A total of 58 lichens from two National Nature Reserves is not impressive, but frequent encounters with clouded yellow butterflies had been a delight. Thirsty, gorse-scoured and slightly dizzy from the heat, I repaired to Coverack for a long swim. Once refreshed, a reconnaissance of Goonhilly Downs NNR in the late afternoon revealed so little in the way of lichen interest that by comparison Crousa Downs seemed almost exciting. Whatever the inland Lizard heathlands are famous for, it certainly is not lichens.

The next day, taking an hour off from a beach party at Kynance Cove, I climbed a rocky hillside and came across three of the great rarities of the south-west, Heterodermia leucomelos, H.obscurata, Cladonia mediterranea. Next time I am down, I'll don shorts and head straight for the coast.

Churchyard leaflet

British Petroleum have kindly given the Lichen Conservation Committee a small grant to cover the cost of printing a series of leaflets. The first of these titled 'Lichens in Churchyards' is enclosed. Additional copies are available from Tony Fletcher, Leicestershire Museum Service, 96 New Walk, Leicester, LE1 6TD. Further leaflets on the use of lichens in dyeing and on aspects of the law affecting lichens are in the process of production.

Keep your remembrance clean

GRAVESTONECLEAN. Simply spray on the stone and wait a few days. The first rainfall will show the astonishing result. Mosses, algae and lichens will be washed away. The stone then shows its original beauty and is protected for months against new attacks.

Advert in the Sunday newspaper 'Sonntagsgrub' 24 April 1984.

RICHARD MULLER

Recent research: Why slugs are faddy lichen grazers

Field observations by James Lawrey showed that a population of slugs inhabiting a rocky wood in Western Virginia, USA, grazed more frequently on certain saxicolous lichens than others. They strongly preferred Aspicilia gibbosa and Lasallia papulosa while mostly rejecting Parmelia baltimorensis and P.cumberlandia. This behaviour pattern can be explained in two ways - either the slugs prefer the more nutritious species or they are avoiding nasty tasting ones regardless of their food value.

To find out which hypothesis produced the best explanation Lawrey analysed the nutritive value of the four lichens as revealed by their content of nitrogen, phosphorus and calcium. Paradoxically the most nutritious species turned out to be those the slugs avoided. By offering the slugs yeast-baited discs of filter paper soaked in acetone soluble lichen extracts from the four species, he then demonstrated that the lichens of nigh nutritive value contained lichen acids which rendered even these normally highly attractive baits unpalatable. Discs soaked in extracts from the Aspicilia and Lasallia however were eagerly grazed. The avoidance hypothesis therefore provided the best explanation of the slugs' grazing pattern. Furthermore, the results suggested that lichens with the highest nutritive value are the ones most likely to produce defence compounds.

This hints at an important ecological role for lichen acids. Though work was not extended to test the effects of individual lichen acids it was shown that the avoided species contained a much wider diversity of secondary compounds and it was also thought that their total phenolic compound content was higher than in the palatable species. It seems that slugs, like children, pay more attention to the taste of food than to its nutritive value.

From Lawrey, J.D. (1983) Lichen herbivore preference: a test of two hypotheses. American Journal of Botany 70(8) : 1188-1194.

(It is hoped to make 'Recent research' a regular feature. Would authors kindly send items for possible inclusion. Ed.)

New mapping card

A new and more comprehensive mapping card has been designed to replace the one introduced sixteen years ago. The card, which can be folded to form four pages, lists 1100 lichen species and 96 commonly found lichenicolous and allied fungi; the lichens are given numbers which cross-reference directly to the computer database at Bradford University, while the non-lichens are unnumbered. NB. When filling-out cards, recorders should only underline (or cross off) the names - the numbers should be free of annotations to facilitate transfer to the computer file.

The nomenclature of the species listed mainly follows that used for the 1980 checklist, but a few changes have proved necessary in the light of recent taxonomic work. Dr. Brian Coppins has kindly supplied the following list of changes:

0062 Arthonia ilicinella Nyl. Examination of type material has shown this to be a distinct species and not a synonym of Arthothelium ilicinum. Differs from latter (to which it is closely related) by smaller spores with only 3-4(-5) transverse septa, and generally smaller ascocarps. Known from W. Scotland and S.W. Ireland.

0074 Arthonia zwackhii Sandst. This species has since been found in Dorset and E. Perthshire. The var. macrospora is mostly of species rank and will be treated in a forthcoming paper by Coppins and James.

0093 Arthopyrenia sublitoralis (Leighton) Arnold. Has large, spherical usually emergent pseudothecia. Spores larger than in A.halodytes. Thallus endolithic. Only on calcareous rocks or barnacles very low down in the littoral zone, often under tangles of seaweed. (A. Fletcher).

0096 Arthothelium reagens (Coppins & P.James) Coppins & P.James. Now regarded as a species distinct from A. ilicinum.

0178 Belonia nidarosiensis (Kindt) P.M.Jørg & Vězda. Syn. Clathroporina calcarea.

0183 Biatorina atropurpurea (Schaerer) Massal. Syn. : Catillaria atropurpurea.

0184 B. neuschildii Körber. Syn.: Catinaria neuschildii
Note: The genus Biatorina also includes Catillaria minuta (not on card) but the status of that species in Britain needs verifying.

0312 Catillaria littorella auct. This entry is for the widely distributed maritime species, which in reality is a Lecania although its correct name has not yet been resolved. The type specimen (from Ireland) of C. littorella (Nyl.) Zahlbr. is a saxicolous form of Catillaria bouteillei.

0426 Cladonia uncialis. Records crossed-off here are presumed to be of subsp. biuncialis unless otherwise instructed. Subsp. uncialis was discovered for the first time in Britain at Culbin Forest (Morayshire) in 1983, and is unlikely to be found outside NE Scotland.

0499 Dirina massiliensis Dur. & Mont. Syn. D.repanda auct.

0500 D.massiliensis f. sorediata (Müll. Arg.) Tehler.
Syn. : D.repanda f. stenhammarii.

s.n. Endococcus alpestris D.Hawksw.See Hawksworth (1983).

s.n. Laeviomyces opegraphae. D. Hawksw.and L.pertusariicola (Nyl.) D. Hawksw. See Hawksworth (1983).

0732 Lecidea icmalea Ach. Member of L. uliginosa group (Placynthiella Gyelnik); treated in forthcoming paper by Coppins and James in Lichenologist.

0806 Lecidoma demissum (Rüstrom) G. Schneider & Hertel.
Syn: Lepidoma demissum.

0832 Leptogium cochleatum (Dickson) P.M. Jorg. Syn:
L. azureum auct. brit.

0862 Megalospora tuberculosa (Fée) Sipman. Syn: Bombyliospora pachycarpa.

0863 Melanolecia jurana (Schaerer) Hertel. Syn: Tremolecia jurana.

0870 Micarea adnata Coppins.

087i M.alabastrites (Nyl.) Coppins. Not a synonym of M.cinerea.

0878 M.intrusa (Th.Fr.) Coppins & Kilias. Syn: Catillaria intrusa, Lecidea aphanoides and L.melaphana.

0881 M.lignaria, var. endoleuca (Leighton) Coppins.

0891 M.subnigrata (Nyl.) Coppins & Kilias. Syn: M.confusula and Catillaria subnigrata.

0894 M. synotheoides (Nyl.) Coppins.

s.n. Mycocalicium subtile (Pers.) Szat. Syn. M.parietinum.

s.n. Mycomicrothelia confusa. D. Hawksw. ined. Syn: Microthelia micula auct. brit.

0943 Opegrapha cinerea Chev. Syn.O.vulgata auct.

s.n. Phaeospora rimosicola (Leighton) Hepp. Syn. Pyrenulella endococcoidea.

s.n. Pectocarpon lichenum (Sommerf.) D. Hawksw Syn: Lichenomyces lichenum.

1177 Porina heterospora (Fink) R.C. Harris.Syn:P.nucula auct.brit.

1199 Psilolechia clavulifera (Nyl.) Coppins. Syn. Micarea clavulifera.

s.n. Pyrenidium actinellum Nyl. Syn: Decampiosphaeria rivana (de Not.) D. Hawksw

s.n. Skyttea buelliae Sherw., D. Hawksw & Coppins.
S.gregaria Sherw., D. Hawksw. & Coppins.
S. nitschkei (Korber) Sherw., D. Hawksw. & Coppins. Syn: Beloniella nitschkei
S. thallophila (P. Karsten) Sherw. & D. Hawksw.

1436 Trapeliopsis percrenata (Nyl.) G. Schneider. See forthcoming paper by Coppins & James in Lichenologist.

1440 Tylothallia biformigera (Leighton) P. James & Kilias. Syn: Catillaria biformigera.

s.n. Vorarlbergia renitens V.J.Grumman.

1526 Xanthoria calcicola Oxner. Syn: X.aureola auct.

The card fulfils two functions: it will be useful for field recording, and also for the storage of records by individuals, data banks, museums, societies, NCC, etc.

Due to the generosity of the World Wildlife Fund, who recognise the importance of our mapping project, the card will be available free of charge to BLS members, but it will be necessary to charge postage. Other researchers and institutions will be supplied with cards at cost.

A proof of the card is illustrated in this Bulletin (annotated by R. Brinklow to indicate the holdings of the BLS herbarium); after correction of a few minor typographical errors and the addition of the WWF logo, the final version should be available from the printers by early June. Orders should be addressed to: Dr. Mark Seaward, School of Environmental Science, University of Bradford, Bradford BD7 1DP.

Grid Ref.

LOCALITY City of Dundee

HABITAT BLS Herbarium

Name BRINKLOW

Date 1990 | V.C.No.

V.C.

Alt. | Code No.

	Abro	bert	0090		saxi	0187	Bryop	gloe	0289	Candelaria		0376		conoid
		micr	0093		sublit	0188	Bryor	bico			conc	0377		conv
		parm	0094	Arthoth	ilic i	0189		capi	0291	Candelariel		0378		cornuta
0004	Acar	amph	0095		dict	0190		chal			laure	0379		cris
0005		atra			lire	0191		furcel	0292		cora	0381		cyat
0008		cerv			orbi	0192		fusc	0296		medi	0383		digi
0010		fusceta	0096		reag	0194		lane	0297		refl	0384		fimb
0011		glau	0097		ruan	0195		nadv	0298		vite	0385		firm
0013		hepp	0099	Arthro	alpi	0198		smit	0299		xant	0386		floe
0014		macr	0100		citr	0199		subc	0300	Cata	cine	0387		foli
0021		rufe			gris	0200	Buel	aeth	0301		lach	0388		frag
0024		sino	0102	Aspi	caes	0203		coni	0304	Catil	anom	0389		furc f
0025		smar	0103		calc	0204		disc	0305		bouy	0390		subr
0030		vero	0104		cinerea	0205		erub	0306		chal	0391		glau
0033	Acro	cong	0107		cont	0207		gris	0307		chlo	0392		grac
0034		gemm	0109		epig	0211		pulverea	0309		contr	0394		incr
0035		macr	0110		flav	0212		punc			epis	0395		lute
0036		salw	0111		gibb	0214		saxo	0310		glob	0396		macil
	Adel	cled	0112		gris	0215		scha	0311		lent	0397		macr
0037	Agon	octo	0113		inso	0216		stel	0312		litt	0399		medi
0038		tris	0115		laev	0217		subd	0316		nigr	0401		meta
0039	Alec	nigr	0116		lepr	0219		verr	0318		pulv	0402		miti
0040		ochr	0117		leuc	0221	Byss	subd	0320		spha	0403		ochr
0041		sarm s	0121		mori	0225	Cali	glau	0323	Catin	gros	0404		para
0042		vexi	0124		subc	0226		parv	0324		laur	0405		phyl
0043	Alla	alpi	0126		supe	0226		sali	0325	Catol	wahl	0406		pleu
0044	Amyg	pelo		Athe	arac	0229		subq	0326	Cave	hult	0407		poci
0045	Anap	cili c	0129	Baci	absi	0231		viri		Cerc	epip	0408		poly
0046		mami	0131		arce	0232	Calo	albo	0327	Cetra	chlo	0409		port
0047		fusc	0132		arno	0236		arnol	0328		comm	0410		pyxi
0048	Anis	bifo	0133		assu	0239		aurantia	0330		deli	0411		rangifer
0049		juis	0135		beck	0240		caes	0331		eric	0412		rangiform
0050	Arct	deli	0136		biat	0241		cerina	0332		hepa	0414		rei
0051	Arthon	arth	0139		carneogl	0242		cerinel	0333		isla i	0415		scab
0052		aspersa	0142		circums	0243		chal	0334		cris	0416		squa s
0053		atla a	0143		cupr	0244		chlo	0336		niva	0417		subs
0054		posi	0144		deli	0246		citr	0337		pina	0420		stre
0055		cine	0145		egen	0247		citr	0338		sepi	0421		subc
		clem	0146		epix	0250		deci	0339	Cetre	oliv	0422		subul
0056		didy	0147		frie	0252		ferr	0341	Chaenotheca		0423		sulp
0058		aleg	0149		hege	0253		fest			brun	0424		symp
0059		endl	0151		herba	0254		flavoru	0342		cart	0426		unci
0060		exil	0153		inco	0255		flavovi	0343		chry	0427		zopf
		fusc	0154		inun	0257		gran	0344		ferr	0429	Clio	arif
		glau	0155		laur	0259		hepp	0345		hisp		Clyp	hypo
0062		ilicinella	0158		musc	0260		herb	0348		stem	0430	Coelo	acul a
0063		impo	0159		naeg	0261		holo	0349		tric	0431		hisp
0064		lapi	0160		obsc	0263		isid	0351	Chaenothecop		0433	Coll	auri
0065		leuc	0161		phac	0264		lact			lign	0434		bach
0067		phae			plum	0265		litt			para	0440		crispu
		punctel	0164		rubg	0266		lute	0354	Chry	cand	0442		cris
0068		punctif	0165		sabu	0267		mari	0355		chlo	0444		fasc
0069		radi	0166		scop	0268		micr	0356		chry	0445		flac
0070		spad	0167		subf	0270		obli	0359	Clad	anom	0446		fluv
0071		stel	0168		subin	0271		obsc	0360		arbu	0447		fragil
0072		tumi	0170		trac	0272		ochr	0361		baci	0448		fragr
0073		vino	0171		vezd	0275		rude	0362		bell	0449		furf
0074		zwac	0172	Bact	cort	0276		sarc	0363		botr	0450		gleb
0075	Arthop	ante	0174	Baeo	plac	0277		saxi	0364		caes	0451		limo
0079		caes	0175		rose	0278		scop	0365		capi	0452		multi
0080		cemb	0176		rufu	0279		stil	0366		cario	0453		nigr
0081		cera	0178	Belonia	inca	0280		subp	0367		carn	0454		occu
0082		cine	0179		nida	0281		teic	0368		ceno	0455		poly
0083		olng	0180		russ	0282		thal	0369		conv c	0457		subfl
0085		halo	0182	Blatorel		0283		ulce	0370		vert	0458		subn
		labu			mona	0284		veri	0371		chlo	0459		tena f
		lapp	0183	Blatorin	atro	0285		vela	0372		cili c	0460		ceran
0086		mone	0184		neus	0286		verr	0373		tenu	0461		cora
0087		oras	0185	Blar	hibe	0287		vire	0374		cocc	0462		vulg
		punc	0186	Brig	fusc	0288		vite	0375		conio	0463		tuni

Grid Ref. | | | | | | |

0464 undu*u*
0465 *gran*
0466 Coni furf/
0468 pall
0469 perc/
0470 sulp
0471 Coris viri/
0472 Corni norm/
Cornut lich
0473 Crypt carn/
0474 Cyph inqu/
0475 nota
sess/
0476 tigi/
0477 Cyst eben/
Dact loba
paras
parel
0478 Dend umha/
0482 Derm
dictyophyllu/
0484 mini*m*/
0485 *comp*/
0486 rivu
0487 webe/
0488 Dict inte
0489 Dime dilu/
0490 lute/
0491 Diplol cane/
0492 Diplosc caes/
0494 musc/
0495 scru/
0496 Diplot albo/
0497 chlo
0498 epip
0499 Dirina mass *m*
0500 *sore*
0501 Ence cere
0502 Endocar adsc
Endoco alpe
pari
prop
rugu
stig
0504 Ente cras/
0506 hutc
0508 Ephe hisp
0509 lana/
0510 Epil scab
0511 Ever prun/
0513 Fulg fulg/
0514 Fusc aust/
0515 cyat *c*/
0516 *cort*
0517 *sore*
0518 goth/
0519 inte
0520 koch/
0521 ligh/
0525 prae
0526 reco
0527 tenu/
0528 Gomp caly/
0529 Graphina
angu/
0531 ruiz/
0532 Graphis eleg/
0533 scri/
0534 Gyale bifo
0535 deri
0536 flot/
0537 fove
0538 gooj/
0539 jene/
0541 trun/
0542 ulmi/
0543 Gyalidea frit
0544 hyal
0547 Gyalideop
arias

0548 musc
0550 Haem caes
0551 elat/
0554 ochr*o*/
0555 *porp*/
0556 vent/
0557 Hert tayl/
0558 Hete leuc/
0559 obsc
Homo pigg
0561 Huil albo/
0562 cine
0563 cons
0564 crus/
0565 flav
0566 glau
0567 hydr/
0568 macr/
0569 meli
0570 nigr
0571 plat
0572 tube/
0573 Hyme lacu/
0574 prev/
0576 Hypoc cara/
0577 frie/
0578 scal/
0579 xant
0580 Hypocy bitt/
0581 inte/
0582 phys/
0583 tubu/
0584 Icma eric/
Illo coral
0585 Iona epul/
0587 hete
0588 mela
0589 odor
0590 suav
Laev opeg
pert
0591 Lasal pust/
0592 Lecanac abie/
0593 absc
0594 amyl
0596 dill/
0597 grum
0598 hemi
0599 homal
0600 lync/
0604 ploc
0605 prem/
0606 suba
0607 umbr
0609 Lecania aipo/
0612 baeo
0613 cyrtella/
0614 cyrtellina
0616 erys*e*/
0617 *sore*
0618 fusc/
0619 myln
0620 ralf
0621 samb
0624 Lecanora
acto/
0626 aite
0627 albes/
0629 andr
0630 atra/
0632 atrosu
0633 badj
0634 caes
0635 camp/
0636 carpi/
0639 chla/
0640 confer
0641 confus/
0643 coniz/
0644 cren/

0646 disp/
0647 epan/
0649 expa/
0652 fugi/
0653 gang/
0654 grum
0655 heli/
0656 intr/
0657 intum/
0658 jame/
0660 lept/
0661 mura/
0663 pall/
0665 pini
0666 polio/
0667 poly/
0669 prae/
0672 pull/
0673 quer
0674 rupi/
0675 salig
0676 salina
0677 samb/
0679 sora/
0680 sten
0682 strob
0683 subau/
0684 subc/
0685 subfus/
0687 subr/
0688 symm/
0689 tena/
0690 vari/
0692 Lecidea aeru/
0693 agla
0695 anti
0697 arme
0699 athr
0701 auri/
0702 bere
0703 botr
0704 brac
0705 caes/
0708 carr
0715 didu
0718 epiz
0719 erra/
0720 eryt
0721 fuli
0722 furv/
0723 fusces
0724 fuscoat/
0726 gela/
0727 gran/
0730 hypn
0731 hypop
0732 icma
0734 imme/
insid
0735 inst
0736 insul/
0737 lact/
0738 lapi/
0739 leuc/
0740 lich
0741 limb
0742 limosa
0743 lith/
0749 metz/
0751 mont/
0755 ocho/
0756 olig
0757 oros/
0761 phae
0764 plan
punc
0766 pycn/
0769 sarc/
0772 sila/
0774 spey
0779 subl
0783 sulp/

supe
0786 torn
0787 turg/
0788 ulig/
0789 umbona
umbonel
0790 vale
0791 vern
0792 viri
vitel
0793 vort
0794 Lecidella
anom
0795 bull
0796 carp
0797 elae*o*/
0798 *sora*
0799 euph
0800 pras
0802 scab/
0803 stig/
0804 subin/
0806 Lecido demi/
0810 Lemph botr
0811 chalazanel
0817 myri
0819 Lepr cras/
0820 inca/
0821 memb/
0822 negl/
0823 zona
0824 Leproc micr/
0825 Leprop chry
0826 xant/
0827 Leptog biat
0828 breb/
0829 brit
0830 burg/
0831 byss
0832 coch
0833 cret
0834 cyan/
0836 hibe
0839 lich/
0840 mass
0841 minu
0842 palm/
0843 plic
0844 satu/
0845 schr/
0846 sinu/
0847 tenu
0848 tere/
0849 turg
Leptorh epid/
isch
Lichenoc
erod
leca
usne
Lichenodi
leca
0851 Lichi conf/
0852 pygm/
0853 Lith toss/
0855 Loba ampl/
0856 laet/
0857 pulm/
0858 scro/
0859 Lopad pezi
0861 Mass carn/
0862 Megal tube
0863 Melanole
jura
Melasp lent
0867 ochr
0868 suba
0869 Mene tere/
Meri lopa
0870 Mica adna
0871 alab
0873 baus

0874 botr
0875 cine
0877 deni/
0878 intr
0879 lepr/
0880 lign/
0881 *endo*/
0882 lutu
0883 melaena/
0884 mise
0885 nits/
0886 pell
0887 pras/
0888 pycn/
0889 stip
0891 subnig
0893 sylv
0894 syno
0895 tern
0896 tube
0897 turf
Microc aren
0898 Microg corr
0900 mode
0901 musc/
0902 sph'ella
0903 sph'oides
Milo grap
0904 Mnia jung
0906 Moel nebu
Muel hosp
lich
pygm
0907 Mycobl affi/
0908 fuca
0909 sang/
0910 ster
Mycoc subt
Mycog myri
Mycom conf
912 Mycopo quer/
Nectria leca
Nectriel robe
tinc
0917 Neph laev/
0918 pari/
Neso oxys
0920 Norm pulc/
0921 Ochr andr/
0922 frig/
0924 inve/
0925 pall/
0926 pare/
0927 subv/
0928 tart/
0929 turn/
0931 Omph eric
0932 grisel
0933 griseop
0934 huds
0935 lute
0938 Opeg atra/
0940 calc
0941 cusa/
0942 chiv/
0943 cine
0944 conf/
0945 cort/
0947 gyro/
0948 herb/
0951 lith
0952 moug
0953 nive/
0954 ochr/
parasi/
0955 parax
pert
0956 pros/
0958 rufe/
0959 saxa/
0960 saxico/
0961 saxig/

0962 sore
0964 vari
0965 verm
0966 viry
0967 zona
0969 Orph atra
0971 Pachyo verr
0972 Pachyph cern
0974 Pann cono
0975 hook
0976 igno
0977 leuc
0978 medi
0979 pezi
0980 rubi
0981 samp
0982 Parmelia acet
0984 arno
0985 borr
0986 brit
0987 cape
0988 cons
0989 crin
0990 deli
0991 disc
0992 disiuv
0993 eleg
0994 endo
0995 exasperata
0996 exasperatul
0997 glab *g*
0998 *fuli*
0999 horr
1000 incu
1001 laci
1002 laev
1003 loxo
1004 mina
1005 moug
1006 omph
1007 past
1008 peri
1009 pull
1010 quer
1011 rudd
1012 reti
1013 revo
1015 saxa
1016 sept
1017 sinu
1018 sore
1019 styg
1020 subaur
1021 subr
1022 sulc
1023 tayl
1024 tili
1026 verr
1027 Parmeliel atla
1028 jame
1029 plum
1030 prae
1031 test
1032 trip
1033 Parmeliop glau
1034 ambi
1035 hype
1036 Parmen chil
1038 Pelti apht
1039 cani
1040 coll
1041 dege
1042 hory
1043 hyme
1045 leuc
1047 memb
1048 neck
1049 poly
1050 prae
1051 rufe
1053 spur
1054 veno
1056 Pert albe *a*
1057 *cora*
1058 amara
1062 ceut
1064 cocc
1066 coral
1068 coro
1069 dact
1070 deal
1071 excl
1072 flavic
1073 flavida
1075 hemi
1076 hyme
1077 lactea
1079 leio
1083 mult
1084 ocul
1085 opht
1087 pert
1089 pseu
1091 pupi
1096 vela
1097 xant
1098 Petr claw
Phacop huus
1100 Phaeog dend
1101 inus
1102 lyel
1103 smit
1105 Phaeoph endo
1106 nigr
1107 orbi
1108 scia
Phaeos para
rimo
1109 Phly agel
1110 orge
Phom cyto
Phra fuckel
pelt
1111 Phyl rosu
1112 Physcia adsc
1113 aipo
1114 caes
1115 clem
1116 dubi
1118 semi
1119 stel
1120 tene
1122 tribacia
1123 tribacioid
1124 wain
1125 Physciop adol
1126 Physcon ente
1127 gris
1129 peri
1130 pulv
1131 Pilo stru
1132 Placi cust
1133 Placop geli
1135 Placynthium flab
1139 nigr
1140 pann
1141 plur
1142 subr
1143 tant
1145 Plati glau
1146 nory
Plec lich
1147 Polyblastia agra
1148 albi
1149 allo
1150 crue
1151 cupu
1152 demi
1153 derm
1155 gela
1157 inum
1158 mela
1162 thel
1164 whel
1165 Polych dend
1166 musc
Polycoc gall
marm
pelt
tryp
1167 Polysp simp
1168 Pori aene
1169 ahle
1170 borr
1171 chlo
1172 cora
1173 curn
1174 guen *g*
1176 *luce*
1177 hete
1178 hibe
1179 inte
1180 lect
1181 lepta
1182 line
1183 mamm
1184 Poro cocc
1186 Prot caly
1188 incr
1189 rupe
1191 Pseudeph dube
1192 Pseudev furf *f*
1193 *cera*
1194 Pseudoc aura
1195 croc
1196 intr
1197 lace
1198 norv
1199 Psil clav
1200 luci
1201 Psora deci
1202 luri
1205 Psorom hypn
1208 Psorot scha
1209 Ptyc flex
1210 xylo
1211 Pycn papi
Pyrenid acti
1219 Pyrenopsis pulv
suba
1220
1221 Pyrenula chlo
1222 derm
1223 laev
1224 macr
1225 negl
1226 nitida
1227 nitidel
1228 Pyrr quer
1229 Raco rupe
1230 Rama bali
1231 cal
1232 cusp
1233 duri
1234 fari
1235 fast
1236 frax
1237 poll
1238 poly
1239 port
1240 sili
1241 subf
1243 Ramon chry
1245 Rhizoc alpi
1246 badi
1249 conc
1250 const
1251 dist
1256 gemi
1257 geog
1262 hoch
1264 lava
1265 leca
1266 obsc
1267 oede
1270 poly
1272 ripa
1276 subg
1279 umbi
1280 viri
1281 Rino atro
1283 bisc
1285 conf
1286 conrad
1287 effl
1288 exig
1289 genn
1291 isid
1293 luri
1294 occu
1295 oxyd
1297 robo
1298 soph
1299 subg
1300 teic
1301 Rocc fuci
1302 phyc
1303 Sagi rhex
1304 Sarcog clav
1305 priv
1306 regu
1307 Sarcopy gibb
1308 Sarcos campe
1309 *macr*
1311 Schaer cine
1313 tene
1315 Schis deco
1316 grap
1317 nive
1318 virg
Scleroc spha
1319 Sclerop circ
1320 Scol chlo
1321 prui
1322 umbr
Scut epib
ster
1323 Siph cera
Skyt buel
greg
nits
thal
1324 Solen cand
1325 holo
1326 vult
1327 Solo bisp
1329 croc
1330 sacc
1331 spon
1332 Sphaerop frag
1333 glob
1334 mela
Sphaerul chlo
Sphin turb
1337 Squa cart c
1338 *pseu*
1340 Stau baci
1341 caes
1343 fiss
1344 hyme
1347 rupi
1348 succ
1349 Stein geop
Steno bryo
byss
sept
1351 Ster cond
1352 dact
1354 deli
1355 evol
1357 nano
1359 pile
1360 saxa
1363 vesu *v*
1364 *nodu*
1365 Stic cana
1366 dufo
1367 fuli
1368 limb
1369 sylv
Stig disp
micr
pelt
1371 Stra micr
1372 mori
1373 ochr
1374 pini
1375 Strig jame
1378 tayl
Taen deli
phae
1381 Telo flav
1382 Thamn verm
1385 Theli deci
1388 impr
1389 inca
1391 meso
1392 micr
1394 papu
1395 pyre
1396 subg
1397 Theloc epib e
1398 *epith*
1399 impr
1400 inte
1401 laur
1404 pall
1406 Thelom ocel
1408 Thelop rubi
1410 Thelot lupu
1411 mono
1412 subt
1414 Thro epig
Tonia gela
lact
1415 Toni arom
1416 caer
1418 cerv
1422 lobu
1423 meso
1425 pulv
1426 squales
1427 squalid
1431 Trapelia coar
1432 invo
1433 moor
1434 obte
1435 Trapeliop glau
1436 perc
1437 wall
1438 Trem atra
Trichon hirt
1440 Tylo bifo
1446 Umbi cyli
1447 deus
1450 hype
1451 polyph
1452 polyr
1453 prob
1455 torr
1456 Usne arti
1458 cera
1460 fili
1461 flam
1462 flor

1464		frag	1481		coer	1498		inte	1514		prom	1525		minu
1465		fulv	1485		dege	1499		kern	1517		stri	1526	Xanthoria	
1466		glabra	1486		ditm	1503		marg	1518		viri v			calc
1467		glabres	1487		dufo	1504		maur	1519		tect	1527		cand
1468		hirt	1488		elae	1505		mela	1520	Vezd	aest	1528		eleg
1469		infl	1489		eric	1506		muco	1521		lepr	1529		fall
1470		rubi	1490		func	1507		mura	1522		reti	1530		pari
1471		subf	1491		fusco	1508		murin		Vorar	reni	1531		poly
1473	Verr	aeth	1492		glau	1509		muta		Voua	lich		Xanthoriic	phys
1474		amph	1493		hall	1510		nigr			unis	1532	Xylo	abie
1476		aqua	1495		hoch	1512		ping			verr	1533		trun
1479		bald	1496		hydr	1513		prae	1524	Wade	dend	1534		viti

A few species not on the mapping card have not been listed, nor have the foreign species present in the Herbarium.

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New Zealand lichens

New Zealand has a richly diverse and well-developed lichen flora, arguably one of the most interesting and best preserved in the world today. Many species are of great size and beauty, and in wetter, forested areas, are often dominant components of the epiphytic and ground vegetation. Overseas lichenologists often find the initial sight of carpets of Cladia retipora (Coral lichen), Cladina confusa (the Southern Hemisphere equivalent of Reindeer lichens), Pseudocyphellaria homeophylla or Siphula spp, quite extraordinary and scarcely believable, but with closer acquaintance, the often remarkable size and luxuriance of many foliose and fruticose lichens is soon taken for granted. For all that, they are common, conspicuous and often splendidly beautiful, New Zealand's lichens have long been the Cinderella group of its flora, disregarded by professional botanists and, except in a few cases, interested amateurs alike. However over the past 10-15 years there has been an awakening of interest in New Zealand's lichens both locally and internationally, and in anticipation of future research into lichen ecology, ecophysiology, sociology, pollution studies and biogeography a detailed flora of lichens known from New Zealand has been compiled.

This was begun at the BM under Peter James's guidance and direction ten years ago, and is now completed and in press in New Zealand. 211 genera are treated encompassing 950 species, probably about 50 of the total lichen flora. Once the complex microlichen flora is adequately known (many years of collection and study are required) one would expect a total of c 2000 species to comprise the lichen flora.

New Zealand's astonishing lichen flora contains centres of speciation in such genera as Megalospora(12), Menegazzia(17), Neuropogon(5), Placopsis(12), Pseudocyphellaria(46), Psoroma(30), Sphaerophorus(11), Siphula (8) and Sticta (13), groups which are often represented in the Northern Hemisphere by only one or a few species.

Lichens were collected in New Zealand by all the early navigators and botanists - the BM for example has specimens collected by Banks and Solander, the Forsters, and by Archibald Menzies. The first New Zealand lichen was described in 1781 and

very many were described in the 19th century, so that when one is faced with compiling a modern flora it is imperative to examine the wide range of early New Zealand material on which the original names were based, and this demands a great deal of herbarium work in mainly European herbaria, though the BM is probably the richest repository of New Zealand type material. Thus it has been that over the past ten years whilst writing the flora, I have spent much more time in London than in New Zealand, a curious but necessary state of affairs.

At the generic level, endemisim in the New Zealand lichen flora is low, slightly less than 1% with only 2 endemic genera (Calycidium and Thysanophoron) both monotypic and both in the Caliciales and both incidentally named by James Stirton. At the species level the order of endemism is roughly 50%, and these two figures together tell us something of the geographical relationships the lichen flora shows, as well as hinting at its great age and isolation, with many species developing on the islands of New Zealand subsequent to its separation from Antarctica and Australia after the breakup of Gondwanaland. It is possible to define 10 different biogeographical elements in the New Zealand lichen flora and the three which give it its special character are the endemic, Australasian and Austral elements, the elements which ally New Zealand most closely with southern South America and with south-eastern Australia. There is a cosmopolitan element (many lichens in lowland, coastal, and urban areas would be quite familiar to a visitor from Britain), a pantropical, a palaeotropical, and a circum-Pacific element and a curious bipolar element which is probably of very great age (developed on old schist mountains in Nelson and Otago, and including Solorina crocea, S. spongiosa and Pannaria hookeri amongst others). The Western Pacific element unites taxa occurring on the Asiatic seaboard, Japan, China, Malaysia, New Guinea, New Caledonia and the east coast of Australia with New Zealand, examples being Cetrelia braunsiana and Thysanothecium scutellatum.

A southern xeric (mediterranean) element defined by winter rainfall - summer drought conditions unites lichens found in the Cape region of South Africa and the deserts of western and southern Australia with lichens in the very driest parts of New Zealand's South Island.

In recent years the main impetus in taxonomic work on New Zealand lichens has been directed towards macrolichen genera. However, the crustose genera provide the main challenge for the future and already several European workers are realising the riches available in New Zealand. Leif Tibell collected genera in the Caliciales in depth during a 10-month stay in 1980-81, and Harrie Sipman and Helmut Mayrhofer have discovered several new taxa in Megalospora sens. lat., and Rinodina respectively. The astonishing diversity of habitats that exists between western and eastern coasts, and between the northern and southern extremities of New Zealand will ensure many lichenological discoveries for many years to come. However this remarkable richness and diversity of New Zealand's lichens is an easily destroyed phenomenon, already atmospheric and terrestrial pollution, hydro-electric power development, changes in land use and especially in management practices in native forests have placed many lichen communities at risk. The great importance of responsible collecting in a country which at first sight appears to possess an over-abundance of living material, cannot be too carefully stressed.

I have been helped by very many people during the preparation of the New Zealand lichen flora and several colleagues in this country and in Europe have contributed specialist accounts of various groups (Peter James Menegazzia, Jack Laundon Leproplaca, Brian Coppins Micarea, Josef Haffelner Brigantiaea, Gunner Degelius Collema, Helmut Mayrhofer Rinodina - for example) and Peter James did a great deal of chemistry, checked keys and helped with proof-reading. Although sponsored by the DSIR as a New Zealand project, were it not for the BM's collections plus help and guidance from colleagues here and abroad, the successful end result could never have been achieved. The Flora is expected to be published in July 1984 by the New Zealand Government Printing Office (Wellington) and will retail for NZ $ 39.95.

DAVID GALLOWAY

Window display composed of birch stems and Cladina
in a dress shop, Kingston-upon-Thames
Photo by Frank Dobson, April,1984.

Detection of didymic acid.

Didymic acid is not readily distinguished from compounds with a similar R_f value when extracts containing this acid are examined by thin-layer chromatography (Bull. Brit.Lichen Soc.46, supplement, May, 1980, p23). The following colour reaction has been found useful in Cladonia to differentiate between species containing thamnolic and barbatic acids, or thamnolic, barbatic and didymic acids.

Alkaline ferricyanide solution: dissolve 0.4g of potassium ferricyanide and 4g of sodium hydroxide in water and dilute to 100ml with water.

Dissolve, or disperse, the residue from the acetone extract of the sample in 2-3 drops of acetone, spot 1 drop of this solution, or mixture, onto filterpaper and allow to dry. Add to the spot 1 drop of alkaline ferricyanide solution; if didymic acid is present a blue spot is produced. The colour reaction may also be given by strepsilin (not available to me) but the two compounds can be identified by thin-layer chromatography. The alkaline ferricyanide reagent can also be used as a spray reagent in thin-layer chromatography.

ALAN ARCHER.

Some Gaelic lichen names

The following information comes from The Gaelic Names of Plants by John Cameron (1900). All the words underlined are in italics in the book.

Peltidea canina - The dog-lichen. Gaelic: lus ghoinnich (from goin, wound; goineach, agonising). This plant was formerly used for curing distemper and hydrophobia in dogs. The name "gearan, the herb dog's-ear," is given in the dictionaries. Probably this name was applied to this plant, meaning a complaint, a groan. Welsh: gerain, to squeak, to cry.

Lecanora - Etymology of this word uncertain (in Celtic, lech or leac, means a stone, a flag). L. tartarea - Cudbear. Gaelic and Irish: corcar or corcur, meaning purple, crimson. Latin: purpura. This lichen was extensively used to dye puple and crimson. It is first dried in the sun, then pulverised and steeped, commonly in urine, and the vessel made air-tight. In this state it is suffered to remain for three weeks, when it is fit to be boiled in the yarn which it is to colour. Formerly, in many Highand districts, the peasants got their living by scraping off this lichen with an iron hoop and sending it to the Glasgow market. MacCodrum alludes to the value of this and the next lichen in his lines -

Cattle on the hills,
Gold on the stones.

Parmelia saxatilis and omphalodes - Stone and heath parmelia. Gaelic and Irish: crotal. These lichens were much used in the Highlands for dyeing a reddish brown colour, prepared like tartarea. And so much did the Highlanders believe in the virtues of crotal that, when they were to start on a journey, they sprinkled it on their hose, as they thought it saved their feet from getting inflamed during the journey. Welsh: cen dù, black head, applied to the species Omphalodes.

According to Shaw, the term grim was applied as a general term for lichens growing on stones. Martin, in his description of his journey to Skye, refers to the superstition "that the natives observe the decrease of the moon for scraping the scurf from the stones.". The two useful lichens, corcur and crotal, gave rise to the proverb "Better the rough stone that yields something, than the smooth stone that yields nothing".

RAY PETCH

Land of the Lichens (The Lichen Play) by Ernest Ruber, published in The American Biology Teacher (1983), Vol.45, part 8, pages 428-430.

No set is needed. The action takes place in a suitable habitat for Dwarf cinquefoil, one of ten characters in the cast, somewhere in "the most barren and cold places of the arctic tundra, where other plants can't grow", and with winter coming on. The opening chorus, part of a lecture on the ecology of lichens and dwarf cinquefoil, is uttered "monotonously" by the Teacher, who is eventually faded out amid the cries of three Students sitting in the audience. Student 3 closes their brief contribution by yelling, "Boring, boring, boring".

The three Lichens in the play have postures to please Billie Whitelaw. "CRUSTOSE lies flat on his face, raising it only to speak, FOLIOSE lies on his side, head propped on one arm, and FRUTICOSE stands and holds both arms forward in a drooping position." All is set, as anyone can see, for a Goonish minimalist drama with entertainment, philosophy and instruction in mind. The author owns to being a disillusioned pedagogue, who has changed the weapons of the summer-school lecturer for those of the variety hall artist, humour and improvisation. "The humour", he tells us, "derives heavily from slapstick, satire and insult and seeks to appeal to both the 'impulsive' and the conscientious' attitudes in the audience".

To say more of the plot would be premature, as we must all hope to see this playlet performed at a B.L.S. Annual General Meeting as soon as possible. Ten roles are available.

A. HENDERSON

Secretary's report for 1983

The most important event of the year was the Silver Jubilee in January. The celebrations included a symposium, special dinner, annual general meeting, and a lecture and exhibition meeting. The dinner was especially memorable and was held in the Conversazione Room of the British Museum (Natural History), the Society having been formed at a meeting in the Board Room of this same museum on Saturday 1 February 1958.

During 1983 the membership rose from 578 to 593. The number of new members joining during the year was 51, compared with 46 in 1982. It is with great regret that the death of our auditor Richard Ashby is reported; Richard was a familiar figure on field meetings and will be greatly missed.

Attendance at field meetings showed a remarkable revival. The spring meeting was held on Coll and Tiree, not the most accessible of locations.

The summer meeting was centred on Exeter and the autumn meeting in the Lake District, the last with a record attendance of almost 30 persons. Day excursions were held at Appledore and Hampstead in conjunction with other societies. A joint workshop with Bristol University was held in March. Mr.F.H.Brightman, Mr. I. Day, Professor B.W. Fox, Dr. O.L. Gilbert, Dr. D.L. Hawksworth, Dr.D.J. Hill, Mr. J.R. Laundon, and Mr. S.N. Tallowin are thanked for arranging and leading these excursions. The Council held three meetings.

Three parts of The Lichenologist, two numbers of the Bulletin, and a membership list were published during the year. Dr Hawksworth and Dr. Gilbert are thanked for all their work in bringing out these issues. The British Bryological Society celebrated its Diamond Jubilee on 17 September and kindly invited a representative to its celebrations. A new position of Archivist was established and we are grateful to Dr. Brown for taking on this office in addition to his other work. Our membership records and various other documents have now been modernised by placement on computer storage. We

are most grateful for grants of £1350 from the Nature Conservancy Council for a survey and report on lowland heaths, £400 from British Petroleum for the production of conservation leaflets etc., and support from the same company for the series 'Literature on air pollution and lichens' which appears in The Lichenologist.

I was first elected Secretary in January 1964, since when I have received great support from officers and members alike. I feel sure you will give your continued support to my successor, Joy Walker.

J.R.LAUNDON

Treasurer's Report on the 1983 Accounts

It will be noted that the increase in subscriptions is not keeping pace with the increase in the cost of processing The Lichenologist. Compared with 1982 the increase is in the region of 20%. This is partly due to increase in membership but the increase is still above the current rate of inflation. In order to maintain the present rate of members' subscription it is necessary to monitor all items of expenditure and I have made this point to the publishers of The Lichenologist. One item in the Revenue Account which I would particularly draw attention to is the valuable source of income from the kind donors of Royalties.

Balance Sheet. B.P. International Limited have made a further grant of £400 which has been allocated towards the work of the Conservation Committee. Stocks have an additional item i.e.: Dr.Hawksworth's Keys. Both the Checklist & Keys remain saleable items and therefore can be classed as an asset in the Balance Sheet.

In ending this report I would like to pay tribute to Richard Ashby who has signed the Auditor's certificate for very many years. His death in 1983 is a great loss to the Society and to me personally. An auditor has an unenviable responsibility to members and I am grateful to Dr.T.D.V.Swinscow for agreeing to fill the position.

S.N. TALLOWIN

BRITISH LICHEN SOCIETY

Statement of Expenditure and Income for the Year ended 31/12/83

1982 £	EXPENDITURE	£	£
4354	Cost of processing Lichenologist		5796
	Subscriptions paid:		
4	CoEnCo	3	
17	Biological Council	17	
26	Cryptogamie Bryol et Lich.	25	
19	American Bryol & Lich.	24	69
875	Bulletin (less receipts)		578
	Reading Circle (Ditto)		11
	A.G.M. & Jubilee celebration	288	
	Less receipts	208	80
	Atlas expenditure	290	
	Less receipts	222	68
	Summer meeting - Exeter	908	
	Less receipts	821	87
	Producing list of Members		155
104	Stationery		119
155	Postage		85
50	Insurance		50
			7098
1296	Excess of Income over expenditure		185
		£	7283

	INCOME	£	£	1982 £
	Subscriptions	6115		
	Add life membership	80	6195	5103
	Checklists		89	74
	Publications		11	3
	Royalties:-			
	Dr. U.K. Duncan's book	72		131
	D.H. Brown's Lichenology	48	120	
	Interest received:-			
	Nat. West	732		758
	Canadian Imp.	90		108
	Girobank	44	866	37
	Donations		2	6
		£	7283	

BALANCE SHEET AS AT 31/12/83

LIABILITIES	£	£	ASSETS	£	£
Subscriptions in advance		194	Balance at banks:-		
Life membership c/forward		240	National Westminster		7031
B.P. International for conservation work		750	Canadian Imp.		828
			Girobank		1040
			Checklist (stock)		649
			Pd. (Ditto)		38
N.C.C. Lowland Heath Survey	1000		Dr. Hawksworth's Keys	372	
Less expenditure	414	586	Less receipts	32	340
General fund	7970				
Add surplus for year	186	8156			
	£	9926		£	9926

Audited and in my opinion a correct record of the Accounts of the British Lichen Society.

T.D.V. Swinscow
Hon. Auditor
23rd April, 1984

S.N. Tallowin
Hon. Treasurer
4th April, 1984.

New, rare or interesting British lichen records

Belonia calcicola V.C. 70, Cumberland: in the Buttermere area, 1981, G. Baron. Second British record, the first being made by Watson c.1935 in Goblin Coomb, North Somerset. Det. P.W.J.

Candelaria concolor Devon: Plymtree nr Cullompton, frequent in orchards which have not been sprayed or the trunks netted, 1983. Barbara Benfield.

Cladonia fragilissima V.C. 57, Derbys: this species is now turning up frequently on dry acid soils. O.L. Gilbert.

Cladonia rei V.C. 25, East Suffolk: in turf on sandy gravel, in what appears to be a gravel working area, Toby's Walks, Blythburgh, May 1983. It somewhat resembles a poor form of C. subulata but has homosekikaic acid. C.J.B. Hitch.

Heterodermia obscurata Somerset: in wind-trimmed Armeria turf on steep coastal slopes east of Hurlstone point, Porlock, (with Parmelia laevigata and P. perlata) 1984. Francis Rose.

Lecania nylanderiana V.C. 26 West Suffolk: on mortar pointing beween flints on the south wall of the church, Honnington, July 1983. It was also noted in V.C. 90, Forfar: on mortar on the north wall of a church in Kirriemuir. Despite a lack of species on the church generally, it was quite abundant. C.J.B. Hitch.

Leptogium cyanescens Somerset: on boulders in the River Barle below Mannsey Castle near Dulverton, 1984. Barbara Benfield.

Pertusaria lactescens V.C. 68, North Northumberland: between Rothbury and Alnwick, 1981, G. Baron. First record this century of a species reported as apparently extinct in the check-list. Det. P.W.J.

Pseudocyphellaria crocata Somerset: on ash in Lea Wood above Tarr Steps. Several patches on one tree, 1984. Francis Rose.

Roccella phycopsis Dorset: Portland about 30m above highwater mark, SY705717. Quite a lot in one small area of boulders derived from a siliceous vein in the limestone. This lichen has not been seen for over 100 years in Dorset though there are old records from Portland by Lord Lewisham, James Sowerby and E.M.Holmes. J.V. Carrington.

Sarcogyne privigna V.C. 60, West Lancs: Salwick near Preston 34/46.31,occasional on vertical sandstone church wall, 1983. M. Gosling.

Verrucaria internigrescens Tiree: Ceann à Mhara, 07/9.4, on vertical rocks in sheltered gulley, April 1983. Brian Coppins. This brings the list for Tiree to 326.

Lichens on dustbins. On rubber lid of a dustbin, Rawcliffe, near Blackpool, Lancs:Lecidella scabra,Physcia tenella, Candelariella vitellina, 1983, M. Gosling. Same habitat, Saxmundham, Suffolk - tiny colonies of Xanthoria parietina and Phaeophyscia orbicularis, 1983, C.J.B. Hitch.

New Members

The following new members joined the Society between October 1983 and March 1984.

JA = Junior Associate. FM = Family Member.

Dr. M.A. Allen, 12 Highfield Way, RICKMANSWORTH, Herts.WD3 2PR.

Mr.A.Aptroot, Toermalijnlaan 42, UTRECHT 3523 BH, Holland.

Miss V.E. Atienza, c/o Depto.Botanica, Fac.Ciencias Biol, Burjasot, VALENCIA, Spain.

Mr.G.H.Battershall, 41 Appledore Ave, Wollaton,NOTTINGHAM NG5 2RL.

Mr.S.B. Bell, 1 Laburnum Close, Lincoln Hill, ROSS ON WYE, Herefordshire, HR9 5UB.

Dr. W.M. Boyd, 10A Royal Terrace, Rothesay, ISLE OF BUTE, Scotland, PA20 9EB.

Mr. O. Breuss, A-1014 Wein, Naturhist.Museum Bot. Abt, BURGRING 7, Austria.

Miss E. M. Buckle, Orleycombe Cottage, Woodland, Ashburton, NEWTON ABBOTT, Devon.

Miss C.L. Burnell, 69 St. Fagans Rd., Fairwater, CARDIFF. (JA)

Dr. A. Buschardt, Paulsenstr.50, D-1000 BERLIN 41, West Germany.

Dr. I.F. Ceni, Via Marsala 8, I-25122, BRESCIA, Italy.

Miss J.H. Egan, 43 Springfield Rd., SHEFFIELD, S7 2GE.

Mr. J.M. Egea, Obispo Frutos nc. 7-3°-0, MURCIA. Spain.

Miss A. Frost, 95 Gipsy Rd., West Norwood, LONDON SE27 9QS.(FM)

Mr.C.Frost, 95 Gipsy Rd., West Norwood, LONDON. SE27 9QS (FM)

Mrs.F.Frost, 95 Gipsy Rd., West Norwood, LONDON. SE27 9QS.

Ms. F.A. Gailey, 9 Lochrin Place, EDINBURGH.

Mr.B.R.E. Green, 11 Dane Close, Blackfield, SOUTHAMPTON, SO4 1ZY.

Mr.R.D.Harding, Birch Holt, Brook Lane, Woodgreen, nr.FORDINGBRIDGE, Hants, SP6 2AZ.

Ms. Heiman, Box 5243 Warren Wilson College, SWANNANOA, N.C. 28778, U.S.A. (JA).

Mr. H. Holien, N. Hallsetvei 91A, 7000 TRONDHEIM, Norway.

Ms. T. Kyriacopoulos, Dept. Biol., University of Athens, Panepistimiopolis, ATHENS 15771, Greece.

Mr.J. Middelborg, Brettevillesgate 13, OSLO 4, Norway.

Mr M.R. Milic, Trebinjska 28, 11000 BEOGRAD, Yugoslavia.

Mr.I.C.Munro, 5 Walton Crescent, DOLLAR, Clackmannanshire, FK14 7HU.

Mr.A. Nordin, N. Fiskargatan 1B n.b., S-80350 GAVLE, Sweden.

Mr.S. Ott, Schellingstr. 9, D-6000 FRANKFURT/M-1, West Germany.

Mrs. L. Pratt, 17 Freehold Rd., Needham Market, IPSWICH, Suffolk IP6 8DU (FM)

Mr.G. Renobales, Rodriques Arias 68° - 6°, BILBAO - 13, Spain.

Mr.J.S.Walton, 6 Allens Close, Baddesley Ensor, ATHERSTONE, Warks. CV9 2DB.

Mrs. M.V. Walton, 6 Allens Close, Baddesley Ensor, ATHERSTONE, Warks, CV9 2DB (FM)

Mrs. P.A. Wolseley, Nettlecombe Studios, Williton, TAUNTON, Somerset, TA4 4AS.

Bulletin 55

Closing date for copy for the next Bulletin is 1 October 1984. Please send contributions typed in double spacing. I would like to include a black and white photograph of general lichenological interest in future numbers, would photographers remember this when out with their cameras.

Ed.

Lichenologist 15 (3) was published on 14 November 1983, and Lichenologist 16 (1) on 8 March 1984.

AHMADJIAN, V. & JACOBS, J. B. 1983. Algal-fungal relationships in lichens: recognition, synthesis, and development. In GOFF, L. J. (Editor) Algal Symbiosis. Cambridge University Press. [Review.]

BRIGHTMAN, F. H. & LAUNDON, J. R. 1984. Lichens in Churchyards. British Lichen Society, London. [Handout.]

BRIGHTMAN, F. H. & SEAWARD, M. R. D. 1983. Notes on the bryophytes and lichens of Ruxley gravel pit. Trans. Kent Fld Club 9: 101 - 102. ["Recolonisation of Salix spp. by lichen epiphytes."]

BRODO, I. M. & VÄNSKÄ, H. 1984. Notes on the maritime, lignicolous lichen Lecanora orae-frigidae. Lichenologist 16: 45 - 51. [Study in the Lecanora symmicta group.]

CHESTER, T. 1983. A liking for lichens. Newsl. Northamptonshire Trust Nat. Conserv. 34: 6 - 8. [Chiefly on lichen habitats, including a full-page drawing.]

DANIËLS, F. J. A. 1983. Lichen communities on stumps of Pinus sylvestris L. in the Netherlands. Phytocoenologia 11: 431 - 444. [Two lichen vegetation types. The Cladonietum glaucae is described as a new union. "The syntaxonomy of Cladonia communities on coniferous tree stumps on the West European continent is discussed."]

EGEA, J. M. & LLIMONA, X. 1983. Mapas de distribución en el S.E. de España de los principales líquenes silicícolas. I. Anales Universidad Murcia (Ciencias) 41: 209 - 219. [69 distribution maps of lichens in S.E. Spain.]

GAMS, W. 1984. An index of fungal names and epithets sanctioned by Persoon and Fries. Mycotaxon 19: 219 - 270.

GILBERT, O. L. 1983. The lichens of Rhum. Trans. bot. Soc. Edinb. 44: 139 - 149. [Descriptive account.]

GILBERT, O. L. 1983. The lichen flora of Derbyshire - supplement 2. Naturalist, Hull 108: 131 - 137. [Numerous records, including Lecidea pernigra Hertel and Vorarlbergia renitens new to Britain.]

GILBERT, O. L. 1984. Some effects of disturbance on the lichen flora of oceanic hazel woodland. Lichenologist 16: 21 - 30. [Study on Eigg, Scotland. Tables of lichens widespread in disturbed hazel woodland, and of species restricted to long-undisturbed hazel woodland, are given. Photographs.]

GILBERT, O. L. 1984. Lichens of the Magnesian Limestone. Lichenologist 16: 31 - 43. [106 taxa on belt of Magnesian Limestone from Nottingham to Tyneside. Photographs. Comparison with Carboniferous Limestone. Lecanora campestris subsp. dolomitica O. Gilbert is described.]

GILBERT, O. [L.] 1984. The lichens of Choire Garbh. New Scientist 101 (1398): 42 - 43. [Lichen flora of snow patches in Britain. Six species new to Britain.]

GILBERT, O. L., COPPINS, B. J. & JAMES, P. W. 1984. Field meeting on Coll and Tiree. Lichenologist 16: 67 - 79. [Lichens recorded; assessment; list.]

GILBERT, O. L. & LAMBLEY, P. W. 1984. Field meeting at Llangollen, Clwyd. Lichenologist 16: 63 - 66. [Lichens recorded.]

HENDERSON, A. & STEWART, P. R. 1983. The occurrence of Ramalina farinacea (L.)Ach. on Millstone Grit in central Halifax. Naturalist, Hull 108: 109 - 110.

HONEGGER, R. 1984. Scanning electron microscopy of the contact site of conidia and trichogynes in Cladonia furcata. Lichenologist 16: 11 - 19. ["The sickle-shaped conidia fused, tip first, with the cell wall of trichogynes."]

JAHNS, H. M. & FREY, P. 1983. Thallus growth and the development of fruit bodies in Peltigera canina. Nova Hedwigia 36: 485 - 498. ["The development of apothecia inhibits the growth of the thallus. With the formation of apothecia the life-span of the thallus does not come to an end".]

JØRGENSEN, P. M. 1983. Distribution patterns of lichens in the Pacific region. Aust. J. Bot. (Suppl. Ser.) 10: 43 - 66. ["Lichens can be valuable phytogeographical indicators." Maps, discussion, etc.]

LANGE, O. L., KILIAN, E., MEYER, A. & TENHUNEN, J. D. 1984. Measurement of lichen photosynthesis in the field with a portable steady-state CO_2-porometer. Lichenologist 16: 1 - 9.

LAUNDON, J. R. 1983. Lichens of Dungeness. Living Countryside 13 (145): 2898 - 2900. [Account of lichen vegetation with map, drawings, and photographs.]

LAUNDON, J. R. 1983. Dungeness: whatever next? Living Countryside 13 (145): back cover. [History of exploitation.]

LAUNDON, J. R. 1984. Lichens in the city. Living Countryside 14 (160): 3198 - 3200. [Review; photographs and drawings showing use of Hawksworth & Rose pollution scale.]

LAUNDON, J. R. 1984. Proposal to emend Cladonia Hill ex Browne, 1756, nom. cons., and delete Cladona Adanson, 1763, nom. rej. (Ascomycetes: Lecanorales). Taxon 33: 109 - 112. [Proposed correction to the list of conserved names. It is considered that new names in Wiggers' Primitae florae holsaticae should be cited as "Weber ex Wiggers".]

LAUNDON, J. R. 1984. Studies in the nomenclature of British lichens I. Lichenologist 16: 53 - 57. [Three new combinations. Caloplaca flavescens (Huds.)Laundon is shown to be the correct name for C. heppiana, and Schismatomma cretaceum (Hue)Laundon for S. virgineum. Coelocaulon muricatum (Ach.)Laundon is considered to be a more appropriate name for C. aculeatum subsp. hispidum.]

LAWREY, J. D. 1984. Vulpinic and pinastric acids as lichen antiherbivore compounds: contrary evidence. Bryologist 86: 365 - 369. [Results of experiments using the lichen-eating slug Pallifera varia.]

MAGNUSSON, M. 1983. Composition and succession of bryophytes and lichens in an outer coastal dune area in southern Sweden. Cryptogamie Bryol. Lichénol 4: 335 - 355.

McCARTHY, P. M. 1983. The composition of some calcicolous lichen communities in the Burren, western Ireland. Lichenologist 15: 231 - 248. [Lichen vegetation mostly dominated by endolithic crusts; communities of epilithic crusts occur only where there is occasional bird-manuring and are not part of a succession.]

MOXHAM, T. H. 1983. British Lichen Society silver jubilee celebrations. Lichenologist 15: 289 - 296. [Account of lectures, etc., with photographs.]

PITT, J. 1983. Corticolous lichens at Lullingstone Park, Kent. Trans. Kent Fld Club 9: 103 - 105. [63 lichens, including seven "old forest" species.]

POPE, C. R. 1984. Field meeting on the Isle of Wight. Lichenologist 16: 59 - 62. [Lichens recorded.]

PROCTOR, M. C. F. 1983. Sizes and growth-rates of thalli of the lichen Rhizocarpon geographicum on the moraines of the Glacier de Valsorey, Valais, Switzerland. Lichenologist 15: 249 - 261. [Lichenometry, with discussion.]

ROGERS, R. W. 1982. Typification of the species of lichens described from Australian specimens by James Stirton. Austrobaileya 1: 502 - 510. [Location of types, etc.]

SANTESSON, R. 1984. The Lichens of Sweden and Norway. Swedish Museum of Natural History, Stockholm. [Annotated catalogue of lichen names. Habitats and important references to all species are included. Cladina is separated from Cladonia, but Cliostomum is retained in Catillaria and Psilolechia in Lecidea.]

SEYD, E. L. & SEAWARD, M. R. D. 1984. The association of oribatid mites with lichens. Zool. J. Linn. Soc. 80: 369 - 420. [Major review. 83 species of mites associated with lichens are grouped into their ecological requirements.]

TIMDAL, E. 1984. The genus Hypocenomyce (Lecanorales, Lecideaceae) with special emphasis on the Norwegian and Swedish species. Nordic J. Bot. 4: 83 - 108. [Monograph of 10 species. The status, delimitation, and homogeneity of the genus is "in need of further elucidation".]

TØNSBERG, T. & HOLTAN-HARTWIG, J. 1983. Phycotype pairs in Nephroma, Peltigera and Lobaria in Norway. Nordic J. Bot. 3: 681 - 688. ["Green and blue-green phycotype pairs formed by the lichens Nephroma arcticum (L.)Torss., Peltigera aphthosa (L.)Willd., P. britannica (Gyelnik) Holt.-Hartw. & Tønsb. comb. nov. and Lobaria amplissima (Scop.) Forss. are reported".]

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J. R. LAUNDON

KEY TO CRUSTOSE PYRENOCARPOUS LICHENS ON LIMESTONE AND ASSOCIATED SUBSTRATA (EXCLUDING AQUATIC AND MARINE HABITATS).

by B.J.Coppins

In advance of this year's 'Lichens on Limestone' course at Bristol University I decided to prepare a key to the pyrenocarpous lichens inhabiting limestones, associated soils, bryophyte cushions etc., in the British Isles. 'Limestones' in this context includes the more or less pure hard-limestones, such as Carboniferous limestone and the Cambrian (e.g. Durness) limestones, soft limestones such as chalk, and also dolomitic (Magnesian) limestone. Additional substrata include old bones, shell fragments, mortar, concrete and asbestos cement. It is sometimes difficult to draw the line between what is and what is not a limestone, so that many species which favour intermediate rock-types (e.g. basic mica-schist, calcareous sandstones) are also included.

Most of the data for the key has been obtained from personally examined specimens, although Dr.Swinscow's previously published keys to Polyblastia and Staurothele were of great assistance for those genera. A few lichenicolous fungi are included as they can often be mistaken for lichenized species; for a more thorough treatment of lichenicolous fungi see Dr. Hawksworth's key in Lichenologist 15: 1-44 (1983).

The terminology is mostly 'traditional' and explanations can be found in the popular guides (e.g. 'Duncan' or 'Dobson') and Figs. 1 & 2. The term 'paraphyses' is used in a loose sense to include alsc 'pseudoparaphyses' and 'paraphysoids', but not 'periphyses' (see Fig 2). To count the number of cells in a muriform spore in 'optical section', focus up and down and judge when the middle of the spore is in focus, and then count the number of cells visible. In richly muriform spores this will give an underestimate of the total number, but this number is not required for the purposes of this key. Spore septation is best observed in sections or squashes mounted in Melzer's Iodine; this is especially true in the case of the Verrucariaceae (viz. Verrucaria, Thelidium, Polyblastia, Staurothele), where the spore septation is often otherwise obscured by oily contents.

The size (diameter) of perithecia is best determined from a vertical median-section. This is most easily obtained by: (1) cutting a perithecium (in situ) in half with a single-edged razor-blade (prior moistening may be necessary); (2) carefully

removing one half (but retaining it for a squash preparation) and measuring the diameter of the remaining piece *in situ*. This is best done with a stereomicroscope equipped with a measuring eyepiece, but with a little skill can also be accomplished with a hand-lens and a finely calibrated ruler. At the same time, the remaining (*in situ*) half of the perithecium can be used to observe its general shape (e.g. whether it is 'simple' or 'compound'; see Fig. 1).

This very provisional key is designed for the keen amateur. Numerous problems exist regarding the taxonomy and nomenclature of several of the groups (especially *Verrucaria*), but it will be many decades before most of these are ironed-out. In the meantime, I hope this key will serve as an encouragement to 'blackdot' enthusiasts, and form a basis for subsequent improved versions. On this final point either the Editor, or myself will welcome constructive points of information or criticism.

1	Spores simple (a few old spores may become 1-sept)...2 Spores septate to muriform..... 17
2(1a)	Terricolous..... 3 Saxicolous..... 5
3(2a)	Sps many/ascus, 6-8.5(11)x 4-4.5 µm; paraph.numerous and slender; 'perith.' citrine-yellow with punctiform disc; associated with algal scum on calcareous turf.. .....*Thelocarpon impressellum* Sps 8/ascus, larger; paraph. absent; perith.black at least in exposed parts..... 4
4(3b)	Sps oblong-ellipsoid, sometimes a few 1-sept., 20-25x6-8 µm; perith. simple, 0.1-0.12mm diam; widespread and local on calc.turf (incl.old walls etc). .....*Verrucaria melaenella* Sps ellipsoid, 17-21x7-10 µm;perith. compound; bare calc. soil, rare, NW Scotland.....*Verrucaria* sp. (possibly a terric. form of *V.muralis*.)
5(2b)	Lichenicolous, forming patches in the thallus of *Aspicilia calcarea*, (a) *Verrucaria aspiciliae* with fusiform-ellipsoid sps, 19-26x6-8 µm; (b) *V.insularis* with subglobose sps, 7-11x6-8 µm. Not lichenicolous, although some species occur as small delimited patches in mosaic communities..... 6
6(5b)	Perith. forming pits in rock; thallus whitish..... 7 Perith. not forming pits, either prominent or immersed in a thick, epilithic thallus..... 9

7(6a) Perith. < 0.2mm diam, radially fissured around ostiole; sps 15-21x8-10 um; common on hard 1st (possibly a species aggregate).....Verrucaria baldensis
Perith. > 0.25mm diam.....8

8(7b) Perith. simple, 0.5-1mm diam, black base often persisting in empty pits; sps 23-32x10-20 µm; common on 1st and mortar.....Verrucaria hochstetteri
Perith. compound, 0.25-0.75mm diam, pits shallow and never with black bases; sps 18-25x8-12 µm; common, esp. on mortar.....Verrucaria muralis

9(6b) Perith. prominent and + superficial on thin or endolithic thallus..... 10
Perith. at least ½-immersed in thick epilithic thallus..... 13

10(9a) Perith. with flat spreading involucrellum, 0.2-0.3mm diam; thallus thin, brown, greenish and subgelatinous when moist; sps (?) 8-14x5-7µm; on shaded flints on chalk soils in S. England.....Verrucaria mutabilis
Without above combination of characters and habitat 11

11(10b) Perith. 0.15-0.2mm diam, + hemispherical; thallus endolithic or thin and pale grey or grey-brown; sps 19-21(26) x 8-11 µm; shaded 1st and stones, widespread, esp.in S. England, overlooked.....Verrucaria murina
Perith. > 0.25mm diam..... 12

12(11b) Perith. 0.3-0.5 mm, very prominent, with ostiole in apical depression; sps 15-24x6-9 µm; thallus whitish to pale brown-grey, smooth and thin or endolithic, often delimited by dark line; frequent on hard (esp. Carboniferous) 1st.....Verrucaria dufourii
Perith. variable, often superficial but less prominent, 0.25-0.75mm diam, without distinct apical depression; sps 18-25x8-12 µm; thallus whitish, ± farinose or endolithic, effuse; common esp. on soft 1st, mortar and concrete.....Verrucaria muralis

13(9b) Thallus blue-grey, finely cracked, delimited by black line (but areolae not black margined); perith. 0.15-0.2mm diam, often with depression around ostiole; sps 14-19x4-7 µm; local on sheltered, hard 1st... .....Verrucaria coerulea
Thallus not blue-grey, but if so then areolae each with a black rim..... 14

14(13b) Thallus in small clearly defined patches c. 1-2cm diam, lead-grey to dark grey-brown, deeply cracked-areolate, minutely 'mosaic-like' with areolae each with black rim; perith. 0.1-0.2mm diam; sps 10-18(23)x5-8 µm;(20-32x5-7 µm in subsp.canella);calc.rocks and walls, usually in small crevices or ledges on vert.surfaces.Verrucaria glaucina
Thallus in large patches and/or individual areolae without black rim..... 15

15(14b) Perith. large, 0.4-0.75mm diam, simple; thallus deeply cracked-areolate (areolae c.0.6-1.2mm diam), fawn-brown to olive-brown,without dark hypothallus, sometimes with soralia developing from edges of areolae (f.tectorum); sps 20-30x12-16 µm; common, esp. on soft 1st. (prob. aggregate species.).....Verrucaria viridula
Perith. 0.3mm diam; with dark hypothallus at least at edge of thallus; areolae < 0.4 mm; usually on harder rocks..... 16

16(15b) Thallus dark brown to blackish, with delimiting black hypothalline line, sometimes with soralia developing from edges of areolae; sps 19-26x9-11 µm; perith. compound, common.....*Verrucaria nigrescens*
Thallus fawn - to pale umber-brown, delimited by blackish line (superficially like *V.coerulea*); sps 11-17 x 4-6 µm; perith. simple; local on hard lst .....*Verrucaria pinguicula*

17(1b) Spores with transverse septa only..... 18
Sps muriform, submuriform or cruciately divided..... 38

18(17a) Sps 1-sept.(occasional abnormal 2-sept. sps sometimes present)..... 19
Sps 3- or more septate..... 32

19(18a) Sps hyaline (at most straw coloured when old).. 20
Sps soon brown; all lichenicolous species..... 29

20(19a) Thread-like paraphyses present amongst mature asci..... 21
Paraphyses absent (short periphyses often present in upper part of perith. around ostiole)..... 25

21(20a) Perith. 0.5-1mm diam (photobiont *Trentepohlia*)..... 22
Perith. 0.3mm diam..... 23

22(21a) Involucrellum incurved under excipulum and ± continuous below; sps 17-27x9-12 µm; on soft lst and mortar.....*Acrocordia salweyi*
Involucrellum spreading, not continuous below; sps 12-19x6-9 µm; on hard lst.....*Acrocordia conoidea*

23(21b) Paraphyses slender, sparingly branched; sps 17-27x6-8 µm; photobiont ? *Trentepohlia*(mixed algal scum usually present); shaded moist lst., esp. chalk stones in S. England.....*Arthopyrenia monensis*
Paraphyses densely branched and anastomosed ('knotted')..... 24

24(23b) Photobiont *Trentepohlia*; perith.± globose; sps 21-25x 8-11 µm; shaded moist lst., chalk pebbles etc.....*Arthopyrenia saxicola*
Photobiont 'blue-green'; perith ± obconical; sps 20-30 x 9-12 µm; inundated lst and basic rocks..... .....*Arthopyrenia caesia*

25(20b) Lichenicolous; perith. minute and sps < 5 µm wide (but up to 8 µm in *S.superpositum* on *Polyblastia theleodes*).....*Stigmidium* spp.
Not lichenicolous; sps mostly > 5 µm wide..... 26

26(25b) Sps 9-14x6-7 um; perith. compound, superficial to ¾-immersed in rock, 0.3-0.4mm diam, usually with depression around ostiole; thallus thin or ± endolithic; on hard lst., local.....*Thelidium impressum*
Sps > 17 µm long 27

27(26b) Perith. immersed in rock and forming pits, 0.3-0.4mm diam; sps 18-40x7-16 µm; thallus endolithic; on hard lst, common.....*Thelidium decipiens*
Perith. superficial, not pit-forming..... 28

28(26b) Perith. large, 0.4-1mm diam; sps 20-32x8-18 µm; local in mountain regions.....Thelidium pyrenophorum
Perith. minute c. 0.2 mm diam; sps 19-28 x 9-12 µm; widespread, on shaded stones.....Thelidium mesotropum

29(19b) Sps many/ascus, 5-8x2-4 um; perith. 0.05-0.11 mm diam; on various crustose lichens. Muellerella lichenicola
Sps 8 or less/ascus, > 8 µm long..... 30

30(29b) Sps < 20 µm long, smooth-walled; paraphyses absent.. Endococcus spp.
Sps > 20 µm long, verrucose; parphyses distinct..... 31

31(30b) Sps 8/ascus, 25-36x12-18 µm; on pyrenocarpous lichens, widespread but local...Polycoccum marmoratum
Sps 2/ascus, 25-30(40) x 8-12 µm; on pyrenocarpous lichens, rare (Gloucs.).....Polycoccum dzieduszyckii

32(18b) Perith. pale when wet, appearing hyaline, yellowish or pinkish..... 33
Perith. dark coloured, even when wet..... 35

33(32a) Sps fusiform, 3-sept., 15-20x6-7 µm (or up to 35 µm long in var. dolichospora); ascocarps 'discothecia' at first immersed, opening with a radially fissured apex to reveal a pale yellowish poriform disc; photobiont Scytonema); widespread.....Petractis clausa
Sps acicular, multiseptate; photobiont Trentepohlia.. 34

34(33b) Perith. 0.25-0.4mm diam, immersed in thalline verrucae; sps 50-100 µm long; thallus mostly epilithic; local on lst and calc. schists in Scottish mountains.. .....Belonia russula
Perith. 0.2-0.25mm diam, ¼-½-immersed in rock; sps 50-75 µm long; thallus mostly endolithic; rare on lst in England.....Belonia calcicola

35(32b) (Three alternatives) Paraphyses distinct, slender unbranched; sps 8/ascus, 3-sept., 16-25 x 4-5 µm; perith. smooth, ± superficial to ½-immersed, c.0.2-0.3mm diam; photobiont Trentepohlia; widespread and common on sheltered lst.....Porina linearis
Paraphyses distinct, slender, unbranched; sps 50+/ascus, 3-sept., 11-20 x 4-7 µm; perith. conspicuously rough-walled, ½-immersed in conspicuously orange(when fresh), thallus or substratum, 0.5-0.8mm diam; photobiont Trentepohlia; rare on moribund bryophytes and plant debris on sheltered basic rock in Scottish Mountains... .....Thelopsis melanthelia.
Paraphyses absent; sps (6-)8/ascus; photobiont not Trentepohlia(fresh thallus not orange when scratched)36

36(35c) Perith. immersed in rock and leaving pits, 0.3-0.5 mm diam; sps 3(4) - sept., occasionally 1 (2)transverse cells with a longitudinal wall, oblong-ellipsoid or clavate-ellipsoid, 35-53x12-21 µm thallus endolithic, whitish or tinged grey or brown; common. Thelidium incavatum (if sps commonly submuriform see couplet 61)
Perith. ± superficial, not leaving pits..... 37

37(36b) Perith. 0.4-0.7mm diam; thallus epilithic, pale-grey to umber-brown, rimose; sps 35-50x15-20 µm, 3(4)-sept., occasionally 1(2) trs cells with a longit. wall; on damp basic rocks in upland areas.....Thelidium papulare
Perith. 0.14-0.2mm diam; thallus endolithic and whitish, or epilithic, thin and pale grey to olivaceous; sps 26-32x10-14 µm; on shaded stones (esp.chalk), frequent in S. England.....Thelidium microcarpum

38(17b) Hymenium with numerous small bright green algal cells..... 39
Hym. without such algal cells..... 46

39(38a) Sps 8/ascus, hyaline to pale straw..... 40
Sps 2 or 4/ascus, brown or hyaline..... 44

40(39a) Hym. algae elongate, 3-10x2-3 µm..... 41
Hym. algae cuboid or globose, 2-4 µm diam.....43

41(40a) Perith. simple, immersed in rock and forming pits, 0.2-0.35mm diam; sps 25-35x15-18 µm; thallus endolithic; on hard lst., rare.....Staurothele bacilligera
Perith. prominent, compound, 0.3-0.7mm diam..... 42

42(41b) Thallus endolithic, whitish; sps 25-32x15-20 µm; widespread, often on chalk stones Staurothele hymenogonia
Thallus epilithic, dark brown to blackish; sps 35-45x 15-25 µm; on periodically flushed or inundated rocks in upland areas.....Staurothele succedens

43(40b) Thallus endolithic, white or pale grey; perith. simple, immersed in rock and forming pits; sps 30-40 x 18-25 µm; freq. on hard lst in England.....
.....Staurothele caesia
Thallus epilithic, yellowish - to brownish grey, thick and rimose; perith. compound, c. ¾-immersed in thallus; and not forming pits; sps 25-35 x 12-19 µm; rare (SW England).....Staurothele rugulosa

44(39b) Sps hyaline to pale straw, 2/ascus, 42-56x15-25 µm; thallus endolithic, whitish; perith. immersed in rock; rare (NW Scotland) .....Staurothele orbicularis
Sps soon brown..... 45

45(44b) Perith. simple, immersed in rock; thallus endolithic, whitish to pale grey; sps 4/ascus, 30-50x18-25 µm; widespread on hard lst.....Staurothele rupifraga
Perith. compound, prominent; thallus endo- to epilithic grey; sps 2/ascus, 35-45x15-25 µm; rare (S Wales) ...
.....Staurothele rufa

46(38b) Paraphyses numerous and slender..... 47
Paraphyses absent (beware periphyses!)..... 48

47(46a) Paraphyses simple, excipulum hyaline but with yellowish oil-droplets esp. in lower part; sps (4)6-8/ascus, fusiform with attenuated apices, (36)50-60(98)x 10-12(14) µm; asci thin-walled at apex; on sheltered lst or basic rocks, esp. underhangs and equivalent niches on walls, widespread (often sterile)..Belonia nidarosiensis
Paraphyses branched and anastomosed; excipulum brown at least in upper part; sps 4/ascus (8/ascus in var. octospora (Nyl.) Cretz.), oblong-ellipsoid, 60-90x 15-25 µm; asci with thickened apex and distinct ocular chamber; muscicolous on calc. soils and rocks, widespread esp. in N and W .....Microglaena muscicola

48(46b) Terricolous (on soil, bryophytes or moribund lichens)..... 49
Saxicolous..... 54

49(48a) Sps soon brown, 70-125x38-60 µm, 8/ascus; perith. 0.4-0.5mm diam, simple; thallus blackish; on calc. sandy soil, mainly in N.Scotland..Polyblastia wheldonii
Sps hyaline (old sps may be straw coloured)..... 50

50(49b) Sps 2/ascus..... 51
Sps mainly 8/ascus (a few sometimes aborting)..... 52

51(50a) Thallus minutely squamulose; perith. 0.4-0.5mm diam, rough-walled and often sulcate; sps 80-120x30-50 µm; usually amongst moribund bryophytes and lichens, often on old walls, common but easily overlooked when sterile.....Agonimia tristicula
Thallus filmy or granular; perith. 0.1-0.2mm diam, smooth; sps 40-70x18-26 µm; coastal dunes and shingle in N Britain, rare.....Polyblastia agraria

52(50b) Perith. simple; thallus dark greenish to blackish; sps 30-60(75) x 15-25 µm; widespread and frequent esp. in N & W .....Polyblastia gelatinosa
Perith. compound; thallus never blackish..... 53

53(52b) Sps 50-80x20-40 µm; thallus superficial pale - to brownish-grey; perith. immersed in thalline warts, involucrellum adhering to excipulum; rare (Scottish mountains). .....Polyblastia terrestris
Sps 20-50(55) x 10-30 µm; thallus whitish, immersed in substratum; perith. only ¼-½-immersed, with spreading involucrellum; rare on consolidated soil (Sussex) but more common on rock (see 64a)..Polyblastia cupularis

54(48b) Sps soon brown..... 55
Sps hyaline (old sps may be straw coloured)..... 59

55(54a) Sps > 50 µm long 56
Sps < 45 µm long 57

56(55a) Sps dark brown, 60-100x30-60 µm; perith. c. 0.7-1.2mm diam; on calc. rocks (often inundated) in upland districts, local.....Polyblastia theleodes
Sps mostly hyaline, occasionally medium brown, 50-75 x 20-35 µm; perith. c. 0.5-0.8mm diam; dry calc. or basic rocks in Scottish mountains, rare.....
.....Polyblastia inumbrata

57(55b) Perith. 0.4-0.8mm diam, mostly ¼-½-immersed in thallus, compound; sps muriform (> 15 cells in optical section); basic rocks (esp. calc. schists) in Highland Britain; local.....Plyblastia melaspora
Perith. < 0.3 mm diam; sps submuriform (< 12 cells in optical section)..... 58

58(57b) Perith. immersed in rock, 0.15-0.25mm diam; sps with thick hyaline epispore, 23-35x8-16 µm; thallus endolithic: mostly on hard lst., local.....
.....Polyblastia deminuta
Perith. prominent, 0.1-0.2mm diam; sps without epispore, often cruciately divided, 10-16(30) x 6-10 (12.5) µm; lichenicolous on thallus of esp. Protoblastenia spp., local.....Merismatium lopadii

59(54b) Perith. simple, immersed in rock, thallus endolithic..... 60
Perith. compound, prominent or partly immersed in an epilithic thallus..... 62

60(59a) Sps fully muriform (> 15 cells in opt. sect.), 25-50x 12-25 µm; widespread and frequent..Polyblastia albida
Sps submuriform (<10 cells in opt.sect.)..... 61

61(60b) Sps mainly 3-sept., occasional sps 4-sept. or with one cell with one longit. wall, 35-53x12-21µm; common.... .....Thelidium incavatum.
Sps basically 3-4 sept. but most sps with 1-2 trs cells longitudinally divided, 25-50x12-25µm; widespread but probably less common than 61a..... .....Polyblastia dermatodes

62(59b) Sps submuriform (<12 cells in opt. sect.)..... 63
Sps fully muriform (>15 cells in opt. sect.)..... 64

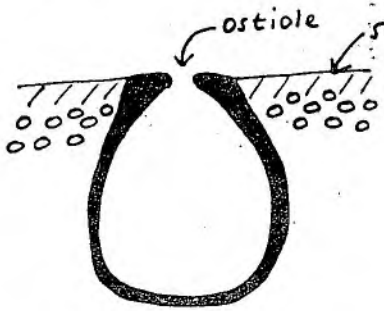
63(62a) Sps mainly 3(4)-sept., occasional sps with 1-2 cells with a single longit. wall, 35-50x15-21 µm; perith. 0.4-0.7mm diam, < ½-immersed; thallus-grey - to umber brown; freq. on damp basic rocks in uplands (see 37a).....Thelidium papulare
Sps mostly submuriform with 3-5 septa and 2-3 trs cells with 1-2 longit. walls, 30-45(68)x15-21 µm; perith. 0.4-0.7mm diam, ½-¾-immersed; thallus whitish to pale grey; rather dry basic rocks in Scottish mountains, rare.....Polyblastia verrucosa

64(63b) Sps 20-55x10-30 µm; perith. 0.4-0.8mm diam, at most ½-immersed; thallus whitish to grey-brown; widespread on lst and basic rock in upland areas..... .....Polyblastia cupularis
Sps within the range 50-80x20-35 µm; rare species.... 65

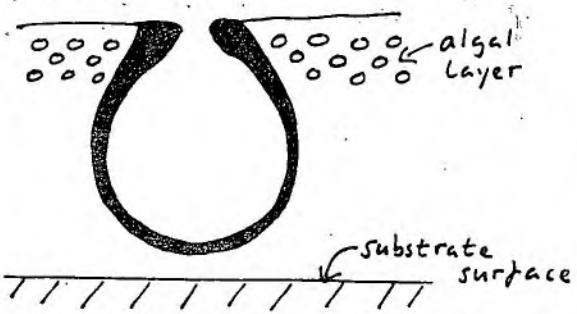
65(64b) Thallus greenish or pale brownish-grey, coarsely granular to smooth or widely cracked; perith. at least ½-immersed in thalline warts; sps 50-80x20-35 µm; on calc. stones and rocks and associated soil and moribund bryophytes, upland areas, rare..Polyblastia terrestris
Thallus greenish grey to dark brown, continuous or finely cracked; perith. at most ½-immersed by thalline cuffs; sps 50-75x20-35 µm; dry calc. or basic rocks in Scottish mountains, rare.....Polyblastia inumbrata

FIG. 1

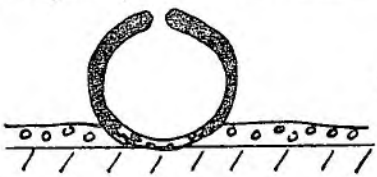
PERITHECIA



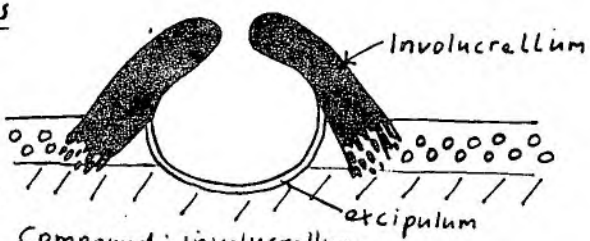
Simple; immersed in thallus and pit-forming (foveolate).
Verrucaria hochstetteri
Thelidinm incavatum
Polyblastia dermatodes



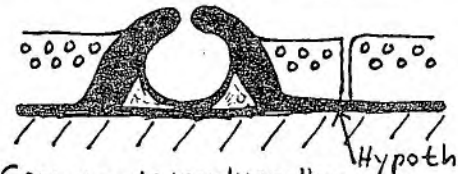
Simple; immersed in thallus
Verrucaria viridula



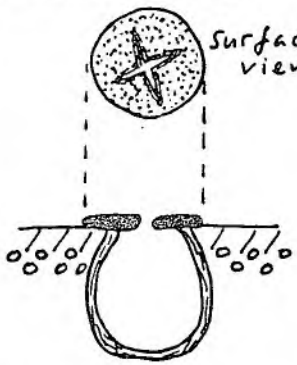
Simple; ± superficial
Verrucaria murina
Thelidinm mesotropum
T. microcarpum



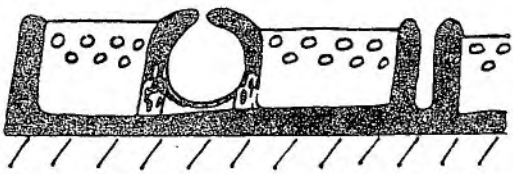
Compound; involucrellum spreading Verrucaria muralis



Compound; involucrellum spreading; ± immersed in thallus.
Verrucaria nigrescens



Compound with narrow, flat involucrellum; fissured around ostiole.
Verrucaria baldensis



± compound (involucrellum often difficult to differentiate from excipulum); immersed in thallus. Hypothallus well-developed and forming rim to areole. Verrucaria glaucina

PARAPHYSES ETC.

FIG. 2

True paraphyses

Originate from bottom of cavity and grow upwards; mostly unbranched.

Acrocordia
Belonia
Porina

Periphyses

Verrucaria, Thelidium, Placidiopsis
Staurothele, Agonimia, Catapyrenium
Polyblastia, Endocarpon, Dermatocarpon

At first short hyphae crossing the cavity — then stretching and resembling pseudoparaphyses.

Arthonia, Opegrapha

Paraphysoides

At first short hyphae originating from top of cavity; finally anchoring to base of cavity; sometimes becoming detached above.

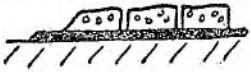
Arthopyrenia

Pseudoparaphyses

THE HYPOTHECIUM

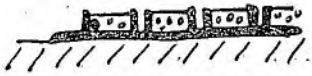
Confined (as dark pigmented tissue) to edge of thallus.

Verrucaria dufourii
V. pinguicula



Continuous underneath thallus and extending to the edge.

Verrucaria nigrescens



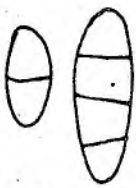
Continuous underneath thallus but also forming rim to individual areolae.

Verrucaria glaucina

SPORES

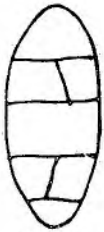
Simple (occasionally an old spore may become one-septate).

Verrucaria



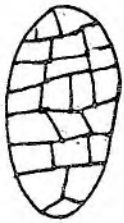
Transversely septate

Thelidium



Submuriform

Polyblastia



muriform

Polyblastia
Staurothele
Microglaena

Acicular; multiseptate

Belonia

spore surrounded by gelatinous — episporeo 'halo'

Polyblastia deminuta

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